



## OpenOffice.org's Documentation of the

# Microsoft Excel File Format

## Excel Versions 2, 3, 4, 5, 95, 97, 2000, XP, 2003

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# 1 Introduction

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## 1.1 License Notices

### 1.1.1 Public Documentation License Notice

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### 1.1.2 Wikipedia

Wikipedia Disclaimer: [http://en.wikipedia.org/wiki/Wikipedia:General\\_disclaimer](http://en.wikipedia.org/wiki/Wikipedia:General_disclaimer)

## 1.2 Abstract

This document contains a description of the binary file format of Microsoft Excel, including all available Excel versions (for Windows) from Excel 2.x to the current Excel 2003.

This project has been started in June 2001 and is still in progress. At several places the remark “2do” indicates an incomplete section of the documentation.

### 1.2.1 Project Status

Chapter	Contents	Status
1 Introduction	Common information	Done
2 Document Structure	Document structure overview	Done
3 Formulas	- Structure of RPN token arrays - Detailed description of all tokens	Done In progress
4 Worksheet/Workbook Stream	Abstract description of complex features represented by several records	In progress
5 Worksheet/Workbook Records	Detailed description of all records of the worksheet/workbook stream	In progress
6 Drawing Objects		Not started
7 Charts	Internals of chart sheets and chart objects	In progress
8 PivotTables		Not started
9 Change Tracking		Not started
10 Workspace Documents		In progress

## 1.2.2 Used Terms, Symbols, and Formatting

- **References**

A reference to another chapter is symbolised by a little arrow: →1.1.

- **Definitions**

Definitions of important terms are shown in a box with light-grey background.

**Definition:**

This is an example of a definition box.

- **Examples**

An example is indented and marked with a light-grey border.

This is an example.

- **Important Passages**

Text passages with important information contain a leading exclamation mark.

! This is an important passage.

- **Numbers and Strings**

Numerical values are shown in several number systems:

Number system	Marking	Example
Decimal	None	1234
Hexadecimal	Trailing “H”	1234 <sub>H</sub>
Binary	Trailing “2”	1001 <sub>2</sub>

Constant strings are enclosed in quotation marks. They may contain specific values (control characters, unprintable characters). These values are enclosed in angle brackets.

Example of a string containing a control character: “abcdef<01<sub>H</sub>>ghij”.

- **Record Listings**

A record listing shows a bundle of records in the required order. A dark grey rectangle stands for a single record, a light grey rectangle stands for a group of records. Either this is a group representing a specific feature and is referred with the *Record Group Name*, or it is a group of various unspecified records that do not matter in this context.

RECORD NAME	Comments
<i>Record Group Name</i>	Comments



### • Record Content Listings

- Data offsets enclosed in square brackets indicate record content that may be omitted (the remark “optional” may point out this).
- The term “*Not used*” means: Ignore the data on import and write zero bytes on export. The same applies for unmentioned bits in bit fields.
- The term “*Unknown*” describes data fields with fixed but unknown contents. On export these fields have to be written as shown.
- At several places a `variable` is introduced, which represents the value of this field for later use. In most common cases this is a field containing a size value, which is used later in the “Size” column of the record content listing. An example can be found in →2.4.

### • Algorithm Listings

Algorithms given in pseudo-code are shown in a box with light-grey background.

```
ALGORITHM Example_Algorithm
```

- ```
1) Command 1
2) Command 2
```

Notation conventions used in algorithms:

| Notation                                      | Description                                                                                      |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------|
| <code>command1 ; command2</code>              | Two commands in one line, first execute <code>command1</code> , then <code>command2</code>       |
| <code>var ← value</code>                      | The value <code>value</code> is assigned to the variable <code>var</code>                        |
| JUMP x)                                       | Continue with line x) in the algorithm                                                           |
| RETURN [value]                                | Returns value <code>value</code> if specified, otherwise returns without a return value          |
| IF cond THEN command                          | Execute <code>command</code> only, if condition <code>cond</code> evaluates to <code>true</code> |
| AND                                           | Binary AND operation                                                                             |
| OR                                            | Binary OR operation                                                                              |
| XOR                                           | Binary XOR (exclusive or) operation                                                              |
| <code>= &lt;&gt; &lt; &gt; &lt;= &gt;=</code> | Comparison operators for conditional execution                                                   |
| <code>array[]</code>                          | An array consisting of equal typed elements                                                      |
| <code>array[0]</code>                         | The first element of the array <code>array[]</code> (arrays are used zero-based)                 |

## 1.3 Byte Order

All data items containing more than one byte are stored using the Little-Endian method<sup>1</sup>. That means the least significant byte is stored first and the most significant byte last. This applies for all data types like 16-bit integers, 32-bit integers, floating-point values and Unicode characters.

Example: The 32-bit integer value `13579BDFH` is converted into the byte sequence `DFH 9BH 57H 13H`.

<sup>1</sup> For more information see <http://en.wikipedia.org/wiki/Endianness>.

## 2 Document Structure

---

### 2.1 Document Types

#### 2.1.1 Microsoft Excel Releases

The following table shows the different Excel versions released for Microsoft Windows and Apple Macintosh<sup>2</sup>:

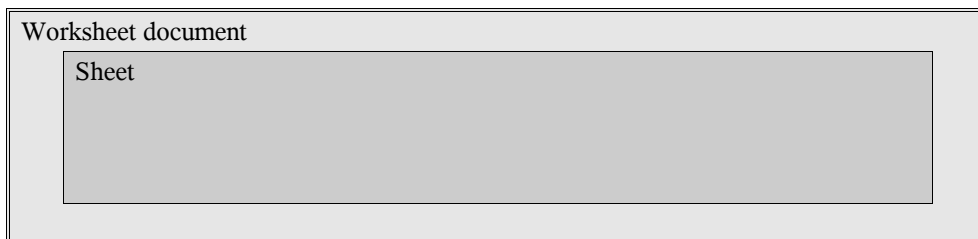
| Excel version | MS Windows | Release year | Apple Macintosh | Release year |
|---------------|------------|--------------|-----------------|--------------|
| Excel 2.x     | Excel 2.0  | 1987         | Excel 2.2       | 1989         |
| Excel 3.0     | Excel 3.0  | 1990         | Excel 3.0       | 1990         |
| Excel 4.0     | Excel 4.0  | 1992         | Excel 4.0       | 1992         |
| Excel 5.0     | Excel 5.0  | 1993         | Excel 5.0       | 1993         |
| Excel 7.0     | Excel 95   | 1995         | —               |              |
| Excel 8.0     | Excel 97   | 1997         | Excel 98        | 1998         |
| Excel 9.0     | Excel 2000 | 1999         | Excel 2001      | 2000         |
| Excel 10.0    | Excel XP   | 2001         | Excel v.X       | 2001         |
| Excel 11.0    | Excel 2003 | 2003         | Excel 2004      | 2004         |

#### 2.1.2 Worksheet Document

**Definition: Worksheet Document**

A worksheet document consists of a single sheet only. Various kinds of sheets are possible, for instance a regular sheet (containing values and formulas), a chart sheet (→7.1.1), or a macro sheet. The default file extension of worksheet documents is “XLS”.

General structure of a worksheet document:



<sup>2</sup> Source: [http://en.wikipedia.org/wiki/Microsoft\\_Excel](http://en.wikipedia.org/wiki/Microsoft_Excel).

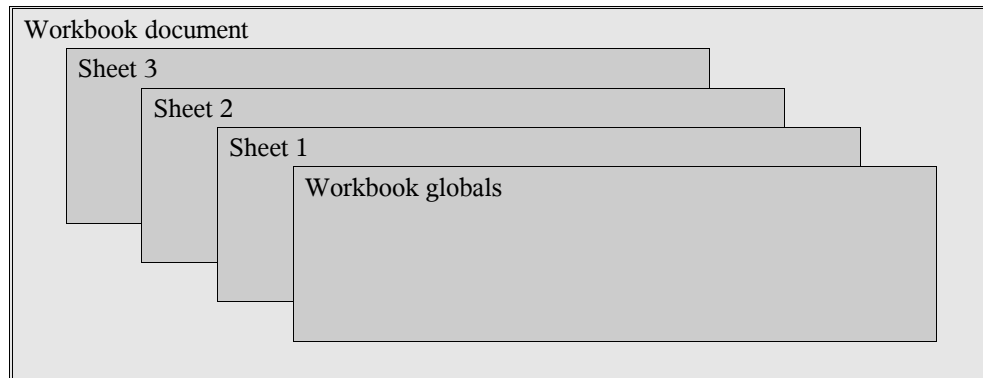
### 2.1.3 Workbook Document

**Definition: Workbook document**

A workbook document contains several sheets. It is possible to combine sheets of all types into the workbook, for instance regular sheets, chart sheets (→7.1.2), macro sheets, or Visual Basic modules. Each workbook document contains global settings for the workbook, called the *workbook globals*. The default file extension of workbook documents is “XLS”.

- ! Note the difference: A *sheet* is part of a worksheet *document* as well as a workbook *document*. A workbook document containing only one sheet is possible, but it is still called a workbook document.

General structure of a workbook document:



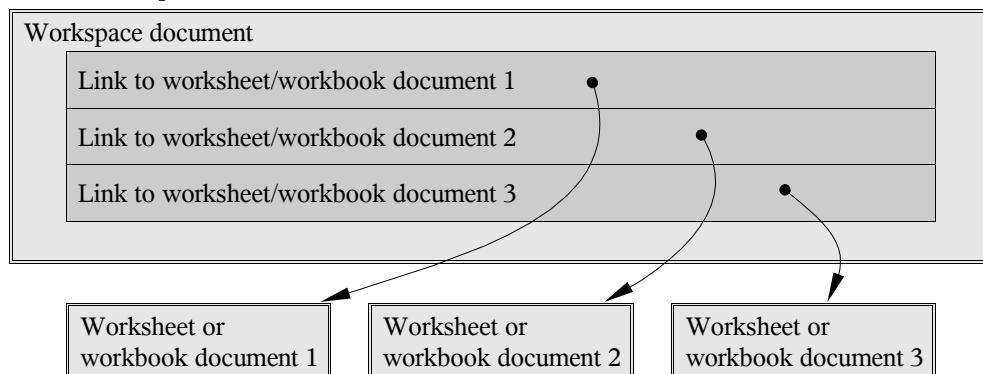
### 2.1.4 Workspace Document

**Definition: Workspace document**

A workspace document contains links to several worksheet and/or workbook documents. It stores the file name, window size, and window position of each document that is part of the workspace. The default file extension of workspace documents is “XLW”.

- ! Note the difference: A workbook document contains several *sheets*, but a workspace document contains links to worksheet or workbook *documents* that are stored in several files.
- ! No rule without exception: A workspace document written by Excel 4.0 is in fact a combination of a workbook document and a workspace document: It may contain links to worksheet documents, and embedded sheets that are loaded from an existing worksheet file or created from scratch. The workspace document contains the complete data of all embedded sheets.

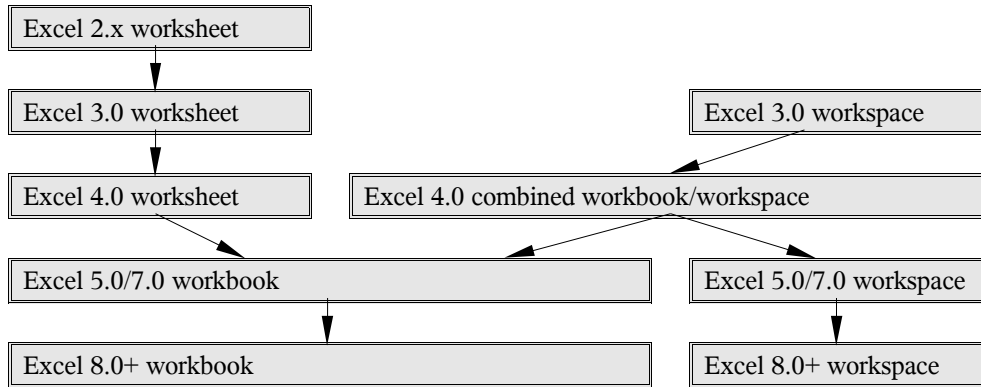
General structure of a workspace document:



The detailed structure of workspace documents is described in chapter →10.

### 2.1.5 Availability of the Document Types

The following illustration shows which document types are available in the different Excel versions:



## 2.2 The Binary Interchange File Format

The Excel file format is named BIFF (Binary Interchange File Format). It is used to store all types of documents: worksheet documents (→2.1.2), workbook documents (→2.1.3), and workspace documents (→2.1.4). There are different versions of this file format, depending on the version of Excel that has written the file (→2.1.1), and depending on the document type.

### 2.2.1 BIFF Versions for Worksheet/Workbook Documents

The following table shows which Excel version writes which file format for worksheet and workbook documents:

| Excel version | BIFF version | Document type |
|---------------|--------------|---------------|
| Excel 2.x     | BIFF2        | Worksheet     |
| Excel 3.0     | BIFF3        | Worksheet     |
| Excel 4.0     | BIFF4        | Worksheet     |
| Excel 5.0     | BIFF5        | Workbook      |
| Excel 7.0     | BIFF5        | Workbook      |
| Excel 8.0     | BIFF8        | Workbook      |
| Excel 9.0     | BIFF8        | Workbook      |
| Excel 10.0    | BIFF8        | Workbook      |
| Excel 11.0    | BIFF8        | Workbook      |

BIFF8 contains major changes towards older BIFF versions, for instance the handling of Unicode strings.

### 2.2.2 BIFF Versions for Workspace Documents

The following table shows which Excel version writes which file format for workspace documents:

| Excel version | BIFF version | Document type               |
|---------------|--------------|-----------------------------|
| Excel 2.x     | —            | —                           |
| Excel 3.0     | BIFF3W       | Workspace                   |
| Excel 4.0     | BIFF4W       | Combined workbook/workspace |
| Excel 5.0     | BIFF5W       | Workspace                   |
| Excel 7.0     | BIFF5W       | Workspace                   |
| Excel 8.0     | BIFF8W       | Workspace                   |
| Excel 9.0     | BIFF8W       | Workspace                   |
| Excel 10.0    | BIFF8W       | Workspace                   |
| Excel 11.0    | BIFF8W       | Workspace                   |

## 2.3 File Structure

### 2.3.1 Stream File

All document types and BIFF versions can be stored in a simple stream file, most of them are always stored this way. The only exception are BIFF5-BIFF8 workbook documents, which are usually stored as compound document files (see below). If these documents are stored as stream files, the entire file consists of the “Book” stream (BIFF5) or “Workbook” stream (BIFF8) only.

### 2.3.2 Compound Document File (BIFF5-BIFF8)

A workbook document with several sheets (BIFF5-BIFF8) is usually stored using the compound document file format (also known as “OLE2 storage file format” or “Microsoft Office compatible storage file format”). It contains several streams for different types of data. A complete documentation of the format of compound document files can be found at <http://sc.openoffice.org/compdocfileformat.pdf>.

The following table lists names of possible streams.

| Stream name                                  | Contents                              |
|----------------------------------------------|---------------------------------------|
| Book                                         | BIFF5 <i>Workbook Stream</i> (→2.3.3) |
| Workbook                                     | BIFF8 <i>Workbook Stream</i> (→2.3.3) |
| <05 <sub>H</sub> >SummaryInformation         | Document settings                     |
| <05 <sub>H</sub> >DocumentSummaryInformation | Document settings                     |
| Ctls                                         | Formatting of form controls           |
| User Names                                   | User names in shared workbooks (→9)   |
| Revision Log                                 | Change tracking log stream (→9)       |

It is possible to create substorages like subdirectories in a file system, for instance for the PivotTable streams. These storages contain substreams itself.

| Storage name     | Contents                                                                     |
|------------------|------------------------------------------------------------------------------|
| LNKxxxxxxxx      | Storage for a linked OLE object (→6)                                         |
| MBDxxxxxxxx      | Storage for an embedded OLE object (→6)                                      |
| _SX_DB_CUR       | Pivot cache storage. The streams contain cached values for PivotTables (→8). |
| _VBA_PROJECT_CUR | Visual BASIC project storage                                                 |

- ! In BIFF8, the Escher stream describing drawing objects (→6) is not stored as separate stream in the compound document file, but split and embedded in several MSODRAWING records that are part of the *Workbook Stream*.

### 2.3.3 Worksheet/Workbook/Workspace Stream

Depending on the document type, different names are used for the stream(s) they contain.

**Definition: Worksheet Stream**

BIFF2-BIFF4 worksheet documents (→2.1.2) are stored as stream files (→2.3.1). The entire stream is called the *Worksheet Stream*.

The *Worksheet Stream* is described in detail in →4.1.1.

**Definition: Workbook Stream**

BIFF5-BIFF8 workbook documents (→2.1.3) that are stored in a compound document file (→2.3.2) contain a stream in the root storage called the *Workbook Stream*. The name of this stream in the compound document file is “Book” for BIFF5 workbooks, and “Workbook” for BIFF8 workbooks.

If a BIFF5-BIFF8 workbook document is stored as stream file (→2.3.1), the entire stream is called the *Workbook Stream*.

The *Worksheet Stream* is described in detail in →4.1.2.

**Definition: Workspace Stream**

BIFF3W-BIFF8W workspace documents (→2.1.4) are stored as stream files (→2.3.1). The entire stream is called the *Workspace Stream*.

The *Workspace Stream* is described in detail in chapter →10.

### 2.3.4 Substreams

The BIFF5-BIFF8 *Workbook Stream* (→2.3.3) is divided into several parts that describe the workbook globals and the contained sheets (→2.1.3). Each of this parts is called a *substream*, defined by a starting and end position in the stream.

**Definition: Workbook Globals Substream**

The substream that contains the global information of a workbook is called the *Workbook Globals Substream*. It is part of the *Workbook Stream* of BIFF5-BIFF8 workbooks.

**Definition: Sheet Substream**

A substream that describes a sheet in a workbook is called *Sheet Substream*. It is part of the BIFF5-BIFF8 *Workbook Stream* as well as the BIFF4W *Workspace Stream*.

The *Sheet Substream* in a *Workbook Stream* can be regarded as a *Worksheet Stream*, because both describe one sheet and are very similar in their structure. A special type of a *Sheet Substream* is the *Chart Substream* (→7.1.2).

#### • Substreams in the BIFF5-BIFF8 Workbook Stream

In BIFF5-BIFF8 *Workbook Streams*, the *Workbook Globals Substream* is the leading part of the stream. It is followed by all *Sheet Substreams* in order of the sheets that are in the document.

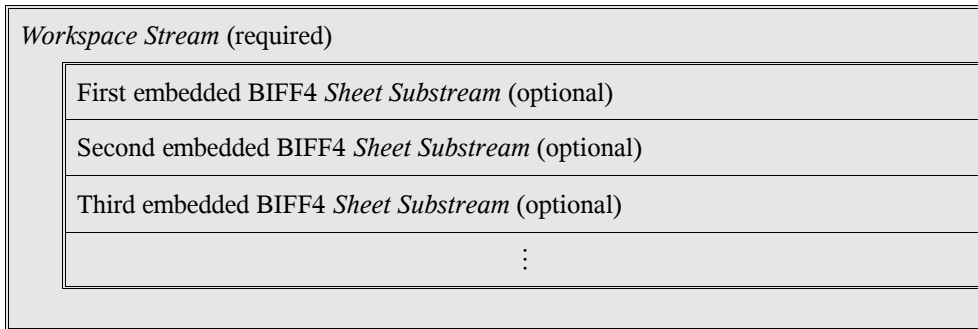
Common structure of a BIFF5-BIFF8 *Workbook Stream*:

|                                              |
|----------------------------------------------|
| <i>Workbook Globals Substream</i> (required) |
| First <i>Sheet Substream</i> (required)      |
| Second <i>Sheet Substream</i> (optional)     |
| Third <i>Sheet Substream</i> (optional)      |
| ⋮                                            |

• **Substreams in the BIFF4 Workspace Stream**

In BIFF4 *Workspace Streams*, the *Sheet Substreams* are embedded in the *Workspace Stream*. They are similar in their structure to BIFF4 *Worksheet Streams*.

Common structure of a BIFF4W *Workspace Stream*:



## 2.4 BIFF Record Structure

**Definition: BIFF Record**

Most of the Excel streams or substreams (including all streams described in →2.3.3 and substreams described in →2.3.4) are divided into *records*. Each record contains specific data for the various contents or features in a document. It consists of a header specifying the record type and size, followed by the record data.

Common structure of a BIFF record:

| Offset | Size      | Contents                                 |                 |
|--------|-----------|------------------------------------------|-----------------|
| 0      | 2         | Identifier                               | } Record header |
| 2      | 2         | Size of the following data ( <u>sz</u> ) |                 |
| 4      | <u>sz</u> | Record data                              |                 |

The maximum size of the record data is limited and depends on the BIFF version. If the size of the record data exceeds the current limit, one or more CONTINUE records (→5.21) will be added. Inside a CONTINUE record the data of the previous record continues as usual.

In this documentation only the record data without the headers is shown. All offsets are relative to the beginning of the record data and not to the entire record. The contents of most of the records differ from BIFF version to version. This will be described in separate tables. A few older records are replaced in newer BIFF versions. Excel does not write these old records in new BIFF versions anymore.



## 2.5 Common Record Substructures

This chapter contains information about basic substructures which do not belong to specific records, for instance strings, error codes, constant values, URLs, or line and area formatting.

### 2.5.1 Formatting Runs

*Formatting runs* describe the character formatting of strings. A formatting run contains the index of a character and the index of a font in the font buffer. The font is used to format the indexed character and the following characters, until the string ends or another formatting run follows.

Formatting run, BIFF2-BIFF5:

| Offset | Size | Contents                               |
|--------|------|----------------------------------------|
| 0      | 1    | First formatted character (zero-based) |
| 1      | 1    | Index to FONT record (→5.45)           |

Formatting run, BIFF8:

| Offset | Size | Contents                               |
|--------|------|----------------------------------------|
| 0      | 2    | First formatted character (zero-based) |
| 2      | 2    | Index to FONT record (→5.45)           |

### 2.5.2 Byte Strings (BIFF2-BIFF5)

All Excel file formats up to BIFF5 contain simple byte strings. The byte string consists of the length of the string followed by the character array. The length is stored either as 8-bit value or as 16-bit value, depending on the current record. The string is not zero-terminated. The encoding of the character array is dependent on the current record (for example taken from the CODEPAGE record, →5.17, or from the FONT record, →5.45).

| Offset | Size      | Contents                                           |
|--------|-----------|----------------------------------------------------|
| 0      | 1 or 2    | Length of the string (character count, <u>ln</u> ) |
| 1 or 2 | <u>ln</u> | Character array (8-bit characters)                 |

### 2.5.3 Unicode Strings (BIFF8)

From BIFF8 on, strings are always stored using UTF-16LE<sup>3</sup> text encoding. The character array is a sequence of 16-bit values<sup>4</sup>. Additionally it is possible to use a compressed format, which omits the high bytes of all characters, if they are all zero.

The following table describes the standard format of the entire string, but in many records the strings differ from this format. This will be mentioned separately. It is possible (but not required) to store Rich-Text formatting information and Asian phonetic information inside a Unicode string. This results in four different ways to store a string. The character array is not zero-terminated.

<sup>3</sup> For more information see <http://en.wikipedia.org/wiki/UTF-16>.

<sup>4</sup> In most cases each value corresponds to a Unicode character. Only the Unicode characters above U+FFFF are encoded with a “surrogate pair”, that are two 16-bit code values in UTF-16 (see footnote 3).

## • Contents of a Unicode String

The string consists of the character count (as usual an 8-bit value or a 16-bit value), option flags, the character array and optional formatting information. In general, the option flags field occurs also for empty strings. But in a few records, this field is omitted, if the string is empty. This is mentioned at the respective place.

| Offset   | Size                      | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
|----------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 0        | 1 or 2                    | Length of the string (character count, <u>ln</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| 1 or 2   | 1                         | Option flags: <table border="1" data-bbox="416 465 1390 819"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>01<sub>H</sub></td> <td>Character compression (<u>ccompr</u>):<br/>0<sub>2</sub> = Compressed (8-bit characters)<br/>1<sub>2</sub> = Uncompressed (16-bit characters)</td> </tr> <tr> <td>2</td> <td>04<sub>H</sub></td> <td>Asian phonetic settings (<u>phonetic</u>):<br/>0<sub>2</sub> = Does not contain Asian phonetic settings<br/>1<sub>2</sub> = Contains Asian phonetic settings</td> </tr> <tr> <td>3</td> <td>08<sub>H</sub></td> <td>Rich-Text settings (<u>richtext</u>):<br/>0<sub>2</sub> = Does not contain Rich-Text settings<br/>1<sub>2</sub> = Contains Rich-Text settings</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 01 <sub>H</sub> | Character compression ( <u>ccompr</u> ):<br>0 <sub>2</sub> = Compressed (8-bit characters)<br>1 <sub>2</sub> = Uncompressed (16-bit characters) | 2 | 04 <sub>H</sub> | Asian phonetic settings ( <u>phonetic</u> ):<br>0 <sub>2</sub> = Does not contain Asian phonetic settings<br>1 <sub>2</sub> = Contains Asian phonetic settings | 3 | 08 <sub>H</sub> | Rich-Text settings ( <u>richtext</u> ):<br>0 <sub>2</sub> = Does not contain Rich-Text settings<br>1 <sub>2</sub> = Contains Rich-Text settings |
| Bit      | Mask                      | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| 0        | 01 <sub>H</sub>           | Character compression ( <u>ccompr</u> ):<br>0 <sub>2</sub> = Compressed (8-bit characters)<br>1 <sub>2</sub> = Uncompressed (16-bit characters)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| 2        | 04 <sub>H</sub>           | Asian phonetic settings ( <u>phonetic</u> ):<br>0 <sub>2</sub> = Does not contain Asian phonetic settings<br>1 <sub>2</sub> = Contains Asian phonetic settings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| 3        | 08 <sub>H</sub>           | Rich-Text settings ( <u>richtext</u> ):<br>0 <sub>2</sub> = Does not contain Rich-Text settings<br>1 <sub>2</sub> = Contains Rich-Text settings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| [2 or 3] | 2                         | (optional, only if <u>richtext</u> =1) Number of Rich-Text formatting runs ( <u>rt</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| [var.]   | 4                         | (optional, only if <u>phonetic</u> =1) Size of Asian phonetic settings block (in bytes, <u>sz</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| var.     | <u>ln</u> or 2· <u>ln</u> | Character array (8-bit characters or 16-bit characters, dependent on <u>ccompr</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| [var.]   | 4· <u>rt</u>              | (optional, only if <u>richtext</u> =1) List of <u>rt</u> formatting runs (→2.5.1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |
| [var.]   | <u>sz</u>                 | (optional, only if <u>phonetic</u> =1) <i>Asian Phonetic Settings Block</i> (see below)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                 |                                                                                                                                                 |   |                 |                                                                                                                                                                |   |                 |                                                                                                                                                 |

### • Asian Phonetic Settings Block

Asian phonetic text<sup>5</sup> (Ruby) can be used to provide extended phonetic information for specific characters or words. It appears above the regular text (or to the right of vertical text), and can refer to single characters, groups of characters, or entire words.

| Offset          | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
|-----------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|-----|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|----------------------------------------------------------------------------|
| 0               | 2                 | Unknown identifier 0001 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 2               | 2                 | Size of the following data (10 + 2· <u>ln</u> + 6· <u>np</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 4               | 2                 | Index to FONT record (→5.45) used for the Asian phonetic text                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 6               | 2                 | Additional settings for the Asian phonetic text:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
|                 |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>1-0</td> <td>0003<sub>H</sub></td> <td>Type of Japanese phonetic text (<u>type</u>):<br/>00<sub>2</sub> = Katakana (narrow)                      10<sub>2</sub> = Hiragana<br/>01<sub>2</sub> = Katakana (wide)</td> </tr> <tr> <td>3-2</td> <td>000C<sub>H</sub></td> <td>Alignment of all portions of the Asian phonetic text (<u>align</u>):<br/>00<sub>2</sub> = Not specified (Japanese only)      10<sub>2</sub> = Centered<br/>01<sub>2</sub> = Left (Top for vertical text)        11<sub>2</sub> = Distributed</td> </tr> <tr> <td>5-4</td> <td>0030<sub>H</sub></td> <td>11<sub>2</sub> (always set)</td> </tr> </tbody> </table> | Bit    | Mask | Contents | 1-0 | 0003 <sub>H</sub> | Type of Japanese phonetic text ( <u>type</u> ):<br>00 <sub>2</sub> = Katakana (narrow)                      10 <sub>2</sub> = Hiragana<br>01 <sub>2</sub> = Katakana (wide) | 3-2 | 000C <sub>H</sub> | Alignment of all portions of the Asian phonetic text ( <u>align</u> ):<br>00 <sub>2</sub> = Not specified (Japanese only)      10 <sub>2</sub> = Centered<br>01 <sub>2</sub> = Left (Top for vertical text)        11 <sub>2</sub> = Distributed | 5-4 | 0030 <sub>H</sub> | 11 <sub>2</sub> (always set)                                               |
| Bit             | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 1-0             | 0003 <sub>H</sub> | Type of Japanese phonetic text ( <u>type</u> ):<br>00 <sub>2</sub> = Katakana (narrow)                      10 <sub>2</sub> = Hiragana<br>01 <sub>2</sub> = Katakana (wide)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 3-2             | 000C <sub>H</sub> | Alignment of all portions of the Asian phonetic text ( <u>align</u> ):<br>00 <sub>2</sub> = Not specified (Japanese only)      10 <sub>2</sub> = Centered<br>01 <sub>2</sub> = Left (Top for vertical text)        11 <sub>2</sub> = Distributed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 5-4             | 0030 <sub>H</sub> | 11 <sub>2</sub> (always set)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 8               | 2                 | Number of portions the Asian phonetic text is broken into ( <u>np</u> ).<br>If <u>np</u> = 0, the Asian phonetic text refers to the entire cell text.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 10              | 2                 | Total length of the following Asian phonetic text (number of characters, <u>ln</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 12              | 2                 | Repeated total length of the text                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 14              | 2· <u>ln</u> or 2 | Character array of Asian phonetic text, no Unicode string header, always 16-bit characters.<br>Note: If <u>ln</u> = 0, this field is <i>not</i> empty but contains 0000 <sub>H</sub> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 14+2· <u>ln</u> | 6· <u>np</u>      | List of <u>np</u> structures that describe the position of each portion in the main text. Each structure contains the following fields:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
|                 |                   | <table border="1"> <thead> <tr> <th>Offset</th> <th>Size</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2</td> <td>First character in the Asian phonetic text of this portion (<u>cpa</u>)</td> </tr> <tr> <td>2</td> <td>2</td> <td>First character of the main text belonging to this portion (<u>cpm</u>)</td> </tr> <tr> <td>4</td> <td>2</td> <td>Number of characters in main text belonging to this portion (<u>ccm</u>)</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                          | Offset | Size | Contents | 0   | 2                 | First character in the Asian phonetic text of this portion ( <u>cpa</u> )                                                                                                   | 2   | 2                 | First character of the main text belonging to this portion ( <u>cpm</u> )                                                                                                                                                                        | 4   | 2                 | Number of characters in main text belonging to this portion ( <u>ccm</u> ) |
| Offset          | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 0               | 2                 | First character in the Asian phonetic text of this portion ( <u>cpa</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 2               | 2                 | First character of the main text belonging to this portion ( <u>cpm</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |
| 4               | 2                 | Number of characters in main text belonging to this portion ( <u>ccm</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |          |     |                   |                                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                                  |     |                   |                                                                            |

Example: Japanese word Tokyo (東京) with added hiragana (とうきょう)<sup>6</sup>. The following examples show the contents of the important fields of the *Asian Phonetic Settings Block*.

*Example 1:* Hiragana centered over the entire word:

とうきょう  
東京

type = 10<sub>2</sub> (hiragana)  
align = 10<sub>2</sub> (centered)  
np = 0 (no portions, hiragana refers to entire text)  
ln = 5 (length of entire hiragana text)  
 No portion structures

<sup>5</sup> For more information see [http://en.wikipedia.org/wiki/Ruby\\_characters](http://en.wikipedia.org/wiki/Ruby_characters).

<sup>6</sup> Example taken from [http://en.wikipedia.org/wiki/Ruby\\_characters](http://en.wikipedia.org/wiki/Ruby_characters).

*Example 2:* Hiragana left-aligned per character:

とう きょう  
東京

`t.type` = 10<sub>2</sub> (hiragana)

`a.align` = 01<sub>2</sub> (left-aligned)

`n.p.` = 2 (hiragana split into 2 portions)

`l.n` = 5 (length of entire hiragana text)

Portion #1: `c.pa` = 0 (start with 1<sup>st</sup> hiragana character); `c.pm` = 0; `c.cm` = 1 (attach to 1<sup>st</sup> character in main text)

Portion #2: `c.pa` = 2 (start with 3<sup>rd</sup> hiragana character); `c.pm` = 1; `c.cm` = 1 (attach to 2<sup>nd</sup> character in main text)

## 2.5.4 RGB Colours

Colour values are represented in RGB mode (red/green/blue).

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | Red component   |
| 1      | 1    | Green component |
| 2      | 1    | Blue component  |
| 3      | 1    | Not used        |

In this documentation, constant colour values are written as 6-digit hexadecimal values in RGB notation: RRGGBB<sub>H</sub>.

Example: The colour value FF8000<sub>H</sub> describes the colour orange: red is FF<sub>H</sub>, green is 80<sub>H</sub>, and blue is 00<sub>H</sub>.

## 2.5.5 RK Values

An RK value is an encoded integer or floating-point value. RK values have a size of 4 bytes and are used to decrease file size for floating-point values.

Structure of an RK value (32-bit value), BIFF3-BIFF8:

| Bit  | Mask                  | Contents                                                          |
|------|-----------------------|-------------------------------------------------------------------|
| 0    | 00000001 <sub>H</sub> | 0 = Value not changed      1 = Encoded value is multiplied by 100 |
| 1    | 00000002 <sub>H</sub> | 0 = Floating-point value      1 = Signed integer value            |
| 31-2 | FFFFFFFC <sub>H</sub> | Encoded value                                                     |

If bit 1 is cleared, the encoded value represents the 30 most significant bits of an IEEE 754 floating-point value (64-bit double precision). The 34 least significant bits must be set to zero. If bit 1 is set, the encoded value represents a signed 30-bit integer value. To get the correct integer, the encoded value has to be shifted right arithmetically by 2 bits. If bit 0 is set, the decoded value (both integer and floating-point) must be divided by 100 to get the final result.

Examples:

| RK value              | Type    | Div 100 | Encoded value         | Decoded value                       | Result   |
|-----------------------|---------|---------|-----------------------|-------------------------------------|----------|
| 3FF00000 <sub>H</sub> | float   | no      | 3FF00000 <sub>H</sub> | 3FF0000000000000 <sub>H</sub> = 1.0 | 1.0      |
| 3FF00001 <sub>H</sub> | float   | yes     | 3FF00000 <sub>H</sub> | 3FF0000000000000 <sub>H</sub> = 1.0 | 0.01     |
| 004B5646 <sub>H</sub> | integer | no      | 004B5644 <sub>H</sub> | 0012D591 <sub>H</sub> = 1234321     | 1234321  |
| 004B5647 <sub>H</sub> | integer | yes     | 004B5644 <sub>H</sub> | 0012D591 <sub>H</sub> = 1234321     | 12343.21 |

## 2.5.6 Error Codes

If the calculation of a formula results in an error or any other action fails, Excel sets a specific error code. These error codes are used for instance in cell records and formulas.

| Error code      | Error value | Description                              |
|-----------------|-------------|------------------------------------------|
| 00 <sub>H</sub> | #NULL!      | Intersection of two cell ranges is empty |
| 07 <sub>H</sub> | #DIV/0!     | Division by zero                         |
| 0F <sub>H</sub> | #VALUE!     | Wrong type of operand                    |
| 17 <sub>H</sub> | #REF!       | Illegal or deleted cell reference        |
| 1D <sub>H</sub> | #NAME?      | Wrong function or range name             |
| 24 <sub>H</sub> | #NUM!       | Value range overflow                     |
| 2A <sub>H</sub> | #N/A        | Argument or function not available       |

## 2.5.7 Constant Values

Sometimes it is needed to store constant values of different data types. These values are used to create linear lists (for instance in the CRN record, →5.23), or two-dimensional arrays (→2.5.8). This chapter describes the format of the individual constant values.

### • Empty Value

| Offset | Size | Contents                                           |
|--------|------|----------------------------------------------------|
| 0      | 1    | 00 <sub>H</sub> (Identifier for an empty constant) |
| 1      | 8    | Not used                                           |

### • Number

| Offset | Size | Contents                                                |
|--------|------|---------------------------------------------------------|
| 0      | 1    | 01 <sub>H</sub> (Identifier for a numerical constant)   |
| 1      | 8    | IEEE 754 floating-point value (64-bit double precision) |

### • String Value

| Offset | Size | Contents                                                                                                                                  |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 02 <sub>H</sub> (Identifier for a string constant)                                                                                        |
| 1      | var. | BIFF2-BIFF5: Byte string, 8-bit string length (→2.5.2)<br>BIFF8: Unicode string, 16-bit string length, option flags occur always (→2.5.3) |

### • Boolean Value

| Offset | Size | Contents                                            |
|--------|------|-----------------------------------------------------|
| 0      | 1    | 04 <sub>H</sub> (Identifier for a Boolean constant) |
| 1      | 1    | 0 = FALSE, 1 = TRUE                                 |
| 2      | 7    | Not used                                            |

## • Error Value

| Offset | Size | Contents                                           |
|--------|------|----------------------------------------------------|
| 0      | 1    | 10 <sub>H</sub> (Identifier for an error constant) |
| 1      | 1    | Error code (→2.5.6)                                |
| 2      | 7    | Not used                                           |

## 2.5.8 Constant Value Array

Two-dimensional arrays of constant values are used to store cached DDE link results (record EXTERNALNAME, →5.39), or for constant arrays in formulas (token tArray, →3.8.7). The array starts with the dimensions (width and height), followed by a list of constant values.

Two-dimensional constant value array, BIFF2-BIFF5:

| Offset | Size | Contents                                                             |
|--------|------|----------------------------------------------------------------------|
| 0      | 1    | Number of columns ( <u>nc</u> ). The value 0 represents 256 columns. |
| 1      | 2    | Number of rows ( <u>nr</u> )                                         |
| 3      | var. | List of <u>nc</u> · <u>nr</u> constant values (→2.5.7)               |

Two-dimensional constant value array, BIFF8:

| Offset | Size | Contents                                                         |
|--------|------|------------------------------------------------------------------|
| 0      | 1    | Number of columns decreased by 1 ( <u>nc</u> )                   |
| 1      | 2    | Number of rows decreased by 1 ( <u>nr</u> )                      |
| 3      | var. | List of ( <u>nc</u> +1)·( <u>nr</u> +1) constant values (→2.5.7) |

## 2.5.9 Encoded File URLs

The intention of encoding file URLs is to make them more platform independent. Encoded URLs occur in the records EXTERNSHEET (BIFF2-BIFF5, →5.41) or EXTERNALBOOK (BIFF8, →5.38), and DCONREF (→5.30).

The first character of the URL is used to determine the type of encoding. In Unicode strings (BIFF8) this could be a 16-bit value.

| First character | BIFF2-BIFF4                                                  | BIFF5                                                                                     | BIFF8                                                                                     |
|-----------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 00 <sub>H</sub> | Not used                                                     | Reference relative to the current sheet (nothing will follow), used e.g. in defined names | Reference relative to the current sheet (nothing will follow), used e.g. in defined names |
| 01 <sub>H</sub> | Encoded URL follows                                          | Encoded URL follows                                                                       | Encoded URL follows                                                                       |
| 02 <sub>H</sub> | Reference to the current sheet (nothing will follow)         | Reference to the current sheet (nothing will follow)                                      | Reference to a sheet in the own document (sheet name follows)                             |
| 03 <sub>H</sub> | Not used                                                     | Reference to a sheet in the own document (sheet name follows)                             | Not used                                                                                  |
| 04 <sub>H</sub> | Not used                                                     | Reference to the own workbook, sheet is unspecified (nothing will follow)                 | Not used                                                                                  |
| others          | Not encoded. This is already the first character of the URL. |                                                                                           |                                                                                           |

Inside of the encoded URL there can occur several control characters.

| Control character | Meaning                                                                        |
|-------------------|--------------------------------------------------------------------------------|
| 01 <sub>H</sub>   | An MS-DOS drive letter will follow, or “@” and the server name of a UNC path   |
| 02 <sub>H</sub>   | Start path name on same drive as own document                                  |
| 03 <sub>H</sub>   | End of subdirectory name                                                       |
| 04 <sub>H</sub>   | Parent directory                                                               |
| 05 <sub>H</sub>   | Unencoded URL. Followed by the length of the URL (1 byte), and the URL itself. |
| 06 <sub>H</sub>   | Start path name in installation directory of Excel                             |
| 08 <sub>H</sub>   | Macro template directory in installation directory of Excel                    |
| 09 <sub>H</sub>   | Sheet in the same workbook (BIFF4W)                                            |

If a sheet name follows the file name in the encoded URL (BIFF4W-BIFF8), the file name (but not the file path) will be enclosed in brackets. Note that in EXTERNALBOOK records (BIFF8) sheet names do not occur and therefore the file names are not enclosed in brackets.

Examples for BIFF2-BIFF4 (own document is saved as “C:\path\own.xls”):

| Formula                              | Encoded filename                                                                                                                                                         |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| =own.xls!A1                          | <02 <sub>H</sub> >                                                                                                                                                       |
| =ext.xls!A1                          | <01 <sub>H</sub> >ext.xls                                                                                                                                                |
| ='sub\ext.xls'!A1                    | <01 <sub>H</sub> >sub<03 <sub>H</sub> >ext.xls                                                                                                                           |
| ='\ext.xls'!A1                       | <01 <sub>H</sub> ><02 <sub>H</sub> >ext.xls                                                                                                                              |
| ='\sub\ext.xls'!A1                   | <01 <sub>H</sub> ><02 <sub>H</sub> >sub<03 <sub>H</sub> >ext.xls                                                                                                         |
| ='\sub\sub2\ext.xls'!A1              | <01 <sub>H</sub> ><02 <sub>H</sub> >sub<03 <sub>H</sub> >sub2<03 <sub>H</sub> >ext.xls                                                                                   |
| ='..\sub\ext.xls'!A1                 | <01 <sub>H</sub> ><04 <sub>H</sub> >sub<03 <sub>H</sub> >ext.xls                                                                                                         |
| ='D:\sub\ext.xls'!A1                 | <01 <sub>H</sub> ><01 <sub>H</sub> >Dsub<03 <sub>H</sub> >ext.xls                                                                                                        |
| ='\pc\sub\ext.xls'!A1                | <01 <sub>H</sub> ><01 <sub>H</sub> >@pc<03 <sub>H</sub> >sub<03 <sub>H</sub> >ext.xls                                                                                    |
| ='http://www.example.org/ext.xls'!A1 | <01 <sub>H</sub> ><05 <sub>H</sub> ><1E <sub>H</sub> >http://www.example.org/ext.xls<br>(the length of the URL (30 = 1E <sub>H</sub> ) follows the 05 <sub>H</sub> byte) |

Examples for BIFF4W internal references (all formulas are located on “Sheet1”):

| Formula    | Encoded filename                           |
|------------|--------------------------------------------|
| =Sheet1!A1 | <02 <sub>H</sub> >                         |
| =Sheet2!A1 | <01 <sub>H</sub> ><09 <sub>H</sub> >Sheet2 |

Examples for BIFF5 internal references (all formulas are located on “Sheet1”):

| Formula              | Encoded filename         |
|----------------------|--------------------------|
| =Sheet1!A1           | <02 <sub>H</sub> >       |
| =Sheet2!A1           | <03 <sub>H</sub> >Sheet2 |
| =NonExistentSheet!A1 | <04 <sub>H</sub> >       |

Examples for BIFF8 internal references (for example in record DCONREF):

| Formula    | Encoded filename         |
|------------|--------------------------|
| =Sheet2!A1 | <02 <sub>H</sub> >Sheet2 |

Examples for BIFF4W-BIFF8 external references (own document is saved as “C:\path\own.xls”):

| Formula                                        | Encoded filename                                                                                                                                                                 |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| = [ext.xls]Sheet1!A1                           | <01 <sub>H</sub> >[ext.xls]Sheet1                                                                                                                                                |
| = 'sub\ [ext.xls]Sheet1' !A1                   | <01 <sub>H</sub> >sub<03 <sub>H</sub> >[ext.xls]Sheet1                                                                                                                           |
| = '\ [ext.xls]Sheet1' !A1                      | <01 <sub>H</sub> ><02 <sub>H</sub> >[ext.xls]Sheet1                                                                                                                              |
| = '\sub\ [ext.xls]Sheet1' !A1                  | <01 <sub>H</sub> ><02 <sub>H</sub> >sub<03 <sub>H</sub> >[ext.xls]Sheet1                                                                                                         |
| = '\sub\sub2\ [ext.xls]Sheet1' !A1             | <01 <sub>H</sub> ><02 <sub>H</sub> >sub<03 <sub>H</sub> >sub2<03 <sub>H</sub> >[ext.xls]Sheet1                                                                                   |
| = '..\sub\ [ext.xls]Sheet1' !A1                | <01 <sub>H</sub> ><04 <sub>H</sub> >sub<03 <sub>H</sub> >[ext.xls]Sheet1                                                                                                         |
| = 'D:\sub\ [ext.xls]Sheet1' !A1                | <01 <sub>H</sub> ><01 <sub>H</sub> >Dsub<03 <sub>H</sub> >[ext.xls]Sheet1                                                                                                        |
| = '\\pc\sub\ [ext.xls]Sheet1' !A1              | <01 <sub>H</sub> ><01 <sub>H</sub> >@pc<03 <sub>H</sub> >sub<03 <sub>H</sub> >[ext.xls]Sheet1                                                                                    |
| = 'http://www.example.org/[ext.xls]Sheet1' !A1 | <01 <sub>H</sub> ><05 <sub>H</sub> ><26 <sub>H</sub> >http://www.example.org/[ext.xls]Sheet1<br>(the length of the URL (38 = 26 <sub>H</sub> ) follows the 05 <sub>H</sub> byte) |

### 2.5.10 Encoded DDE and OLE Links

A DDE link contains the name of the server application and the DDE topic. An OLE link contains the class name and the URL of the document. In both cases the names are stored in one string, separated by the control character 03<sub>H</sub>. The URLs are *not* encoded.

Example: A document contains a DDE link and an OLE link to Sheet1 in the file “D:\sub\example.xls”.

| Link | Server/Class  | Topic/URL                  | Encoded document name                             |
|------|---------------|----------------------------|---------------------------------------------------|
| DDE  | excel         | D:\sub\[example.xls]Sheet1 | excel<03 <sub>H</sub> >D:\sub\[example.xls]Sheet1 |
| OLE  | Excel.Sheet.8 | D:\sub\example.xls         | Excel.Sheet.8<03 <sub>H</sub> >D:\sub\example.xls |

### 2.5.11 Line Styles for Cell Borders (BIFF3-BIFF8)

These line styles are used to define cell borders. The styles 08<sub>H</sub> to 0D<sub>H</sub> are available in BIFF8 only.

| Index           | Style   | Sample | Index           | Style                         | Sample    |
|-----------------|---------|--------|-----------------|-------------------------------|-----------|
| 00 <sub>H</sub> | No line |        |                 | The following for BIFF8 only: |           |
| 01 <sub>H</sub> | Thin    | —————  | 08 <sub>H</sub> | Medium dashed                 | -----     |
| 02 <sub>H</sub> | Medium  | —————  | 09 <sub>H</sub> | Thin dash-dotted              | -.-.-.-.- |
| 03 <sub>H</sub> | Dashed  | -----  | 0A <sub>H</sub> | Medium dash-dotted            | -.-.-.-.- |
| 04 <sub>H</sub> | Dotted  | .....  | 0B <sub>H</sub> | Thin dash-dot-dotted          | -.-.-.-.- |
| 05 <sub>H</sub> | Thick   | —————  | 0C <sub>H</sub> | Medium dash-dot-dotted        | -.-.-.-.- |
| 06 <sub>H</sub> | Double  | =====  | 0D <sub>H</sub> | Slanted medium dash-dotted    | -----     |
| 07 <sub>H</sub> | Hair    | .....  |                 |                               |           |



## 2.5.12 Patterns for Cell and Chart Background Area

The background area of cells (BIFF3-BIFF8) and chart objects (BIFF2-BIFF8) may contain a pattern. Pattern colour and pattern background colour are defined separately. In the following table black is used as pattern colour and white as pattern background colour.

| Index           | Pattern | Sample     | Index           | Pattern | Sample |
|-----------------|---------|------------|-----------------|---------|--------|
| 00 <sub>H</sub> |         | No pattern | 0A <sub>H</sub> |         |        |
| 01 <sub>H</sub> |         |            | 0B <sub>H</sub> |         |        |
| 02 <sub>H</sub> |         |            | 0C <sub>H</sub> |         |        |
| 03 <sub>H</sub> |         |            | 0D <sub>H</sub> |         |        |
| 04 <sub>H</sub> |         |            | 0E <sub>H</sub> |         |        |
| 05 <sub>H</sub> |         |            | 0F <sub>H</sub> |         |        |
| 06 <sub>H</sub> |         |            | 10 <sub>H</sub> |         |        |
| 07 <sub>H</sub> |         |            | 11 <sub>H</sub> |         |        |
| 08 <sub>H</sub> |         |            | 12 <sub>H</sub> |         |        |
| 09 <sub>H</sub> |         |            |                 |         |        |

The following table shows how a pattern is used with the correct colour indexes.

| Cell format                                                 | Pattern         | Pattern colour index          | Background colour index       |
|-------------------------------------------------------------|-----------------|-------------------------------|-------------------------------|
| No background (shows system window background)              | 00 <sub>H</sub> | System window text (not used) | System window background      |
| Red background (solid)                                      | 01 <sub>H</sub> | Red                           | System window text (not used) |
| Red background with thin horizontal blue lines              | 0B <sub>H</sub> | Blue                          | Red                           |
| Red background with thin horizontal lines, automatic colour | 0B <sub>H</sub> | System window text            | Red                           |
| No background, thin horizontal blue lines                   | 0B <sub>H</sub> | Blue                          | System window background      |
| No background, thin horizontal lines, automatic colour      | 0B <sub>H</sub> | System window text            | System window background      |

The description of the PALETTE record (→5.74) contains information how the special system colours are used. Note the behaviour of solid coloured backgrounds, where pattern 01<sub>H</sub> is used in conjunction with the pattern colour.

### 2.5.13 Cell Attributes (BIFF2)

All cell records in BIFF2 contain a cell attribute field with a size of 3 bytes. They contain an index to an XF record (→5.115) and some repeated contents of the referenced XF record. The XF index field has a size of only 6 bits, so the index range is 0...63. If a real XF index greater than 62 is used, the XF index field always contains the value 63, and an IXFE record (→5.62) occurs in front of a cell record. The IXFE record contains the correct index of the XF record. In a ROW record (→5.88) this field is not used, because there will always occur a real XF index field.

Cell attributes field (3 bytes), BIFF2:

| Offset | Size            | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
|--------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|-----|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------|--------------------------------|---|-----------------|---------------------------------|---|-----------------|-------------------------------|---|-----------------|----------------------------------|---|-----------------|--------------------------------|
| 0      | 1               | Cell protection and XF index:<br><table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>5-0</td> <td>3F<sub>H</sub></td> <td>Index to XF record (→5.115). The value 3F<sub>H</sub> = 63 indicates a preceding IXFE record (→5.62). Not used in ROW records (→5.88).</td> </tr> <tr> <td>6</td> <td>40<sub>H</sub></td> <td>1 = Cell is locked</td> </tr> <tr> <td>7</td> <td>80<sub>H</sub></td> <td>1 = Formula is hidden</td> </tr> </tbody> </table>                                                                                                                                                                                | Bit | Mask | Contents | 5-0 | 3F <sub>H</sub> | Index to XF record (→5.115). The value 3F <sub>H</sub> = 63 indicates a preceding IXFE record (→5.62). Not used in ROW records (→5.88). | 6   | 40 <sub>H</sub> | 1 = Cell is locked             | 7 | 80 <sub>H</sub> | 1 = Formula is hidden           |   |                 |                               |   |                 |                                  |   |                 |                                |
| Bit    | Mask            | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 5-0    | 3F <sub>H</sub> | Index to XF record (→5.115). The value 3F <sub>H</sub> = 63 indicates a preceding IXFE record (→5.62). Not used in ROW records (→5.88).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 6      | 40 <sub>H</sub> | 1 = Cell is locked                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 7      | 80 <sub>H</sub> | 1 = Formula is hidden                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 1      | 1               | Indexes to FORMAT and FONT records:<br><table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>5-0</td> <td>3F<sub>H</sub></td> <td>Index to FORMAT record (→5.49)</td> </tr> <tr> <td>7-6</td> <td>C0<sub>H</sub></td> <td>Index to FONT record (→5.45)</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                   | Bit | Mask | Contents | 5-0 | 3F <sub>H</sub> | Index to FORMAT record (→5.49)                                                                                                          | 7-6 | C0 <sub>H</sub> | Index to FONT record (→5.45)   |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| Bit    | Mask            | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 5-0    | 3F <sub>H</sub> | Index to FORMAT record (→5.49)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 7-6    | C0 <sub>H</sub> | Index to FONT record (→5.45)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 2      | 1               | Cell style:<br><table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>2-0</td> <td>07<sub>H</sub></td> <td>XF_HOR_ALIGN – Horizontal alignment (→5.115.1)</td> </tr> <tr> <td>3</td> <td>08<sub>H</sub></td> <td>1 = Cell has left black border</td> </tr> <tr> <td>4</td> <td>10<sub>H</sub></td> <td>1 = Cell has right black border</td> </tr> <tr> <td>5</td> <td>20<sub>H</sub></td> <td>1 = Cell has top black border</td> </tr> <tr> <td>6</td> <td>40<sub>H</sub></td> <td>1 = Cell has bottom black border</td> </tr> <tr> <td>7</td> <td>80<sub>H</sub></td> <td>1 = Cell has shaded background</td> </tr> </tbody> </table> | Bit | Mask | Contents | 2-0 | 07 <sub>H</sub> | XF_HOR_ALIGN – Horizontal alignment (→5.115.1)                                                                                          | 3   | 08 <sub>H</sub> | 1 = Cell has left black border | 4 | 10 <sub>H</sub> | 1 = Cell has right black border | 5 | 20 <sub>H</sub> | 1 = Cell has top black border | 6 | 40 <sub>H</sub> | 1 = Cell has bottom black border | 7 | 80 <sub>H</sub> | 1 = Cell has shaded background |
| Bit    | Mask            | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 2-0    | 07 <sub>H</sub> | XF_HOR_ALIGN – Horizontal alignment (→5.115.1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 3      | 08 <sub>H</sub> | 1 = Cell has left black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 4      | 10 <sub>H</sub> | 1 = Cell has right black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 5      | 20 <sub>H</sub> | 1 = Cell has top black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 6      | 40 <sub>H</sub> | 1 = Cell has bottom black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 7      | 80 <sub>H</sub> | 1 = Cell has shaded background                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                 |                                                                                                                                         |     |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |

### 2.5.14 Cell Range Address

A cell range address specifies a fixed cell range in the current sheet.

Cell range address, BIFF2-BIFF5:

| Offset | Size | Contents              |
|--------|------|-----------------------|
| 0      | 2    | Index to first row    |
| 2      | 2    | Index to last row     |
| 4      | 1    | Index to first column |
| 5      | 1    | Index to last column  |

Cell range address, BIFF8:

| Offset | Size | Contents              |
|--------|------|-----------------------|
| 0      | 2    | Index to first row    |
| 2      | 2    | Index to last row     |
| 4      | 2    | Index to first column |
| 6      | 2    | Index to last column  |

! In several cases, BIFF8 still writes the BIFF2-BIFF5 format of a cell range address (using 8-bit values for the column indexes). This will be mentioned at the respective place.

### 2.5.15 Cell Range Address List

A cell range address list consists of a field with the number of ranges and the list of the range addresses.

Cell range address list, BIFF2-BIFF8:

| Offset | Size                         | Contents                                               |
|--------|------------------------------|--------------------------------------------------------|
| 0      | 2                            | Number of following cell range addresses ( <u>nm</u> ) |
| 2      | 6· <u>nm</u> or 8· <u>nm</u> | List of <u>nm</u> cell range addresses (→2.5.14)       |

- ! In several cases, BIFF8 still writes the BIFF2-BIFF5 format of a cell range address (using 8-bit values for the column indexes). This will be mentioned at the respective place.

## 3 Formulas

### 3.1 Common Formula Structure

#### 3.1.1 Common Structure

Formulas are stored as part of a record, for instance inside of a FORMULA record or a DEFINEDNAME record. The common format of a formula is as follows:

Formula in BIFF2:

| Offset          | Size      | Contents                                                                                  |
|-----------------|-----------|-------------------------------------------------------------------------------------------|
| 0               | 1         | Size of the following formula data (RPN token array, <i>sz</i> )                          |
| 1               | <i>sz</i> | Formula data (RPN token array)                                                            |
| [1+ <i>sz</i> ] | var.      | (optional) Additional data for specific tokens (→3.1.6, for example tArray token, →3.8.7) |

Formula in BIFF3-BIFF8:

| Offset          | Size      | Contents                                                                                  |
|-----------------|-----------|-------------------------------------------------------------------------------------------|
| 0               | 2         | Size of the following formula data ( <i>sz</i> )                                          |
| 2               | <i>sz</i> | Formula data (RPN token array)                                                            |
| [2+ <i>sz</i> ] | var.      | (optional) Additional data for specific tokens (→3.1.6, for example tArray token, →3.8.7) |

Sometimes the size field is not stored directly before the RPN token array, but somewhere else. If this happens, it will be mentioned at the respective place. If there does not exist any formula data, only the size field (which contains 0 then) is present.

#### 3.1.2 Tokens

**Definition: Formula token**

Formula tokens are the indivisible particles of a formula. There might be operators, numerical or string constants or function names.

Each token contains a token identifier. Several tokens contain additional information. A token does not contain any size information, so importing and exporting tokens must be done carefully.

Common structure of a formula token, BIFF2-BIFF8:

| Offset | Size | Contents                                 |
|--------|------|------------------------------------------|
| 0      | 1    | Token identifier                         |
| [1]    | var. | (optional) Additional data for the token |

### 3.1.3 Token Notation

Tokens are referred to by their name. All token names start with a small “t” (for “Token”). If a token contains additional information, it is appended to the token name in parentheses.

Examples:

The addition operator + is represented by the token tAdd. It does not contain any additional data.

The integer constant 1 is represented by the token tInt(1).

An absolute reference to cell \$A\$1 is represented by the token tRef(\$A\$1).

### 3.1.4 Operators

There are 3 types of operators:

- Unary operators like the minus sign that negates a value. These operators pop the topmost operand from the stack.
- Binary operators like addition or multiplication. These operators pop the two topmost operands from the stack.
- Function operators represent the sheet functions of Excel. They operate on different numbers of topmost operands on the stack. Either the function expects a fixed number of operands (for instance SIN expects one operand), or a variable number of operands given in the function token (for instance SUM is able to process 0 to 30 operands).

All operators push the (single) result of their operation back onto the stack.

### 3.1.5 Token Arrays

***Definition: Token array***

The token array represents an entire formula and contains all used tokens of the formula in a specific order.

The tokens of the formula are stored in the Reverse-Polish Notation (RPN). This means, first there occur all operands of an operation, followed by the respective operator.

Example: the simple term 1+2 consists of the 3 tokens “1”, “+” and “2”. Written in RPN, the formula is converted to the token list “1”, “2”, “+”.

During parsing such an expression, operands are pushed onto a stack. An operator pops the needed number of operands from stack, performs the operation and pushes the result back onto the stack.

Other examples for RPN token arrays:

| Formula     | Token array      | Excel notation                                      | Parsing result                                                                                                                                                                                                                                                                                                                      |
|-------------|------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2*4+5       | 2, 4, *, 5, +    | tInt(2), tInt(4),<br>tMul, tInt(5), tAdd            | First, the integer constants 2 and 4 are pushed onto the stack. The * operator pops them from the stack and pushes 8. Then the constant 5 is pushed. The + operator pops 5 and 8 and pushes 13 (the final result).                                                                                                                  |
| 2+4*5       | 2, 4, 5, *, +    | tInt(2), tInt(4),<br>tInt(5), tMul, tAdd            | First, the integer constants 2, 4, and 5 are pushed onto the stack. The * operator pops 5 and 4 and pushes 20, the + operator pops 20 and 2 and pushes 22 (the final result).                                                                                                                                                       |
| ABS (2*-A1) | 2, A1, -, *, ABS | tInt(2), tRefV(A1),<br>tUminus, tMul,<br>tFunc(ABS) | First, the integer constant 2 and the value from cell A1 (for example 3) are pushed onto the stack. The unary - operator (tUminus) pops the topmost value 3 from stack and pushes the negated value -3. The * operator pops -3 and 2 and pushes -6. The ABS function needs 1 parameter. It pops -6 and pushes 6 (the final result). |

Example of the complete byte representation of the formula 2\*4+5.

- The RPN representation of the formula is: 2, 4, 5, \*, +.
- Written in Excel token notation, this is: tInt(2), tInt(4), tInt(5), tMul, tAdd.

| Offset | Size | Contents          | Token name | Description                               |
|--------|------|-------------------|------------|-------------------------------------------|
| 0      | 2    | 000B <sub>H</sub> |            | Size of the following formula data (s.z.) |
| 2      | 1    | 1E <sub>H</sub>   | tInt       | } Integer value token for 2               |
| 3      | 2    | 0002 <sub>H</sub> |            |                                           |
| 5      | 1    | 1E <sub>H</sub>   | tInt       | } Integer value token for 4               |
| 6      | 2    | 0004 <sub>H</sub> |            |                                           |
| 8      | 1    | 05 <sub>H</sub>   | tMul       | Multiplication operator                   |
| 9      | 1    | 1E <sub>H</sub>   | tInt       | } Integer value token for 5               |
| 10     | 2    | 0005 <sub>H</sub> |            |                                           |
| 12     | 1    | 03 <sub>H</sub>   | tAdd       | Addition operator                         |

### 3.1.6 Additional Token Data

A few tokens contain additional data that does not follow the token identifier, but is appended to the token array. Its size is *not* contained in the leading field containing the token array size. Affected tokens are the tArray token (→3.8.7), the tMemArea token (→3.9.4), and a few subtypes of the the tNlr token (→3.10.4). The additional data of each token is appended in the same order the tokens are located in the token array.

Example: The formula = { 1 } + A1 : A2 A2 : A3 + { 2 } contains 3 tokens with additional data: 2 tArray tokens representing the constant arrays, and a tMemArea token containing the result of the intersection operator (the cell reference A2). The detailed example below applies for BIFF8.

- The RPN representation of the formula is: { 1 }, A1:A2, A2:A3, “ ”, +, { 2 }, +.
- Written in Excel token notation, this is (the term A1:A2, A2:A3, “ ” is led by a tMemArea token): tArrayV({ 1 }), tMemAreaV(A2), tAreaR(A1:A2), tAreaR(A2:A3), tIsect, tAdd, tArrayV({ 2 }), tAdd.

| Offset | Size | Token name | Description                                                                                                                                         |
|--------|------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    |            | Size of the following formula data (44 bytes), <i>without</i> the additional data following the last tAdd token                                     |
| 2      | 8    | tArrayV    | Placeholder for first constant array { 1 }                                                                                                          |
| 10     | 7    | tMemAreaV  | Constant reference subexpression follows in next 19 bytes (until and including the tIsect token)                                                    |
| 17     | 9    | tAreaR     | Cell reference A1 : A2                                                                                                                              |
| 26     | 9    | tAreaR     | Cell reference A2 : A3                                                                                                                              |
| 35     | 1    | tIsect     | Intersection operator                                                                                                                               |
| 36     | 1    | tAdd       | Addition operator                                                                                                                                   |
| 37     | 8    | tArrayV    | Placeholder for second constant array { 2 }                                                                                                         |
| 45     | 1    | tAdd       | Addition operator                                                                                                                                   |
| 46     | 12   |            | Constant value array (→2.5.8) containing the values of the constant array { 1 } : contains width 1, height 1, value 1                               |
| 58     | 10   |            | Cell range address list (→2.5.15) containing the result of the reference subexpression A1 : A2 A2 : A3: a one-element list with the cell address A2 |
| 68     | 12   |            | Constant value array (→2.5.8) containing the values of the constant array { 2 } : contains width 1, height 1, value 2                               |

## 3.2 Token Classes

### 3.2.1 Classified Tokens

All function operators and most operand tokens exist in 3 different versions: as *reference class token*, *value class token*, and *array class token*. The token class depends on which type of data the involved operator expects. Sometimes only 1 or 2 token classes are valid for a token (for example, *array class tokens* cannot exist as *reference class tokens*, but they can exist as *value class tokens*).

- *Reference class token*: The reference address itself, independent of the cell contents.
- *Value class token*: A value (a constant, a function result, or one specific value from a dereferenced cell range).
- *Array class token*: An array of values (array of constant values, an array function result, or all values of a cell range).

The structure of the 8-bit identifier of a classified token is described in the following table.

| Bit | Mask            | Contents                                                                                                                                                                                                                                                              |
|-----|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4-0 | 1F <sub>H</sub> | Basic token identifier                                                                                                                                                                                                                                                |
| 6-5 | 60 <sub>H</sub> | 01 <sub>2</sub> = Reference class token (token range 20 <sub>H</sub> -3F <sub>H</sub> )<br>10 <sub>2</sub> = Value class token (token range 40 <sub>H</sub> -5F <sub>H</sub> )<br>11 <sub>2</sub> = Array class token (token range 60 <sub>H</sub> -7F <sub>H</sub> ) |
| 7   | 80 <sub>H</sub> | 0 <sub>2</sub> (zero)                                                                                                                                                                                                                                                 |

The token class is marked in the names of the tokens. The names of *reference class tokens* contain a trailing “R”, *value class tokens* contain a trailing “V”, and the names of *array class tokens* a trailing “A”.

Example: The tArea token (→3.9.3) is no specific token, but refers to the three tokens tAreaR (25<sub>H</sub>), tAreaV (45<sub>H</sub>), and tAreaA (65<sub>H</sub>).

- The tAreaR token represents the cell range address itself.
- The tAreaV token represents one value in the cell range (for example the value in the current row or column).
- The tAreaA token represents the entire array of values in the cell range.

### 3.2.2 Operand Classes

Each operator and operand has a default token class, called operand class. For operands itself, the operand class is dependent on the data the token represents. The operand class of operators is determined from its return value. For functions (tokens tFunc, →3.7.1, and tFuncVar, →3.7.2), the operand class is dependent on the value the function returns. Classified tokens can represent their operand class, other tokens cannot.

Examples for operand classes:

| Term                | Operand class | Token identifier | Description                               |
|---------------------|---------------|------------------|-------------------------------------------|
| A1                  | Reference     | tRefR            | Reference to cell A1                      |
| A1 A1               | Reference     | tIsect           | Return value of the intersection operator |
| INDEX (A1 , 1 , 1)  | Reference     | tFuncVarR        | Return value of the INDEX function        |
| 2                   | Value         | tInt             | The constant 2                            |
| 2+3                 | Value         | tAdd             | Return value of the addition operator     |
| SUM (2 , 3)         | Value         | tFuncVarV        | Return value of the SUM function          |
| { 2 , 3 }           | Array         | tArrayA          | The constant array { 2 , 3 }              |
| TREND ( { 2 , 3 } ) | Array         | tFuncVarA        | Return value of the TREND function        |



### 3.2.3 Expected Parameter Classes

Function parameters expect operands of specific operand classes. The expected token classes of all function parameters are specified in the list of built-in functions (→3.11). The result of the whole formula is handled as a parameter, called the *root level* parameter (the parameter of the equality sign). The *root level* also expects a specific token class.

Examples for function parameter classes:

- *Reference class*:  
ROW (A1) (the first parameter of the function ROW expects *reference class*, ROW (1) would produce an error).
- *Value class*:  
ABS (A1) (the first parameter of the function ABS expects *value class*, it dereferences the cell reference to a value).
- *Array class*:  
MDETERM (A1 : C3) (the first parameter of the function MDETERM expects *array class*, it dereferences the cell range to an array of values).
- *Root level*:  
=A1 (parameter is on formula root level, expected class is dependent on formula type).

### 3.2.4 Token Class Transformation

The final class of a token depends on the combination of the operand class of the token and the expected parameter class. Furthermore it is dependent on the type of the formula. There are 3 different types of formulas:

| Formula type       | Examples                                                                                    |
|--------------------|---------------------------------------------------------------------------------------------|
| Cell type formula  | Cell formulas (→4.7), shared formulas (→4.8)                                                |
| Array type formula | Array formulas (→4.8), conditional formatting (→4.12), data validity (→4.14)                |
| Name type formula  | Defined names (→4.10), reference lists (for example chart source range, form control links) |

Token class transformation is done in several steps. All steps have to be performed for each classified token in a formula.

#### • Step 1: Value Operators

If the token has *reference operand class*, and if it is a direct operand of a unary or binary value operator (tAdd, tSub, tMul, tDiv, tPower, tConcat, tLT, tLE, tEQ, tGE, tGT, tNE, tUplus, tUminus, or tPercent – the binary reference operators tRange, tList, and tIsect are *not* included here), its class will be changed to *value class*, and further handling is done regarding this new class (for example it may be changed to *array class* later).

Example: In the formula =SUM (A1 , B1+1) , the cell addresses A1 and B1 are represented by tRefR tokens. Because the second tRefR token containing B1 has *reference operand class*, and it is an operand of the addition operator, it will be changed to *value class* (tRefV). As described below, in *array type formulas* this token will be changed to *array class* then, while the *reference class* of the first tRefR(A1) token is retained.

## • Step 2: Forced Array Class

If the token is part of a function parameter (directly or indirectly, for example nested in another function), transformation of the token class is dependent on the expected token classes of all involved functions. For this purpose, a Boolean state “*forced array class*” is carried, and it will be updated whenever processing of a new function parameter is started. If this state is set to *true* already, nothing will be changed (the state is still *true*). If the state is *false*, it will be changed to *true*, if one of the following conditions is met:

- In *cell type formulas*: if the parameter expects *array class*, or
- In *array type formulas*: if the parameter expects *reference class* or *array class*, or
- In *name type formulas*: if the parameter expects *reference class* or *array class*, or if the function returns a value with *value class* or *array class*.

The *forced array class* state will be restored, when the entire function parameter is processed. The state starts with *false* at root level of all formula types.

As described below, the cell formula =ABS (A1) changes its tRefR token to value class (tRefV). The formula =MDETERM (ABS (A1) ) behaves differently: The first parameter of the MDETERM function expects *array class*. Therefore the “*forced array class*” state is set to *true*, when the parameter (the term SUM (A1) ) is started. This state is the reason that the tRefR token will be changed to *array class* (tRefA), regardless that the ABS function does not indicate this. When the parameter is completed, the *forced array class* state is restored to its old value (*false*).

## • Step 3: Token Class Transformation

Token class transformation is dependent on the expected token class of the current position in the formula.

- Current position is a function parameter expecting a *reference class token* (for example the parameters of the SUM function), or it is the *root level* of a *name type formula* (for example the return value of the outer function in a defined name):
  - *Reference class tokens* are not modified.
  - *Value class tokens* will be changed dependent on further conditions. In *array type functions* and *name type functions*, or if the *forced array class* state is set, it is changed to *array class*. In all other cases (*cell type formula* without *forced array class*), *value class* is retained.
  - *Array class tokens* are not modified.

Examples for *reference class tokens*, when *reference class* is expected:

- In the formula =SUM (A1) , the tRefR token is not modified (function parameter expects *reference class*).
- In the defined name =Sheet1!A1, the tRef3dR token is not modified (root level of a *name type formula*).

Examples for *value class tokens*, when *reference class* is expected:

- In the cell formula =SUM (PI ( ) ) , the tFuncV(PI) token is not modified (cell formula, no *forced array class*).
- In the array formula { =SUM (PI ( ) ) } , the tFuncV(PI) token is set to array class (*array type formula*).
- In the cell formula =MDETERM (SUM (PI ( ) ) ) , the tFuncV(PI) token is set to *array class* (*forced array class* in MDETERM function parameter).

Examples for *array class tokens*, when *reference class* is expected:

- In the formula =SUM ( { 1 } ) , the tArrayA token is not modified.
- In the defined name = { 1 } , the tArrayA token is not modified (root level of a *name type formula*).

- Current position is a function parameter expecting a *value class token* (for example the parameter of the ABS function), or it is the *root level* of a *cell type formula* or an *array type formula* (for example the return value of the outer function in a cell formula, a shared formula, or an array formula):
  - If the *forced array class* state is set, all tokens will be changed to *array class*, otherwise to *value class*.

Examples for token transformation, when *value class* is expected without *forced array class* state:

- In the cell formula =ABS (A1) , the tRefR token is changed to *value class* (tRefV), and the tFuncV(ABS) token keeps its *value class* (*root level* of a cell function).
- In the cell formula =ABS (PI ( ) ) , the tFuncV(PI) token keeps unchanged.
- In the cell formula =ABS ( { 1 } ) , the tArrayA token is changed to *value class* (tArrayV).

Examples for token transformation, when *value class* is expected with *forced array class* state:

- In the name formula =ABS (A1) , the tRefR token is changed to *array class* (tRefA, a *name type formula* sets the *forced array class* state for all parameters of functions returning a value).
- In the cell formula =MDETERM (ABS (A1) ) , the tRefR token is set to *array class* (tRefA, *forced array class* in MDETERM function parameter).

- Current position is a function parameter expecting an *array class token* (for example the parameter of the MDETERM function):
  - All tokens are changed to *array class*.

Examples for token transformation, when *array class* is expected:

- In the formula =MDETERM (A1) , the tRefR token is changed to *array class* (tRefA).
- In the formula =MDETERM (PI ( ) ) , the tFuncV(PI) token is changed to *array class* (tFuncA).
- In the formula =MDETERM ( { 1 } ) , the tArrayA token keeps unchanged.

### 3.2.5 Binary Reference Operators

The binary reference operators tIsect (→3.6.13), tList (→3.6.14), and tRange (→3.6.15) are always encapsulated into reference subexpression tokens (for instance tMemArea, →3.9.4, or tMemFunc, →3.9.7). These tokens will change their token class, but the operands of the reference operators will not be changed. Because these operators require *reference operands* (constant references or functions returning a reference), the actual operands of these operators always have *reference class*.

Example: The ABS function in the cell formula =ABS (A1 A1) expects *value class* for its parameter. The intersection operator tIsect and its operands are encapsulated into a tMemAreaR token, which is changed to *value class* in cell formulas. The tRefR tokens of the intersection operator are not changed.

The resulting token array of this formula is:

tMemAreaV, tRefR(A1), tRefR(A1), tIsect, tFuncV(ABS).

## 3.3 Cell Addresses in Tokens

All tokens containing cell addresses (with the two components row and column) store them in the same format. There are differences in storing relative components of an address.

### 3.3.1 Absolute and Relative Components of a Cell Address

An absolute component of an address (for example the row in B\$6) points always to the same fixed row or column. It is stored with its zero-based index (the value 0 refers to row 1 or column A).

To store a relative component (for example the column in B\$6), there are two different ways used in an Excel file:

- In method [A], the reference component is stored equally to absolute components (with its zero-based index), together with the information, that the component is relative.
- In method [B], a signed offset is stored for the reference component. The resulting address can be calculated later from the position in the current context (for example the cell position in which a defined name is used).

The following table shows which formula type in Excel uses which method to store relative components:

| Method | Formula type                                                                                         |
|--------|------------------------------------------------------------------------------------------------------|
| [A]    | Cell formulas (→4.7), array formulas (→4.8)                                                          |
| [B]    | Shared formulas (→4.8), conditional formatting (→4.12), data validity (→4.14), defined names (→4.10) |

Example for method [A]: The reference in the cell formula =C4 is stored in a tRef token (→3.9.2). Regardless of the position of the formula, the token always contains the row index 3 (zero-based index for row 4) and the column index 2 (zero-based column index for column C), together with two flags, that row and column indexes are relative. These flags are used for example when the cell is copied to another position (to adjust the relative reference components), but they do not influence the evaluation of the formula.

Example for method [B]: The reference in the condition =C4 in a conditional formatting, entered in cell A7, is stored in a tRefN token (→3.9.10). The token does not contain the address C4 itself, but the difference to the base cell A7, therefore it contains the row offset -3 (three rows up) and the column offset +2 (2 columns to the right). If the same conditional formatting is copied, the token will not be modified, because it only contains offset values, and not an explicit cell address. If it is copied for example to cell B8, the condition will refer to cell D5 (three rows up and 2 columns to the right from cell B8).

### 3.3.2 Reference Token Replacement

In formulas using method [B], several tokens are replaced by similar tokens that have the letter “N” appended to their name. Other tokens do not have such a counterpart and are used in both types of formulas (for example, tRef always uses method [A], tRefN always uses method [B], and tRef3d uses either method, dependent on the formula type). The following tables show the details.

Reference token replacement, BIFF2-BIFF4:

| Cell formulas, array formulas [A] | Defined names [B] |
|-----------------------------------|-------------------|
| tRef/tArea                        | tRefN/tAreaN      |
| tRefErr/tAreaErr                  | tRefErr/tAreaErr  |
| tMemArea                          | tMemAreaN         |
| tMemNoMem                         | tMemNoMemN        |
| tMemFunc                          | tMemFunc          |
| tMemErr                           | tMemErr           |

Reference token replacement, BIFF5-BIFF8:

| Cell formulas, array formulas [A] | Defined names [B]    | Shared formulas [B] | Conditional formatting, data validity [B] (BIFF8) |
|-----------------------------------|----------------------|---------------------|---------------------------------------------------|
| tRef/tArea                        | tRef3d/tArea3d       | tRefN/tAreaN        | tRefN/tAreaN                                      |
| tRefErr/tAreaErr                  | tRefErr3d/tAreaErr3d | tRefErr/tAreaErr    | tRefErr/tAreaErr                                  |
| tRef3d/tArea3d                    | tRef3d/tArea3d       | —                   | —                                                 |
| tRefErr3d/tAreaErr3d              | tRefErr3d/tAreaErr3d | —                   | —                                                 |
| tMemArea                          | tMemFunc             | —                   | —                                                 |
| tMemNoMem                         | tMemFunc             | —                   | —                                                 |
| tMemFunc                          | tMemFunc             | —                   | —                                                 |
| tMemErr                           | tMemErr              | —                   | —                                                 |

In BIFF5-BIFF8, the tRefN and tAreaN tokens do *not* occur, if all components of the contained cell address or cell range address are absolute. In this case, the respective tRef or tArea tokens are used.

Example: The shared formulas =A1, =\$A1, and =A\$1 (shared formulas use method [B]) use a tRefNV token. But the shared formula =\$A\$1 uses a tRefV token instead.

### 3.3.3 Cell Addresses in BIFF2-BIFF5

In the file format versions up to BIFF5, it is possible to use 16384 ( $2^{14}$ ) rows. A cell address contains the row index as a 14-bit value, the column index as an 8-bit value, and two flags. The flags, encoded into the row index, specify whether the row or column index is absolute or relative. The differences in interpreting relative indexes are described in 3.3.1.

Index to row or row offset, with embedded relative flags (16-bit value), BIFF2-BIFF5:

| Bit  | Mask              | Contents                                                                   |
|------|-------------------|----------------------------------------------------------------------------|
| 13-0 | 3FFF <sub>H</sub> | Index to row (0...16383) or row offset (method [B], -8192...8191)          |
| 14   | 4000 <sub>H</sub> | 0 = Absolute column index      1 = Relative column index, or column offset |
| 15   | 8000 <sub>H</sub> | 0 = Absolute row index      1 = Relative row index, or row offset          |

Cell address, BIFF2-BIFF5:

| Offset | Size | Contents                                                            |
|--------|------|---------------------------------------------------------------------|
| 0      | 2    | Index to row or row offset, with relative flags (see table above)   |
| 2      | 1    | Index to column (0...255) or column offset (method [B], -128...127) |

Cell range address, BIFF2-BIFF5:

| Offset | Size | Contents                                                                                |
|--------|------|-----------------------------------------------------------------------------------------|
| 0      | 2    | Index to first row or offset of first row, with relative flags (see table above)        |
| 2      | 2    | Index to last row or relative offset of last row, with relative flags (see table above) |
| 4      | 1    | Index to first column (0...255) or offset of first column (method [B], -128...127)      |
| 5      | 1    | Index to last column (0...255) or offset of last column (method [B], -128...127)        |

Example for a reference in a cell formula (method [A], token tRef): The reference B\$6 consists of the absolute row index 5 and the relative column index 1. The value of the encoded row index is 4005<sub>H</sub> (row 6, column is relative). The value of the column index is 01<sub>H</sub> (column B). Though the column is relative, the fixed index to column B is stored in cell formulas.

Example for a relative reference in a shared formula (method [B], token tRefN): The reference “decrease column by 1, absolute row 6” (which would evaluate to the address B6, if used in cell C1) consists of the absolute row index 5, and (in shared formulas) the relative column offset -1. The value of the encoded row index is 4005<sub>H</sub> (row 6, column is relative). The value of the column index is FF<sub>H</sub> (the signed offset -1).

### 3.3.4 Cell Addresses in BIFF8

From BIFF8 on, 65536 ( $2^{16}$ ) rows are available. A cell address contains the row index as a 16-bit value, the column index as an 8-bit value, and two flags. The flags are encoded into the column index (which therefore needs 2 bytes), and specify whether the row or column index is absolute or relative. The differences in interpreting relative indexes are described in 3.3.1.

Index to column or column offset, with embedded relative flags (16-bit value), BIFF8:

| Bit | Mask              | Contents                                                                   |
|-----|-------------------|----------------------------------------------------------------------------|
| 7-0 | 00FF <sub>H</sub> | Index to column (0...255) or column offset (method [B], -128...127)        |
| 14  | 4000 <sub>H</sub> | 0 = Absolute column index      1 = Relative column index, or column offset |
| 15  | 8000 <sub>H</sub> | 0 = Absolute row index      1 = Relative row index, or row offset          |

Cell address, BIFF8:

| Offset | Size | Contents                                                                |
|--------|------|-------------------------------------------------------------------------|
| 0      | 2    | Index to row (0...65535) or row offset (method [B], -32768...32767)     |
| 2      | 2    | Index to column or column offset, with relative flags (see table above) |

Cell range address, BIFF8:

| Offset | Size | Contents                                                                               |
|--------|------|----------------------------------------------------------------------------------------|
| 0      | 2    | Index to first row (0...65535) or offset of first row (method [B], -32768...32767)     |
| 2      | 2    | Index to last row (0...65535) or offset of last row (method [B], -32768...32767)       |
| 4      | 2    | Index to first column or offset of first column, with relative flags (see table above) |
| 6      | 2    | Index to last column or offset of last column, with relative flags (see table above)   |

Example for a reference in a cell formula (method [A], token tRef): The reference B\$6 consists of the absolute row index 5 and the relative column index 1. The value of the row index is 0005<sub>H</sub> (row 6). The value of the encoded column index is 4001<sub>H</sub> (column B, column is relative). Though the column is relative, the fixed index to column B is stored in cell formulas.

Example for a relative reference in a shared formula (method [B], token tRefN): The reference “decrease column by 1, absolute row 6” (which would evaluate to the address B6, if used in cell C1) consists of the absolute row index 5, and (in shared formulas) the relative column offset -1. The value of the row index is 0005<sub>H</sub> (row 6). The value of the encoded column index is 7FFF<sub>H</sub> (the signed 14-bit offset 3FFF<sub>H</sub> = -1, and the column relative flag).

## 3.4 Token Overview

Following a list of all tokens, separated into the several token types and ordered by token identifier.

### 3.4.1 Unary Operator Tokens

| Token ID        | Token name | Description  |
|-----------------|------------|--------------|
| 12 <sub>H</sub> | tUplus     | Unary plus   |
| 13 <sub>H</sub> | tUminus    | Unary minus  |
| 14 <sub>H</sub> | tPercent   | Percent sign |

### 3.4.2 Binary Operator Tokens

| Token ID        | Token name | Description             |
|-----------------|------------|-------------------------|
| 03 <sub>H</sub> | tAdd       | Addition                |
| 04 <sub>H</sub> | tSub       | Subtraction             |
| 05 <sub>H</sub> | tMul       | Multiplication          |
| 06 <sub>H</sub> | tDiv       | Division                |
| 07 <sub>H</sub> | tPower     | Exponentiation          |
| 08 <sub>H</sub> | tConcat    | Concatenation           |
| 09 <sub>H</sub> | tLT        | Less than               |
| 0A <sub>H</sub> | tLE        | Less than or equal      |
| 0B <sub>H</sub> | tEQ        | Equal                   |
| 0C <sub>H</sub> | tGE        | Greater than or equal   |
| 0D <sub>H</sub> | tGT        | Greater than            |
| 0E <sub>H</sub> | tNE        | Not equal               |
| 0F <sub>H</sub> | tIsect     | Cell range intersection |
| 10 <sub>H</sub> | tList      | Cell range list         |
| 11 <sub>H</sub> | tRange     | Cell range              |

### 3.4.3 Function Operator Tokens

| Token ID                                        | Token name | Description                                                   |
|-------------------------------------------------|------------|---------------------------------------------------------------|
| 21 <sub>H</sub> 41 <sub>H</sub> 61 <sub>H</sub> | tFunc      | Function with fixed number of arguments                       |
| 22 <sub>H</sub> 42 <sub>H</sub> 62 <sub>H</sub> | tFuncVar   | Function or macro command with variable number of arguments   |
| 38 <sub>H</sub> 58 <sub>H</sub> 78 <sub>H</sub> | tFuncCE    | Macro command with variable number of arguments (BIFF2-BIFF3) |



### 3.4.4 Constant Operand Tokens

| Token ID                                        | Token name | Description             |
|-------------------------------------------------|------------|-------------------------|
| 16 <sub>H</sub>                                 | tMissArg   | Missing argument        |
| 17 <sub>H</sub>                                 | tStr       | String constant         |
| 1C <sub>H</sub>                                 | tErr       | Error constant          |
| 1D <sub>H</sub>                                 | tBool      | Boolean constant        |
| 1E <sub>H</sub>                                 | tInt       | Integer constant        |
| 1F <sub>H</sub>                                 | tNum       | Floating-point constant |
| 20 <sub>H</sub> 40 <sub>H</sub> 60 <sub>H</sub> | tArray     | Array constant          |

### 3.4.5 Operand Tokens

| Token ID                                        | Token name | Description                                          |
|-------------------------------------------------|------------|------------------------------------------------------|
| 23 <sub>H</sub> 43 <sub>H</sub> 63 <sub>H</sub> | tName      | Internal defined name                                |
| 24 <sub>H</sub> 44 <sub>H</sub> 64 <sub>H</sub> | tRef       | 2D cell reference                                    |
| 25 <sub>H</sub> 45 <sub>H</sub> 65 <sub>H</sub> | tArea      | 2D area reference                                    |
| 26 <sub>H</sub> 46 <sub>H</sub> 66 <sub>H</sub> | tMemArea   | Constant reference subexpression                     |
| 27 <sub>H</sub> 47 <sub>H</sub> 67 <sub>H</sub> | tMemErr    | Deleted constant reference subexpression             |
| 28 <sub>H</sub> 48 <sub>H</sub> 68 <sub>H</sub> | tMemNoMem  | Incomplete constant reference subexpression          |
| 29 <sub>H</sub> 49 <sub>H</sub> 69 <sub>H</sub> | tMemFunc   | Variable reference subexpression                     |
| 2A <sub>H</sub> 4A <sub>H</sub> 6A <sub>H</sub> | tRefErr    | Deleted 2D cell reference                            |
| 2B <sub>H</sub> 4B <sub>H</sub> 6B <sub>H</sub> | tAreaErr   | Deleted 2D area reference                            |
| 2C <sub>H</sub> 4C <sub>H</sub> 6C <sub>H</sub> | tRefN      | Relative 2D cell reference                           |
| 2D <sub>H</sub> 4D <sub>H</sub> 6D <sub>H</sub> | tAreaN     | Relative 2D area reference                           |
| 2E <sub>H</sub> 4E <sub>H</sub> 6E <sub>H</sub> | tMemAreaN  | Relative constant reference subexpression            |
| 2F <sub>H</sub> 4F <sub>H</sub> 6F <sub>H</sub> | tMemNoMemN | Incomplete relative constant reference subexpression |
| 39 <sub>H</sub> 59 <sub>H</sub> 79 <sub>H</sub> | tNameX     | External name (BIFF5-BIFF8)                          |
| 3A <sub>H</sub> 5A <sub>H</sub> 7A <sub>H</sub> | tRef3d     | 3D cell reference (BIFF5-BIFF8)                      |
| 3B <sub>H</sub> 5B <sub>H</sub> 7B <sub>H</sub> | tArea3d    | 3D area reference (BIFF5-BIFF8)                      |
| 3C <sub>H</sub> 5C <sub>H</sub> 7C <sub>H</sub> | tRefErr3d  | Deleted 3D cell reference (BIFF5-BIFF8)              |
| 3D <sub>H</sub> 5D <sub>H</sub> 7D <sub>H</sub> | tAreaErr3d | Deleted 3D area reference (BIFF5-BIFF8)              |

### 3.4.6 Control Tokens, Special Tokens

| Token ID        | Token name | Description                                     |
|-----------------|------------|-------------------------------------------------|
| 01 <sub>H</sub> | tExp       | Matrix formula or shared formula                |
| 02 <sub>H</sub> | tTbl       | Multiple operation table                        |
| 15 <sub>H</sub> | tParen     | Parentheses                                     |
| 18 <sub>H</sub> | tNlr       | Natural language reference (BIFF8)              |
| 19 <sub>H</sub> | tAttr      | Special attribute                               |
| 1A <sub>H</sub> | tSheet     | Start of external sheet reference (BIFF2-BIFF4) |
| 1B <sub>H</sub> | tEndSheet  | End of external sheet reference (BIFF2-BIFF4)   |

### 3.4.7 Overview, Ordered by Token Identifiers

The following table shows all tokens, ordered by their identifiers, together with their sizes in bytes. The sizes include the token identifier. Note that the tStr token, the tNlr token, and the tAttr token do not have a fixed size.

#### • Base Tokens (00<sub>H</sub>–1F<sub>H</sub>)

| Token ID        | Token name      | BIFF2 | BIFF3 | BIFF4 | BIFF5/7 | BIFF8 |
|-----------------|-----------------|-------|-------|-------|---------|-------|
| 00 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 01 <sub>H</sub> | tExp            | 4     | 5     | 5     | 5       | 5     |
| 02 <sub>H</sub> | tTbl            | 4     | 5     | 5     | 5       | 5     |
| 03 <sub>H</sub> | tAdd            | 1     | 1     | 1     | 1       | 1     |
| 04 <sub>H</sub> | tSub            | 1     | 1     | 1     | 1       | 1     |
| 05 <sub>H</sub> | tMul            | 1     | 1     | 1     | 1       | 1     |
| 06 <sub>H</sub> | tDiv            | 1     | 1     | 1     | 1       | 1     |
| 07 <sub>H</sub> | tPower          | 1     | 1     | 1     | 1       | 1     |
| 08 <sub>H</sub> | tConcat         | 1     | 1     | 1     | 1       | 1     |
| 09 <sub>H</sub> | tLT             | 1     | 1     | 1     | 1       | 1     |
| 0A <sub>H</sub> | tLE             | 1     | 1     | 1     | 1       | 1     |
| 0B <sub>H</sub> | tEQ             | 1     | 1     | 1     | 1       | 1     |
| 0C <sub>H</sub> | tGE             | 1     | 1     | 1     | 1       | 1     |
| 0D <sub>H</sub> | tGT             | 1     | 1     | 1     | 1       | 1     |
| 0E <sub>H</sub> | tNE             | 1     | 1     | 1     | 1       | 1     |
| 0F <sub>H</sub> | tIsect          | 1     | 1     | 1     | 1       | 1     |
| 10 <sub>H</sub> | tList           | 1     | 1     | 1     | 1       | 1     |
| 11 <sub>H</sub> | tRange          | 1     | 1     | 1     | 1       | 1     |
| 12 <sub>H</sub> | tUplus          | 1     | 1     | 1     | 1       | 1     |
| 13 <sub>H</sub> | tUminus         | 1     | 1     | 1     | 1       | 1     |
| 14 <sub>H</sub> | tPercent        | 1     | 1     | 1     | 1       | 1     |
| 15 <sub>H</sub> | tParen          | 1     | 1     | 1     | 1       | 1     |
| 16 <sub>H</sub> | tMissArg        | 1     | 1     | 1     | 1       | 1     |
| 17 <sub>H</sub> | tStr            | var.  | var.  | var.  | var.    | var.  |
| 18 <sub>H</sub> | tNlr            | —     | —     | —     | —       | var.  |
| 19 <sub>H</sub> | tAttr           | var.  | var.  | var.  | var.    | var.  |
| 1A <sub>H</sub> | tSheet          | 8     | 11    | 11    | —       | —     |
| 1B <sub>H</sub> | tEndSheet       | 4     | 5     | 5     | —       | —     |
| 1C <sub>H</sub> | tErr            | 2     | 2     | 2     | 2       | 2     |
| 1D <sub>H</sub> | tBool           | 2     | 2     | 2     | 2       | 2     |
| 1E <sub>H</sub> | tInt            | 3     | 3     | 3     | 3       | 3     |
| 1F <sub>H</sub> | tNum            | 9     | 9     | 9     | 9       | 9     |

- **Classified Tokens (20<sub>H</sub>–7F<sub>H</sub>)**

| Token ID                                        | Token name      | BIFF2 | BIFF3 | BIFF4 | BIFF5/7 | BIFF8 |
|-------------------------------------------------|-----------------|-------|-------|-------|---------|-------|
| 20 <sub>H</sub> 40 <sub>H</sub> 60 <sub>H</sub> | tArray          | 7     | 8     | 8     | 8       | 8     |
| 21 <sub>H</sub> 41 <sub>H</sub> 61 <sub>H</sub> | tFunc           | 3     | 3     | 4     | 4       | 4     |
| 22 <sub>H</sub> 42 <sub>H</sub> 62 <sub>H</sub> | tFuncVar        | 4     | 4     | 5     | 5       | 5     |
| 23 <sub>H</sub> 43 <sub>H</sub> 63 <sub>H</sub> | tName           | 8     | 11    | 11    | 15      | 5     |
| 24 <sub>H</sub> 44 <sub>H</sub> 64 <sub>H</sub> | tRef            | 4     | 4     | 4     | 4       | 5     |
| 25 <sub>H</sub> 45 <sub>H</sub> 65 <sub>H</sub> | tArea           | 7     | 7     | 7     | 7       | 9     |
| 26 <sub>H</sub> 46 <sub>H</sub> 66 <sub>H</sub> | tMemArea        | 5     | 7     | 7     | 7       | 7     |
| 27 <sub>H</sub> 47 <sub>H</sub> 67 <sub>H</sub> | tMemErr         | 5     | 7     | 7     | 7       | 7     |
| 28 <sub>H</sub> 48 <sub>H</sub> 68 <sub>H</sub> | tMemNoMem       | 5     | 7     | 7     | 7       | 7     |
| 29 <sub>H</sub> 49 <sub>H</sub> 69 <sub>H</sub> | tMemFunc        | 2     | 3     | 3     | 3       | 3     |
| 2A <sub>H</sub> 4A <sub>H</sub> 6A <sub>H</sub> | tRefErr         | 4     | 4     | 4     | 4       | 5     |
| 2B <sub>H</sub> 4B <sub>H</sub> 6B <sub>H</sub> | tAreaErr        | 7     | 7     | 7     | 7       | 9     |
| 2C <sub>H</sub> 4C <sub>H</sub> 6C <sub>H</sub> | tRefN           | 4     | 4     | 4     | 4       | 5     |
| 2D <sub>H</sub> 4D <sub>H</sub> 6D <sub>H</sub> | tAreaN          | 7     | 7     | 7     | 7       | 9     |
| 2E <sub>H</sub> 4E <sub>H</sub> 6E <sub>H</sub> | tMemAreaN       | 2     | 3     | 3     | 3       | 3     |
| 2F <sub>H</sub> 4F <sub>H</sub> 6F <sub>H</sub> | tMemNoMemN      | 2     | 3     | 3     | 3       | 3     |
| 30 <sub>H</sub> 50 <sub>H</sub> 70 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 31 <sub>H</sub> 51 <sub>H</sub> 71 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 32 <sub>H</sub> 52 <sub>H</sub> 72 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 33 <sub>H</sub> 53 <sub>H</sub> 73 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 34 <sub>H</sub> 54 <sub>H</sub> 74 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 35 <sub>H</sub> 55 <sub>H</sub> 75 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 36 <sub>H</sub> 56 <sub>H</sub> 76 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 37 <sub>H</sub> 57 <sub>H</sub> 77 <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 38 <sub>H</sub> 58 <sub>H</sub> 78 <sub>H</sub> | tFuncCE         | 3     | 3     | —     | —       | —     |
| 39 <sub>H</sub> 59 <sub>H</sub> 79 <sub>H</sub> | tNameX          | —     | —     | —     | 25      | 7     |
| 3A <sub>H</sub> 5A <sub>H</sub> 7A <sub>H</sub> | tRef3d          | —     | —     | —     | 18      | 7     |
| 3B <sub>H</sub> 5B <sub>H</sub> 7B <sub>H</sub> | tArea3d         | —     | —     | —     | 21      | 11    |
| 3C <sub>H</sub> 5C <sub>H</sub> 7C <sub>H</sub> | tRefErr3d       | —     | —     | —     | 18      | 7     |
| 3D <sub>H</sub> 5D <sub>H</sub> 7D <sub>H</sub> | tAreaErr3d      | —     | —     | —     | 21      | 11    |
| 3E <sub>H</sub> 5E <sub>H</sub> 7E <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |
| 3F <sub>H</sub> 5F <sub>H</sub> 7F <sub>H</sub> | <i>Not used</i> | —     | —     | —     | —       | —     |

## 3.5 Unary Operator Tokens

Unary operators perform an operation with the topmost operand from stack. The tokens do not contain any additional data.

### 3.5.1 tUplus (12<sub>H</sub>)

Unary plus operator. This operator has no effect on the operand. Operand class: *value*.

Token tUplus, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 12 <sub>H</sub> |

Example: +A1 returns the value of cell A1.

### 3.5.2 tUminus (13<sub>H</sub>)

Unary minus operator. Negates the operand. Operand class: *value*.

Token tUminus, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 13 <sub>H</sub> |

Example: -A1 returns the negated value of cell A1.

### 3.5.3 tPercent (14<sub>H</sub>)

Percent sign. Divides the operand by 100. Operand class: *value*.

Token tPercent, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 14 <sub>H</sub> |

Example: 1% returns 0.01.

## 3.6 Binary Operator Tokens

Binary operators perform an operation with the two topmost operands from stack. The tokens do not contain any additional data.

### 3.6.1 tAdd (03<sub>H</sub>)

Addition operator. Adds the operands. Operand class: *value*.

Token tAdd, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 03 <sub>H</sub> |

Example: 3+2 returns 5.

### 3.6.2 tSub (04<sub>H</sub>)

Subtraction operator. Subtracts the top operand from the second-to-top operand. Operand class: *value*.

Token tSub, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 04 <sub>H</sub> |

Example: 3-2 returns 1.

### 3.6.3 tMul (05<sub>H</sub>)

Multiplication operator. Multiplies the operands. Operand class: *value*.

Token tMul, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 05 <sub>H</sub> |

Example: 3\*2 returns 6.

### 3.6.4 tDiv (06<sub>H</sub>)

Division operator. Divides the second-to-top operand by the top operand. Operand class: *value*.

Token tDiv, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 06 <sub>H</sub> |

Example: 3/2 returns 1.5.

### 3.6.5 tPower (07<sub>H</sub>)

Exponentiation operator. Raises the second-to-top operand to the power of the top operand. Operand class: *value*.

Token tPower, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 07 <sub>H</sub> |

Example:  $3^2$  returns 9.

### 3.6.6 tConcat (08<sub>H</sub>)

Concatenation operator. Appends the top operand to the second-to-top operand. Operand class: *value*.

Token tConcat, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 08 <sub>H</sub> |

Example: "ABC"&"DEF" returns "ABCDEF".

### 3.6.7 tLT (09<sub>H</sub>)

Less than operator. Returns TRUE if the second-to-top operand is less than the top operand. Operand class: *value*.

Token tLT, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 09 <sub>H</sub> |

Example:  $3 < 2$  returns FALSE.

### 3.6.8 tLE (0A<sub>H</sub>)

Less than or equal operator. Returns TRUE if the second-to-top operand is less than or equal to the top operand. Operand class: *value*.

Token tLE, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 0A <sub>H</sub> |

Example:  $3 \leq 2$  returns FALSE.

### 3.6.9 tEQ (0B<sub>H</sub>)

Equality operator. Returns TRUE if the operands are equal. Operand class: *value*.

Token tEQ, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 0B <sub>H</sub> |

Example: 3=2 returns FALSE.

### 3.6.10 tGE (0C<sub>H</sub>)

Greater than or equal operator. Returns TRUE if the second-to-top operand is greater than or equal to the top operand. Operand class: *value*.

Token tGE, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 0C <sub>H</sub> |

Example: 3>=2 returns TRUE.

### 3.6.11 tGT (0D<sub>H</sub>)

Greater than operator. Returns TRUE if the second-to-top operand is greater than the top operand. Operand class: *value*.

Token tGT, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 0D <sub>H</sub> |

Example: 3>2 returns TRUE.

### 3.6.12 tNE (0E<sub>H</sub>)

Inequality operator. Returns TRUE if the operands are not equal. Operand class: *value*.

Token tNE, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 0E <sub>H</sub> |

Example: 3<>2 returns TRUE.

### 3.6.13 tIsect (0F<sub>H</sub>)

Intersection operator, represented by the space sign. Returns the intersected range of two ranges. If the resulting cell range is empty, the formula will return the error code “#NULL!” (for instance A1:A2 B3). This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tIsect, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 0F <sub>H</sub> |

Example: A1:B3 B2:C3 returns B2:B3.

### 3.6.14 tList (10<sub>H</sub>)

Range list operator, represented by the system's list separator sign (for example comma sign). Treats two ranges as one operator. This might be useful for function parameters. Note: This is *not* a union operator. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tList, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 10 <sub>H</sub> |

Example: (A1:A2, A2:A3) will be handled as one operand. Cell A2 will be handled twice, therefore this is a range list operator, *no* union operator.

### 3.6.15 tRange (11<sub>H</sub>)

Range operator, represented by the colon sign. Returns the minimal rectangular range that contains both parameters. This token occurs for instance by using defined names. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tRange, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 11 <sub>H</sub> |

Example: namedcell:D5 returns A1:D5, if the defined name namedcell contains A1:B2.



## 3.7 Function Operator Tokens

The reference class of function operator tokens depend on the function itself and on the position of the function inside of the formula (for instance the expected class for the current parameter of an enclosing function).

### 3.7.1 tFunc (21<sub>H</sub>, 41<sub>H</sub>, 61<sub>H</sub>)

This token contains the index to a built-in function with fixed number of arguments. The operand class is dependent on the return type of the function.

Token tFunc, BIFF2-BIFF3:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 21 <sub>H</sub> (tFuncR), 41 <sub>H</sub> (tFuncV), 61 <sub>H</sub> (tFuncA) |
| 1      | 1    | Index to a built-in sheet function (→3.11)                                   |

Token tFunc, BIFF4-BIFF8:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 21 <sub>H</sub> (tFuncR), 41 <sub>H</sub> (tFuncV), 61 <sub>H</sub> (tFuncA) |
| 1      | 2    | Index to a built-in sheet function (→3.11)                                   |

### 3.7.2 tFuncVar (22<sub>H</sub>, 42<sub>H</sub>, 62<sub>H</sub>)

This token contains the index to a built-in function or a macro command with variable number of arguments. The operand class is dependent on the return type of the function.

Token tFuncVar, BIFF2-BIFF3:

| Offset | Size | Contents                                                                              |
|--------|------|---------------------------------------------------------------------------------------|
| 0      | 1    | 22 <sub>H</sub> (tFuncVarR), 42 <sub>H</sub> (tFuncVarV), 62 <sub>H</sub> (tFuncVarA) |
| 1      | 1    | Number of arguments                                                                   |
| 2      | 1    | Index to a built-in sheet function (→3.11)                                            |

Token tFuncVar, BIFF4-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                           |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
|--------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|------|-------------------|---------------------------------------------------------------|----|-------------------|------------------------------------------------------------------------------------------|
| 0      | 1                 | 22 <sub>H</sub> (tFuncVarR), 42 <sub>H</sub> (tFuncVarV), 62 <sub>H</sub> (tFuncVarA)                                                                                                                                                                                                                                                              |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
| 1      | 1                 | Number of arguments                                                                                                                                                                                                                                                                                                                                |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>6-0</td> <td>7F<sub>H</sub></td> <td>Number of arguments</td> </tr> <tr> <td>7</td> <td>80<sub>H</sub></td> <td>1 = User prompt for macro commands (shown by a question mark following the command name)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 6-0  | 7F <sub>H</sub>   | Number of arguments                                           | 7  | 80 <sub>H</sub>   | 1 = User prompt for macro commands (shown by a question mark following the command name) |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                           |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
| 6-0    | 7F <sub>H</sub>   | Number of arguments                                                                                                                                                                                                                                                                                                                                |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
| 7      | 80 <sub>H</sub>   | 1 = User prompt for macro commands (shown by a question mark following the command name)                                                                                                                                                                                                                                                           |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
| 2      | 2                 | Index to a sheet function                                                                                                                                                                                                                                                                                                                          |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>14-0</td> <td>7FFF<sub>H</sub></td> <td>Index to a built-in sheet function (→3.11) or a macro command</td> </tr> <tr> <td>15</td> <td>8000<sub>H</sub></td> <td>0 = Built-in function; 1 = Macro command</td> </tr> </tbody> </table> | Bit | Mask | Contents | 14-0 | 7FFF <sub>H</sub> | Index to a built-in sheet function (→3.11) or a macro command | 15 | 8000 <sub>H</sub> | 0 = Built-in function; 1 = Macro command                                                 |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                           |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
| 14-0   | 7FFF <sub>H</sub> | Index to a built-in sheet function (→3.11) or a macro command                                                                                                                                                                                                                                                                                      |     |      |          |      |                   |                                                               |    |                   |                                                                                          |
| 15     | 8000 <sub>H</sub> | 0 = Built-in function; 1 = Macro command                                                                                                                                                                                                                                                                                                           |     |      |          |      |                   |                                                               |    |                   |                                                                                          |

### 3.7.3 tFuncCE (38<sub>H</sub>, 58<sub>H</sub>, 78<sub>H</sub>)

This token contains the index to a macro sheet command. From BIFF4 on, macro commands are represented by tFuncVar tokens (→3.7.2). Operand class: *reference*.

Token tFuncCE, BIFF2-BIFF3:

| Offset | Size | Contents                                                                           |
|--------|------|------------------------------------------------------------------------------------|
| 0      | 1    | 38 <sub>H</sub> (tFuncCER), 58 <sub>H</sub> (tFuncCEV), 78 <sub>H</sub> (tFuncCEA) |
| 1      | 1    | Number of arguments                                                                |
| 2      | 1    | Index to a macro sheet command                                                     |

## 3.8 Constant Operand Tokens

### 3.8.1 tMissArg (16<sub>H</sub>)

A missing argument in a function argument list is stored as a tMissArg token. Operand class: *value*.

Token tMissArg, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 16 <sub>H</sub> |

Example: SUM ( 1 , , 3 ) – Second argument is missing and represented by a tMissArg token.

### 3.8.2 tStr (17<sub>H</sub>)

This token contains a string constant. The maximum length of the string is 253 characters in BIFF2 (due to the limitation of 255 bytes per formula) and 255 characters in BIFF3-BIFF8. Operand class: *value*.

Token tStr, BIFF2-BIFF5:

| Offset | Size | Contents                                  |
|--------|------|-------------------------------------------|
| 0      | 1    | 17 <sub>H</sub>                           |
| 1      | var. | Byte string, 8-bit string length (→2.5.2) |

Token tStr, BIFF8:

| Offset | Size | Contents                                                                |
|--------|------|-------------------------------------------------------------------------|
| 0      | 1    | 17 <sub>H</sub>                                                         |
| 1      | var. | Unicode string, 8-bit string length, option flags occur always (→2.5.3) |

Example: LEN ( "ABC" ) – The string constant "ABC" is represented by a tStr token.

### 3.8.3 tErr (1C<sub>H</sub>)

This token contains an error code. Operand class: *value*.

Token tErr, BIFF2-BIFF8:

| Offset | Size | Contents            |
|--------|------|---------------------|
| 0      | 1    | 1C <sub>H</sub>     |
| 1      | 1    | Error code (→2.5.6) |

Example: ERROR . TYPE ( #N/A ) – The constant error code #N/A is represented by a tErr token.

### 3.8.4 tBool (1D<sub>H</sub>)

This token contains a Boolean value (TRUE or FALSE). Operand class: *value*.

Token tBool, BIFF2-BIFF8:

| Offset | Size | Contents            |
|--------|------|---------------------|
| 0      | 1    | 1D <sub>H</sub>     |
| 1      | 1    | 0 = FALSE, 1 = TRUE |

Example: IF (A1<0, FALSE, TRUE) – The constants FALSE and TRUE are represented by tBool tokens.

### 3.8.5 tInt (1E<sub>H</sub>)

This token contains an unsigned 16-bit integer value in the range from 0 to 65535. Operand class: *value*.

Token tInt, BIFF2-BIFF8:

| Offset | Size | Contents               |
|--------|------|------------------------|
| 0      | 1    | 1E <sub>H</sub>        |
| 1      | 2    | Unsigned integer value |

Example: 3+2.2222 – The constant 3 is represented by a tInt token.

### 3.8.6 tNum (1F<sub>H</sub>)

This token contains a floating-point number. Operand class: *value*.

Token tNum, BIFF2-BIFF8:

| Offset | Size | Contents                                                             |
|--------|------|----------------------------------------------------------------------|
| 0      | 1    | 1F <sub>H</sub>                                                      |
| 1      | 8    | IEEE 754 floating-point value (64-bit double precision) <sup>7</sup> |

Example: 3+2.2222 – The constant 2.2222 is represented by a tNum token.

<sup>7</sup> For details about the internal structure of floating-point values see [http://en.wikipedia.org/wiki/IEEE\\_floating-point\\_standard](http://en.wikipedia.org/wiki/IEEE_floating-point_standard).

### 3.8.7 tArray (20<sub>H</sub>, 40<sub>H</sub>, 60<sub>H</sub>)

This token contains an array constant. For instance the 2x1 matrix { 1 ; 2 } is an array constant. The values of the array constant do not follow the token identifier but are stored behind the complete token array (→3.1.6) in a constant value array(→2.5.8). This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *array*.

Token tArray, BIFF2:

| Offset | Size | Contents                                                                        |
|--------|------|---------------------------------------------------------------------------------|
| 0      | 1    | 20 <sub>H</sub> (tArrayR), 40 <sub>H</sub> (tArrayV), 60 <sub>H</sub> (tArrayA) |
| 1      | 6    | Not used                                                                        |

Token tArray, BIFF3-BIFF8:

| Offset | Size | Contents                                                                        |
|--------|------|---------------------------------------------------------------------------------|
| 0      | 1    | 20 <sub>H</sub> (tArrayR), 40 <sub>H</sub> (tArrayV), 60 <sub>H</sub> (tArrayA) |
| 1      | 7    | Not used                                                                        |

Example: MDETERM ( { 1 , 2 ; 3 , 4 } ) – The constant { 1 , 2 ; 3 , 4 } is represented by a tArrayA token.

## 3.9 Operand Tokens

### 3.9.1 tName (23<sub>H</sub>, 43<sub>H</sub>, 63<sub>H</sub>)

This token contains the *one-based* index to a DEFINEDNAME record (→5.33). In BIFF2-BIFF4 this could be the index to an EXTERNALNAME record (→5.39) too. From BIFF5 on an external name or an internal name with explicit sheet name (for example “Sheet1!localname”) is represented by the token tNameX (→3.9.14). If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tName, BIFF2:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 23 <sub>H</sub> (tNameR), 43 <sub>H</sub> (tNameV), 63 <sub>H</sub> (tNameA) |
| 1      | 2    | <i>One-based</i> index to DEFINEDNAME (→5.33) or EXTERNALNAME record (→5.39) |
| 3      | 5    | Not used                                                                     |

Token tName, BIFF3-BIFF4:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 23 <sub>H</sub> (tNameR), 43 <sub>H</sub> (tNameV), 63 <sub>H</sub> (tNameA) |
| 1      | 2    | <i>One-based</i> index to DEFINEDNAME (→5.33) or EXTERNALNAME record (→5.39) |
| 3      | 8    | Not used                                                                     |

Token tName, BIFF5:

| Offset | Size | Contents                                                                                       |
|--------|------|------------------------------------------------------------------------------------------------|
| 0      | 1    | 23 <sub>H</sub> (tNameR), 43 <sub>H</sub> (tNameV), 63 <sub>H</sub> (tNameA)                   |
| 1      | 2    | <i>One-based</i> index to DEFINEDNAME record (→5.33) in the <i>Global Link Table</i> (→4.10.2) |
| 3      | 12   | Not used                                                                                       |

Token tName, BIFF8:

| Offset | Size | Contents                                                                                |
|--------|------|-----------------------------------------------------------------------------------------|
| 0      | 1    | 23 <sub>H</sub> (tNameR), 43 <sub>H</sub> (tNameV), 63 <sub>H</sub> (tNameA)            |
| 1      | 2    | <i>One-based</i> index to DEFINEDNAME record (→5.33) in the <i>Link Table</i> (→4.10.3) |
| 3      | 2    | Not used                                                                                |

### 3.9.2 tRef (24<sub>H</sub>, 44<sub>H</sub>, 64<sub>H</sub>)

This token contains the reference to a cell in the same sheet. Operand class: *reference*.

Token tRef, BIFF2-BIFF5:

| Offset | Size | Contents                                                                  |
|--------|------|---------------------------------------------------------------------------|
| 0      | 1    | 24 <sub>H</sub> (tRefR), 44 <sub>H</sub> (tRefV), 64 <sub>H</sub> (tRefA) |
| 1      | 3    | Encoded cell address (→3.3.3)                                             |

Token tRef, BIFF8:

| Offset | Size | Contents                                                                  |
|--------|------|---------------------------------------------------------------------------|
| 0      | 1    | 24 <sub>H</sub> (tRefR), 44 <sub>H</sub> (tRefV), 64 <sub>H</sub> (tRefA) |
| 1      | 4    | Encoded cell address (→3.3.4)                                             |

### 3.9.3 tArea (25<sub>H</sub>, 45<sub>H</sub>, 65<sub>H</sub>)

This token contains the reference to a cell range in the same sheet. Operand class: *reference*.

Token tArea, BIFF2-BIFF5:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 25 <sub>H</sub> (tAreaR), 45 <sub>H</sub> (tAreaV), 65 <sub>H</sub> (tAreaA) |
| 1      | 6    | Encoded cell range address (→3.3.3)                                          |

Token tArea, BIFF8:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 25 <sub>H</sub> (tAreaR), 45 <sub>H</sub> (tAreaV), 65 <sub>H</sub> (tAreaA) |
| 1      | 8    | Encoded cell range address (→3.3.4)                                          |

### 3.9.4 tMemArea (26<sub>H</sub>, 46<sub>H</sub>, 66<sub>H</sub>)

This token encapsulates a reference subexpression (→3.2.5) that results in a constant cell address, cell range address, or cell range list on the same sheet. The token provides the result of the reference subexpression in a cell range address list (→2.5.15). This list does not follow the token identifier, but is stored behind the complete token array (→3.1.6).

The tMemArea token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tMemArea, BIFF2:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 26 <sub>H</sub> (tMemAreaR), 46 <sub>H</sub> (tMemAreaV), 66 <sub>H</sub> (tMemAreaA)       |
| 1      | 3    | Not used                                                                                    |
| 4      | 1    | Size of the following reference subexpression (all reference operators with their operands) |

Token tMemArea, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 26 <sub>H</sub> (tMemAreaR), 46 <sub>H</sub> (tMemAreaV), 66 <sub>H</sub> (tMemAreaA)       |
| 1      | 4    | Not used                                                                                    |
| 5      | 2    | Size of the following reference subexpression (all reference operators with their operands) |

Examples for constant reference subexpressions represented by a tMemArea token:

| Reference subexpression | Resulting cell range address list |
|-------------------------|-----------------------------------|
| A1:B2 B2:C3             | B2                                |
| A1:B2:B2:C3             | A1:C3                             |
| (A1:B2, B2:C3)          | A1:B2, B2:C3                      |
| (A1:B2, B2:C3) B1:B3    | B1:B2, B2:B3                      |

### 3.9.5 tMemErr (27<sub>H</sub>, 47<sub>H</sub>, 67<sub>H</sub>)

This token encapsulates a reference subexpression (→3.2.5) that results in an erroneous cell range list on the same sheet. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tMemErr, BIFF2:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 27 <sub>H</sub> (tMemErrR), 47 <sub>H</sub> (tMemErrV), 67 <sub>H</sub> (tMemErrA)          |
| 1      | 3    | Not used                                                                                    |
| 4      | 1    | Size of the following reference subexpression (all reference operators with their operands) |

Token tMemArea, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 27 <sub>H</sub> (tMemErrR), 47 <sub>H</sub> (tMemErrV), 67 <sub>H</sub> (tMemErrA)          |
| 1      | 4    | Not used                                                                                    |
| 5      | 2    | Size of the following reference subexpression (all reference operators with their operands) |

Examples for erroneous reference subexpressions represented by a tMemErr token:

| Reference subexpression | Reason for the error                                                |
|-------------------------|---------------------------------------------------------------------|
| A1:B2 C3:D4             | Intersection results in an empty cell range list (#NULL! error)     |
| (A1:B2, #REF!)          | One of the references is invalid (for example after deleting a row) |

### 3.9.6 tMemNoMem (28<sub>H</sub>, 48<sub>H</sub>, 68<sub>H</sub>)

Whenever a tMemArea token (→3.9.4) should be created (containing the result cell range list of a reference subexpression, →3.2.5), but there was not enough memory to calculate that resulting cell range list, a tMemNoMem token is used instead. Its contents are equal to the tMemArea token but it does not append a cell range list to the token array.

This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tMemNoMem, BIFF2:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 28 <sub>H</sub> (tMemNoMemR), 48 <sub>H</sub> (tMemNoMemV), 68 <sub>H</sub> (tMemNoMemA)    |
| 1      | 3    | Not used                                                                                    |
| 4      | 1    | Size of the following reference subexpression (all reference operators with their operands) |

Token tMemNoMem, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 28 <sub>H</sub> (tMemNoMemR), 48 <sub>H</sub> (tMemNoMemV), 68 <sub>H</sub> (tMemNoMemA)    |
| 1      | 4    | Not used                                                                                    |
| 5      | 2    | Size of the following reference subexpression (all reference operators with their operands) |



### 3.9.7 tMemFunc (29<sub>H</sub>, 49<sub>H</sub>, 69<sub>H</sub>)

This token encapsulates a reference subexpression (→3.2.5) that results in a non-constant cell address, cell range address, or cell range list. Whenever one operand of the reference subexpression is a function, a defined name, a 3D reference, or an external reference (and no error occurs), a tMemFunc token is used.

This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tMemFunc, BIFF2:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 29 <sub>H</sub> (tMemFuncR), 49 <sub>H</sub> (tMemFuncV), 69 <sub>H</sub> (tMemFuncA)       |
| 1      | 1    | Size of the following reference subexpression (all reference operators with their operands) |

Token tMemFunc, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 29 <sub>H</sub> (tMemFuncR), 49 <sub>H</sub> (tMemFuncV), 69 <sub>H</sub> (tMemFuncA)       |
| 1      | 2    | Size of the following reference subexpression (all reference operators with their operands) |

Examples for non-constant reference subexpressions represented by a tMemFunc token:

| Reference subexpression | Description             |
|-------------------------|-------------------------|
| A1:B2 myname            | Defined name used       |
| A1:INDEX(A2;1;1)        | Function used           |
| (A1:B2,Sheet2!C3)       | 3D reference used       |
| (A1:B2,extfile.xls!C3)  | External reference used |

### 3.9.8 tRefErr (2A<sub>H</sub>, 4A<sub>H</sub>, 6A<sub>H</sub>)

This token contains the last reference to a deleted cell in the same sheet. Operand class: *reference*.

Token tRefErr, BIFF2-BIFF5:

| Offset | Size | Contents                                                                           |
|--------|------|------------------------------------------------------------------------------------|
| 0      | 1    | 2A <sub>H</sub> (tRefErrR), 4A <sub>H</sub> (tRefErrV), 6A <sub>H</sub> (tRefErrA) |
| 1      | 3    | Not used                                                                           |

Token tRefErr, BIFF8:

| Offset | Size | Contents                                                                           |
|--------|------|------------------------------------------------------------------------------------|
| 0      | 1    | 2A <sub>H</sub> (tRefErrR), 4A <sub>H</sub> (tRefErrV), 6A <sub>H</sub> (tRefErrA) |
| 1      | 4    | Not used                                                                           |

### 3.9.9 tAreaErr (2B<sub>H</sub>, 4B<sub>H</sub>, 6B<sub>H</sub>)

This token contains the last reference to a deleted cell range in the same sheet. Operand class: *reference*.

Token tAreaErr, BIFF2-BIFF5:

| Offset | Size | Contents                                                                              |
|--------|------|---------------------------------------------------------------------------------------|
| 0      | 1    | 2B <sub>H</sub> (tAreaErrR), 4B <sub>H</sub> (tAreaErrV), 6B <sub>H</sub> (tAreaErrA) |
| 1      | 6    | Not used                                                                              |

Token tAreaErr, BIFF8:

| Offset | Size | Contents                                                                              |
|--------|------|---------------------------------------------------------------------------------------|
| 0      | 1    | 2B <sub>H</sub> (tAreaErrR), 4B <sub>H</sub> (tAreaErrV), 6B <sub>H</sub> (tAreaErrA) |
| 1      | 8    | Not used                                                                              |

### 3.9.10 tRefN (2C<sub>H</sub>, 4C<sub>H</sub>, 6C<sub>H</sub>)

This token contains the relative reference to a cell in the same sheet. It stores relative components as signed offsets and is used in defined names (BIFF2-BIFF4), shared formulas, conditional formatting, and data validity. If all components of the cell address are absolute, a tRef token (→3.9.2) is used instead. For more details see →3.3.1 and →3.3.2. Operand class: *reference*.

Token tRefN, BIFF2-BIFF5:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 2C <sub>H</sub> (tRefNR), 4C <sub>H</sub> (tRefNV), 6C <sub>H</sub> (tRefNA) |
| 1      | 3    | Encoded cell address (→3.3.3)                                                |

Token tRefN, BIFF8:

| Offset | Size | Contents                                                                     |
|--------|------|------------------------------------------------------------------------------|
| 0      | 1    | 2C <sub>H</sub> (tRefNR), 4C <sub>H</sub> (tRefNV), 6C <sub>H</sub> (tRefNA) |
| 1      | 4    | Encoded cell address (→3.3.4)                                                |

### 3.9.11 tAreaN (2D<sub>H</sub>, 4D<sub>H</sub>, 6D<sub>H</sub>)

This token contains the relative reference to a cell range in the same sheet. It stores relative components as signed offsets and is used in defined names (BIFF2-BIFF4), shared formulas, conditional formatting, and data validity. If all components of the cell range address are absolute, a tArea token (→3.9.3) is used instead. For more details see →3.3.1 and →3.3.2. Operand class: *reference*.

Token tAreaN, BIFF2-BIFF5:

| Offset | Size | Contents                                                                        |
|--------|------|---------------------------------------------------------------------------------|
| 0      | 1    | 2D <sub>H</sub> (tAreaNR), 4D <sub>H</sub> (tAreaNV), 6D <sub>H</sub> (tAreaNA) |
| 1      | 6    | Encoded cell range address (→3.3.3)                                             |

Token tAreaN, BIFF8:

| Offset | Size | Contents                                                                        |
|--------|------|---------------------------------------------------------------------------------|
| 0      | 1    | 2D <sub>H</sub> (tAreaNR), 4D <sub>H</sub> (tAreaNV), 6D <sub>H</sub> (tAreaNA) |
| 1      | 8    | Encoded cell range address (→3.3.4)                                             |

### 3.9.12 tMemAreaN (2E<sub>H</sub>, 4E<sub>H</sub>, 6E<sub>H</sub>)

This token is closely related to the tMemArea token (→3.9.4). It is used in defined names in BIFF2-BIFF4, and encapsulates a reference subexpression (→3.2.5) that results in a constant cell address, cell range address, or cell range list on the same sheet. It does *not* append a cell range address list to the token array. The token is not used anymore in BIFF5-BIFF8, but import filters should be prepared for its existence. Operand class: *reference*.

Token tMemAreaN, BIFF2:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 2E <sub>H</sub> (tMemAreaNR), 4E <sub>H</sub> (tMemAreaNV), 6E <sub>H</sub> (tMemAreaNA)    |
| 1      | 1    | Size of the following reference subexpression (all reference operators with their operands) |

Token tMemAreaN, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 2E <sub>H</sub> (tMemAreaNR), 4E <sub>H</sub> (tMemAreaNV), 6E <sub>H</sub> (tMemAreaNA)    |
| 1      | 2    | Size of the following reference subexpression (all reference operators with their operands) |

### 3.9.13 tMemNoMemN (2F<sub>H</sub>, 4F<sub>H</sub>, 6F<sub>H</sub>)

This token is closely related to the tMemAreaN token (→3.9.12). It is used in reference subexpressions (→3.2.5) in defined names in BIFF2-BIFF4. Whenever a tMemAreaN token should be created, but there was not enough memory for any reason, a tMemNoMemN token is used instead. Its contents are equal to the tMemAreaN token. The token is not used anymore in BIFF5-BIFF8, but import filters should be prepared for its existence. Operand class: *reference*.

Token tMemNoMemN, BIFF2:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 2F <sub>H</sub> (tMemNoMemNR), 4F <sub>H</sub> (tMemNoMemNV), 6F <sub>H</sub> (tMemNoMemNA) |
| 1      | 1    | Size of the following reference subexpression (all reference operators with their operands) |

Token tMemNoMemN, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 2F <sub>H</sub> (tMemNoMemNR), 4F <sub>H</sub> (tMemNoMemNV), 6F <sub>H</sub> (tMemNoMemNA) |
| 1      | 2    | Size of the following reference subexpression (all reference operators with their operands) |

### 3.9.14 tNameX (39<sub>H</sub>, 59<sub>H</sub>, 79<sub>H</sub>) (BIFF5-BIFF8)

This token contains the index to a DEFINEDNAME or EXTERNALNAME record. It occurs by using external names or internal names with explicit sheet name (for example “Sheet1!localname”), add-in functions, DDE links, and OLE links. In BIFF5 the contents of this token differs for internal respectively external names. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tNameX for *internal names*, BIFF5:

| Offset | Size | Contents                                                                                                                                                                               |
|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 39 <sub>H</sub> (tNameXR), 59 <sub>H</sub> (tNameXV), 79 <sub>H</sub> (tNameXA)                                                                                                        |
| 1      | 2    | This is always a negative value to indicate an internal name. The absolute value is the <i>one-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 8    | Not used                                                                                                                                                                               |
| 11     | 2    | <i>One-based</i> index to DEFINEDNAME record (→5.33) in the <i>Global Link Table</i> (→4.10.2)                                                                                         |
| 13     | 12   | Not used                                                                                                                                                                               |

Token tNameX for *external names*, BIFF5:

| Offset | Size | Contents                                                                                                                                                     |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 39 <sub>H</sub> (tNameXR), 59 <sub>H</sub> (tNameXV), 79 <sub>H</sub> (tNameXA)                                                                              |
| 1      | 2    | This is always a positive value to indicate an external name. <i>One-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 8    | Not used                                                                                                                                                     |
| 11     | 2    | <i>One-based</i> index to EXTERNALNAME record (→5.39)                                                                                                        |
| 13     | 12   | Not used                                                                                                                                                     |

Token tNameX, BIFF8:

| Offset | Size | Contents                                                                            |
|--------|------|-------------------------------------------------------------------------------------|
| 0      | 1    | 39 <sub>H</sub> (tNameXR), 59 <sub>H</sub> (tNameXV), 79 <sub>H</sub> (tNameXA)     |
| 1      | 2    | Index to REF entry in EXTERNSHEET record (→5.41) in the <i>Link Table</i> (→4.10.3) |
| 3      | 2    | <i>One-based</i> index to DEFINEDNAME (→5.33) or EXTERNALNAME record (→5.39)        |
| 5      | 2    | Not used                                                                            |

### 3.9.15 tRef3d (3A<sub>H</sub>, 5A<sub>H</sub>, 7A<sub>H</sub>) (BIFF5-BIFF8)

This token contains a 3D reference or an external reference to a cell. In BIFF5 the contents of this token differs for 3D respectively external references. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tRef3d for *3D references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                                                                                                      |
|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3A <sub>H</sub> (tRef3dR), 5A <sub>H</sub> (tRef3dV), 7A <sub>H</sub> (tRef3dA)                                                                                                                                                               |
| 1      | 2    | This is always a negative value to indicate a 3D reference. The absolute value is the <i>one-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2) containing the name of the <i>first</i> referenced sheet. |
| 3      | 8    | Not used                                                                                                                                                                                                                                      |
| 11     | 2    | Zero-based index to first referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                                                                |
| 13     | 2    | Zero-based index to last referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                                                                 |
| 15     | 3    | Encoded cell address (→3.3.3)                                                                                                                                                                                                                 |

Token tRef3d for *external references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                          |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3A <sub>H</sub> (tRef3dR), 5A <sub>H</sub> (tRef3dV), 7A <sub>H</sub> (tRef3dA)                                                                                   |
| 1      | 2    | This is always a positive value to indicate an external reference. <i>One-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 12   | Not used                                                                                                                                                          |
| 15     | 3    | Encoded cell address (→3.3.3)                                                                                                                                     |

Token tRef3d, BIFF8:

| Offset | Size | Contents                                                                            |
|--------|------|-------------------------------------------------------------------------------------|
| 0      | 1    | 3A <sub>H</sub> (tRef3dR), 5A <sub>H</sub> (tRef3dV), 7A <sub>H</sub> (tRef3dA)     |
| 1      | 2    | Index to REF entry in EXTERNSHEET record (→5.41) in the <i>Link Table</i> (→4.10.3) |
| 3      | 4    | Encoded cell address (→3.3.4)                                                       |

### 3.9.16 tArea3d (3B<sub>H</sub>, 5B<sub>H</sub>, 7B<sub>H</sub>) (BIFF5-BIFF8)

This token contains a 3D reference or an external reference to a cell range. In BIFF5 the contents of this token differs for 3D respectively external references. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tArea3d for *3D references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                                                                                                      |
|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3B <sub>H</sub> (tArea3dR), 5B <sub>H</sub> (tArea3dV), 7B <sub>H</sub> (tArea3dA)                                                                                                                                                            |
| 1      | 2    | This is always a negative value to indicate a 3D reference. The absolute value is the <i>one-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2) containing the name of the <i>first</i> referenced sheet. |
| 3      | 8    | Not used                                                                                                                                                                                                                                      |
| 11     | 2    | Zero-based index to first referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                                                                |
| 13     | 2    | Zero-based index to last referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                                                                 |
| 15     | 6    | Encoded cell range address (→3.3.3)                                                                                                                                                                                                           |

Token tArea3d for *external references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                          |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3B <sub>H</sub> (tArea3dR), 5B <sub>H</sub> (tArea3dV), 7B <sub>H</sub> (tArea3dA)                                                                                |
| 1      | 2    | This is always a positive value to indicate an external reference. <i>One-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 12   | Not used                                                                                                                                                          |
| 15     | 6    | Encoded cell range address (→3.3.3)                                                                                                                               |

Token tArea3d, BIFF8:

| Offset | Size | Contents                                                                            |
|--------|------|-------------------------------------------------------------------------------------|
| 0      | 1    | 3B <sub>H</sub> (tArea3dR), 5B <sub>H</sub> (tArea3dV), 7B <sub>H</sub> (tArea3dA)  |
| 1      | 2    | Index to REF entry in EXTERNSHEET record (→5.41) in the <i>Link Table</i> (→4.10.3) |
| 3      | 8    | Encoded cell range address (→3.3.4)                                                 |

### 3.9.17 tRefErr3d (3C<sub>H</sub>, 5C<sub>H</sub>, 7C<sub>H</sub>) (BIFF5-BIFF8)

This token contains the last 3D reference or external reference to a cell in a deleted row or column. In BIFF5 the contents of this token differs for 3D respectively external references. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tRefErr3d for *3D references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                                             |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3C <sub>H</sub> (tRefErr3dR), 5C <sub>H</sub> (tRefErr3dV), 7C <sub>H</sub> (tRefErr3dA)                                                                                             |
| 1      | 2    | This is always a negative value to indicate a 3D reference. The absolute value is the <i>one-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 8    | Not used                                                                                                                                                                             |
| 11     | 2    | Index to first referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                  |
| 13     | 2    | Index to last referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                   |
| 15     | 3    | Not used                                                                                                                                                                             |

Token tRefErr3d for *external references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                          |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3C <sub>H</sub> (tRefErr3dR), 5C <sub>H</sub> (tRefErr3dV), 7C <sub>H</sub> (tRefErr3dA)                                                                          |
| 1      | 2    | This is always a positive value to indicate an external reference. <i>One-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 15   | Not used                                                                                                                                                          |

Token tRefErr3d, BIFF8:

| Offset | Size | Contents                                                                                 |
|--------|------|------------------------------------------------------------------------------------------|
| 0      | 1    | 3C <sub>H</sub> (tRefErr3dR), 5C <sub>H</sub> (tRefErr3dV), 7C <sub>H</sub> (tRefErr3dA) |
| 1      | 2    | Index to REF entry in EXTERNSHEET record (→5.41) in the <i>Link Table</i> (→4.10.3)      |
| 3      | 4    | Not used                                                                                 |

### 3.9.18 tAreaErr3d (3D<sub>H</sub>, 5D<sub>H</sub>, 7D<sub>H</sub>) (BIFF5-BIFF8)

This token contains the last 3D reference or external reference to a cell range in deleted columns or rows. In BIFF5 the contents of this token differs for 3D respectively external references. This token is not allowed in conditions of conditional formattings and in data validity. If this token is used in cell formulas, it prevents the creation of shared formulas. Operand class: *reference*.

Token tAreaErr3d for *3D references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                                             |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3D <sub>H</sub> (tAreaErr3dR), 5D <sub>H</sub> (tAreaErr3dV), 7D <sub>H</sub> (tAreaErr3dA)                                                                                          |
| 1      | 2    | This is always a negative value to indicate a 3D reference. The absolute value is the <i>one-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 8    | Not used                                                                                                                                                                             |
| 11     | 2    | Index to first referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                  |
| 13     | 2    | Index to last referenced sheet (FFFF <sub>H</sub> = deleted sheet)                                                                                                                   |
| 15     | 6    | Not used                                                                                                                                                                             |

Token tAreaErr3d for *external references*, BIFF5:

| Offset | Size | Contents                                                                                                                                                          |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 3D <sub>H</sub> (tAreaErr3dR), 5D <sub>H</sub> (tAreaErr3dV), 7D <sub>H</sub> (tAreaErr3dA)                                                                       |
| 1      | 2    | This is always a positive value to indicate an external reference. <i>One-based</i> index to EXTERNSHEET record (→5.41) in the <i>Local Link Table</i> (→4.10.2). |
| 3      | 18   | Not used                                                                                                                                                          |

Token tAreaErr3d, BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 3D <sub>H</sub> (tAreaErr3dR), 5D <sub>H</sub> (tAreaErr3dV), 7D <sub>H</sub> (tAreaErr3dA) |
| 1      | 2    | Index to REF entry in EXTERNSHEET record (→5.41) in the <i>Link Table</i> (→4.10.3)         |
| 3      | 8    | Not used                                                                                    |



## 3.10 Control Tokens

### 3.10.1 tExp (01<sub>H</sub>)

This token is used to mark that a formula cell is part of an array formula or shared formula (→4.8). It is always the only token in a token array and is only allowed in the FORMULA record (→5.50). It contains the address of the base FORMULA record for this formula range. Note that in shared formulas this address may be different to the top-left cell of the formula range (if the top left cell is not part of the shared formula).

Token tExp, BIFF2:

| Offset | Size | Contents                                                     |
|--------|------|--------------------------------------------------------------|
| 0      | 1    | 01 <sub>H</sub>                                              |
| 1      | 2    | Index to row of first FORMULA record in the formula range    |
| 3      | 1    | Index to column of first FORMULA record in the formula range |

Token tExp, BIFF3-BIFF8:

| Offset | Size | Contents                                                     |
|--------|------|--------------------------------------------------------------|
| 0      | 1    | 01 <sub>H</sub>                                              |
| 1      | 2    | Index to row of first FORMULA record in the formula range    |
| 3      | 2    | Index to column of first FORMULA record in the formula range |

### 3.10.2 tTbl (02<sub>H</sub>)

This token is used to mark that a formula cell is part of a multiple operation table (→4.9). It is always the only token in a token array and is only allowed in the FORMULA record (→5.50).

Token tTbl, BIFF2:

| Offset | Size | Contents                                 |
|--------|------|------------------------------------------|
| 0      | 1    | 02 <sub>H</sub>                          |
| 1      | 2    | Index to first row of the table range    |
| 3      | 1    | Index to first column of the table range |

Token tTbl, BIFF3-BIFF8:

| Offset | Size | Contents                                 |
|--------|------|------------------------------------------|
| 0      | 1    | 02 <sub>H</sub>                          |
| 1      | 2    | Index to first row of the table range    |
| 3      | 2    | Index to first column of the table range |

### 3.10.3 tParen (15<sub>H</sub>)

Parentheses. This token is for display purposes only, it does not affect the result of the token array. If it follows an operator, the parentheses will enclose the operator and its operand(s), which in fact is the result of the enclosed operation.

Token tParen, BIFF2-BIFF8:

| Offset | Size | Contents        |
|--------|------|-----------------|
| 0      | 1    | 15 <sub>H</sub> |

Examples for enclosed operands:

=3+ (2) is represented by tInt(3), tInt(2), tParen, tAdd;  
 = (3) % is represented by tInt(3), tParen, tPercent;  
 =SUM (3 , (2) ) is represented by tInt(3), tInt(2), tParen, tFuncV(SUM).

Examples for enclosed operators:

= (3+2) is represented by tInt(3), tInt(2), tAdd, tParen;  
 = (3%) is represented by tInt(3), tPercent, tParen;  
 = (SUM (3 , 2) ) is represented by tInt(3), tInt(2), tFuncV(SUM), tParen.

### 3.10.4 tNlr (18<sub>H</sub>) (BIFF8)

2do

Operand class: *reference*.

### 3.10.5 tAttr (19<sub>H</sub>)

Special attribute. This token is able to represent a variety of information, described in the following chapters.

Common structure of the tAttr token, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1      | 1    | Attribute type flags:<br>01 <sub>H</sub> = This is a <i>tAttrVolatile</i> token (volatile function)<br>02 <sub>H</sub> = This is a <i>tAttrIf</i> token (IF function control)<br>04 <sub>H</sub> = This is a <i>tAttrChoose</i> token (CHOOSE function control)<br>08 <sub>H</sub> = This is a <i>tAttrSkip</i> token (skip part of token array)<br>10 <sub>H</sub> = This is a <i>tAttrSum</i> token (SUM function with one parameter)<br>20 <sub>H</sub> = This is a <i>tAttrAssign</i> token (assignment-style formula in a macro sheet)<br>40 <sub>H</sub> = This is a <i>tAttrSpace</i> token (spaces and carriage returns, BIFF3-BIFF8)<br>41 <sub>H</sub> = This is a <i>tAttrSpaceVolatile</i> token (BIFF3-BIFF8, see below) |
| 2      | var. | Additional information dependent on the attribute type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Theoretically, the attribute type flags may be combined to represent several attributes in one tAttr token. In practise, this is only done with the tAttrVolatile token and a leading tAttrSpace token. This “tAttrSpaceVolatile” token contains the attribute type 41<sub>H</sub> (flags of the tAttrVolatile token and the tAttrSpace token). The data of the token is equivalent to a regular tAttrSpace token. This is possible, because the tAttrVolatile token does not contain additional valid data.

### • Volatile Formula – The tAttrVolatile Token

If the formula contains a volatile function (a function that needs to be recalculated always, for example the NOW function, →3.11), or a defined name that directly or indirectly includes a volatile function, this token will lead the token array (except in assignment-style formulas in macro sheets, see tAttrAssign token below).

Token tAttrVolatile, BIFF2:

| Offset | Size | Contents                                                 |
|--------|------|----------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                          |
| 1      | 1    | 01 <sub>H</sub> (identifier for the tAttrVolatile token) |
| 2      | 1    | Not used                                                 |

Token tAttrVolatile, BIFF3-BIFF8:

| Offset | Size | Contents                                                 |
|--------|------|----------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                          |
| 1      | 1    | 01 <sub>H</sub> (identifier for the tAttrVolatile token) |
| 2      | 2    | Not used                                                 |

### • IF Function Control – The tAttrIf Token

This token always follows the first parameter of the IF function (containing the condition). It contains a relative offset that allows to skip the *true* parameter of the function (second parameter), if the condition evaluates to *false*.

The token promises that the topmost operand on the formula stack (the last processed subexpression) is the condition of an IF function. This operand is popped from the stack, and processing continues depending on its value.

- If the condition is *true*, the following tokens are processed, and at the end of the parameter, a tAttrSkip token (see below) will occur that jumps right behind the tFuncVar(IF) token (this has to be assured during creation of the formula). Thus, the *false* parameter is not evaluated at all, and cannot cause an error code as final formula result, if it contains an error.
- If the condition is *false*, the following tokens are skipped (the *true* parameter), and evaluation continues with the *false* parameter. Again, at the end of the parameter, a tAttrSkip token will occur that jumps behind the tFuncVar(IF) token. If the *false* parameter does not exist, the tAttrIf token causes to jump to the tFuncVar(IF) token, and a simple *false* constant is pushed onto the formula stack.

If the IF function is processed, the result of either the *true* parameter or the *false* parameter will be on top of the formula stack.

Token tAttrIf, BIFF2:

| Offset | Size | Contents                                                                                                                                                                                                                                              |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                                                                                                                                                                                                                       |
| 1      | 1    | 02 <sub>H</sub> (identifier for the tAttrIf token)                                                                                                                                                                                                    |
| 2      | 1    | Distance (number of bytes) from start of next token (first token of second parameter) to start of first token of the <i>false</i> parameter (if extant); otherwise to start of the respective tFuncVar(IF) token. See example below for more details. |

Token tAttrIf, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                             |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                                      |
| 1      | 1    | 02 <sub>H</sub> (identifier for the tAttrIf token)                                                                                                                                                                                                                                                                                                                                   |
| 2      | 2    | Distance (number of bytes) from start of next token (first token of second parameter) to start of first token of the <i>false</i> parameter (if extant, <i>including</i> all leading tAttrSpace tokens); otherwise to start of the respective tFuncVar(IF) token ( <i>skipping</i> all leading tAttrSpace tokens related to the tFuncVar token). See example below for more details. |

Example of the formula = IF (TRUE , 1 , 2) . The formula contains spaces before the function identifier and before the second and third parameter.

| Offset | Size | Token name   | Description                                                                                                                                                         |
|--------|------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | tBool        | The condition of the IF function: the constant <i>true</i>                                                                                                          |
| 2      | 4    | tAttrIf      | Distance to start of <i>false</i> parameter: $7+4 = 11$ bytes                                                                                                       |
| 6      | 4    | tAttrSpace   | Leading spaces for the next token (the <i>true</i> parameter)                                                                                                       |
| 10     | 3    | tInt         | <i>True</i> parameter of the IF function: the integer constant 1                                                                                                    |
| 13     | 4    | tAttrSkip    | Distance to position behind tFuncVar(IF) token (minus 1): $7+12-1 = 18$ bytes                                                                                       |
| 17     | 4    | tAttrSpace   | Leading spaces for the next token (the <i>false</i> parameter)                                                                                                      |
| 21     | 3    | tInt         | <i>False</i> parameter of the IF function: the integer constant 2                                                                                                   |
| 24     | 4    | tAttrSpace   | Leading spaces for the next token (the function identifier). Note that the tAttrSpace tokens related to the function itself are located before the tAttrSkip token! |
| 28     | 4    | tAttrSkip    | Distance to position behind tFuncVar(IF) token (minus 1): $4-1 = 3$ bytes.                                                                                          |
| 32     | 4    | tFuncVar(IF) | Identifier of the IF function, function with 3 parameters                                                                                                           |

Example of the formula = IF (TRUE , 1) . The formula contains spaces before the function identifier and the second parameter.

| Offset | Size | Token name   | Description                                                                                                                                                         |
|--------|------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | tBool        | The condition of the IF function: the constant <i>true</i>                                                                                                          |
| 2      | 4    | tAttrIf      | Distance to start of tFuncVar(IF) token: $7+8 = 15$ bytes                                                                                                           |
| 6      | 4    | tAttrSpace   | Leading spaces for the next token (the <i>true</i> parameter)                                                                                                       |
| 10     | 3    | tInt         | <i>True</i> parameter of the IF function: the integer constant 1                                                                                                    |
| 13     | 4    | tAttrSpace   | Leading spaces for the next token (the function identifier). Note that the tAttrSpace tokens related to the function itself are located before the tAttrSkip token! |
| 17     | 4    | tAttrSkip    | Distance to position behind tFuncVar(IF) token (minus 1): $4-1 = 3$ bytes                                                                                           |
| 21     | 4    | tFuncVar(IF) | Identifier of the IF function with 3 parameters                                                                                                                     |

### • CHOOSE Function Control – The tAttrChoose Token

This token always follows the first parameter of the CHOOSE function (containing the value which parameter to choose). It contains a relative offset that allows to skip all unused choices and to jump directly to the correct parameter.

The token promises that the topmost operand on the formula stack (the last processed subexpression) is the first parameter of a CHOOSE function. This operand is popped from the stack, and processing continues at the specified position in the token array. At the end of the parameter, a tAttrSkip token (see below) will occur that jumps right behind the tFuncVar(CHOOSE) token (this has to be assured during creation of the formula). Thus, only one more parameter of the function is evaluated at all, all other parameters cannot cause an error code as final formula result, if they contain an error. If the choice from the first parameter is wrong, the tAttrChoose token causes to jump to the tFuncVar(CHOOSE) token, and an error is generated.

Token tAttrChoose, BIFF2:

| Offset         | Size        | Contents                                                                                                                                                                                                |
|----------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0              | 1           | 19 <sub>H</sub>                                                                                                                                                                                         |
| 1              | 1           | 04 <sub>H</sub> (identifier for the tAttrChoose token)                                                                                                                                                  |
| 2              | 1           | Number of choices in the CHOOSE function ( <u>n.c.</u> , number of parameters decreased by 1)                                                                                                           |
| 3              | <u>n.c.</u> | Jump table containing <u>n.c.</u> distances (8-bit values specifying numbers of bytes) from start of <i>this jump table</i> to start of first token of the respective parameter of the CHOOSE function. |
| 3+ <u>n.c.</u> | 1           | Distance (numbers of bytes) from start of the <i>jump table</i> of this token to start of the tFuncVar(CHOOSE) token. Used in case of an error (wrong choice in first parameter).                       |

Token tAttrChoose, BIFF3-BIFF8:

| Offset           | Size           | Contents                                                                                                                                                                                                                                                         |
|------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                | 1              | 19 <sub>H</sub>                                                                                                                                                                                                                                                  |
| 1                | 1              | 04 <sub>H</sub> (identifier for the tAttrChoose token)                                                                                                                                                                                                           |
| 2                | 2              | Number of choices in the CHOOSE function ( <u>n.c.</u> , number of parameters decreased by 1)                                                                                                                                                                    |
| 4                | 2· <u>n.c.</u> | Jump table containing <u>n.c.</u> distances (16-bit values specifying numbers of bytes) from start of <i>this jump table</i> to start of first token of the respective parameter of the CHOOSE function.                                                         |
| 4+2· <u>n.c.</u> | 2              | Distance (numbers of bytes) from start of the <i>jump table</i> of this token to start of the tFuncVar(CHOOSE) token ( <i>skipping</i> all leading tAttrSpace tokens related to the tFuncVar token). Used in case of an error (wrong choice in first parameter). |

Example of the formula = CHOOSE ( 2 , 1 , 2 , 3 ) . The formula contains spaces before the function identifier and before the second and fourth parameter.

| Offset | Size | Token name       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------|------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | tInt             | The choice: the integer constant 2 (take second choice)                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2      | 12   | tAttrChoose      | Function contains 3 choices ( $n_c = 3$ )<br>Jump table: distances to start positions of the next $n_c = 3$ parameters (including the size of this jump table: $n_c \cdot 2 + 2 = 3 \cdot 2 + 2 = 8$ bytes):<br>- First choice: 8 bytes (skip the jump table only)<br>- Second choice: $8 + 7 + 4 = 19$ bytes<br>- Third choice: $8 + 7 + 7 + 4 = 26$ bytes<br>Distance to start of tFuncVar(CHOOSE) token (including jump table size, leading tAttrSpace tokens will be skipped too): $8 + 7 + 7 + 11 + 8 = 41$ bytes |
| 14     | 4    | tAttrSpace       | Leading spaces for the next token                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 18     | 3    | tInt             | First choice parameter: the constant 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 21     | 4    | tAttrSkip        | Distance to position behind tFuncVar(CHOOSE) token (minus 1): $11 + 11 + 8 - 1 = 29$ bytes                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 25     | 3    | tInt             | Second choice parameter: the constant 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 28     | 4    | tAttrSkip        | Distance to position behind tFuncVar(CHOOSE) token (minus 1): $11 + 8 - 1 = 18$ bytes                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 32     | 4    | tAttrSpace       | Leading spaces for the next token                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 36     | 3    | tInt             | Third choice parameter: the constant 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 39     | 4    | tAttrSpace       | Leading spaces for the next token (the function identifier). Note that the tAttrSpace tokens related to the function itself are located before the tAttrSkip token!                                                                                                                                                                                                                                                                                                                                                    |
| 43     | 4    | tAttrSkip        | Distance to position behind tFuncVar(CHOOSE) token (minus 1): $4 - 1 = 3$ bytes                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 47     | 4    | tFuncVar(CHOOSE) | Identifier of the CHOOSE function with 4 parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

• Jump to Position – The tAttrSkip Token

This token is used to let formula evaluation continue at another position in the token array. It contains the number of bytes to skip from the current position. For no obvious reason, this value is always one less than the actual number. This token is only used in conjunction with the tAttrIf token and tAttrChoose token (see tAttrIf and tAttrChosse tokens above for examples).

Token tAttrSkip, BIFF2:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                                                             |
| 1      | 1    | 08 <sub>H</sub> (identifier for the tAttrSkip token)                                        |
| 2      | 1    | Distance (number of bytes) from start of next token to destination position, decreased by 1 |

Token tAttrSkip, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                                                             |
| 1      | 1    | 08 <sub>H</sub> (identifier for the tAttrSkip token)                                        |
| 2      | 2    | Distance (number of bytes) from start of next token to destination position, decreased by 1 |

### • Sum with One Parameter – The tAttrSum Token

This token replaces the tFuncVar(SUM) token, if the SUM function takes one parameter only. This is the only tAttr token that behaves like a real operator.

Token tAttrSum, BIFF2:

| Offset | Size | Contents                                            |
|--------|------|-----------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                     |
| 1      | 1    | 10 <sub>H</sub> (identifier for the tAttrSum token) |
| 2      | 1    | Not used                                            |

Token tAttrSum, BIFF3-BIFF8:

| Offset | Size | Contents                                            |
|--------|------|-----------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                     |
| 1      | 1    | 10 <sub>H</sub> (identifier for the tAttrSum token) |
| 2      | 2    | Not used                                            |

Example: The formula =SUM (1) is represented with the token array tInt(1), tAttrSum; instead of the token array tInt(1), tFuncVarV(SUM).

### • Assignment in Macro Sheet – The tAttrAssign Token

In macro sheets it is possible to replace the SET.NAME function with an assignment-style formula. The usual syntax =SET . NAME (name , value) will be replaced with the command name=value then.

Example: The macro sheet function =SET . NAME (myname , 1) is represented by the token array tNameV(myname), tInt(1), tFuncVarV(SET.NAME).

The used name is contained in a tName token.

The same can be done with the assignment-style formula myname=1. The token array of this function is tAttrAssign, tAttrStr("myname"), tAttrInt(1), tFuncVarV(SET.NAME).

Now, the used name is given as string in a tStr token, not in a tName token anymore.

Token tAttrAssign, BIFF2:

| Offset | Size | Contents                                               |
|--------|------|--------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                        |
| 1      | 1    | 20 <sub>H</sub> (identifier for the tAttrAssign token) |
| 2      | 1    | Not used                                               |

Token tAttrAssign, BIFF3-BIFF8:

| Offset | Size | Contents                                               |
|--------|------|--------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                        |
| 1      | 1    | 20 <sub>H</sub> (identifier for the tAttrAssign token) |
| 2      | 2    | Not used                                               |

In an assignment-style formulas the tAttrVolatile token will not be the first token in the formula, but it will follow the tStr token containing the name used in the assignment (as usual, this can also be a tAttrSpaceVolatile token).

Example: The assignment-style formula myname=NOW () is represented by the following token array: tAttrAssign, tStr("myname"), tAttrVolatile, tFuncV(NOW), tFuncVarV(SET.NAME).

See also the examples for the tAttrSpace token below.

### • Spaces and Carriage Returns – The tAttrSpace Token (BIFF3-BIFF8)

This token is a placeholder for space characters and carriage returns inserted into the formula representation. It specifies the type and number of inserted characters preceding the next token. It does not affect the evaluation of the token array. In BIFF3, only spaces are allowed, and they can only occur in macro sheets and only in front of the entire formula, following the equality sign.

Several tAttrSpace tokens may occur before a token, for example mixed spaces and carriage returns. Parentheses and function calls can contain spaces at different positions:

- Parentheses: before the opening parenthesis and before the closing parenthesis.
- Function call: before the function name and before the closing parenthesis. It is not possible to add a space between function name and opening parenthesis, and in front of the parameter separator.

The position of the added characters is specified inside the tAttrSpace token.

Token tAttrSpace, BIFF3:

| Offset | Size | Contents                                                                                                                   |
|--------|------|----------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                                                                                            |
| 1      | 1    | 40 <sub>H</sub> (identifier for the tAttrSpace token), or<br>41 <sub>H</sub> (identifier for the tAttrSpaceVolatile token) |
| 2      | 2    | Number of spaces following the equality sign (1...255)                                                                     |

Token tAttrSpace, BIFF4-BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | 19 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1      | 1    | 40 <sub>H</sub> (identifier for the tAttrSpace token), or<br>41 <sub>H</sub> (identifier for the tAttrSpaceVolatile token)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2      | 1    | Type and position of the inserted character(s):<br>00 <sub>H</sub> = Spaces before the next token (not allowed before tParen token)<br>01 <sub>H</sub> = Carriage returns before the next token (not allowed before tParen token)<br>02 <sub>H</sub> = Spaces before opening parenthesis (only allowed before tParen token)<br>03 <sub>H</sub> = Carriage returns before opening parenthesis (only allowed before tParen token)<br>04 <sub>H</sub> = Spaces before closing parenthesis (only allowed before tParen, tFunc, and tFuncVar tokens)<br>05 <sub>H</sub> = Carriage returns before closing parenthesis (only allowed before tParen, tFunc, and tFuncVar tokens)<br>06 <sub>H</sub> = Spaces following the equality sign (only in macro sheets) |
| 3      | 1    | Number of inserted spaces or carriage returns                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



In the following examples, the space characters are replaced by “°” characters, and a carriage return is shown as “<cr>”. The tAttrSpace tokens are shown using the following notation: tAttrSpace(type,count).

| Formula             | Token array                                                                                                                           |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| =°1                 | tAttrSpace(00 <sub>H</sub> ,1), tInt(1)                                                                                               |
| =°1°°+°°°2          | tAttrSpace(00 <sub>H</sub> ,1), tInt(1), tAttrSpace(00 <sub>H</sub> ,3), tInt(2), tAttrSpace(00 <sub>H</sub> ,2), tAdd                |
| =1°<cr><br>°°+2     | tInt(1), tInt(2), tAttrSpace(00 <sub>H</sub> ,1), tAttrSpace(01 <sub>H</sub> ,1), tAttrSpace(00 <sub>H</sub> ,2), tAdd                |
| =1+°(2°°)           | tInt(1), tInt(2), tAttrSpace(02 <sub>H</sub> ,1), tAttrSpace(04 <sub>H</sub> ,2), tParen, tAdd                                        |
| =°SUM(1°°)          | tInt(1), tAttrSpace(00 <sub>H</sub> ,1), tAttrSpace(04 <sub>H</sub> ,2), tAttrSum                                                     |
| =°NOW()             | tAttrSpaceVolatile(00 <sub>H</sub> ,1), tFuncV(NOW)                                                                                   |
| Macro sheet formula | Token array                                                                                                                           |
| =°1                 | tAttrSpace(06 <sub>H</sub> ,1), tInt(1)                                                                                               |
| =°NOW()             | tAttrSpaceVolatile(06 <sub>H</sub> ,1), tFuncV(NOW)                                                                                   |
| °myname=°°1         | tAttrAssign, tAttrSpace(06 <sub>H</sub> ,1), tStr("myname"), tAttrSpace(00 <sub>H</sub> ,2), tInt(1), tFuncVarV(SET.NAME)             |
| °myname=°°NOW()     | tAttrAssign, tAttrSpace(06 <sub>H</sub> ,1), tStr("myname"), tAttrSpaceVolatile(00 <sub>H</sub> ,2), tFuncV(NOW), tFuncVarV(SET.NAME) |

## 3.11 Built-In Sheet Functions

Meaning of the table column headers:

| Column header     | Meaning                                                                                                                                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Func ID           | Function identifier used in tFunc (→3.7.1) and tFuncVar (→3.7.2) tokens                                                                                                                                                                            |
| Function name     | English name of the function                                                                                                                                                                                                                       |
| Min par           | Minimum number of parameters this function requires                                                                                                                                                                                                |
| Max par           | Maximum number of parameters this function allows. If equal to “Min par”, a tFunc token is used for this function, otherwise a tFuncVar token.                                                                                                     |
| Ret class         | Default token class of the return value (→3.2.2).<br>R = <i>reference class</i> ;<br>V = <i>value class</i> ;<br>A = <i>array class</i> .                                                                                                          |
| Parameter classes | Token classes expected by the respective parameters of the function (→3.2.3). The ellipsis “...” repeats the last specified token class for all following parameters.                                                                              |
| Volatile          | If marked, the function result is volatile (needs to be recalculated always). Existence of such a function causes the “Recalculate always” flag to be set in the ARRAY (→5.4), FORMULA (→5.50), DATATABLE (→5.24), and DATATABLE2 (→5.25) records. |

### 3.11.1 Built-In Sheet Functions in BIFF2

| Func ID | Function name       | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|---------------------|---------|---------|-----------|-------------------|----------|
| 0       | COUNT               | 0       | 30      | V         | R ...             |          |
| 1       | IF                  | 2       | 3       | R         | V R R             |          |
| 2       | ISNA                | 1       | 1       | V         | V                 |          |
| 3       | ISERROR             | 1       | 1       | V         | V                 |          |
| 4       | SUM                 | 0       | 30      | V         | R ...             |          |
| 5       | AVERAGE             | 1       | 30      | V         | R ...             |          |
| 6       | MIN                 | 1       | 30      | V         | R ...             |          |
| 7       | MAX                 | 1       | 30      | V         | R ...             |          |
| 8       | ROW                 | 0       | 1       | V         | R                 |          |
| 9       | COLUMN              | 0       | 1       | V         | R                 |          |
| 10      | NA                  | 0       | 0       | V         | –                 |          |
| 11      | NPV                 | 2       | 30      | V         | V R ...           |          |
| 12      | STDEV               | 1       | 30      | V         | R ...             |          |
| 13      | DOLLAR              | 1       | 2       | V         | V V               |          |
| 14      | FIXED <sup>8</sup>  | 2       | 2       | V         | V V               |          |
| 15      | SIN                 | 1       | 1       | V         | V                 |          |
| 16      | COS                 | 1       | 1       | V         | V                 |          |
| 17      | TAN                 | 1       | 1       | V         | V                 |          |
| 18      | ATAN                | 1       | 1       | V         | V                 |          |
| 19      | PI                  | 0       | 0       | V         | –                 |          |
| 20      | SQRT                | 1       | 1       | V         | V                 |          |
| 21      | EXP                 | 1       | 1       | V         | V                 |          |
| 22      | LN                  | 1       | 1       | V         | V                 |          |
| 23      | LOG10               | 1       | 1       | V         | V                 |          |
| 24      | ABS                 | 1       | 1       | V         | V                 |          |
| 25      | INT                 | 1       | 1       | V         | V                 |          |
| 26      | SIGN                | 1       | 1       | V         | V                 |          |
| 27      | ROUND               | 2       | 2       | V         | V V               |          |
| 28      | LOOKUP              | 2       | 3       | V         | V R R             |          |
| 29      | INDEX               | 2       | 4       | R         | R V V V           |          |
| 30      | REPT                | 2       | 2       | V         | V V               |          |
| 31      | MID                 | 3       | 3       | V         | V V V             |          |
| 32      | LEN                 | 1       | 1       | V         | V                 |          |
| 33      | VALUE               | 1       | 1       | V         | V                 |          |
| 34      | TRUE                | 0       | 0       | V         | –                 |          |
| 35      | FALSE               | 0       | 0       | V         | –                 |          |
| 36      | AND                 | 1       | 30      | V         | R ...             |          |
| 37      | OR                  | 1       | 30      | V         | R ...             |          |
| 38      | NOT                 | 1       | 1       | V         | V                 |          |
| 39      | MOD                 | 2       | 2       | V         | V V               |          |
| 40      | DCOUNT              | 3       | 3       | V         | R R R             |          |
| 41      | DSUM                | 3       | 3       | V         | R R R             |          |
| 42      | DAVERAGE            | 3       | 3       | V         | R R R             |          |
| 43      | DMIN                | 3       | 3       | V         | R R R             |          |
| 44      | DMAX                | 3       | 3       | V         | R R R             |          |
| 45      | DSTDEV              | 3       | 3       | V         | R R R             |          |
| 46      | VAR                 | 1       | 30      | V         | R ...             |          |
| 47      | DVAR                | 3       | 3       | V         | R R R             |          |
| 48      | TEXT                | 2       | 2       | V         | V V               |          |
| 49      | LINEST <sup>9</sup> | 1       | 2       | A         | R R               |          |
| 50      | TREND <sup>9</sup>  | 1       | 3       | A         | R R R             |          |
| 51      | LOGEST <sup>9</sup> | 1       | 2       | A         | R R               |          |
| 52      | GROWTH <sup>9</sup> | 1       | 3       | A         | R R R             |          |
| 56      | PV                  | 3       | 5       | V         | V V V V V         |          |

<sup>8</sup> Parameter count will change in BIFF4.

<sup>9</sup> Parameter count will change in BIFF3.

| Func ID | Function name         | Min par | Max par | Ret class | Parameter classes | Volatile | Func ID | Function name       | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|-----------------------|---------|---------|-----------|-------------------|----------|---------|---------------------|---------|---------|-----------|-------------------|----------|
| 57      | FV                    | 3       | 5       | V         | VVVVVV            |          | 116     | RIGHT               | 1       | 2       | V         | VV                |          |
| 58      | NPV                   | 3       | 5       | V         | VVVVVV            |          | 117     | EXACT               | 2       | 2       | V         | VV                |          |
| 59      | PMT                   | 3       | 5       | V         | VVVVVV            |          | 118     | TRIM                | 1       | 1       | V         | V                 |          |
| 60      | RATE                  | 3       | 6       | V         | VVVVVVV           |          | 119     | REPLACE             | 4       | 4       | V         | VVVVV             |          |
| 61      | MIRR                  | 3       | 3       | V         | RVV               |          | 120     | SUBSTITUTE          | 3       | 4       | V         | VVVVV             |          |
| 62      | IRR                   | 1       | 2       | V         | RV                |          | 121     | CODE                | 1       | 1       | V         | V                 |          |
| 63      | RAND                  | 0       | 0       | V         | -                 | •        | 124     | FIND                | 2       | 3       | V         | VVV               |          |
| 64      | MATCH                 | 2       | 3       | V         | VRR               |          | 125     | CELL                | 1       | 2       | V         | VR                | •        |
| 65      | DATE                  | 3       | 3       | V         | VVV               |          | 126     | ISERR               | 1       | 1       | V         | V                 |          |
| 66      | TIME                  | 3       | 3       | V         | VVV               |          | 127     | ISTEXT              | 1       | 1       | V         | V                 |          |
| 67      | DAY                   | 1       | 1       | V         | V                 |          | 128     | ISNUMBER            | 1       | 1       | V         | V                 |          |
| 68      | MONTH                 | 1       | 1       | V         | V                 |          | 129     | ISBLANK             | 1       | 1       | V         | V                 |          |
| 69      | YEAR                  | 1       | 1       | V         | V                 |          | 130     | T                   | 1       | 1       | V         | R                 |          |
| 70      | WEEKDAY <sup>10</sup> | 1       | 1       | V         | V                 |          | 131     | N                   | 1       | 1       | V         | R                 |          |
| 71      | HOUR                  | 1       | 1       | V         | V                 |          | 140     | DATEVALUE           | 1       | 1       | V         | V                 |          |
| 72      | MINUTE                | 1       | 1       | V         | V                 |          | 141     | TIMEVALUE           | 1       | 1       | V         | V                 |          |
| 73      | SECOND                | 1       | 1       | V         | V                 |          | 142     | SLN                 | 3       | 3       | V         | VVV               |          |
| 74      | NOW                   | 0       | 0       | V         | -                 | •        | 143     | SYD                 | 4       | 4       | V         | VVVV              |          |
| 75      | AREAS                 | 1       | 1       | V         | R                 |          | 144     | DDB                 | 4       | 5       | V         | VVVVV             |          |
| 76      | ROWS                  | 1       | 1       | V         | R                 |          | 148     | INDIRECT            | 1       | 2       | R         | VV                | •        |
| 77      | COLUMNS               | 1       | 1       | V         | R                 |          | 162     | CLEAN               | 1       | 1       | V         | V                 |          |
| 78      | OFFSET                | 3       | 5       | R         | RVVVV             | •        | 163     | MDETERM             | 1       | 1       | V         | A                 |          |
| 82      | SEARCH                | 2       | 3       | V         | VVV               |          | 164     | MINVERSE            | 1       | 1       | A         | A                 |          |
| 83      | TRANSPOSE             | 1       | 1       | A         | A                 |          | 165     | MMULT               | 2       | 2       | A         | AA                |          |
| 86      | TYPE                  | 1       | 1       | V         | V                 |          | 167     | IPMT                | 4       | 6       | V         | VVVVVV            |          |
| 97      | ATAN2                 | 2       | 2       | V         | VV                |          | 168     | PPMT                | 4       | 6       | V         | VVVVVV            |          |
| 98      | ASIN                  | 1       | 1       | V         | V                 |          | 169     | COUNTA              | 0       | 30      | V         | R...              |          |
| 99      | ACOS                  | 1       | 1       | V         | V                 |          | 183     | PRODUCT             | 0       | 30      | V         | R...              |          |
| 100     | CHOOSE                | 2       | 30      | R         | VR...             |          | 184     | FACT                | 1       | 1       | V         | V                 |          |
| 101     | HLOOKUP <sup>10</sup> | 3       | 3       | V         | VRR               |          | 189     | DPRODUCT            | 3       | 3       | V         | RRR               |          |
| 102     | VLOOKUP <sup>10</sup> | 3       | 3       | V         | VRR               |          | 190     | ISNONTEXT           | 1       | 1       | V         | V                 |          |
| 105     | ISREF                 | 1       | 1       | V         | R                 |          | 193     | STDEVP              | 1       | 30      | V         | R...              |          |
| 109     | LOG                   | 1       | 2       | V         | VV                |          | 194     | VARP                | 1       | 30      | V         | R...              |          |
| 111     | CHAR                  | 1       | 1       | V         | V                 |          | 195     | DSTDEVP             | 3       | 3       | V         | RRR               |          |
| 112     | LOWER                 | 1       | 1       | V         | V                 |          | 196     | DVARP               | 3       | 3       | V         | RRR               |          |
| 113     | UPPER                 | 1       | 1       | V         | V                 |          | 197     | TRUNC <sup>11</sup> | 1       | 1       | V         | V                 |          |
| 114     | PROPER                | 1       | 1       | V         | V                 |          | 198     | ISLOGICAL           | 1       | 1       | V         | V                 |          |
| 115     | LEFT                  | 1       | 2       | V         | VV                |          | 199     | DCOUNTA             | 3       | 3       | V         | RRR               |          |

<sup>10</sup> Parameter count will change in BIFF5.<sup>11</sup> Parameter count will change in BIFF3.

## 3.11.2 New Built-In Sheet Functions in BIFF3

| Func ID | Function name         | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|-----------------------|---------|---------|-----------|-------------------|----------|
| 49      | LINEST <sup>12</sup>  | 1       | 4       | A         | R R V V           |          |
| 50      | TREND <sup>12</sup>   | 1       | 4       | A         | R R R V           |          |
| 51      | LOGEST <sup>12</sup>  | 1       | 4       | A         | R R V V           |          |
| 52      | GROWTH <sup>12</sup>  | 1       | 4       | A         | R R R V           |          |
| 197     | TRUNC <sup>12</sup>   | 1       | 2       | V         | V V               |          |
| 204     | YEN <sup>13</sup>     | 1       | 2       | V         | V V               |          |
| 205     | FINDB                 | 2       | 3       | V         | V V V             |          |
| 206     | SEARCHB               | 2       | 3       | V         | V V V             |          |
| 207     | REPLACEB              | 4       | 4       | V         | V V V V           |          |
| 208     | LEFTB                 | 1       | 2       | V         | V V               |          |
| 209     | RIGHTB                | 1       | 2       | V         | V V               |          |
| 210     | MIDB                  | 3       | 3       | V         | V V V             |          |
| 211     | LENB                  | 1       | 1       | V         | V                 |          |
| 212     | ROUNDUP               | 2       | 2       | V         | V V               |          |
| 213     | ROUNDDOWN             | 2       | 2       | V         | V V               |          |
| 214     | ASC                   | 1       | 1       | V         | V                 |          |
| Func ID | Function name         | Min par | Max par | Ret class | Parameter classes | Volatile |
| 215     | JIS <sup>14</sup>     | 1       | 1       | V         | V                 |          |
| 219     | ADDRESS               | 2       | 5       | V         | V V V V V         |          |
| 220     | DAYS360 <sup>10</sup> | 2       | 2       | V         | V V               |          |
| 221     | TODAY                 | 0       | 0       | V         | -                 | •        |
| 222     | VDB                   | 5       | 7       | V         | V V V V V V V     |          |
| 227     | MEDIAN                | 1       | 30      | V         | R ...             |          |
| 228     | SUMPRODUCT            | 1       | 30      | V         | A ...             |          |
| 229     | SINH                  | 1       | 1       | V         | V                 |          |
| 230     | COSH                  | 1       | 1       | V         | V                 |          |
| 231     | TANH                  | 1       | 1       | V         | V                 |          |
| 232     | ASINH                 | 1       | 1       | V         | V                 |          |
| 233     | ACOSH                 | 1       | 1       | V         | V                 |          |
| 234     | ATANH                 | 1       | 1       | V         | V                 |          |
| 235     | DGET                  | 3       | 3       | V         | R R R             |          |
| 244     | INFO                  | 1       | 1       | V         | V                 |          |

<sup>12</sup> Function exists in BIFF2, but parameter count has been changed.

<sup>13</sup> Function name YEN will change to USDOLLAR in BIFF4.

<sup>14</sup> Function name JIS will change to DBCS in BIFF4.

## 3.11.3 New Built-In Sheet Functions in BIFF4

| Func ID | Function name          | Min par | Max par | Ret class | Parameter classes | Volatile | Func ID | Function name | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|------------------------|---------|---------|-----------|-------------------|----------|---------|---------------|---------|---------|-----------|-------------------|----------|
| 14      | FIXED <sup>15</sup>    | 2       | 3       | V         | V V V             |          | 298     | ODD           | 1       | 1       | V         | V                 |          |
| 204     | USDOLLAR <sup>16</sup> | 1       | 2       | V         | V V               |          | 299     | PERMUT        | 2       | 2       | V         | V V               |          |
| 215     | DBCS <sup>17</sup>     | 1       | 1       | V         | V                 |          | 300     | POISSON       | 3       | 3       | V         | V V V             |          |
| 216     | RANK                   | 2       | 3       | V         | V R V             |          | 301     | TDIST         | 3       | 3       | V         | V V V             |          |
| 247     | DB                     | 4       | 5       | V         | V V V V V         |          | 302     | WEIBULL       | 4       | 4       | V         | V V V V           |          |
| 252     | FREQUENCY              | 2       | 2       | A         | R R               |          | 303     | SUMXMY2       | 2       | 2       | V         | A A               |          |
| 261     | ERROR.TYPE             | 1       | 1       | V         | V                 |          | 304     | SUMX2MY2      | 2       | 2       | V         | A A               |          |
| 269     | AVEDEV                 | 1       | 30      | V         | R ...             |          | 305     | SUMX2PY2      | 2       | 2       | V         | A A               |          |
| 270     | BETADIST               | 3       | 5       | V         | V V V V V         |          | 306     | CHITEST       | 2       | 2       | V         | A A               |          |
| 271     | GAMMALN                | 1       | 1       | V         | V                 |          | 307     | CORREL        | 2       | 2       | V         | A A               |          |
| 272     | BETAINV                | 3       | 5       | V         | V V V V V         |          | 308     | COVAR         | 2       | 2       | V         | A A               |          |
| 273     | BINOMDIST              | 4       | 4       | V         | V V V V           |          | 309     | FORECAST      | 3       | 3       | V         | V A A             |          |
| 274     | CHIDIST                | 2       | 2       | V         | V V               |          | 310     | FTEST         | 2       | 2       | V         | A A               |          |
| 275     | CHIINV                 | 2       | 2       | V         | V V               |          | 311     | INTERCEPT     | 2       | 2       | V         | A A               |          |
| 276     | COMBIN                 | 2       | 2       | V         | V V               |          | 312     | PEARSON       | 2       | 2       | V         | A A               |          |
| 277     | CONFIDENCE             | 3       | 3       | V         | V V V             |          | 313     | RSQ           | 2       | 2       | V         | A A               |          |
| 278     | CRITBINOM              | 3       | 3       | V         | V V V             |          | 314     | STEYX         | 2       | 2       | V         | A A               |          |
| 279     | EVEN                   | 1       | 1       | V         | V                 |          | 315     | SLOPE         | 2       | 2       | V         | A A               |          |
| 280     | EXPONDIS               | 3       | 3       | V         | V V V             |          | 316     | TTEST         | 4       | 4       | V         | A A V V           |          |
| 281     | FDIST                  | 3       | 3       | V         | V V V             |          | 317     | PROB          | 3       | 4       | V         | A A V V           |          |
| 282     | FINV                   | 3       | 3       | V         | V V V             |          | 318     | DEVSQ         | 1       | 30      | V         | R ...             |          |
| 283     | FISHER                 | 1       | 1       | V         | V                 |          | 319     | GEOMEAN       | 1       | 30      | V         | R ...             |          |
| 284     | FISHERINV              | 1       | 1       | V         | V                 |          | 320     | HARMEAN       | 1       | 30      | V         | R ...             |          |
| 285     | FLOOR                  | 2       | 2       | V         | V V               |          | 321     | SUMSQ         | 0       | 30      | V         | R ...             |          |
| 286     | GAMMADIST              | 4       | 4       | V         | V V V V           |          | 322     | KURT          | 1       | 30      | V         | R ...             |          |
| 287     | GAMMAINV               | 3       | 3       | V         | V V V             |          | 323     | SKEW          | 1       | 30      | V         | R ...             |          |
| 288     | CEILING                | 2       | 2       | V         | V V               |          | 324     | ZTEST         | 2       | 3       | V         | R V V             |          |
| 289     | HYPGEOMDIST            | 4       | 4       | V         | V V V V           |          | 325     | LARGE         | 2       | 2       | V         | R V               |          |
| 290     | LOGNORMDIST            | 3       | 3       | V         | V V V             |          | 326     | SMALL         | 2       | 2       | V         | R V               |          |
| 291     | LOGINV                 | 3       | 3       | V         | V V V             |          | 327     | QUARTILE      | 2       | 2       | V         | R V               |          |
| 292     | NEGBINOMDIST           | 3       | 3       | V         | V V V             |          | 328     | PERCENTILE    | 2       | 2       | V         | R V               |          |
| 293     | NORMDIST               | 4       | 4       | V         | V V V V           |          | 329     | PERCENTRANK   | 2       | 3       | V         | R V V             |          |
| 294     | NORMSDIST              | 1       | 1       | V         | V                 |          | 330     | MODE          | 1       | 30      | V         | A ...             |          |
| 295     | NORMINV                | 3       | 3       | V         | V V V             |          | 331     | TRIMMEAN      | 2       | 2       | V         | R V               |          |
| 296     | NORMSINV               | 1       | 1       | V         | V                 |          | 332     | TINV          | 2       | 2       | V         | V V               |          |
| 297     | STANDARDIZE            | 3       | 3       | V         | V V V             |          |         |               |         |         |           |                   |          |

<sup>15</sup> Function exists in BIFF2-BIFF3, but parameter count has been changed.

<sup>16</sup> Function exists in BIFF3, but function name has been changed from YEN to USDOLLAR.

<sup>17</sup> Function exists in BIFF3, but function name has been changed from JIS to DBCS.

### 3.11.4 New Built-In Sheet Functions in BIFF5

| Func ID | Function name         | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|-----------------------|---------|---------|-----------|-------------------|----------|
| 70      | WEEKDAY <sup>18</sup> | 1       | 2       | V         | V V               |          |
| 101     | HLOOKUP <sup>18</sup> | 3       | 4       | V         | V R R V           |          |
| 102     | VLOOKUP <sup>18</sup> | 3       | 4       | V         | V R R V           |          |
| 220     | DAYS360 <sup>19</sup> | 2       | 3       | V         | V V V             |          |
| 336     | CONCATENATE           | 0       | 30      | V         | V ...             |          |
| 337     | POWER                 | 2       | 2       | V         | V V               |          |
| 342     | RADIANS               | 1       | 1       | V         | V                 |          |
| 343     | DEGREES               | 1       | 1       | V         | V                 |          |
| 344     | SUBTOTAL              | 2       | 30      | V         | V R ...           |          |

| Func ID | Function name | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|---------------|---------|---------|-----------|-------------------|----------|
| 345     | SUMIF         | 2       | 3       | V         | R V R             |          |
| 346     | COUNTIF       | 2       | 2       | V         | R V               |          |
| 347     | COUNTBLANK    | 1       | 1       | V         | R                 |          |
| 350     | ISPMT         | 4       | 4       | V         | V V V V           |          |
| 351     | DATEDIF       | 3       | 3       | V         | V V V             |          |
| 352     | DATESTRING    | 1       | 1       | V         | V                 |          |
| 353     | NUMBERSTRING  | 2       | 2       | V         | V V               |          |
| 354     | ROMAN         | 1       | 2       | V         | V V               |          |

### 3.11.5 New Built-In Sheet Functions in BIFF8

| Func ID | Function name | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|---------------|---------|---------|-----------|-------------------|----------|
| 358     | GETPIVOTDATA  | 2       | 30      |           |                   |          |
| 359     | HYPERLINK     | 1       | 2       | V         | V V               |          |
| 360     | PHONETIC      | 1       | 1       | V         | R                 |          |
| 361     | AVERAGEA      | 1       | 30      | V         | R ...             |          |
| 362     | MAXA          | 1       | 30      | V         | R ...             |          |

| Func ID | Function name | Min par | Max par | Ret class | Parameter classes | Volatile |
|---------|---------------|---------|---------|-----------|-------------------|----------|
| 363     | MINA          | 1       | 30      | V         | R ...             |          |
| 364     | STDEVPA       | 1       | 30      | V         | R ...             |          |
| 365     | VARPA         | 1       | 30      | V         | R ...             |          |
| 366     | STDEVA        | 1       | 30      | V         | R ...             |          |
| 367     | VARA          | 1       | 30      | V         | R ...             |          |

<sup>18</sup> Function exists in BIFF2-BIFF4, but parameter count has been changed.

<sup>19</sup> Function exists in BIFF3-BIFF4, but parameter count has been changed.

## 4 Worksheet/Workbook Stream

The complex contents in an Excel document are split into several records. To keep the *Worksheet/Workbook Stream* consistent, the position and order of the records is very important. This chapter contains details about the correct order and combination of the records inside the stream. The internal structure of the records is described in chapter →5.

The following record listings show which records are required or optional, using small symbols in front of the record name. The following table shows all possible combinations.

|                                       |                                    |                                                                                      |
|---------------------------------------|------------------------------------|--------------------------------------------------------------------------------------|
| •                                     | RECORD NAME                        | A single required record                                                             |
| ○                                     | RECORD NAME                        | A single optional record                                                             |
| •                                     | RECORD NAME 1<br>RECORD NAME 2     | Exactly one of the specified records                                                 |
| ○                                     | RECORD NAME 1<br>RECORD NAME 2     | Exactly one of the specified records, or no record                                   |
| ••                                    | RECORD NAME                        | A required record list (record occurs 1 to n times)                                  |
| ○○                                    | RECORD NAME                        | An optional record list (record occurs 0 to n times)                                 |
| ••                                    | RECORD NAME 1<br>RECORD NAME 2     | An unordered list of any of the specified records                                    |
| ○○                                    | RECORD NAME 1<br>RECORD NAME 2     | An unordered list of any of the specified records, or no record                      |
| •                                     | <i>Record Group Name</i>           | A required group of records                                                          |
| ○                                     | <i>Record Group Name</i>           | An optional group of records                                                         |
| ••                                    | <i>Record Group Name</i>           | A required list of record groups                                                     |
| ○○                                    | <i>Record Group Name</i>           | An optional list of record groups                                                    |
| ••                                    | • RECORD NAME 1<br>• RECORD NAME 2 | A required list of record groups, each group consists only of the specified records  |
| ○○                                    | • RECORD NAME 1<br>• RECORD NAME 2 | An optional list of record groups, each group consists only of the specified records |
| Uninteresting records in this context |                                    |                                                                                      |

## 4.1 Worksheet/Workbook Stream

This chapter continues the description of the *Worksheet Stream* and *Workbook Stream* started in →2.3.3 on a more detailed level.

### 4.1.1 Worksheet Stream (BIFF2-BIFF4)

The whole worksheet document (→2.1.2) consists of the *Worksheet Stream* (→2.3.3). All records of the worksheet are enclosed by a leading BOF record and a trailing EOF record. The stream contains all information about the worksheet, for instance sheet type (general sheet, chart, macro sheet), sheet dimension, view settings, a font list, a list of defined names and external references, of course the contents and formats of all cells, row heights, column widths, etc.

Records in a *Worksheet Stream* (BIFF2-BIFF4):

|   |     |                                         |
|---|-----|-----------------------------------------|
| • | BOF | Type = sheet, chart, macro sheet (→5.8) |
|   |     | Sheet records                           |
| • | EOF | →5.37                                   |

### 4.1.2 Workbook Stream (BIFF5-BIFF8)

The workbook document (→2.1.3) contains the *Workbook Stream* (→2.3.3), which is divided into *Workbook Globals Substream* and several *Sheet Substreams* (→2.3.4).

Common structure of the *Workbook Stream*, BIFF5-BIFF8:

|    |                                   |
|----|-----------------------------------|
| •  | <i>Workbook Globals Substream</i> |
| •• | <i>Sheet Substreams</i>           |

Records in the *Workbook Stream*, BIFF5-BIFF8:

|    |     |                                |                                                            |
|----|-----|--------------------------------|------------------------------------------------------------|
| •  | BOF | Type = workbook globals (→5.8) |                                                            |
|    |     | Global workbook records        |                                                            |
| •  | EOF | →5.37                          |                                                            |
| •• | •   | BOF                            | Type = sheet, chart, macro sheet, Basic module, ... (→5.8) |
|    |     |                                | Sheet records                                              |
|    | •   | EOF                            | →5.37                                                      |



## 4.2 Record Order in Streams and Substreams

Each of the following chapters describes the order of all records as they appear in a file written by Excel. Often it is valid to modify this order, but in general the order described here should be used when writing Excel files. Note that only normal sheets are described here. Special sheets like charts or macros are not subject of this chapter.

### 4.2.1 Record Order in a BIFF2 Worksheet Stream

|    |                                      |                                                     |
|----|--------------------------------------|-----------------------------------------------------|
| •  | BOF                                  | Type = sheet (→5.8)                                 |
| ○  | FILEPASS                             | →4.19 (File Protection), →5.43                      |
| ○  | INDEX                                | →4.7 ( <i>Row Blocks</i> ), →5.59                   |
| ○  | CODEPAGE                             | →5.17                                               |
| ○  | <i>Calculation Settings Block</i>    | →4.3                                                |
| ○  | PRINTHEADERS                         | →5.81                                               |
| ○  | PRINTGRIDLINES                       | →5.80                                               |
| ○  | DEFAULTROWHEIGHT                     | →5.31                                               |
| ○  | HORIZONTALPAGEBREAKS                 | →5.57 (separated from <i>Page Settings Block</i> )  |
| ○  | VERTICALPAGEBREAKS                   | →5.108 (separated from <i>Page Settings Block</i> ) |
| ○  | • FONT                               | →5.45                                               |
| ○○ | ○ FONT2                              | →5.46                                               |
|    | ○ FONTCOLOR                          | →5.47                                               |
| ○  | <i>Page Settings Block</i>           | →4.4                                                |
| ○  | BACKUP                               | →5.5                                                |
| ○  | <i>Link Table</i>                    | →4.10.1                                             |
| ○  | • BUILTINFMTCOUNT                    | →5.12                                               |
|    | •• FORMAT                            | →5.49                                               |
| ○○ | DEFINEDNAME                          | →5.33                                               |
| ○  | <i>Worksheet Protection Block</i>    | →4.18                                               |
| ○○ | XF                                   | →5.115                                              |
| ○  | DEFCOLWIDTH                          | →5.32                                               |
| ○○ | COLWIDTH                             | →5.20                                               |
| •  | DIMENSION                            | →5.35                                               |
| ○○ | COLUMNDEFAULT                        | →5.19                                               |
| ○○ | <i>Row Blocks</i>                    | →4.7                                                |
| ○○ | NOTE                                 | →5.70                                               |
| ○  | WINDOW1                              | →5.109                                              |
| •  | <i>Worksheet View Settings Block</i> | →4.5                                                |
| •  | EOF                                  | →5.37                                               |

## 4.2.2 Record Order in a BIFF3 Worksheet Stream

|    |                                      |                                                     |
|----|--------------------------------------|-----------------------------------------------------|
| •  | BOF                                  | Type = sheet (→5.8)                                 |
| ○  | <i>File Protection Block</i>         | →4.19                                               |
| ○  | INDEX                                | →4.7 ( <i>Row Blocks</i> ), →5.59                   |
| ○  | CODEPAGE                             | →5.17                                               |
| ○  | <i>Calculation Settings Block</i>    | →4.3                                                |
| ○  | PRINTHEADERS                         | →5.81                                               |
| ○  | PRINTGRIDLINES                       | →5.80                                               |
| ○  | GRIDSET                              | →5.52                                               |
| ○  | HCENTER                              | →5.54 (separated from <i>Page Settings Block</i> )  |
| ○  | VCENTER                              | →5.107 (separated from <i>Page Settings Block</i> ) |
| ○  | GUTS                                 | →5.53                                               |
| ○  | DEFAULTROWHEIGHT                     | →5.31                                               |
| ○  | COUNTRY                              | →5.22                                               |
| ○  | HIDEOBJ                              | →5.56                                               |
| ○  | SHEETPR                              | →5.97                                               |
| ○  | HORIZONTALPAGEBREAKS                 | →5.57 (separated from <i>Page Settings Block</i> )  |
| ○  | VERTICALPAGEBREAKS                   | →5.108 (separated from <i>Page Settings Block</i> ) |
| •• | FONT                                 | →5.45                                               |
| ○  | <i>Page Settings Block</i>           | →4.4                                                |
| ○  | BACKUP                               | →5.5                                                |
| ○  | <i>Link Table</i>                    | →4.10.1                                             |
| ○  | • BULTINFMTCOUNT                     | →5.12                                               |
|    | •• FORMAT                            | →5.49                                               |
| ○○ | DEFINEDNAME                          | →5.33                                               |
| ○  | <i>Workbook Protection Block</i>     | →4.18                                               |
| •• | XF                                   | →5.115                                              |
| •• | STYLE                                | →5.103                                              |
| ○  | PALETTE                              | →5.74                                               |
| ○  | DEFCOLWIDTH                          | →5.32                                               |
| ○○ | COLINFO                              | →5.18                                               |
| •  | DIMENSION                            | →5.35                                               |
| ○○ | <i>Row Blocks</i>                    | →4.7                                                |
| ○○ | NOTE                                 | →5.70                                               |
| •  | WINDOW1                              | →5.109                                              |
| •  | <i>Worksheet View Settings Block</i> | →4.5                                                |
| •  | EOF                                  | →5.37                                               |

### 4.2.3 Record Order in a BIFF4 Worksheet Stream

2do

### 4.2.4 Record Order in a BIFF5 Workbook Stream

#### • Workbook Globals Substream

|                                    |                                |
|------------------------------------|--------------------------------|
| • BOF                              | Type = workbook globals (→5.8) |
| ○ <i>File Protection Block</i>     | →4.19                          |
| ○ CODEPAGE                         | →5.17                          |
| ○ TABID                            |                                |
| ○ FNGROUPCOUNT                     |                                |
| ○ <i>Global Link Table</i>         | →4.10.2                        |
| ○○ DEFINEDNAME                     | →5.33                          |
| ○ <i>Workbook Protection Block</i> | →4.18                          |
| • WINDOW1                          | →5.109                         |
| ○ BACKUP                           | →5.5                           |
| ○ HIDEOBJ                          | →5.56                          |
| ○ DATEMODE                         | →5.28                          |
| ○ PRECISION                        | →5.79                          |
| ○ BOOKBOOL                         | →5.9                           |
| •• FONT                            | →5.45                          |
| ○○ FORMAT                          | →5.49                          |
| •• XF                              | →5.115                         |
| •• STYLE                           | →5.103                         |
| ○ PALETTE                          | →5.74                          |
| •• SHEET                           | →5.95                          |
| • EOF                              | →5.37                          |

• **Sheet Substream**

|                                        |                                   |
|----------------------------------------|-----------------------------------|
| • BOF                                  | Type = sheet (→5.8)               |
| ○ INDEX                                | →4.7 ( <i>Row Blocks</i> ), →5.59 |
| ○ <i>Calculation Settings Block</i>    | →4.3                              |
| ○ PRINTHEADERS                         | →5.81                             |
| ○ PRINTGRIDLINES                       | →5.80                             |
| ○ GRIDSET                              | →5.52                             |
| ○ GUTS                                 | →5.53                             |
| ○ DEFAULTTROWHEIGHT                    | →5.31                             |
| ○ COUNTRY                              | →5.22                             |
| ○ SHEETPR                              | →5.97                             |
| ○ <i>Page Settings Block</i>           | →4.4                              |
| ○ <i>Local Link Table</i>              | →4.10.2                           |
| ○ <i>Worksheet Protection Block</i>    | →4.18                             |
| ○ DEFCOLWIDTH                          | →5.32                             |
| ○○ COLINFO                             | →5.18                             |
| ○ SORT                                 | →5.99                             |
| • DIMENSION                            | →5.35                             |
| ○○ <i>Row Blocks</i>                   | →4.7                              |
| ○○ NOTE                                | →5.70                             |
| • <i>Worksheet View Settings Block</i> | →4.5                              |
| ○ GCW                                  | →5.51                             |
| ○ STANDARDWIDTH                        | →5.101                            |
| • EOF                                  | →5.37                             |

## 4.2.5 Record Order in a BIFF8 Workbook Stream

### • Workbook Globals Substream

|                                    |                                |
|------------------------------------|--------------------------------|
| • BOF                              | Type = workbook globals (→5.8) |
| ○ <i>File Protection Block</i>     | →4.19                          |
| ○ CODEPAGE                         | →5.17                          |
| ○ DSF                              | →5.36                          |
| ○ TABID                            |                                |
| ○ FNGROUPCOUNT                     |                                |
| ○ <i>Workbook Protection Block</i> | →4.18                          |
| • WINDOW1                          | →5.109                         |
| ○ BACKUP                           | →5.5                           |
| ○ HIDEOBJ                          | →5.56                          |
| ○ DATEMODE                         | →5.28                          |
| ○ PRECISION                        | →5.79                          |
| ○ REFRESHALL                       |                                |
| ○ BOOKBOOL                         | →5.9                           |
| •• FONT                            | →5.45                          |
| ○○ FORMAT                          | →5.49                          |
| •• XF                              | →5.115                         |
| •• STYLE                           | →5.103                         |
| ○ PALETTE                          | →5.74                          |
| ○ USESELFS                         | →5.106                         |
| •• SHEET                           | →5.95                          |
| ○ COUNTRY                          | →5.22                          |
| ○ <i>Link Table</i>                | →4.10.3                        |
| ○○ DEFINEDNAME                     | →5.33                          |
| ○ <i>Shared String Table</i>       | →4.11                          |
| • EOF                              | →5.37                          |

• **Sheet Substream**

|                                        |                                   |
|----------------------------------------|-----------------------------------|
| • BOF                                  | Type = sheet (→5.8)               |
| ○ INDEX                                | →4.7 ( <i>Row Blocks</i> ), →5.59 |
| ○ <i>Calculation Settings Block</i>    | →4.3                              |
| ○ PRINTHEADERS                         | →5.81                             |
| ○ PRINTGRIDLINES                       | →5.80                             |
| ○ GRIDSET                              | →5.52                             |
| ○ GUTS                                 | →5.53                             |
| ○ DEFAULTTROWHEIGHT                    | →5.31                             |
| ○ SHEETPR                              | →5.97                             |
| ○ <i>Page Settings Block</i>           | →4.4                              |
| ○ <i>Worksheet Protection Block</i>    | →4.18                             |
| ○ DEFCOLWIDTH                          | →5.32                             |
| ○○ COLINFO                             | →5.18                             |
| ○ SORT                                 | →5.99                             |
| • DIMENSION                            | →5.35                             |
| ○○ <i>Row Blocks</i>                   | →4.7                              |
| • <i>Worksheet View Settings Block</i> | →4.5                              |
| ○ STANDARDWIDTH                        | →5.101                            |
| ○○ MERGEDCELLS                         | →5.67                             |
| ○ LABELRANGES                          | →5.64                             |
| ○ PHONETICPR                           | →5.77                             |
| ○ <i>Conditional Formatting Table</i>  | →4.12                             |
| ○ <i>Hyperlink Table</i>               | →4.13                             |
| ○ <i>Data Validity Table</i>           | →4.14                             |
| ○ SHEETLAYOUT                          | →5.96                             |
| ○ SHEETPROTECTION                      | Additional protection, →5.98      |
| ○ RANGEPROTECTION                      | Additional protection, →5.84      |
| • EOF                                  | →5.37                             |

## 4.3 Calculation Settings Block

**Definition: Calculation Settings Block**

The calculation settings for a sheet are stored in several records in the *Worksheet Stream* (BIFF2-BIFF4) or *Sheet Substream* (BIFF5-BIFF8), called the *Calculation Settings Block*. Note that the settings are global for the entire workbook document in BIFF5-BIFF8, but most of the records occurs equally in every *Sheet Substream*.

Structure of the *Calculation Settings Block*:

|              |                                                                   |
|--------------|-------------------------------------------------------------------|
| ○ UNCALCED   | →5.105 (BIFF3-BIFF8 only)                                         |
| ○ CALCCOUNT  | →5.13                                                             |
| ○ CALCMODE   | →5.14                                                             |
| ○ PRECISION  | →5.79 (moved to <i>Workbook Globals Substream</i> in BIFF5-BIFF8) |
| ○ REFMODE    | →5.85                                                             |
| ○ DELTA      | →5.34                                                             |
| ○ ITERATION  | →5.61                                                             |
| ○ DATEMODE   | →5.28 (moved to <i>Workbook Globals Substream</i> in BIFF5-BIFF8) |
| ○ SAFERECALC | →5.90 (BIFF3-BIFF8 only)                                          |

## 4.4 Page Settings Block

**Definition: Page Settings Block**

The records in the *Page Settings Block* describe options and settings for printing. The record block is contained in the *Worksheet Stream* (BIFF2-BIFF4) or in every *Sheet Substream* of the workbook (BIFF5-BIFF8).

Structure of the *Page Settings Block*:

|                        |                                               |
|------------------------|-----------------------------------------------|
| ○ HORIZONTALPAGEBREAKS | →5.57 (seperated in BIFF2-BIFF4, see below)   |
| ○ VERTICALPAGEBREAKS   | →5.108 (seperated in BIFF2-BIFF4, see below)  |
| ○ HEADER               | →5.55                                         |
| ○ FOOTER               | →5.48                                         |
| ○ HCENTER              | →5.54 (BIFF4-BIFF8 only, seperated in BIFF3)  |
| ○ VCENTER              | →5.107 (BIFF4-BIFF8 only, seperated in BIFF3) |
| ○ LEFTMARGIN           | →5.66                                         |
| ○ RIGHTMARGIN          | →5.86                                         |
| ○ TOPMARGIN            | →5.104                                        |
| ○ BOTTOMMARGIN         | →5.11                                         |
| ○ PLS                  | →5.78                                         |
| ○ PAGESETUP            | →5.73 (BIFF4-BIFF8 only)                      |
| ○ BITMAP               | →5.6 (BIFF8 only)                             |

In BIFF2-BIFF4, Excel does not write the HORIZONTALPAGEBREAKS and VERTICALPAGEBREAKS records together with the other records of this block (BIFF2: →4.2.1; BIFF3: →4.2.2; BIFF4: →4.2.3). In BIFF3, additionally the HCENTER and VCENTER records occur at another place (→4.2.2). Anyway, it is valid to write all records together when a document is exported.

## 4.5 Sheet View Settings Block

**Definition: Sheet View Settings Block**

The view settings for a sheet are stored in several records in the *Worksheet Stream* (BIFF2-BIFF4) or *Sheet Substream* (BIFF5-BIFF8), called the *Sheet View Settings Block*.

Structure of the *Sheet View Settings Block*:

|              |                          |
|--------------|--------------------------|
| • WINDOW2    | →5.110                   |
| ○ SCL        | →5.92 (BIFF4-BIFF8 only) |
| ○ PANE       | →5.75                    |
| ○○ SELECTION | →5.93                    |



## 4.6 Cell Formatting

All cell formatting attributes are stored in XF records (→5.115). The cell records themselves contain an index into the XF record list. This way of storing cell formatting saves memory and decreases the file size.

### 4.6.1 Cell Formatting and Cell Styles

The XF record is able to store explicit cell formatting attributes or the attributes of a cell style (BIFF3-BIFF8). Explicit formatting includes the reference to a cell style XF record. This allows to extend a defined cell style with some explicit attributes.

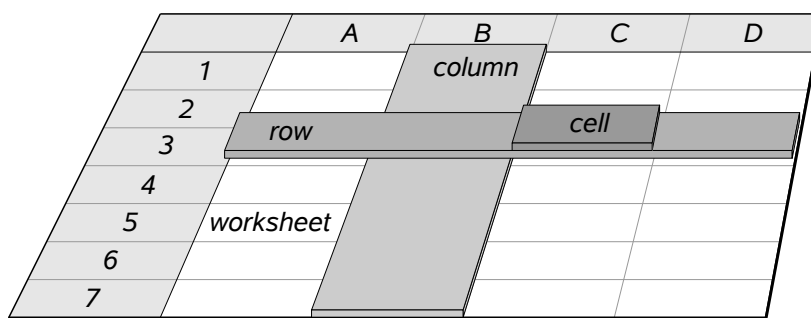
The formatting attributes are divided into 6 groups:

| Group         | Attributes                                                                                      |
|---------------|-------------------------------------------------------------------------------------------------|
| Number format | Number format index (index to FORMAT record)                                                    |
| Font          | Font index (index to FONT record)                                                               |
| Alignment     | Horizontal and vertical alignment, text wrap, indentation, orientation/rotation, text direction |
| Border        | Border line styles and colours                                                                  |
| Background    | Background area style and colours                                                               |
| Protection    | Cell locked, formula hidden                                                                     |

For each group a flag in the cell XF record specifies whether to use the attributes contained in that XF record or in the referenced style XF record. In style XF records, these flags specify whether the attributes will overwrite explicit cell formatting when the style is applied to a cell. Changing a cell style (without applying this style to a cell) will change all cells which already use that style and do not contain explicit cell attributes for the changed style attributes. If a cell XF record does not contain explicit attributes in a group (if the attribute group flag is not set), it repeats the attributes of its style XF record.

### 4.6.2 Default Formatting

Default formatting is applied to all cells which are not described by a cell record. In this case the default format of the row or column may be used (if defined). If an undefined cell contains a row and a column default format, the row format will overwrite the column format. If there are no row and column default formats available, the worksheet/workbook default cell format will be used.



Default column formatting is stored in the COLUMNDEFAULT record (BIFF2, →5.19) or in the COLINFO record (BIFF3-BIFF8, →5.18). The ROW record (→5.88) contains the default format of a specific row. The default cell format is always present in an Excel file, described by the XF record with the fixed index 15 (0-based). By default, it uses the worksheet/workbook default cell style, described by the very first XF record (index 0).

## 4.7 Cell Table and Row Blocks

### 4.7.1 Cell Table

**Definition: Cell Table**

The *Cell Table* describes all cells in a sheet, together with all row and column settings for that sheet.

Structure of the *Cell Table* in the *Worksheet Stream* (BIFF2):

|    |                     |                                    |
|----|---------------------|------------------------------------|
| ○  | DEFAULTROWHEIGHT    | →5.31                              |
| ○  | DEFCOLWIDTH         | →5.32                              |
| ○○ | COLWIDTH            | →5.20                              |
| ●  | DIMENSION           | →5.35                              |
| ○○ | COLUMNDEFAULT       | →5.19                              |
| ○○ | <i>Row Block(s)</i> | Groups of rows with cells (→4.7.2) |

Structure of the *Cell Table* in the *Worksheet Stream* (BIFF3-BIFF4), and *Sheet Substream* (BIFF5-BIFF8):

|    |                     |                                    |
|----|---------------------|------------------------------------|
| ○  | DEFAULTROWHEIGHT    | →5.31                              |
| ○  | DEFCOLWIDTH         | →5.32                              |
| ○○ | COLINFO             | →5.18                              |
| ●  | DIMENSION           | →5.35                              |
| ○○ | <i>Row Block(s)</i> | Groups of rows with cells (→4.7.2) |
| ○  | STANDARDWIDTH       | →5.101 (BIFF4-BIFF8 only)          |

### 4.7.2 Row Block

**Definition: Row Block**

All cells in the *Cell Table* are divided into blocks of 32 consecutive rows, called *Row Blocks*. The first *Row Block* starts with the first used row in that sheet. Inside each *Row Block* there will occur ROW records describing the properties of the rows, and cell records with all the cell contents in this *Row Block*.

Example: The first used cell in the sheet is located in row 10, or row 10 is the first formatted row. The first *Row Block* will contain the rows 10...41, the second *Row Block* will contain the rows 42...73, and so on.

Each *Row Block* contains ROW records describing the row properties (in ascending order), followed by all cell records in this block. The cell records are stored row by row (ascending), and in each row from left to right. A *used row* either contains any (filled or formatted) cells or is changed in another way (for instance height or default formatting). If a row is not used, there will not occur a ROW record in the *Row Block*.

Structure of a *Row Block* in the *Worksheet Stream* (BIFF2-BIFF4) or in the *Sheet Substream* (BIFF5-BIFF8):

|    |                      |                                                                          |
|----|----------------------|--------------------------------------------------------------------------|
| ●● | ROW                  | Properties of the used rows (→5.88)                                      |
| ○○ | <i>Cell Block(s)</i> | Cell records for all used cells (→4.7.3)                                 |
| ●  | DBCELL               | Stream offsets to the cell records of each row (BIFF5-BIFF8 only, →5.29) |

### 4.7.3 Cell Block

**Definition: Cell Block**

A *Cell Block* is in most cases simply a single cell record. In BIFF2 it may be preceded by an IXFE record containing the index to an XF record.

Structure of a common *Cell Block* in a *Row Block*, BIFF2-BIFF8:

|            |                                 |
|------------|---------------------------------|
| ○ IXFE     | Index to XF (BIFF2 only, →5.62) |
| BLANK      | →5.7                            |
| BOOLERR    | →5.10                           |
| INTEGER    | →5.60 (BIFF2 only)              |
| LABEL      | →5.63 (BIFF2-BIFF8)             |
| LABELSST   | →5.65 (BIFF8 only)              |
| ● MULBLANK | →5.68 (BIFF5-BIFF8)             |
| MULRK      | →5.69 (BIFF5-BIFF8)             |
| NUMBER     | →5.71                           |
| RK         | →5.87 (BIFF3-BIFF8)             |
| RSTRING    | →5.89 (BIFF5-BIFF8)             |

If the cell contains a formula, there may occur additional records for array formulas (→4.8), shared formulas (→4.8), multiple operation tables (→4.9), and/or the result string.

Structure of a *Formula Cell Block* in a *Row Block*, BIFF2-BIFF8:

|              |                                                        |
|--------------|--------------------------------------------------------|
| ○ IXFE       | Index to XF (BIFF2 only, →5.62)                        |
| ● FORMULA    | →5.50                                                  |
| ARRAY        | Top left cell of an array formula (→5.4)               |
| ○ SHAREDFMLA | Top left cell of a shared formula (BIFF5-BIFF8, →5.94) |
| DATATABLE    | Top left cell of a multiple operations table (→5.24)   |
| DATATABLE2   | Top left cell of a multiple operations table (→5.25)   |
| ○ STRING     | Formula cell returns a string value (→5.102)           |

## 4.7.4 Finding Cells in a Row Block

### • Finding Cells in a Row Block (BIFF2-BIFF4)

In BIFF2-BIFF4, the ROW record contains a stream offset, pointing to the cell records of the respective row. The offset value of the first ROW record in a *Row Block* represents the difference between the start of the second ROW record and the first cell record. The offset of the second ROW record contains the size of all cell records of the first row, and so on. If a row does not contain any cells, the offset to the cells in the next filled row is stored.

Example: A *Row Block* contains one cell per row in the rows 10, 11, and 12. Row 13 is not used, the height of row 14 is changed (but it does not contain a cell). Row 15 contains a cell again. In this example, the first column shows the absolute stream position of each record.

|                   |        |                                                             |
|-------------------|--------|-------------------------------------------------------------|
| 048E <sub>H</sub> | ROW    | Row = 10, offset = 0050 <sub>H</sub>                        |
| 04A2 <sub>H</sub> | ROW    | Row = 11, offset = 000E <sub>H</sub>                        |
| 04B6 <sub>H</sub> | ROW    | Row = 12, offset = 0012 <sub>H</sub>                        |
| 04CA <sub>H</sub> | ROW    | Row = 14, offset = 000E <sub>H</sub> (no record for row 13) |
| 04DE <sub>H</sub> | ROW    | Row = 15, offset = 0000 <sub>H</sub>                        |
| 04F2 <sub>H</sub> | RK     | Address = A10                                               |
| 0500 <sub>H</sub> | NUMBER | Address = A11                                               |
| 0512 <sub>H</sub> | RK     | Address = A12                                               |
| 0520 <sub>H</sub> | NUMBER | Address = A15                                               |

The base position for the calculation of all cell record positions is the start of the second ROW record, 04A2<sub>H</sub>. This is for convenience: After reading the first ROW record it is possible to calculate the position of the first cell record, using the current stream position and the offset contained in the ROW record.

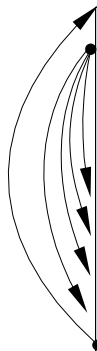
- The first ROW record describes row 10. The cell records of this row start in  $04A2_{\text{H}} + 0050_{\text{H}} = 04F2_{\text{H}}$ .
- The second ROW record describes row 11. The cell records start in  $04A2_{\text{H}} + 0050_{\text{H}} + 000E_{\text{H}} = 0500_{\text{H}}$ .
- The third ROW record describes row 12. The cell records of row 12 start in  $04A2_{\text{H}} + 0050_{\text{H}} + 000E_{\text{H}} + 0012_{\text{H}} = 0512_{\text{H}}$ .
- The fourth ROW record describes row 14. It does not contain cell records. So the offset points to the cells of the next used row (row 15).  
The stream position is  $04A2_{\text{H}} + 0050_{\text{H}} + 000E_{\text{H}} + 0012_{\text{H}} + 000E_{\text{H}} = 0520_{\text{H}}$ .
- The last ROW record describes row 15. Because for row 14 the stream position for row 15 is calculated already, this ROW record contains the offset 0000<sub>H</sub>. The stream position evaluates to the correct value  $04A2_{\text{H}} + 0050_{\text{H}} + 000E_{\text{H}} + 0012_{\text{H}} + 000E_{\text{H}} + 0000_{\text{H}} = 0520_{\text{H}}$ .

If the size of all cell records of a row exceeds FFFF<sub>H</sub>, the respective ROW record will contain the offset 0000<sub>H</sub>. From this row on, the offsets cannot be used anymore to calculate stream positions.

### • Finding Cells in a Row Block (BIFF5-BIFF8)

In BIFF5-BIFF8 the DBCELL record (→5.29) follows the cell records and contains exactly the stream offsets which the ROW records would contain in BIFF2-BIFF4. In the DBCELL record this offset list is lead by an offset to the first ROW record in this *Row Block*. This offset is a positive value, although it points backwards to an earlier stream position. While no record would occur in BIFF2-BIFF4 for empty *Row Blocks*, in BIFF5-BIFF8 a DBCELL record is written for each and every *Row Block*.

Example: A *Row Block* contains one cell per row in the rows 10, 11, and 12. Row 13 is not used, the height of row 14 is changed (but it does not contain a cell). Row 15 contains a cell again. In this example, the first column shows the absolute stream position of each record.



|                   |        |                                                                                                                                                               |
|-------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 07B2 <sub>H</sub> | ROW    | Row = 10 (Record size with header = 0014 <sub>H</sub> )                                                                                                       |
| 07C6 <sub>H</sub> | ROW    | Row = 11                                                                                                                                                      |
| 07DA <sub>H</sub> | ROW    | Row = 12                                                                                                                                                      |
| 07EE <sub>H</sub> | ROW    | Row = 14 (no record for row 13)                                                                                                                               |
| 0802 <sub>H</sub> | ROW    | Row = 15                                                                                                                                                      |
| 0816 <sub>H</sub> | RK     | Address = A10                                                                                                                                                 |
| 0824 <sub>H</sub> | NUMBER | Address = A11                                                                                                                                                 |
| 0836 <sub>H</sub> | RK     | Address = A12                                                                                                                                                 |
| 0844 <sub>H</sub> | NUMBER | Address = A15                                                                                                                                                 |
| 0856 <sub>H</sub> | DBCELL | Offset to first ROW record = 00A4 <sub>H</sub><br>Offsets = 0050 <sub>H</sub> , 000E <sub>H</sub> , 0012 <sub>H</sub> , 000E <sub>H</sub> , 0000 <sub>H</sub> |

The base position for the calculation of all cell record positions is the start of the second ROW record, 07C6<sub>H</sub>. It is calculated from the position of the DBCELL record (contained in the INDEX record, →4.7.5), the first offset this DBCELL record contains, and the size of the first ROW record:

$$0856_{\text{H}} - 00A4_{\text{H}} + 0014_{\text{H}} = 07B2_{\text{H}} + 0014_{\text{H}} = 07C6_{\text{H}}$$

The calculation of the cell record positions works equally to the example for BIFF2-BIFF4 above (using 07C6<sub>H</sub> as base stream position).

If the size of all cell records of a row exceeds FFFF<sub>H</sub>, the respective position in the DBCELL record will contain the offset 0000<sub>H</sub>. From this point on, the offsets cannot be used anymore to calculate stream positions.

## 4.7.5 Finding Row Blocks in a Worksheet

Sometimes it may be useful to jump directly to a specific cell in the *Worksheet Stream* or *Sheet Substream*. The first step is to find the *Row Block* which contains the cell. How to find a cell inside the *Row Block* is described in →4.7.4.

The INDEX record (→5.59) stores the index to the first used row and stream offsets for each *Row Block* in the sheet.

### • Finding Row Blocks in BIFF2-BIFF4

In BIFF2-BIFF4 the INDEX record contains an array with the stream positions of the first ROW record of each *Row Block*. This array contains also positions for empty *Row Blocks*. In this case the position of the next extant *Row Block* is used.

Example: A worksheet contains data in the rows 2, 4, 65, and 100. The range of used rows in the INDEX record is 2...101 (last used row + 1). There are 4 *Row Blocks* in the sheet: 2...33, 34...65, 66...97, and 98...130. The third *Row Block* is empty.

|                   |       |                                                                                                                |
|-------------------|-------|----------------------------------------------------------------------------------------------------------------|
| 0000 <sub>H</sub> | BOF   | Type = worksheet                                                                                               |
|                   |       | Sheet records                                                                                                  |
| 002E <sub>H</sub> | INDEX | Row range = 2...101<br>Offsets = 049A <sub>H</sub> , 04DE <sub>H</sub> , 0500 <sub>H</sub> , 0500 <sub>H</sub> |
|                   |       | Sheet records                                                                                                  |
| 049A <sub>H</sub> | ROW   | Row = 2                                                                                                        |
| 04AE <sub>H</sub> | ROW   | Row = 4                                                                                                        |
|                   |       | Cell records for this <i>Row Block</i>                                                                         |
| 04DE <sub>H</sub> | ROW   | Row = 65                                                                                                       |
|                   |       | Cell records for this <i>Row Block</i>                                                                         |
| 0500 <sub>H</sub> | ROW   | Row = 100                                                                                                      |
|                   |       | Cell records for this <i>Row Block</i>                                                                         |
|                   |       | Sheet records                                                                                                  |
|                   |       | EOF                                                                                                            |

Because the third *Row Block* is empty, the third offset in the INDEX record array points to the fourth *Row Block*.

### • Finding Row Blocks in BIFF5-BIFF8

In BIFF5-BIFF8 the INDEX record contains an array with the stream positions of the DBCELL record (→5.29) following the cell records in each *Row Block*. Because the DBCELL record is mandatory, a *Row Block* cannot be empty anymore.

Example: A worksheet contains data in the rows 2, 4, 65, and 100. The range of used rows in the INDEX record is 2...101 (last used row + 1). There are 4 *Row Blocks* in the sheet: 2...33, 34...65, 66...97, and 98...130. The third *Row Block* is empty except its DBCELL record.

|                   |        |                                                                                                                |
|-------------------|--------|----------------------------------------------------------------------------------------------------------------|
| 0835 <sub>H</sub> | BOF    | Type = worksheet                                                                                               |
| 0849 <sub>H</sub> | INDEX  | Row range = 2...101<br>Offsets = 09A9 <sub>H</sub> , 09D7 <sub>H</sub> , 09E1 <sub>H</sub> , 0A0B <sub>H</sub> |
|                   |        | Sheet records                                                                                                  |
|                   | ROW    | Row = 2                                                                                                        |
|                   | ROW    | Row = 4                                                                                                        |
|                   |        | Cell records for this <i>Row Block</i>                                                                         |
| 09A9 <sub>H</sub> | DBCELL |                                                                                                                |
|                   | ROW    | Row = 65                                                                                                       |
|                   |        | Cell records for this <i>Row Block</i>                                                                         |
| 09D7 <sub>H</sub> | DBCELL |                                                                                                                |
| 09E1 <sub>H</sub> | DBCELL |                                                                                                                |
|                   | ROW    | Row = 100                                                                                                      |
|                   |        | Cell records for this <i>Row Block</i>                                                                         |
| 0A0B <sub>H</sub> | DBCELL |                                                                                                                |
|                   |        | Sheet records                                                                                                  |
|                   | EOF    |                                                                                                                |

## 4.8 Array Formulas and Shared Formulas

An array formula (BIFF2-BIFF8) and a shared formula (BIFF5-BIFF8) is a formula spanning over a range of cells. Array formulas are handled different from single cell formulas in a spreadsheet. Shared formulas are only an optimisation to decrease the file size, they are not distinguishable from other cell formulas. Naturally an array formula cannot be a shared formula at the same time. Shared formulas are created for instance when filling a cell range from a single formula cell.

In general an array or shared formula is stored only once in a file, either in the ARRAY record (→5.4) for array formulas, or in the SHAREDFMLA record (→5.94) for shared formulas. These records are part of the *Formula Cell Block* (→4.7.2). They immediately follow the first FORMULA record (→5.50) for this range<sup>20</sup>. All array or shared formula cells contain a reference to the formula data. This reference (tExp token, →3.10.1) consists of the cell address of the top left cell of the range. In this way each formula cell can be associated with its formula data.

If a formula returns a string value, a STRING record (→5.102) follows the FORMULA record normally. In the case of array and shared formulas, this STRING record follows the ARRAY or SHAREDFMLA record.

Example: A document contains, among other cells, an array formula in A2:B3, a single formula cell in D2, and a shared formula in F2:F3, which returns string values.

|            |                                                         |
|------------|---------------------------------------------------------|
| ROW        | Row = 1 (row 2 in user interface)                       |
| ROW        | Row = 2 (row 3 in user interface)                       |
| FORMULA    | Address = A2, is array formula, cell range origin = A2  |
| ARRAY      | Range = A2:B3, token array of the array formula         |
| FORMULA    | Address = B2, is array formula, cell range origin = A2  |
| FORMULA    | Address = D2, token array of the formula                |
| FORMULA    | Address = F2, is shared formula, cell range origin = F2 |
| SHAREDFMLA | Range = F2:F3, token array of the shared formula        |
| STRING     | Result of previous formula (cell F2)                    |
|            | Cell records                                            |
| FORMULA    | Address = A3, is array formula, cell range origin = A2  |
| FORMULA    | Address = B3, is array formula, cell range origin = A2  |
| FORMULA    | Address = F3, is shared formula, cell range origin = F2 |
| STRING     | Result of previous formula (cell F3)                    |
|            | Cell records                                            |

<sup>20</sup> For shared formulas the first FORMULA record may not be the top-left cell of the range. It is possible to overwrite single cells of a shared formula range without invalidating the shared formula itself (the remaining formula cells).



## 4.9 Multiple Operation Tables

A multiple operation table is a cell range filled with results of a given series of formulas and input values. Three different kinds of multiple operations are supported:

- 1) A column with formulas is aggregated with a row of input values.
- 2) A row with formulas is aggregated with a column of input values.
- 3) A column and a row of input values are aggregated using one formula.

The formulas and input values are not included in the actual operation table. They must be located in the column left of the table and in the row above the table. In case 3), the single formula is in the cell at top left of the table (outside).

All formulas should refer to a specific cell, the "input cell". On calculation, this cell reference is replaced by the respective value from the input value range in each formula. If the input values are located in the column, the input cell is called "column input cell", otherwise "row input cell". In case 3) there is a column value range and a row value range. Therefore both kinds of input cells are required here. The following examples show how multiple operation tables work.

Example for a multiple operation table in the range C2:D3, with formulas in a row (C1:D1 implicitly), and input values in the column (B2:B3 implicitly). The table has been created with A1 as input cell. The highlighted range is the operation table. The example shows the calculated formulas, but they are not really contained there.

|   | A          | B | C     | D         | E |
|---|------------|---|-------|-----------|---|
| 1 | Input cell |   | =A1^2 | =SQRT(A1) |   |
| 2 |            | 4 | =B2^2 | =SQRT(B2) |   |
| 3 |            | 9 | =B3^2 | =SQRT(B3) |   |

Example for a multiple operation table in the range C2:D3, with input values in column and row (C1:D1 and B2:B3 implicitly, formula in B1). The table has been created with A1 as row input cell and A2 as column input cell. Again, the highlighted range is the operation table.

|   | A                 | B      | C      | D      | E |
|---|-------------------|--------|--------|--------|---|
| 1 | Row input cell    | =A1^A2 | 4      | 5      |   |
| 2 | Column input cell | 2      | =C1^B2 | =D1^B2 |   |
| 3 |                   | 3      | =C1^B3 | =D1^B3 |   |

Similar to array and shared formulas a multiple operation table is described only once in a file. The DATATABLE record (→5.24) is used for that, and possibly the DATATABLE2 record (→5.25) in BIFF2. These records are part of the *Formula Cell Block* (→4.7.2). They immediately follow the first FORMULA record (→5.50) for this table. Each cell in the table (which are all formula cells) contain a single tTbl token (→3.10.2) only. The token consists of the cell address of the top left cell of the table. In this way each cell can be associated with the description of the table.

If a formula returns a string value, a STRING record (→5.102) follows the FORMULA record normally. In the case of multiple operation table, this STRING record follows the DATATABLE or DATATABLE2 record.

Example: A document contains, among other cells, a multiple operation table in C2:D3.

|           |                                                             |
|-----------|-------------------------------------------------------------|
| ROW       | Row = 1 (row 2 in user interface)                           |
| ROW       | Row = 2 (row 3 in user interface)                           |
| FORMULA   | Address = C2, is multiple operation, cell range origin = C2 |
| DATATABLE | Range = C2:D3, table mode, input cell                       |
| FORMULA   | Address = D2, is multiple operation, cell range origin = C2 |
|           | Cell records                                                |
| FORMULA   | Address = C3, is array formula, cell range origin = C2      |
| FORMULA   | Address = D3, is array formula, cell range origin = C2      |
|           | Cell records                                                |

## 4.10 Internal and External References

This chapter describes all types of 3D and external references. In detail, this could be:

- A reference to a cell or a cell range of another sheet in the same workbook (3D reference);
- A reference to a cell or a cell range of a sheet in another workbook (external reference);
- A reference to a global or local defined name (internal name);
- A reference to a defined name in another workbook (external name);
- An external function (add-in, sheet macro, Basic macro);
- A DDE link;
- An OLE link.

For external references and external names a combination of XCT and CRN records will occur. These records store values of cells of the document. If the external document cannot be found, these values will be used to get the result of an external reference. An XCT record (→5.114) contains the number of following CRN records. A CRN record (→5.23) stores the contents of one cell or a sequence of cells of one row. Fragmentary cell ranges or cell ranges spanning over more than one row are split into several CRN records. 3D references do not use these records because the referenced cells are located in the own document.

It is possible to determine whether the cached cell values (the XCT and CRN records) will be stored in the file. In BIFF3 and BIFF4 this option is stored in the SHEETPR record (→5.97). From BIFF5 on the optional record BOOKBOOL (→5.9) contains this option.

For all the following examples an external document “example.xls” is used. It contains 3 sheets named “ExtSheet1”, “ExtSheet2” and “ExtSheet3”.

### **4.10.1 References in BIFF2-BIFF4**

2do

## 4.10.2 References in BIFF5

The data of references is spread in several *Link Tables*.

### **Definition: Global Link Table**

The *Global Link Table* contains reference data used by internal defined names. It is located in the *Workbook Globals Substream* (→4.2.4) and is followed by the list of DEFINEDNAME records containing definitions of all internal defined names. If no names are defined in the document, or none of the defined names needs any reference data, the *Global Link Table* will not occur.

### **Definition: Local Link Table**

The reference data used in sheets (for example cell formulas) is stored in *Local Link Tables* inside the *Sheet Substreams* (→4.2.4). Each worksheet that uses references contains its own *Local Link Table*.

### • Structure of the Link Table

Common structure of the *Link Table*, BIFF5:

|                              |                                                 |
|------------------------------|-------------------------------------------------|
| • EXTERNCOUNT                | →5.40                                           |
| •• <i>EXTERNSHEET Blocks</i> | Settings for a referenced worksheet or document |

There are three different kinds of *EXTERNSHEET Blocks*, all starting with an EXTERNSHEET record.

The *Internal EXTERNSHEET Sheet Block* represents a referenced worksheet in the own document. The EXTERNSHEET record contains the sheet name only. There will not be any other records following it.

Common structure of an *Internal EXTERNSHEET Sheet Block*, BIFF5:

|               |       |
|---------------|-------|
| • EXTERNSHEET | →5.41 |
|---------------|-------|

The *External EXTERNSHEET Sheet Block* represents a referenced worksheet in an external document. The EXTERNSHEET record contains the URL of the document together with the sheet name. It is followed by cached cell contents if enabled (see record BOOKBOOL, →5.9).

Common structure of an *External EXTERNSHEET Sheet Block*, BIFF5:

|               |        |
|---------------|--------|
| • EXTERNSHEET | →5.41  |
| ○ XCT         | →5.114 |
| ○○ CRN        | →5.23  |

The *EXTERNSHEET Document Block* represents a complete external document (for example used for external names, add-in functions, or DDE links). The EXTERNSHEET record only contains the URL of the document without a sheet name. It is followed by external name definitions.

Common structure of an *EXTERNSHEET Document Block*, BIFF5:

|                 |       |
|-----------------|-------|
| • EXTERNSHEET   | →5.41 |
| •• EXTERNALNAME | →5.39 |

## • External and 3D References

External and 3D references are represented in a formula by the tokens tRef3d (→3.9.15) or tArea3d (→3.9.16). These tokens contain an index to an EXTERNSHEET record located in the own *Local Link Table* and indexes to the first and last referenced sheet.

For 3D references, the tokens contain a negative EXTERNSHEET index, indicating a reference into the own workbook. The absolute value is the *one-based* index of the EXTERNSHEET record that contains the name of the first sheet. The tokens additionally contain absolute indexes of the first and last referenced sheet. These indexes are independent of the EXTERNSHEET record list. If the referenced sheets do not exist anymore, these indexes contain the value -1 (3D reference to a deleted sheet), and an EXTERNSHEET record with the special name “<04<sub>H</sub>>” (own document) is used.

Each external reference contains the positive *one-based* index to an EXTERNSHEET record containing the URL of the external document and the name of the sheet used. The sheet index fields of the tokens are not used.

Example: A document with 7 sheets (named from “Sheet1” to “Sheet7”) contains on “Sheet1” the formulas

```
=Sheet2!A1,
=Sheet1!A1,
=SUM(Sheet4:Sheet6!A1:B3),
=SUM([example.xls]ExtSheet1!A1:B2) (contents: A1=1.11, B1=2.22, A2=3.33, B2=4.44),
=[example.xls]ExtSheet3!A1 (contents: “ABCD”), and
=Sheet8!A1.
```

The *Local Link Table* of Sheet1 contains 7 EXTERNSHEET Sheet Blocks:

|               |                                                    |
|---------------|----------------------------------------------------|
| EXTERNCOUNT   | Number of EXTERNSHEET records = 7                  |
| EXTERNSHEET 1 | Name = “<03 <sub>H</sub> >Sheet2”                  |
| EXTERNSHEET 2 | Name = “<02 <sub>H</sub> >” (own sheet, →2.5.9)    |
| EXTERNSHEET 3 | Name = “<03 <sub>H</sub> >Sheet4”                  |
| EXTERNSHEET 4 | Name = “<03 <sub>H</sub> >Sheet6”                  |
| EXTERNSHEET 5 | Name = “<01 <sub>H</sub> >[example.xls]ExtSheet1”  |
| XCT           | Number of CRN = 2                                  |
| CRN 0         | Cell range = A1:B1, contents = 1.11, 2.22          |
| CRN 1         | Cell range = A2:B2, contents = 3.33, 4.44          |
| EXTERNSHEET 6 | Name = “<01 <sub>H</sub> >[example.xls]ExtSheet3”  |
| XCT           | Number of CRN = 1                                  |
| CRN 0         | Cell range = A1, contents = “ABCD”                 |
| EXTERNSHEET 7 | Name = “<04 <sub>H</sub> >” (own workbook, →2.5.9) |

Inside of the first formula the cell reference is represented by the token tRef3d (→3.9.15). The third formula contains the token tArea3d (→3.9.16). The last formula contains a tRef3d token which refers to the last EXTERNSHEET record and contains -1 as sheet indexes.

## • Internal Names

All internal names are stored in the *Global Link Table* in a list of DEFINEDNAME records (→5.33). There exist two types of internal names: global names which are valid in the whole workbook and local names which are attached to a specific sheet. For instance the local name “MyCell” of the sheet “Sheet1” can be used from everywhere in the workbook by entering =Sheet1!MyCell. Each DEFINEDNAME record contains the name itself and a *one-based* index to the preceding EXTERNSHEET records to indicate a local name, or the index zero to indicate a global name.

Inside of a formula a global name or a local name of the own sheet is represented by the token tName (→3.9.1) with a *one-based* index to the DEFINEDNAME record list. Local names from other sheets (with explicitly denoted sheet name) are represented by the token tNameX (→3.9.14) with an index to a special EXTERNSHEET record and an index to the DEFINEDNAME record list.

In defined names, only 3D references are allowed. The special syntax =!<reference> allowed in defined names only (<reference> being a 2D cell reference or range reference) makes it possible to refer to cells or ranges in the same sheet that contains the formula cell with the defined name.

Example: A document contains the global name “GlobalName”, and the local names “Sheet1!LocalName” and “Sheet2!LocalName”. In “Sheet1” there are the formulas

```
=GlobalName,
=LocalName,
=Sheet1!LocalName, and
=Sheet2!LocalName.
```

The defined name “GlobalName” contains the formula

```
=!$A$1.
```

The *Global Link Table* (together with the list of DEFINEDNAME records) contains the following records:

|               |                                                                                                                                                    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| EXTERNCOUNT   | Number of EXTERNSHEET records = 3                                                                                                                  |
| EXTERNSHEET 1 | Name = “<00 <sub>H</sub> >” (Current sheet for defined names, →2.5.9)                                                                              |
| EXTERNSHEET 2 | Name = “<03 <sub>H</sub> >Sheet1”                                                                                                                  |
| EXTERNSHEET 3 | Name = “<03 <sub>H</sub> >Sheet2”                                                                                                                  |
| DEFINEDNAME 1 | Name = “GlobalName”, EXTERNSHEET = 0 (Global)<br>Formula = tRef3d token with EXTERNSHEET = -1 (negative one-based index to EXTERNSHEET 1, →3.9.15) |
| DEFINEDNAME 2 | Name = “LocalName”, EXTERNSHEET = 2 (Sheet1)                                                                                                       |
| DEFINEDNAME 3 | Name = “LocalName”, EXTERNSHEET = 3 (Sheet2)                                                                                                       |

The *Local Link Table* of Sheet1 contains the following records:

|               |                                                                         |
|---------------|-------------------------------------------------------------------------|
| EXTERNCOUNT   | Number of EXTERNSHEET records = 1                                       |
| EXTERNSHEET 1 | Name = “<04 <sub>H</sub> >” (Unspecified sheet in own workbook, →2.5.9) |

The two former formulas contain a tNameV token each. The token in the first formula refers to DEFINEDNAME 1 and the token in the second formula to DEFINEDNAME 2.

The two latter formulas contain a tNameXV token each. Both contain a reference to EXTERNSHEET 1 in the *Local Link Table*. The token in the third formula refers to DEFINEDNAME 2 and the last formula refers to DEFINEDNAME 3.

## • External Names

In Excel, formulas can use defined names located in another workbook, called “external names”. The definitions for external names are stored in a combination of *EXTERNSHEET Sheet Blocks* and *EXTERNSHEET Document Blocks*. The *EXTERNSHEET Sheet Blocks* contain the source document and sheet names the external names are located in, and the cached cell contents. Following a single *EXTERNSHEET Document Block* that only contains the source document name and the external name definitions themselves. This is repeated for each external document.

Inside of a formula an external name is represented by the token tNameX (→3.9.14). It contains the *one-based* index to the EXTERNSHEET record (of the *EXTERNSHEET Document Block*) and a *one-based* index to an EXTERNALNAME record inside this block. Each EXTERNALNAME record refers to a preceding EXTERNSHEET record containing the sheet name.

Example: A document contains the formulas

```
=example.xls!GlobalName (location: ExtSheet3!C33; contents: 33),
=[example.xls]ExtSheet3!LocalName (location: ExtSheet1!B22; contents: “ABCD”),
=[example.xls]ExtSheet1!LocalName (location: ExtSheet1!A11; contents: 11), and
=another_example.xls!GlobalName (location: ExtSheet2!B2; contents: 2).
```

The *Local Link Table* of Sheet1 contains two *EXTERNSHEET Sheet Blocks* followed by an *EXTERNSHEET Document Block* for the document “example.xls”; and one *EXTERNSHEET Sheet Block* and one *EXTERNSHEET Document Block* for the document “another\_example.xls”:

|                |                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------|
| EXTERNCOUNT    | Number of EXTERNSHEET records = 5                                                                |
| EXTERNSHEET 1  | Name = “<01 <sub>H</sub> >[example.xls]ExtSheet1”                                                |
| XCT            | Number of CRN = 2                                                                                |
| CRN 0          | Cell range = A11, contents = 11                                                                  |
| CRN 1          | Cell range = B22, contents = “ABCD”                                                              |
| EXTERNSHEET 2  | Name = “<01 <sub>H</sub> >[example.xls]ExtSheet3”                                                |
| XCT            | Number of CRN = 1                                                                                |
| CRN 0          | Cell range = C33, contents = 33                                                                  |
| EXTERNSHEET 3  | Name = “<01 <sub>H</sub> >example.xls”                                                           |
| EXTERNALNAME 1 | Name = “GlobalName”, EXTERNSHEET = 0 (global),<br>Formula = “=[example.xls]ExtSheet3!C33”        |
| EXTERNALNAME 2 | Name = “LocalName”, EXTERNSHEET = 2,<br>Formula = “=[example.xls]ExtSheet1!B22”                  |
| EXTERNALNAME 3 | Name = “LocalName”, EXTERNSHEET = 1,<br>Formula = “=[example.xls]ExtSheet1!A11”                  |
| EXTERNSHEET 4  | Name = “<01 <sub>H</sub> >[another_example.xls]ExtSheet2”                                        |
| XCT            | Number of CRN = 1                                                                                |
| CRN 0          | Cell range = B2, contents = 2                                                                    |
| EXTERNSHEET 5  | Name = “<01 <sub>H</sub> >another_example.xls”                                                   |
| EXTERNALNAME 1 | Name = “GlobalName”, EXTERNSHEET = 0 (global),<br>Formula = “=[another_example.xls]ExtSheet2!B2” |

All formulas in the example above contain the token tNameXV.

The tokens of the first three formulas refer to EXTERNSHEET 3 (the *EXTERNSHEET Document Block* of “example.xls”). Each token refers to the respective EXTERNALNAME record following this EXTERNSHEET record. For instance, the third formula refers to EXTERNALNAME 3 which contains the name “LocalName” and refers to EXTERNSHEET 1. EXTERNSHEET 1 is used to obtain the sheet name of the external name. The name is completed to “[example.xls]ExtSheet1!LocalName”.

The tNameXV token of the last formula refers to EXTERNSHEET 5 (the *EXTERNSHEET Document Block* of “another\_example.xls”). Because EXTERNSHEET 5 describes a global external name, the name is directly completed to “another\_example.xls!GlobalName”.

## • Add-In Functions

If a worksheet uses add-in functions, a special EXTERNALNAME record containing the byte sequence 01<sub>H</sub> 3A<sub>H</sub> will occur. It is followed by the names of all used add-in functions, each inside of an EXTERNALNAME record.

Example: A document contains the formulas =ISODD(1) and =ISEVEN(1).

The *Local Link Table* of Sheet1 contains an *EXTERNSHEET Document Block* with the special EXTERNSHEET record for add-in functions:

|                |                                      |
|----------------|--------------------------------------|
| EXTERNCOUNT    | Number of EXTERNSHEET records = 1    |
| EXTERNSHEET 1  | Name = "<3A <sub>H</sub> >" (add-in) |
| EXTERNALNAME 1 | Name = "ISODD"                       |
| EXTERNALNAME 2 | Name = "ISEVEN"                      |

The add-in function names are represented by tNameXR tokens in the formula, here referring to EXTERNSHEET 1 and to the respective EXTERNALNAME record. The token is the first argument of the EXTERN.CALL function, which invokes the call of the add-in function.

## • DDE Links, OLE Links

DDE links and OLE links expect the name of the server application (DDE) or the class name (OLE) and the name of a source document. These items are encoded in an EXTERNSHEET record. It is followed by EXTERNALNAME records with additional data of the links. An EXTERNALNAME record contains the item (data source range) or the identifier of the OLE object data storage. Inside a formula, a DDE link or OLE data link is represented by the token tNameXV (→3.9.14). An OLE object link contains a tNameX token in its OBJ record.

Example: A document contains a DDE link and an OLE data link to the range A1:B2 of Sheet1 in the Excel document "D:\example.xls" and a linked OLE object to the bitmap file "D:\example.bmp".

The *Local Link Table* of Sheet1 contains two *EXTERNSHEET Document Blocks*, one for the DDE link, one for the OLE data link, and one for the linked OLE object:

|                |                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------|
| EXTERNCOUNT    | Number of EXTERNSHEET records = 1                                                                              |
| EXTERNSHEET 1  | Name = "excel<03 <sub>H</sub> >D:\[example.xls]Sheet1"<br>(Server = "excel"; Topic = "D:\[example.xls]Sheet1") |
| EXTERNALNAME 1 | Type = DDE link, representing the "StdDocumentName" identifier<br>Item = "StdDocumentName"                     |
| EXTERNALNAME 2 | Type = DDE link<br>Item = "A1:B2"                                                                              |
| EXTERNSHEET 2  | Name = "Excel.Sheet.5<03 <sub>H</sub> >D:\example.xls"<br>(Server = "Excel.Sheet.5"; Topic = "D:\example.xls") |
| EXTERNALNAME 1 | Type = OLE link<br>Item = "!Sheet1!A1:B2"                                                                      |
| EXTERNSHEET 3  | Name = "Package<03 <sub>H</sub> >D:\example.bmp"<br>(Class name = "Package"; Document = "D:\example.bmp")      |
| EXTERNALNAME 1 | Type = OLE link<br>Storage = 00012345 <sub>H</sub> (storage name = "LNK00012345")                              |



### 4.10.3 References in BIFF8

The main data of all types of references is stored in the *Link Table* inside the *Workbook Globals Substream* (→4.2.5). All formulas use only indexes for specific references. The *Link Table* itself is optional and occurs only, if there are any references in the document.

Common structure of the *Link Table*, BIFF8:

|    |                            |                                    |
|----|----------------------------|------------------------------------|
| ●● | <i>EXTERNALBOOK Blocks</i> | Settings for a referenced document |
| ●  | EXTERNSHEET                | →5.41                              |
| ○○ | DEFINEDNAME                | →5.33                              |

Each referenced document is represented by an *EXTERNALBOOK Block*. It starts with an *EXTERNALBOOK* record. It contains the name of the document and the names of its sheets. It is followed by additional records that allow to dereference the data in the document. After the last *EXTERNALBOOK Block* occurs only one *EXTERNSHEET* record. It contains a list with indexes to the *SUPBOOKS* for each used reference anywhere in the document. Formulas use indexes into this *EXTERNSHEET* list.

Example: A document contains (among other references) the two formulas

= [example.xls]ExtSheet2!A1 and

= [example.xls]ExtSheet1!A1.

|                             |                                                                                                                                                                               |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>EXTERNALBOOK Block 0</i> | Any content                                                                                                                                                                   |
| <i>EXTERNALBOOK Block 1</i> | Document = "example.xls"<br>Sheet 0 = "ExtSheet1"<br>Sheet 1 = "ExtSheet2"<br>Sheet 2 = "ExtSheet3"                                                                           |
| <i>EXTERNALBOOK Block 2</i> | Any content                                                                                                                                                                   |
| EXTERNSHEET                 | REF 0 = any reference<br>REF 1 = {EXTERNALBOOK = 1, sheet range = 1...1}<br>REF 2 = any reference<br>REF 3 = {EXTERNALBOOK = 1, sheet range = 0...0}<br>REF 4 = any reference |

The first formula uses REF 1 in the *EXTERNSHEET* record. REF 1 refers to *EXTERNALBOOK Block 1* and sheet range 1...1. This means, the document "example.xls" is used (document of *EXTERNALBOOK Block 1*) and the name of the sheet is "ExtSheet2" (sheet 1 of *EXTERNALBOOK Block 1*). In the same way, the second formula uses REF 3 in the *EXTERNSHEET* record. All list entries inside of the *EXTERNSHEET* record are unique. For instance all formulas in the workbook referring to sheet "ExtSheet2" of the document "example.xls" use REF 1. All other *EXTERNALBOOK Blocks* and *REFs* are placeholders for other references in this example.

Common structure of an *EXTERNALBOOK Block*, BIFF8:

|    |              |        |
|----|--------------|--------|
| ●  | EXTERNALBOOK | →5.38  |
| ○○ | EXTERNALNAME | →5.39  |
| ○○ | ● XCT        | →5.114 |
|    | ●● CRN       | →5.23  |

The *EXTERNALBOOK Block* may contain cached values of cells in the referenced document. These values are stored in several *XCT* and *CRN* records.

## • External and 3D References

The EXTERNALBOOK for the own document has a special format: It contains only the number of all sheets and the byte sequence 01<sub>H</sub> 04<sub>H</sub> instead of the sheet names. The sheet range indexes in the EXTERNSHEET record refer to the position of the sheets (zero-based). If a referenced sheet does not exist anymore, the sheet index -1 will occur (deleted 3D reference).

Example: A document with 7 sheets (named from “Sheet1” to “Sheet7”) contains the formulas  
 =Sheet2!A1,  
 =SUM(Sheet4:Sheet6!A1:B3),  
 =SUM([example.xls]ExtSheet1!A1:B2) (contents: A1=1.11, B1=2.22, A2=3.33, B2=4.44),  
 =[example.xls]ExtSheet3!A1 (contents: “ABCD”), and  
 =Sheet8!A1.

|                |                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EXTERNALBOOK 0 | Number of sheets: 7<br>01 <sub>H</sub> 04 <sub>H</sub> (own workbook)                                                                                                                                                                                         |
| EXTERNALBOOK 1 | Number of sheets: 3<br>Document = “example.xls”<br>Sheet 0 = “ExtSheet1”<br>Sheet 1 = “ExtSheet2”<br>Sheet 2 = “ExtSheet3”                                                                                                                                    |
| XCT            | Number of CRN = 2, sheet = 0 (ExtSheet1)                                                                                                                                                                                                                      |
| CRN 0          | Cell range = A1:B1, contents = 1.11, 2.22                                                                                                                                                                                                                     |
| CRN 1          | Cell range = A2:B2, contents = 3.33, 4.44                                                                                                                                                                                                                     |
| XCT            | Number of CRN = 1, sheet = 2 (ExtSheet3)                                                                                                                                                                                                                      |
| CRN 0          | Cell range = A1, contents = “ABCD”                                                                                                                                                                                                                            |
| EXTERNSHEET    | REF 0 = {EXTERNALBOOK = 0, sheet range = 1...1}<br>REF 1 = {EXTERNALBOOK = 0, sheet range = 3...5}<br>REF 2 = {EXTERNALBOOK = 1, sheet range = 0...0}<br>REF 3 = {EXTERNALBOOK = 1, sheet range = 1...1}<br>REF 4 = {EXTERNALBOOK = 0, sheet range = -1...-1} |

Inside of the first formula the cell reference is represented by the token tRef3d (→3.9.15). The second formula contains the token tArea3d (→3.9.16).

## • Internal Names

All internal names are stored in a list of DEFINEDNAME records (→5.33) that follows the EXTERNSHEET record. There exist two types of internal names: global names which are valid in the whole workbook and local names which are attached to a specific sheet. For instance the local name “MyCell” of the sheet “Sheet1” can be used from everywhere in the workbook by entering =Sheet1!MyCell. Each DEFINEDNAME record contains the name itself and a *one-based* sheet index. The index zero indicates a global name. If the document contains local names, a special REF entry will be created in the EXTERNSHEET record. It contains the index to the internal EXTERNALBOOK and the sheet range -2...-2.

Inside of a formula a global name or a local name of the own sheet is represented by the token tName (→3.9.1) with a *one-based* index to the DEFINEDNAME record list. Local names from other sheets (with explicitly denoted sheet name) are represented by the token tNameX (→3.9.14) with an index to the special REF entry of the EXTERNSHEET record and an index to the DEFINEDNAME record list.

In defined names, only 3D references are allowed. The special syntax =!<reference> allowed in defined names only (<reference> being a 2D cell reference or range reference) makes it possible to refer to cells or ranges in the same sheet that contains the formula cell with the defined name.

Example for internal names: A document contains the global name “GlobalName”, and the local names “Sheet1!LocalName” and “Sheet2!LocalName”. In “Sheet1” there are the formulas

```
=GlobalName,
=LocalName,
=Sheet1!LocalName, and
=Sheet2!LocalName.
```

The defined name “GlobalName” contains the formula

```
=!$A$1.
```

|                |                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EXTERNALBOOK 0 | Number of sheets: 3<br>01 <sub>H</sub> 04 <sub>H</sub> (own workbook)                                                                                       |
| EXTERNALBOOK 1 | Number of sheets: 0<br>Document = “<00 <sub>H</sub> >” (Current sheet for defined names, →2.5.9)                                                            |
| EXTERNSHEET    | REF 0 = {EXTERNALBOOK = 0, sheet range = 0...0}<br>REF 1 = { EXTERNALBOOK = 0, sheet range = -2...-2}<br>REF 2 = { EXTERNALBOOK = 1, sheet range = -2...-2} |
| DEFINEDNAME 1  | Name = “GlobalName”, sheet ( <i>one-based</i> ) = 0 (Global)<br>Formula = tRef3d token to REF 2 (→3.9.15)                                                   |
| DEFINEDNAME 2  | Name = “LocalName”, sheet ( <i>one-based</i> ) = 1 (Sheet1)                                                                                                 |
| DEFINEDNAME 3  | Name = “LocalName”, sheet ( <i>one-based</i> ) = 2 (Sheet2)                                                                                                 |

The first formula in the example above contains the token tNameV referring to DEFINEDNAME 1 and the second formula the same token referring to DEFINEDNAME 2.

The two latter formulas contain the token tNameXV with a reference to REF 1 in the EXTERNSHEET record. REF 1 refers to EXTERNALBOOK 0 with the special sheet indexes for defined names. The token of the third formula refers to DEFINEDNAME 2 and the token of the last formula refers to DEFINEDNAME 3.

## • External Names

In Excel, formulas can use defined names located in another workbook, called “external names”. In this case for each name an EXTERNALNAME record (→5.39) occurs after the EXTERNALBOOK record. The EXTERNALNAME record contains the name itself and the *one-based* index to the sheet name of the EXTERNALBOOK record. Again the index zero indicates a global name. If an EXTERNALBOOK contains external names, a special REF entry will be created in the EXTERNSHEET record. It contains the index to the EXTERNALBOOK and the sheet range  $-2\dots-2$ .

Inside of a formula an external name is represented by the token tNameX (→3.9.14). It contains the index to the special REF entry inside of the EXTERNSHEET record and the index to an EXTERNALNAME record (*one-based*).

Example: A document contains the formulas

=example.xls!GlobalName (location: ExtSheet3!C33; contents: 33),  
 =[example.xls]ExtSheet3!LocalName (location: ExtSheet1!B22; contents: “ABCD”), and  
 =[example.xls]ExtSheet1!LocalName (location: ExtSheet1!A11; contents: 11).

|                |                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------|
| EXTERNALBOOK 0 | Document = “example.xls”<br>Sheet 0 = “ExtSheet1”<br>Sheet 1 = “ExtSheet2”<br>Sheet 2 = “ExtSheet3”        |
| EXTERNALNAME 1 | Name = “GlobalName”, sheet ( <i>one-based</i> ) = 0 (Global),<br>Formula = “=[example.xls]ExtSheet3!C33”   |
| EXTERNALNAME 2 | Name = “LocalName”, sheet ( <i>one-based</i> ) = 3 (ExtSheet3),<br>Formula = “=[example.xls]ExtSheet1!B22” |
| EXTERNALNAME 3 | Name = “LocalName”, sheet ( <i>one-based</i> ) = 1 (ExtSheet1),<br>Formula = “=[example.xls]ExtSheet1!A11” |
| XCT            | Number of CRN = 2, sheet = 0 (ExtSheet1)                                                                   |
| CRN 0          | Cell range = A11, contents = 11                                                                            |
| CRN 1          | Cell range = B22, contents = “ABCD”                                                                        |
| XCT            | Number of CRN = 1, sheet = 2 (ExtSheet3)                                                                   |
| CRN 0          | Cell range = C33, contents = 33                                                                            |
| EXTERNSHEET    | REF 0 = {EXTERNALBOOK = 0, sheet range = $-2\dots-2$ }                                                     |

All formulas in the example above contain the token tNameXV with a reference to REF 0 in the EXTERNSHEET record. REF 0 refers to EXTERNALBOOK 0 with the special sheet indexes for defined names. Therefore the EXTERNALNAME records of EXTERNALBOOK 0 are used.

The token of the first formula refers to EXTERNALNAME 1, the token of the second formula refers to EXTERNALNAME 2, and the token of the last formula refers to EXTERNALNAME 3.

## • Add-In Functions

If a workbook uses add-in functions, a special EXTERNALBOOK containing the byte sequence  $01_H 3A_H$  will occur. It is followed by the names of all used add-in functions, each inside of an EXTERNALNAME record. A special REF entry with the sheet range  $-2\dots-2$  will be inserted into the EXTERNSHEET reference list.

Example: A document contains the formulas =ISODD (1) and =ISEVEN (1) .

|                |                                                        |
|----------------|--------------------------------------------------------|
| EXTERNALBOOK 0 | $01_H 3A_H$ (add-in)                                   |
| EXTERNALNAME 1 | Name = “ISODD”                                         |
| EXTERNALNAME 2 | Name = “ISEVEN”                                        |
| EXTERNSHEET    | REF 0 = {EXTERNALBOOK = 0, sheet range = $-2\dots-2$ } |

The add-in function names are represented by tNameXR tokens in the formula, here referring to REF 0 and to the respective EXTERNALNAME record. The token is the first argument of the EXTERN.CALL function, which invokes the call of the add-in function.

### • DDE Links, OLE Links

DDE links and OLE links expect the name of the server application (DDE) or the class name (OLE) and the name of a source document. These items are encoded in an EXTERNSHEET record. It is followed by EXTERNALNAME records with additional data of the links. An EXTERNALNAME record contains the item (data source range) or the identifier of the OLE object data storage. Inside a formula, a DDE link or OLE data link is represented by the token tNameXV (→3.9.14). An OLE object link contains a tNameX token in its OBJ record.

Example: A document contains a DDE link and an OLE data link to the range A1:B2 of Sheet1 in the Excel document “D:\example.xls” and a linked OLE object to the bitmap file “D:\example.bmp”.

|                |                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EXTERNALBOOK 0 | Server application = “excel”<br>Topic = “D:[example.xls]Sheet1”                                                                                             |
| EXTERNALNAME 1 | Type = DDE link, representing the “StdDocumentName” identifier<br>Item = “StdDocumentName”                                                                  |
| EXTERNALNAME 2 | Type = DDE link<br>Item = “A1:B2”                                                                                                                           |
| EXTERNALBOOK 1 | Class name = “Excel.Sheet.8”<br>Document = “D:\example.xls”                                                                                                 |
| EXTERNALNAME 1 | Type = OLE link<br>Item = “!Sheet1!A1:B2”                                                                                                                   |
| EXTERNALBOOK 2 | Class name = “Package”<br>Document = “D:\example.bmp”                                                                                                       |
| EXTERNALNAME 1 | Type = OLE link<br>Storage = 00012345 <sub>H</sub> (storage name = “LNK00012345”)                                                                           |
| EXTERNSHEET    | REF 0 = {EXTERNALBOOK = 0, sheet range = -2...-2}<br>REF 1 = {EXTERNALBOOK = 1, sheet range = -2...-2}<br>REF 2 = {EXTERNALBOOK = 2, sheet range = -2...-2} |

## 4.11 Shared String Table (BIFF8)

### 4.11.1 The SST Record

**Definition: Shared String Table**

A BIFF8 workbook collects the strings of all text cells in a global list, the *Shared String Table*. This table is located in the record SST in the *Workbook Globals Substream* (→4.2.5).

An SST record may be followed by an EXTSSST record which stores stream positions for a string hash table.

Common structure of the *Shared String Table*, BIFF8:

|           |        |
|-----------|--------|
| • SST     | →5.100 |
| ○ EXTSSST | →5.42  |

Text cells are represented by LABELSST records (→5.65) which contain indexes into the SST record. For reading Excel files, only the SST record and the LABELSST records are important.

Example: A workbook contains anywhere the strings “AAA”, “BBB” and “CCC”.

|          |                                                                                                                         |
|----------|-------------------------------------------------------------------------------------------------------------------------|
| BOF      | Type = workbook globals                                                                                                 |
|          | Workbook globals records                                                                                                |
| SST      | Total number of strings in document = 4, strings in SST = 3<br>String 0 = “AAA”<br>String 1 = “BBB”<br>String 2 = “CCC” |
| EXTSSST  | See below                                                                                                               |
|          | Workbook globals records                                                                                                |
| EOF      |                                                                                                                         |
| BOF      | Type = worksheet                                                                                                        |
|          | Cell records                                                                                                            |
| LABELSST | String index = 0 (results in “AAA”)                                                                                     |
| LABELSST | String index = 2 (results in “CCC”)                                                                                     |
|          | Cell records                                                                                                            |
| LABELSST | String index = 1 (results in “BBB”)                                                                                     |
| LABELSST | String index = 0 (results in “AAA”)                                                                                     |
|          | Cell records                                                                                                            |
| EOF      |                                                                                                                         |

### 4.11.2 The EXTSSST Record

The EXTSSST record is used by Excel to create a string hash table, while loading the document. It contains stream positions of specific strings in the SST record. The SST record will be divided into several portions, which all contain the same number of strings. The first string in each portion will be referenced in the EXTSSST record. It is not required to write an EXTSSST record when exporting an Excel document.

The following example shows the absolute stream position in the first column and the relative record position (including the record headers) in the second column. The SST record is too long so that some of the strings are following in the CONTINUE record.

| Abs. stream offset    | Rel. rec. offset  | Contents              | Description                                                 |
|-----------------------|-------------------|-----------------------|-------------------------------------------------------------|
| 00020000 <sub>H</sub> | 0000 <sub>H</sub> | 00FC <sub>H</sub>     | SST identifier                                              |
| 00020002 <sub>H</sub> | 0002 <sub>H</sub> | 1000 <sub>H</sub>     | Size of the SST record                                      |
| 00020004 <sub>H</sub> | 0004 <sub>H</sub> | 00000011 <sub>H</sub> | Total number of strings in the document                     |
| 00020008 <sub>H</sub> | 0008 <sub>H</sub> | 00000011 <sub>H</sub> | Number of unique strings following                          |
| 0002000C <sub>H</sub> | 000C <sub>H</sub> |                       | String 0 (total size = 0100 <sub>H</sub> bytes)             |
| 0002010C <sub>H</sub> | 010C <sub>H</sub> |                       | String 1 (total size = 0200 <sub>H</sub> bytes)             |
| 0002030C <sub>H</sub> | 030C <sub>H</sub> |                       | String 2 (total size = 0100 <sub>H</sub> bytes)             |
| ⋮                     | ⋮                 |                       | ⋮                                                           |
| 00020800 <sub>H</sub> | 0800 <sub>H</sub> |                       | String 8 (total size = 0100 <sub>H</sub> bytes)             |
| ⋮                     | ⋮                 |                       | ⋮                                                           |
| 00021004 <sub>H</sub> | 0000 <sub>H</sub> | 003C <sub>H</sub>     | CONTINUE identifier                                         |
| 00021006 <sub>H</sub> | 0002 <sub>H</sub> | 0320 <sub>H</sub>     | Size of the CONTINUE record                                 |
| 00021008 <sub>H</sub> | 0004 <sub>H</sub> |                       | Continuation of string 14 (size = 0020 <sub>H</sub> bytes)  |
| 00021028 <sub>H</sub> | 0024 <sub>H</sub> |                       | String 15 (total size = 0100 <sub>H</sub> bytes)            |
| 00021128 <sub>H</sub> | 0124 <sub>H</sub> |                       | String 16 (total size = 0200 <sub>H</sub> bytes)            |
| 00021328 <sub>H</sub> | 0000 <sub>H</sub> | 00FF <sub>H</sub>     | EXTSSST identifier                                          |
| 0002132A <sub>H</sub> | 0002 <sub>H</sub> | 001A <sub>H</sub>     | Size of the EXTSSST record                                  |
| 0002132C <sub>H</sub> | 0004 <sub>H</sub> | 0008 <sub>H</sub>     | 8 strings in each portion                                   |
| 0002132E <sub>H</sub> | 0006 <sub>H</sub> | 0002000C <sub>H</sub> | Absolute stream position of string 0                        |
| 00021332 <sub>H</sub> | 000A <sub>H</sub> | 000C <sub>H</sub>     | Relative record position of string 0 (in SST)               |
| 00021334 <sub>H</sub> | 000C <sub>H</sub> | 0000 <sub>H</sub>     | Not used                                                    |
| 00021336 <sub>H</sub> | 000E <sub>H</sub> | 00020800 <sub>H</sub> | Absolute stream position of string 8                        |
| 0002133A <sub>H</sub> | 0012 <sub>H</sub> | 0800 <sub>H</sub>     | Relative record position of string 8 (in SST)               |
| 0002133C <sub>H</sub> | 0014 <sub>H</sub> | 0000 <sub>H</sub>     | Not used                                                    |
| 0002133E <sub>H</sub> | 0016 <sub>H</sub> | 00021128 <sub>H</sub> | Absolute stream position of string 16                       |
| 00021342 <sub>H</sub> | 001A <sub>H</sub> | 0124 <sub>H</sub>     | Relative record position of string 16 (in <i>CONTINUE</i> ) |
| 00021344 <sub>H</sub> | 001C <sub>H</sub> | 0000 <sub>H</sub>     | Not used                                                    |

## 4.12 Conditional Formatting Table (BIFF8)

**Definition: Conditional Formatting Table**

The settings of conditional formattings are stored for each sheet in the *Conditional Formatting Table*. It is contained in the *Sheet Substream* following the cell records (→4.2.5).

Structure of the *Conditional Formatting Table*, BIFF8:

|    |    |          |       |
|----|----|----------|-------|
| •• | •  | CFHEADER | →5.15 |
|    | •• | CFRULE   | →5.16 |

Each CFHEADER record in this table with its following CFRULE records describes identical conditional formatting attributes for several cells in the worksheet.

## 4.13 Hyperlink Table (BIFF8)

**Definition: Hyperlink Table**

Hyperlinks are stored for each sheet in the *Hyperlink Table*. It is contained in the *Sheet Substream* following the cell records (→4.2.5).

Structure of the *Hyperlink Table*, BIFF8:

|    |   |           |       |
|----|---|-----------|-------|
| •• | • | HYPERLINK | →5.58 |
|    | ○ | QUICKTIP  | →5.83 |

Each HYPERLINK record in this table describes a hyperlink. The optional QUICKTIP record contains a tool tip that occurs when the mouse pointer is over the hyperlink cell.

## 4.14 Data Validity Table (BIFF8)

**Definition: Data Validity Table**

Data validity settings are stored for each sheet in the *Data Validity Table*. It is contained in the *Sheet Substream* following the cell records (→4.2.5).

Structure of the *Data Validity Table*, BIFF8:

|    |                 |       |
|----|-----------------|-------|
| •  | DATAVALIDATIONS | →5.27 |
| •• | DATAVALIDATION  | →5.26 |

A DATAVALIDATIONS record introduces the list of DATAVALIDATION records. The DATAVALIDATIONS record contains the number of DATAVALIDATION records. Each DATAVALIDATION record contains data validity settings for and the addresses of all affected cells.



## **4.15 AutoFilter, Advanced Filter**

2do

## **4.16 Scenarios**

2do

## **4.17 Web Queries (BIFF8)**

2do

## 4.18 Worksheet/Workbook Protection

An Excel document may contain different types of protection.

**Definition: Worksheet/workbook protection**

Worksheet/workbook protection protects specific contents of the worksheet or workbook, for instance window settings, cell contents, or objects.

**Definition: File protection**

File protection protects the file itself, either sets to read-only, or restricts read and write access. File protection does not care about the contents of the document. This type of protection is described in the next chapter (→4.19).

Not all records regarding protection must occur in the stream. If a record is omitted, the corresponding item is not active (for instance: omitting the OBJECTPROTECT record leaves objects unprotected). For the position of the mentioned records in the substreams see →4.2.

### 4.18.1 Single Worksheet Protection (BIFF2-BIFF4)

**Definition: Worksheet Protection Block**

Several records in the *Worksheet Protection Block* determine the protected items in the sheet.

PROTECT protects the cell contents, WINDOWPROTECT protects the window settings, and OBJECTPROTECT protects the embedded objects. The PASSWORD record contains the hash value of the password (→4.18.4) used to protect the sheet. All the mentioned records occur always, if the file was written by Excel, but may be omitted.

If a protection password is set in the PASSWORD record, the read/write file protection (→4.19) will be enabled, which causes encryption of the file (→4.19.1) in every case. If this protection is not enabled manually while saving the file, the built-in password “VelvetSweatshop” is used, *not* the password set for worksheet protection.

Structure of the *Worksheet Protection Block*, BIFF2-BIFF4:

|                 |                                                     |
|-----------------|-----------------------------------------------------|
| ○ PROTECT       | Cell contents: 1 = protected (→5.82)                |
| ○ WINDOWPROTECT | Window settings: 1 = protected (→5.111)             |
| ○ OBJECTPROTECT | Embedded objects: 1 = protected (→5.72)             |
| ○ PASSWORD      | Hash value of the password; 0 = No password (→5.76) |

### 4.18.2 Sheet Protection in a Workbook (BIFF5-BIFF8)

The PROTECT record in the *Worksheet Protection Block* indicates that the sheet is protected. There may follow a SCENPROTECT record or/and an OBJECTPROTECT record. The optional PASSWORD record contains the hash value of the password used to protect the sheet (→4.18.4). In BIFF8, there may occur additional records following the cell records in the *Sheet Substream* (→4.2.5).

Sheet protection with password does not cause to switch on read/write file protection. Therefore the file will not be encrypted.

Structure of the *Worksheet Protection Block*, BIFF5-BIFF8:

|                 |                                                     |
|-----------------|-----------------------------------------------------|
| ○ PROTECT       | Worksheet contents: 1 = protected (→5.82)           |
| ○ OBJECTPROTECT | Embedded objects: 1 = protected (→5.72)             |
| ○ SCENPROTECT   | Scenarios: 1 = protected (→5.91)                    |
| ○ PASSWORD      | Hash value of the password; 0 = no password (→5.76) |

### 4.18.3 Workbook Protection (BIFF5-BIFF8)

**Definition: Workbook Protection Block**

The *Workbook Protection Block* in the *Workbook Globals Substream* determines the protected items in the entire workbook.

The PROTECT record protects the workbook contents and the WINDOWPROTECT record protects the window settings. The PASSWORD record contains the hash value of the password used to protect the workbook (→4.18.4). All the mentioned records occur always, if the file was written by Excel, but may be omitted.

If a protection password is set in the PASSWORD record, the read/write file protection (→4.19) will be enabled, which causes encryption of the file (→4.19.1) in every case. If this protection is not enabled manually while saving the file, the built-in password “VelvetSweatshop” is used, *not* the password set for workbook protection.

Structure of the *Workbook Protection Block*:

|                 |                                                     |
|-----------------|-----------------------------------------------------|
| ○ WINDOWPROTECT | Window settings: 1 = protected (→5.111)             |
| ○ PROTECT       | Workbook contents: 1 = protected (→5.82)            |
| ○ PASSWORD      | Hash value of the password; 0 = no password (→5.76) |
| ○ PROT4REV      | Shared workbook: 1 = protected                      |
| ○ PROT4REVPASS  | Hash value of the shared password; 0 = no password  |

### 4.18.4 Password Hash Value

In several records the hash value of a password is stored, used for later verification of an entered password. The length of the password is restricted to 15 characters.

The following pseudo-code algorithm shows how to create such a hash value from a given byte-string password:

ALGORITHM Get\_Password\_Hash( password )

- 1) hash ← 0 ; char\_index ← char\_count ← character count of password
- 2) char\_index ← char\_index - 1
- 3) char ← character from password with index char\_index {0 is leftmost character}
- 4) hash ← hash XOR char
- 5) rotate the lower 15 bits of hash left by 1 bit
- 6) IF char\_index > 0 THEN JUMP 2)
- 7) RETURN hash XOR char\_count XOR CE4B<sub>H</sub>

Example: The password is “abcdefghij” (10 characters).

| Step    | char_index | char (step 3)         | hash (step 4)     | hash (step 5)     |
|---------|------------|-----------------------|-------------------|-------------------|
| 1)      | 10         |                       |                   | 0000 <sub>H</sub> |
| 2) - 5) | 9          | 6A <sub>H</sub> ('j') | 006A <sub>H</sub> | 00D4 <sub>H</sub> |
| 2) - 5) | 8          | 69 <sub>H</sub> ('i') | 00BD <sub>H</sub> | 017A <sub>H</sub> |
| 2) - 5) | 7          | 68 <sub>H</sub> ('h') | 0112 <sub>H</sub> | 0224 <sub>H</sub> |
| 2) - 5) | 6          | 67 <sub>H</sub> ('g') | 0243 <sub>H</sub> | 0486 <sub>H</sub> |
| 2) - 5) | 5          | 66 <sub>H</sub> ('f') | 04E0 <sub>H</sub> | 09C0 <sub>H</sub> |
| 2) - 5) | 4          | 65 <sub>H</sub> ('e') | 09A5 <sub>H</sub> | 134A <sub>H</sub> |
| 2) - 5) | 3          | 64 <sub>H</sub> ('d') | 132E <sub>H</sub> | 265C <sub>H</sub> |
| 2) - 5) | 2          | 63 <sub>H</sub> ('c') | 263F <sub>H</sub> | 4C7E <sub>H</sub> |
| 2) - 5) | 1          | 62 <sub>H</sub> ('b') | 4C1C <sub>H</sub> | 1839 <sub>H</sub> |
| 2) - 5) | 0          | 61 <sub>H</sub> ('a') | 1858 <sub>H</sub> | 30B0 <sub>H</sub> |
| 7)      |            |                       |                   | FEF1 <sub>H</sub> |

## 4.19 File Protection

A file might be protected with a password against modifying (write protection), or against opening at all (read/write protection). These passwords are set in the Save-As dialogue of Excel.

- Write protection (BIFF3-BIFF8): The WRITEPROT record marks the file to be protected against modifying. The password to unprotect the file is stored in the FILESHARING record. Write protection does not cause to encrypt the file.
- Read/write protection (BIFF2-BIFF8): A FILEPASS record occurs containing stream encryption information, which includes the encrypted password. All following records are encrypted (→4.19.1).

**Definition: File Protection Block**

The records of the *File Protection Block* describe the file protection and are the first records in a file (→4.2).

Structure of the *File Protection Block*:

|               |                                                                        |
|---------------|------------------------------------------------------------------------|
| ○ WRITEPROT   | File is write protected (BIFF3-BIFF8, →5.113), password in FILESHARING |
| ○ FILEPASS    | File is read/write-protected, encryption information (→5.43)           |
| ○ WRITEACCESS | User name (BIFF3-BIFF8, →5.112)                                        |
| ○ FILESHARING | File sharing options (BIFF3-BIFF8, →5.44)                              |

### 4.19.1 BIFF2-BIFF5 XOR Stream Encryption

Encryption takes place for the contents of a record. The record header (record identifier and size) is not encrypted. There are a few records or data fields that are never encrypted either:

- The entire BOF record (→5.8)
- The entire INTERFACEHDR record
- The stream position field in the SHEET record (→5.95)

Stream encryption takes place in several steps:

- 4) get the password from the user
- 5) create hash value (16-bit, →4.18.4) and encryption key (16-bit, see below) from the password
- 6) store hash value and encryption key in FILEPASS record (→5.43)
- 7) create the 128-bit sized key sequence from password and encryption key (see below)
- 8) encrypt all following records using the key sequence (see below)

Stream decryption works similar to encryption:

- 9) get the password from the user
- 10) create hash value (16-bit, →4.18.4) and encryption key (16-bit, see below) from the password
- 11) compare with values contained in FILEPASS record
- 12) if password is correct, create the 128-bit sized key sequence from password and encryption key (see below)
- 13) decrypt all following records using the key sequence (see below)

### • BIFF2-BIFF5 Encryption Key

The 16-bit encryption key is used for the BIFF2-BIFF5 XOR stream encryption algorithm (→4.19.1). It is calculated from the password. The FILEPASS record stores this key and the hash value (→4.18.4) of the password (the hash value is not used to encrypt the data). The length of the password is restricted to 15 characters.

The following pseudo-code algorithm shows how to create the encryption key from a given byte-string password:

```
ALGORITHM Get_Encryption_Key_XOR( password )
1) key ← 0 ; key_base ← 8000H ; key_final ← FFFFH ; char_index ← 0
2) char_count ← character count of password
3) char ← character from password with index char_index {right-to-left, 0 is rightmost}
4) char ← char AND 7FH {use only the lower 7 bits of each character}
5) bit_index ← 0
6) rotate the lower 16 bits of key_base left by 1 bit
7) IF (least significant bit of key_base) = 1 THEN key_base ← key_base XOR 1020H
8) rotate the lower 16 bits of key_final left by 1 bit
9) IF (least significant bit of key_final) = 1 THEN key_final ← key_final XOR 1020H
10) IF (bit with index bit_index in char) = 1 THEN key ← key XOR key_base
11) bit_index ← bit_index + 1
12) IF bit_index < 8 THEN JUMP 6)
13) char_index ← char_index + 1
14) IF char_index < char_count THEN JUMP 3)
15) RETURN key XOR key_final
```

### • BIFF2-BIFF5 Encryption Key Sequence

The encryption sequence is needed to encrypt or decrypt the record contents. It is generated from the password and the encryption key (which is generated from the password too, see above). The size of the encryption key sequence is always 128 bit.

The following pseudo-code algorithm shows how to create the encryption key from a given byte-string password (and the encryption key “key”):

```
ALGORITHM Get_Key_Sequence_XOR( password, key )
1) char_count ← character count of password
2) create a sequence key_seq[] containing 16 bytes
3) fill the first char_count bytes of key_seq[] with all characters of password
4) fill the remaining (16 - char_count) bytes of key_seq[] with the first bytes of the sequence
   { BBH, FFH, FFH, BAH, FFH, FFH, B9H, 80H, 00H, BEH, 0FH, 00H, BFH, 0FH, 00H }
5) key_lower ← lower 8 bits of key ; key_upper ← upper 8 bits of key
6) seq_index ← 0
7) key_seq[seq_index] ← key_seq[seq_index] XOR key_lower
8) key_seq[seq_index + 1] ← key_seq[seq_index + 1] XOR key_upper
9) seq_index ← seq_index + 2
10) IF seq_index < 16 THEN JUMP 7)
11) rotate all bytes of key_seq left by 2 bits
12) RETURN key_seq[]
```

### • BIFF2-BIFF5 Stream Encryption

To encrypt record data, a 128-bit sized key sequence is used, which has been generated from a password before (see above). All stream data is encrypted in blocks of 16 bytes using the key sequence. In every data block, each byte is encoded using the corresponding byte of the key sequence. The offset pointer into the key sequence is reinitialised whenever a new record is started. The initial value of this offset is dependent on the stream position and size of the new record (it does *not* simply restart at 0). For details see the following algorithm.

The following pseudo-code algorithm shows how to encrypt the data of an entire record (assuming that stream points to the start of the record data):

```
ALGORITHM Write_Record_XOR( stream, record_data[], record_size, key_seq[]
)
1) key_index ← ((position of stream) + record_size) AND 0FH
2) record_index ← 0
3) IF record_index = record_size THEN RETURN
4) data_byte = record_data[record_index] XOR key_seq[key_index]
5) rotate all 8 bits of data_byte right by 3 bits
6) write data_byte to stream
7) key_index ← (key_index + 1) AND 0FH           {rotate inside key_seq[]}
8) record_index ← record_index + 1
9) JUMP 3)
```

### • BIFF2-BIFF5 Stream Decryption

To decrypt record data, a 128-bit sized key sequence is used, which has been generated from a password before (see above). Decryption works similar to encryption (see above), but in reversed order of operations.

The following pseudo-code algorithm shows how to decrypt the data of an entire record (assuming that stream points to the start of the record data):

```
ALGORITHM Read_Record_XOR( stream, record_size, key_seq[] )
1) key_index ← ((position of stream) + record_size) AND 0FH
2) create a sequence record_data[] containing record_size bytes
3) record_index ← 0
4) IF record_index = record_size THEN RETURN record_data[]
5) data_byte ← read 1 byte from stream
6) rotate all 8 bits of data_byte left by 3 bits
7) record_data[record_index] ← data_byte XOR key_seq[key_index]
8) key_index ← (key_index + 1) AND 0FH           {rotate inside key_seq[]}
9) record_index ← record_index + 1
10) JUMP 4)
```

## 5 Worksheet/Workbook Records

The filled dot “●” means, that Excel supports the record on import and export. The unfilled dot “○” means, that Excel can read the record, but does not write it anymore in the respective BIFF version. An empty field denotes that the record is not supported, or that the identifier has been changed in this BIFF version.

### 5.1 Overview, Ordered by Record Identifier

| Record ID         | Record name | Occurs in BIFF versions |   |   |   |   |
|-------------------|-------------|-------------------------|---|---|---|---|
|                   |             | 2                       | 3 | 4 | 5 | 8 |
| 0000 <sub>H</sub> | DIMENSION   | ●                       |   |   |   |   |
| 0001 <sub>H</sub> | BLANK       | ●                       |   |   |   |   |
| 0002 <sub>H</sub> | INTEGER     | ●                       |   |   |   |   |
| 0003 <sub>H</sub> | NUMBER      | ●                       |   |   |   |   |
| 0004 <sub>H</sub> | LABEL       | ●                       |   |   |   |   |
| 0005 <sub>H</sub> | BOOLERR     | ●                       |   |   |   |   |
| 0006 <sub>H</sub> | FORMULA     | ●                       |   |   | ● | ● |
| 0007 <sub>H</sub> | STRING      | ●                       |   |   |   |   |
| 0008 <sub>H</sub> | ROW         | ●                       |   |   |   |   |
| 0009 <sub>H</sub> | BOF         | ●                       |   |   |   |   |
| 000A <sub>H</sub> | EOF         | ●                       | ● | ● | ● | ● |
| 000B <sub>H</sub> | INDEX       | ●                       |   |   |   |   |
| 000C <sub>H</sub> | CALCCOUNT   | ●                       | ● | ● | ● | ● |
| 000D <sub>H</sub> | CALCMODE    | ●                       | ● | ● | ● | ● |
| 000E <sub>H</sub> | PRECISION   | ●                       | ● | ● | ● | ● |
| 000F <sub>H</sub> | REFMODE     | ●                       | ● | ● | ● | ● |
| 0010 <sub>H</sub> | DELTA       | ●                       | ● | ● | ● | ● |
| 0011 <sub>H</sub> | ITERATION   | ●                       | ● | ● | ● | ● |
| 0012 <sub>H</sub> | PROTECT     | ●                       | ● | ● | ● | ● |
| 0013 <sub>H</sub> | PASSWORD    | ●                       | ● | ● | ● | ● |
| 0014 <sub>H</sub> | HEADER      | ●                       | ● | ● | ● | ● |
| 0015 <sub>H</sub> | FOOTER      | ●                       | ● | ● | ● | ● |
| 0016 <sub>H</sub> | EXTERNCOUNT | ●                       | ● | ● |   |   |
| 0017 <sub>H</sub> | EXTERNSHEET | ●                       | ● | ● | ● | ● |
| 0018 <sub>H</sub> | DEFINEDNAME | ●                       |   |   | ● | ● |



| Record ID         | Record name          | Occurs in BIFF versions |   |   |   |   |
|-------------------|----------------------|-------------------------|---|---|---|---|
|                   |                      | 2                       | 3 | 4 | 5 | 8 |
| 0019 <sub>H</sub> | WINDOWPROTECT        | •                       | • | • | • | • |
| 001A <sub>H</sub> | VERTICALPAGEBREAKS   | •                       | • | • | • | • |
| 001B <sub>H</sub> | HORIZONTALPAGEBREAKS | •                       | • | • | • | • |
| 001C <sub>H</sub> | NOTE                 | •                       | • | • | • | • |
| 001D <sub>H</sub> | SELECTION            | •                       | • | • | • | • |
| 001E <sub>H</sub> | FORMAT               | •                       | • |   |   |   |
| 001F <sub>H</sub> | BUILTINFMTCOUNT      | •                       |   |   |   |   |
| 0020 <sub>H</sub> | COLUMNDEFAULT        | •                       |   |   |   |   |
| 0021 <sub>H</sub> | ARRAY                | •                       |   |   |   |   |
| 0022 <sub>H</sub> | DATEMODE             | •                       | • | • | • | • |
| 0023 <sub>H</sub> | EXTERNALNAME         | •                       |   |   | • | • |
| 0024 <sub>H</sub> | COLWIDTH             | •                       |   |   |   |   |
| 0025 <sub>H</sub> | DEFAULTROWHEIGHT     | •                       |   |   |   |   |
| 0026 <sub>H</sub> | LEFTMARGIN           | •                       | • | • | • | • |
| 0027 <sub>H</sub> | RIGHTMARGIN          | •                       | • | • | • | • |
| 0028 <sub>H</sub> | TOPMARGIN            | •                       | • | • | • | • |
| 0029 <sub>H</sub> | BOTTOMMARGIN         | •                       | • | • | • | • |
| 002A <sub>H</sub> | PRINTHEADERS         | •                       | • | • | • | • |
| 002B <sub>H</sub> | PRINTGRIDLINES       | •                       | • | • | • | • |
| 002F <sub>H</sub> | FILEPASS             | •                       | • | • | • | • |
| 0031 <sub>H</sub> | FONT                 | •                       |   |   | • | • |
| 0032 <sub>H</sub> | FONT2                | •                       |   |   |   |   |
| 0036 <sub>H</sub> | DATATABLE            | •                       |   |   |   |   |
| 0037 <sub>H</sub> | DATATABLE2           | •                       |   |   |   |   |
| 003C <sub>H</sub> | CONTINUE             | •                       | • | • | • | • |
| 003D <sub>H</sub> | WINDOW1              | •                       | • | • | • | • |
| 003E <sub>H</sub> | WINDOW2              | •                       |   |   |   |   |
| 0040 <sub>H</sub> | BACKUP               | •                       | • | • | • | • |
| 0041 <sub>H</sub> | PANE                 | •                       | • | • | • | • |
| 0042 <sub>H</sub> | CODEPAGE             | •                       | • | • | • | • |
| 0043 <sub>H</sub> | XF                   | •                       |   |   |   |   |
| 0044 <sub>H</sub> | IXFE                 | •                       |   |   |   |   |
| 0045 <sub>H</sub> | FONTCOLOR            | •                       |   |   |   |   |
| 004D <sub>H</sub> | PLS                  | •                       | • | • | • | • |
| 0051 <sub>H</sub> | DCONREF              | •                       | • | • | • | • |
| 0055 <sub>H</sub> | DEFCOLWIDTH          | •                       | • | • | • | • |
| 0056 <sub>H</sub> | BUILTINFMTCOUNT      |                         | • | • |   |   |
| 0059 <sub>H</sub> | XCT                  |                         | • | • | • | • |
| 005A <sub>H</sub> | CRN                  |                         | • | • | • | • |
| 005B <sub>H</sub> | FILESHARING          |                         | • | • | • | • |
| 005C <sub>H</sub> | WRITEACCESS          |                         | • | • | • | • |
| 005E <sub>H</sub> | UNCALCED             |                         | • | • | • | • |
| 005F <sub>H</sub> | SAVERECALC           |                         | • | • | • | • |
| 0063 <sub>H</sub> | OBJECTPROTECT        |                         | • | • | • | • |

| Record ID         | Record name     | Occurs in BIFF versions |   |   |   |   |
|-------------------|-----------------|-------------------------|---|---|---|---|
|                   |                 | 2                       | 3 | 4 | 5 | 8 |
| 007D <sub>H</sub> | COLINFO         |                         | • | • | • | • |
| 0080 <sub>H</sub> | GUTS            |                         | • | • | • | • |
| 0081 <sub>H</sub> | SHEETPR         |                         | • | • | • | • |
| 0082 <sub>H</sub> | GRIDSET         |                         | • | • | • | • |
| 0083 <sub>H</sub> | HCENTER         |                         | • | • | • | • |
| 0084 <sub>H</sub> | VCENTER         |                         | • | • | • | • |
| 0085 <sub>H</sub> | SHEET           |                         |   |   | • | • |
| 0086 <sub>H</sub> | WRITEPROT       |                         | • | • | • | • |
| 008C <sub>H</sub> | COUNTRY         |                         | • | • | • | • |
| 008D <sub>H</sub> | HIDEOBJ         |                         | • | • | • | • |
| 0090 <sub>H</sub> | SORT            |                         |   |   | • | • |
| 0092 <sub>H</sub> | PALETTE         |                         | • | • | • | • |
| 0099 <sub>H</sub> | STANDARDWIDTH   |                         |   | • | • | • |
| 00A0 <sub>H</sub> | SCL             |                         |   | • | • | • |
| 00A1 <sub>H</sub> | PAGESETUP       |                         |   | • | • | • |
| 00AB <sub>H</sub> | GCW             |                         |   | • | • |   |
| 00BD <sub>H</sub> | MULRK           |                         |   |   | • | • |
| 00BE <sub>H</sub> | MULBLANK        |                         |   |   | • | • |
| 00D6 <sub>H</sub> | RSTRING         |                         |   |   | • | • |
| 00D7 <sub>H</sub> | DBCELL          |                         |   |   | • | • |
| 00DA <sub>H</sub> | BOOKBOOL        |                         |   |   | • | • |
| 00DD <sub>H</sub> | SCENPROTECT     |                         |   |   | • | • |
| 00E0 <sub>H</sub> | XF              |                         |   |   | • | • |
| 00E5 <sub>H</sub> | MERGEDCELLS     |                         |   |   |   | • |
| 00E9 <sub>H</sub> | BITMAP          |                         |   |   |   | • |
| 00EF <sub>H</sub> | PHONETICPR      |                         |   |   |   | • |
| 00FC <sub>H</sub> | SST             |                         |   |   |   | • |
| 00FD <sub>H</sub> | LABELSST        |                         |   |   |   | • |
| 00FF <sub>H</sub> | EXTSST          |                         |   |   |   | • |
| 015F <sub>H</sub> | LABELRANGES     |                         |   |   |   | • |
| 0160 <sub>H</sub> | USESELFS        |                         |   |   |   | • |
| 0161 <sub>H</sub> | DSF             |                         |   |   |   | • |
| 01AE <sub>H</sub> | EXTERNALBOOK    |                         |   |   |   | • |
| 01B0 <sub>H</sub> | CFHEADER        |                         |   |   |   | • |
| 01B2 <sub>H</sub> | DATAVALIDATIONS |                         |   |   |   | • |
| 01B8 <sub>H</sub> | HYPERLINK       |                         |   |   |   | • |
| 01BE <sub>H</sub> | DATAVALIDATION  |                         |   |   |   | • |
| 0200 <sub>H</sub> | DIMENSION       |                         | • | • | • | • |
| 0201 <sub>H</sub> | BLANK           |                         | • | • | • | • |
| 0203 <sub>H</sub> | NUMBER          |                         | • | • | • | • |
| 0204 <sub>H</sub> | LABEL           |                         | • | • | • | • |
| 0205 <sub>H</sub> | BOOLERR         |                         | • | • | • | • |
| 0206 <sub>H</sub> | FORMULA         |                         | • |   |   |   |
| 0207 <sub>H</sub> | STRING          |                         | • | • | • | • |

| Record ID         | Record name      | Occurs in BIFF versions |   |   |   |   |
|-------------------|------------------|-------------------------|---|---|---|---|
|                   |                  | 2                       | 3 | 4 | 5 | 8 |
| 0208 <sub>H</sub> | ROW              |                         | • | • | • | • |
| 0209 <sub>H</sub> | BOF              |                         | • |   |   |   |
| 020B <sub>H</sub> | INDEX            |                         | • | • | • | • |
| 0218 <sub>H</sub> | DEFINEDNAME      |                         | • | • |   |   |
| 0221 <sub>H</sub> | ARRAY            |                         | • | • | • | • |
| 0223 <sub>H</sub> | EXTERNALNAME     |                         | • | • |   |   |
| 0225 <sub>H</sub> | DEFAULTROWHEIGHT |                         | • | • | • | • |
| 0231 <sub>H</sub> | FONT             |                         | • | • |   |   |
| 0236 <sub>H</sub> | DATATABLE        |                         | • | • | • | • |
| 023E <sub>H</sub> | WINDOW2          |                         | • | • | • | • |
| 0243 <sub>H</sub> | XF               |                         | • |   |   |   |
| 027E <sub>H</sub> | RK               |                         | • | • | • | • |
| 0293 <sub>H</sub> | STYLE            |                         | • | • | • | • |
| 0406 <sub>H</sub> | FORMULA          |                         |   | • |   |   |
| 0409 <sub>H</sub> | BOF              |                         |   | • |   |   |
| 041E <sub>H</sub> | FORMAT           |                         |   | • | • | • |
| 0443 <sub>H</sub> | XF               |                         |   | • |   |   |
| 04BC <sub>H</sub> | SHAREDFMLA       |                         |   |   | • | • |
| 0800 <sub>H</sub> | QUICKTIP         |                         |   |   |   | • |
| 0809 <sub>H</sub> | BOF              |                         |   |   | • | • |
| 0862 <sub>H</sub> | SHEETLAYOUT      |                         |   |   |   | • |
| 0867 <sub>H</sub> | SHEETPROTECTION  |                         |   |   |   | • |
| 0868 <sub>H</sub> | RANGEPROTECTION  |                         |   |   |   | • |

## 5.2 Overview, Ordered by Record Names

| Record ID                           | Record name      | Occurs in BIFF versions |   |   |   |   |
|-------------------------------------|------------------|-------------------------|---|---|---|---|
|                                     |                  | 2                       | 3 | 4 | 5 | 8 |
| 0021 <sub>H</sub> 0221 <sub>H</sub> | ARRAY            | •                       | • | • | • | • |
| 0040 <sub>H</sub>                   | BACKUP           | •                       | • | • | • | • |
| 00E9 <sub>H</sub>                   | BITMAP           |                         |   |   |   | • |
| 0001 <sub>H</sub> 0201 <sub>H</sub> | BLANK            | •                       | • | • | • | • |
| 0*09 <sub>H</sub>                   | BOF              | •                       | • | • | • | • |
| 00DA <sub>H</sub>                   | BOOKBOOL         |                         |   |   | • | • |
| 0005 <sub>H</sub> 0205 <sub>H</sub> | BOOLERR          | •                       | • | • | • | • |
| 0029 <sub>H</sub>                   | BOTTOMMARGIN     | •                       | • | • | • | • |
| 001F <sub>H</sub> 0056 <sub>H</sub> | BUILTINFMTCOUNT  | •                       | • | • |   |   |
| 000C <sub>H</sub>                   | CALCCOUNT        | •                       | • | • | • | • |
| 000D <sub>H</sub>                   | CALCMODE         | •                       | • | • | • | • |
| 01B0 <sub>H</sub>                   | CFHEADER         |                         |   |   |   | • |
| 01B1 <sub>H</sub>                   | CFRULE           |                         |   |   |   | • |
| 0042 <sub>H</sub>                   | CODEPAGE         | •                       | • | • | • | • |
| 007D <sub>H</sub>                   | COLINFO          |                         | • | • | • | • |
| 0020 <sub>H</sub>                   | COLUMNDEFAULT    | •                       |   |   |   |   |
| 0024 <sub>H</sub>                   | COLWIDTH         | •                       |   |   |   |   |
| 003C <sub>H</sub>                   | CONTINUE         | •                       | • | • | • | • |
| 008C <sub>H</sub>                   | COUNTRY          |                         | • | • | • | • |
| 005A <sub>H</sub>                   | CRN              |                         | • | • | • | • |
| 0036 <sub>H</sub> 0236 <sub>H</sub> | DATATABLE        | •                       | • | • | • | • |
| 0037 <sub>H</sub>                   | DATATABLE2       | •                       |   |   |   |   |
| 01BE <sub>H</sub>                   | DATAVALIDATION   |                         |   |   |   | • |
| 01B2 <sub>H</sub>                   | DATAVALIDATIONS  |                         |   |   |   | • |
| 0022 <sub>H</sub>                   | DATEMODE         | •                       | • | • | • | • |
| 00D7 <sub>H</sub>                   | DBCELL           |                         |   |   | • | • |
| 0051 <sub>H</sub>                   | DCONREF          | •                       | • | • | • | • |
| 0025 <sub>H</sub> 0225 <sub>H</sub> | DEFAULTROWHEIGHT | •                       | • | • | • | • |
| 0055 <sub>H</sub>                   | DEFCOLWIDTH      | •                       | • | • | • | • |
| 0018 <sub>H</sub> 0218 <sub>H</sub> | DEFINEDNAME      | •                       | • | • | • | • |
| 0010 <sub>H</sub>                   | DELTA            | •                       | • | • | • | • |
| 0000 <sub>H</sub> 0200 <sub>H</sub> | DIMENSION        | •                       | • | • | • | • |
| 0161 <sub>H</sub>                   | DSF              |                         |   |   |   | • |
| 000A <sub>H</sub>                   | EOF              | •                       | • | • | • | • |
| 01AE <sub>H</sub>                   | EXTERNALBOOK     |                         |   |   |   | • |
| 0023 <sub>H</sub> 0223 <sub>H</sub> | EXTERNALNAME     | •                       | • | • | • | • |
| 0016 <sub>H</sub>                   | EXTERNCOUNT      | •                       | • | • | • |   |
| 0017 <sub>H</sub>                   | EXTERNSHEET      | •                       | • | • | • | • |
| 00FF <sub>H</sub>                   | EXTSST           |                         |   |   |   | • |
| 002F <sub>H</sub>                   | FILEPASS         | •                       | • | • | • | • |
| 005B <sub>H</sub>                   | FILESHARING      |                         | • | • | • | • |

| Record ID                           | Record name          | Occurs in BIFF versions |   |   |   |   |
|-------------------------------------|----------------------|-------------------------|---|---|---|---|
|                                     |                      | 2                       | 3 | 4 | 5 | 8 |
| 0031 <sub>H</sub> 0231 <sub>H</sub> | FONT                 | •                       | • | • | • | • |
| 0032 <sub>H</sub>                   | FONT2                | •                       |   |   |   |   |
| 0045 <sub>H</sub>                   | FONTCOLOR            | •                       |   |   |   |   |
| 0015 <sub>H</sub>                   | FOOTER               | •                       | • | • | • | • |
| 001E <sub>H</sub> 041E <sub>H</sub> | FORMAT               | •                       | • | • | • | • |
| 0*06 <sub>H</sub>                   | FORMULA              | •                       | • | • | • | • |
| 00AB <sub>H</sub>                   | GCW                  |                         |   | • | • |   |
| 0082 <sub>H</sub>                   | GRIDSET              |                         | • | • | • | • |
| 0080 <sub>H</sub>                   | GUTS                 |                         | • | • | • | • |
| 0083 <sub>H</sub>                   | HCENTER              |                         | • | • | • | • |
| 0014 <sub>H</sub>                   | HEADER               | •                       | • | • | • | • |
| 008D <sub>H</sub>                   | HIDEOBJ              |                         | • | • | • | • |
| 001B <sub>H</sub>                   | HORIZONTALPAGEBREAKS | •                       | • | • | • | • |
| 01B8 <sub>H</sub>                   | HYPERLINK            |                         |   |   |   | • |
| 000B <sub>H</sub> 020B <sub>H</sub> | INDEX                | •                       | • | • | • | • |
| 0002 <sub>H</sub>                   | INTEGER              | •                       |   |   |   |   |
| 0011 <sub>H</sub>                   | ITERATION            | •                       | • | • | • | • |
| 0044 <sub>H</sub>                   | IXFE                 | •                       |   |   |   |   |
| 0004 <sub>H</sub> 0204 <sub>H</sub> | LABEL                | •                       | • | • | • | • |
| 015F <sub>H</sub>                   | LABELRANGES          |                         |   |   |   | • |
| 00FD <sub>H</sub>                   | LABELSST             |                         |   |   |   | • |
| 0026 <sub>H</sub>                   | LEFTMARGIN           | •                       | • | • | • | • |
| 00E5 <sub>H</sub>                   | MERGEDCELLS          |                         |   |   |   | • |
| 00BE <sub>H</sub>                   | MULBLANK             |                         |   |   | • | • |
| 00BD <sub>H</sub>                   | MULRK                |                         |   |   | • | • |
| 001C <sub>H</sub>                   | NOTE                 | •                       | • | • | • | • |
| 0003 <sub>H</sub> 0203 <sub>H</sub> | NUMBER               | •                       | • | • | • | • |
| 0063 <sub>H</sub>                   | OBJECTPROTECT        |                         | • | • | • | • |
| 00A1 <sub>H</sub>                   | PAGESETUP            |                         |   | • | • | • |
| 0092 <sub>H</sub>                   | PALETTE              | •                       | • | • | • | • |
| 0041 <sub>H</sub>                   | PANE                 | •                       | • | • | • | • |
| 0013 <sub>H</sub>                   | PASSWORD             | •                       | • | • | • | • |
| 00EF <sub>H</sub>                   | PHONETICPR           |                         |   |   |   | • |
| 004D <sub>H</sub>                   | PLS                  | •                       | • | • | • | • |
| 000E <sub>H</sub>                   | PRECISION            | •                       | • | • | • | • |
| 002B <sub>H</sub>                   | PRINTGRIDLINES       | •                       | • | • | • | • |
| 002A <sub>H</sub>                   | PRINTHEADERS         | •                       | • | • | • | • |
| 0012 <sub>H</sub>                   | PROTECT              | •                       | • | • | • | • |
| 0800 <sub>H</sub>                   | QUICKTIP             |                         |   |   |   | • |
| 0868 <sub>H</sub>                   | RANGEPROTECTION      |                         |   |   |   | • |
| 000F <sub>H</sub>                   | REFMODE              | •                       | • | • | • | • |
| 0027 <sub>H</sub>                   | RIGHTMARGIN          | •                       | • | • | • | • |
| 027E <sub>H</sub>                   | RK                   |                         | • | • | • | • |
| 0008 <sub>H</sub> 0208 <sub>H</sub> | ROW                  | •                       | • | • | • | • |

| Record ID                           | Record name        | Occurs in BIFF versions |   |   |   |   |
|-------------------------------------|--------------------|-------------------------|---|---|---|---|
|                                     |                    | 2                       | 3 | 4 | 5 | 8 |
| 00D6 <sub>H</sub>                   | RSTRING            |                         |   |   | • | • |
| 005F <sub>H</sub>                   | SAVERECALC         |                         | • | • | • | • |
| 00DD <sub>H</sub>                   | SCENPROTECT        |                         |   |   | • | • |
| 00A0 <sub>H</sub>                   | SCL                |                         |   | • | • | • |
| 001D <sub>H</sub>                   | SELECTION          | •                       | • | • | • | • |
| 04BC <sub>H</sub>                   | SHAREDFMLA         |                         |   |   | • | • |
| 0085 <sub>H</sub>                   | SHEET              |                         |   |   | • | • |
| 0862 <sub>H</sub>                   | SHEETLAYOUT        |                         |   |   |   | • |
| 0081 <sub>H</sub>                   | SHEETPR            |                         | • | • | • | • |
| 0867 <sub>H</sub>                   | SHEETPROTECTION    |                         |   |   |   | • |
| 0090 <sub>H</sub>                   | SORT               |                         |   |   | • | • |
| 00FC <sub>H</sub>                   | SST                |                         |   |   |   | • |
| 0099 <sub>H</sub>                   | STANDARDWIDTH      |                         |   | • | • | • |
| 0007 <sub>H</sub> 0207 <sub>H</sub> | STRING             | •                       | • | • | • | • |
| 0293 <sub>H</sub>                   | STYLE              |                         | • | • | • | • |
| 0028 <sub>H</sub>                   | TOPMARGIN          | •                       | • | • | • | • |
| 005E <sub>H</sub>                   | UNCALCED           |                         | • | • | • | • |
| 0160 <sub>H</sub>                   | USESELFS           |                         |   |   |   | • |
| 0084 <sub>H</sub>                   | VCENTER            |                         | • | • | • | • |
| 001A <sub>H</sub>                   | VERTICALPAGEBREAKS | •                       | • | • | • | • |
| 003D <sub>H</sub>                   | WINDOW1            | •                       | • | • | • | • |
| 003E <sub>H</sub> 023E <sub>H</sub> | WINDOW2            | •                       | • | • | • | • |
| 0019 <sub>H</sub>                   | WINDOWPROTECT      | •                       | • | • | • | • |
| 005C <sub>H</sub>                   | WRITEACCESS        |                         | • | • | • | • |
| 0086 <sub>H</sub>                   | WRITEPROT          |                         | • | • | • | • |
| 0059 <sub>H</sub>                   | XCT                |                         | • | • | • | • |
| 0*43 <sub>H</sub> 00E0 <sub>H</sub> | XF                 | •                       | • | • | • | • |

## 5.3 Overview, Ordered by BIFF Versions

### 5.3.1 New Records

#### • All Records in BIFF2

| Record ID                           | Record name          | Occurs in BIFF versions |   |   |   |   |
|-------------------------------------|----------------------|-------------------------|---|---|---|---|
|                                     |                      | 2                       | 3 | 4 | 5 | 8 |
| 0000 <sub>H</sub> 0200 <sub>H</sub> | DIMENSION            | •                       | • | • | • | • |
| 0001 <sub>H</sub> 0201 <sub>H</sub> | BLANK                | •                       | • | • | • | • |
| 0002 <sub>H</sub>                   | INTEGER              | •                       |   |   |   |   |
| 0003 <sub>H</sub> 0203 <sub>H</sub> | NUMBER               | •                       | • | • | • | • |
| 0004 <sub>H</sub> 0204 <sub>H</sub> | LABEL                | •                       | • | • | • | • |
| 0005 <sub>H</sub> 0205 <sub>H</sub> | BOOLERR              | •                       | • | • | • | • |
| 0*06 <sub>H</sub>                   | FORMULA              | •                       | • | • | • | • |
| 0007 <sub>H</sub> 0207 <sub>H</sub> | STRING               | •                       | • | • | • | • |
| 0008 <sub>H</sub> 0208 <sub>H</sub> | ROW                  | •                       | • | • | • | • |
| 0*09 <sub>H</sub>                   | BOF                  | •                       | • | • | • | • |
| 000A <sub>H</sub>                   | EOF                  | •                       | • | • | • | • |
| 000B <sub>H</sub> 020B <sub>H</sub> | INDEX                | •                       | • | • | • | • |
| 000C <sub>H</sub>                   | CALCCOUNT            | •                       | • | • | • | • |
| 000D <sub>H</sub>                   | CALCMODE             | •                       | • | • | • | • |
| 000E <sub>H</sub>                   | PRECISION            | •                       | • | • | • | • |
| 000F <sub>H</sub>                   | REFMODE              | •                       | • | • | • | • |
| 0010 <sub>H</sub>                   | DELTA                | •                       | • | • | • | • |
| 0011 <sub>H</sub>                   | ITERATION            | •                       | • | • | • | • |
| 0012 <sub>H</sub>                   | PROTECT              | •                       | • | • | • | • |
| 0013 <sub>H</sub>                   | PASSWORD             | •                       | • | • | • | • |
| 0014 <sub>H</sub>                   | HEADER               | •                       | • | • | • | • |
| 0015 <sub>H</sub>                   | FOOTER               | •                       | • | • | • | • |
| 0016 <sub>H</sub>                   | EXTERNCOUNT          | •                       | • | • | • |   |
| 0017 <sub>H</sub>                   | EXTERNSHEET          | •                       | • | • | • | • |
| 0018 <sub>H</sub> 0218 <sub>H</sub> | DEFINEDNAME          | •                       | • | • | • | • |
| 0019 <sub>H</sub>                   | WINDOWPROTECT        | •                       | • | • | • | • |
| 001A <sub>H</sub>                   | VERTICALPAGEBREAKS   | •                       | • | • | • | • |
| 001B <sub>H</sub>                   | HORIZONTALPAGEBREAKS | •                       | • | • | • | • |
| 001C <sub>H</sub>                   | NOTE                 | •                       | • | • | • | • |
| 001D <sub>H</sub>                   | SELECTION            | •                       | • | • | • | • |
| 001E <sub>H</sub> 041E <sub>H</sub> | FORMAT               | •                       | • | • | • | • |
| 001F <sub>H</sub> 0056 <sub>H</sub> | BUILTINFMTCOUNT      | •                       | • | • |   |   |
| 0020 <sub>H</sub>                   | COLUMNDEFAULT        | •                       |   |   |   |   |
| 0021 <sub>H</sub> 0221 <sub>H</sub> | ARRAY                | •                       | • | • | • | • |
| 0022 <sub>H</sub>                   | DATEMODE             | •                       | • | • | • | • |
| 0023 <sub>H</sub> 0223 <sub>H</sub> | EXTERNALNAME         | •                       | • | • | • | • |
| 0024 <sub>H</sub>                   | COLWIDTH             | •                       |   |   |   |   |

| Record ID                           | Record name      | Occurs in BIFF versions |   |   |   |   |
|-------------------------------------|------------------|-------------------------|---|---|---|---|
|                                     |                  | 2                       | 3 | 4 | 5 | 8 |
| 0025 <sub>H</sub> 0225 <sub>H</sub> | DEFAULTROWHEIGHT | •                       | • | • | • | • |
| 0026 <sub>H</sub>                   | LEFTMARGIN       | •                       | • | • | • | • |
| 0027 <sub>H</sub>                   | RIGHTMARGIN      | •                       | • | • | • | • |
| 0028 <sub>H</sub>                   | TOPMARGIN        | •                       | • | • | • | • |
| 0029 <sub>H</sub>                   | BOTTOMMARGIN     | •                       | • | • | • | • |
| 002A <sub>H</sub>                   | PRINTHEADERS     | •                       | • | • | • | • |
| 002B <sub>H</sub>                   | PRINTGRIDLINES   | •                       | • | • | • | • |
| 002F <sub>H</sub>                   | FILEPASS         | •                       | • | • | • | • |
| 0031 <sub>H</sub> 0231 <sub>H</sub> | FONT             | •                       | • | • | • | • |
| 0032 <sub>H</sub>                   | FONT2            | •                       |   |   |   |   |
| 0036 <sub>H</sub> 0236 <sub>H</sub> | DATATABLE        | •                       | • | • | • | • |
| 0037 <sub>H</sub>                   | DATATABLE2       | •                       |   |   |   |   |
| 003C <sub>H</sub>                   | CONTINUE         | •                       | • | • | • | • |
| 003D <sub>H</sub>                   | WINDOW1          | •                       | • | • | • | • |
| 003E <sub>H</sub> 023E <sub>H</sub> | WINDOW2          | •                       | • | • | • | • |
| 0040 <sub>H</sub>                   | BACKUP           | •                       | • | • | • | • |
| 0041 <sub>H</sub>                   | PANE             | •                       | • | • | • | • |
| 0042 <sub>H</sub>                   | CODEPAGE         | •                       | • | • | • | • |
| 0*43 <sub>H</sub> 00E0 <sub>H</sub> | XF               | •                       | • | • | • | • |
| 0044 <sub>H</sub>                   | IXFE             | •                       |   |   |   |   |
| 0045 <sub>H</sub>                   | FONTCOLOR        | •                       |   |   |   |   |
| 004D <sub>H</sub>                   | PLS              | •                       | • | • | • | • |
| 0051 <sub>H</sub>                   | DCONREF          | •                       | • | • | • | • |
| 0055 <sub>H</sub>                   | DEFCOLWIDTH      | •                       | • | • | • | • |

### • New Records in BIFF3

| Record ID         | Record name   | Occurs in BIFF versions |   |   |   |   |
|-------------------|---------------|-------------------------|---|---|---|---|
|                   |               | 2                       | 3 | 4 | 5 | 8 |
| 0059 <sub>H</sub> | XCT           |                         | • | • | • | • |
| 005A <sub>H</sub> | CRN           |                         | • | • | • | • |
| 005B <sub>H</sub> | FILESHARING   |                         | • | • | • | • |
| 005C <sub>H</sub> | WRITEACCESS   |                         | • | • | • | • |
| 005E <sub>H</sub> | UNCALCED      |                         | • | • | • | • |
| 005F <sub>H</sub> | SAVERECALC    |                         | • | • | • | • |
| 0063 <sub>H</sub> | OBJECTPROTECT |                         | • | • | • | • |
| 007D <sub>H</sub> | COLINFO       |                         | • | • | • | • |
| 027E <sub>H</sub> | RK            |                         | • | • | • | • |
| 0080 <sub>H</sub> | GUTS          |                         | • | • | • | • |
| 0081 <sub>H</sub> | SHEETPR       |                         | • | • | • | • |
| 0082 <sub>H</sub> | GRIDSET       |                         | • | • | • | • |
| 0083 <sub>H</sub> | HCENTER       |                         | • | • | • | • |
| 0084 <sub>H</sub> | VCENTER       |                         | • | • | • | • |
| 0086 <sub>H</sub> | WRITEPROT     |                         | • | • | • | • |
| 008C <sub>H</sub> | COUNTRY       |                         | • | • | • | • |



| Record ID         | Record name | Occurs in BIFF versions |   |   |   |   |
|-------------------|-------------|-------------------------|---|---|---|---|
|                   |             | 2                       | 3 | 4 | 5 | 8 |
| 008D <sub>H</sub> | HIDEOBJ     |                         | • | • | • | • |
| 0092 <sub>H</sub> | PALETTE     |                         | • | • | • | • |
| 0293 <sub>H</sub> | STYLE       |                         | • | • | • | • |

• **New Records in BIFF4**

| Record ID         | Record name   | Occurs in BIFF versions |   |   |   |   |
|-------------------|---------------|-------------------------|---|---|---|---|
|                   |               | 2                       | 3 | 4 | 5 | 8 |
| 0099 <sub>H</sub> | STANDARDWIDTH |                         |   | • | • | • |
| 00A0 <sub>H</sub> | SCL           |                         |   | • | • | • |
| 00A1 <sub>H</sub> | PAGESETUP     |                         |   | • | • | • |
| 00AB <sub>H</sub> | GCW           |                         |   | • | • |   |

• **New Records in BIFF5**

| Record ID         | Record name | Occurs in BIFF versions |   |   |   |   |
|-------------------|-------------|-------------------------|---|---|---|---|
|                   |             | 2                       | 3 | 4 | 5 | 8 |
| 0085 <sub>H</sub> | SHEET       |                         |   |   | • | • |
| 0090 <sub>H</sub> | SORT        |                         |   |   | • | • |
| 00BD <sub>H</sub> | MULRK       |                         |   |   | • | • |
| 00BE <sub>H</sub> | MULBLANK    |                         |   |   | • | • |
| 00D6 <sub>H</sub> | RSTRING     |                         |   |   | • | • |
| 00D7 <sub>H</sub> | DBCELL      |                         |   |   | • | • |
| 00DA <sub>H</sub> | BOOKBOOL    |                         |   |   | • | • |
| 00DD <sub>H</sub> | SCENPROTECT |                         |   |   | • | • |
| 04BC <sub>H</sub> | SHAREDFMLA  |                         |   |   | • | • |

• **New Records in BIFF8**

| Record ID         | Record name     | Occurs in BIFF versions |   |   |   |   |
|-------------------|-----------------|-------------------------|---|---|---|---|
|                   |                 | 2                       | 3 | 4 | 5 | 8 |
| 00E5 <sub>H</sub> | MERGEDCELLS     |                         |   |   |   | • |
| 00E9 <sub>H</sub> | BITMAP          |                         |   |   |   | • |
| 00EF <sub>H</sub> | PHONETICPR      |                         |   |   |   | • |
| 00FC <sub>H</sub> | SST             |                         |   |   |   | • |
| 00FD <sub>H</sub> | LABELSST        |                         |   |   |   | • |
| 00FF <sub>H</sub> | EXTSST          |                         |   |   |   | • |
| 015F <sub>H</sub> | LABELRANGES     |                         |   |   |   | • |
| 0160 <sub>H</sub> | USESELFS        |                         |   |   |   | • |
| 0161 <sub>H</sub> | DSF             |                         |   |   |   | • |
| 01AE <sub>H</sub> | EXTERNALBOOK    |                         |   |   |   | • |
| 01B0 <sub>H</sub> | CFHEADER        |                         |   |   |   | • |
| 01B1 <sub>H</sub> | CFRULE          |                         |   |   |   | • |
| 01B2 <sub>H</sub> | DATAVALIDATIONS |                         |   |   |   | • |
| 01B8 <sub>H</sub> | HYPERLINK       |                         |   |   |   | • |

| Record ID         | Record name     | Occurs in BIFF versions |   |   |   |   |
|-------------------|-----------------|-------------------------|---|---|---|---|
|                   |                 | 2                       | 3 | 4 | 5 | 8 |
| 01BE <sub>H</sub> | DATAVALIDATION  |                         |   |   |   | • |
| 0800 <sub>H</sub> | QUICKTIP        |                         |   |   |   | • |
| 0862 <sub>H</sub> | SHEETLAYOUT     |                         |   |   |   | • |
| 0867 <sub>H</sub> | SHEETPROTECTION |                         |   |   |   | • |
| 0868 <sub>H</sub> | RANGEPROTECTION |                         |   |   |   | • |

### 5.3.2 Deleted Records

#### • Records Deleted in BIFF3

| Record ID         | Record name   | Occurs in BIFF versions |   |   |   |   |
|-------------------|---------------|-------------------------|---|---|---|---|
|                   |               | 2                       | 3 | 4 | 5 | 8 |
| 0002 <sub>H</sub> | INTEGER       | •                       |   |   |   |   |
| 0020 <sub>H</sub> | COLUMNDEFAULT | •                       |   |   |   |   |
| 0024 <sub>H</sub> | COLWIDTH      | •                       |   |   |   |   |
| 0032 <sub>H</sub> | FONT2         | •                       |   |   |   |   |
| 0037 <sub>H</sub> | DATATABLE2    | •                       |   |   |   |   |
| 0044 <sub>H</sub> | IXFE          | •                       |   |   |   |   |
| 0045 <sub>H</sub> | FONTCOLOR     | •                       |   |   |   |   |

#### • Records Deleted in BIFF5

| Record ID                           | Record name    | Occurs in BIFF versions |   |   |   |   |
|-------------------------------------|----------------|-------------------------|---|---|---|---|
|                                     |                | 2                       | 3 | 4 | 5 | 8 |
| 001F <sub>H</sub> 0056 <sub>H</sub> | BULTINFMTCOUNT | •                       | • | • |   |   |

#### • Records Deleted in BIFF8

| Record ID         | Record name | Occurs in BIFF versions |   |   |   |   |
|-------------------|-------------|-------------------------|---|---|---|---|
|                   |             | 2                       | 3 | 4 | 5 | 8 |
| 0016 <sub>H</sub> | EXTERNCOUNT | •                       | • | • | • |   |
| 00AB <sub>H</sub> | GCW         |                         |   | • | • |   |

## 5.4 ARRAY

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0021 <sub>H</sub> | 0221 <sub>H</sub> | 0221 <sub>H</sub> | 0221 <sub>H</sub> | 0221 <sub>H</sub> |

This record stores the token array of an array formula. It is not a real cell record, but follows the first FORMULA record (→5.50) of the array cell range. For more information about array formulas see →4.8.

Record ARRAY, BIFF2:

| Offset | Size | Contents                                                                       |
|--------|------|--------------------------------------------------------------------------------|
| 0      | 6    | The cell range address of the array formula (→2.5.14)                          |
| 6      | 1    | 0 = Do not recalculate the array formula, 1 = Always recalculate array formula |
| 7      | var. | Token array of the array formula (→3)                                          |

Record ARRAY, BIFF3-BIFF4:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                    |     |      |          |   |                   |                                      |   |                   |                                     |
|--------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|--------------------------------------|---|-------------------|-------------------------------------|
| 0      | 6                 | The cell range address of the array formula (→2.5.14)                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                      |   |                   |                                     |
| 6      | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Always recalculate array formula</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Calculate array formula on open</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Always recalculate array formula | 1 | 0002 <sub>H</sub> | 1 = Calculate array formula on open |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                    |     |      |          |   |                   |                                      |   |                   |                                     |
| 0      | 0001 <sub>H</sub> | 1 = Always recalculate array formula                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                   |                                      |   |                   |                                     |
| 1      | 0002 <sub>H</sub> | 1 = Calculate array formula on open                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                      |   |                   |                                     |
| 8      | var.              | Token array of the array formula (→3)                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                      |   |                   |                                     |

Record ARRAY, BIFF5-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                      |   |                   |                                     |
|--------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|--------------------------------------|---|-------------------|-------------------------------------|
| 0      | 6                 | The cell range address of the array formula (→2.5.14). Column indexes are always 8-bit values, also in BIFF8.                                                                                                                                                                                                                                                 |     |      |          |   |                   |                                      |   |                   |                                     |
| 6      | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Always recalculate array formula</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Calculate array formula on open</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Always recalculate array formula | 1 | 0002 <sub>H</sub> | 1 = Calculate array formula on open |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                      |   |                   |                                     |
| 0      | 0001 <sub>H</sub> | 1 = Always recalculate array formula                                                                                                                                                                                                                                                                                                                          |     |      |          |   |                   |                                      |   |                   |                                     |
| 1      | 0002 <sub>H</sub> | 1 = Calculate array formula on open                                                                                                                                                                                                                                                                                                                           |     |      |          |   |                   |                                      |   |                   |                                     |
| 8      | 4                 | Not used                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                      |   |                   |                                     |
| 12     | var.              | Token array of the array formula (→3)                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                      |   |                   |                                     |

## 5.5 BACKUP

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0040 <sub>H</sub> | 0040 <sub>H</sub> | 0040 <sub>H</sub> | 0040 <sub>H</sub> | 0040 <sub>H</sub> |

This record contains a Boolean value determining whether Excel makes a backup of the file while saving.

Record BACKUP, BIFF2-BIFF8:

| Offset | Size | Contents                      |
|--------|------|-------------------------------|
| 0      | 2    | 1 = Create a backup on saving |

## 5.6 BITMAP

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 00E9 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It stores the background bitmap of a worksheet.

Record BITMAP, BIFF8:

| Offset | Size | Contents                                                                                                            |
|--------|------|---------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Unknown value 0009 <sub>H</sub>                                                                                     |
| 2      | 2    | Unknown value 0001 <sub>H</sub>                                                                                     |
| 4      | 4    | Total size of the following record data, without this field (including CONTINUE records)                            |
| 8      | 2    | Unknown value 000C <sub>H</sub>                                                                                     |
| 10     | 2    | Unknown value 0000 <sub>H</sub>                                                                                     |
| 12     | 2    | Width of the picture ( <u>w</u> i <u>d</u> t <u>h</u> ), in pixel                                                   |
| 14     | 2    | Height of the picture ( <u>h</u> e <u>i</u> g <u>h</u> t), in pixel                                                 |
| 16     | 2    | Number of planes, must be 0001 <sub>H</sub>                                                                         |
| 18     | 2    | Colour depth, must be 0018 <sub>H</sub> (24 bit true-colour)                                                        |
| 20     | var. | Pixel data (array of <u>h</u> e <u>i</u> g <u>h</u> t lines of the bitmap, from bottom line to top line, see below) |

In each line all pixels are written from left to right. Each pixel is stored as 3-byte array: the red, green, and blue component of the colour of the pixel, in this order. The size of each line is aligned to multiples of 4 by inserting zero bytes after the last pixel.

Example of the bitmap data for a 3 × 3 image, each entry represents one byte. The three pixels of one line are stored in 9 bytes, therefore each line is expanded to 12 bytes (next multiple of 4).

| Offset | Contents |   |   |   |   |   |   |   |   | Remarks |   |   |                                   |
|--------|----------|---|---|---|---|---|---|---|---|---------|---|---|-----------------------------------|
| 20     | R        | G | B | R | G | B | R | G | B | 0       | 0 | 0 | Third (bottom) line of the bitmap |
| 32     | R        | G | B | R | G | B | R | G | B | 0       | 0 | 0 | Second line of the bitmap         |
| 44     | R        | G | B | R | G | B | R | G | B | 0       | 0 | 0 | First (top) line of the bitmap    |

## 5.7 BLANK

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0001 <sub>H</sub> | 0201 <sub>H</sub> | 0201 <sub>H</sub> | 0201 <sub>H</sub> | 0201 <sub>H</sub> |

This record represents an empty cell. It contains the cell address and formatting information.

Record BLANK, BIFF2:

| Offset | Size | Contents                  |
|--------|------|---------------------------|
| 0      | 2    | Index to row              |
| 2      | 2    | Index to column           |
| 4      | 3    | Cell attributes (→2.5.13) |

Record BLANK, BIFF3-BIFF8:

| Offset | Size | Contents                    |
|--------|------|-----------------------------|
| 0      | 2    | Index to row                |
| 2      | 2    | Index to column             |
| 4      | 2    | Index to XF record (→5.115) |

## 5.8 BOF – Beginning of File

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0009 <sub>H</sub> | 0209 <sub>H</sub> | 0409 <sub>H</sub> | 0809 <sub>H</sub> | 0809 <sub>H</sub> |

The BOF record is the first record of any kind of stream or substream:

- The *Worksheet Stream* (→4.1.1) and the *Chart Stream* (→7.1.1)
- All substreams in the *Workbook Stream* (the *Sheet Substream* and the *Workbook Globals Substream*, →4.1.2, and the *Chart Substream*, →7.1.2)
- The *Workspace Stream*.

A BOF record will never be encrypted, regardless of its type and position in the stream.

- ! If a BIFF8 version of Excel (Excel 8.0 and newer) writes a BIFF5 workbook, it writes a wrong BIFF version in BOF records of the *Sheet Substreams*. Only the leading BOF record of the *Workbook Globals Substream* contains the correct value and should be used to determine the BIFF version for the entire stream.

### 5.8.1 BOF Records Written by Excel

Record BOF, BIFF2 (record identifier is 0009<sub>H</sub>):

| Offset | Size | Contents                                                                                                                                                                         |
|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | BIFF version (not used)                                                                                                                                                          |
| 2      | 2    | Type of the following data: <ul style="list-style-type: none"> <li>0010<sub>H</sub> = Sheet</li> <li>0020<sub>H</sub> = Chart</li> <li>0040<sub>H</sub> = Macro sheet</li> </ul> |

Record BOF, BIFF3 (record identifier is 0209<sub>H</sub>) and BIFF4 (record identifier is 0409<sub>H</sub>):

| Offset | Size | Contents                                                                                                                                                                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | BIFF version (not used)                                                                                                                                                                                                                     |
| 2      | 2    | Type of the following data: <ul style="list-style-type: none"> <li>0010<sub>H</sub> = Sheet</li> <li>0020<sub>H</sub> = Chart</li> <li>0040<sub>H</sub> = Macro sheet</li> <li>0100<sub>H</sub> = Workspace (BIFF3W/BIFF4W only)</li> </ul> |
| 4      | 2    | Not used                                                                                                                                                                                                                                    |

Record BOF, BIFF5 (record identifier is 0809<sub>H</sub>):

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                           |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | BIFF version (always 0500 <sub>H</sub> for BIFF5). Should only be used, if this record is the leading workbook globals BOF (see above).                                                                                                                                                                                                                            |
| 2      | 2    | Type of the following data: <ul style="list-style-type: none"> <li>0005<sub>H</sub> = Workbook globals</li> <li>0006<sub>H</sub> = Visual Basic module</li> <li>0010<sub>H</sub> = Sheet or dialogue (see SHEETPR, →5.97)</li> <li>0020<sub>H</sub> = Chart</li> <li>0040<sub>H</sub> = Macro sheet</li> <li>0100<sub>H</sub> = Workspace (BIFF5W only)</li> </ul> |
| 4      | 2    | Build identifier, must not be 0                                                                                                                                                                                                                                                                                                                                    |
| 6      | 2    | Build year                                                                                                                                                                                                                                                                                                                                                         |

Record BOF, BIFF8 (record identifier is 0809<sub>H</sub>):

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                           |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | BIFF version (always 0600 <sub>H</sub> for BIFF8)                                                                                                                                                                                                                                                                                                                  |
| 2      | 2    | Type of the following data: <ul style="list-style-type: none"> <li>0005<sub>H</sub> = Workbook globals</li> <li>0006<sub>H</sub> = Visual Basic module</li> <li>0010<sub>H</sub> = Sheet or dialogue (see SHEETPR, →5.97)</li> <li>0020<sub>H</sub> = Chart</li> <li>0040<sub>H</sub> = Macro sheet</li> <li>0100<sub>H</sub> = Workspace (BIFF8W only)</li> </ul> |
| 4      | 2    | Build identifier, must not be 0                                                                                                                                                                                                                                                                                                                                    |
| 6      | 2    | Build year, must not be 0                                                                                                                                                                                                                                                                                                                                          |
| 8      | 4    | File history flags                                                                                                                                                                                                                                                                                                                                                 |
| 12     | 4    | Lowest Excel version that can read all records in this file                                                                                                                                                                                                                                                                                                        |

## 5.8.2 BOF Records Written by Other External Tools

Various external tools write non-standard BOF records with the record identifier 0809<sub>H</sub> (determining a BIFF5-BIFF8 BOF record), but with a different BIFF version field. In this case, the record identifier is ignored, and only the version field is used to set the BIFF version of the workbook.

Record BOF (record identifier is 0809<sub>H</sub>):

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                             |
|--------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | BIFF version: <ul style="list-style-type: none"> <li>0000<sub>H</sub> = BIFF5</li> <li>0200<sub>H</sub> = BIFF2</li> <li>0300<sub>H</sub> = BIFF3</li> <li>0400<sub>H</sub> = BIFF4</li> <li>0500<sub>H</sub> = BIFF5</li> <li>0600<sub>H</sub> = BIFF8</li> </ul>                                                                                   |
| 2      | 2    | Type of the following data: <ul style="list-style-type: none"> <li>0005<sub>H</sub> = Workbook globals</li> <li>0006<sub>H</sub> = Visual Basic module</li> <li>0010<sub>H</sub> = Sheet or dialogue (see SHEETPR, →5.97)</li> <li>0020<sub>H</sub> = Chart</li> <li>0040<sub>H</sub> = Macro sheet</li> <li>0100<sub>H</sub> = Workspace</li> </ul> |
| [4]    | var. | (optional) Additional fields of a BOF record, should be ignored                                                                                                                                                                                                                                                                                      |



## 5.9 BOOKBOOL

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 00DA <sub>H</sub> | 00DA <sub>H</sub> |

This record contains a Boolean value determining whether to save values linked from external workbooks (CRN records, →5.23 and XCT records, →5.114). In BIFF3 and BIFF4 this option is stored in the SHEETPR record (→5.97). See →4.10 for details about external references.

Record BOOKBOOL, BIFF5-BIFF8:

| Offset | Size | Contents                                                                       |
|--------|------|--------------------------------------------------------------------------------|
| 0      | 2    | 0 = Save external linked values; 1 = <i>Do not</i> save external linked values |

## 5.10 BOOLERR

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0005 <sub>H</sub> | 0205 <sub>H</sub> | 0205 <sub>H</sub> | 0205 <sub>H</sub> | 0205 <sub>H</sub> |

This record represents a Boolean value or error value cell.

Record BOOLERR, BIFF2:

| Offset | Size | Contents                                                    |
|--------|------|-------------------------------------------------------------|
| 0      | 2    | Index to row                                                |
| 2      | 2    | Index to column                                             |
| 4      | 3    | Cell attributes (→2.5.13)                                   |
| 7      | 1    | Boolean or error value (type depends on the following byte) |
| 8      | 1    | 0 = Boolean value; 1 = Error code                           |

Record BOOLERR, BIFF3-BIFF8:

| Offset | Size | Contents                                                    |
|--------|------|-------------------------------------------------------------|
| 0      | 2    | Index to row                                                |
| 2      | 2    | Index to column                                             |
| 4      | 2    | Index to XF record (→5.115)                                 |
| 6      | 1    | Boolean or error value (type depends on the following byte) |
| 7      | 1    | 0 = Boolean value; 1 = Error code                           |

If the value field is a Boolean value, it will contain 0 for FALSE and 1 for TRUE. See →2.5.6 for a list of error codes.

## 5.11 BOTTOMMARGIN

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0029 <sub>H</sub> | 0029 <sub>H</sub> | 0029 <sub>H</sub> | 0029 <sub>H</sub> | 0029 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It contains the bottom page margin of the current worksheet.

Record BOTTOMMARGIN, BIFF2-BIFF8:

| Offset | Size | Contents                                                                              |
|--------|------|---------------------------------------------------------------------------------------|
| 0      | 8    | Bottom page margin in inches (IEEE 754 floating-point value, 64-bit double precision) |

## 5.12 BUILTINFMTCOUNT

| BIFF2             | BIFF3             | BIFF4             | BIFF5 | BIFF8 |
|-------------------|-------------------|-------------------|-------|-------|
| 001F <sub>H</sub> | 0056 <sub>H</sub> | 0056 <sub>H</sub> | —     | —     |

This record contains the number of following FORMAT records (→5.49) that contain built-in number formats. All additional FORMAT records contain user-defined number formats. Note that the record identifier changes in BIFF3.

Record BUILTINFMTCOUNT, BIFF2-BIFF4:

| Offset | Size | Contents                                                              |
|--------|------|-----------------------------------------------------------------------|
| 0      | 2    | Number of following FORMAT records containing built-in number formats |

## 5.13 CALCCOUNT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 000C <sub>H</sub> | 000C <sub>H</sub> | 000C <sub>H</sub> | 000C <sub>H</sub> | 000C <sub>H</sub> |

This record is part of the *Calculation Settings Block* (→4.3). It specifies the maximum number of times the formulas should be iteratively calculated. This is a fail-safe against mutually recursive formulas locking up a spreadsheet application.

Record CALCCOUNT, BIFF2-BIFF8:

| Offset | Size | Contents                                                    |
|--------|------|-------------------------------------------------------------|
| 0      | 2    | Maximum number of iterations allowed in circular references |

## 5.14 CALCMODE

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 000D <sub>H</sub> | 000D <sub>H</sub> | 000D <sub>H</sub> | 000D <sub>H</sub> | 000D <sub>H</sub> |

This record is part of the *Calculation Settings Block* (→4.3). It specifies whether to calculate formulas manually, automatically or automatically except for multiple table operations.

Record CALCMODE, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                               |
|--------|------|--------------------------------------------------------------------------------------------------------|
| 0      | 2    | -1 = automatically except for multiple table operations<br>0 = manually<br>1 = automatically (default) |

## 5.15 CFHEADER

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 01B0 <sub>H</sub> |

This record is part of the Conditional Formatting Table (→4.12). It contains a list of cell range addresses for all cells with equal conditional formatting. It is followed by a list of CFRULE records (up to 3 records in BIFF8, →5.16) which contain the conditions and cell formatting attributes.

Record CFHEADER, BIFF8:

| Offset | Size | Contents                                                                               |
|--------|------|----------------------------------------------------------------------------------------|
| 0      | 2    | Number of following CFRULE records                                                     |
| 2      | 2    | 1 = Conditionally formatted cells need recalculation or redraw                         |
| 4      | 8    | Cell range address of the range enclosing all conditionally formatted ranges (→2.5.14) |
| 12     | var. | Cell range address list of all conditionally formatted ranges (→2.5.15)                |

The record contains the cell range address list and the minimal cell range enclosing all the ranges from this list.

Example: This record describes the cells B9, G3:I8 and E15. The address of the cell range enclosing this list is B3:I15.

## 5.16 CFRULE – Conditional Formatting Rule

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 01B1 <sub>H</sub> |

This record is part of the *Conditional Formatting Table* (→4.12). A list of CFRULE records is always following a CFHEADER record (→5.15). Each CFRULE record contains a condition and the formatting attributes applied to the cells specified in the CFHEADER record, if the condition is met.

There are some restrictions in the usage of conditional formattings:

- In the user interface of Microsoft Excel it is possible to modify the font style (boldness and posture), the text colour, the underline style, and the strikeout style. It is not possible to change the used font, the font height, and the escapement style, though it is possible to specify these attributes in this record which are correctly displayed by Excel.
- It is not possible to change a border line style, but to preserve the line colour, and vice versa. The user interface only offers thin line styles, but files containing other line styles work correctly too. Diagonal lines are not supported at all, but can be stored in this record.
- It is not possible to set the background pattern colour to “No colour” (using system window background colour) and to preserve the pattern style of the cell. “No colour” will always set the pattern to transparent.
- Alignment and protection attributes can be stored, but are not supported at all.
- A changed number formatting cannot be stored in this record.

### • Record Contents

Record CFRULE, BIFF8:

| Offset | Size       | Contents                                                                                                                                                                                                                                                                                                                                                           |
|--------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1          | Type of the conditional formatting:<br>01 <sub>H</sub> = Compare with current cell value (the comparison specified below is used)<br>02 <sub>H</sub> = Evaluate a formula (condition is met if formula evaluates to a value not equal to 0)                                                                                                                        |
| 1      | 1          | Comparison operator:<br>00 <sub>H</sub> = No comparison (only valid for formula type, see above)<br>01 <sub>H</sub> = Between<br>02 <sub>H</sub> = Not between<br>03 <sub>H</sub> = Equal<br>04 <sub>H</sub> = Not equal<br>05 <sub>H</sub> = Greater than<br>06 <sub>H</sub> = Less than<br>07 <sub>H</sub> = Greater or equal<br>08 <sub>H</sub> = Less or equal |
| 2      | 2          | Size of the formula data for first value or formula ( <u>sz1</u> )                                                                                                                                                                                                                                                                                                 |
| 4      | 2          | Size of the formula data for second value or formula ( <u>sz2</u> , used for second part of “Between” and “Not between” comparison, this field is 0 for other comparisons)                                                                                                                                                                                         |
| 6      | 4          | Option flags (see below)                                                                                                                                                                                                                                                                                                                                           |
| 10     | 2          | Not used                                                                                                                                                                                                                                                                                                                                                           |
| [12]   | 118        | (optional, only if <u>font</u> = 1, see option flags) Font formatting block, see below                                                                                                                                                                                                                                                                             |
| [var.] | 8          | (optional, only if <u>align</u> = 1, see option flags) Alignment formatting block, see below                                                                                                                                                                                                                                                                       |
| [var.] | 8          | (optional, only if <u>border</u> = 1, see option flags) Border formatting block, see below                                                                                                                                                                                                                                                                         |
| [var.] | 4          | (optional, only if <u>pattern</u> = 1, see option flags) Pattern formatting block, see below                                                                                                                                                                                                                                                                       |
| [var.] | 2          | (optional, only if <u>protect</u> = 1, see option flags) Protection formatting block, see below                                                                                                                                                                                                                                                                    |
| var.   | <u>sz1</u> | Formula data for first value or formula (RPN token array without size field, →3)                                                                                                                                                                                                                                                                                   |
| var.   | <u>sz2</u> | Formula data for second value or formula (RPN token array without size field, →3)                                                                                                                                                                                                                                                                                  |

## • Option Flags

If none of the formatting attributes is set, the option flags field contains 00000000<sub>H</sub>. The following table assumes that the conditional formatting contains at least one modified formatting attribute (there is at least one of the formatting blocks in the record).

- ! All flags describing a modified attribute contain the value 0<sub>2</sub>, if the conditional formatting changes the respective attribute, and 1<sub>2</sub>, if the original cell formatting is preserved. The flags for modified font attributes are not contained in this option flags field, but in the font formatting block itself.

| Bit   | Mask                  | Name                  | Contents                                          |
|-------|-----------------------|-----------------------|---------------------------------------------------|
| 0     | 00000001 <sub>H</sub> | <u>align-hor</u>      | 0 = Horizontal alignment modified                 |
| 1     | 00000002 <sub>H</sub> | <u>align-ver</u>      | 0 = Vertical alignment modified                   |
| 2     | 00000004 <sub>H</sub> | <u>align-wrap</u>     | 0 = Text wrapped flag modified                    |
| 3     | 00000008 <sub>H</sub> | <u>align-rot</u>      | 0 = Text rotation modified                        |
| 4     | 00000010 <sub>H</sub> | <u>align-justlast</u> | 0 = Justify last line flag modified               |
| 5     | 00000020 <sub>H</sub> | <u>align-indent</u>   | 0 = Indentation modified                          |
| 6     | 00000040 <sub>H</sub> | <u>align-shrink</u>   | 0 = Shrink to fit flag modified                   |
| 7     | 00000080 <sub>H</sub> |                       | Always 1 <sub>2</sub>                             |
| 8     | 00000100 <sub>H</sub> | <u>prot-locked</u>    | 0 = Cell locked flag modified                     |
| 9     | 00000200 <sub>H</sub> | <u>prot-hidden</u>    | 0 = Cell hidden flag modified                     |
| 10    | 00000400 <sub>H</sub> | <u>bord-left</u>      | 0 = Left border style and colour modified         |
| 11    | 00000800 <sub>H</sub> | <u>bord-right</u>     | 0 = Right border style and colour modified        |
| 12    | 00001000 <sub>H</sub> | <u>bord-top</u>       | 0 = Top border style and colour modified          |
| 13    | 00002000 <sub>H</sub> | <u>bord-bot</u>       | 0 = Bottom border style and colour modified       |
| 14    | 00004000 <sub>H</sub> | <u>bord-tl-br</u>     | 0 = Top-left to bottom-right border flag modified |
| 15    | 00008000 <sub>H</sub> | <u>bord-bl-tr</u>     | 0 = Bottom-left to top-right border flag modified |
| 16    | 00010000 <sub>H</sub> | <u>patt-style</u>     | 0 = Pattern style modified                        |
| 17    | 00020000 <sub>H</sub> | <u>patt-col</u>       | 0 = Pattern colour modified                       |
| 18    | 00040000 <sub>H</sub> | <u>patt-bgcol</u>     | 0 = Pattern background colour modified            |
| 21-19 | 00380000 <sub>H</sub> |                       | Always 111 <sub>2</sub>                           |
| 26    | 04000000 <sub>H</sub> | <u>font</u>           | 1 = Record contains font formatting block         |
| 27    | 08000000 <sub>H</sub> | <u>align</u>          | 1 = Record contains alignment formatting block    |
| 28    | 10000000 <sub>H</sub> | <u>bord</u>           | 1 = Record contains border formatting block       |
| 29    | 20000000 <sub>H</sub> | <u>patt</u>           | 1 = Record contains pattern formatting block      |
| 30    | 40000000 <sub>H</sub> | <u>prot</u>           | 1 = Record contains protection formatting block   |
| 31    | 80000000 <sub>H</sub> | <u>align-textdir</u>  | 0 = Text direction modified                       |

• **Font Formatting Block**

| Offset | Size                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
|--------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------|----------|----------|-----------------------|-----------------------------------------------------------------------|-------------------------|--------------------------------------------|------------------------------------------------------------------|-----------------------|---------------------------|----------------------------------------------------------------|---|-----------------------|----------------------------------------------------------------|--------------------------|-----------------------|--------------------------------------------------------------------|------------------------|----------------------------|---|-----------------------|------------------------|--------------------------------|
| 0      | 64                    | Font name (Unicode string, 8-bit string length, →2.5.3). The empty string (length 0) preserves the font name of the current cell. The remaining bytes of this fixed-size block (always 64 bytes) are not used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 64     | 4                     | Font height (in twips = $\frac{1}{20}$ of a point); or -1 to preserve the cell font height                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 68     | 4                     | Font options:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
|        |                       | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>00000002<sub>H</sub></td> <td>Posture: 0 = Normal; 1 = Italic (only if <code>font-style</code> = 0)</td> </tr> <tr> <td>3</td> <td>00000008<sub>H</sub></td> <td>Outline: 0 = Off; 1 = On (only if <code>font-outline</code> = 0)</td> </tr> <tr> <td>4</td> <td>00000010<sub>H</sub></td> <td>Shadow: 0 = Off; 1 = On (only if <code>font-shadow</code> = 0)</td> </tr> <tr> <td>5</td> <td>00000020<sub>H</sub></td> <td>Condense: 0 = Off; 1 = On (only if <code>font-cond</code> = 0)</td> </tr> <tr> <td>7</td> <td>00000080<sub>H</sub></td> <td>Cancellation: 0 = Off; 1 = On (only if <code>font-canc</code> = 0)</td> </tr> </tbody> </table>     | Bit                                        | Mask | Contents | 1        | 00000002 <sub>H</sub> | Posture: 0 = Normal; 1 = Italic (only if <code>font-style</code> = 0) | 3                       | 00000008 <sub>H</sub>                      | Outline: 0 = Off; 1 = On (only if <code>font-outline</code> = 0) | 4                     | 00000010 <sub>H</sub>     | Shadow: 0 = Off; 1 = On (only if <code>font-shadow</code> = 0) | 5 | 00000020 <sub>H</sub> | Condense: 0 = Off; 1 = On (only if <code>font-cond</code> = 0) | 7                        | 00000080 <sub>H</sub> | Cancellation: 0 = Off; 1 = On (only if <code>font-canc</code> = 0) |                        |                            |   |                       |                        |                                |
| Bit    | Mask                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 1      | 00000002 <sub>H</sub> | Posture: 0 = Normal; 1 = Italic (only if <code>font-style</code> = 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 3      | 00000008 <sub>H</sub> | Outline: 0 = Off; 1 = On (only if <code>font-outline</code> = 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 4      | 00000010 <sub>H</sub> | Shadow: 0 = Off; 1 = On (only if <code>font-shadow</code> = 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 5      | 00000020 <sub>H</sub> | Condense: 0 = Off; 1 = On (only if <code>font-cond</code> = 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 7      | 00000080 <sub>H</sub> | Cancellation: 0 = Off; 1 = On (only if <code>font-canc</code> = 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 72     | 2                     | Font weight (100-1000, only if <code>font-style</code> = 0). Standard values are 0190 <sub>H</sub> (400) for normal text and 02BC <sub>H</sub> (700) for bold text.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 74     | 2                     | Escapement type (only if <code>font-esc</code> = 0):<br>0 = None<br>1 = Superscript<br>2 = Subscript                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 76     | 1                     | Underline type (only if <code>font-underl</code> = 0):<br>00 <sub>H</sub> = None<br>01 <sub>H</sub> = Single                      21 <sub>H</sub> = Single accounting<br>02 <sub>H</sub> = Double                      22 <sub>H</sub> = Double accounting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 77     | 3                     | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 80     | 4                     | Font colour index (→5.74); or -1 to preserve the cell font colour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 84     | 4                     | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 88     | 4                     | Option flags for modified font attributes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
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| Bit    | Mask                  | Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Contents                                   |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 1      | 00000002 <sub>H</sub> | <code>font-style</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0 = Font style (posture/boldness) modified |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 3      | 00000008 <sub>H</sub> | <code>font-outline</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0 = Font outline modified                  |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 4      | 00000010 <sub>H</sub> | <code>font-shadow</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0 = Font shadow modified                   |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 5      | 00000020 <sub>H</sub> | <code>font-cond</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 = Font condense modified                 |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 7      | 00000080 <sub>H</sub> | <code>font-canc</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 = Font cancellation modified             |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 92     | 4                     | 0 = Escapement type modified, 1 = preserved ( <code>font-esc</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 96     | 4                     | 0 = Underline type modified, 1 = preserved ( <code>font-underl</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 100    | 4                     | Always 00000001 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 104    | 4                     | Always 00000001 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 108    | 8                     | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |
| 116    | 2                     | Always 0001 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |      |          |          |                       |                                                                       |                         |                                            |                                                                  |                       |                           |                                                                |   |                       |                                                                |                          |                       |                                                                    |                        |                            |   |                       |                        |                                |

• **Alignment Formatting Block**

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|-----|-------------------|----------------------------------------------------------------------------------------------------------------|---|-------------------|---------------------------------------------------------------------------|-----|-------------------|--------------------------------------------------------------------------------------------------------------------------|---|-----------------|-------------------------------------------------------------------------------|
| 0      | 1                 | Alignment and text break:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>2-0</td> <td>07<sub>H</sub></td> <td>Horizontal alignment (see XF_HOR_ALIGN constant list in XF record →5.115, only if <code>align-hor = 0</code>)</td> </tr> <tr> <td>3</td> <td>08<sub>H</sub></td> <td>Text wrapped: 0 = off; 1 = On (only if <code>align-wrap = 0</code>)</td> </tr> <tr> <td>6-4</td> <td>70<sub>H</sub></td> <td>Vertical alignment (see XF_VERT_ALIGN constant list in XF record →5.115, only if <code>align-ver = 0</code>)</td> </tr> <tr> <td>7</td> <td>80<sub>H</sub></td> <td>Justify last line: 0 = off; 1 = On (only if <code>align-justlast = 0</code>)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 2-0 | 07 <sub>H</sub>   | Horizontal alignment (see XF_HOR_ALIGN constant list in XF record →5.115, only if <code>align-hor = 0</code> ) | 3 | 08 <sub>H</sub>   | Text wrapped: 0 = off; 1 = On (only if <code>align-wrap = 0</code> )      | 6-4 | 70 <sub>H</sub>   | Vertical alignment (see XF_VERT_ALIGN constant list in XF record →5.115, only if <code>align-ver = 0</code> )            | 7 | 80 <sub>H</sub> | Justify last line: 0 = off; 1 = On (only if <code>align-justlast = 0</code> ) |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 2-0    | 07 <sub>H</sub>   | Horizontal alignment (see XF_HOR_ALIGN constant list in XF record →5.115, only if <code>align-hor = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 3      | 08 <sub>H</sub>   | Text wrapped: 0 = off; 1 = On (only if <code>align-wrap = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 6-4    | 70 <sub>H</sub>   | Vertical alignment (see XF_VERT_ALIGN constant list in XF record →5.115, only if <code>align-ver = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 7      | 80 <sub>H</sub>   | Justify last line: 0 = off; 1 = On (only if <code>align-justlast = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 1      | 1                 | Text rotation angle (see XF_ROTATION constant list in XF record →5.115, only if <code>align-rot = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 2      | 2                 | Indentation, shrink to cell size, and text direction:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>3-0</td> <td>000F<sub>H</sub></td> <td>Indent level (only if <code>align-indent = 0</code>)</td> </tr> <tr> <td>4</td> <td>0010<sub>H</sub></td> <td>Shrink contents: 0 = off; 1 = On (only if <code>align-shrink = 0</code>)</td> </tr> <tr> <td>7-6</td> <td>00C0<sub>H</sub></td> <td>Text direction: 0 = According to context; 1 = Left-to-right; 2 = Right-to-left (only if <code>align-textdir = 0</code>)</td> </tr> </tbody> </table>                                                                                                                                                                        | Bit | Mask | Contents | 3-0 | 000F <sub>H</sub> | Indent level (only if <code>align-indent = 0</code> )                                                          | 4 | 0010 <sub>H</sub> | Shrink contents: 0 = off; 1 = On (only if <code>align-shrink = 0</code> ) | 7-6 | 00C0 <sub>H</sub> | Text direction: 0 = According to context; 1 = Left-to-right; 2 = Right-to-left (only if <code>align-textdir = 0</code> ) |   |                 |                                                                               |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 3-0    | 000F <sub>H</sub> | Indent level (only if <code>align-indent = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 4      | 0010 <sub>H</sub> | Shrink contents: 0 = off; 1 = On (only if <code>align-shrink = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 7-6    | 00C0 <sub>H</sub> | Text direction: 0 = According to context; 1 = Left-to-right; 2 = Right-to-left (only if <code>align-textdir = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 4      | 2                 | Relative indentation (255 = absolute indentation, only if <code>align-indent = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |
| 6      | 2                 | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                   |                                                                                                                |   |                   |                                                                           |     |                   |                                                                                                                          |   |                 |                                                                               |

• **Border Formatting Block**

| Offset | Size                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
|--------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|-----|-----------------------|------------------------------------------------------------------------|------|-----------------------|---------------------------------------------------------------------------|-------|-----------------------|------------------------------------------------------------------------------------------------------------------------|-------|-----------------------|-------------------------------------------------------------------------------------------------------|-------|-----------------------|--------------------------------------------------------------------------|-------|-----------------------|----------------------------------------------------------------------------|----|-----------------------|-----------------------------------------------------------------------------|----|-----------------------|-----------------------------------------------------------------------------|
| 0      | 4                     | Border line styles and colors:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
|        |                       | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>3-0</td> <td>0000000F<sub>H</sub></td> <td>Left line style (only if <code>bord-left = 0</code>, →2.5.11)</td> </tr> <tr> <td>7-4</td> <td>000000F0<sub>H</sub></td> <td>Right line style (only if <code>bord-right = 0</code>, →2.5.11)</td> </tr> <tr> <td>11-8</td> <td>00000F00<sub>H</sub></td> <td>Top line style (only if <code>bord-top = 0</code>, →2.5.11)</td> </tr> <tr> <td>15-12</td> <td>0000F000<sub>H</sub></td> <td>Bottom line style (only if <code>bord-bot = 0</code>, →2.5.11)</td> </tr> <tr> <td>22-16</td> <td>007F0000<sub>H</sub></td> <td>Colour index (→5.74) for left line (only if <code>bord-left = 0</code>)</td> </tr> <tr> <td>29-23</td> <td>3F800000<sub>H</sub></td> <td>Colour index (→5.74) for right line (only if <code>bord-right = 0</code>)</td> </tr> <tr> <td>30</td> <td>40000000<sub>H</sub></td> <td>Top-left to bottom-right line on/off (only if <code>bord-tl-br = 0</code>)</td> </tr> <tr> <td>31</td> <td>80000000<sub>H</sub></td> <td>Bottom-left to top-right line on/off (only if <code>bord-bl-tr = 0</code>)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 3-0 | 0000000F <sub>H</sub> | Left line style (only if <code>bord-left = 0</code> , →2.5.11)         | 7-4  | 000000F0 <sub>H</sub> | Right line style (only if <code>bord-right = 0</code> , →2.5.11)          | 11-8  | 00000F00 <sub>H</sub> | Top line style (only if <code>bord-top = 0</code> , →2.5.11)                                                           | 15-12 | 0000F000 <sub>H</sub> | Bottom line style (only if <code>bord-bot = 0</code> , →2.5.11)                                       | 22-16 | 007F0000 <sub>H</sub> | Colour index (→5.74) for left line (only if <code>bord-left = 0</code> ) | 29-23 | 3F800000 <sub>H</sub> | Colour index (→5.74) for right line (only if <code>bord-right = 0</code> ) | 30 | 40000000 <sub>H</sub> | Top-left to bottom-right line on/off (only if <code>bord-tl-br = 0</code> ) | 31 | 80000000 <sub>H</sub> | Bottom-left to top-right line on/off (only if <code>bord-bl-tr = 0</code> ) |
| Bit    | Mask                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 3-0    | 0000000F <sub>H</sub> | Left line style (only if <code>bord-left = 0</code> , →2.5.11)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 7-4    | 000000F0 <sub>H</sub> | Right line style (only if <code>bord-right = 0</code> , →2.5.11)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 11-8   | 00000F00 <sub>H</sub> | Top line style (only if <code>bord-top = 0</code> , →2.5.11)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 15-12  | 0000F000 <sub>H</sub> | Bottom line style (only if <code>bord-bot = 0</code> , →2.5.11)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 22-16  | 007F0000 <sub>H</sub> | Colour index (→5.74) for left line (only if <code>bord-left = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 29-23  | 3F800000 <sub>H</sub> | Colour index (→5.74) for right line (only if <code>bord-right = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 30     | 40000000 <sub>H</sub> | Top-left to bottom-right line on/off (only if <code>bord-tl-br = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 31     | 80000000 <sub>H</sub> | Bottom-left to top-right line on/off (only if <code>bord-bl-tr = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 4      | 4                     | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>6-0</td> <td>0000007F<sub>H</sub></td> <td>Colour index (→5.74) for top line (only if <code>bord-top = 0</code>)</td> </tr> <tr> <td>13-7</td> <td>00003F80<sub>H</sub></td> <td>Colour index (→5.74) for bottom line (only if <code>bord-bot = 0</code>)</td> </tr> <tr> <td>20-14</td> <td>001FC000<sub>H</sub></td> <td>Colour index (→5.74) for diagonal line colour (only if <code>bord-tl-br = 0</code> or if <code>bord-bl-tr = 0</code>)</td> </tr> <tr> <td>24-21</td> <td>01E00000<sub>H</sub></td> <td>Diagonal line style (only if <code>bord-tl-br = 0</code> or if <code>bord-bl-tr = 0</code>, →2.5.11)</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Bit | Mask | Contents | 6-0 | 0000007F <sub>H</sub> | Colour index (→5.74) for top line (only if <code>bord-top = 0</code> ) | 13-7 | 00003F80 <sub>H</sub> | Colour index (→5.74) for bottom line (only if <code>bord-bot = 0</code> ) | 20-14 | 001FC000 <sub>H</sub> | Colour index (→5.74) for diagonal line colour (only if <code>bord-tl-br = 0</code> or if <code>bord-bl-tr = 0</code> ) | 24-21 | 01E00000 <sub>H</sub> | Diagonal line style (only if <code>bord-tl-br = 0</code> or if <code>bord-bl-tr = 0</code> , →2.5.11) |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| Bit    | Mask                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 6-0    | 0000007F <sub>H</sub> | Colour index (→5.74) for top line (only if <code>bord-top = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 13-7   | 00003F80 <sub>H</sub> | Colour index (→5.74) for bottom line (only if <code>bord-bot = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 20-14  | 001FC000 <sub>H</sub> | Colour index (→5.74) for diagonal line colour (only if <code>bord-tl-br = 0</code> or if <code>bord-bl-tr = 0</code> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |
| 24-21  | 01E00000 <sub>H</sub> | Diagonal line style (only if <code>bord-tl-br = 0</code> or if <code>bord-bl-tr = 0</code> , →2.5.11)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                       |                                                                        |      |                       |                                                                           |       |                       |                                                                                                                        |       |                       |                                                                                                       |       |                       |                                                                          |       |                       |                                                                            |    |                       |                                                                             |    |                       |                                                                             |

### • Pattern Formatting Block

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|-------|-------------------|----------------------------------------------------------------------|------|-------------------|-----------------------------------------------------------------------------------|
| 0      | 2                 | Fill pattern style:                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>15-10</td> <td>FC00<sub>H</sub></td> <td>Fill pattern style (only if <code>patt-style</code> = 0, →2.5.12)</td> </tr> </tbody> </table>                                                                                                                                                | Bit | Mask | Contents | 15-10 | FC00 <sub>H</sub> | Fill pattern style (only if <code>patt-style</code> = 0, →2.5.12)    |      |                   |                                                                                   |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |
| 15-10  | FC00 <sub>H</sub> | Fill pattern style (only if <code>patt-style</code> = 0, →2.5.12)                                                                                                                                                                                                                                                                                                                                   |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |
| 2      | 2                 | Fill pattern colour indexes:                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>6-0</td> <td>007F<sub>H</sub></td> <td>Colour index (→5.74) for pattern (only if <code>patt-col</code> = 0)</td> </tr> <tr> <td>13-7</td> <td>3F80<sub>H</sub></td> <td>Colour index (→5.74) for pattern background (only if <code>patt-bgcol</code> = 0)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 6-0   | 007F <sub>H</sub> | Colour index (→5.74) for pattern (only if <code>patt-col</code> = 0) | 13-7 | 3F80 <sub>H</sub> | Colour index (→5.74) for pattern background (only if <code>patt-bgcol</code> = 0) |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |
| 6-0    | 007F <sub>H</sub> | Colour index (→5.74) for pattern (only if <code>patt-col</code> = 0)                                                                                                                                                                                                                                                                                                                                |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |
| 13-7   | 3F80 <sub>H</sub> | Colour index (→5.74) for pattern background (only if <code>patt-bgcol</code> = 0)                                                                                                                                                                                                                                                                                                                   |     |      |          |       |                   |                                                                      |      |                   |                                                                                   |

### • Protection Formatting Block

| Offset | Size            | Contents                                                                                                                                                                                                                                                                                                                                                   |     |      |          |   |                 |                                                           |   |                 |                                                              |
|--------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-----------------|-----------------------------------------------------------|---|-----------------|--------------------------------------------------------------|
| 0      | 2               | Protection flags:                                                                                                                                                                                                                                                                                                                                          |     |      |          |   |                 |                                                           |   |                 |                                                              |
|        |                 | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>01<sub>H</sub></td> <td>Cell locked on/off (only if <code>prot-locked</code> = 0)</td> </tr> <tr> <td>1</td> <td>02<sub>H</sub></td> <td>Formula hidden on/off (only if <code>prot-hidden</code> = 0)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 01 <sub>H</sub> | Cell locked on/off (only if <code>prot-locked</code> = 0) | 1 | 02 <sub>H</sub> | Formula hidden on/off (only if <code>prot-hidden</code> = 0) |
| Bit    | Mask            | Contents                                                                                                                                                                                                                                                                                                                                                   |     |      |          |   |                 |                                                           |   |                 |                                                              |
| 0      | 01 <sub>H</sub> | Cell locked on/off (only if <code>prot-locked</code> = 0)                                                                                                                                                                                                                                                                                                  |     |      |          |   |                 |                                                           |   |                 |                                                              |
| 1      | 02 <sub>H</sub> | Formula hidden on/off (only if <code>prot-hidden</code> = 0)                                                                                                                                                                                                                                                                                               |     |      |          |   |                 |                                                           |   |                 |                                                              |



## 5.17 CODEPAGE

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0042 <sub>H</sub> | 0042 <sub>H</sub> | 0042 <sub>H</sub> | 0042 <sub>H</sub> | 0042 <sub>H</sub> |

This record stores the text encoding used to write byte strings, stored as MS Windows code page identifier.

- ! The CODEPAGE record in BIFF8 always contains the code page 1200 (UTF-16, →2.5.3). Therefore it is not possible to obtain the encoding used for a protection password (it is not UTF-16).

Record CODEPAGE, BIFF2-BIFF8:

| Offset | Size | Contents                                                                 |
|--------|------|--------------------------------------------------------------------------|
| 0      | 2    | Code page identifier used for byte string text encoding <sup>21</sup> :  |
|        |      | 016F <sub>H</sub> = 367 = ASCII                                          |
|        |      | 01B5 <sub>H</sub> = 437 = IBM PC CP-437 (US)                             |
|        |      | 02D0 <sub>H</sub> = 720 = IBM PC CP-720 (OEM Arabic)                     |
|        |      | 02E1 <sub>H</sub> = 737 = IBM PC CP-737 (Greek)                          |
|        |      | 0307 <sub>H</sub> = 775 = IBM PC CP-775 (Baltic)                         |
|        |      | 0352 <sub>H</sub> = 850 = IBM PC CP-850 (Latin I)                        |
|        |      | 0354 <sub>H</sub> = 852 = IBM PC CP-852 (Latin II (Central European))    |
|        |      | 0357 <sub>H</sub> = 855 = IBM PC CP-855 (Cyrillic)                       |
|        |      | 0359 <sub>H</sub> = 857 = IBM PC CP-857 (Turkish)                        |
|        |      | 035A <sub>H</sub> = 858 = IBM PC CP-858 (Multilingual Latin I with Euro) |
|        |      | 035C <sub>H</sub> = 860 = IBM PC CP-860 (Portuguese)                     |
|        |      | 035D <sub>H</sub> = 861 = IBM PC CP-861 (Icelandic)                      |
|        |      | 035E <sub>H</sub> = 862 = IBM PC CP-862 (Hebrew)                         |
|        |      | 035F <sub>H</sub> = 863 = IBM PC CP-863 (Canadian (French))              |
|        |      | 0360 <sub>H</sub> = 864 = IBM PC CP-864 (Arabic)                         |
|        |      | 0361 <sub>H</sub> = 865 = IBM PC CP-865 (Nordic)                         |
|        |      | 0362 <sub>H</sub> = 866 = IBM PC CP-866 (Cyrillic (Russian))             |
|        |      | 0365 <sub>H</sub> = 869 = IBM PC CP-869 (Greek (Modern))                 |
|        |      | 036A <sub>H</sub> = 874 = Windows CP-874 (Thai)                          |
|        |      | 03A4 <sub>H</sub> = 932 = Windows CP-932 (Japanese Shift-JIS)            |
|        |      | 03A8 <sub>H</sub> = 936 = Windows CP-936 (Chinese Simplified GBK)        |
|        |      | 03B5 <sub>H</sub> = 949 = Windows CP-949 (Korean (Wansung))              |
|        |      | 03B6 <sub>H</sub> = 950 = Windows CP-950 (Chinese Traditional BIG5)      |
|        |      | 04B0 <sub>H</sub> = 1200 = UTF-16 (BIFF8)                                |
|        |      | 04E2 <sub>H</sub> = 1250 = Windows CP-1250 (Latin II) (Central European) |
|        |      | 04E3 <sub>H</sub> = 1251 = Windows CP-1251 (Cyrillic)                    |
|        |      | 04E4 <sub>H</sub> = 1252 = Windows CP-1252 (Latin I) (BIFF4-BIFF5)       |
|        |      | 04E5 <sub>H</sub> = 1253 = Windows CP-1253 (Greek)                       |
|        |      | 04E6 <sub>H</sub> = 1254 = Windows CP-1254 (Turkish)                     |
|        |      | 04E7 <sub>H</sub> = 1255 = Windows CP-1255 (Hebrew)                      |
|        |      | 04E8 <sub>H</sub> = 1256 = Windows CP-1256 (Arabic)                      |
|        |      | 04E9 <sub>H</sub> = 1257 = Windows CP-1257 (Baltic)                      |
|        |      | 04EA <sub>H</sub> = 1258 = Windows CP-1258 (Vietnamese)                  |
|        |      | 0551 <sub>H</sub> = 1361 = Windows CP-1361 (Korean (Johab))              |
|        |      | 2710 <sub>H</sub> = 10000 = Apple Roman                                  |
|        |      | 8000 <sub>H</sub> = 32768 = Apple Roman                                  |
|        |      | 8001 <sub>H</sub> = 32769 = Windows CP-1252 (Latin I) (BIFF2-BIFF3)      |

<sup>21</sup> For more information see [http://en.wikipedia.org/wiki/Character\\_encoding](http://en.wikipedia.org/wiki/Character_encoding).

## 5.18 COLINFO

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 007D <sub>H</sub> | 007D <sub>H</sub> | 007D <sub>H</sub> | 007D <sub>H</sub> |

This record specifies the width and default cell formatting for a given range of columns.

In BIFF3, if a COLINFO record is missing for a column, the width specified in the record DEFCOLWIDTH (→5.32) is used instead.

In BIFF4-BIFF5, the width set in this record is only used, if the corresponding bit for this column is cleared in the GCW record (→5.51), otherwise the column width set in the DEFCOLWIDTH record (→5.32) is used (the STANDARDWIDTH record (→5.101) is always ignored in this case).

In BIFF8, if a COLINFO record is missing for a column, the width specified in the record STANDARDWIDTH (→5.101) is used. If this record is also missing, the column width of the record DEFCOLWIDTH (→5.32) is used instead.

This record also specifies a default XF record (→5.115) to use for cells in the columns that are not described by any cell record (which contain the XF index for that cell). Additionally, the option flags field contains hidden, outline, and collapsed options applied at the columns.

In BIFF2, the column width is stored in the record COLWIDTH (→5.20) and default column formatting in the record COLUMNDEFAULT (→5.19).

Record COLINFO, BIFF3-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
|--------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|----------|---|-------------------|------------------------|------|-------------------|-----------------------------------------------|----|-------------------|---------------------------|
| 0      | 2                 | Index to first column in the range                                                                                                                                                                                                                                                                                                                                                                                                                |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 2      | 2                 | Index to last column in the range                                                                                                                                                                                                                                                                                                                                                                                                                 |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 4      | 2                 | Width of the columns in $\frac{1}{256}$ of the width of the zero character, using default font (first FONT record in the file)                                                                                                                                                                                                                                                                                                                    |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 6      | 2                 | Index to XF record (→5.115) for default column formatting                                                                                                                                                                                                                                                                                                                                                                                         |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 8      | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bits</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Columns are hidden</td> </tr> <tr> <td>10-8</td> <td>0700<sub>H</sub></td> <td>Outline level of the columns (0 = no outline)</td> </tr> <tr> <td>12</td> <td>1000<sub>H</sub></td> <td>1 = Columns are collapsed</td> </tr> </tbody> </table> | Bits | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Columns are hidden | 10-8 | 0700 <sub>H</sub> | Outline level of the columns (0 = no outline) | 12 | 1000 <sub>H</sub> | 1 = Columns are collapsed |
| Bits   | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 0      | 0001 <sub>H</sub> | 1 = Columns are hidden                                                                                                                                                                                                                                                                                                                                                                                                                            |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 10-8   | 0700 <sub>H</sub> | Outline level of the columns (0 = no outline)                                                                                                                                                                                                                                                                                                                                                                                                     |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 12     | 1000 <sub>H</sub> | 1 = Columns are collapsed                                                                                                                                                                                                                                                                                                                                                                                                                         |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |
| 10     | 2                 | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |      |          |   |                   |                        |      |                   |                                               |    |                   |                           |

## 5.19 COLUMNDEFAULT

| BIFF2             | BIFF3 | BIFF4 | BIFF5 | BIFF8 |
|-------------------|-------|-------|-------|-------|
| 0020 <sub>H</sub> | —     | —     | —     | —     |

This record contains default formatting attributes for a given range of columns. The formatting attributes are stored separate for each column in the given range. From BIFF3 on the record COLINFO (→5.18) is used to specify default column formatting.

Record COLUMNDEFAULT, BIFF2:

| Offset           | Size           | Contents                                                                                             |
|------------------|----------------|------------------------------------------------------------------------------------------------------|
| 0                | 2              | Index to first column referred in this record ( <u>f.c.</u> )                                        |
| 2                | 2              | Index to last column referred in this record ( <u>l.c.</u> )                                         |
| 4                | 3· <u>n.c.</u> | List of <u>n.c.</u> = <u>l.c.</u> - <u>f.c.</u> +1 cell attribute structures (3 bytes each, →2.5.13) |
| 4+3· <u>n.c.</u> | 2              | Not used                                                                                             |

## 5.20 COLWIDTH

| BIFF2             | BIFF3 | BIFF4 | BIFF5 | BIFF8 |
|-------------------|-------|-------|-------|-------|
| 0024 <sub>H</sub> | —     | —     | —     | —     |

This record specifies the width for a given range of columns. If a column does not have a corresponding COLWIDTH record, the width specified by the record DEFCOLWIDTH (→5.32) is used instead. From BIFF3 on the record COLINFO (→5.18) is used to specify the column width.

| Offset | Size | Contents                                                                                                                       |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | Index to first column                                                                                                          |
| 1      | 1    | Index to last column                                                                                                           |
| 2      | 2    | Width of the columns in $\frac{1}{256}$ of the width of the zero character, using default font (first FONT record in the file) |

## 5.21 CONTINUE

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 003C <sub>H</sub> | 003C <sub>H</sub> | 003C <sub>H</sub> | 003C <sub>H</sub> | 003C <sub>H</sub> |

Whenever the content of a record exceeds the given limits (see table), the record must be split. Several CONTINUE records containing the additional data are added after the parent record.

| BIFF version | Maximum data size of a record                   |
|--------------|-------------------------------------------------|
| BIFF2-BIFF5  | 2080 bytes (2084 bytes including record header) |
| BIFF8        | 8224 bytes (8228 bytes including record header) |

Record CONTINUE, BIFF2-BIFF8:

| Offset | Size | Contents                                 |
|--------|------|------------------------------------------|
| 0      | var. | Data continuation of the previous record |

Unicode strings are split in a special way. At the beginning of each CONTINUE record the option flags byte is repeated. Only the character size flag will be set in this flags byte, the Rich-Text flag and the Far-East flag are set to zero.

- ! In each CONTINUE record it is possible that the character size changes from 8-bit characters to 16-bit characters and vice versa.
- ! Never a Unicode string is split until and including the first character. That means, all header fields (string length, option flags, optional Rich-Text size, and optional Far-East data size) and the first character of the string have to occur together in the leading record, or have to be moved completely into the CONTINUE record.
- ! Formatting runs (→2.5.1) cannot be split between their components (character index and FONT record index). If a string is split between two formatting runs, the option flags field will not be repeated in the CONTINUE record.

Example: The remaining size of a record may be 10 bytes (it has 8214 bytes of data). Now the string “ABCDE-GHΩI” has to be stored in this record. “Ω” is the capital Greek character Omega with the Unicode character code 03A9<sub>H</sub>.

Note: The records are shown with their headers to make the example clearer.

| Offset | Size | Contents                                            | Description                                     |
|--------|------|-----------------------------------------------------|-------------------------------------------------|
| 0      | 2    |                                                     | Any record identifier                           |
| 2      | 2    | 2020 <sub>H</sub> (8224)                            | Record data size                                |
| 4      | 8214 |                                                     | Any data                                        |
| 8218   | 2    | 000A <sub>H</sub> (10)                              | Unicode string character count                  |
| 8220   | 1    | 00 <sub>H</sub>                                     | Unicode string option flags (8-bit characters)  |
| 8221   | 7    | 41 <sub>H</sub> 42 <sub>H</sub> ... 47 <sub>H</sub> | 8-bit character array “ABCDEFG”                 |
| 8228   | 2    | 003C <sub>H</sub>                                   | Record identifier CONTINUE                      |
| 8230   | 2    | 0007 <sub>H</sub> (7)                               | Record data size                                |
| 8232   | 1    | 01 <sub>H</sub>                                     | Unicode string option flags (16-bit characters) |
| 8233   | 2    | 0048 <sub>H</sub>                                   | 16-bit character “H”                            |
| 8235   | 2    | 03A9 <sub>H</sub>                                   | 16-bit character “Ω”                            |
| 8237   | 2    | 0049 <sub>H</sub>                                   | 16-bit character “I”                            |

## 5.22 COUNTRY

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 008C <sub>H</sub> | 008C <sub>H</sub> | 008C <sub>H</sub> | 008C <sub>H</sub> |

This record stores two Windows country identifiers. The first represents the user interface language of the Excel version that has saved the file, and the second represents the system regional settings at the time the file was saved.

Record COUNTRY, BIFF3-BIFF8:

| Offset | Size | Contents                                                           |
|--------|------|--------------------------------------------------------------------|
| 0      | 2    | Windows country identifier of the user interface language of Excel |
| 2      | 2    | Windows country identifier of the system regional settings         |

The following table shows most of the used country identifiers. Most of these identifiers are equal to the international country calling codes<sup>22</sup>.

| ID | Country              | ID  | Country                            | ID  | Country                         | ID  | Country                           | ID  | Country                            | ID  | Country                        |
|----|----------------------|-----|------------------------------------|-----|---------------------------------|-----|-----------------------------------|-----|------------------------------------|-----|--------------------------------|
| 1  | USA <sup>23</sup>    | 66  | Thailand                           | 240 | Equatorial Guinea <sup>26</sup> | 350 | Gibraltar <sup>26</sup>           | 506 | Costa Rica                         | 692 | Marshall Islands <sup>26</sup> |
| 2  | Canada <sup>24</sup> | 81  | Japan                              | 241 | Gabon <sup>26</sup>             | 351 | Portugal                          | 507 | Panama                             | 850 | North Korea <sup>26</sup>      |
| 7  | Russia <sup>25</sup> | 82  | South Korea                        | 242 | Congo <sup>26</sup>             | 352 | Luxembourg                        | 508 | St. Pierre <sup>26</sup>           | 852 | Hong Kong S.A.R.               |
| 20 | Egypt                | 84  | Viet Nam                           | 243 | Zaire <sup>27</sup>             | 353 | Ireland                           | 509 | Haiti <sup>26</sup>                | 853 | Macao S.A.R.                   |
| 27 | South Africa         | 86  | PR China                           | 244 | Angola <sup>26</sup>            | 354 | Iceland                           | 590 | Guadeloupe <sup>26</sup>           | 855 | Cambodia <sup>26</sup>         |
| 30 | Greece               | 90  | Turkey                             | 245 | Guinea-Bissau <sup>26</sup>     | 355 | Albania                           | 591 | Bolivia                            | 856 | Laos <sup>26</sup>             |
| 31 | Netherlands          | 91  | India                              | 246 | Diego Garcia <sup>26</sup>      | 356 | Malta <sup>26</sup>               | 592 | Guyana <sup>26</sup>               | 880 | Bangladesh <sup>26</sup>       |
| 32 | Belgium              | 92  | Pakistan                           | 247 | Ascension Island <sup>26</sup>  | 357 | Cyprus <sup>26</sup>              | 593 | Ecuador                            | 886 | Taiwan                         |
| 33 | France               | 93  | Afghanistan <sup>26</sup>          | 248 | Seychelles <sup>26</sup>        | 358 | Finland                           | 594 | French Guiana <sup>26</sup>        | 960 | Maldives                       |
| 34 | Spain                | 94  | Sri Lanka <sup>26</sup>            | 249 | Sudan <sup>26</sup>             | 359 | Bulgaria                          | 595 | Paraguay                           | 961 | Lebanon                        |
| 36 | Hungary              | 95  | Burma (Myanmar) <sup>26</sup>      | 250 | Rwanda <sup>26</sup>            | 370 | Lithuania                         | 596 | Martinique <sup>26</sup>           | 962 | Jordan                         |
| 39 | Italy                | 212 | Morocco                            | 251 | Ethiopia <sup>26</sup>          | 371 | Latvia                            | 597 | Suriname <sup>26</sup>             | 963 | Syria                          |
| 40 | Romania              | 213 | Algeria                            | 252 | Somalia <sup>26</sup>           | 372 | Estonia                           | 598 | Uruguay                            | 964 | Iraq                           |
| 41 | Switzerland          | 216 | Tunisia                            | 253 | Djibouti <sup>26</sup>          | 373 | Moldova <sup>26</sup>             | 599 | Netherlands Antilles <sup>26</sup> | 965 | Kuwait                         |
| 43 | Austria              | 218 | Libya                              | 254 | Kenya                           | 374 | Armenia                           | 670 | East Timor <sup>26</sup>           | 966 | Saudi Arabia                   |
| 44 | United Kingdom       | 220 | Gambia <sup>26</sup>               | 255 | Tanzania <sup>26</sup>          | 375 | Belarus <sup>30</sup>             | 672 | Antarctica <sup>26</sup>           | 967 | Yemen                          |
| 45 | Denmark              | 221 | Senegal <sup>27</sup>              | 256 | Uganda <sup>26</sup>            | 376 | Andorra <sup>26</sup>             | 673 | Brunei Darussalam                  | 968 | Oman                           |
| 46 | Sweden               | 222 | Mauritania <sup>26</sup>           | 257 | Burundi <sup>26</sup>           | 377 | Monaco                            | 674 | Narupu <sup>26</sup>               | 970 | Palestine <sup>26</sup>        |
| 47 | Norway               | 223 | Mali <sup>27</sup>                 | 258 | Mozambique <sup>26</sup>        | 378 | San Marino <sup>26</sup>          | 675 | Papua New Guinea <sup>26</sup>     | 971 | U.A.E.                         |
| 48 | Poland               | 224 | Guinea <sup>26</sup>               | 259 | Zanzibar <sup>26</sup>          | 379 | Vatican City <sup>26</sup>        | 676 | Tonga <sup>26</sup>                | 972 | Israel                         |
| 49 | Germany              | 225 | Côte d'Ivoire <sup>27</sup>        | 260 | Zambia <sup>26</sup>            | 380 | Ukraine                           | 677 | Solomon Islands <sup>26</sup>      | 973 | Bahrain                        |
| 51 | Peru                 | 226 | Burkina Faso <sup>26</sup>         | 261 | Madagascar <sup>26</sup>        | 381 | Serbia                            | 678 | Vanuatu <sup>26</sup>              | 974 | Qatar                          |
| 52 | Mexico               | 227 | Niger <sup>26</sup>                | 262 | Reunion Island <sup>27</sup>    | 385 | Croatia                           | 679 | Fiji <sup>26</sup>                 | 975 | Bhutan <sup>26</sup>           |
| 53 | Cuba <sup>26</sup>   | 228 | Togo <sup>26</sup>                 | 263 | Zimbabwe                        | 386 | Slovenia                          | 680 | Palau <sup>26</sup>                | 976 | Mongolia                       |
| 54 | Argentina            | 229 | Benin <sup>26</sup>                | 264 | Namibia <sup>26</sup>           | 387 | Bosnia, Herzegovina <sup>26</sup> | 681 | Wallis and Futuna <sup>26</sup>    | 977 | Nepal <sup>26</sup>            |
| 55 | Brazil               | 230 | Mauritius <sup>26</sup>            | 265 | Malawi <sup>26</sup>            | 389 | Macedonia                         | 682 | Cook Islands <sup>26</sup>         | 981 | Iran <sup>29</sup>             |
| 56 | Chile                | 231 | Liberia <sup>26</sup>              | 266 | Lesotho <sup>26</sup>           | 420 | Czech                             | 683 | Niue Island <sup>26</sup>          | 992 | Tajikistan <sup>30</sup>       |
| 57 | Colombia             | 232 | Sierra Leone <sup>26</sup>         | 267 | Botswana <sup>26</sup>          | 421 | Slovak                            | 684 | American Samoa <sup>26</sup>       | 993 | Turkmenistan <sup>26</sup>     |
| 58 | Venezuela            | 233 | Ghana <sup>26</sup>                | 268 | Swaziland <sup>26</sup>         | 423 | Liechtenstein <sup>28</sup>       | 685 | Western Samoa <sup>26</sup>        | 994 | Azerbaijan                     |
| 60 | Malaysia             | 234 | Nigeria <sup>26</sup>              | 269 | Comoros, Mayotte <sup>26</sup>  | 500 | Falkland Islands <sup>26</sup>    | 686 | Kiribati <sup>26</sup>             | 995 | Georgia                        |
| 61 | Australia            | 235 | Chad <sup>26</sup>                 | 290 | St. Helena <sup>26</sup>        | 501 | Belize                            | 687 | New Caledonia <sup>26</sup>        | 996 | Kyrgyzstan                     |
| 62 | Indonesia            | 236 | Central African Rep. <sup>26</sup> | 291 | Eritrea <sup>26</sup>           | 502 | Guatemala                         | 688 | Tuvalu <sup>26</sup>               | 998 | Uzbekistan <sup>30</sup>       |
| 63 | Philippines          | 237 | Cameroon <sup>27</sup>             | 297 | Aruba <sup>26</sup>             | 503 | El Salvador                       | 689 | French Polynesia <sup>26</sup>     |     |                                |
| 64 | New Zealand          | 238 | Cape Verde <sup>26</sup>           | 298 | Faeroe Islands                  | 504 | Honduras                          | 690 | Tokelau <sup>26</sup>              |     |                                |
| 65 | Singapore            | 239 | Sao Tome <sup>26</sup>             | 299 | Green Island <sup>26</sup>      | 505 | Nicaragua                         | 691 | Micronesia <sup>26</sup>           |     |                                |

<sup>22</sup> Source: [http://en.wikipedia.org/wiki/List\\_of\\_country\\_calling\\_codes](http://en.wikipedia.org/wiki/List_of_country_calling_codes)

<sup>23</sup> Including the countries of the North America Numbering Plan (NANP), e.g. Bahamas, Dominican Republic, Jamaica, Puerto Rico.

<sup>24</sup> Real country calling code of Canada is 1.

<sup>25</sup> Including Kazakhstan and Tatarstan.

<sup>26</sup> Not used in Windows.

<sup>27</sup> Windows uses France (33) instead.

<sup>28</sup> Windows uses Switzerland (41) instead.

<sup>29</sup> Real country calling code of Iran is 98.

<sup>30</sup> Windows uses Russia (7) instead.

## 5.23 CRN

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 005A <sub>H</sub> | 005A <sub>H</sub> | 005A <sub>H</sub> | 005A <sub>H</sub> |

This record stores the contents of an external cell or cell range. An external cell range has one row only. If a cell range spans over more than one row, several CRN records will be created. See →4.10 for details about external references.

Record CRN, BIFF3-BIFF8:

| Offset | Size | Contents                                                           |
|--------|------|--------------------------------------------------------------------|
| 0      | 1    | Index to last column inside of the referenced sheet ( <u>l</u> c)  |
| 1      | 1    | Index to first column inside of the referenced sheet ( <u>f</u> c) |
| 2      | 2    | Index to row inside of the referenced sheet                        |
| 4      | var. | List of <u>l</u> c- <u>f</u> c+1 constant values (→2.5.7)          |

## 5.24 DATATABLE – Multiple Operation Table

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0036 <sub>H</sub> | 0236 <sub>H</sub> | 0236 <sub>H</sub> | 0236 <sub>H</sub> | 0236 <sub>H</sub> |

This record stores information about a multiple operation table in the sheet. It follows the first FORMULA record (→5.50) of the cell range containing the operation table. For more information about multiple operations see →4.9.

In BIFF2, a multiple operation with two data source ranges is stored in the DATATABLE2 record, see →5.25. From BIFF3 on, the DATATABLE record is able to represent this kind of multiple operation too.

Record DATATABLE, BIFF2:

| Offset | Size | Contents                                                                                                                                                                                 |
|--------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 6    | Cell range address of the multiple operation table range (→2.5.14)                                                                                                                       |
| 6      | 1    | 0 = Do not recalculate the table, 1 = Always recalculate the table                                                                                                                       |
| 7      | 1    | 0 = Input data is in the column left of the table, formulas are in the row above the table<br>1 = Input data is in the row above the table, formulas are in the column left of the table |
| 8      | 2    | Row index of the input cell                                                                                                                                                              |
| 10     | 2    | Column index of the input cell                                                                                                                                                           |

Record DATATABLE, BIFF3-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
|--------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|--------------------------------------|---|-------------------|-------------------------------------|---|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------|---------------------------------------------------------------|---|-------------------|----------------------------------------------------|---|-------------------|-----------------------------------------------------|
| 0      | 6                 | Cell range address of the multiple operation table range (→2.5.14). Column indexes are always 8-bit values, also in BIFF8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 6      | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Always recalculate array formula</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Calculate array formula on open</td> </tr> <tr> <td>2</td> <td>0004<sub>H</sub></td> <td>0 = Input data is in the column left of the table, formulas are in the row above the table<br/>1 = Input data is in the row above the table, formulas are in the column left of the table</td> </tr> <tr> <td>3</td> <td>0008<sub>H</sub></td> <td>1 = Table uses row and column input data (2-dimensional mode)</td> </tr> <tr> <td>4</td> <td>0010<sub>H</sub></td> <td>1 = First input cell has been deleted (BIFF8 only)</td> </tr> <tr> <td>5</td> <td>0020<sub>H</sub></td> <td>1 = Second input cell has been deleted (BIFF8 only)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Always recalculate array formula | 1 | 0002 <sub>H</sub> | 1 = Calculate array formula on open | 2 | 0004 <sub>H</sub> | 0 = Input data is in the column left of the table, formulas are in the row above the table<br>1 = Input data is in the row above the table, formulas are in the column left of the table | 3 | 0008 <sub>H</sub> | 1 = Table uses row and column input data (2-dimensional mode) | 4 | 0010 <sub>H</sub> | 1 = First input cell has been deleted (BIFF8 only) | 5 | 0020 <sub>H</sub> | 1 = Second input cell has been deleted (BIFF8 only) |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 0      | 0001 <sub>H</sub> | 1 = Always recalculate array formula                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 1      | 0002 <sub>H</sub> | 1 = Calculate array formula on open                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 2      | 0004 <sub>H</sub> | 0 = Input data is in the column left of the table, formulas are in the row above the table<br>1 = Input data is in the row above the table, formulas are in the column left of the table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 3      | 0008 <sub>H</sub> | 1 = Table uses row and column input data (2-dimensional mode)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 4      | 0010 <sub>H</sub> | 1 = First input cell has been deleted (BIFF8 only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 5      | 0020 <sub>H</sub> | 1 = Second input cell has been deleted (BIFF8 only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 8      | 2                 | Row index of first input cell (in 2D mode, this is the “row input cell”)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 10     | 2                 | Column index of first input cell (in 2D mode, this is the “row input cell”)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 12     | 2                 | Row index of second input cell (2D mode only, for the “column input cell”)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |
| 14     | 2                 | Column index of second input cell (2D mode only, for the “column input cell”)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |   |                   |                                      |   |                   |                                     |   |                   |                                                                                                                                                                                          |   |                   |                                                               |   |                   |                                                    |   |                   |                                                     |

## 5.25 DATATABLE2 – Multiple Operation Table

| BIFF2             | BIFF3 | BIFF4 | BIFF5 | BIFF8 |
|-------------------|-------|-------|-------|-------|
| 0037 <sub>H</sub> | —     | —     | —     | —     |

In BIFF2 this record stores information about a multiple operation table in a sheet using two independent input ranges. It follows the first FORMULA record (→5.50) of the cell range containing the operation table. For more information about multiple operations see →4.9. From BIFF3 on, the DATATABLE record (→5.24) contains this kind of multiple operation too.

Record DATATABLE2, BIFF2:

| Offset | Size | Contents                                                           |
|--------|------|--------------------------------------------------------------------|
| 0      | 6    | Cell range address of the multiple operation table range (→2.5.14) |
| 6      | 1    | 0 = Do not recalculate the table, 1 = Always recalculate the table |
| 7      | 1    | Not used                                                           |
| 8      | 2    | Row index of first input cell (“row input cell”)                   |
| 10     | 2    | Column index of first input cell (“row input cell”)                |
| 12     | 2    | Row index of second input cell (“column input cell”)               |
| 14     | 2    | Column index of second input cell (“column input cell”)            |



## 5.26 DATAVALIDATION

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 01BE <sub>H</sub> |

This record is part of the *Data Validity Table* (→4.14). It stores data validity settings and a list of cell ranges which contain these settings. The “prompt box” appears while editing such a cell. The “error box” appears, if the entered value does not fit the conditions. The data validity settings of a sheet are stored in a list of DATAVALIDATION records which is preceded by a DATAVALIDATIONS record (→5.27). If a string is empty and the default text should appear in the prompt box or error box, the string must contain a single zero character (string length will be 1).

Record DATAVALIDATION, BIFF8:

| Offset | Size         | Contents                                                                   |
|--------|--------------|----------------------------------------------------------------------------|
| 0      | 4            | Option flags (see below)                                                   |
| 4      | var.         | Title of the prompt box (Unicode string, 16-bit string length, →2.5.3)     |
| var.   | var.         | Title of the error box (Unicode string, 16-bit string length, →2.5.3)      |
| var.   | var.         | Text of the prompt box (Unicode string, 16-bit string length, →2.5.3)      |
| var.   | var.         | Text of the error box (Unicode string, 16-bit string length, →2.5.3)       |
| var.   | 2            | Size of the formula data for first condition ( <u>s.z.1</u> )              |
| var.   | 2            | Not used                                                                   |
| var.   | <u>s.z.1</u> | Formula data for first condition (RPN token array without size field, →3)  |
| var.   | 2            | Size of the formula data for second condition ( <u>s.z.2</u> )             |
| var.   | 2            | Not used                                                                   |
| var.   | <u>s.z.2</u> | Formula data for second condition (RPN token array without size field, →3) |
| var.   | var.         | Cell range address list with all affected ranges (→2.5.15)                 |

Option flags field:

| Bit                                 | Mask                               | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
|-------------------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------|----------------------------------|-----------------------------|----------------------------------|------------------------------------|-------------------------------------|---------------------------------|
| 3-0                                 | 0000000F <sub>H</sub>              | Data type: <table style="display: inline-table; vertical-align: top; margin-left: 20px;"> <tr> <td>00<sub>H</sub> = Any value</td> <td>04<sub>H</sub> = Date</td> </tr> <tr> <td>01<sub>H</sub> = Integer values</td> <td>05<sub>H</sub> = Time</td> </tr> <tr> <td>02<sub>H</sub> = Decimal values</td> <td>06<sub>H</sub> = Text length</td> </tr> <tr> <td>03<sub>H</sub> = User defined list</td> <td>07<sub>H</sub> = Formula</td> </tr> </table>            | 00 <sub>H</sub> = Any value | 04 <sub>H</sub> = Date         | 01 <sub>H</sub> = Integer values | 05 <sub>H</sub> = Time      | 02 <sub>H</sub> = Decimal values | 06 <sub>H</sub> = Text length      | 03 <sub>H</sub> = User defined list | 07 <sub>H</sub> = Formula       |
| 00 <sub>H</sub> = Any value         | 04 <sub>H</sub> = Date             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 01 <sub>H</sub> = Integer values    | 05 <sub>H</sub> = Time             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 02 <sub>H</sub> = Decimal values    | 06 <sub>H</sub> = Text length      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 03 <sub>H</sub> = User defined list | 07 <sub>H</sub> = Formula          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 6-4                                 | 00000070 <sub>H</sub>              | Error style: <table style="display: inline-table; vertical-align: top; margin-left: 20px;"> <tr> <td>00<sub>H</sub> = Stop</td> </tr> <tr> <td>01<sub>H</sub> = Warning</td> </tr> <tr> <td>02<sub>H</sub> = Info</td> </tr> </table>                                                                                                                                                                                                                             | 00 <sub>H</sub> = Stop      | 01 <sub>H</sub> = Warning      | 02 <sub>H</sub> = Info           |                             |                                  |                                    |                                     |                                 |
| 00 <sub>H</sub> = Stop              |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 01 <sub>H</sub> = Warning           |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 02 <sub>H</sub> = Info              |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 7                                   | 00000080 <sub>H</sub>              | 1 = In list type validity the string list is explicitly given in the formula                                                                                                                                                                                                                                                                                                                                                                                      |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 8                                   | 00000100 <sub>H</sub>              | 1 = Empty cells allowed                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 9                                   | 00000200 <sub>H</sub>              | 1 = Suppress the drop down arrow in list type validity                                                                                                                                                                                                                                                                                                                                                                                                            |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 18                                  | 00040000 <sub>H</sub>              | 1 = Show prompt box if cell selected                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 19                                  | 00080000 <sub>H</sub>              | 1 = Show error box if invalid values entered                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 23-20                               | 00F00000 <sub>H</sub>              | Condition operator: <table style="display: inline-table; vertical-align: top; margin-left: 20px;"> <tr> <td>00<sub>H</sub> = Between</td> <td>04<sub>H</sub> = Greater than</td> </tr> <tr> <td>01<sub>H</sub> = Not between</td> <td>05<sub>H</sub> = Less than</td> </tr> <tr> <td>02<sub>H</sub> = Equal</td> <td>06<sub>H</sub> = Greater or equal</td> </tr> <tr> <td>03<sub>H</sub> = Not equal</td> <td>07<sub>H</sub> = Less or equal</td> </tr> </table> | 00 <sub>H</sub> = Between   | 04 <sub>H</sub> = Greater than | 01 <sub>H</sub> = Not between    | 05 <sub>H</sub> = Less than | 02 <sub>H</sub> = Equal          | 06 <sub>H</sub> = Greater or equal | 03 <sub>H</sub> = Not equal         | 07 <sub>H</sub> = Less or equal |
| 00 <sub>H</sub> = Between           | 04 <sub>H</sub> = Greater than     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 01 <sub>H</sub> = Not between       | 05 <sub>H</sub> = Less than        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 02 <sub>H</sub> = Equal             | 06 <sub>H</sub> = Greater or equal |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |
| 03 <sub>H</sub> = Not equal         | 07 <sub>H</sub> = Less or equal    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                |                                  |                             |                                  |                                    |                                     |                                 |

In list type validity it is possible to enter an explicit string list. This string list is stored as tStr token (→3.8.2). The string items are separated by zero characters. There is no zero character at the end of the string list.

Example for a string list with the 3 strings A, B, and C: “A<00<sub>H</sub>>B<00<sub>H</sub>>C” (contained in a tStr token, string length is 5).

## 5.27 DATAVALIDATIONS

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 01B2 <sub>H</sub> |

This record is the list header of the *Data Validity Table* (→4.14) in the current sheet.

Record DATAVALIDATIONS, BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
|--------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|------------------------------------------------------------------|---|-------------------|--------------------------------------------------------------------------------|---|-------------------|-------------------------------------------------------------------|
| 0      | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>0 = Prompt box not visible      1 = Prompt box currently visible</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>0 = Prompt box has fixed position      1 = Prompt box appears at cell position</td> </tr> <tr> <td>2</td> <td>0004<sub>H</sub></td> <td>1 = Cell validity data cached in following DATAVALIDATION records</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 0 = Prompt box not visible      1 = Prompt box currently visible | 1 | 0002 <sub>H</sub> | 0 = Prompt box has fixed position      1 = Prompt box appears at cell position | 2 | 0004 <sub>H</sub> | 1 = Cell validity data cached in following DATAVALIDATION records |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
| 0      | 0001 <sub>H</sub> | 0 = Prompt box not visible      1 = Prompt box currently visible                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
| 1      | 0002 <sub>H</sub> | 0 = Prompt box has fixed position      1 = Prompt box appears at cell position                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
| 2      | 0004 <sub>H</sub> | 1 = Cell validity data cached in following DATAVALIDATION records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
| 2      | 4                 | Horizontal position of the prompt box, if it has fixed position, in pixel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
| 6      | 4                 | Vertical position of the prompt box, if it has fixed position, in pixel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
| 10     | 4                 | Object identifier of the drop down arrow object for a list box (→6), if a list box is visible at the current cursor position, FFFFFFFF <sub>H</sub> otherwise                                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |
| 14     | 4                 | Number of following DATAVALIDATION records (→5.26)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |   |                   |                                                                  |   |                   |                                                                                |   |                   |                                                                   |

## 5.28 DATEMODE

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0022 <sub>H</sub> | 0022 <sub>H</sub> | 0022 <sub>H</sub> | 0022 <sub>H</sub> | 0022 <sub>H</sub> |

This record specifies the base date for displaying date values. All dates are stored as count of days past this base date. In BIFF2-BIFF4 this record is part of the *Calculation Settings Block* (→4.3). In BIFF5-BIFF8 it is stored in the *Workbook Globals Substream*.

Record DATEMODE, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                                                                         |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | 0 = Base date is 1899-Dec-31 (the cell value 1 represents 1900-Jan-01)<br>1 = Base date is 1904-Jan-01 (the cell value 1 represents 1904-Jan-02) |

## 5.29 DBCELL

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 00D7 <sub>H</sub> | 00D7 <sub>H</sub> |

This record is written once in a *Row Block*. It contains relative offsets to calculate the stream position of the first cell record for each row. The offset list in this record contains as many offsets as ROW records are present in the *Row Block*. For details about calculation of cell record positions see →4.7.

Record DBCELL, BIFF5-BIFF8:

| Offset | Size         | Contents                                                                                                                                                                                                   |
|--------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 4            | Relative offset to first ROW record in the <i>Row Block</i> (difference between record position of this record and the ROW record; positive offset for an earlier stream position)                         |
| 4      | 2· <u>nm</u> | Array of <u>nm</u> relative offsets (16-bit values) to calculate stream position of the first cell record for the respective row (→4.7.2). <u>nm</u> is the number of ROW records in this <i>Row Block</i> |

## 5.30 DCONREF – Data Consolidation Reference

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0051 <sub>H</sub> | 0051 <sub>H</sub> | 0051 <sub>H</sub> | 0051 <sub>H</sub> | 0051 <sub>H</sub> |

2do

## 5.31 DEFAULTROWHEIGHT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0025 <sub>H</sub> | 0225 <sub>H</sub> | 0225 <sub>H</sub> | 0225 <sub>H</sub> | 0225 <sub>H</sub> |

This record specifies the default height and default flags for rows that do not have a corresponding ROW record (→5.88).

Record DEFAULTROWHEIGHT, BIFF2:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                        |     |      |          |      |                   |                                                                      |    |                   |                                     |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|------|-------------------|----------------------------------------------------------------------|----|-------------------|-------------------------------------|
| 0      | 2                 | Default height for unused rows, in twips = $\frac{1}{20}$ of a point                                                                                                                                                                                                                                                                                            |     |      |          |      |                   |                                                                      |    |                   |                                     |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0-14</td> <td>7FFF<sub>H</sub></td> <td>Default height for unused rows, in twips = <math>\frac{1}{20}</math> of a point</td> </tr> <tr> <td>15</td> <td>8000<sub>H</sub></td> <td>1 = Row height not changed manually</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0-14 | 7FFF <sub>H</sub> | Default height for unused rows, in twips = $\frac{1}{20}$ of a point | 15 | 8000 <sub>H</sub> | 1 = Row height not changed manually |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                        |     |      |          |      |                   |                                                                      |    |                   |                                     |
| 0-14   | 7FFF <sub>H</sub> | Default height for unused rows, in twips = $\frac{1}{20}$ of a point                                                                                                                                                                                                                                                                                            |     |      |          |      |                   |                                                                      |    |                   |                                     |
| 15     | 8000 <sub>H</sub> | 1 = Row height not changed manually                                                                                                                                                                                                                                                                                                                             |     |      |          |      |                   |                                                                      |    |                   |                                     |

Record DEFAULTROWHEIGHT, BIFF3-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |   |                   |                                                     |   |                   |                   |   |                   |                                    |   |                   |                                    |
|--------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|-----------------------------------------------------|---|-------------------|-------------------|---|-------------------|------------------------------------|---|-------------------|------------------------------------|
| 0      | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Row height and default font height do not match</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Row is hidden</td> </tr> <tr> <td>2</td> <td>0004<sub>H</sub></td> <td>1 = Additional space above the row</td> </tr> <tr> <td>3</td> <td>0008<sub>H</sub></td> <td>1 = Additional space below the row</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Row height and default font height do not match | 1 | 0002 <sub>H</sub> | 1 = Row is hidden | 2 | 0004 <sub>H</sub> | 1 = Additional space above the row | 3 | 0008 <sub>H</sub> | 1 = Additional space below the row |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |   |                   |                                                     |   |                   |                   |   |                   |                                    |   |                   |                                    |
| 0      | 0001 <sub>H</sub> | 1 = Row height and default font height do not match                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |   |                   |                                                     |   |                   |                   |   |                   |                                    |   |                   |                                    |
| 1      | 0002 <sub>H</sub> | 1 = Row is hidden                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |   |                   |                                                     |   |                   |                   |   |                   |                                    |   |                   |                                    |
| 2      | 0004 <sub>H</sub> | 1 = Additional space above the row                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                                                     |   |                   |                   |   |                   |                                    |   |                   |                                    |
| 3      | 0008 <sub>H</sub> | 1 = Additional space below the row                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                                                     |   |                   |                   |   |                   |                                    |   |                   |                                    |
| 2      | 2                 | Default height for unused rows, in twips = $\frac{1}{20}$ of a point                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                                                     |   |                   |                   |   |                   |                                    |   |                   |                                    |

## 5.32 DEFCOLWIDTH

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0055 <sub>H</sub> | 0055 <sub>H</sub> | 0055 <sub>H</sub> | 0055 <sub>H</sub> | 0055 <sub>H</sub> |

This record specifies the default column width for columns that do not have a specific width set using the records COLWIDTH (BIFF2, →5.20), COLINFO (BIFF3-BIFF8, →5.18), or STANDARDWIDTH (→5.101).

Record DEFCOLWIDTH, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                    |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Column width in characters, using the width of the zero character from default font (first FONT record in the file). Excel adds some extra space to the default width, depending on the default font and default font size. The algorithm how to exactly calculate the resulting column width is not known. |
|        |      | <div style="border: 1px solid gray; padding: 5px;">           Example: The default width of 8 set in this record results in a column width of 8.43 using Arial font with a size of 10 points.         </div>                                                                                                |

## 5.33 DEFINEDNAME

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0018 <sub>H</sub> | 0218 <sub>H</sub> | 0218 <sub>H</sub> | 0018 <sub>H</sub> | 0018 <sub>H</sub> |

This record is part of a *Link Table* (→4.10). It contains the name and the token array of an internal defined name. Token arrays of defined names contain tokens with aberrant token classes (→3.2).

Record DEFINEDNAME, BIFF2:

| Offset                                   | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                 |                                     |   |                 |                                                      |
|------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-----------------|-------------------------------------|---|-----------------|------------------------------------------------------|
| 0                                        | 1                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>02<sub>H</sub></td> <td>1 = Function macro or command macro</td> </tr> <tr> <td>2</td> <td>04<sub>H</sub></td> <td>1 = Complex function (array formula or user defined)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 1 | 02 <sub>H</sub> | 1 = Function macro or command macro | 2 | 04 <sub>H</sub> | 1 = Complex function (array formula or user defined) |
| Bit                                      | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                 |                                     |   |                 |                                                      |
| 1                                        | 02 <sub>H</sub>   | 1 = Function macro or command macro                                                                                                                                                                                                                                                                                                                                     |     |      |          |   |                 |                                     |   |                 |                                                      |
| 2                                        | 04 <sub>H</sub>   | 1 = Complex function (array formula or user defined)                                                                                                                                                                                                                                                                                                                    |     |      |          |   |                 |                                     |   |                 |                                                      |
| 1                                        | 1                 | If name is function macro or command macro (see option flags above):<br>01 <sub>H</sub> = Function macro, 02 <sub>H</sub> = Command macro                                                                                                                                                                                                                               |     |      |          |   |                 |                                     |   |                 |                                                      |
| 2                                        | 1                 | Keyboard shortcut (only for command macro names)                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                 |                                     |   |                 |                                                      |
| 3                                        | 1                 | Length of the name (character count, <u>l</u> <u>n</u> )                                                                                                                                                                                                                                                                                                                |     |      |          |   |                 |                                     |   |                 |                                                      |
| 4                                        | 1                 | Size of the formula data ( <u>s</u> <u>z</u> )                                                                                                                                                                                                                                                                                                                          |     |      |          |   |                 |                                     |   |                 |                                                      |
| 5                                        | <u>l</u> <u>n</u> | Character array of the name                                                                                                                                                                                                                                                                                                                                             |     |      |          |   |                 |                                     |   |                 |                                                      |
| 5+ <u>l</u> <u>n</u>                     | <u>s</u> <u>z</u> | Formula data (RPN token array without size field, →3)                                                                                                                                                                                                                                                                                                                   |     |      |          |   |                 |                                     |   |                 |                                                      |
| 5+ <u>l</u> <u>n</u> + <u>s</u> <u>z</u> | 1                 | Duplicate of the formula data size field ( <u>s</u> <u>z</u> )                                                                                                                                                                                                                                                                                                          |     |      |          |   |                 |                                     |   |                 |                                                      |

Record DEFINEDNAME, BIFF3-BIFF4:

| Offset               | Size              | Contents                                                    |
|----------------------|-------------------|-------------------------------------------------------------|
| 0                    | 2                 | Option flags, see below                                     |
| 2                    | 1                 | Keyboard shortcut (only for command macro names, see below) |
| 3                    | 1                 | Length of the name (character count, <u>l</u> <u>n</u> )    |
| 4                    | 2                 | Size of the formula data ( <u>s</u> <u>z</u> )              |
| 6                    | <u>l</u> <u>n</u> | Character array of the name                                 |
| 6+ <u>l</u> <u>n</u> | <u>s</u> <u>z</u> | Formula data (RPN token array without size field, →3)       |

## Record DEFINEDNAME, BIFF5:

| Offset                                    | Size              | Contents                                                                    |
|-------------------------------------------|-------------------|-----------------------------------------------------------------------------|
| 0                                         | 2                 | Option flags, see below                                                     |
| 2                                         | 1                 | Keyboard shortcut (only for command macro names, see below)                 |
| 3                                         | 1                 | Length of the name (character count, <u>l</u> <u>n</u> )                    |
| 4                                         | 2                 | Size of the formula data ( <u>s</u> <u>z</u> )                              |
| 6                                         | 2                 | 0 = Global name, otherwise index to EXTERNSHEET record ( <i>one-based</i> ) |
| 8                                         | 2                 | 0 = Global name, otherwise index to sheet ( <i>one-based</i> )              |
| 10                                        | 1                 | Length of menu text (character count, <u>l</u> <u>m</u> )                   |
| 11                                        | 1                 | Length of description text (character count, <u>l</u> <u>d</u> )            |
| 12                                        | 1                 | Length of help topic text (character count, <u>l</u> <u>h</u> )             |
| 13                                        | 1                 | Length of status bar text (character count, <u>l</u> <u>s</u> )             |
| 14                                        | <u>l</u> <u>n</u> | Character array of the name                                                 |
| 14+ <u>l</u> <u>n</u>                     | <u>s</u> <u>z</u> | Formula data (RPN token array without size field, →3)                       |
| 14+ <u>l</u> <u>n</u> + <u>s</u> <u>z</u> | <u>l</u> <u>m</u> | Character array of menu text                                                |
| var.                                      | <u>l</u> <u>d</u> | Character array of description text                                         |
| var.                                      | <u>l</u> <u>h</u> | Character array of help topic text                                          |
| var.                                      | <u>l</u> <u>s</u> | Character array of status bar text                                          |

## Record DEFINEDNAME, BIFF8:

| Offset | Size              | Contents                                                                                                 |
|--------|-------------------|----------------------------------------------------------------------------------------------------------|
| 0      | 2                 | Option flags, see below                                                                                  |
| 2      | 1                 | Keyboard shortcut (only for command macro names, see below)                                              |
| 3      | 1                 | Length of the name (character count, <u>l</u> <u>n</u> )                                                 |
| 4      | 2                 | Size of the formula data ( <u>s</u> <u>z</u> )                                                           |
| 6      | 2                 | Not used                                                                                                 |
| 8      | 2                 | 0 = Global name, otherwise index to sheet ( <i>one-based</i> )                                           |
| 10     | 1                 | Length of menu text (character count, <u>l</u> <u>m</u> )                                                |
| 11     | 1                 | Length of description text (character count, <u>l</u> <u>d</u> )                                         |
| 12     | 1                 | Length of help topic text (character count, <u>l</u> <u>h</u> )                                          |
| 13     | 1                 | Length of status bar text (character count, <u>l</u> <u>s</u> )                                          |
| 14     | var.              | Name (Unicode string without length field, →2.5.3)                                                       |
| var.   | <u>s</u> <u>z</u> | Formula data (RPN token array without size field, →3)                                                    |
| [var.] | var.              | (optional, only if <u>l</u> <u>m</u> > 0) Menu text (Unicode string without length field, →2.5.3)        |
| [var.] | var.              | (optional, only if <u>l</u> <u>d</u> > 0) Description text (Unicode string without length field, →2.5.3) |
| [var.] | var.              | (optional, only if <u>l</u> <u>h</u> > 0) Help topic text (Unicode string without length field, →2.5.3)  |
| [var.] | var.              | (optional, only if <u>l</u> <u>s</u> > 0) Status bar text (Unicode string without length field, →2.5.3)  |

## • Option Flags

| Bit  | Mask              | Flag name        | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------|-------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0    | 0001 <sub>H</sub> | <u>hidden</u>    | 0 = Visible                      1 = Hidden                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1    | 0002 <sub>H</sub> | <u>func</u>      | 0 = Command macro              1 = Function macro                                                                                                                                                                                                                                                                                                                                                                                                    |
| 2    | 0004 <sub>H</sub> | <u>vbasic</u>    | 0 = Sheet macro                 1 = VisualBasic macro                                                                                                                                                                                                                                                                                                                                                                                                |
| 3    | 0008 <sub>H</sub> | <u>macro</u>     | 0 = Standard name               1 = Macro name (see below)                                                                                                                                                                                                                                                                                                                                                                                           |
| 4    | 0010 <sub>H</sub> | <u>complex</u>   | 0 = Simple formula               1 = Complex formula (array formula or user defined)                                                                                                                                                                                                                                                                                                                                                                 |
| 5    | 0020 <sub>H</sub> | <u>builtin</u>   | 0 = User-defined name           1 = Built-in name (see below)                                                                                                                                                                                                                                                                                                                                                                                        |
| 11-6 | 0FC0 <sub>H</sub> | <u>funcgroup</u> | Function group (BIFF4-BIFF8), only if <u>macro</u> = 1, must be >0 then<br>1 = Financial                      8 = Logical<br>2 = Date & Time                 9 = Information<br>3 = Math & Trig                 10 = Commands<br>4 = Statistical                   11 = Customizing<br>5 = Lookup & Reference         12 = Macro Control<br>6 = Database                     13 = DDE/External<br>7 = Text                         14 = User Defined |
| 12   | 1000 <sub>H</sub> | <u>binary</u>    | 0 = Formula definition           1 = Binary data (BIFF5-BIFF8)                                                                                                                                                                                                                                                                                                                                                                                       |

## • Macro Names

If the macro flag in the option flags field is set to 1 (see above), the defined name specifies a macro function or procedure. The type of the macro is specified by the flags func, vbasic, and funcgroup (all these flags must be 0, if the defined name is not a macro).

Command macros (macro = 1, func = 0) are shown in the “Select Macro” dialog of Excel. Function macros (macro = 1, func = 1) are shown in the “Insert Function” dialog of Excel. They will be inserted into the function group specified by funcgroup. If the flag vbasic is set, the name refers to a macro in the VisualBasic project, otherwise to a sheet macro.

## • Built-In Names

In BIFF2, the built-in names are written with their full name and differ in localised versions of Excel. From BIFF3 on only an index to a built-in names is stored. If the builtin flag of the option flags field is set (see above), the name string contains only one character with the following meaning:

| Character          | Built-in name    | Character          | Built-in name                 |
|--------------------|------------------|--------------------|-------------------------------|
| <00 <sub>H</sub> > | Consolidate_Area | <07 <sub>H</sub> > | Pint_Titles                   |
| <01 <sub>H</sub> > | Auto_Open        | <08 <sub>H</sub> > | Recorder                      |
| <02 <sub>H</sub> > | Auto_Close       | <09 <sub>H</sub> > | Data_Form                     |
| <03 <sub>H</sub> > | Extract          | <0A <sub>H</sub> > | Auto_Activate (BIFF5-BIFF8)   |
| <04 <sub>H</sub> > | Database         | <0B <sub>H</sub> > | Auto_Deactivate (BIFF5-BIFF8) |
| <05 <sub>H</sub> > | Criteria         | <0C <sub>H</sub> > | Sheet_Title (BIFF5-BIFF8)     |
| <06 <sub>H</sub> > | Print_Area       | <0D <sub>H</sub> > | _FilterDatabase (BIFF8)       |

- ! In BIFF5, the name “\_FilterDatabase” (used to define filtered cell ranges) occurs as full name, not with its index.
- The builtin flag of the option flags field is not set for this name.

## 5.34 DELTA

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0010 <sub>H</sub> | 0010 <sub>H</sub> | 0010 <sub>H</sub> | 0010 <sub>H</sub> | 0010 <sub>H</sub> |

This record is part of the *Calculation Settings Block* (→4.3). It stores the maximum change of the result to exit an iteration.

Record DELTA, BIFF2-BIFF8:

| Offset | Size | Contents                                                                             |
|--------|------|--------------------------------------------------------------------------------------|
| 0      | 8    | Maximum change in iteration (IEEE 754 floating-point value, 64-bit double precision) |

## 5.35 DIMENSION

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0000 <sub>H</sub> | 0200 <sub>H</sub> | 0200 <sub>H</sub> | 0200 <sub>H</sub> | 0200 <sub>H</sub> |

This record contains the range address of the used area in the current sheet.

Record DIMENSION, BIFF2:

| Offset | Size | Contents                                  |
|--------|------|-------------------------------------------|
| 0      | 2    | Index to first used row                   |
| 2      | 2    | Index to last used row, increased by 1    |
| 4      | 2    | Index to first used column                |
| 6      | 2    | Index to last used column, increased by 1 |

Record DIMENSION, BIFF3-BIFF5:

| Offset | Size | Contents                                  |
|--------|------|-------------------------------------------|
| 0      | 2    | Index to first used row                   |
| 2      | 2    | Index to last used row, increased by 1    |
| 4      | 2    | Index to first used column                |
| 6      | 2    | Index to last used column, increased by 1 |
| 8      | 2    | Not used                                  |

Record DIMENSION, BIFF8:

| Offset | Size | Contents                                  |
|--------|------|-------------------------------------------|
| 0      | 4    | Index to first used row                   |
| 4      | 4    | Index to last used row, increased by 1    |
| 8      | 2    | Index to first used column                |
| 10     | 2    | Index to last used column, increased by 1 |
| 12     | 2    | Not used                                  |



## 5.36 DSF – Double Stream File

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 0161 <sub>H</sub> |

This record specifies if the BIFF8 workbook document contains an additional BIFF5 *Workbook Stream* with the name “Book” (→2.3.3).

Record DSF, BIFF8:

| Offset | Size | Contents                                                                                             |
|--------|------|------------------------------------------------------------------------------------------------------|
| 0      | 2    | 0 = Only the BIFF8 “Workbook” stream is present<br>1 = Additional BIFF5 “Book” stream is in the file |

A double stream file can be read by Excel 5.0 and Excel 7.0, and still contains all new features added to BIFF8 (which are left out in the BIFF5 “Book” stream).

## 5.37 EOF – End of File

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 000A <sub>H</sub> | 000A <sub>H</sub> | 000A <sub>H</sub> | 000A <sub>H</sub> | 000A <sub>H</sub> |

This record has no content. It indicates the end of a record block with leading BOF record (→5.8). This could be the end of the workbook globals, a worksheet, a chart, etc.

## 5.38 EXTERNALBOOK – External Workbook

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 01AE <sub>H</sub> |

This record mainly stores the URL of an external document and a list of sheet names inside this document. Furthermore it is used to store DDE and OLE links, or to indicate an internal 3D reference or an add-in function. See →4.10.3 for details about external references in BIFF8.

### 5.38.1 External References

An EXTERNALBOOK record for external references stores the URL and a list of sheet names.

Record EXTERNALBOOK for external references, BIFF8:

| Offset | Size | Contents                                                                                |
|--------|------|-----------------------------------------------------------------------------------------|
| 0      | 2    | Number of sheet names ( <u>mm</u> )                                                     |
| 2      | var. | Encoded URL without sheet name (→2.5.9). Unicode string, 16-bit string length (→2.5.3). |
| var.   | var. | List of <u>mm</u> sheet names (Unicode strings with 16-bit string length, →2.5.3)       |

### 5.38.2 Internal References

In each file occurs an EXTERNALBOOK that is used for internal 3D references. It stores the number of sheets of the own document.

Record EXTERNALBOOK for 3D references, BIFF8:

| Offset | Size | Contents                                                                                            |
|--------|------|-----------------------------------------------------------------------------------------------------|
| 0      | 2    | Number of sheets in this document                                                                   |
| 2      | 2    | 01 <sub>H</sub> 04 <sub>H</sub> (relict of BIFF5, the byte string “<04 <sub>H</sub> >”, see →2.5.9) |

### 5.38.3 Add-In Functions

Add-in function names are stored in EXTERNNAME records following this EXTERNALBOOK record.

Record EXTERNALBOOK for add-in functions, BIFF8:

| Offset | Size | Contents                                                                                              |
|--------|------|-------------------------------------------------------------------------------------------------------|
| 0      | 2    | 0001 <sub>H</sub>                                                                                     |
| 2      | 2    | 01 <sub>H</sub> 3A <sub>H</sub> (relict of BIFF5, the byte string “:”, see EXTERNSHEET record, →5.41) |

### 5.38.4 DDE Links, OLE Links

The EXTERNALBOOK record of a DDE link or an OLE link contains the name of the server application (DDE) or the class name (OLE) and the name of a source document. These names are encoded in one string.

Record EXTERNALBOOK for DDE links and OLE links, BIFF8:

| Offset | Size | Contents                                                                               |
|--------|------|----------------------------------------------------------------------------------------|
| 0      | 2    | 0000 <sub>H</sub>                                                                      |
| 2      | var. | Encoded source document name (→2.5.10). Unicode string, 16-bit string length (→2.5.3). |

## 5.39 EXTERNALNAME

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0023 <sub>H</sub> | 0223 <sub>H</sub> | 0223 <sub>H</sub> | 0023 <sub>H</sub> | 0023 <sub>H</sub> |

This record contains the name of an external defined name, the name of an Analysis add-in function, a DDE item or an OLE item.

### 5.39.1 Record Contents (BIFF2)

In BIFF2, all EXTERNNAME records follow an EXTERNSHEET record that contains the URL of the source document. See →4.10.1 for details about external references in BIFF2.

Record EXTERNNAME, BIFF2-BIFF4:

| Offset | Size | Contents                                        |
|--------|------|-------------------------------------------------|
| 0      | var. | Name (byte string, 8-bit string length, →2.5.2) |
| var.   | var. | Formula data (RPN token array, →3)              |

Record EXTERNNAME for DDE links, BIFF2:

| Offset | Size | Contents                                                                        |
|--------|------|---------------------------------------------------------------------------------|
| 0      | var. | DDE item name (byte string, 8-bit string length, →2.5.2)                        |
| [var.] | var. | (optional) Last received results of the DDE link (constant value array, →2.5.8) |

### 5.39.2 Record Contents (BIFF3-BIFF4)

In BIFF3-BIFF4, all EXTERNNAME records follow an EXTERNSHEET record that contains the URL of the source document. See →4.10.1 for details about external references in BIFF3-BIFF4.

Record EXTERNNAME for external names (BIFF3-BIFF4) and Analysis add-in functions (BIFF4):

| Offset | Size | Contents                                                                                                                                                             |
|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Option flags (see below)                                                                                                                                             |
| 2      | var. | Name (byte string, 8-bit string length, →2.5.2). See DEFINEDNAME record (→5.33) for a list of built-in names, if the built-in flag is set in the option flags above. |
| var.   | var. | Formula data (RPN token array, →3)                                                                                                                                   |

Record EXTERNNAME for DDE links, BIFF3-BIFF4:

| Offset | Size | Contents                                                                        |
|--------|------|---------------------------------------------------------------------------------|
| 0      | 2    | Option flags (see below)                                                        |
| 2      | var. | DDE item name (byte string, 8-bit string length, →2.5.2)                        |
| [var.] | var. | (optional) Last received results of the DDE link (constant value array, →2.5.8) |

Option flags for external names (BIFF3-BIFF4):

| Bit | Mask              | Contents                                             |
|-----|-------------------|------------------------------------------------------|
| 0   | 0001 <sub>H</sub> | 0 = Standard name; 1 = Built-in name                 |
| 1   | 0002 <sub>H</sub> | 0 = Manual link; 1 = Automatic link (DDE links only) |
| 2   | 0004 <sub>H</sub> | 1 = Picture link (DDE links only)                    |



## 5.40 EXTERNCOUNT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8 |
|-------------------|-------------------|-------------------|-------------------|-------|
| 0016 <sub>H</sub> | 0016 <sub>H</sub> | 0016 <sub>H</sub> | 0016 <sub>H</sub> | —     |

This record contains the number of following EXTERNSHEET records. In BIFF8 this record is omitted because there occurs only one EXTERNSHEET record. See →4.10.1 for details about external references in BIFF2-BIFF4 and →4.10.2 for BIFF5.

Record EXTERNCOUNT, BIFF2-BIFF5:

| Offset | Size | Contents                                        |
|--------|------|-------------------------------------------------|
| 0      | 2    | Number of following EXTERNSHEET records (→5.41) |

## 5.41 EXTERNSHEET

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0017 <sub>H</sub> | 0017 <sub>H</sub> | 0017 <sub>H</sub> | 0017 <sub>H</sub> | 0017 <sub>H</sub> |

### 5.41.1 Record Contents (BIFF2-BIFF5)

In the file format versions up to BIFF5 this record stores the name of an external document and a sheet name inside of this document. See →4.10.1 for details about external references in BIFF2-BIFF4 and →4.10.2 for BIFF5.

Record EXTERNSHEET, BIFF2-BIFF5:

| Offset | Size | Contents                                                                             |
|--------|------|--------------------------------------------------------------------------------------|
| 0      | var. | Encoded document and sheet name (→2.5.9). Byte string, 8-bit string length (→2.5.2). |

- ! The string length field is decreased by 1, if the EXTERNSHEET stores a reference to one of the own sheets (first character is 03<sub>H</sub>). Example: The formula =Sheet2!A1 contains a reference to an EXTERNSHEET record with the string "<03<sub>H</sub>

If a formula uses an add-in function, a special EXTERNSHEET record will occur, followed by an EXTERNNAME record with the name of the function.

Record EXTERNSHEET for add-in functions, BIFF2-BIFF5:

| Offset | Size | Contents                                                                                     |
|--------|------|----------------------------------------------------------------------------------------------|
| 0      | 2    | 01 <sub>H</sub> 3A <sub>H</sub> (byte string, 8-bit string length, containing the colon ":") |

### 5.41.2 Record Contents (BIFF8)

In BIFF8 the record stores a list with indexes to EXTERNALBOOK records (list of REF structures, →5.38). See →4.10.3 for details about external references in BIFF8.

Record EXTERNSHEET, BIFF8:

| Offset | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                           |        |      |          |   |   |                              |   |   |                                                 |   |   |                                                |
|--------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|---|---|------------------------------|---|---|-------------------------------------------------|---|---|------------------------------------------------|
| 0      | 2            | Number of following REF structures ( <u>nm</u> )                                                                                                                                                                                                                                                                                                                                   |        |      |          |   |   |                              |   |   |                                                 |   |   |                                                |
| 2      | 6· <u>nm</u> | List of <u>nm</u> REF structures. Each REF contains the following data:                                                                                                                                                                                                                                                                                                            |        |      |          |   |   |                              |   |   |                                                 |   |   |                                                |
|        |              | <table border="1"> <thead> <tr> <th>Offset</th> <th>Size</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2</td> <td>Index to EXTERNALBOOK record</td> </tr> <tr> <td>2</td> <td>2</td> <td>Index to first sheet in EXTERNALBOOK sheet list</td> </tr> <tr> <td>4</td> <td>2</td> <td>Index to last sheet in EXTERNALBOOK sheet list</td> </tr> </tbody> </table> | Offset | Size | Contents | 0 | 2 | Index to EXTERNALBOOK record | 2 | 2 | Index to first sheet in EXTERNALBOOK sheet list | 4 | 2 | Index to last sheet in EXTERNALBOOK sheet list |
| Offset | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                           |        |      |          |   |   |                              |   |   |                                                 |   |   |                                                |
| 0      | 2            | Index to EXTERNALBOOK record                                                                                                                                                                                                                                                                                                                                                       |        |      |          |   |   |                              |   |   |                                                 |   |   |                                                |
| 2      | 2            | Index to first sheet in EXTERNALBOOK sheet list                                                                                                                                                                                                                                                                                                                                    |        |      |          |   |   |                              |   |   |                                                 |   |   |                                                |
| 4      | 2            | Index to last sheet in EXTERNALBOOK sheet list                                                                                                                                                                                                                                                                                                                                     |        |      |          |   |   |                              |   |   |                                                 |   |   |                                                |

## 5.42 EXTSST – Extended SST

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 00FF <sub>H</sub> |

This record occurs in conjunction with the SST record (→5.100). It is used by Excel to create a hash table with stream offsets to the SST record to optimise string search operations. Excel may not shorten this record if strings are deleted from the shared string table, so the last part might contain invalid data. The stream indexes in this record divide the SST into portions containing a constant number of strings. See →4.11 for more information about shared string tables. It is not required to write this record when exporting an Excel document.

Record EXTSST, BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |          |   |   |                                                         |   |   |                                                                                                                                                                                  |   |   |          |
|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|---|---|---------------------------------------------------------|---|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|----------|
| 0      | 2    | Number of strings in a portion, this number is ≥8                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |          |   |   |                                                         |   |   |                                                                                                                                                                                  |   |   |          |
| 2      | var. | List of OFFSET structures for all portions. Each OFFSET contains the following data:                                                                                                                                                                                                                                                                                                                                                                                                                     |        |      |          |   |   |                                                         |   |   |                                                                                                                                                                                  |   |   |          |
|        |      | <table border="1"> <thead> <tr> <th>Offset</th> <th>Size</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>Absolute stream position of first string of the portion</td> </tr> <tr> <td>4</td> <td>2</td> <td>Position of first string of the portion inside of current record, including record header. This counter restarts at zero, if the SST record is continued with a CONTINUE record.</td> </tr> <tr> <td>6</td> <td>2</td> <td>Not used</td> </tr> </tbody> </table> | Offset | Size | Contents | 0 | 4 | Absolute stream position of first string of the portion | 4 | 2 | Position of first string of the portion inside of current record, including record header. This counter restarts at zero, if the SST record is continued with a CONTINUE record. | 6 | 2 | Not used |
| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |          |   |   |                                                         |   |   |                                                                                                                                                                                  |   |   |          |
| 0      | 4    | Absolute stream position of first string of the portion                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |          |   |   |                                                         |   |   |                                                                                                                                                                                  |   |   |          |
| 4      | 2    | Position of first string of the portion inside of current record, including record header. This counter restarts at zero, if the SST record is continued with a CONTINUE record.                                                                                                                                                                                                                                                                                                                         |        |      |          |   |   |                                                         |   |   |                                                                                                                                                                                  |   |   |          |
| 6      | 2    | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |          |   |   |                                                         |   |   |                                                                                                                                                                                  |   |   |          |

## 5.43 FILEPASS

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 002F <sub>H</sub> | 002F <sub>H</sub> | 002F <sub>H</sub> | 002F <sub>H</sub> | 002F <sub>H</sub> |

This record is part of the *File Protection Block* (→4.19). It contains information about the read/write password of the file. All record contents following this record will be encrypted (→4.19.1).

### 5.43.1 Record Contents (BIFF2-BIFF5)

Record FILEPASS, BIFF2-BIFF5:

| Offset | Size | Contents                                                         |
|--------|------|------------------------------------------------------------------|
| 0      | 2    | Encryption key calculated from the read/write password (→4.19.1) |
| 2      | 2    | Hash value calculated from the read/write password (→4.18.4)     |

### 5.43.2 Record Contents (BIFF8)

From BIFF8 on it is possible to use different encryption algorithms.

Record FILEPASS, BIFF8, for BIFF2-BIFF5 weak XOR encryption:

| Offset | Size | Contents                                                         |
|--------|------|------------------------------------------------------------------|
| 0      | 2    | 0000 <sub>H</sub> = BIFF2-BIFF5 weak XOR encryption              |
| 2      | 2    | Encryption key calculated from the read/write password (→4.19.1) |
| 4      | 2    | Hash value calculated from the read/write password (→4.18.4)     |

Record FILEPASS, BIFF8, for BIFF8 standard encryption:

| Offset | Size | Contents                                                               |
|--------|------|------------------------------------------------------------------------|
| 0      | 2    | 0001 <sub>H</sub> = BIFF8 standard encryption or strong encryption     |
| 2      | 2    | not used, should be equal to next field (0001 <sub>H</sub> )           |
| 4      | 2    | 0001 <sub>H</sub> = BIFF8 standard encryption                          |
| 6      | 16   | Unique document identifier used to initialise the encryption algorithm |
| 22     | 16   | Encrypted document identifier used to verify the entered password      |
| 38     | 16   | Digest used to verify the entered password                             |



Record FILEPASS, BIFF8, for BIFF8 strong encryption (available only in Excel 10.0 (Excel XP) and later):

| Offset | Size                  | Contents                                                                                                                                                                                                                                                                                                           |     |      |          |   |                       |                       |   |                       |                                               |
|--------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-----------------------|-----------------------|---|-----------------------|-----------------------------------------------|
| 0      | 2                     | 0001 <sub>H</sub> = BIFF8 standard encryption or strong encryption                                                                                                                                                                                                                                                 |     |      |          |   |                       |                       |   |                       |                                               |
| 2      | 2                     | not used, should be equal to next field (0002 <sub>H</sub> )                                                                                                                                                                                                                                                       |     |      |          |   |                       |                       |   |                       |                                               |
| 4      | 2                     | 0002 <sub>H</sub> = BIFF8 strong encryption                                                                                                                                                                                                                                                                        |     |      |          |   |                       |                       |   |                       |                                               |
| 6      | 4                     | Option flags:                                                                                                                                                                                                                                                                                                      |     |      |          |   |                       |                       |   |                       |                                               |
|        |                       | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>00000004<sub>H</sub></td> <td>Always 1<sub>Z</sub></td> </tr> <tr> <td>3</td> <td>00000008<sub>H</sub></td> <td>1 = <i>Do not</i> encrypt document properties</td> </tr> </tbody> </table> | Bit | Mask | Contents | 2 | 00000004 <sub>H</sub> | Always 1 <sub>Z</sub> | 3 | 00000008 <sub>H</sub> | 1 = <i>Do not</i> encrypt document properties |
| Bit    | Mask                  | Contents                                                                                                                                                                                                                                                                                                           |     |      |          |   |                       |                       |   |                       |                                               |
| 2      | 00000004 <sub>H</sub> | Always 1 <sub>Z</sub>                                                                                                                                                                                                                                                                                              |     |      |          |   |                       |                       |   |                       |                                               |
| 3      | 00000008 <sub>H</sub> | 1 = <i>Do not</i> encrypt document properties                                                                                                                                                                                                                                                                      |     |      |          |   |                       |                       |   |                       |                                               |
| 10     | var.                  | <i>FILEPASS Info Block</i> (see below)                                                                                                                                                                                                                                                                             |     |      |          |   |                       |                       |   |                       |                                               |
| var.   | 4                     | Size of unique document identifier ( <u>uidl</u> )                                                                                                                                                                                                                                                                 |     |      |          |   |                       |                       |   |                       |                                               |
| var.   | <u>uidl</u>           | Unique document identifier used to initialise the encryption algorithm                                                                                                                                                                                                                                             |     |      |          |   |                       |                       |   |                       |                                               |
| var.   | <u>uidl</u>           | Encrypted document identifier used to verify the entered password                                                                                                                                                                                                                                                  |     |      |          |   |                       |                       |   |                       |                                               |
| var.   | 4                     | Size of following verification digest ( <u>dl</u> )                                                                                                                                                                                                                                                                |     |      |          |   |                       |                       |   |                       |                                               |
| var.   | <u>dl</u>             | Digest used to verify the entered password                                                                                                                                                                                                                                                                         |     |      |          |   |                       |                       |   |                       |                                               |

*FILEPASS Info Block*, BIFF8, for BIFF8 strong encryption:

| Offset | Size | Contents                                                                                                                                                                                                                                              |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 4    | Size of the following data in this block, without this field                                                                                                                                                                                          |
| 4      | 4    | Repeated option flags from main record (see above)                                                                                                                                                                                                    |
| 8      | 4    | Not used                                                                                                                                                                                                                                              |
| 12     | 4    | Stream encryption algorithm identifier:<br>00006801 <sub>H</sub> = RC4 (Ron's Code 4)<br>00006802 <sub>H</sub> = SEAL (Secure Encryption Algorithm)                                                                                                   |
| 16     | 4    | Password hashing algorithm identifier:<br>00008001 <sub>H</sub> = MD2 (Message Digest 2)<br>00008002 <sub>H</sub> = MD4 (Message Digest 4)<br>00008003 <sub>H</sub> = MD5 (Message Digest 5)<br>00008004 <sub>H</sub> = SHA-1 (Secure Hash Algorithm) |
| 20     | 4    | Hash key length (bits)                                                                                                                                                                                                                                |
| 24     | 4    | Cryptographic provider type:<br>00000001 <sub>H</sub> = RSA<br>0000000C <sub>H</sub> = RSA SChannel<br>0000000D <sub>H</sub> = DSS and Diffie-Hellman<br>00000012 <sub>H</sub> = DH SChannel<br>00000018 <sub>H</sub> = RSA and AES                   |
| 28     | 8    | Not used                                                                                                                                                                                                                                              |
| 36     | var. | Cryptographic provider name, Unicode character array with trailing null character                                                                                                                                                                     |

## 5.44 FILESHARING

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 005B <sub>H</sub> | 005B <sub>H</sub> | 005B <sub>H</sub> | 005B <sub>H</sub> |

This record is part of the *File Protection Block* (→4.19). It contains information about write protection, for instance the write protection password. The write protection state of the file is switched on with the WRITEPROT record (→5.113).

Record FILESHARING, BIFF2-BIFF8:

| Offset | Size | Contents                                                    |
|--------|------|-------------------------------------------------------------|
| 0      | 2    | 1 = Recommend read-only state while loading the file        |
| 2      | 2    | Hash value calculated from the read-only password (→4.18.4) |
| 4      | var. | User name of the file creator                               |
|        |      | BIFF2-BIFF5: Byte string, 8-bit string length (→2.5.2)      |
|        |      | BIFF8: Unicode string, 16-bit string length (→2.5.3)        |

## 5.45 FONT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0031 <sub>H</sub> | 0231 <sub>H</sub> | 0231 <sub>H</sub> | 0031 <sub>H</sub> | 0031 <sub>H</sub> |

This record contains information about a used font, including character formatting. All FONT records occur together in a sequential list. Other records referencing a FONT record contain an index into this list.

- ! The font with index 4 is omitted in all BIFF versions. This means the first four fonts have zero-based indexes, and
- the fifth font and all following fonts are referenced with one-based indexes.

Record FONT, BIFF2:

| Offset | Size | Contents                                                  |
|--------|------|-----------------------------------------------------------|
| 0      | 2    | Height of the font (in twips = $\frac{1}{20}$ of a point) |
| 2      | 2    | Option flags, see below                                   |
| 4      | var. | Font name (byte string, 8-bit string length, →2.5.2)      |

A FONTCOLOR record (→5.47) containing the font colour may follow.

Record FONT, BIFF3-BIFF4:

| Offset | Size | Contents                                                  |
|--------|------|-----------------------------------------------------------|
| 0      | 2    | Height of the font (in twips = $\frac{1}{20}$ of a point) |
| 2      | 2    | Option flags, see below                                   |
| 4      | 2    | Colour index (→5.74)                                      |
| 6      | var. | Font name (byte string, 8-bit string length, →2.5.2)      |

Record FONT, BIFF5-BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                            |
|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Height of the font (in twips = $\frac{1}{20}$ of a point)                                                                                                                                                                                                                                                                                                           |
| 2      | 2    | Option flags, see below                                                                                                                                                                                                                                                                                                                                             |
| 4      | 2    | Colour index (→5.74)                                                                                                                                                                                                                                                                                                                                                |
| 6      | 2    | Font weight (100-1000). Standard values are 0190 <sub>H</sub> (400) for normal text and 02BC <sub>H</sub> (700) for bold text.                                                                                                                                                                                                                                      |
| 8      | 2    | Escapement type: 0000 <sub>H</sub> = None<br>0001 <sub>H</sub> = Superscript<br>0002 <sub>H</sub> = Subscript                                                                                                                                                                                                                                                       |
| 10     | 1    | Underline type: 00 <sub>H</sub> = None<br>01 <sub>H</sub> = Single                    21 <sub>H</sub> = Single accounting<br>02 <sub>H</sub> = Double                    22 <sub>H</sub> = Double accounting                                                                                                                                                        |
| 11     | 1    | Font family: 00 <sub>H</sub> = None (unknown or don't care)<br>01 <sub>H</sub> = Roman (variable width, serifed)<br>02 <sub>H</sub> = Swiss (variable width, sans-serifed)<br>03 <sub>H</sub> = Modern (fixed width, serifed or sans-serifed)<br>04 <sub>H</sub> = Script (cursive)<br>05 <sub>H</sub> = Decorative (specialised, for example Old English, Fraktur) |
| 12     | 1    | Character set (used by all cell records containing byte strings), see below                                                                                                                                                                                                                                                                                         |
| 13     | 1    | Not used                                                                                                                                                                                                                                                                                                                                                            |
| 14     | var. | Font name: BIFF5: Byte string, 8-bit string length (→2.5.2)<br>BIFF8: Unicode string, 8-bit string length (→2.5.3)                                                                                                                                                                                                                                                  |

## Option flags, BIFF2-BIFF8:

| Bit | Mask              | Contents                                                            |
|-----|-------------------|---------------------------------------------------------------------|
| 0   | 0001 <sub>H</sub> | 1 = Characters are bold (redundant in BIFF5-BIFF8, see below)       |
| 1   | 0002 <sub>H</sub> | 1 = Characters are italic                                           |
| 2   | 0004 <sub>H</sub> | 1 = Characters are underlined (redundant in BIFF5-BIFF8, see below) |
| 3   | 0008 <sub>H</sub> | 1 = Characters are struck out                                       |
| 4   | 0010 <sub>H</sub> | 1 = Characters are outlined                                         |
| 5   | 0020 <sub>H</sub> | 1 = Characters are shadowed                                         |
| 6   | 0040 <sub>H</sub> | 1 = Characters are condensed                                        |
| 7   | 0080 <sub>H</sub> | 1 = Characters are extended                                         |

## Character set, BIFF5-BIFF8:

| Character set                                         | Character set                                            |
|-------------------------------------------------------|----------------------------------------------------------|
| 00 <sub>H</sub> = 0 = ANSI Latin                      | A2 <sub>H</sub> = 162 = ANSI Turkish                     |
| 01 <sub>H</sub> = 1 = System default                  | A3 <sub>H</sub> = 163 = ANSI Vietnamese                  |
| 02 <sub>H</sub> = 2 = Symbol                          | B1 <sub>H</sub> = 177 = ANSI Hebrew                      |
| 4D <sub>H</sub> = 77 = Apple Roman                    | B2 <sub>H</sub> = 178 = ANSI Arabic                      |
| 80 <sub>H</sub> = 128 = ANSI Japanese Shift-JIS       | BA <sub>H</sub> = 186 = ANSI Baltic                      |
| 81 <sub>H</sub> = 129 = ANSI Korean (Hangul)          | CC <sub>H</sub> = 204 = ANSI Cyrillic                    |
| 82 <sub>H</sub> = 130 = ANSI Korean (Johab)           | DE <sub>H</sub> = 222 = ANSI Thai                        |
| 86 <sub>H</sub> = 134 = ANSI Chinese Simplified GBK   | EE <sub>H</sub> = 238 = ANSI Latin II (Central European) |
| 88 <sub>H</sub> = 136 = ANSI Chinese Traditional BIG5 | FF <sub>H</sub> = 255 = OEM Latin I                      |
| A1 <sub>H</sub> = 161 = ANSI Greek                    |                                                          |

In BIFF5-BIFF8, the boldness and underline flags are still set in the options field, but not used on reading the font. Font weight and underline type are specified in separate fields instead. The character set specifies the encoding used by cell records that contain byte strings, for instance LABEL (→5.63), RSTRING (→5.89), FORMULA (→5.50), or STRING (→5.102).

## 5.46 FONT2

| BIFF2             | BIFF3 | BIFF4 | BIFF5 | BIFF8 |
|-------------------|-------|-------|-------|-------|
| 0032 <sub>H</sub> | —     | —     | —     | —     |

This record stores additional system-specific data about the font described in the preceding FONT record (→5.45). This record is optional. The contents of this record are unknown.

## 5.47 FONTCOLOR

| BIFF2             | BIFF3 | BIFF4 | BIFF5 | BIFF8 |
|-------------------|-------|-------|-------|-------|
| 0045 <sub>H</sub> | —     | —     | —     | —     |

This record stores the colour of the font that is described in the preceding FONT record (→5.45). From BIFF3 on, the colour index is part of the FONT record.

Record FONTCOLOR, BIFF2:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Font colour index for the font described in the preceding FONT record:<br>0000 <sub>H</sub> = 000000 <sub>H</sub> = EGA Black                      0004 <sub>H</sub> = 0000FF <sub>H</sub> = EGA Blue<br>0001 <sub>H</sub> = FFFFFFF <sub>H</sub> = EGA White                      0005 <sub>H</sub> = FFFF00 <sub>H</sub> = EGA Yellow<br>0002 <sub>H</sub> = FF0000 <sub>H</sub> = EGA Red                      0006 <sub>H</sub> = FF00FF <sub>H</sub> = EGA Magenta<br>0003 <sub>H</sub> = 00FF00 <sub>H</sub> = EGA Green                      0007 <sub>H</sub> = 00FFFF <sub>H</sub> = EGA Cyan<br>7FFF <sub>H</sub> = Automatic (system window text colour)<br>These values are equal to the colour indexes described in the PALETTE record (→5.74). |

## 5.48 FOOTER

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0015 <sub>H</sub> | 0015 <sub>H</sub> | 0015 <sub>H</sub> | 0015 <sub>H</sub> | 0015 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It specifies the page footer string for the current worksheet. If this record is not present or completely empty (record size is 0), the sheet does not contain a page footer.

Record FOOTER for non-empty page footer, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                                                                                 |
|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | var. | Page footer string<br>BIFF2-BIFF5: Non-empty byte string, 8-bit string length (→2.5.2)<br>BIFF8: Non-empty Unicode string, 16-bit string length (→2.5.3) |

The structure of the page footer string is equal to the page header string. For a detailed description see HEADER record, →5.55.

## 5.49 FORMAT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 001E <sub>H</sub> | 001E <sub>H</sub> | 041E <sub>H</sub> | 041E <sub>H</sub> | 041E <sub>H</sub> |

This record contains information about a number format. All FORMAT records occur together in a sequential list.

In BIFF2-BIFF4 other records referencing a FORMAT record contain a zero-based index into this list. From BIFF5 on the FORMAT record contains the index itself that will be used by other records.

Record FORMAT, BIFF2-BIFF3:

| Offset | Size | Contents                                                        |
|--------|------|-----------------------------------------------------------------|
| 0      | var. | Number format string (byte string, 8-bit string length, →2.5.2) |

Record FORMAT, BIFF4-BIFF5:

| Offset | Size | Contents                                                        |
|--------|------|-----------------------------------------------------------------|
| 0      | 2    | BIFF4: Not used<br>BIFF5: Format index used in other records    |
| 2      | var. | Number format string (byte string, 8-bit string length, →2.5.2) |

Record FORMAT, BIFF8:

| Offset | Size | Contents                                                            |
|--------|------|---------------------------------------------------------------------|
| 0      | 2    | Format index used in other records                                  |
| 2      | var. | Number format string (Unicode string, 16-bit string length, →2.5.3) |

From BIFF5 on, the built-in number formats will be omitted. The built-in formats are dependent on the current regional settings of the operating system. The following table shows which number formats are used by default in a US-English environment. All indexes from 0 to 163 are reserved for built-in formats. The first user-defined format starts at 164.

The built-in number formats, BIFF5-BIFF8:

| Index | Type       | Format string                     | Index   | Type       | Format string                                           |
|-------|------------|-----------------------------------|---------|------------|---------------------------------------------------------|
| 0     | General    | General                           | 18      | Time       | h:mm AM/PM                                              |
| 1     | Decimal    | 0                                 | 19      | Time       | h:mm:ss AM/PM                                           |
| 2     | Decimal    | 0.00                              | 20      | Time       | h:mm                                                    |
| 3     | Decimal    | #,##0                             | 21      | Time       | h:mm:ss                                                 |
| 4     | Decimal    | #,##0.00                          | 2232    | Date/Time  | M/D/YY h:mm                                             |
| 531   | Currency   | "\$"#,##0);("\$"#,##0)            | 37      | Account.   | _(#,##0);(##,##0)                                       |
| 631   | Currency   | "\$"#,##0);[Red]("\$"#,##0)       | 38      | Account.   | _(#,##0);[Red](##,##0)                                  |
| 731   | Currency   | "\$"#,##0.00);("\$"#,##0.00)      | 39      | Account.   | _(#,##0.00);(##,##0.00)                                 |
| 831   | Currency   | "\$"#,##0.00);[Red]("\$"#,##0.00) | 40      | Account.   | _(#,##0.00);[Red](##,##0.00)                            |
| 9     | Percent    | 0%                                | 4131    | Currency   | _"\$"* #,##0);_("\$"* (#,##0);_("\$"* "-");_(@_)        |
| 10    | Percent    | 0.00%                             | 4231 33 | Currency   | _* #,##0);_(* (#,##0);_* "-");_(@_)                     |
| 11    | Scientific | 0.00E+00                          | 4331    | Currency   | _"\$"* #,##0.00);_("\$"* (#,##0.00);_("\$"* "-"?);_(@_) |
| 12    | Fraction   | # ?/?                             | 4431 33 | Currency   | _* #,##0.00);_(* (#,##0.00);_* "-"?);_(@_)              |
| 13    | Fraction   | # ??/??                           | 45      | Time       | mm:ss                                                   |
| 1432  | Date       | M/D/YY                            | 46      | Time       | [h]:mm:ss                                               |
| 15    | Date       | D-MMM-YY                          | 47      | Time       | mm:ss.0                                                 |
| 16    | Date       | D-MMM                             | 48      | Scientific | ##0.0E+0                                                |
| 17    | Date       | MMM-YY                            | 49      | Text       | @                                                       |

<sup>31</sup> These formats are always written by Excel, though they are built-in. They contain the currency symbol of the current locale as plain text. It precedes or follows the value, according to the local settings. It is *not* required to write these formats.

<sup>32</sup> These formats are taken from the Microsoft Windows regional settings. Changes of these system settings will be reflected in the Excel document.

<sup>33</sup> These formats contain a blind currency symbol (an underscore precedes each character), if it follows the value. This happens for example in a German format with the Euro sign. Here the built-in format 42 looks like this: \_\* #,##0 \_€\_-;\_\* #,##0 \_€\_-;\_\* "- \_€\_-;\_@\_

Some of the built-in number formats are only used in special locales. As an example, the following table shows special Japanese formats:

| Index | Type | Format string           | Index | Type | Format string      |
|-------|------|-------------------------|-------|------|--------------------|
| 27    | Date | [\$-0411]GE.M.D         | 50    | Date | [\$-0411]GE.M.D    |
| 28    | Date | [\$-0411]GGGE年M月D日      | 51    | Date | [\$-0411]GGGE年M月D日 |
| 29    | Date | [\$-0411]GGGE年M月D日      | 52    | Date | [\$-0411]YYYY年M月   |
| 30    | Date | [\$-0411]M/D/YY         | 53    | Date | [\$-0411]M月D日      |
| 31    | Date | [\$-0411]YYYY年M月D日      | 54    | Date | [\$-0411]GGGE年M月D日 |
| 32    | Time | [\$-0411]h時mm分          | 55    | Date | [\$-0411]YYYY年M月   |
| 33    | Time | [\$-0411]h"時"mm"分"ss"秒" | 56    | Date | [\$-0411]M月D日      |
| 34    | Date | [\$-0411]YYYY年M月        | 57    | Date | [\$-0411]GE.M.D    |
| 35    | Date | [\$-0411]M月D日           | 58    | Date | [\$-0411]GGGE年M月D日 |
| 36    | Date | [\$-0411]GE.M.D         |       |      |                    |

## 5.50 FORMULA

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0006 <sub>H</sub> | 0206 <sub>H</sub> | 0406 <sub>H</sub> | 0006 <sub>H</sub> | 0006 <sub>H</sub> |

This record contains the token array and the result of a formula cell.

### • Record Contents

Record FORMULA, BIFF2:

| Offset | Size | Contents                                                                       |
|--------|------|--------------------------------------------------------------------------------|
| 0      | 2    | Index to row                                                                   |
| 2      | 2    | Index to column                                                                |
| 4      | 3    | Cell attributes (→2.5.13)                                                      |
| 7      | 8    | Result of the formula (IEEE 754 floating-point value, 64-bit double precision) |
| 15     | 1    | 0 = Do not recalculate, 1 = Recalculate always                                 |
| 16     | var. | Formula data (RPN token array, →3)                                             |

Record FORMULA, BIFF3-BIFF4:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                          |     |      |          |   |                   |                        |   |                   |                       |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|------------------------|---|-------------------|-----------------------|
| 0      | 2                 | Index to row                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                        |   |                   |                       |
| 2      | 2                 | Index to column                                                                                                                                                                                                                                                                                                                   |     |      |          |   |                   |                        |   |                   |                       |
| 4      | 2                 | Index to XF record (→5.115)                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                        |   |                   |                       |
| 6      | 8                 | Result of the formula. See below for details.                                                                                                                                                                                                                                                                                     |     |      |          |   |                   |                        |   |                   |                       |
| 14     | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Recalculate always</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Calculate on open</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Recalculate always | 1 | 0002 <sub>H</sub> | 1 = Calculate on open |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                          |     |      |          |   |                   |                        |   |                   |                       |
| 0      | 0001 <sub>H</sub> | 1 = Recalculate always                                                                                                                                                                                                                                                                                                            |     |      |          |   |                   |                        |   |                   |                       |
| 1      | 0002 <sub>H</sub> | 1 = Calculate on open                                                                                                                                                                                                                                                                                                             |     |      |          |   |                   |                        |   |                   |                       |
| 16     | var.              | Formula data (RPN token array, →3)                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                        |   |                   |                       |

Record FORMULA, BIFF5-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
|--------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|------------------------|---|-------------------|-----------------------|---|-------------------|------------------------------|
| 0      | 2                 | Index to row                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 2      | 2                 | Index to column                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 4      | 2                 | Index to XF record (→5.115)                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 6      | 8                 | Result of the formula. See below for details.                                                                                                                                                                                                                                                                                                                                                                           |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 14     | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Recalculate always</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Calculate on open</td> </tr> <tr> <td>3</td> <td>0008<sub>H</sub></td> <td>1 = Part of a shared formula</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Recalculate always | 1 | 0002 <sub>H</sub> | 1 = Calculate on open | 3 | 0008 <sub>H</sub> | 1 = Part of a shared formula |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 0      | 0001 <sub>H</sub> | 1 = Recalculate always                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 1      | 0002 <sub>H</sub> | 1 = Calculate on open                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 3      | 0008 <sub>H</sub> | 1 = Part of a shared formula                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 16     | 4                 | Not used                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |
| 20     | var.              | Formula data (RPN token array, →3)                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                        |   |                   |                       |   |                   |                              |



### • Result of the Formula

Dependent on the type of value the formula returns, the result field has the following format:

Result is a numeric value:

| Offset | Size | Contents                                                |
|--------|------|---------------------------------------------------------|
| 0      | 8    | IEEE 754 floating-point value (64-bit double precision) |

Result is a string (the string follows in a STRING record, →5.102):

| Offset | Size | Contents                                        |
|--------|------|-------------------------------------------------|
| 0      | 1    | 00 <sub>H</sub> (identifier for a string value) |
| 1      | 5    | Not used                                        |
| 6      | 2    | FFFF <sub>H</sub>                               |

Note: In BIFF8 the string must not be empty. For empty cells there is a special identifier defined (see below).

Result is a Boolean value:

| Offset | Size | Contents                                         |
|--------|------|--------------------------------------------------|
| 0      | 1    | 01 <sub>H</sub> (identifier for a Boolean value) |
| 1      | 1    | Not used                                         |
| 2      | 1    | 0 = FALSE, 1 = TRUE                              |
| 3      | 3    | Not used                                         |
| 6      | 2    | FFFF <sub>H</sub>                                |

Result is an error value:

| Offset | Size | Contents                                        |
|--------|------|-------------------------------------------------|
| 0      | 1    | 02 <sub>H</sub> (identifier for an error value) |
| 1      | 1    | Not used                                        |
| 2      | 1    | Error code (→2.5.6)                             |
| 3      | 3    | Not used                                        |
| 6      | 2    | FFFF <sub>H</sub>                               |

Result is an empty cell (BIFF8), for example an empty string:

| Offset | Size | Contents                                       |
|--------|------|------------------------------------------------|
| 0      | 1    | 03 <sub>H</sub> (identifier for an empty cell) |
| 1      | 5    | Not used                                       |
| 6      | 2    | FFFF <sub>H</sub>                              |

## 5.51 GCW – Global Column Width

| BIFF2 | BIFF3 | BIFF4             | BIFF5             | BIFF8 |
|-------|-------|-------------------|-------------------|-------|
| —     | —     | 00AB <sub>H</sub> | 00AB <sub>H</sub> | —     |

This record contains a bitfield with one bit for every column in the worksheet, describing how to set the column width for the respective column. If this record is omitted, all columns are using the default column width.

Record GCW, BIFF4-BIFF5:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Size of the following bitfield (in bytes, always 0020 <sub>H</sub> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2      | 32   | <p>Bit field with one bit for every column in the worksheet. The first byte of the bitfield contains flags for the first 8 columns (A to H), the second byte for the next 8 columns and so on. Bit 0 (mask 0x01) of each byte is for the leftmost column in the column interval, bit 7 (mask 0x80) is for the rightmost column.</p> <p>If a bit is set, the corresponding column uses the width set in the STANDARDWIDTH record (→5.101). If a bit is cleared, the corresponding column uses the width set in the COLINFO record (→5.18) for this column.</p> <p>If a bit is set, and the worksheet does not contain the STANDARDWIDTH record, or if the bit is cleared, and the worksheet does not contain the COLINFO record, the DEFCOLWIDTH record (→5.32) of the worksheet will be used instead.</p> |

## 5.52 GRIDSET

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0082 <sub>H</sub> | 0082 <sub>H</sub> | 0082 <sub>H</sub> | 0082 <sub>H</sub> |

This record specifies if the option to print sheet grid lines (record PRINTGRIDLINES, →5.80) has ever been changed.

Record GRIDSET, BIFF3-BIFF8:

| Offset | Size | Contents                                                                         |
|--------|------|----------------------------------------------------------------------------------|
| 0      | 2    | 0 = Print grid lines option never changed<br>1 = Print grid lines option changed |

## 5.53 GUTS

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0080 <sub>H</sub> | 0080 <sub>H</sub> | 0080 <sub>H</sub> | 0080 <sub>H</sub> |

This record contains information about the layout of outline symbols.

Record GUTS, BIFF3-BIFF8:

| Offset | Size | Contents                                                                            |
|--------|------|-------------------------------------------------------------------------------------|
| 0      | 2    | Width of the area to display row outlines (left of the sheet), in pixel             |
| 2      | 2    | Height of the area to display column outlines (above the sheet), in pixel           |
| 4      | 2    | Number of visible row outline levels (used row levels + 1; or 0, if not used)       |
| 6      | 2    | Number of visible column outline levels (used column levels + 1; or 0, if not used) |

## 5.54 HCENTER

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0083 <sub>H</sub> | 0083 <sub>H</sub> | 0083 <sub>H</sub> | 0083 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It specifies if the sheet is centred horizontally when printed.

Record HCENTER, BIFF3-BIFF8:

| Offset | Size | Contents                                                             |
|--------|------|----------------------------------------------------------------------|
| 0      | 2    | 0 = Print sheet left aligned<br>1 = Print sheet centred horizontally |

## 5.55 HEADER

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0014 <sub>H</sub> | 0014 <sub>H</sub> | 0014 <sub>H</sub> | 0014 <sub>H</sub> | 0014 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It specifies the page header string for the current worksheet. If this record is not present or completely empty (record size is 0), the sheet does not contain a page header.

Record HEADER for non-empty page header, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                                                                                 |
|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | var. | Page header string<br>BIFF2-BIFF5: Non-empty byte string, 8-bit string length (→2.5.2)<br>BIFF8: Non-empty Unicode string, 16-bit string length (→2.5.3) |

The header string may contain special commands, for example placeholders for the page number, current date, or text formatting attributes. These fields are represented by single letters (exception: font name and size, see below) with a leading ampersand (“&”). If the ampersand is part of the regular header text, it will be duplicated (“&&”).

The page header is divided into 3 sections: the left, the centred, and the right section. Each section is introduced by a special command. All text and all commands following are part of the selected section. Each section starts with the text formatting specified in the default font (first FONT record in the file). Active formatting attributes from a previous section do not go into the next section.

The following table shows all available commands:

| Command | Contents                                | Command | Contents                            |
|---------|-----------------------------------------|---------|-------------------------------------|
| &&      | The “&” character itself                |         |                                     |
| &L      | Start of the left section               |         |                                     |
| &C      | Start of the centred section            |         |                                     |
| &R      | Start of the right section              |         |                                     |
| &P      | Current page number                     | &A      | Sheet name (BIFF5-BIFF8)            |
| &N      | Page count                              | &F      | File name without path              |
| &D      | Current date                            | &Z      | File path without file name (BIFF8) |
| &T      | Current time                            | &G      | Picture (BIFF8)                     |
| &B      | Bold on/off                             | &H      | Shadowed text on/off                |
| &I      | Italic on/off                           | &O      | Outlined text on/off                |
| &U      | Underlining on/off                      | &X      | Superscript on/off (BIFF5-BIFF8)    |
| &E      | Double underlining on/off (BIFF5-BIFF8) | &Y      | Subscript on/off (BIFF5-BIFF8)      |
| &S      | Strikeout on/off                        |         |                                     |

More complex commands:

| Command                   | Contents                                                                                                                                                                                                                                                                        |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| &"<fontname>"             | Set new font <fontname>                                                                                                                                                                                                                                                         |
| &"<fontname>,<fontstyle>" | Set new font with specified style <fontstyle>. The style <fontstyle> is in most cases one of “Regular”, “Bold”, “Italic”, or “Bold Italic”. But this setting is dependent on the used font, it may differ (localised style names, or “Standard”, “Oblique”, ...). (BIFF5-BIFF8) |
| &<fontheight>             | Set font height in points (<fontheight> is a decimal value). If this command is followed by a plain number to be printed in the header, it will be separated from the font height with a space character.                                                                       |

! In BIFF2 the commands differ in the localised versions of Excel.

## 5.56 HIDEOBJ

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 008D <sub>H</sub> | 008D <sub>H</sub> | 008D <sub>H</sub> | 008D <sub>H</sub> |

This record specifies whether and how to show objects in the workbook.

Record HIDEOBJ, BIFF3-BIFF8:

| Offset | Size | Contents                                                                                              |
|--------|------|-------------------------------------------------------------------------------------------------------|
| 0      | 2    | Viewing mode for objects:<br>0 = Show all objects<br>1 = Show placeholders<br>2 = Do not show objects |

## 5.57 HORIZONTALPAGEBREAKS

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 001B <sub>H</sub> | 001B <sub>H</sub> | 001B <sub>H</sub> | 001B <sub>H</sub> | 001B <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It contains all horizontal manual page breaks.

Record HORIZONTALPAGEBREAKS, BIFF2-BIFF5:

| Offset | Size         | Contents                                                                                    |
|--------|--------------|---------------------------------------------------------------------------------------------|
| 0      | 2            | Number of following row indexes ( <u>nm</u> )                                               |
| 2      | 2· <u>nm</u> | List of <u>nm</u> row indexes. Each row index specifies the first row after the page break. |

Record HORIZONTALPAGEBREAKS, BIFF8:

| Offset | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |          |   |   |                                         |   |   |                                          |   |   |                                         |
|--------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|---|---|-----------------------------------------|---|---|------------------------------------------|---|---|-----------------------------------------|
| 0      | 2            | Number of following row index structures ( <u>nm</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |          |   |   |                                         |   |   |                                          |   |   |                                         |
| 2      | 6· <u>nm</u> | List of <u>nm</u> row index structures. Each row index structure contains: <table border="1"> <thead> <tr> <th>Offset</th> <th>Size</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2</td> <td>Index to first row below the page break</td> </tr> <tr> <td>2</td> <td>2</td> <td>Index to first column of this page break</td> </tr> <tr> <td>4</td> <td>2</td> <td>Index to last column of this page break</td> </tr> </tbody> </table> | Offset | Size | Contents | 0 | 2 | Index to first row below the page break | 2 | 2 | Index to first column of this page break | 4 | 2 | Index to last column of this page break |
| Offset | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |          |   |   |                                         |   |   |                                          |   |   |                                         |
| 0      | 2            | Index to first row below the page break                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |          |   |   |                                         |   |   |                                          |   |   |                                         |
| 2      | 2            | Index to first column of this page break                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |          |   |   |                                         |   |   |                                          |   |   |                                         |
| 4      | 2            | Index to last column of this page break                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |          |   |   |                                         |   |   |                                          |   |   |                                         |

The row indexes in the lists must be ordered ascending. If in BIFF8 a row contains several page breaks, they must be ordered ascending by start column index.

## 5.58 HYPERLINK

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 01B8 <sub>H</sub> |

In Excel, every cell may contain a hyperlink. The HYPERLINK record refers to one cell address or a cell range where all cells contain the same hyperlink. It is part of the *Hyperlink Table* in the *Sheet Substream* (→4.13). Every hyperlink can contain a text mark and a description that is shown in the sheet instead of the real link. Text marks are appended behind a link, separated by the hash sign (“#”).

Examples for text marks: `www.example.org#table1` or `C:\example.xls#Sheet1!A1`.

Inside of this record strings are stored in several formats. Sometimes occurs the character count, otherwise the character array size (in 16-bit character arrays the character count is half of the array size). Furthermore some strings are zero-terminated, others not. They are stored either as 16-bit character arrays or as 8-bit character arrays, independent of the characters.

### 5.58.1 Common Record Contents

Each HYPERLINK record starts with the same data items and continues with special data related to the current type of hyperlink. It starts with a cell range. Each cell of this range will contain the same hyperlink.

Record HYPERLINK, BIFF8:

| Offset | Size          | Contents                                                                                                                                                                                                                                                                                                                      |
|--------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 8             | Cell range address of all cells containing this hyperlink (→2.5.14)                                                                                                                                                                                                                                                           |
| 8      | 16            | GUID of StdLink:<br>D0 <sub>H</sub> C9 <sub>H</sub> EA <sub>H</sub> 79 <sub>H</sub> F9 <sub>H</sub> BA <sub>H</sub> CE <sub>H</sub> 11 <sub>H</sub> 8C <sub>H</sub> 82 <sub>H</sub> 00 <sub>H</sub> AA <sub>H</sub> 00 <sub>H</sub> 4B <sub>H</sub> A9 <sub>H</sub> 0B <sub>H</sub><br>(79EAC9D0-BAF9-11CE-8C82-00AA004BA90B) |
| 24     | 4             | Unknown value: 00000002 <sub>H</sub>                                                                                                                                                                                                                                                                                          |
| 28     | 4             | Option flags (see below)                                                                                                                                                                                                                                                                                                      |
| [32]   | 4             | (optional, see option flags) Character count of description text, including trailing zero word ( <u>d</u> 1)                                                                                                                                                                                                                  |
| [36]   | 2· <u>d</u> 1 | (optional, see option flags) Character array of description text, no Unicode string header, always 16-bit characters, zero-terminated                                                                                                                                                                                         |
| [var.] | 4             | (optional, see option flags) Character count of target frame, including trailing zero word ( <u>f</u> 1)                                                                                                                                                                                                                      |
| [var.] | 2· <u>f</u> 1 | (optional, see option flags) Character array of target frame, no Unicode string header, always 16-bit characters, zero-terminated                                                                                                                                                                                             |
| var.   | var.          | Special data (→5.58.2 and following)                                                                                                                                                                                                                                                                                          |
| [var.] | 4             | (optional, see option flags) Character count of the text mark, including trailing zero word ( <u>t</u> 1)                                                                                                                                                                                                                     |
| [var.] | 2· <u>t</u> 1 | (optional, see option flags) Character array of the text mark without “#” sign, no Unicode string header, always 16-bit characters, zero-terminated                                                                                                                                                                           |

The special data parts in the following are described with relative offsets (starting again by zero). The real offset inside of the record data (without header) is either 32 (without description) or 36+2·d1 (with description).

### • Option Flags

The option flags specify the following content of the record.

| Bit     | Mask                  | Contents               |                                  |
|---------|-----------------------|------------------------|----------------------------------|
| 0       | 00000001 <sub>H</sub> | 0 = No link extant     | 1 = File link or URL             |
| 1       | 00000002 <sub>H</sub> | 0 = Relative file path | 1 = Absolute path or URL         |
| 2 and 4 | 00000014 <sub>H</sub> | 0 = No description     | 1 (both bits) = Description      |
| 3       | 00000008 <sub>H</sub> | 0 = No text mark       | 1 = Text mark                    |
| 7       | 00000080 <sub>H</sub> | 0 = No target frame    | 1 = Target frame                 |
| 8       | 00000100 <sub>H</sub> | 0 = File link or URL   | 1 = UNC path (incl. server name) |

## 5.58.2 Hyperlink containing a URL (Uniform Resource Locator)

These data fields occur for links which are not local files or files in the local network (for instance HTTP and FTP links and e-mail addresses). The lower 9 bits of the option flags field must be 0 . x00x . xx11<sub>2</sub> (x means optional, depending on hyperlink content). The GUID could be used to distinguish a URL from a file link.

| Offset | Size        | Contents                                                                                                                                                                                                                                                                                                                          |
|--------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 16          | GUID of URL Moniker:<br>E0 <sub>H</sub> C9 <sub>H</sub> EA <sub>H</sub> 79 <sub>H</sub> F9 <sub>H</sub> BA <sub>H</sub> CE <sub>H</sub> 11 <sub>H</sub> 8C <sub>H</sub> 82 <sub>H</sub> 00 <sub>H</sub> AA <sub>H</sub> 00 <sub>H</sub> 4B <sub>H</sub> A9 <sub>H</sub> 0B <sub>H</sub><br>(79EAC9E0-BAF9-11CE-8C82-00AA004BA90B) |
| 16     | 4           | Size of character array of the URL, including trailing zero word ( <u>u.s.</u> ). There are <u>u.s.</u> /2-1 characters in the following string.                                                                                                                                                                                  |
| 20     | <u>u.s.</u> | Character array of the URL, no Unicode string header, always 16-bit characters, zero-terminated                                                                                                                                                                                                                                   |

### 5.58.3 Hyperlink to a Local File

These data fields are for links to files on local drives. The path of the file can be complete with drive letter (absolute) or relative to the location of the workbook. The lower 9 bits of the option flags field must be  $0.x00x.xx1_2$ . The GUID could be used to distinguish a URL from a file link.

| Offset            | Size       | Contents                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                 | 16         | GUID of File Moniker:<br>03 <sub>H</sub> 03 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> C0 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 46 <sub>H</sub><br>(0000303-0000-0000-C000-000000000046)                                                                                               |
| 16                | 2          | Directory up-level count. Each leading “.” in the file link is deleted and increases this counter.                                                                                                                                                                                                                                                                                                                              |
| 18                | 4          | Character count of the shortened file path and name, including trailing zero byte ( <u>s.l</u> )                                                                                                                                                                                                                                                                                                                                |
| 22                | <u>s.l</u> | Character array of the shortened file path and name in 8.3-DOS-format. This field can be filled with a long file name too. No Unicode string header, always 8-bit characters, zero-terminated.                                                                                                                                                                                                                                  |
| 22+ <u>s.l</u>    | 24         | Unknown byte sequence:<br>FF <sub>H</sub> FF <sub>H</sub> AD <sub>H</sub> DE <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub><br>00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub><br>00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> |
| 46+ <u>s.l</u>    | 4          | Size of the following file link field including string length field and additional data field ( <u>s.z</u> ). If <u>s.z</u> is zero, nothing will follow (except a text mark).                                                                                                                                                                                                                                                  |
| [50+ <u>s.l</u> ] | 4          | (optional) Size of character array of the extended file path and name ( <u>x.l</u> ). There are <u>x.l</u> /2 characters in the following string.                                                                                                                                                                                                                                                                               |
| [54+ <u>s.l</u> ] | 2          | (optional) Unknown byte sequence: 03 <sub>H</sub> 00 <sub>H</sub>                                                                                                                                                                                                                                                                                                                                                               |
| [56+ <u>s.l</u> ] | <u>x.l</u> | (optional) Character array of the extended file path and name ( <u>x.l</u> ), no Unicode string header, always 16-bit characters, <i>not</i> zero-terminated                                                                                                                                                                                                                                                                    |

### 5.58.4 Hyperlink to a File with UNC (Universal Naming Convention) Path

These data fields are for UNC paths containing a server name (for instance “\\server\path\file.xls”). The lower 9 bits of the option flags field must be  $1.x00x.xx11_2$ .

| Offset | Size          | Contents                                                                                         |
|--------|---------------|--------------------------------------------------------------------------------------------------|
| 0      | 4             | Character count of the UNC, including trailing zero word ( <u>f.l</u> )                          |
| 4      | 2* <u>f.l</u> | Character array of the UNC, no Unicode string header, always 16-bit characters, zero-terminated. |

### 5.58.5 Hyperlink to the Current Workbook

In this case only the text mark field is present (optional with description).

Example: The URL “#Sheet2!B1:C2” refers to the given range in the current workbook.

The lower 9 bits of the option flags field must be  $0.x00x.1x00_2$ .



## 5.59 INDEX

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 000B <sub>H</sub> | 020B <sub>H</sub> | 020B <sub>H</sub> | 020B <sub>H</sub> | 020B <sub>H</sub> |

This record stores the range of used rows and stream positions of several records of the current sheet. In particular the position of the first DEFINEDNAME record and XF record is stored (BIFF2-BIFF4) and the position of a specific record in each *Row Block* (the first ROW record in BIFF2-BIFF4, and the DBCELL record in BIFF5-BIFF8). This stream position array also contains stream offsets to empty *Row Blocks*, they will point to the next extant *Row Block*.

The number of entries  $nm$  in this array can be calculated from the row range given in this record ( $rf$  is the index to the first used row,  $rl$  is the index to the first row of unused tail of sheet):  $nm = (rl - rf - 1) / 32 + 1$  (using integer division).

For details about *Row Blocks* in a worksheet see →4.7.

Record INDEX, BIFF2:

| Offset | Size    | Contents                                                                                     |
|--------|---------|----------------------------------------------------------------------------------------------|
| 0      | 4       | Absolute stream position of the first DEFINEDNAME record (→5.33)                             |
| 4      | 2       | Index to first used row ( $rf$ , 0-based)                                                    |
| 6      | 2       | Index to first row of unused tail of sheet ( $rl$ , last used row + 1, 0-based)              |
| 8      | 4· $nm$ | Array of $nm$ absolute stream positions to first ROW record (→5.88) of each <i>Row Block</i> |

Record INDEX, BIFF3-BIFF4:

| Offset | Size    | Contents                                                                                       |
|--------|---------|------------------------------------------------------------------------------------------------|
| 0      | 4       | Absolute stream position of the first DEFINEDNAME record (→5.33).                              |
| 4      | 2       | Index to first used row ( $rf$ , 0-based)                                                      |
| 6      | 2       | Index to first row of unused tail of sheet ( $rl$ , last used row + 1, 0-based)                |
| 8      | 4       | Absolute stream position of the first XF record (→5.115).                                      |
| 12     | 4· $nm$ | Array of $nm$ absolute stream positions to first ROW record (→5.88) of each <i>Row Block</i> . |

Record INDEX, BIFF5:

| Offset | Size    | Contents                                                                                                                                                                                                  |
|--------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 4       | Not used                                                                                                                                                                                                  |
| 4      | 2       | Index to first used row ( $rf$ , 0-based)                                                                                                                                                                 |
| 6      | 2       | Index to first row of unused tail of sheet ( $rl$ , last used row + 1, 0-based)                                                                                                                           |
| 8      | 4       | Absolute stream position of the DEFCOLWIDTH record (→5.32) of the current sheet. If this record does not exist, the offset points to the record at the position where the DEFCOLWIDTH record would occur. |
| 12     | 4· $nm$ | Array of $nm$ absolute stream positions to the DBCELL record (→5.29) of each <i>Row Block</i>                                                                                                             |

Record INDEX, BIFF8:

| Offset | Size    | Contents                                                                                                                                                                                                  |
|--------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 4       | Not used                                                                                                                                                                                                  |
| 4      | 4       | Index to first used row ( $rf$ , 0-based)                                                                                                                                                                 |
| 8      | 4       | Index to first row of unused tail of sheet ( $rl$ , last used row + 1, 0-based)                                                                                                                           |
| 12     | 4       | Absolute stream position of the DEFCOLWIDTH record (→5.32) of the current sheet. If this record does not exist, the offset points to the record at the position where the DEFCOLWIDTH record would occur. |
| 16     | 4· $nm$ | Array of $nm$ absolute stream positions to the DBCELL record (→5.29) of each <i>Row Block</i>                                                                                                             |

## 5.60 INTEGER

| BIFF2             | BIFF3 | BIFF4 | BIFF5 | BIFF8 |
|-------------------|-------|-------|-------|-------|
| 0002 <sub>H</sub> | —     | —     | —     | —     |

This record represents a cell that contains an unsigned 16-bit integer value. If a value cannot be stored as a 16-bit integer, a NUMBER record (→5.71) must be written. From BIFF3 on this record is replaced by the RK record (→5.87).

Record INTEGER, BIFF2:

| Offset | Size | Contents                      |
|--------|------|-------------------------------|
| 0      | 2    | Index to row                  |
| 2      | 2    | Index to column               |
| 4      | 3    | Cell attributes (→2.5.13)     |
| 7      | 2    | Unsigned 16-bit integer value |

## 5.61 ITERATION

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0011 <sub>H</sub> | 0011 <sub>H</sub> | 0011 <sub>H</sub> | 0011 <sub>H</sub> | 0011 <sub>H</sub> |

This record is part of the *Calculation Settings Block* (→4.3). It stores if iterations are allowed while calculating recursive formulas.

Record ITERATION, BIFF2-BIFF8:

| Offset | Size | Contents                              |
|--------|------|---------------------------------------|
| 0      | 2    | 0 = Iterations off; 1 = Iterations on |

## 5.62 IXFE – Index to XF

| BIFF2             | BIFF3 | BIFF4 | BIFF5 | BIFF8 |
|-------------------|-------|-------|-------|-------|
| 0044 <sub>H</sub> | —     | —     | —     | —     |

This record occurs in front of every cell record (for instance BLANK, INTEGER, NUMBER, LABEL, FORMULA) that references to an XF record (→5.115) with an index greater than 62. The XF index field of the cell record consists only of 6 bits. The maximum value 63 is used to indicate a preceding IXFE record containing the real XF index. See →2.5.13 for more details.

Record IXFE, BIFF2:

| Offset | Size | Contents                    |
|--------|------|-----------------------------|
| 0      | 2    | Index to XF record (→5.115) |

## 5.63 LABEL

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0004 <sub>H</sub> | 0204 <sub>H</sub> | 0204 <sub>H</sub> | 0204 <sub>H</sub> | 0204 <sub>H</sub> |

This record represents a cell that contains a string. In BIFF8 it is usually replaced by the LABELSST record (→5.65). Excel still uses this record, if it copies unformatted text cells to the clipboard.

Record LABEL, BIFF2:

| Offset | Size | Contents                                  |
|--------|------|-------------------------------------------|
| 0      | 2    | Index to row                              |
| 2      | 2    | Index to column                           |
| 4      | 3    | Cell attributes (→2.5.13)                 |
| 7      | var. | Byte string, 8-bit string length (→2.5.2) |

Record LABEL, BIFF3-BIFF5:

| Offset | Size | Contents                                   |
|--------|------|--------------------------------------------|
| 0      | 2    | Index to row                               |
| 2      | 2    | Index to column                            |
| 4      | 2    | Index to XF record (→5.115)                |
| 6      | var. | Byte string, 16-bit string length (→2.5.2) |

Record LABEL, BIFF8:

| Offset | Size | Contents                                      |
|--------|------|-----------------------------------------------|
| 0      | 2    | Index to row                                  |
| 2      | 2    | Index to column                               |
| 4      | 2    | Index to XF record (→5.115)                   |
| 6      | var. | Unicode string, 16-bit string length (→2.5.3) |

## 5.64 LABELRANGES

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 015F <sub>H</sub> |

This record contains the addresses of all row and column label ranges in the current sheet.

Record LABELRANGES, BIFF8:

| Offset | Size | Contents                                                       |
|--------|------|----------------------------------------------------------------|
| 0      | var. | Cell range address list with all row label ranges (→2.5.15)    |
| var.   | var. | Cell range address list with all column label ranges (→2.5.15) |

## 5.65 LABELSST

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 00FD <sub>H</sub> |

This record represents a cell that contains a string. It replaces the LABEL record (→5.63) and RSTRING record (→5.89) used in BIFF2-BIFF5. See →4.11 for more information about shared string tables.

Record LABELSST, BIFF8:

| Offset | Size | Contents                       |
|--------|------|--------------------------------|
| 0      | 2    | Index to row                   |
| 2      | 2    | Index to column                |
| 4      | 2    | Index to XF record (→5.115)    |
| 6      | 4    | Index into SST record (→5.100) |

## 5.66 LEFTMARGIN

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0026 <sub>H</sub> | 0026 <sub>H</sub> | 0026 <sub>H</sub> | 0026 <sub>H</sub> | 0026 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It contains the left page margin of the current worksheet.

Record LEFTMARGIN, BIFF2-BIFF8:

| Offset | Size | Contents                                                                            |
|--------|------|-------------------------------------------------------------------------------------|
| 0      | 8    | Left page margin in inches (IEEE 754 floating-point value, 64-bit double precision) |

## 5.67 MERGEDCELLS

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 00E5 <sub>H</sub> |

This record contains the addresses of merged cell ranges in the current sheet.

Record MERGEDCELLS, BIFF8:

| Offset | Size | Contents                                             |
|--------|------|------------------------------------------------------|
| 0      | var. | Cell range address list with merged ranges (→2.5.15) |

If the record size exceeds the limit, it is *not* continued with a CONTINUE record, but another self-contained MERGEDCELLS record is started. The limit of 8224 bytes per record results in a maximum number of 1027 merged ranges.

Example: A sheet contains 1040 merged cell ranges. The first MERGEDCELLS record contains a list of 1027 range addresses (the leading number of ranges is 1027 too). Following a second MERGEDCELLS record with the remaining 13 merged ranges.

## 5.68 MULBLANK – Multiple BLANK

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 00BE <sub>H</sub> | 00BE <sub>H</sub> |

This record represents a cell range of empty cells. All cells are located in the same row.

Record MULBLANK, BIFF5-BIFF8:

| Offset         | Size         | Contents                                                                           |
|----------------|--------------|------------------------------------------------------------------------------------|
| 0              | 2            | Index to row                                                                       |
| 2              | 2            | Index to first column ( <u>f.c.</u> )                                              |
| 4              | 2· <u>nc</u> | List of <u>nc</u> = <u>lc</u> - <u>fc</u> +1 16-bit indexes to XF records (→5.115) |
| 4+2· <u>nc</u> | 2            | Index to last column ( <u>lc</u> )                                                 |

## 5.69 MULRK – Multiple RK

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 00BD <sub>H</sub> | 00BD <sub>H</sub> |

This record represents a cell range containing RK value cells. All cells are located in the same row.

Record MULRK, BIFF5-BIFF8:

| Offset         | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                      |        |      |          |   |   |                             |   |   |                   |
|----------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|---|---|-----------------------------|---|---|-------------------|
| 0              | 2            | Index to row                                                                                                                                                                                                                                                                                                                                                                  |        |      |          |   |   |                             |   |   |                   |
| 2              | 2            | Index to first column ( <u>f.c.</u> )                                                                                                                                                                                                                                                                                                                                         |        |      |          |   |   |                             |   |   |                   |
| 4              | 6· <u>nc</u> | List of <u>nc</u> = <u>lc</u> - <u>fc</u> +1 XF/RK structures. Each XF/RK contains: <table border="1"> <thead> <tr> <th>Offset</th> <th>Size</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2</td> <td>Index to XF record (→5.115)</td> </tr> <tr> <td>2</td> <td>4</td> <td>RK value (→2.5.5)</td> </tr> </tbody> </table> | Offset | Size | Contents | 0 | 2 | Index to XF record (→5.115) | 2 | 4 | RK value (→2.5.5) |
| Offset         | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                      |        |      |          |   |   |                             |   |   |                   |
| 0              | 2            | Index to XF record (→5.115)                                                                                                                                                                                                                                                                                                                                                   |        |      |          |   |   |                             |   |   |                   |
| 2              | 4            | RK value (→2.5.5)                                                                                                                                                                                                                                                                                                                                                             |        |      |          |   |   |                             |   |   |                   |
| 4+6· <u>nc</u> | 2            | Index to last column ( <u>lc</u> )                                                                                                                                                                                                                                                                                                                                            |        |      |          |   |   |                             |   |   |                   |

## 5.70 NOTE

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 001C <sub>H</sub> | 001C <sub>H</sub> | 001C <sub>H</sub> | 001C <sub>H</sub> | 001C <sub>H</sub> |

This record represents a cell annotation.

Record NOTE, BIFF2-BIFF5:

| Offset | Size | Contents                                                                                                                                                                                                                                                                                                                                                                  |
|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Index to row                                                                                                                                                                                                                                                                                                                                                              |
| 2      | 2    | Index to column                                                                                                                                                                                                                                                                                                                                                           |
| 4      | 2    | Total length of the annotation string (character count, <u>l<sub>n</sub></u> )                                                                                                                                                                                                                                                                                            |
| 6      | var. | Character array (8-bit characters). This character array will contain at most 2048 characters. If an annotation is longer than 2048 characters, the remaining string will be written in one or more following NOTE records (see below). Nevertheless the string length field <u>l<sub>n</sub></u> in this record contains the <i>total length</i> of the annotation text. |

Record NOTE for continuation of long notes, BIFF2-BIFF5:

| Offset | Size | Contents                                                                                               |
|--------|------|--------------------------------------------------------------------------------------------------------|
| 0      | 2    | always FFFF <sub>H</sub>                                                                               |
| 2      | 2    | Not used                                                                                               |
| 4      | 2    | Length of <i>this</i> part of the annotation string (character count, 1...2048, <u>l<sub>n</sub></u> ) |
| 6      | var. | Character array containing <u>l<sub>n</sub></u> characters (8-bit characters)                          |

Example: An annotation contains 5000 characters. The string will be split into 3 parts: the first two NOTE records contain 2048 characters each, and the third NOTE record contains the remaining 904 characters. The first NOTE record contains the total length of the string (5000), the second and third record contain the local length (2048 respectively 904).

Record NOTE, BIFF8:

2do

## 5.71 NUMBER

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0003 <sub>H</sub> | 0203 <sub>H</sub> | 0203 <sub>H</sub> | 0203 <sub>H</sub> | 0203 <sub>H</sub> |

This record represents a cell that contains a floating-point value.

Record NUMBER, BIFF2:

| Offset | Size | Contents                                                              |
|--------|------|-----------------------------------------------------------------------|
| 0      | 2    | Index to row                                                          |
| 2      | 2    | Index to column                                                       |
| 4      | 3    | Cell attributes (→2.5.13)                                             |
| 7      | 8    | IEEE 754 floating-point value (64-bit double precision) <sup>34</sup> |

Record NUMBER, BIFF3-BIFF8:

| Offset | Size | Contents                                                              |
|--------|------|-----------------------------------------------------------------------|
| 0      | 2    | Index to row                                                          |
| 2      | 2    | Index to column                                                       |
| 4      | 2    | Index to XF record (→5.115)                                           |
| 6      | 8    | IEEE 754 floating-point value (64-bit double precision) <sup>34</sup> |

## 5.72 OBJECTPROTECT

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0063 <sub>H</sub> | 0063 <sub>H</sub> | 0063 <sub>H</sub> | 0063 <sub>H</sub> |

This record is part of the worksheet/workbook protection (→4.18). It determines whether the objects of the current sheet are protected. Object protection is not active, if this record is omitted.

Record OBJECTPROTECT, BIFF3-BIFF8:

| Offset | Size | Contents                                         |
|--------|------|--------------------------------------------------|
| 0      | 2    | 0 = Objects not protected; 1 = Objects protected |

<sup>34</sup> For details about the internal structure of floating-point values see [http://en.wikipedia.org/wiki/IEEE\\_floating-point\\_standard](http://en.wikipedia.org/wiki/IEEE_floating-point_standard).

## 5.73 PAGESETUP

| BIFF2 | BIFF3 | BIFF4             | BIFF5             | BIFF8             |
|-------|-------|-------------------|-------------------|-------------------|
| —     | —     | 00A1 <sub>H</sub> | 00A1 <sub>H</sub> | 00A1 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It stores the page format settings of the current sheet. The pages may be scaled in percent or by using an absolute number of pages. This setting is located in the SHEETPR record (→5.97). If pages are scaled in percent, the scaling factor in this record is used, otherwise the “Fit to pages” values. One of the “Fit to pages” values may be 0. In this case the sheet is scaled to fit only to the other value.

### • Record Contents

Record PAGESETUP, BIFF4:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
|--------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|---------------------------------------------------------|---|-------------------|-------------------------------------------------|---|-------------------|------------------------------------------------------------------------------------------------|---|-------------------|---------------------------------------------------------------|
| 0      | 2                 | Paper size (see below)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 2      | 2                 | Scaling factor in percent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 4      | 2                 | Start page number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 6      | 2                 | Fit worksheet width to this number of pages (0 = use as many as needed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 8      | 2                 | Fit worksheet height to this number of pages (0 = use as many as needed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 10     | 2                 | Option flags:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
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| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 0      | 0001 <sub>H</sub> | 0 = Print pages in columns      1 = Print pages in rows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 1      | 0002 <sub>H</sub> | 0 = Landscape                      1 = Portrait                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 2      | 0004 <sub>H</sub> | 1 = Paper size, scaling factor, and paper orientation (portrait/landscape) are not initialised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |
| 3      | 0008 <sub>H</sub> | 0 = Print coloured                  1 = Print black and white                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                |   |                   |                                                               |



Record PAGESETUP, BIFF5-BIFF8:

| Offset                                        | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
|-----------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|---------------------------------------------------------|---|-------------------|-------------------------------------------------|---|-------------------|-----------------------------------------------------------------------------------------------------------------------------------|---|-------------------|---------------------------------------------------------------|---|-------------------|------------------------------------------------------|---|-------------------|---------------------------------------------------------|---|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------|-------------------------------------------------------------------|-----------------------------------------------|--|--|---|-------------------|---------------------------------------------------------------------|-------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                                             | 10                | Equal to BIFF4, see above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 10                                            | 2                 | Option flags:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
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| Bit                                           | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 0                                             | 0001 <sub>H</sub> | 0 = Print pages in columns      1 = Print pages in rows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 1                                             | 0002 <sub>H</sub> | 0 = Landscape                      1 = Portrait                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 2                                             | 0004 <sub>H</sub> | 1 = Paper size, scaling factor, paper orientation (portrait/landscape), print resolution and number of copies are not initialised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 3                                             | 0008 <sub>H</sub> | 0 = Print coloured                  1 = Print black and white                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 4                                             | 0010 <sub>H</sub> | 0 = Default print quality          1 = Draft quality                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 5                                             | 0020 <sub>H</sub> | 0 = Do not print cell notes        1 = Print cell notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 6                                             | 0040 <sub>H</sub> | 0 = Use paper orientation (portrait/landscape) flag above      1 = Use default paper orientation (landscape for chart sheets, portrait otherwise)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 7                                             | 0080 <sub>H</sub> | 0 = Automatic page numbers        1 = Use start page number above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| The following flags are valid for BIFF8 only: |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 9                                             | 0200 <sub>H</sub> | 0 = Print notes as displayed        1 = Print notes at end of sheet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 11-10                                         | 0C00 <sub>H</sub> | 00 <sub>2</sub> = Print errors as displayed    10 <sub>2</sub> = Print errors as "--"<br>01 <sub>2</sub> = Do not print errors            11 <sub>2</sub> = Print errors as "#N/A"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 12                                            | 2                 | Print resolution in dpi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 14                                            | 2                 | Vertical print resolution in dpi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 16                                            | 8                 | Header margin (IEEE 754 floating-point value, 64-bit double precision)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 24                                            | 8                 | Footer margin (IEEE 754 floating-point value, 64-bit double precision)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |
| 32                                            | 2                 | Number of copies to print                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                                         |   |                   |                                                 |   |                   |                                                                                                                                   |   |                   |                                                               |   |                   |                                                      |   |                   |                                                         |   |                   |                                                                                                                                                   |   |                   |                                                                   |                                               |  |  |   |                   |                                                                     |       |                   |                                                                                                                                                                                    |

## • Paper Size Table

| Index | Paper type           | Paper size    | Index | Paper type              | Paper size                               |
|-------|----------------------|---------------|-------|-------------------------|------------------------------------------|
| 0     | Undefined            |               | 48    | Undefined               |                                          |
| 1     | Letter               | 8½" × 11"     | 49    | Undefined               |                                          |
| 2     | Letter small         | 8½" × 11"     | 50    | Letter Extra            | 9½" × 12"                                |
| 3     | Tabloid              | 11" × 17"     | 51    | Legal Extra             | 9½" × 15"                                |
| 4     | Ledger               | 17" × 11"     | 52    | Tabloid Extra           | 11 <sup>11</sup> / <sub>16</sub> " × 18" |
| 5     | Legal                | 8½" × 14"     | 53    | A4 Extra                | 235mm × 322mm                            |
| 6     | Statement            | 5½" × 8½"     | 54    | Letter Transverse       | 8½" × 11"                                |
| 7     | Executive            | 7¼" × 10½"    | 55    | A4 Transverse           | 210mm × 297mm                            |
| 8     | A3                   | 297mm × 420mm | 56    | Letter Extra Transv.    | 9½" × 12"                                |
| 9     | A4                   | 210mm × 297mm | 57    | Super A/A4              | 227mm × 356mm                            |
| 10    | A4 small             | 210mm × 297mm | 58    | Super B/A3              | 305mm × 487mm                            |
| 11    | A5                   | 148mm × 210mm | 59    | Letter Plus             | 8½" × 12 <sup>11</sup> / <sub>16</sub> " |
| 12    | B4 (JIS)             | 257mm × 364mm | 60    | A4 Plus                 | 210mm × 330mm                            |
| 13    | B5 (JIS)             | 182mm × 257mm | 61    | A5 Transverse           | 148mm × 210mm                            |
| 14    | Folio                | 8½" × 13"     | 62    | B5 (JIS) Transverse     | 182mm × 257mm                            |
| 15    | Quarto               | 215mm × 275mm | 63    | A3 Extra                | 322mm × 445mm                            |
| 16    | 10×14                | 10" × 14"     | 64    | A5 Extra                | 174mm × 235mm                            |
| 17    | 11×17                | 11" × 17"     | 65    | B5 (ISO) Extra          | 201mm × 276mm                            |
| 18    | Note                 | 8½" × 11"     | 66    | A2                      | 420mm × 594mm                            |
| 19    | Envelope #9          | 3⅞" × 8⅞"     | 67    | A3 Transverse           | 297mm × 420mm                            |
| 20    | Envelope #10         | 4⅞" × 9½"     | 68    | A3 Extra Transverse     | 322mm × 445mm                            |
| 21    | Envelope #11         | 4½" × 10⅞"    | 69    | Dbl. Japanese Postcard  | 200mm × 148mm                            |
| 22    | Envelope #12         | 4¾" × 11"     | 70    | A6                      | 105mm × 148mm                            |
| 23    | Envelope #14         | 5" × 11½"     | 71    |                         |                                          |
| 24    | C                    | 17" × 22"     | 72    |                         |                                          |
| 25    | D                    | 22" × 34"     | 73    |                         |                                          |
| 26    | E                    | 34" × 44"     | 74    |                         |                                          |
| 27    | Envelope DL          | 110mm × 220mm | 75    | Letter Rotated          | 11" × 8½"                                |
| 28    | Envelope C5          | 162mm × 229mm | 76    | A3 Rotated              | 420mm × 297mm                            |
| 29    | Envelope C3          | 324mm × 458mm | 77    | A4 Rotated              | 297mm × 210mm                            |
| 30    | Envelope C4          | 229mm × 324mm | 78    | A5 Rotated              | 210mm × 148mm                            |
| 31    | Envelope C6          | 114mm × 162mm | 79    | B4 (JIS) Rotated        | 364mm × 257mm                            |
| 32    | Envelope C6/C5       | 114mm × 229mm | 80    | B5 (JIS) Rotated        | 257mm × 182mm                            |
| 33    | B4 (ISO)             | 250mm × 353mm | 81    | Japanese Postcard Rot.  | 148mm × 100mm                            |
| 34    | B5 (ISO)             | 176mm × 250mm | 82    | Dbl. Jap. Postcard Rot. | 148mm × 200mm                            |
| 35    | B6 (ISO)             | 125mm × 176mm | 83    | A6 Rotated              | 148mm × 105mm                            |
| 36    | Envelope Italy       | 110mm × 230mm | 84    |                         |                                          |
| 37    | Envelope Monarch     | 3⅞" × 7½"     | 85    |                         |                                          |
| 38    | 6¾ Envelope          | 3⅞" × 6½"     | 86    |                         |                                          |
| 39    | US Standard Fanfold  | 14⅞" × 11"    | 87    |                         |                                          |
| 40    | German Std. Fanfold  | 8½" × 12"     | 88    | B6 (JIS)                | 128mm × 182mm                            |
| 41    | German Legal Fanfold | 8½" × 13"     | 89    | B6 (JIS) Rotated        | 182mm × 128mm                            |
| 42    | B4 (ISO)             | 250mm × 353mm | 90    | 12×11                   | 12" × 11"                                |
| 43    | Japanese Postcard    | 100mm × 148mm |       |                         |                                          |
| 44    | 9×11                 | 9" × 11"      |       |                         |                                          |
| 45    | 10×11                | 10" × 11"     |       |                         |                                          |
| 46    | 15×11                | 15" × 11"     |       |                         |                                          |
| 47    | Envelope Invite      | 220mm × 220mm |       |                         |                                          |

## 5.74 PALETTE

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0092 <sub>H</sub> | 0092 <sub>H</sub> | 0092 <sub>H</sub> | 0092 <sub>H</sub> |

This record contains the definition of all user-defined colours available for cell and object formatting. This record is optional. If it is omitted, a built-in default colour table will be used (see →5.74.3).

### 5.74.1 Record Contents

Record PALETTE, BIFF3-BIFF8:

| Offset | Size         | Contents                                                                                     |
|--------|--------------|----------------------------------------------------------------------------------------------|
| 0      | 2            | Number of following colours ( <u>nm</u> ). Contains 16 in BIFF3-BIFF4 and 56 in BIFF5-BIFF8. |
| 2      | 4· <u>nm</u> | List of <u>nm</u> RGB colours (→2.5.4)                                                       |

### 5.74.2 Special Built-In Colours

Beside the colours described in a PALETTE record, Excel may use a couple of built-in colours:

| Colour index                  | Resulting colour or internal list index                                                                                |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 00 <sub>H</sub>               | 000000 <sub>H</sub> = EGA Black                                                                                        |
| 01 <sub>H</sub>               | FFFFFF <sub>H</sub> = EGA White                                                                                        |
| 02 <sub>H</sub>               | FF0000 <sub>H</sub> = EGA Red                                                                                          |
| 03 <sub>H</sub>               | 00FF00 <sub>H</sub> = EGA Green                                                                                        |
| 04 <sub>H</sub>               | 0000FF <sub>H</sub> = EGA Blue                                                                                         |
| 05 <sub>H</sub>               | FFFF00 <sub>H</sub> = EGA Yellow                                                                                       |
| 06 <sub>H</sub>               | FF00FF <sub>H</sub> = EGA Magenta                                                                                      |
| 07 <sub>H</sub>               | 00FFFF <sub>H</sub> = EGA Cyan                                                                                         |
| 08 <sub>H</sub>               | First colour from user-defined PALETTE record or from default colour table (→5.74.3)                                   |
| ⋮                             | ⋮                                                                                                                      |
| 17 <sub>H</sub> (BIFF3-BIFF4) | Last colour from user-defined PALETTE record or from default colour table (→5.74.3)                                    |
| 3F <sub>H</sub> (BIFF5-BIFF8) |                                                                                                                        |
| 18 <sub>H</sub> (BIFF3-BIFF4) | System window text colour for border lines (used in records XF →5.115, CFRULE →5.16, and WINDOW2 (BIFF8 only), →5.110) |
| 40 <sub>H</sub> (BIFF5-BIFF8) |                                                                                                                        |
| 19 <sub>H</sub> (BIFF3-BIFF4) | System window background colour for pattern background (used in records XF, and CFRULE)                                |
| 41 <sub>H</sub> (BIFF5-BIFF8) |                                                                                                                        |
| 43 <sub>H</sub>               | System face colour (dialogue background colour)                                                                        |
| 4D <sub>H</sub>               | System window text colour for chart border lines                                                                       |
| 4E <sub>H</sub>               | System window background colour for chart areas                                                                        |
| 4F <sub>H</sub>               | Automatic colour for chart border lines (seems to be always Black)                                                     |
| 50 <sub>H</sub>               | System tool tip background colour (used in note objects)                                                               |
| 51 <sub>H</sub>               | System tool tip text colour (used in note objects)                                                                     |
| 7FFF <sub>H</sub>             | System window text colour for fonts (used in records FONT →5.45, FONTCOLOR →5.47, and CFRULE)                          |

### 5.74.3 Built-In Default Colour Tables

If the workbook does not contain a PALETTE record, Excel uses a built-in colour table. The contents of this colour table are dependent on the BIFF version.

Default colour table for BIFF3/BIFF4:

| Colour Index    | Colour                            | Colour Index    | Colour                               |
|-----------------|-----------------------------------|-----------------|--------------------------------------|
| 08 <sub>H</sub> | 000000 <sub>H</sub> = EGA Black   | 10 <sub>H</sub> | 800000 <sub>H</sub> = EGA Dark Red   |
| 09 <sub>H</sub> | FFFFFF <sub>H</sub> = EGA White   | 11 <sub>H</sub> | 008000 <sub>H</sub> = EGA Dark Green |
| 0A <sub>H</sub> | FF0000 <sub>H</sub> = EGA Red     | 12 <sub>H</sub> | 000080 <sub>H</sub> = EGA Dark Blue  |
| 0B <sub>H</sub> | 00FF00 <sub>H</sub> = EGA Green   | 13 <sub>H</sub> | 808000 <sub>H</sub> = EGA Olive      |
| 0C <sub>H</sub> | 0000FF <sub>H</sub> = EGA Blue    | 14 <sub>H</sub> | 800080 <sub>H</sub> = EGA Purple     |
| 0D <sub>H</sub> | FFFF00 <sub>H</sub> = EGA Yellow  | 15 <sub>H</sub> | 008080 <sub>H</sub> = EGA Teal       |
| 0E <sub>H</sub> | FF00FF <sub>H</sub> = EGA Magenta | 16 <sub>H</sub> | C0C0C0 <sub>H</sub> = EGA Silver     |
| 0F <sub>H</sub> | 00FFFF <sub>H</sub> = EGA Cyan    | 17 <sub>H</sub> | 808080 <sub>H</sub> = EGA Grey       |

Default colour table for BIFF5 (colours 08<sub>H</sub>–17<sub>H</sub> are equal to the BIFF3/BIFF4 default colour table):

| Index           | Colour              | Index           | Colour              | Index           | Colour              | Index           | Colour              | Index           | Colour              |
|-----------------|---------------------|-----------------|---------------------|-----------------|---------------------|-----------------|---------------------|-----------------|---------------------|
| 08 <sub>H</sub> | 000000 <sub>H</sub> | 14 <sub>H</sub> | 800080 <sub>H</sub> | 20 <sub>H</sub> | 000080 <sub>H</sub> | 2C <sub>H</sub> | A6CAF0 <sub>H</sub> | 38 <sub>H</sub> | 1D2FBE <sub>H</sub> |
| 09 <sub>H</sub> | FFFFFF <sub>H</sub> | 15 <sub>H</sub> | 008080 <sub>H</sub> | 21 <sub>H</sub> | FF00FF <sub>H</sub> | 2D <sub>H</sub> | DD9CB3 <sub>H</sub> | 39 <sub>H</sub> | 286676 <sub>H</sub> |
| 0A <sub>H</sub> | FF0000 <sub>H</sub> | 16 <sub>H</sub> | C0C0C0 <sub>H</sub> | 22 <sub>H</sub> | FFFF00 <sub>H</sub> | 2E <sub>H</sub> | B38FEE <sub>H</sub> | 3A <sub>H</sub> | 004500 <sub>H</sub> |
| 0B <sub>H</sub> | 00FF00 <sub>H</sub> | 17 <sub>H</sub> | 808080 <sub>H</sub> | 23 <sub>H</sub> | 00FFFF <sub>H</sub> | 2F <sub>H</sub> | E3E3E3 <sub>H</sub> | 3B <sub>H</sub> | 453E01 <sub>H</sub> |
| 0C <sub>H</sub> | 0000FF <sub>H</sub> | 18 <sub>H</sub> | 8080FF <sub>H</sub> | 24 <sub>H</sub> | 800080 <sub>H</sub> | 30 <sub>H</sub> | 2A6FF9 <sub>H</sub> | 3C <sub>H</sub> | 6A2813 <sub>H</sub> |
| 0D <sub>H</sub> | FFFF00 <sub>H</sub> | 19 <sub>H</sub> | 802060 <sub>H</sub> | 25 <sub>H</sub> | 800000 <sub>H</sub> | 31 <sub>H</sub> | 3FB8CD <sub>H</sub> | 3D <sub>H</sub> | 85396A <sub>H</sub> |
| 0E <sub>H</sub> | FF00FF <sub>H</sub> | 1A <sub>H</sub> | FFFFC0 <sub>H</sub> | 26 <sub>H</sub> | 008080 <sub>H</sub> | 32 <sub>H</sub> | 488436 <sub>H</sub> | 3E <sub>H</sub> | 4A3285 <sub>H</sub> |
| 0F <sub>H</sub> | 00FFFF <sub>H</sub> | 1B <sub>H</sub> | A0E0F0 <sub>H</sub> | 27 <sub>H</sub> | 0000FF <sub>H</sub> | 33 <sub>H</sub> | 958C41 <sub>H</sub> | 3F <sub>H</sub> | 424242 <sub>H</sub> |
| 10 <sub>H</sub> | 800000 <sub>H</sub> | 1C <sub>H</sub> | 600080 <sub>H</sub> | 28 <sub>H</sub> | 00CFFF <sub>H</sub> | 34 <sub>H</sub> | 8E5E42 <sub>H</sub> |                 |                     |
| 11 <sub>H</sub> | 008000 <sub>H</sub> | 1D <sub>H</sub> | FF8080 <sub>H</sub> | 29 <sub>H</sub> | 69FFFF <sub>H</sub> | 35 <sub>H</sub> | A0627A <sub>H</sub> |                 |                     |
| 12 <sub>H</sub> | 000080 <sub>H</sub> | 1E <sub>H</sub> | 0080C0 <sub>H</sub> | 2A <sub>H</sub> | E0FFE0 <sub>H</sub> | 36 <sub>H</sub> | 624FAC <sub>H</sub> |                 |                     |
| 13 <sub>H</sub> | 808000 <sub>H</sub> | 1F <sub>H</sub> | C0C0FF <sub>H</sub> | 2B <sub>H</sub> | FFFF80 <sub>H</sub> | 37 <sub>H</sub> | 969696 <sub>H</sub> |                 |                     |

Default colour table for BIFF8 (colours 08<sub>H</sub>–17<sub>H</sub> are equal to the BIFF3/BIFF4 default colour table):

| Index           | Colour              | Index           | Colour              | Index           | Colour              | Index           | Colour              | Index           | Colour              |
|-----------------|---------------------|-----------------|---------------------|-----------------|---------------------|-----------------|---------------------|-----------------|---------------------|
| 08 <sub>H</sub> | 000000 <sub>H</sub> | 14 <sub>H</sub> | 800080 <sub>H</sub> | 20 <sub>H</sub> | 000080 <sub>H</sub> | 2C <sub>H</sub> | 99CCFF <sub>H</sub> | 38 <sub>H</sub> | 003366 <sub>H</sub> |
| 09 <sub>H</sub> | FFFFFF <sub>H</sub> | 15 <sub>H</sub> | 008080 <sub>H</sub> | 21 <sub>H</sub> | FF00FF <sub>H</sub> | 2D <sub>H</sub> | FF99CC <sub>H</sub> | 39 <sub>H</sub> | 339966 <sub>H</sub> |
| 0A <sub>H</sub> | FF0000 <sub>H</sub> | 16 <sub>H</sub> | C0C0C0 <sub>H</sub> | 22 <sub>H</sub> | FFFF00 <sub>H</sub> | 2E <sub>H</sub> | CC99FF <sub>H</sub> | 3A <sub>H</sub> | 003300 <sub>H</sub> |
| 0B <sub>H</sub> | 00FF00 <sub>H</sub> | 17 <sub>H</sub> | 808080 <sub>H</sub> | 23 <sub>H</sub> | 00FFFF <sub>H</sub> | 2F <sub>H</sub> | FFCC99 <sub>H</sub> | 3B <sub>H</sub> | 333300 <sub>H</sub> |
| 0C <sub>H</sub> | 0000FF <sub>H</sub> | 18 <sub>H</sub> | 9999FF <sub>H</sub> | 24 <sub>H</sub> | 800080 <sub>H</sub> | 30 <sub>H</sub> | 3366FF <sub>H</sub> | 3C <sub>H</sub> | 993300 <sub>H</sub> |
| 0D <sub>H</sub> | FFFF00 <sub>H</sub> | 19 <sub>H</sub> | 993366 <sub>H</sub> | 25 <sub>H</sub> | 800000 <sub>H</sub> | 31 <sub>H</sub> | 33CCCC <sub>H</sub> | 3D <sub>H</sub> | 993366 <sub>H</sub> |
| 0E <sub>H</sub> | FF00FF <sub>H</sub> | 1A <sub>H</sub> | FFFFCC <sub>H</sub> | 26 <sub>H</sub> | 008080 <sub>H</sub> | 32 <sub>H</sub> | 99CC00 <sub>H</sub> | 3E <sub>H</sub> | 333399 <sub>H</sub> |
| 0F <sub>H</sub> | 00FFFF <sub>H</sub> | 1B <sub>H</sub> | CCFFFF <sub>H</sub> | 27 <sub>H</sub> | 0000FF <sub>H</sub> | 33 <sub>H</sub> | FFCC00 <sub>H</sub> | 3F <sub>H</sub> | 333333 <sub>H</sub> |
| 10 <sub>H</sub> | 800000 <sub>H</sub> | 1C <sub>H</sub> | 660066 <sub>H</sub> | 28 <sub>H</sub> | 00CCFF <sub>H</sub> | 34 <sub>H</sub> | FF9900 <sub>H</sub> |                 |                     |
| 11 <sub>H</sub> | 008000 <sub>H</sub> | 1D <sub>H</sub> | FF8080 <sub>H</sub> | 29 <sub>H</sub> | CCFFFF <sub>H</sub> | 35 <sub>H</sub> | FF6600 <sub>H</sub> |                 |                     |
| 12 <sub>H</sub> | 000080 <sub>H</sub> | 1E <sub>H</sub> | 0066CC <sub>H</sub> | 2A <sub>H</sub> | CCFFCC <sub>H</sub> | 36 <sub>H</sub> | 666699 <sub>H</sub> |                 |                     |
| 13 <sub>H</sub> | 808000 <sub>H</sub> | 1F <sub>H</sub> | CCCCFF <sub>H</sub> | 2B <sub>H</sub> | FFFF99 <sub>H</sub> | 37 <sub>H</sub> | 969696 <sub>H</sub> |                 |                     |

## 5.75 PANE

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0041 <sub>H</sub> | 0041 <sub>H</sub> | 0041 <sub>H</sub> | 0041 <sub>H</sub> | 0041 <sub>H</sub> |

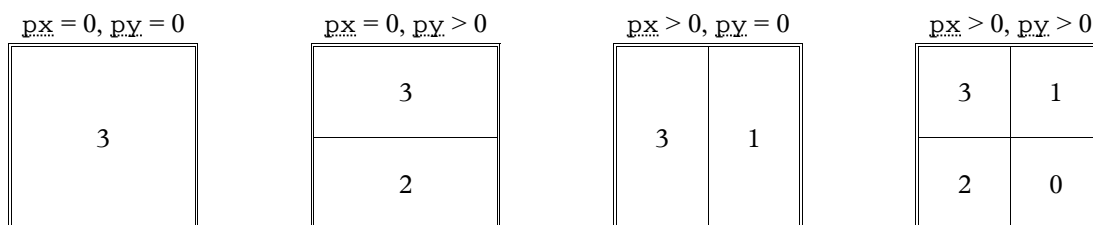
This record stores the position of window panes. It is part of the *Sheet View Settings Block* (→4.5). If the sheet does not contain any splits, this record will not occur.

A sheet can be split in two different ways, with unfrozen panes or with frozen panes. A flag in the WINDOW2 record (→5.110) specifies, if the panes are frozen, which affects the contents of this record.

Record PANE, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                            |
|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Position of the vertical split ( $p_x$ , 0 = No vertical split):<br><i>Unfrozen pane:</i> Width of the left pane(s) (in twips = $1/20$ of a point)<br><i>Frozen pane:</i> Number of visible columns in left pane(s) |
| 2      | 2    | Position of the horizontal split ( $p_y$ , 0 = No horizontal split):<br><i>Unfrozen pane:</i> Height of the top pane(s) (in twips = $1/20$ of a point)<br><i>Frozen pane:</i> Number of visible rows in top pane(s) |
| 4      | 2    | Index to first visible row in bottom pane(s)                                                                                                                                                                        |
| 6      | 2    | Index to first visible column in right pane(s)                                                                                                                                                                      |
| 8      | 1    | Identifier of pane with active cell cursor (see below)                                                                                                                                                              |
| [9]    | 1    | Not used (BIFF5-BIFF8 only, not written in BIFF2-BIFF4)                                                                                                                                                             |

If panes are unfrozen, every visible pane may be active. The active pane shows the current selection (which may be different in each pane) and reacts on cursor movement and other user input. If the panes are frozen, the bottom pane (if no horizontal split present), right pane (if no vertical split present), or bottom-right pane is always active, regardless of the cursor position. The correct identifiers for all possible combinations of visible panes are shown in the following pictures.



## 5.76 PASSWORD

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0013 <sub>H</sub> | 0013 <sub>H</sub> | 0013 <sub>H</sub> | 0013 <sub>H</sub> | 0013 <sub>H</sub> |

This record is part of the worksheet/workbook protection (→4.18). It stores a 16-bit hash value, calculated from the worksheet or workbook protection password.

Record PASSWORD, BIFF2-BIFF8:

| Offset | Size | Contents                                    |
|--------|------|---------------------------------------------|
| 0      | 2    | 16-bit hash value of the password (→4.18.4) |

## 5.77 PHONETICPR

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 00EF <sub>H</sub> |

This record contains default settings for the “Asian Phonetic Settings” dialog and the addresses of all cells which show Asian phonetic text.

Record PHONETICPR, BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|-----|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|------------------------------|
| 0      | 2                 | Index to FONT record (→5.45) used for Asian phonetic text of new cells                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |
| 2      | 2                 | Additional settings used for Asian phonetic text of new cells:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>1-0</td> <td>0003<sub>H</sub></td> <td>Type of Japanese phonetic text:<br/>00<sub>2</sub> = Katakana (narrow)                      10<sub>2</sub> = Hiragana<br/>01<sub>2</sub> = Katakana (wide)</td> </tr> <tr> <td>3-2</td> <td>000C<sub>H</sub></td> <td>Alignment of all portions of the Asian phonetic text:<br/>00<sub>2</sub> = Not specified (Japanese only)      10<sub>2</sub> = Centered<br/>01<sub>2</sub> = Left (Top for vertical text)        11<sub>2</sub> = Distributed</td> </tr> <tr> <td>5-4</td> <td>0030<sub>H</sub></td> <td>11<sub>2</sub> (always set)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 1-0 | 0003 <sub>H</sub> | Type of Japanese phonetic text:<br>00 <sub>2</sub> = Katakana (narrow)                      10 <sub>2</sub> = Hiragana<br>01 <sub>2</sub> = Katakana (wide) | 3-2 | 000C <sub>H</sub> | Alignment of all portions of the Asian phonetic text:<br>00 <sub>2</sub> = Not specified (Japanese only)      10 <sub>2</sub> = Centered<br>01 <sub>2</sub> = Left (Top for vertical text)        11 <sub>2</sub> = Distributed | 5-4 | 0030 <sub>H</sub> | 11 <sub>2</sub> (always set) |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |
| 1-0    | 0003 <sub>H</sub> | Type of Japanese phonetic text:<br>00 <sub>2</sub> = Katakana (narrow)                      10 <sub>2</sub> = Hiragana<br>01 <sub>2</sub> = Katakana (wide)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |
| 3-2    | 000C <sub>H</sub> | Alignment of all portions of the Asian phonetic text:<br>00 <sub>2</sub> = Not specified (Japanese only)      10 <sub>2</sub> = Centered<br>01 <sub>2</sub> = Left (Top for vertical text)        11 <sub>2</sub> = Distributed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |
| 5-4    | 0030 <sub>H</sub> | 11 <sub>2</sub> (always set)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |
| 4      | var.              | Cell range address list (→2.5.15) with all cells with visible Asian phonetic text                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |      |          |     |                   |                                                                                                                                                             |     |                   |                                                                                                                                                                                                                                 |     |                   |                              |

## 5.78 PLS

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 004D <sub>H</sub> | 004D <sub>H</sub> | 004D <sub>H</sub> | 004D <sub>H</sub> | 004D <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It stores a binary blob containing internal settings for the current printer. The binary data is dependent on the current printer and not documented. On import, this record can be ignored.

## 5.79 PRECISION

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 000E <sub>H</sub> | 000E <sub>H</sub> | 000E <sub>H</sub> | 000E <sub>H</sub> | 000E <sub>H</sub> |

This record stores if formulas use the real cell values for calculation or the values displayed on the screen. In BIFF2-BIFF4 this record is part of the *Calculation Settings Block* (→4.3). In BIFF5-BIFF8 it is stored in the *Workbook Globals Substream*.

Record PRECISION, BIFF2-BIFF8:

| Offset | Size | Contents                                           |
|--------|------|----------------------------------------------------|
| 0      | 2    | 0 = Use displayed values; 1 = Use real cell values |

## 5.80 PRINTGRIDLINES

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 002B <sub>H</sub> | 002B <sub>H</sub> | 002B <sub>H</sub> | 002B <sub>H</sub> | 002B <sub>H</sub> |

This record stores if sheet grid lines will be printed.

Record PRINTGRIDLINES, BIFF2-BIFF8:

| Offset | Size | Contents                                                      |
|--------|------|---------------------------------------------------------------|
| 0      | 2    | 0 = Do not print sheet grid lines; 1 = Print sheet grid lines |

## 5.81 PRINTHEADERS

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 002A <sub>H</sub> | 002A <sub>H</sub> | 002A <sub>H</sub> | 002A <sub>H</sub> | 002A <sub>H</sub> |

This record stores if the row and column headers (the areas with row numbers and column letters) will be printed.

Record PRINTHEADERS, BIFF2-BIFF8:

| Offset | Size | Contents                                                          |
|--------|------|-------------------------------------------------------------------|
| 0      | 2    | 0 = Do not print row/column headers; 1 = Print row/column headers |

## 5.82 PROTECT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0012 <sub>H</sub> | 0012 <sub>H</sub> | 0012 <sub>H</sub> | 0012 <sub>H</sub> | 0012 <sub>H</sub> |

This record is part of the worksheet/workbook protection (→4.18). It specifies whether a worksheet or a workbook is protected against modification. Protection is not active, if this record is omitted.

Record PROTECT, BIFF2-BIFF8:

| Offset | Size | Contents                         |
|--------|------|----------------------------------|
| 0      | 2    | 0 = Not protected; 1 = Protected |

## 5.83 QUICKTIP

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 0800 <sub>H</sub> |

This record contains the cell range and text for a tool tip. It occurs in conjunction with the HYPERLINK record for hyperlinks (→5.58) in the *Hyperlink Table* (→4.13). This feature is only available in Excel 9.0 (Excel 2000) and later.

Record QUICKTIP, BIFF8:

| Offset | Size | Contents                                                                                             |
|--------|------|------------------------------------------------------------------------------------------------------|
| 0      | 2    | 0800 <sub>H</sub> (repeated record identifier)                                                       |
| 2      | 8    | Cell range address of all cells containing the tool tip (→2.5.14)                                    |
| 10     | var. | Character array of the tool tip, no Unicode string header, always 16-bit characters, zero-terminated |

## 5.84 RANGEPROTECTION

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 0868 <sub>H</sub> |

This record is part of the worksheet/workbook protection (→4.18). It stores information about special protected ranges in a protected sheet. This feature is only available in Excel 10.0 (Excel XP) and later.

Record RANGEPROTECTION, BIFF8:

| Offset | Size | Contents                                       |
|--------|------|------------------------------------------------|
| 0      | 2    | 0868 <sub>H</sub> (repeated record identifier) |
| 2      |      | 2do                                            |



## 5.85 REFMODE

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 000F <sub>H</sub> | 000F <sub>H</sub> | 000F <sub>H</sub> | 000F <sub>H</sub> | 000F <sub>H</sub> |

This record is part of the *Calculation Settings Block* (→4.3). It stores which method is used to show cell addresses in formulas.

- The “RC” mode uses numeric indexes for rows and columns, for example “R(1)C(-1)”, or “R1C1:R2C2”.
- The “A1” mode uses characters for columns and numbers for rows, for example “B1”, or “\$A\$1:\$B\$2”.

Record REFMODE, BIFF2-BIFF8:

| Offset | Size | Contents                 |
|--------|------|--------------------------|
| 0      | 2    | 0 = RC mode; 1 = A1 mode |

## 5.86 RIGHTMARGIN

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0027 <sub>H</sub> | 0027 <sub>H</sub> | 0027 <sub>H</sub> | 0027 <sub>H</sub> | 0027 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It contains the right page margin of the current worksheet.

Record RIGHTMARGIN, BIFF2-BIFF8:

| Offset | Size | Contents                                                                             |
|--------|------|--------------------------------------------------------------------------------------|
| 0      | 8    | Right page margin in inches (IEEE 754 floating-point value, 64-bit double precision) |

## 5.87 RK

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 027E <sub>H</sub> | 027E <sub>H</sub> | 027E <sub>H</sub> | 027E <sub>H</sub> |

This record represents a cell that contains an RK value (encoded integer or floating-point value). If a floating-point value cannot be encoded to an RK value, a NUMBER record (→5.71) will be written. This record replaces the record INTEGER (→5.60) written in BIFF2.

Record RK, BIFF3-BIFF8:

| Offset | Size | Contents                    |
|--------|------|-----------------------------|
| 0      | 2    | Index to row                |
| 2      | 2    | Index to column             |
| 4      | 2    | Index to XF record (→5.115) |
| 6      | 4    | RK value (→2.5.5)           |

## 5.88 ROW

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0008 <sub>H</sub> | 0208 <sub>H</sub> | 0208 <sub>H</sub> | 0208 <sub>H</sub> | 0208 <sub>H</sub> |

This record contains the properties of a single row in a sheet. Rows and cells in a sheet are divided into blocks of 32 rows. For details about *Row Blocks* see →4.7.

Record ROW, BIFF2:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                             |     |      |          |      |                   |                                                         |    |                   |                                                       |
|--------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|------|-------------------|---------------------------------------------------------|----|-------------------|-------------------------------------------------------|
| 0      | 2                 | Index of this row                                                                                                                                                                                                                                                                                                                                                    |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 2      | 2                 | Index to column of the first cell which is described by a cell record                                                                                                                                                                                                                                                                                                |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 4      | 2                 | Index to column of the last cell which is described by a cell record, increased by 1                                                                                                                                                                                                                                                                                 |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 6      | 2                 | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>14-0</td> <td>7FFF<sub>H</sub></td> <td>Height of the row, in twips = <math>\frac{1}{20}</math> of a point</td> </tr> <tr> <td>15</td> <td>8000<sub>H</sub></td> <td>0 = Row has custom height; 1 = Row has default height</td> </tr> </tbody> </table> | Bit | Mask | Contents | 14-0 | 7FFF <sub>H</sub> | Height of the row, in twips = $\frac{1}{20}$ of a point | 15 | 8000 <sub>H</sub> | 0 = Row has custom height; 1 = Row has default height |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                             |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 14-0   | 7FFF <sub>H</sub> | Height of the row, in twips = $\frac{1}{20}$ of a point                                                                                                                                                                                                                                                                                                              |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 15     | 8000 <sub>H</sub> | 0 = Row has custom height; 1 = Row has default height                                                                                                                                                                                                                                                                                                                |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 8      | 2                 | Not used                                                                                                                                                                                                                                                                                                                                                             |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 10     | 1                 | 0 = No defaults written; 1 = Default row attribute field and XF index occur below (f.l.)                                                                                                                                                                                                                                                                             |     |      |          |      |                   |                                                         |    |                   |                                                       |
| 11     | 2                 | Relative offset to calculate stream position of the first cell record for this row (→4.7.2)                                                                                                                                                                                                                                                                          |     |      |          |      |                   |                                                         |    |                   |                                                       |
| [13]   | 3                 | (written only if f.l. = 1) Default row attributes (→2.5.13)                                                                                                                                                                                                                                                                                                          |     |      |          |      |                   |                                                         |    |                   |                                                       |
| [16]   | 2                 | (written only if f.l. = 1) Index to XF record (→5.115)                                                                                                                                                                                                                                                                                                               |     |      |          |      |                   |                                                         |    |                   |                                                       |

Record ROW, BIFF3-BIFF8:

| Offset | Size                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
|--------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|------|-----------------------|---------------------------------------------------------|----|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------|---------------------------------------------------------------|---|-----------------------|-----------------------------------------------------|---|-----------------------|----------------------------------------------------|---|-----------------------|----------|-------|-----------------------|--------------------------------------------------------|----|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------------------|---------------------------------------------------------------|
| 0      | 2                     | Index of this row                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 2      | 2                     | Index to column of the first cell which is described by a cell record                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 4      | 2                     | Index to column of the last cell which is described by a cell record, increased by 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 6      | 2                     | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>14-0</td> <td>7FFF<sub>H</sub></td> <td>Height of the row, in twips = <math>\frac{1}{20}</math> of a point</td> </tr> <tr> <td>15</td> <td>8000<sub>H</sub></td> <td>0 = Row has custom height; 1 = Row has default height</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bit | Mask | Contents | 14-0 | 7FFF <sub>H</sub>     | Height of the row, in twips = $\frac{1}{20}$ of a point | 15 | 8000 <sub>H</sub>     | 0 = Row has custom height; 1 = Row has default height                                                                                   |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| Bit    | Mask                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 14-0   | 7FFF <sub>H</sub>     | Height of the row, in twips = $\frac{1}{20}$ of a point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 15     | 8000 <sub>H</sub>     | 0 = Row has custom height; 1 = Row has default height                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 8      | 2                     | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 10     | 2                     | In BIFF3-BIFF4 this field contains a relative offset to calculate stream position of the first cell record for this row (→4.7.2). In BIFF5-BIFF8 this field is not used anymore, but the DBCELL record (→5.29) instead.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 12     | 4                     | Option flags and default row formatting: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>2-0</td> <td>00000007<sub>H</sub></td> <td>Outline level of the row</td> </tr> <tr> <td>4</td> <td>00000010<sub>H</sub></td> <td>1 = Outline group starts or ends here (depending on where the outline buttons are located, see SHEETPR record, →5.97), and is collapsed</td> </tr> <tr> <td>5</td> <td>00000020<sub>H</sub></td> <td>1 = Row is hidden (manually, or by a filter or outline group)</td> </tr> <tr> <td>6</td> <td>00000040<sub>H</sub></td> <td>1 = Row height and default font height do not match</td> </tr> <tr> <td>7</td> <td>00000080<sub>H</sub></td> <td>1 = Row has explicit default format (<u>f.l</u>)</td> </tr> <tr> <td>8</td> <td>00000100<sub>H</sub></td> <td>Always 1</td> </tr> <tr> <td>27-16</td> <td>0FFF0000<sub>H</sub></td> <td>If <u>f.l</u> = 1: Index to default XF record (→5.115)</td> </tr> <tr> <td>28</td> <td>10000000<sub>H</sub></td> <td>1 = Additional space above the row. This flag is set, if the upper border of at least one cell in this row or if the lower border of at least one cell in the row above is formatted with a thick line style. Thin and medium line styles are not taken into account.</td> </tr> <tr> <td>29</td> <td>20000000<sub>H</sub></td> <td>1 = Additional space below the row. This flag is set, if the lower border of at least one cell in this row or if the upper border of at least one cell in the row below is formatted with a medium or thick line style. Thin line styles are not taken into account.</td> </tr> <tr> <td>30</td> <td>40000000<sub>H</sub></td> <td>1 = Show phonetic text for all cells in this row (BIFF8 only)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 2-0  | 00000007 <sub>H</sub> | Outline level of the row                                | 4  | 00000010 <sub>H</sub> | 1 = Outline group starts or ends here (depending on where the outline buttons are located, see SHEETPR record, →5.97), and is collapsed | 5 | 00000020 <sub>H</sub> | 1 = Row is hidden (manually, or by a filter or outline group) | 6 | 00000040 <sub>H</sub> | 1 = Row height and default font height do not match | 7 | 00000080 <sub>H</sub> | 1 = Row has explicit default format ( <u>f.l</u> ) | 8 | 00000100 <sub>H</sub> | Always 1 | 27-16 | 0FFF0000 <sub>H</sub> | If <u>f.l</u> = 1: Index to default XF record (→5.115) | 28 | 10000000 <sub>H</sub> | 1 = Additional space above the row. This flag is set, if the upper border of at least one cell in this row or if the lower border of at least one cell in the row above is formatted with a thick line style. Thin and medium line styles are not taken into account. | 29 | 20000000 <sub>H</sub> | 1 = Additional space below the row. This flag is set, if the lower border of at least one cell in this row or if the upper border of at least one cell in the row below is formatted with a medium or thick line style. Thin line styles are not taken into account. | 30 | 40000000 <sub>H</sub> | 1 = Show phonetic text for all cells in this row (BIFF8 only) |
| Bit    | Mask                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 2-0    | 00000007 <sub>H</sub> | Outline level of the row                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 4      | 00000010 <sub>H</sub> | 1 = Outline group starts or ends here (depending on where the outline buttons are located, see SHEETPR record, →5.97), and is collapsed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 5      | 00000020 <sub>H</sub> | 1 = Row is hidden (manually, or by a filter or outline group)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 6      | 00000040 <sub>H</sub> | 1 = Row height and default font height do not match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 7      | 00000080 <sub>H</sub> | 1 = Row has explicit default format ( <u>f.l</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 8      | 00000100 <sub>H</sub> | Always 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 27-16  | 0FFF0000 <sub>H</sub> | If <u>f.l</u> = 1: Index to default XF record (→5.115)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 28     | 10000000 <sub>H</sub> | 1 = Additional space above the row. This flag is set, if the upper border of at least one cell in this row or if the lower border of at least one cell in the row above is formatted with a thick line style. Thin and medium line styles are not taken into account.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 29     | 20000000 <sub>H</sub> | 1 = Additional space below the row. This flag is set, if the lower border of at least one cell in this row or if the upper border of at least one cell in the row below is formatted with a medium or thick line style. Thin line styles are not taken into account.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |
| 30     | 40000000 <sub>H</sub> | 1 = Show phonetic text for all cells in this row (BIFF8 only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |      |                       |                                                         |    |                       |                                                                                                                                         |   |                       |                                                               |   |                       |                                                     |   |                       |                                                    |   |                       |          |       |                       |                                                        |    |                       |                                                                                                                                                                                                                                                                       |    |                       |                                                                                                                                                                                                                                                                      |    |                       |                                                               |

## 5.89 RSTRING

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 00D6 <sub>H</sub> | 00D6 <sub>H</sub> |

This record stores a formatted text cell (Rich-Text). In BIFF8 it is usually replaced by the LABELSST record (→5.100). Excel still uses this record, if it copies formatted text cells to the clipboard.

Record RSTRING, BIFF5:

| Offset       | Size         | Contents                                          |
|--------------|--------------|---------------------------------------------------|
| 0            | 2            | Index to row                                      |
| 2            | 2            | Index to column                                   |
| 4            | 2            | Index to XF record (→5.115)                       |
| 6            | <u>sz</u>    | Byte string, 16-bit string length (→2.5.2)        |
| 6+ <u>sz</u> | 1            | Number of Rich-Text formatting runs ( <u>rt</u> ) |
| 7+ <u>sz</u> | 2· <u>rt</u> | List of <u>rt</u> formatting runs (→2.5.1)        |

Record RSTRING, BIFF8:

| Offset       | Size         | Contents                                                         |
|--------------|--------------|------------------------------------------------------------------|
| 0            | 2            | Index to row                                                     |
| 2            | 2            | Index to column                                                  |
| 4            | 2            | Index to XF record (→5.115)                                      |
| 6            | <u>sz</u>    | <i>Unformatted</i> Unicode string, 16-bit string length (→2.5.3) |
| 6+ <u>sz</u> | 2            | Number of Rich-Text formatting runs ( <u>rt</u> )                |
| 8+ <u>sz</u> | 4· <u>rt</u> | List of <u>rt</u> formatting runs (→2.5.1)                       |

## 5.90 SAVERECALC

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 005F <sub>H</sub> | 005F <sub>H</sub> | 005F <sub>H</sub> | 005F <sub>H</sub> |

This record is part of the *Calculation Settings Block* (→4.3). It contains the “Recalculate before save” option in Excel's calculation settings dialogue.

Record SAVERECALC, BIFF3-BIFF8:

| Offset | Size | Contents                                                           |
|--------|------|--------------------------------------------------------------------|
| 0      | 2    | 0 = Do not recalculate; 1 = Recalculate before saving the document |

## 5.91 SCENPROTECT

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 00DD <sub>H</sub> | 00DD <sub>H</sub> |

This record is part of the worksheet/workbook protection (→4.18). It determines whether the scenarios of the current sheet are protected. Scenario protection is not active, if this record is omitted.

Record SCENPROTECT, BIFF5-BIFF8:

| Offset | Size | Contents                                             |
|--------|------|------------------------------------------------------|
| 0      | 2    | 0 = Scenarios not protected; 1 = Scenarios protected |

## 5.92 SCL

| BIFF2 | BIFF3 | BIFF4             | BIFF5             | BIFF8             |
|-------|-------|-------------------|-------------------|-------------------|
| —     | —     | 00A0 <sub>H</sub> | 00A0 <sub>H</sub> | 00A0 <sub>H</sub> |

This record stores the magnification of the active view of the current worksheet. In BIFF8 this can be either the normal view or the page break preview. This is determined in the WINDOW2 record (→5.110). The SCL record is part of the *Sheet View Settings Block* (→4.5).

Record SCL, BIFF4-BIFF8:

| Offset | Size | Contents                                                      |
|--------|------|---------------------------------------------------------------|
| 0      | 2    | Numerator of the view magnification fraction ( <u>num</u> )   |
| 2      | 2    | Denominator of the view magnification fraction ( <u>den</u> ) |

The magnification is stored as reduced fraction. The magnification results from num/den.

## 5.93 SELECTION

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 001D <sub>H</sub> | 001D <sub>H</sub> | 001D <sub>H</sub> | 001D <sub>H</sub> | 001D <sub>H</sub> |

This record contains the addresses of all selected cell ranges and the position of the active cell for a pane in the current sheet. It is part of the *Sheet View Settings Block* (→4.5). There is one SELECTION record for each pane in the sheet.

Record SELECTION, BIFF2-BIFF8:

| Offset | Size | Contents                                                                                                                      |
|--------|------|-------------------------------------------------------------------------------------------------------------------------------|
| 0      | 1    | Pane identifier (see PANE record, →5.75)                                                                                      |
| 1      | 2    | Index to row of the active cell                                                                                               |
| 3      | 2    | Index to column of the active cell                                                                                            |
| 5      | 2    | Index into the following cell range list to the entry that contains the active cell                                           |
| 7      | var. | Cell range address list containing all selected cell ranges (→2.5.15). Column indexes are always 8-bit values, also in BIFF8. |

## 5.94 SHAREDFORMULA – Shared Formula

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 04BC <sub>H</sub> | 04BC <sub>H</sub> |

This record stores the token array of a shared formula. Shared formulas are similar to array formulas, they store a formula used in a range of cells. The SHAREDFORMULA record is not a real cell record, but follows the first FORMULA record (→5.50) of the cell range. For more information about shared formulas see →4.8.

Record SHAREDFORMULA, BIFF5-BIFF8:

| Offset | Size | Contents                                                                                                                    |
|--------|------|-----------------------------------------------------------------------------------------------------------------------------|
| 0      | 6    | Cell range address of the area used by the shared formula (→2.5.14). Column indexes are always 8-bit values, also in BIFF8. |
| 6      | 1    | Not used                                                                                                                    |
| 7      | 1    | Number of existing FORMULA records for this shared formula                                                                  |
| 8      | var. | Token array of the shared formula (→3)                                                                                      |

## 5.95 SHEET

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 0085 <sub>H</sub> | 0085 <sub>H</sub> |

This record is located in the *Workbook Globals Substream* and represents a sheet inside the workbook. One SHEET record is written for each sheet. It stores the sheet name and a stream offset to the BOF record (→5.8) of the respective *Sheet Substream* within the *Workbook Stream*.

Record SHEET, BIFF5-BIFF8:

| Offset | Size | Contents                                                                                                                                                                                                  |
|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 4    | Absolute stream position of the BOF record of the sheet represented by this record. This field is never encrypted in protected files.                                                                     |
| 4      | 1    | Sheet state:<br>0 = Visible<br>1 = Hidden<br>2 = “Very hidden”. Can only be set programmatically, e.g. with a Visual Basic macro. It is not possible to make such a sheet visible via the user interface. |
| 5      | 1    | Sheet type:<br>00 <sub>H</sub> = Worksheet<br>02 <sub>H</sub> = Chart<br>06 <sub>H</sub> = Visual Basic module                                                                                            |
| 6      | var. | Sheet name:<br>BIFF5: Byte string, 8-bit string length (→2.5.2)<br>BIFF8: Unicode string, 8-bit string length (→2.5.3)                                                                                    |

## 5.96 SHEETLAYOUT

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 0862 <sub>H</sub> |

This record stores the colour of the tab below the sheet containing the sheet name. This feature is only available in Excel 10.0 (Excel XP) and later.

Record SHEETLAYOUT, BIFF8:

| Offset | Size | Contents                                                                      |
|--------|------|-------------------------------------------------------------------------------|
| 0      | 2    | 0862 <sub>H</sub> (repeated record identifier)                                |
| 2      | 10   | Not used                                                                      |
| 12     | 4    | Unknown data: 14 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> 00 <sub>H</sub> |
| 16     | 2    | Colour index (→5.74) for sheet name tab                                       |
| 18     | 2    | Not used                                                                      |

## 5.97 SHEETPR

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0081 <sub>H</sub> | 0081 <sub>H</sub> | 0081 <sub>H</sub> | 0081 <sub>H</sub> |

This record stores a 16-bit value with Boolean options for the current sheet. From BIFF5 on the “Save external linked values” option is moved to the record BOOKBOOL (→5.9). This record is also used to distinguish standard sheets from dialogue sheets.

Option flags of record SHEETPR, BIFF3-BIFF8:

| Bit   | Mask              | Contents                                                                                                                                                                                                                                                              |
|-------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0     | 0001 <sub>H</sub> | 0 = Do not show automatic page breaks<br>1 = Show automatic page breaks                                                                                                                                                                                               |
| 4     | 0010 <sub>H</sub> | 0 = Standard sheet<br>1 = Dialogue sheet (BIFF5-BIFF8)                                                                                                                                                                                                                |
| 5     | 0020 <sub>H</sub> | 0 = No automatic styles in outlines<br>1 = Apply automatic styles to outlines                                                                                                                                                                                         |
| 6     | 0040 <sub>H</sub> | 0 = Outline buttons above outline group<br>1 = Outline buttons below outline group                                                                                                                                                                                    |
| 7     | 0080 <sub>H</sub> | 0 = Outline buttons left of outline group<br>1 = Outline buttons right of outline group                                                                                                                                                                               |
| 8     | 0100 <sub>H</sub> | 0 = Scale printout in percent (→5.73)<br>1 = Fit printout to number of pages (→5.73)                                                                                                                                                                                  |
| 9     | 0200 <sub>H</sub> | 0 = Save external linked values<br>(BIFF3-BIFF4 only, →4.10)<br>1 = Do not save external linked values<br>(BIFF3-BIFF4 only, →4.10)                                                                                                                                   |
| 10    | 0400 <sub>H</sub> | 0 = Do not show row outline symbols<br>1 = Show row outline symbols                                                                                                                                                                                                   |
| 11    | 0800 <sub>H</sub> | 0 = Do not show column outline symbols<br>1 = Show column outline symbols                                                                                                                                                                                             |
| 13-12 | 3000 <sub>H</sub> | These flags specify the arrangement of windows. They are stored in BIFF4 only.<br>00 <sub>2</sub> = Arrange windows tiled<br>01 <sub>2</sub> = Arrange windows horizontal<br>10 <sub>2</sub> = Arrange windows vertical<br>11 <sub>2</sub> = Arrange windows cascaded |

The following flags are valid for BIFF4-BIFF8 only:

|    |                   |                                                                              |
|----|-------------------|------------------------------------------------------------------------------|
| 14 | 4000 <sub>H</sub> | 0 = Excel like expression evaluation<br>1 = Lotus like expression evaluation |
| 15 | 8000 <sub>H</sub> | 0 = Excel like formula editing<br>1 = Lotus like formula editing             |

## 5.98 SHEETPROTECTION

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 0867 <sub>H</sub> |

This record is part of the worksheet/workbook protection (→4.18). It stores additional options for sheet protection. These settings are only available in Excel 10.0 (Excel XP) and later.

Record SHEETPROTECTION, BIFF8:

| Offset | Size | Contents                                                                                                                                      |
|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | 0867 <sub>H</sub> (repeated record identifier)                                                                                                |
| 2      | 9    | Not used                                                                                                                                      |
| 11     | 8    | Unknown data: 02 <sub>H</sub> 00 <sub>H</sub> 01 <sub>H</sub> 00 <sub>H</sub> FF <sub>H</sub> FF <sub>H</sub> FF <sub>H</sub> FF <sub>H</sub> |
| 19     | 2    | Option flags, see below (default: 4400 <sub>H</sub> )                                                                                         |
| 21     | 2    | Not used                                                                                                                                      |

The following flags specify, which actions are allowed while the sheet is protected. The state of object and scenario protection is also contained in the records OBJECTPROTECT (→5.72) and SCENPROTECT (→5.91). These records are stored for compatibility to Excel 97 and Excel 2000.

Option flags for sheet protection (a set bit specifies that the action is allowed):

| Bit | Mask              | Contents                 | Bit | Mask              | Contents              |
|-----|-------------------|--------------------------|-----|-------------------|-----------------------|
| 0   | 0001 <sub>H</sub> | Edit objects             | 8   | 0100 <sub>H</sub> | Delete columns        |
| 1   | 0002 <sub>H</sub> | Edit scenarios           | 9   | 0200 <sub>H</sub> | Delete rows           |
| 2   | 0004 <sub>H</sub> | Change cell formatting   | 10  | 0400 <sub>H</sub> | Select locked cells   |
| 3   | 0008 <sub>H</sub> | Change column formatting | 11  | 0800 <sub>H</sub> | Sort a cell range     |
| 4   | 0010 <sub>H</sub> | Change row formatting    | 12  | 1000 <sub>H</sub> | Edit auto filters     |
| 5   | 0020 <sub>H</sub> | Insert columns           | 13  | 2000 <sub>H</sub> | Edit PivotTables      |
| 6   | 0040 <sub>H</sub> | Insert rows              | 14  | 4000 <sub>H</sub> | Select unlocked cells |
| 7   | 0080 <sub>H</sub> | Insert hyperlinks        |     |                   |                       |



## 5.99 SORT

| BIFF2 | BIFF3 | BIFF4 | BIFF5             | BIFF8             |
|-------|-------|-------|-------------------|-------------------|
| —     | —     | —     | 0090 <sub>H</sub> | 0090 <sub>H</sub> |

This record stores the last settings from the “Sort” dialogue for each sheet. These settings are not attached to a cell range in the sheet, that means, it is not possible to determine the cell range sorted with the settings of this record.

Record SORT, BIFF5:

| Offset                                          | Size                | Contents                                                          |
|-------------------------------------------------|---------------------|-------------------------------------------------------------------|
| 0                                               | 2                   | Option flags, see below                                           |
| 2                                               | 1                   | Length of first sort key (character count, <a href="#">1.1</a> )  |
| 3                                               | 1                   | Length of second sort key (character count, <a href="#">1.2</a> ) |
| 4                                               | 1                   | Length of third sort key (character count, <a href="#">1.3</a> )  |
| 5                                               | <a href="#">1.1</a> | Character array of first sort key                                 |
| [5+ <a href="#">1.1</a> ]                       | <a href="#">1.2</a> | (optional) Character array of description text                    |
| [5+ <a href="#">1.1</a> + <a href="#">1.2</a> ] | <a href="#">1.3</a> | (optional) Character array of help topic text                     |
| var.                                            | 1                   | Not used                                                          |

Record SORT, BIFF8:

| Offset | Size | Contents                                                                                                                   |
|--------|------|----------------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Option flags, see below                                                                                                    |
| 2      | 1    | Length of first sort key (character count, <a href="#">1.1</a> )                                                           |
| 3      | 1    | Length of second sort key (character count, <a href="#">1.2</a> )                                                          |
| 4      | 1    | Length of third sort key (character count, <a href="#">1.3</a> )                                                           |
| 5      | var. | First sort key (Unicode string without length field, <a href="#">→2.5.3</a> )                                              |
| [var.] | var. | (optional, only if <a href="#">1.2</a> > 0) Second sort key (Unicode string without length field, <a href="#">→2.5.3</a> ) |
| [var.] | var. | (optional, only if <a href="#">1.3</a> > 0) Third sort key (Unicode string without length field, <a href="#">→2.5.3</a> )  |
| var.   | 1    | Not used                                                                                                                   |

Option flags, BIFF5-BIFF8:

| Bit | Mask              | Contents                                                                                     |
|-----|-------------------|----------------------------------------------------------------------------------------------|
| 0   | 0001 <sub>H</sub> | 0 = Sort rows (top-to-bottom)      1 = Sort columns (left-to-right)                          |
| 1   | 0002 <sub>H</sub> | 0 = Sort first key in ascending order      1 = Sort first key in descending order            |
| 2   | 0004 <sub>H</sub> | 0 = Sort second key in ascending order      1 = Sort second key in descending order          |
| 3   | 0008 <sub>H</sub> | 0 = Sort third key in ascending order      1 = Sort third key in descending order            |
| 4   | 0010 <sub>H</sub> | 0 = Sort case-insensitive      1 = Sort case-sensitive                                       |
| 9-5 | 03E0 <sub>H</sub> | <i>One-based</i> index into the table of defined sort lists, or 0 for sorting without a list |

## 5.100 SST – Shared String Table

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 00FC <sub>H</sub> |

This record contains a list of all strings used anywhere in the workbook. Each string occurs only once. The workbook uses indexes into the list to reference the strings. See →4.11 for more information.

Record SST, BIFF8:

| Offset | Size | Contents                                                         |
|--------|------|------------------------------------------------------------------|
| 0      | 4    | Total number of strings in the workbook (see below)              |
| 4      | 4    | Number of following strings ( <u>nm</u> )                        |
| 8      | var. | List of <u>nm</u> Unicode strings, 16-bit string length (→2.5.3) |

The first field of the SST record counts the total occurrence of strings in the workbook. For instance, the string “AAA” is used 3 times and the string “BBB” is used 2 times. The first field contains 5 and the second field contains 2, followed by the two strings.

## 5.101 STANDARDWIDTH

| BIFF2 | BIFF3 | BIFF4             | BIFF5             | BIFF8             |
|-------|-------|-------------------|-------------------|-------------------|
| —     | —     | 0099 <sub>H</sub> | 0099 <sub>H</sub> | 0099 <sub>H</sub> |

This record specifies the default column width for columns that have a set bit in the GCW record (BIFF4-BIFF5, →5.51), or columns that do not have a corresponding COLINFO record (BIFF8, →5.18).

Record STANDARDWIDTH, BIFF4-BIFF8:

| Offset | Size | Contents                                                                                                                       |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------|
| 4      | 2    | Default width of the columns in $1/256$ of the width of the zero character, using default font (first FONT record in the file) |

## 5.102 STRING

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0007 <sub>H</sub> | 0207 <sub>H</sub> | 0207 <sub>H</sub> | 0207 <sub>H</sub> | 0207 <sub>H</sub> |

This record stores the result of a string formula. It occurs directly after a string formula (→5.50).

Record STRING, BIFF2:

| Offset | Size | Contents                                  |
|--------|------|-------------------------------------------|
| 0      | var. | Byte string, 8-bit string length (→2.5.2) |

Record STRING, BIFF3-BIFF5:

| Offset | Size | Contents                                   |
|--------|------|--------------------------------------------|
| 0      | var. | Byte string, 16-bit string length (→2.5.2) |

In BIFF8 files no STRING record occurs, if the result string is empty.

Record STRING, BIFF8:

| Offset | Size | Contents                                                |
|--------|------|---------------------------------------------------------|
| 0      | var. | Non-empty Unicode string, 16-bit string length (→2.5.3) |

## 5.103 STYLE

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0293 <sub>H</sub> | 0293 <sub>H</sub> | 0293 <sub>H</sub> | 0293 <sub>H</sub> |

This record stores the name of a user-defined cell style or specific options for a built-in cell style. All STYLE records occur together behind the XF record list (→5.115). Each STYLE record refers to a style XF record, which contains the formatting attributes for the cell style.

### 5.103.1 User-Defined Cell Styles

STYLE record for user-defined cell styles, BIFF3-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                       |                   |                                   |          |      |                   |                                   |    |                   |                                  |
|--------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------|----------|------|-------------------|-----------------------------------|----|-------------------|----------------------------------|
| 0      | 2                 | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>11-0</td> <td>0FFF<sub>H</sub></td> <td>Index to style XF record (→5.115)</td> </tr> <tr> <td>15</td> <td>8000<sub>H</sub></td> <td>Always 0 for user-defined styles</td> </tr> </tbody> </table> | Bit               | Mask                              | Contents | 11-0 | 0FFF <sub>H</sub> | Index to style XF record (→5.115) | 15 | 8000 <sub>H</sub> | Always 0 for user-defined styles |
|        |                   | Bit                                                                                                                                                                                                                                                                                                            | Mask              | Contents                          |          |      |                   |                                   |    |                   |                                  |
|        |                   | 11-0                                                                                                                                                                                                                                                                                                           | 0FFF <sub>H</sub> | Index to style XF record (→5.115) |          |      |                   |                                   |    |                   |                                  |
| 15     | 8000 <sub>H</sub> | Always 0 for user-defined styles                                                                                                                                                                                                                                                                               |                   |                                   |          |      |                   |                                   |    |                   |                                  |
| 2      | var.              | BIFF2-BIFF5: Non-empty byte string, 8-bit string length (→2.5.2)<br>BIFF8: Non-empty Unicode string, 16-bit string length (→2.5.3)                                                                                                                                                                             |                   |                                   |          |      |                   |                                   |    |                   |                                  |

### 5.103.2 Built-In Cell Styles

STYLE record for built-in cell styles, BIFF3-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                                   |          |      |                   |                                   |    |                   |                              |
|--------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------|----------|------|-------------------|-----------------------------------|----|-------------------|------------------------------|
| 0      | 2                 | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>11-0</td> <td>0FFF<sub>H</sub></td> <td>Index to style XF record (→5.115)</td> </tr> <tr> <td>15</td> <td>8000<sub>H</sub></td> <td>Always 1 for built-in styles</td> </tr> </tbody> </table>                                                                                                                                                         | Bit               | Mask                              | Contents | 11-0 | 0FFF <sub>H</sub> | Index to style XF record (→5.115) | 15 | 8000 <sub>H</sub> | Always 1 for built-in styles |
|        |                   | Bit                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Mask              | Contents                          |          |      |                   |                                   |    |                   |                              |
|        |                   | 11-0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0FFF <sub>H</sub> | Index to style XF record (→5.115) |          |      |                   |                                   |    |                   |                              |
| 15     | 8000 <sub>H</sub> | Always 1 for built-in styles                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                                   |          |      |                   |                                   |    |                   |                              |
| 2      | 1                 | Identifier of the built-in cell style:<br>00 <sub>H</sub> = Normal<br>01 <sub>H</sub> = RowLevel_ <u>l</u> v (see next field)<br>02 <sub>H</sub> = ColLevel_ <u>l</u> v (see next field)<br>03 <sub>H</sub> = Comma<br>04 <sub>H</sub> = Currency<br>05 <sub>H</sub> = Percent<br>06 <sub>H</sub> = Comma [0] (BIFF4-BIFF8)<br>07 <sub>H</sub> = Currency [0] (BIFF4-BIFF8)<br>08 <sub>H</sub> = Hyperlink (BIFF8)<br>09 <sub>H</sub> = Followed Hyperlink (BIFF8) |                   |                                   |          |      |                   |                                   |    |                   |                              |
| 3      | 1                 | Level for RowLevel or ColLevel style (zero-based, <u>l</u> v), FF <sub>H</sub> otherwise                                                                                                                                                                                                                                                                                                                                                                           |                   |                                   |          |      |                   |                                   |    |                   |                              |

The RowLevel and ColLevel styles specify the formatting of subtotal cells in a specific outline level. The level is specified by the last field in the STYLE record. Valid values are 0...6 for the outline levels 1...7.

## 5.104 TOPMARGIN

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0028 <sub>H</sub> | 0028 <sub>H</sub> | 0028 <sub>H</sub> | 0028 <sub>H</sub> | 0028 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It contains the top page margin of the current worksheet.

Record TOPMARGIN, BIFF2-BIFF8:

| Offset | Size | Contents                                                                           |
|--------|------|------------------------------------------------------------------------------------|
| 0      | 8    | Top page margin in inches (IEEE 754 floating-point value, 64-bit double precision) |

## 5.105 UNCALCED

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 005E <sub>H</sub> | 005E <sub>H</sub> | 005E <sub>H</sub> | 005E <sub>H</sub> |

This record is part of the *Calculation Settings Block* (→4.3). If it occurs in the *Sheet Substream*, it indicates that the formulas have not been recalculated before the document was saved.

Record UNCALCED, BIFF2-BIFF8:

| Offset | Size | Contents |
|--------|------|----------|
| 0      | 2    | Not used |

## 5.106 USESELSFS

| BIFF2 | BIFF3 | BIFF4 | BIFF5 | BIFF8             |
|-------|-------|-------|-------|-------------------|
| —     | —     | —     | —     | 0160 <sub>H</sub> |

This record specifies if the formulas in the workbook can use “natural language formulas”. This type of formula can refer to cells by its content or the content of the column or row header cell.

Record USESELSFS, BIFF8:

| Offset | Size | Contents                                                                      |
|--------|------|-------------------------------------------------------------------------------|
| 0      | 2    | 0 = Do not use natural language formulas<br>1 = Use natural language formulas |

## 5.107 VCENTER

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0084 <sub>H</sub> | 0084 <sub>H</sub> | 0084 <sub>H</sub> | 0084 <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It specifies if the sheet is centred vertically when printed.

Record VCENTER, BIFF3-BIFF8:

| Offset | Size | Contents                                                                         |
|--------|------|----------------------------------------------------------------------------------|
| 0      | 2    | 0 = Print sheet aligned at top page border<br>1 = Print sheet vertically centred |

## 5.108 VERTICALPAGEBREAKS

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 001A <sub>H</sub> | 001A <sub>H</sub> | 001A <sub>H</sub> | 001A <sub>H</sub> | 001A <sub>H</sub> |

This record is part of the *Page Settings Block* (→4.4). It contains all vertical manual page breaks.

Record VERTICALPAGEBREAKS, BIFF2-BIFF5:

| Offset | Size         | Contents                                                                                      |
|--------|--------------|-----------------------------------------------------------------------------------------------|
| 0      | 2            | Number of following column indexes ( <u>nm</u> )                                              |
| 2      | 2· <u>nm</u> | List of <u>nm</u> column indexes. Each index specifies the first column after the page break. |

Record VERTICALPAGEBREAKS, BIFF8:

| Offset | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |          |   |   |                                                |   |   |                                       |   |   |                                      |
|--------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|---|---|------------------------------------------------|---|---|---------------------------------------|---|---|--------------------------------------|
| 0      | 2            | Number of following column index structures ( <u>nm</u> )                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |          |   |   |                                                |   |   |                                       |   |   |                                      |
| 2      | 6· <u>nm</u> | List of <u>nm</u> column index structures. Each column index structure contains: <table border="1"> <thead> <tr> <th>Offset</th> <th>Size</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2</td> <td>Index to first column following the page break</td> </tr> <tr> <td>2</td> <td>2</td> <td>Index to first row of this page break</td> </tr> <tr> <td>4</td> <td>2</td> <td>Index to last row of this page break</td> </tr> </tbody> </table> | Offset | Size | Contents | 0 | 2 | Index to first column following the page break | 2 | 2 | Index to first row of this page break | 4 | 2 | Index to last row of this page break |
| Offset | Size         | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |          |   |   |                                                |   |   |                                       |   |   |                                      |
| 0      | 2            | Index to first column following the page break                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |          |   |   |                                                |   |   |                                       |   |   |                                      |
| 2      | 2            | Index to first row of this page break                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |          |   |   |                                                |   |   |                                       |   |   |                                      |
| 4      | 2            | Index to last row of this page break                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |          |   |   |                                                |   |   |                                       |   |   |                                      |

The column indexes in the lists must be ordered ascending. If in BIFF8 a column contains several page breaks, they must be ordered ascending by start row index.

## 5.109 WINDOW1

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 003D <sub>H</sub> | 003D <sub>H</sub> | 003D <sub>H</sub> | 003D <sub>H</sub> | 003D <sub>H</sub> |

This record contains general settings for the document window and global workbook settings (BIFF5-BIFF8).

Record WINDOW1, BIFF2-BIFF4:

| Offset | Size | Contents                                                                          |
|--------|------|-----------------------------------------------------------------------------------|
| 0      | 2    | Horizontal position of the document window (in twips = $\frac{1}{20}$ of a point) |
| 2      | 2    | Vertical position of the document window (in twips = $\frac{1}{20}$ of a point)   |
| 4      | 2    | Width of the document window (in twips = $\frac{1}{20}$ of a point)               |
| 6      | 2    | Height of the document window (in twips = $\frac{1}{20}$ of a point)              |
| 8      | 1    | 0 = Window is visible; 1 = Window is hidden                                       |

Record WINDOW1, BIFF5-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|----------|---|-------------------|-------------------------------------------------|---|-------------------|-------------------------------------------------|---|-------------------|-------------------------------------------------------------------------|---|-------------------|---------------------------------------------------------------------|---|-------------------|-----------------------------------------------------------------|
| 0      | 2                 | Horizontal position of the document window (in twips = $\frac{1}{20}$ of a point)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 2      | 2                 | Vertical position of the document window (in twips = $\frac{1}{20}$ of a point)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 4      | 2                 | Width of the document window (in twips = $\frac{1}{20}$ of a point)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 6      | 2                 | Height of the document window (in twips = $\frac{1}{20}$ of a point)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 8      | 2                 | Option flags: <table border="1"> <thead> <tr> <th>Bits</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>0 = Window is visible      1 = Window is hidden</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>0 = Window is open      1 = Window is minimised</td> </tr> <tr> <td>3</td> <td>0008<sub>H</sub></td> <td>0 = Horizontal scroll bar hidden      1 = Horizontal scroll bar visible</td> </tr> <tr> <td>4</td> <td>0010<sub>H</sub></td> <td>0 = Vertical scroll bar hidden      1 = Vertical scroll bar visible</td> </tr> <tr> <td>5</td> <td>0020<sub>H</sub></td> <td>0 = Worksheet tab bar hidden      1 = Worksheet tab bar visible</td> </tr> </tbody> </table> | Bits | Mask | Contents | 0 | 0001 <sub>H</sub> | 0 = Window is visible      1 = Window is hidden | 1 | 0002 <sub>H</sub> | 0 = Window is open      1 = Window is minimised | 3 | 0008 <sub>H</sub> | 0 = Horizontal scroll bar hidden      1 = Horizontal scroll bar visible | 4 | 0010 <sub>H</sub> | 0 = Vertical scroll bar hidden      1 = Vertical scroll bar visible | 5 | 0020 <sub>H</sub> | 0 = Worksheet tab bar hidden      1 = Worksheet tab bar visible |
| Bits   | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 0      | 0001 <sub>H</sub> | 0 = Window is visible      1 = Window is hidden                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 1      | 0002 <sub>H</sub> | 0 = Window is open      1 = Window is minimised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 3      | 0008 <sub>H</sub> | 0 = Horizontal scroll bar hidden      1 = Horizontal scroll bar visible                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 4      | 0010 <sub>H</sub> | 0 = Vertical scroll bar hidden      1 = Vertical scroll bar visible                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 5      | 0020 <sub>H</sub> | 0 = Worksheet tab bar hidden      1 = Worksheet tab bar visible                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 10     | 2                 | Index to active (displayed) worksheet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 12     | 2                 | Index of first visible tab in the worksheet tab bar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 14     | 2                 | Number of selected worksheets (highlighted in the worksheet tab bar)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |
| 16     | 2                 | Width of worksheet tab bar (in $\frac{1}{1000}$ of window width). The remaining space is used by the horizontal scrollbar.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |      |          |   |                   |                                                 |   |                   |                                                 |   |                   |                                                                         |   |                   |                                                                     |   |                   |                                                                 |

## 5.110 WINDOW2

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 003E <sub>H</sub> | 023E <sub>H</sub> | 023E <sub>H</sub> | 023E <sub>H</sub> | 023E <sub>H</sub> |

This record contains additional settings for the document window (BIFF2-BIFF4) or for the window of a specific worksheet (BIFF5-BIFF8). It is part of the *Sheet View Settings Block* (→4.5).

### 5.110.1 Contents of the WINDOW2 Record

Record WINDOW2, BIFF2:

| Offset | Size | Contents                                                                      |
|--------|------|-------------------------------------------------------------------------------|
| 0      | 1    | 0 = Show formula results<br>1 = Show formulas                                 |
| 1      | 1    | 0 = Do not show grid lines<br>1 = Show grid lines                             |
| 2      | 1    | 0 = Do not show sheet headers<br>1 = Show sheet headers                       |
| 3      | 1    | 0 = Panes are not frozen<br>1 = Panes are frozen ( <u>f</u> reeze)            |
| 4      | 1    | 0 = Show zero values as empty cells<br>1 = Show zero values                   |
| 5      | 2    | Index to first visible row                                                    |
| 7      | 2    | Index to first visible column                                                 |
| 9      | 1    | 0 = Use manual grid line colour (below)<br>1 = Use automatic grid line colour |
| 10     | 4    | Grid line RGB colour (→2.5.4)                                                 |

Record WINDOW2, BIFF3-BIFF5:

| Offset | Size | Contents                      |
|--------|------|-------------------------------|
| 0      | 2    | Option flags (see below)      |
| 2      | 2    | Index to first visible row    |
| 4      | 2    | Index to first visible column |
| 6      | 4    | Grid line RGB colour (→2.5.4) |

Record WINDOW2, BIFF8:

| Offset | Size | Contents                                                                                             |
|--------|------|------------------------------------------------------------------------------------------------------|
| 0      | 2    | Option flags (see below)                                                                             |
| 2      | 2    | Index to first visible row                                                                           |
| 4      | 2    | Index to first visible column                                                                        |
| 6      | 2    | Colour index of grid line colour (→5.74). Note that in BIFF2-BIFF5 an RGB colour is written instead. |
| 8      | 2    | Not used                                                                                             |
| 10     | 2    | Cached magnification factor in page break preview (in percent); 0 = Default (60%)                    |
| 12     | 2    | Cached magnification factor in normal view (in percent); 0 = Default (100%)                          |
| 14     | 4    | Not used                                                                                             |

In BIFF8 this record stores used magnification factors for page break preview and normal view. These values are used to restore the magnification, when the view is changed. The real magnification of the currently active view is stored in the SCL record (→5.92). The type of the active view is stored in the option flags field (see below).



## 5.110.2 Option Flags

Option flags, BIFF3-BIFF8:

| Bits | Mask              | Contents                                  |                                             |
|------|-------------------|-------------------------------------------|---------------------------------------------|
| 0    | 0001 <sub>H</sub> | 0 = Show formula results                  | 1 = Show formulas                           |
| 1    | 0002 <sub>H</sub> | 0 = Do not show grid lines                | 1 = Show grid lines                         |
| 2    | 0004 <sub>H</sub> | 0 = Do not show sheet headers             | 1 = Show sheet headers                      |
| 3    | 0008 <sub>H</sub> | 0 = Panes are not frozen                  | 1 = Panes are frozen ( <u>f</u> reeze)      |
| 4    | 0010 <sub>H</sub> | 0 = Show zero values as empty cells       | 1 = Show zero values                        |
| 5    | 0020 <sub>H</sub> | 0 = Manual grid line colour               | 1 = Automatic grid line colour              |
| 6    | 0040 <sub>H</sub> | 0 = Columns from left to right            | 1 = Columns from right to left              |
| 7    | 0080 <sub>H</sub> | 0 = Do not show outline symbols           | 1 = Show outline symbols                    |
| 8    | 0100 <sub>H</sub> | 0 = Keep splits if pane freeze is removed | 1 = Remove splits if pane freeze is removed |
| 9    | 0200 <sub>H</sub> | 0 = Sheet not selected                    | 1 = Sheet selected (BIFF5-BIFF8)            |
| 10   | 0400 <sub>H</sub> | 0 = Sheet not active                      | 1 = Sheet active (BIFF5-BIFF8)              |
| 11   | 0800 <sub>H</sub> | 0 = Show in normal view                   | 1 = Show in page break preview (BIFF8)      |

The freeze flag specifies, if a following PANE record (→5.75) describes unfrozen or frozen panes.

## 5.111 WINDOWPROTECT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0019 <sub>H</sub> | 0019 <sub>H</sub> | 0019 <sub>H</sub> | 0019 <sub>H</sub> | 0019 <sub>H</sub> |

This record is part of the worksheet/workbook protection (→4.18). It determines whether the window configuration of this document is protected. Window protection is not active, if this record is omitted.

Record WINDOWPROTECT, BIFF2-BIFF8:

| Offset | Size | Contents                                                         |
|--------|------|------------------------------------------------------------------|
| 0      | 2    | 0 = Window settings not protected; 1 = Window settings protected |

## 5.112 WRITEACCESS

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 005C <sub>H</sub> | 005C <sub>H</sub> | 005C <sub>H</sub> | 005C <sub>H</sub> |

This record is part of the *File Protection Block* (→4.19). It contains the name of the user that has saved the file. The user name is always stored as an equal-sized string. All unused characters after the name are filled with space characters. It is not required to write the mentioned string length. Every other length will be accepted too.

Record WRITEACCESS, BIFF3-BIFF4:

| Offset | Size | Contents                                                            |
|--------|------|---------------------------------------------------------------------|
| 0      | 32   | User name, byte string, 8-bit string length, 31 characters (→2.5.2) |

Record WRITEACCESS, BIFF5:

| Offset | Size | Contents                                                            |
|--------|------|---------------------------------------------------------------------|
| 0      | 54   | User name, byte string, 8-bit string length, 53 characters (→2.5.2) |

Record WRITEACCESS, BIFF8:

| Offset | Size | Contents                                                                 |
|--------|------|--------------------------------------------------------------------------|
| 0      | var. | User name, Unicode string, 16-bit string length, 109 characters (→2.5.3) |

## 5.113 WRITEPROT

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0086 <sub>H</sub> | 0086 <sub>H</sub> | 0086 <sub>H</sub> | 0086 <sub>H</sub> |

This record is part of the *File Protection Block* (→4.19). It does not contain any data. If present it specifies that the file is write protected. The write protection password is stored in the FILESHARING record (→5.44).

## 5.114 XCT – CRN Count

| BIFF2 | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------|-------------------|-------------------|-------------------|-------------------|
| —     | 0059 <sub>H</sub> | 0059 <sub>H</sub> | 0059 <sub>H</sub> | 0059 <sub>H</sub> |

This record stores the number of immediately following CRN records. These records are used to store the cell contents of external references. See →4.10 for details about external references.

Record XCT, BIFF3-BIFF5:

| Offset | Size | Contents                                |
|--------|------|-----------------------------------------|
| 0      | 2    | Number of following CRN records (→5.23) |

Record XCT, BIFF8:

| Offset | Size | Contents                                                           |
|--------|------|--------------------------------------------------------------------|
| 0      | 2    | Number of following CRN records (→5.23)                            |
| 2      | 2    | Index into sheet table of the involved EXTERNALBOOK record (→5.38) |

## 5.115 XF – Extended Format

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0043 <sub>H</sub> | 0243 <sub>H</sub> | 0443 <sub>H</sub> | 00E0 <sub>H</sub> | 00E0 <sub>H</sub> |

This record contains formatting information for cells, rows, columns or styles.

### 5.115.1 XF Substructures

From BIFF3 on, some of the elements occur unchanged in every BIFF version. These elements are described in the following using a specific name for each element. In the description of the record structure the names are used to reference to these tables.

#### • XF\_TYPE\_PROT – XF Type and Cell Protection (3 Bits), BIFF3-BIFF8

These 3 bits are part of a specific data byte.

| Bit | Mask            | Contents                  |
|-----|-----------------|---------------------------|
| 0   | 01 <sub>H</sub> | 1 = Cell is locked        |
| 1   | 02 <sub>H</sub> | 1 = Formula is hidden     |
| 2   | 04 <sub>H</sub> | 0 = Cell XF; 1 = Style XF |

#### • XF\_USED\_ATTRIB – Attributes Used from Parent Style XF (6 Bits), BIFF3-BIFF8

Each bit describes the validity of a specific group of attributes. In cell XFs a cleared bit means the attributes of the parent style XF are used (but only if the attributes are valid there), a set bit means the attributes of this XF are used. In style XFs a cleared bit means the attribute setting is valid, a set bit means the attribute should be ignored.

| Bit | Mask            | Contents                                                                                                      |
|-----|-----------------|---------------------------------------------------------------------------------------------------------------|
| 0   | 01 <sub>H</sub> | Flag for number format                                                                                        |
| 1   | 02 <sub>H</sub> | Flag for font                                                                                                 |
| 2   | 04 <sub>H</sub> | Flag for horizontal and vertical alignment, text wrap, indentation, orientation, rotation, and text direction |
| 3   | 08 <sub>H</sub> | Flag for border lines                                                                                         |
| 4   | 10 <sub>H</sub> | Flag for background area style                                                                                |
| 5   | 20 <sub>H</sub> | Flag for cell protection (cell locked and formula hidden)                                                     |

#### • XF\_HOR\_ALIGN – Horizontal Alignment (3 Bits), BIFF2-BIFF8

The horizontal alignment consists of 3 bits and is part of a specific data byte.

| Value | Horizontal alignment                                                   |
|-------|------------------------------------------------------------------------|
| 0     | General                                                                |
| 1     | Left                                                                   |
| 2     | Centred                                                                |
| 3     | Right                                                                  |
| 4     | Filled                                                                 |
| 5     | Justified (BIFF4-BIFF8)                                                |
| 6     | Centred across selection (BIFF4-BIFF8)                                 |
| 7     | Distributed (BIFF8, available in Excel 10.0 (Excel XP) and later only) |

• **XF\_VERT\_ALIGN – Vertical Alignment (2 or 3 Bits), BIFF4-BIFF8**

The vertical alignment consists of 2 bits (BIFF4) or 3 bits (BIFF5-BIFF8) and is part of a specific data byte. Vertical alignment is not available in BIFF2 and BIFF3.

| Value | Vertical alignment                                                     |
|-------|------------------------------------------------------------------------|
| 0     | Top                                                                    |
| 1     | Centred                                                                |
| 2     | Bottom                                                                 |
| 3     | Justified (BIFF5-BIFF8)                                                |
| 4     | Distributed (BIFF8, available in Excel 10.0 (Excel XP) and later only) |

• **XF\_ORIENTATION – Text Orientation (2 Bits), BIFF4-BIFF5**

In the BIFF versions BIFF4-BIFF5, text can be rotated in steps of 90 degrees or stacked. The orientation mode consists of 2 bits and is part of a specific data byte. In BIFF8 a rotation angle occurs instead of these flags.

| Value | Text orientation                                   |
|-------|----------------------------------------------------|
| 0     | Not rotated                                        |
| 1     | Letters are stacked top-to-bottom, but not rotated |
| 2     | Text is rotated 90 degrees counterclockwise        |
| 3     | Text is rotated 90 degrees clockwise               |

• **XF\_ROTATION – Text Rotation Angle (1 Byte), BIFF8**

| Value  | Text rotation                                      |
|--------|----------------------------------------------------|
| 0      | Not rotated                                        |
| 1-90   | 1 to 90 degrees counterclockwise                   |
| 91-180 | 1 to 90 degrees clockwise                          |
| 255    | Letters are stacked top-to-bottom, but not rotated |

• **XF\_BORDER\_34 – Cell Border Style (4 Bytes), BIFF3-BIFF4**

Cell borders contain a line style and a line colour for each line of the border.

| Bit   | Mask                  | Contents                                    |
|-------|-----------------------|---------------------------------------------|
| 2-0   | 00000007 <sub>H</sub> | Top line style (→2.5.11)                    |
| 7-3   | 000000F8 <sub>H</sub> | Colour index (→5.74) for top line colour    |
| 10-8  | 00000700 <sub>H</sub> | Left line style (→2.5.11)                   |
| 15-11 | 0000F800 <sub>H</sub> | Colour index (→5.74) for left line colour   |
| 18-16 | 00070000 <sub>H</sub> | Bottom line style (→2.5.11)                 |
| 23-19 | 00F80000 <sub>H</sub> | Colour index (→5.74) for bottom line colour |
| 26-24 | 07000000 <sub>H</sub> | Right line style (→2.5.11)                  |
| 31-27 | F8000000 <sub>H</sub> | Colour index (→5.74) for right line colour  |

### • XF\_AREA\_34 – Cell Background Area Style (2 Bytes), BIFF3-BIFF4

A cell background area style contains an area pattern and a foreground and background colour.

| Bit   | Mask              | Contents                                    |
|-------|-------------------|---------------------------------------------|
| 5-0   | 003F <sub>H</sub> | Fill pattern (→2.5.12)                      |
| 10-6  | 07C0 <sub>H</sub> | Colour index (→5.74) for pattern colour     |
| 15-11 | F800 <sub>H</sub> | Colour index (→5.74) for pattern background |

## 5.115.2 XF Record Contents

Record XF, BIFF2:

| Offset | Size            | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
|--------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|-----|-----------------|-------------------------------------------------|---|-----------------|--------------------------------|---|-----------------|---------------------------------|---|-----------------|-------------------------------|---|-----------------|----------------------------------|---|-----------------|--------------------------------|
| 0      | 1               | Index to FONT record (→5.45)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 1      | 1               | Not used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 2      | 1               | Number format and cell flags: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>5-0</td> <td>3F<sub>H</sub></td> <td>Index to FORMAT record (→5.49)</td> </tr> <tr> <td>6</td> <td>40<sub>H</sub></td> <td>1 = Cell is locked</td> </tr> <tr> <td>7</td> <td>80<sub>H</sub></td> <td>1 = Formula is hidden</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                   | Bit | Mask | Contents | 5-0 | 3F <sub>H</sub> | Index to FORMAT record (→5.49)                  | 6 | 40 <sub>H</sub> | 1 = Cell is locked             | 7 | 80 <sub>H</sub> | 1 = Formula is hidden           |   |                 |                               |   |                 |                                  |   |                 |                                |
| Bit    | Mask            | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 5-0    | 3F <sub>H</sub> | Index to FORMAT record (→5.49)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 6      | 40 <sub>H</sub> | 1 = Cell is locked                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 7      | 80 <sub>H</sub> | 1 = Formula is hidden                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 3      | 1               | Horizontal alignment, border style, and background: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>2-0</td> <td>07<sub>H</sub></td> <td>XF_HOR_ALIGN – Horizontal alignment (see above)</td> </tr> <tr> <td>3</td> <td>08<sub>H</sub></td> <td>1 = Cell has left black border</td> </tr> <tr> <td>4</td> <td>10<sub>H</sub></td> <td>1 = Cell has right black border</td> </tr> <tr> <td>5</td> <td>20<sub>H</sub></td> <td>1 = Cell has top black border</td> </tr> <tr> <td>6</td> <td>40<sub>H</sub></td> <td>1 = Cell has bottom black border</td> </tr> <tr> <td>7</td> <td>80<sub>H</sub></td> <td>1 = Cell has shaded background</td> </tr> </tbody> </table> | Bit | Mask | Contents | 2-0 | 07 <sub>H</sub> | XF_HOR_ALIGN – Horizontal alignment (see above) | 3 | 08 <sub>H</sub> | 1 = Cell has left black border | 4 | 10 <sub>H</sub> | 1 = Cell has right black border | 5 | 20 <sub>H</sub> | 1 = Cell has top black border | 6 | 40 <sub>H</sub> | 1 = Cell has bottom black border | 7 | 80 <sub>H</sub> | 1 = Cell has shaded background |
| Bit    | Mask            | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 2-0    | 07 <sub>H</sub> | XF_HOR_ALIGN – Horizontal alignment (see above)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 3      | 08 <sub>H</sub> | 1 = Cell has left black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 4      | 10 <sub>H</sub> | 1 = Cell has right black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 5      | 20 <sub>H</sub> | 1 = Cell has top black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 6      | 40 <sub>H</sub> | 1 = Cell has bottom black border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |
| 7      | 80 <sub>H</sub> | 1 = Cell has shaded background                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |      |          |     |                 |                                                 |   |                 |                                |   |                 |                                 |   |                 |                               |   |                 |                                  |   |                 |                                |

Record XF, BIFF3:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
|--------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|-----|-------------------|-------------------------------------------------|---|-------------------|-------------------------------------|------|-------------------|-----------------------------------------------------------------|
| 0      | 1                 | Index to FONT record (→5.45)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 1      | 1                 | Index to FORMAT record (→5.49)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 2      | 1                 | XF_TYPE_PROT – XF type and cell protection (see above)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 3      | 1                 | Flags for used attribute groups: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>7-2</td> <td>FC<sub>H</sub></td> <td>XF_USED_ATTRIB – Used attributes (see above)</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                | Bit | Mask | Contents | 7-2 | FC <sub>H</sub>   | XF_USED_ATTRIB – Used attributes (see above)    |   |                   |                                     |      |                   |                                                                 |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 7-2    | FC <sub>H</sub>   | XF_USED_ATTRIB – Used attributes (see above)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 4      | 2                 | Horizontal alignment, text break, parent style XF: <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>2-0</td> <td>0007<sub>H</sub></td> <td>XF_HOR_ALIGN – Horizontal alignment (see above)</td> </tr> <tr> <td>3</td> <td>0008<sub>H</sub></td> <td>1 = Text is wrapped at right border</td> </tr> <tr> <td>15-4</td> <td>FFF0<sub>H</sub></td> <td>Index to parent style XF (always FFF<sub>H</sub> in style XFs)</td> </tr> </tbody> </table> | Bit | Mask | Contents | 2-0 | 0007 <sub>H</sub> | XF_HOR_ALIGN – Horizontal alignment (see above) | 3 | 0008 <sub>H</sub> | 1 = Text is wrapped at right border | 15-4 | FFF0 <sub>H</sub> | Index to parent style XF (always FFF <sub>H</sub> in style XFs) |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 2-0    | 0007 <sub>H</sub> | XF_HOR_ALIGN – Horizontal alignment (see above)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 3      | 0008 <sub>H</sub> | 1 = Text is wrapped at right border                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 15-4   | FFF0 <sub>H</sub> | Index to parent style XF (always FFF <sub>H</sub> in style XFs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 6      | 2                 | XF_AREA_34 – Cell background area (see above)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |
| 8      | 4                 | XF_BORDER_34 – Cell border lines (see above)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |      |          |     |                   |                                                 |   |                   |                                     |      |                   |                                                                 |

## Record XF, BIFF4:

| Offset | Size | Contents                                                                                  |
|--------|------|-------------------------------------------------------------------------------------------|
| 0      | 1    | Index to FONT record (→5.45)                                                              |
| 1      | 1    | Index to FORMAT record (→5.49)                                                            |
| 2      | 2    | XF type, cell protection, and parent style XF:                                            |
|        |      | <b>Bit</b> <b>Mask</b> <b>Contents</b>                                                    |
|        |      | 2-0    0007 <sub>H</sub> XF_TYPE_PROT – XF type, cell protection (see above)              |
|        |      | 15-4    FFF0 <sub>H</sub> Index to parent style XF (always FFF <sub>H</sub> in style XFs) |
| 4      | 1    | Alignment, text break, and text orientation:                                              |
|        |      | <b>Bit</b> <b>Mask</b> <b>Contents</b>                                                    |
|        |      | 2-0    07 <sub>H</sub> XF_HOR_ALIGN – Horizontal alignment (see above)                    |
|        |      | 3    08 <sub>H</sub> 1 = Text is wrapped at right border                                  |
|        |      | 5-4    30 <sub>H</sub> XF_VERT_ALIGN – Vertical alignment (see above)                     |
|        |      | 7-6    C0 <sub>H</sub> XF_ORIENTATION – Text orientation (see above)                      |
| 5      | 1    | Flags for used attribute groups:                                                          |
|        |      | <b>Bit</b> <b>Mask</b> <b>Contents</b>                                                    |
|        |      | 7-2    FC <sub>H</sub> XF_USED_ATTRIB – Used attributes (see above)                       |
| 6      | 2    | XF_AREA_34 – Cell background area (see above)                                             |
| 8      | 4    | XF_BORDER_34 – Cell border lines (see above)                                              |

Record XF, BIFF5:

| Offset | Size | Contents                                                                                    |
|--------|------|---------------------------------------------------------------------------------------------|
| 0      | 2    | Index to FONT record (→5.45)                                                                |
| 2      | 2    | Index to FORMAT record (→5.49)                                                              |
| 4      | 2    | XF type, cell protection, and parent style XF:                                              |
|        |      | <b>Bit      Mask      Contents</b>                                                          |
|        |      | 2-0      0007 <sub>H</sub> XF_TYPE_PROT – XF type, cell protection (see above)              |
|        |      | 15-4      FFF0 <sub>H</sub> Index to parent style XF (always FFF <sub>H</sub> in style XFs) |
| 6      | 1    | Alignment and text break:                                                                   |
|        |      | <b>Bit      Mask      Contents</b>                                                          |
|        |      | 2-0      07 <sub>H</sub> XF_HOR_ALIGN – Horizontal alignment (see above)                    |
|        |      | 3      08 <sub>H</sub> 1 = Text is wrapped at right border                                  |
|        |      | 6-4      70 <sub>H</sub> XF_VERT_ALIGN – Vertical alignment (see above)                     |
| 7      | 1    | Text orientation and flags for used attribute groups:                                       |
|        |      | <b>Bit      Mask      Contents</b>                                                          |
|        |      | 1-0      03 <sub>H</sub> XF_ORIENTATION – Text orientation (see above)                      |
|        |      | 7-2      FC <sub>H</sub> XF_USED_ATTRIB – Used attributes (see above)                       |
| 8      | 4    | Cell border lines and background area:                                                      |
|        |      | <b>Bit      Mask      Contents</b>                                                          |
|        |      | 6-0      0000007F <sub>H</sub> Colour index (→5.74) for pattern colour                      |
|        |      | 13-7      00003F80 <sub>H</sub> Colour index (→5.74) for pattern background                 |
|        |      | 21-16      003F0000 <sub>H</sub> Fill pattern (→2.5.12)                                     |
|        |      | 24-22      01C00000 <sub>H</sub> Bottom line style (→2.5.11)                                |
|        |      | 31-25      FE000000 <sub>H</sub> Colour index (→5.74) for bottom line colour                |
| 12     | 4    |                                                                                             |
|        |      | <b>Bit      Mask      Contents</b>                                                          |
|        |      | 2-0      00000007 <sub>H</sub> Top line style (→2.5.11)                                     |
|        |      | 5-3      00000038 <sub>H</sub> Left line style (→2.5.11)                                    |
|        |      | 8-6      000001C0 <sub>H</sub> Right line style (→2.5.11)                                   |
|        |      | 15-9      0000FE00 <sub>H</sub> Colour index (→5.74) for top line colour                    |
|        |      | 22-16      007F0000 <sub>H</sub> Colour index (→5.74) for left line colour                  |
|        |      | 29-23      3F800000 <sub>H</sub> Colour index (→5.74) for right line colour                 |

Record XF, BIFF8:

| Offset | Size | Contents                                                                                                             |
|--------|------|----------------------------------------------------------------------------------------------------------------------|
| 0      | 2    | Index to FONT record (→5.45)                                                                                         |
| 2      | 2    | Index to FORMAT record (→5.49)                                                                                       |
| 4      | 2    | XF type, cell protection, and parent style XF:                                                                       |
|        |      | <b>Bit Mask Contents</b>                                                                                             |
|        |      | 2-0 0007 <sub>H</sub> XF_TYPE_PROT – XF type, cell protection (see above)                                            |
|        |      | 15-4 FFF0 <sub>H</sub> Index to parent style XF (always FFF <sub>H</sub> in style XFs)                               |
| 6      | 1    | Alignment and text break:                                                                                            |
|        |      | <b>Bit Mask Contents</b>                                                                                             |
|        |      | 2-0 07 <sub>H</sub> XF_HOR_ALIGN – Horizontal alignment (see above)                                                  |
|        |      | 3 08 <sub>H</sub> 1 = Text is wrapped at right border                                                                |
|        |      | 6-4 70 <sub>H</sub> XF_VERT_ALIGN – Vertical alignment (see above)                                                   |
|        |      | 7 80 <sub>H</sub> 1 = Justify last line in justified or distributed text                                             |
| 7      | 1    | XF_ROTATION: Text rotation angle (see above)                                                                         |
| 8      | 1    | Indentation, shrink to cell size, and text direction:                                                                |
|        |      | <b>Bit Mask Contents</b>                                                                                             |
|        |      | 3-0 0F <sub>H</sub> Indent level                                                                                     |
|        |      | 4 10 <sub>H</sub> 1 = Shrink content to fit into cell                                                                |
|        |      | 7-6 C0 <sub>H</sub> Text direction:<br>0 = According to context <sup>35</sup> ; 1 = Left-to-right; 2 = Right-to-left |
| 9      | 1    | Flags for used attribute groups:                                                                                     |
|        |      | <b>Bit Mask Contents</b>                                                                                             |
|        |      | 7-2 FC <sub>H</sub> XF_USED_ATTRIB – Used attributes (see above)                                                     |
| 10     | 4    | Cell border lines and background area:                                                                               |
|        |      | <b>Bit Mask Contents</b>                                                                                             |
|        |      | 3-0 000000F <sub>H</sub> Left line style (→2.5.11)                                                                   |
|        |      | 7-4 00000F0 <sub>H</sub> Right line style (→2.5.11)                                                                  |
|        |      | 11-8 0000F00 <sub>H</sub> Top line style (→2.5.11)                                                                   |
|        |      | 15-12 0000F000 <sub>H</sub> Bottom line style (→2.5.11)                                                              |
|        |      | 22-16 007F0000 <sub>H</sub> Colour index (→5.74) for left line colour                                                |
|        |      | 29-23 3F800000 <sub>H</sub> Colour index (→5.74) for right line colour                                               |
|        |      | 30 40000000 <sub>H</sub> 1 = Diagonal line from top left to right bottom                                             |
|        |      | 31 80000000 <sub>H</sub> 1 = Diagonal line from bottom left to right top                                             |
| 14     | 4    | <b>Bit Mask Contents</b>                                                                                             |
|        |      | 6-0 0000007F <sub>H</sub> Colour index (→5.74) for top line colour                                                   |
|        |      | 13-7 00003F80 <sub>H</sub> Colour index (→5.74) for bottom line colour                                               |
|        |      | 20-14 001FC000 <sub>H</sub> Colour index (→5.74) for diagonal line colour                                            |
|        |      | 24-21 01E00000 <sub>H</sub> Diagonal line style (→2.5.11)                                                            |
|        |      | 31-26 FC000000 <sub>H</sub> Fill pattern (→2.5.12)                                                                   |
| 18     | 2    | <b>Bit Mask Contents</b>                                                                                             |
|        |      | 6-0 007F <sub>H</sub> Colour index (→5.74) for pattern colour                                                        |
|        |      | 13-7 3F80 <sub>H</sub> Colour index (→5.74) for pattern background                                                   |

<sup>35</sup> Left-to-right, if the text starts with a character from a left-to-right script, or right-to-left, if the text starts with a character from a right-to-left script.



## 6 Drawing Objects

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# 7 Charts

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## 7.1 Document Integration

This chapter describes how a chart is integrated into a spreadsheet document.

### 7.1.1 Chart Document (BIFF2-BIFF4)

**Definition: Chart document**

A BIFF2-BIFF4 chart document is a special type of a worksheet document (→2.1.2) that contains exactly one chart. The default file extension of chart documents is “XLC”.

The source data may be embedded in the chart or linked to another worksheet document.

**Definition: Chart Stream**

The entire chart document consists of the *Chart Stream* (similar to the *Worksheet Stream* in a regular worksheet document, →2.3.3, →4.1.1). The BOF record of the stream contains the type identifier of a chart stream.

Records in the *Chart Stream*, BIFF2-BIFF4:

|       |                     |
|-------|---------------------|
| • BOF | Type = chart (→5.8) |
|       | Chart records       |
| • EOF | →5.37               |

## 7.1.2 Chart Sheet in Workbook Document (BIFF5-BIFF8)

Besides other sheets, a workbook document (→2.1.3) may contain several chart sheets.

**Definition: Chart Substream**

Each chart sheet is stored in a *Chart Substream*. This is a special type of a *Sheet Substream* (→2.3.4, →4.1.2) with a BOF record containing the type identifier for a chart.

Records in the *Workbook Stream* (→2.3.3) containing a *Chart Substream*, BIFF5-BIFF8:

|       |                                                             |
|-------|-------------------------------------------------------------|
| • BOF | Type = workbook globals (→5.8)                              |
|       | Global workbook records                                     |
| • EOF | →5.37                                                       |
| ○○    | Other <i>Sheet Substreams</i> (or <i>Chart Substreams</i> ) |
| • BOF | Type = chart (→5.8)                                         |
|       | Chart records                                               |
| • EOF | →5.37                                                       |
| ○○    | Other <i>Sheet Substreams</i> (or <i>Chart Substreams</i> ) |

BIFF2-BIFF4 *Chart Streams* and BIFF5-BIFF8 *Chart Substreams* are nearly identical in their internal structure.

## 7.1.3 Embedded Chart Object (BIFF3-BIFF8)

From BIFF3 on, all types of sheets (including chart sheets) may contain embedded chart objects. The chart is described by a *Chart Substream* (→7.1.2) which is embedded into another *Sheet Substream* or *Worksheet Stream* and follows an OBJ record.

Records in the *Worksheet Stream* containing a *Chart Substream* of an embedded chart object, BIFF3-BIFF4:

|       |                                                               |
|-------|---------------------------------------------------------------|
| • BOF | Type = sheet, dialogue, chart, macro sheet (→5.8)             |
|       | Sheet records                                                 |
| • OBJ | Object description for the chart                              |
| • BOF | Type = chart (→5.8)                                           |
|       | Chart records                                                 |
| • EOF | End of the <i>Chart Substream</i> of the chart object (→5.37) |
|       | Sheet records                                                 |
| • EOF | End of the <i>Sheet Substream</i> (→5.37)                     |

Records in the *Workbook Stream* containing a *Chart Substream* of an embedded chart object, BIFF5-BIFF8:

|       |                                                               |
|-------|---------------------------------------------------------------|
| •     | <i>Workbook Globals Substream</i>                             |
| ○○    | <i>Other Sheet Substreams (or Chart Substreams)</i>           |
| • BOF | Type = sheet, dialogue, chart, macro sheet (→5.8)             |
|       | Sheet records                                                 |
| • OBJ | Object description for the chart                              |
| • BOF | Type = chart (→5.8)                                           |
|       | Chart records                                                 |
| • EOF | End of the <i>Chart Substream</i> of the chart object (→5.37) |
|       | Sheet records                                                 |
| • EOF | End of the <i>Sheet Substream</i> (→5.37)                     |
| ○○    | <i>Other Sheet Substreams (or Chart Substreams)</i>           |

In BIFF5-BIFF8, simple drawing objects may be embedded into chart objects. In that case, the records describing the drawing objects are embedded into the *Chart Substream* of the chart object. It is not possible to embed charts and OLE objects into chart objects (this includes ActiveX form controls).

## 7.2 General Chart Structure

### 7.2.1 Chart Stream or Substream

All objects a chart is made of are organised in a strict hierarchy which is also reflected in the file format. The *Chart (Sub)stream* consists of page settings (similar to a regular *Sheet Substream*) followed by the chart description. Each chart contains a list of data series information (a list of values for the data points, and formatting information for the series and the data points), and additional information about all axes, series groupings, chart type, legend, data table, and so on.

Structure of the *Chart Substream*, BIFF5-BIFF8:

|   |                                      |                                     |
|---|--------------------------------------|-------------------------------------|
| • | BOF                                  | Type = chart (→5.8)                 |
| ○ | <i>Page Settings Block</i>           | →4.4                                |
| ○ | <i>Worksheet Protection Block</i>    | →4.18 (without SCENPROTECT record)  |
| • | <i>Global Chart Block</i>            | →7.2.3                              |
| • | DIMENSION                            | →5.35                               |
| • | <i>Worksheet View Settings Block</i> | →4.5 (WINDOW2 and SCL records only) |
| • | EOF                                  | →5.37                               |

### 7.2.2 Chart Record Block

The chart stream contains blocks of records describing specific details of the chart. All record blocks are embedded into other record blocks up to and including the *Global Chart Block* (→7.2.3) which represents the entire chart and is stored in the *Chart (Sub)stream* (→7.2.1).

**Definition: Chart record block**

A chart record block is a group of records in the *Chart (Sub)stream* that describes a specific object or other specific data in the chart. A block consists of one or more header records (in a fixed order) and the inner block records which are enclosed into special block-start and block-end records. A chart record block may contain other embedded chart record blocks.

Structure of a chart record block:

|    |                                            |
|----|--------------------------------------------|
| •• | Block header record(s)                     |
| •  | CHBEGIN Begin of chart record block (→7.8) |
| ○  | Embedded block records                     |
| •  | CHEND End of chart record block (→7.9)     |

It is possible to have an empty block that consists of the header records only, or that consists of the header records followed by an empty pair of CHBEGIN and CHEND records.

Chart record blocks are named according to their (first) header record.

Example: The chart record block that describes a text object is led by a CHTEXT record. Therefore the chart record block is called “*CHTEXT Block*”.

### 7.2.3 Global Chart Block

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## 7.3 Common Record Blocks

### 7.3.1 CHPICFORMAT Block (BIFF5)

The *CHPICFORMAT Block* describes a bitmap texture used to fill the area of a chart object.

Structure of the *CHPICFORMAT Block*, BIFF5:

|   |             |              |
|---|-------------|--------------|
| • | CHPICFORMAT |              |
| ○ | •           | CHBEGIN →7.8 |
|   | •           | IMDATA       |
|   | •           | CHEND →7.9   |

### 7.3.2 CHESCHERFORMAT Block (BIFF8)

The *CHESCHERFORMAT Block* describes a complex area format (colour gradients with and without transparence, hatches, or bitmap textures).

Structure of the *CHESCHERFORMAT Block*, BIFF8:

|   |                |              |
|---|----------------|--------------|
| • | CHESCHERFORMAT |              |
| ○ | •              | CHBEGIN →7.8 |
|   | •              | CHPICFORMAT  |
|   | •              | CHEND →7.9   |

### 7.3.3 CHFRAME Block

The *CHFRAME Block* describes the border and area formatting of a frame. A frame is a rectangular object in the chart, for instance a text object, the legend, or even the chart itself. The *CHFRAME Block* does not include positioning information for the frame.

Structure of the *CHFRAME Block*:

|   |         |                             |                    |
|---|---------|-----------------------------|--------------------|
| • | CHFRAME | →7.10                       |                    |
| ○ | •       | CHBEGIN →7.8                |                    |
|   | ○       | CHLINEFORMAT →7.11          |                    |
|   | ○       | CHAREAFORMAT →7.6           |                    |
|   | ○       | <i>CHPICFORMAT Block</i>    | BIFF5 only, →7.3.1 |
|   | ○       | <i>CHESCHERFORMAT Block</i> | BIFF8 only, →7.3.2 |
|   | •       | CHEND                       | →7.9               |

### 7.3.4 CHSOURCELINK Block

The *CHSOURCELINK Block* contains the link to source data in a sheet. It is used to specify the source data for data series (values, category names, series title, bubble sizes), to specify a fixed string for a text box (chart title, axis titles), or to link such a text box to a cell in the document.

#### • Linked Cell Range or Cell Range List

Structure of the *CHSOURCELINK Block* for linked ranges:

|   |              |                                 |
|---|--------------|---------------------------------|
| • | CHSOURCELINK | →7.12                           |
| ○ | •            | CHBEGIN (BIFF3-BIFF4 only) →7.8 |
|   | ••           | CHMULTILINK (BIFF3-BIFF4 only)  |
|   | •            | CHEND (BIFF3-BIFF4 only) →7.9   |

#### • Text Box or Series Title

If this block is used for a text box or series title, the CHSTRING record contains the fixed string data, if not linked, or the last received string data from the link. The block does *not* contain CHBEGIN and CHEND records. If there is no text, the CHSTRING record will be omitted.

Structure of the *CHSOURCELINK Block* for a fixed text or a link to a single text cell:

|   |              |       |
|---|--------------|-------|
| • | CHSOURCELINK | →7.12 |
| ○ | CHSTRING     | →7.13 |

### 7.3.5 CHTEXT Block

The *CHTEXT Block* describes position, formatting, and contents of a text box in the chart, for instance the chart title, axis titles, the legend, or data point labels.

Structure of the *CHTEXT Block*:

|   |                           |        |
|---|---------------------------|--------|
| • | CHTEXT                    |        |
| • | CHBEGIN                   | →7.8   |
| ○ | CHPOS                     |        |
| ○ | CHFONT                    |        |
| ○ | CHFORMATRUNS              |        |
| ○ | <i>CHSOURCELINK Block</i> | →7.3.4 |
| ○ | <i>CHFRAME Block</i>      | →7.3.3 |
| ○ | CHOBJECTLINK              |        |
| • | CHEND                     | →7.9   |



### 7.3.6 CHDEFAULTTEXT Block

The *CHDEFAULTTEXT Block* defines default formatting attributes for specific text boxes in the chart. The formatting information from this block is used if no *CHTEXT Block* exists for a text box. This block contains two header records, the *CHDEFAULTTEXT* record and the *CHTEXT* record.

Structure of the *CHDEFAULTTEXT Block*:

|                       |        |
|-----------------------|--------|
| • CHDEFAULTTEXT       |        |
| • <i>CHTEXT Block</i> | →7.3.5 |

### 7.3.7 CHAXISLINE Block

2do

## 7.4 Record Overview, Ordered by Identifier

| Record ID         | Record name  | Occurs in BIFF versions |   |   |   |   |
|-------------------|--------------|-------------------------|---|---|---|---|
|                   |              | 2                       | 3 | 4 | 5 | 8 |
| 1004 <sub>H</sub> | CHSOURCELINK | •                       | • | • |   |   |
| 1007 <sub>H</sub> | CHLINEFORMAT | •                       | • | • | • | • |
| 100D <sub>H</sub> | CHSTRING     | •                       | • | • | • | • |
| 100A <sub>H</sub> | CHAREAFORMAT | •                       | • | • | • | • |
| 1021 <sub>H</sub> | CHAXISLINE   | •                       | • | • | • | • |
| 1032 <sub>H</sub> | CHFRAME      | •                       | • | • | • | • |
| 1033 <sub>H</sub> | CHBEGIN      | •                       | • | • | • | • |
| 1034 <sub>H</sub> | CHEND        | •                       | • | • | • | • |
| 103B <sub>H</sub> | CHMULTILINK  |                         | • | • |   |   |
| 1051 <sub>H</sub> | CHSOURCELINK |                         |   |   | • | • |

## 7.5 Record Overview, Ordered by Name

| Record ID                           | Record name  | Occurs in BIFF versions |   |   |   |   |
|-------------------------------------|--------------|-------------------------|---|---|---|---|
|                                     |              | 2                       | 3 | 4 | 5 | 8 |
| 100A <sub>H</sub>                   | CHAREAFORMAT | •                       | • | • | • | • |
| 1021 <sub>H</sub>                   | CHAXISLINE   | •                       | • | • | • | • |
| 1033 <sub>H</sub>                   | CHBEGIN      | •                       | • | • | • | • |
| 1034 <sub>H</sub>                   | CHEND        | •                       | • | • | • | • |
| 1032 <sub>H</sub>                   | CHFRAME      | •                       | • | • | • | • |
| 1007 <sub>H</sub>                   | CHLINEFORMAT | •                       | • | • | • | • |
| 103B <sub>H</sub>                   | CHMULTILINK  |                         | • | • |   |   |
| 1004 <sub>H</sub> 1051 <sub>H</sub> | CHSOURCELINK | •                       | • | • | • | • |
| 100D <sub>H</sub>                   | CHSTRING     | •                       | • | • | • | • |

## 7.6 CHAREAFORMAT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 100A <sub>H</sub> | 100A <sub>H</sub> | 100A <sub>H</sub> | 100A <sub>H</sub> | 100A <sub>H</sub> |

This record describes the formatting attributes of the area of a chart object.

Record CHAREAFORMAT, BIFF2-BIFF5:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                                               |     |      |          |   |                   |                                                          |   |                   |                                                       |
|--------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|----------------------------------------------------------|---|-------------------|-------------------------------------------------------|
| 0      | 4                 | RGB colour of the pattern (→2.5.4)                                                                                                                                                                                                                                                                                                                     |     |      |          |   |                   |                                                          |   |                   |                                                       |
| 4      | 4                 | RGB colour of the pattern background (→2.5.4)                                                                                                                                                                                                                                                                                                          |     |      |          |   |                   |                                                          |   |                   |                                                       |
| 8      | 2                 | Fill pattern (→2.5.12)                                                                                                                                                                                                                                                                                                                                 |     |      |          |   |                   |                                                          |   |                   |                                                       |
| 10     | 2                 | Additional flags:                                                                                                                                                                                                                                                                                                                                      |     |      |          |   |                   |                                                          |   |                   |                                                       |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Automatic area format, ignore all other fields above</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Exchange pattern colours for negative data points</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Automatic area format, ignore all other fields above | 1 | 0002 <sub>H</sub> | 1 = Exchange pattern colours for negative data points |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                                               |     |      |          |   |                   |                                                          |   |                   |                                                       |
| 0      | 0001 <sub>H</sub> | 1 = Automatic area format, ignore all other fields above                                                                                                                                                                                                                                                                                               |     |      |          |   |                   |                                                          |   |                   |                                                       |
| 1      | 0002 <sub>H</sub> | 1 = Exchange pattern colours for negative data points                                                                                                                                                                                                                                                                                                  |     |      |          |   |                   |                                                          |   |                   |                                                       |

Record CHAREAFORMAT, BIFF8:

| Offset | Size | Contents                                                                               |
|--------|------|----------------------------------------------------------------------------------------|
| 0      | 4    | Not used (Excel writes RGB colour of the pattern, but ignores it on import)            |
| 4      | 4    | Not used (Excel writes RGB colour of the pattern background, but ignores it on import) |
| 8      | 2    | Fill pattern (→2.5.12)                                                                 |
| 10     | 2    | Additional flags (see above)                                                           |
| 12     | 2    | Colour index (→5.74) for pattern colour                                                |
| 14     | 2    | Colour index (→5.74) for pattern background                                            |

## 7.7 CHAXISLINE

| <b>BIFF2</b>      | <b>BIFF3</b>      | <b>BIFF4</b>      | <b>BIFF5</b>      | <b>BIFF8</b>      |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1021 <sub>H</sub> | 1021 <sub>H</sub> | 1021 <sub>H</sub> | 1021 <sub>H</sub> | 1021 <sub>H</sub> |

2do

## 7.8 CHBEGIN – Begin of Block

| <b>BIFF2</b>      | <b>BIFF3</b>      | <b>BIFF4</b>      | <b>BIFF5</b>      | <b>BIFF8</b>      |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1033 <sub>H</sub> | 1033 <sub>H</sub> | 1033 <sub>H</sub> | 1033 <sub>H</sub> | 1033 <sub>H</sub> |

This record has no content. It indicates the begin of a chart record block (→7.2.2).

## 7.9 CHEND – End of Block

| <b>BIFF2</b>      | <b>BIFF3</b>      | <b>BIFF4</b>      | <b>BIFF5</b>      | <b>BIFF8</b>      |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1034 <sub>H</sub> | 1034 <sub>H</sub> | 1034 <sub>H</sub> | 1034 <sub>H</sub> | 1034 <sub>H</sub> |

This record has no content. It indicates the end of a chart record block (→7.2.2).

## 7.10 CHFRAME

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1032 <sub>H</sub> | 1032 <sub>H</sub> | 1032 <sub>H</sub> | 1032 <sub>H</sub> | 1032 <sub>H</sub> |

This record is the header record of a *CHFRAME Block* (→7.3.3) that describes the border and area formatting of a chart object.

Record CHFRAME, BIFF2-BIFF8:

| Offset | Size              | Contents                                                                                                                                                                                                                                                                                                                          |     |      |          |   |                   |                                            |   |                   |                                                |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|---|-------------------|--------------------------------------------|---|-------------------|------------------------------------------------|
| 0      | 2                 | Frame format: 0 = Standard, 4 = Shadowed                                                                                                                                                                                                                                                                                          |     |      |          |   |                   |                                            |   |                   |                                                |
| 2      | 2                 | Option flags:                                                                                                                                                                                                                                                                                                                     |     |      |          |   |                   |                                            |   |                   |                                                |
|        |                   | <table border="1"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Frame size is calculated automatically</td> </tr> <tr> <td>1</td> <td>0002<sub>H</sub></td> <td>1 = Frame position is calculated automatically</td> </tr> </tbody> </table> | Bit | Mask | Contents | 0 | 0001 <sub>H</sub> | 1 = Frame size is calculated automatically | 1 | 0002 <sub>H</sub> | 1 = Frame position is calculated automatically |
| Bit    | Mask              | Contents                                                                                                                                                                                                                                                                                                                          |     |      |          |   |                   |                                            |   |                   |                                                |
| 0      | 0001 <sub>H</sub> | 1 = Frame size is calculated automatically                                                                                                                                                                                                                                                                                        |     |      |          |   |                   |                                            |   |                   |                                                |
| 1      | 0002 <sub>H</sub> | 1 = Frame position is calculated automatically                                                                                                                                                                                                                                                                                    |     |      |          |   |                   |                                            |   |                   |                                                |



## 7.11 CHLINEFORMAT

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1007 <sub>H</sub> | 1007 <sub>H</sub> | 1007 <sub>H</sub> | 1007 <sub>H</sub> | 1007 <sub>H</sub> |

This record describes the formatting attributes of a line or a border.

Record CHLINEFORMAT, BIFF2-BIFF5:

| Offset                                          | Size                                 | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
|-------------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------|----------------------------|--------------------------------------|----------------------------|----------------------------------------------------------|---------------------------------|--------------------------------------|---------------------------------------------------------------------|--|
| 0                                               | 4                                    | RGB colour of the line (→2.5.4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 4                                               | 2                                    | Line pattern: <table style="margin-left: 20px;"> <tr> <td>0000<sub>H</sub> = Solid</td> <td>0005<sub>H</sub> = None (invisible)</td> </tr> <tr> <td>0001<sub>H</sub> = Dashed</td> <td>0006<sub>H</sub> = 25% grey pattern</td> </tr> <tr> <td>0002<sub>H</sub> = Dotted</td> <td>0007<sub>H</sub> = 50% grey pattern</td> </tr> <tr> <td>0003<sub>H</sub> = Dash-dotted</td> <td>0008<sub>H</sub> = 75% grey pattern</td> </tr> <tr> <td>0004<sub>H</sub> = Dash-dot-dotted</td> <td></td> </tr> </table> | 0000 <sub>H</sub> = Solid                       | 0005 <sub>H</sub> = None (invisible) | 0001 <sub>H</sub> = Dashed | 0006 <sub>H</sub> = 25% grey pattern | 0002 <sub>H</sub> = Dotted | 0007 <sub>H</sub> = 50% grey pattern                     | 0003 <sub>H</sub> = Dash-dotted | 0008 <sub>H</sub> = 75% grey pattern | 0004 <sub>H</sub> = Dash-dot-dotted                                 |  |
| 0000 <sub>H</sub> = Solid                       | 0005 <sub>H</sub> = None (invisible) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0001 <sub>H</sub> = Dashed                      | 0006 <sub>H</sub> = 25% grey pattern |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0002 <sub>H</sub> = Dotted                      | 0007 <sub>H</sub> = 50% grey pattern |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0003 <sub>H</sub> = Dash-dotted                 | 0008 <sub>H</sub> = 75% grey pattern |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0004 <sub>H</sub> = Dash-dot-dotted             |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 6                                               | 2                                    | Line weight: <table style="margin-left: 20px;"> <tr> <td>FFFF<sub>H</sub> = Hairline (BIFF3-BIFF8 only)</td> </tr> <tr> <td>0000<sub>H</sub> = Thin</td> </tr> <tr> <td>0001<sub>H</sub> = Medium</td> </tr> <tr> <td>0002<sub>H</sub> = Thick</td> </tr> </table>                                                                                                                                                                                                                                         | FFFF <sub>H</sub> = Hairline (BIFF3-BIFF8 only) | 0000 <sub>H</sub> = Thin             | 0001 <sub>H</sub> = Medium | 0002 <sub>H</sub> = Thick            |                            |                                                          |                                 |                                      |                                                                     |  |
| FFFF <sub>H</sub> = Hairline (BIFF3-BIFF8 only) |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0000 <sub>H</sub> = Thin                        |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0001 <sub>H</sub> = Medium                      |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0002 <sub>H</sub> = Thick                       |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 8                                               | 2                                    | Additional flags: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Bit</th> <th>Mask</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0001<sub>H</sub></td> <td>1 = Automatic line format, ignore all other fields above</td> </tr> <tr> <td>2</td> <td>0004<sub>H</sub></td> <td>1 = Axis is enabled (only used in <i>CHAXISLINE Block</i>, →7.3.7)</td> </tr> </tbody> </table>                                                                                           | Bit                                             | Mask                                 | Contents                   | 0                                    | 0001 <sub>H</sub>          | 1 = Automatic line format, ignore all other fields above | 2                               | 0004 <sub>H</sub>                    | 1 = Axis is enabled (only used in <i>CHAXISLINE Block</i> , →7.3.7) |  |
| Bit                                             | Mask                                 | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 0                                               | 0001 <sub>H</sub>                    | 1 = Automatic line format, ignore all other fields above                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |
| 2                                               | 0004 <sub>H</sub>                    | 1 = Axis is enabled (only used in <i>CHAXISLINE Block</i> , →7.3.7)                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |                                      |                            |                                      |                            |                                                          |                                 |                                      |                                                                     |  |

Record CHLINEFORMAT, BIFF8:

| Offset | Size | Contents                                                                 |
|--------|------|--------------------------------------------------------------------------|
| 0      | 4    | Not used (Excel writes RGB colour of the line, but ignores it on import) |
| 4      | 2    | Line pattern (see above)                                                 |
| 6      | 2    | Line weight (see above)                                                  |
| 8      | 2    | Additional flags (see above)                                             |
| 10     | 2    | Colour index (→5.74) for line colour                                     |



## 7.13 CHSTRING

| BIFF2             | BIFF3             | BIFF4             | BIFF5             | BIFF8             |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 100D <sub>H</sub> | 100D <sub>H</sub> | 100D <sub>H</sub> | 100D <sub>H</sub> | 100D <sub>H</sub> |

This record contains the category name of a series, or the text for a text box in the chart, for instance the chart title, axis titles, or data point labels. It is always part of a *CHSOURCELINK Block* (→7.3.4).

Record CHSTRING, BIFF2-BIFF5:

| Offset | Size | Contents                                            |
|--------|------|-----------------------------------------------------|
| 0      | 2    | Not used                                            |
| 2      | var. | Non-empty byte string, 8-bit string length (→2.5.2) |

Record CHSTRING, BIFF8:

| Offset | Size | Contents                                               |
|--------|------|--------------------------------------------------------|
| 0      | 2    | Not used                                               |
| 2      | var. | Non-empty Unicode string, 8-bit string length (→2.5.3) |

## 8 PivotTables

---

2do

### 8.0.1 Record Order in a PivotTable Cache Stream

|    |             |
|----|-------------|
| •  | SXDB        |
| ○  | SXDBEX      |
| •• | • SXFIELD   |
|    | ○ SXDBTYPE  |
|    | SXDOUBLE    |
|    | SXBOOLEAN   |
|    | •• SXERROR  |
|    | •• SXSTRING |
|    | SXDATETIME  |
|    | SXEMPTY     |
| •• | SXINDEXLIST |
| •  | EOF         |

### 8.0.2 Record Order in a PivotTable

|    |          |
|----|----------|
| •  | SXVIEW   |
| •• | • SXVD   |
|    | •• SXVI  |
|    | ○ SXVDEX |
| •  | SXIVD    |
| ○  | SXIVD    |
| ○  | SXPI     |
| ○○ | SXDI     |
| •  | SXLI     |
| •  | SXLI     |
| •  | SXEX     |

## 9 Change Tracking

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2do

# 10 Workspace Documents

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2do

## 10.1 Workspace Stream

### 10.1.1 Workbook Stream (BIFF4W)

The whole BIFF4W workbook file consists of the *Workbook Stream*. It contains the global workbook data in the *Workbook Globals Substream*, and a list of worksheets, the *Sheet Substreams*.

The *Workbook Globals Substream* contains common information about the workbook, for instance text encoding, global view settings or a list of all sheet names. Additionally each workbook holds a SHEETSOFFSET record.

The data of the sheets is stored in *Sheet Substreams*, which are embedded in the *Workbook Globals Substream*. Each substream is preceded with a SHEETHDR record which contains the name of the sheet and the size of the following substream. The SHEETSOFFSET record mentioned above contains the stream position of the first SHEETHDR record. Each substream is a complete BIFF4 *Worksheet Stream* (→4.1.1).

Common structure of the *Workspace Stream*, BIFF4W:

|                         |              |                                                            |
|-------------------------|--------------|------------------------------------------------------------|
| •                       | BOF          | Type = workbook globals                                    |
| Global workbook records |              |                                                            |
| •                       | SHEETSOFFSET | Position of the first SHEETHDR record (→10.5)              |
| Global workbook records |              |                                                            |
| ○○                      | •            | SHEETHDR Sheet name, length of following substream (→10.4) |
|                         | •            | BOF Type = sheet, chart, macro sheet                       |
|                         | ••           | Embedded BIFF4 <i>Sheet Substream</i> , →4.1.1             |
|                         | •            | EOF                                                        |
| •                       | EOF          |                                                            |

Structure of the *Worksheet Protection Block*, BIFF4W:

|   |               |                                                     |
|---|---------------|-----------------------------------------------------|
| ○ | PROTECT       | Worksheet contents: 1 = protected (→5.82)           |
| ○ | WINDOWPROTECT | Window settings: 1 = protected (→5.111)             |
| ○ | OBJECTPROTECT | Embedded objects: 1 = protected (→5.72)             |
| ○ | SCENPROTECT   | Scenarios: 1 = protected (→5.91)                    |
| ○ | PASSWORD      | Hash value of the password; 0 = no password (→5.76) |

Structure of the *Workbook Protection Block*, BIFF4W:

|                 |                                                     |
|-----------------|-----------------------------------------------------|
| ○ WINDOWPROTECT | Window settings: 1 = protected (→5.111)             |
| ○ PROTECT       | Workbook contents: 1 = protected (→5.82)            |
| ○ OBJECTPROTECT | Embedded objects: 1 = protected (→5.72)             |
| ○ PASSWORD      | Hash value of the password; 0 = no password (→5.76) |
| ○ PROT4REV      | Shared workbook: 1 = protected                      |
| ○ PROT4REVPASS  | Hash value of the shared password; 0 = no password  |

## 10.2 Overview, Ordered by Record Identifier

| Record ID         | Record name  | Occurs in BIFF versions |    |    |    |    |
|-------------------|--------------|-------------------------|----|----|----|----|
|                   |              | 3W                      | 4W | 5W | 7W | 8W |
| 0085 <sub>H</sub> | SHEET        |                         | •  |    |    |    |
| 008E <sub>H</sub> | SHEETSOFFSET |                         | •  |    |    |    |
| 008F <sub>H</sub> | SHEETHDR     |                         | •  |    |    |    |



## 10.3 INDEX

| BIFF3W | BIFF4W            | BIFF5W | BIFF8W |
|--------|-------------------|--------|--------|
| —      | 020B <sub>H</sub> | ???    | ???    |

2do

This record stores the range of used rows and stream positions of several records of the current sheet. In particular the position of the first DEFINEDNAME record and XF record is stored (BIFF2-BIFF4) and the position of a specific record in each *Row Block* (the first ROW record in BIFF2-BIFF4, and the DBCELL record in BIFF5-BIFF8). This stream position array also contains stream offsets to empty *Row Blocks*, they will point to the next extant *Row Block*.

The number of entries  $\underline{nm}$  in this array can be calculated from the row range given in this record ( $\underline{rf}$  is the index to the first used row,  $\underline{rl}$  is the index to the first row of unused tail of sheet):  $\underline{nm} = (\underline{rl} - \underline{rf} - 1) / 32 + 1$  (using integer division).

For details about *Row Blocks* in a worksheet see →4.7.

Record INDEX, BIFF4W:

| Offset | Size                    | Contents                                                                                                                                                                                                 |
|--------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 4                       | Stream position of the first DEFINEDNAME record (→5.33). The offset is relative to the starting position of the SHEETHDR record (→10.4) of the current sheet.                                            |
| 4      | 2                       | Index to first used row ( $\underline{rf}$ , 0-based)                                                                                                                                                    |
| 6      | 2                       | Index to first row of unused tail of sheet ( $\underline{rl}$ , last used row + 1, 0-based)                                                                                                              |
| 8      | 4                       | Stream position of the first XF record (→5.115). The offset is relative to the starting position of the SHEETHDR record (→10.4) of the current sheet.                                                    |
| 12     | 4 $\cdot\underline{nm}$ | Array of $\underline{nm}$ stream positions to first ROW record (→5.88) of each <i>Row Block</i> . The offsets are relative to the starting position of the SHEETHDR record (→10.4) of the current sheet. |

## 10.4 SHEETHDR

| BIFF3W | BIFF4W            | BIFF5W | BIFF8W |
|--------|-------------------|--------|--------|
| —      | 008F <sub>H</sub> | —      | —      |

This record occurs only in BIFF4W workbook files. It precedes a BIFF4 *Sheet Substream* that describes a single sheet in the BIFF4W workbook. It contains the sheet name and the byte length of the following substream data. Adding this substream length to the stream position of the following BOF record gives the position of the next SHEETHDR record. See →10.1.1 for details about the BIFF4W *Workbook Stream*.

Record SHEETHDR, BIFF4W:

| Offset | Size | Contents                                                     |
|--------|------|--------------------------------------------------------------|
| 0      | 4    | Byte length of the following BIFF4 <i>Sheet Substream</i>    |
| 4      | var. | Name of the sheet (byte string, 8-bit string length, →2.5.2) |

## 10.5 SHEETSOFFSET

| BIFF3W | BIFF4W            | BIFF5W | BIFF8W |
|--------|-------------------|--------|--------|
| —      | 008E <sub>H</sub> | —      | —      |

This record occurs only in BIFF4W workbook files. It is located in the *Workbook Globals Substream* and contains the stream position of the first SHEETHDR record (→10.4). See →10.1.1 for details about the BIFF4W *Workbook Stream*.

Record SHEETSOFFSET, BIFF4W:

| Offset | Size | Contents                                                                             |
|--------|------|--------------------------------------------------------------------------------------|
| 0      | 4    | Absolute stream position of the first SHEETHDR record (from beginning of the stream) |