# Bitmap File Format

## General

| Section | Size | Description |
|---|---|---|
| Header | 14 bytes | General information about the file |
| DIB | 40 bytes | General information about the image |
| Color Table | Variable size | Color table being used in the image |
| Pixel Array | Variable size | Map of pixel colors from the image |

## Details

### *Header Format*

| Byte No. (HEX) | Size | Description |
|---|---|---|
| 0000: | 2 bytes | Bitmap file signature<br>Two characters 'BM' on Windows platform |
| 0002: | 4 bytes | File size |
| 0006: | 2 bytes | Reserved |
| 0008: | 2 bytes | Reserved |
| 000A: | 4 bytes | Pixel Array byte offset |

### *DIB Format*

| Byte No. (HEX) | Size | Description |
|---|---|---|
| 000E: | 4 bytes | DIB size (40 bytes) |
| 0012: | 4 bytes | Image width (pixels) |
| 0016: | 4 bytes | Image height (pixels) |
| 001A: | 2 bytes | Color planes (1). |
| 001C: | 2 bytes | Color depth (1, 4, 8, 16, 24, 32 bits). |
| 001E: | 4 bytes | Compression algorithm<br>(0-No, 1-RLE, 3-Huffman, 4-JPEG, 5-PNG) |
| 0022: | 4 bytes | Pixel Array size |
| 0026: | 4 bytes | Horizontal resolution (pixels/m) |
| 002A: | 4 bytes | Vertical resolution (pixels/m) |
| 002E: | 4 bytes | Number of colors in Color Table |
| 0032: | 4 bytes | Number of important colors in Color Table |

### *Color Table Format*

One dimensional array stores a list of colors used in the image. Each array element is a 4-byte color number.

- For >= 24-bit image: Color Table is omitted.
- For < 24-bit image:

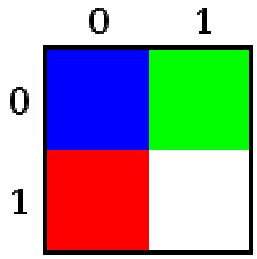
| Byte No. (HEX) | Size | Description |
|---|---|---|
| 0036: | 4 bytes | #1 color in BGRA<br>B-Blue, G-Green, R-Red, A-Alpha |
| 003A: | 4 bytes | #2 color… |
| … | … | … |

### *Pixel Array Format*

Two dimensional array stores a matrix of pixel colors of the image, from bottom to top and from left to right. Size of array element equals to image color depth.
Matrix rows = image height.
Matrix columns = image width + [padding, for columns is a multiple of 4-byte].

| Byte No. (HEX) | Size | Description |
|---|---|---|
| [54+ Color Table Size] | Depends on image color depth | Pixel color #1<br>- For >= 24-bit image: BGR (B-Blue, G-Green, R-Red)<br>- For < 24-bit image: color index from Color Table. |
| | Depends on image color depth | Pixel color #2… |

**Example: 24-bit bitmap file, 2 x 2 pixels**




| Offset | Size | Hex Value | Value | Description |
|---|---|---|---|---|
| BMP Header | | | | |
| 0h | 2 | 42 4D | "BM" | Magic number (unsigned integer 66, 77) |
| 2h | 4 | 46 00 00 00 | 70 Bytes | Size of the BMP file |
| 6h | 2 | 00 00 | Unused | Application specific |
| 8h | 2 | 00 00 | Unused | Application specific |
| Ah | 4 | 36 00 00 00 | 54 bytes | Offset where the pixel array (bitmap data) can be found |
| DIB Header | | | | |
| Eh | 4 | 28 00 00 00 | 40 bytes | Number of bytes in the DIB header (from this point) |
| 12h | 4 | 02 00 00 00 | 2 pixels | Width of the bitmap in pixels |
| 16h | 4 | 02 00 00 00 | 2 pixels | Height of the bitmap in pixels |
| 1Ah | 2 | 01 00 | 1 plane | Number of color planes being used |
| 1Ch | 2 | 18 00 | 24 bits | Number of bits per pixel |
| 1Eh | 4 | 00 00 00 00 | 0 | BI_RGB, no pixel array compression used |
| 22h | 4 | 10 00 00 00 | 16 bytes | Size of the raw data in the pixel array (including padding) |
| 26h | 4 | 13 0B 00 00 | 2,835 pixels/meter | Horizontal resolution of the image |
| 2Ah | 4 | 13 0B 00 00 | 2,835 pixels/meter | Vertical resolution of the image |
| 2Eh | 4 | 00 00 00 00 | 0 colors | Number of colors in the palette |
| 32h | 4 | 00 00 00 00 | 0 important colors | 0 means all colors are important |
| Start of pixel array (bitmap data) | | | | |
| 36h | 3 | 00 00 FF | 0 0 255 | Red, Pixel (0,1) |
| 39h | 3 | FF FF FF | 255 255 255 | White, Pixel (1,1) |
| 3Ch | 2 | 00 00 | 0 0 | Padding for 4 byte alignment (could be a value other than zero) |
| 3Eh | 3 | FF 00 00 | 255 0 0 | Blue, Pixel (0,0) |
| 41h | 3 | 00 FF 00 | 0 255 0 | Green, Pixel (1,0) |
| 44h | 2 | 00 00 | 0 0 | Padding for 4 byte alignment (could be a value other than zero) |