NAME

libtiff − introduction to *libtiff*, a library for reading and writing TIFF files

SYNOPSIS

#include <tiffio.h>

cc file.c **-ltiff**

DESCRIPTION

libtiff is a library for reading and writing data files encoded with the *Tag Image File* format, Revision 6.0 (or revision 5.0 or revision 4.0). This file format is suitable for archiving multi-color and monochromatic image data.

The library supports several compression algorithms, as indicated by the *Compression* field, including: no compression (1), CCITT 1D Huffman compression (2), CCITT Group 3 Facsimile compression (3), CCITT Group 4 Facsimile compression (4), Lempel-Ziv & Welch compression (5), baseline JPEG compression (7), word-aligned 1D Huffman compression (32771), and PackBits compression (32773). In addition, several nonstandard compression algorithms are supported: the 4-bit compression algorithm used by the *ThunderScan* program (32809) (decompression only), NeXT's 2-bit compression algorithm (32766) (decompression only), an experimental LZ-style algorithm known as Deflate (32946), and an experimental CIE LogLuv compression scheme designed for images with high dynamic range (32845 for LogL and 32845 for LogLuv). Directory information may be in either little- or big-endian byte order−byte swapping is automatically done by the library. Data bit ordering may be either Most Significant Bit (MSB) to Least Significant Bit (LSB) or LSB to MSB. Finally, the library does not support files in which the *BitsPerSample*, *Compression*, *MinSampleValue*, or *MaxSampleValue* fields are defined differently on a per-sample basis (in Rev. 6.0 the *Compression* tag is not defined on a per-sample basis, so this is immaterial).

DATA TYPES

The library makes extensive use of C typedefs to promote portability. Two sets of typedefs are used, one for communication with clients of the library and one for internal data structures and parsing of the TIFF format. The following typedefs are exposed to users either through function definitions or through parameters passed through the varargs interfaces.

typedef unsigned short uint16;	16-bit unsigned integer
typedef unsigned <*thing*> uint32;	32-bit unsigned integer
typedef unsigned int ttag_t;	directory tag
typedef uint16 tdir_t;	directory index
typedef uint16 tsample_t;	sample number
typedef uint32 tstrip_t;	strip number
typedef uint32 ttile_t;	tile number
typedef int32 tsize_t;	i/o size in bytes
typedef void* tdata_t;	image data ref
typedef void* thandle_t;	client data handle
typedef int32 toff_t;	file offset

Note that *tstrip_t*, *ttile_t*, and *tsize_t* are constrained to be no more than 32-bit quantities by 32-bit fields they are stored in in the TIFF image. Likewise *tsample_t* is limited by the 16-bit field used to store the *SamplesPerPixel* tag. *tdir_t* constrains the maximum number of IFDs that may appear in an image and may be an arbitrary size (w/o penalty). *ttag_t* must be either int, unsigned int, pointer, or double because the library uses a varargs interface and ANSI C restricts the type of the parameter before an ellipsis to be a promoted type. *toff_t* is defined as int32 because TIFF file offsets are (unsigned) 32-bit quantities. A signed value is used because some interfaces return −1 on error. Finally, note that user-specified data references are passed as opaque handles and only cast at the lowest layers where their type is presumed.

LIST OF ROUTINES

The following routines are part of the library. Consult specific manual pages for details on their operation; on most systems doing ''man function-name'' will work.

Name	*Description*
TIFFCheckpointDirectory	writes the current state of the directory
TIFFCheckTile	very x,y,z,sample is within image
TIFFCIELabToRGBInit	initialize CIE L*a*b* 1976 to RGB conversion state
TIFFCIELabToXYZ	perform CIE L*a*b* 1976 to CIE XYZ conversion
TIFFClientOpen	open a file for reading or writing
TIFFClose	close an open file
TIFFComputeStrip	return strip containing y,sample
TIFFComputeTile	return tile containing x,y,z,sample
TIFFCurrentDirectory	return index of current directory
TIFFCurrentRow	return index of current scanline
TIFFCurrentStrip	return index of current strip
TIFFCurrentTile	return index of current tile
TIFFDataWidth	return the size of TIFF data types
TIFFError	library error handler
TIFFFdOpen	open a file for reading or writing
TIFFFieldDataType	get data type from field information
TIFFFieldName	get field name from field information
TIFFFieldPassCount	get whether to pass a value count to Get/SetField
TIFFFieldReadCount	get number of values to be read from field
TIFFFieldTag	get tag value from field information
TIFFFieldWithName	get field information given field name
TIFFFieldWithTag	get field information given tag
TIFFFieldWriteCount	get number of values to be written to field
TIFFFileName	return name of open file
TIFFFileno	return open file descriptor
TIFFFindCODEC	find standard codec for the specific scheme
TIFFFindField	get field information given tag and data type
TIFFFlush	flush all pending writes
TIFFFlushData	flush pending data writes
TIFFGetBitRevTable	return bit reversal table
TIFFGetField	return tag value in current directory
TIFFGetFieldDefaulted	return tag value in current directory
TIFFGetMode	return open file mode
TIFFGetVersion	return library version string
TIFFIsCODECConfigured	check, whether we have working codec
TIFFIsMSB2LSB	return true if image data is being returned with bit 0 as the most significant bit
TIFFIsTiled	return true if image data is tiled
TIFFIsByteSwapped	return true if image data is byte-swapped
TIFFNumberOfStrips	return number of strips in an image
TIFFNumberOfTiles	return number of tiles in an image
TIFFOpen	open a file for reading or writing
TIFFPrintDirectory	print description of the current directory
TIFFReadBufferSetup	specify i/o buffer for reading
TIFFReadDirectory	read the next directory
TIFFReadEncodedStrip	read and decode a strip of data
TIFFReadEncodedTile	read and decode a tile of data
TIFFReadRawStrip	read a raw strip of data
TIFFReadRawTile	read a raw tile of data
TIFFReadRGBAImage	read an image into a fixed format raster
TIFFReadScanline	read and decode a row of data
TIFFReadTile	read and decode a tile of data
TIFFRegisterCODEC	override standard codec for the specific scheme

TIFFReverseBits	reverse bits in an array of bytes
TIFFRGBAImageBegin	setup decoder state for TIFFRGBAImageGet
TIFFRGBAImageEnd	release TIFFRGBAImage decoder state
TIFFRGBAImageGet	read and decode an image
TIFFRGBAImageOK	is image readable by TIFFRGBAImageGet
TIFFScanlineSize	return size of a scanline
TIFFSetDirectory	set the current directory
TIFFSetSubDirectory	set the current directory
TIFFSetErrorHandler	set error handler function
TIFFSetField	set a tag's value in the current directory
TIFFSetWarningHandler	set warning handler function
TIFFStripSize	returns size of a strip
TIFFRawStripSize	returns the number of bytes in a raw strip
TIFFSwabShort	swap bytes of short
TIFFSwabLong	swap bytes of long
TIFFSwabArrayOfShort	swap bytes of an array of shorts
TIFFSwabArrayOfLong	swap bytes of an array of longs
TIFFTileRowSize	return size of a row in a tile
TIFFTileSize	return size of a tile
TIFFUnRegisterCODEC	unregisters the codec
TIFFVGetField	return tag value in current directory
TIFFVGetFieldDefaulted	return tag value in current directory
TIFFVSetField	set a tag's value in the current directory
TIFFVStripSize	returns the number of bytes in a strip
TIFFWarning	library warning handler
TIFFWriteDirectory	write the current directory
TIFFWriteEncodedStrip	compress and write a strip of data
TIFFWriteEncodedTile	compress and write a tile of data
TIFFWriteRawStrip	write a raw strip of data
TIFFWriteRawTile	write a raw tile of data
TIFFWriteScanline	write a scanline of data
TIFFWriteTile	compress and write a tile of data
TIFFXYZToRGB	perform CIE XYZ to RGB conversion
TIFFYCbCrToRGBInit	initialize YCbCr to RGB conversion state
TIFFYCbCrtoRGB	perform YCbCr to RGB conversion

Auxiliary functions:

_TIFFfree	free memory buffer
_TIFFmalloc	dynamically allocate memory buffer
_TIFFmemcmp	compare contents of the memory buffers
_TIFFmemcpy	copy contents of the one buffer to another
_TIFFmemset	fill memory buffer with a constant byte
_TIFFrealloc	dynamically reallocate memory buffer

TAG USAGE

The table below lists the TIFF tags that are recognized and handled by the library. If no use is indicated in the table, then the library reads and writes the tag, but does not use it internally. Note that some tags are meaningful only when a particular compression scheme is being used; e.g. *Group3Options* is only useful if *Compression* is set to CCITT Group 3 encoding. Tags of this sort are considered *codec-specific* tags and the library does not recognize them except when the *Compression* tag has been previously set to the relevant compression scheme.

Tag Name	*Value*	*R/W*	*Library Use/Notes*
Artist	315	R/W	

BadFaxLines	326	R/W	
BitsPerSample	258	R/W	lots
CellLength	265		parsed but ignored
CellWidth	264		parsed but ignored
CleanFaxData	327	R/W	
ColorMap	320	R/W	
ColorResponseUnit	300		parsed but ignored
Compression	259	R/W	choosing codec
ConsecutiveBadFaxLines	328	R/W	
Copyright	33432	R/W	
DataType	32996	R	obsoleted by SampleFormat tag
DateTime	306	R/W	
DocumentName	269	R/W	
DotRange	336	R/W	
ExtraSamples	338	R/W	lots
FaxRecvParams	34908	R/W	
FaxSubAddress	34909	R/W	
FaxRecvTime	34910	R/W	
FillOrder	266	R/W	control bit order
FreeByteCounts	289		parsed but ignored
FreeOffsets	288		parsed but ignored
GrayResponseCurve	291		parsed but ignored
GrayResponseUnit	290		parsed but ignored
Group3Options	292	R/W	used by Group 3 codec
Group4Options	293	R/W	
HostComputer	316	R/W	
ImageDepth	32997	R/W	tile/strip calculations
ImageDescription	270	R/W	
ImageLength	257	R/W	lots
ImageWidth	256	R/W	lots
InkNames	333	R/W	
InkSet	332	R/W	
JPEGTables	347	R/W	used by JPEG codec
Make	271	R/W	
Matteing	32995	R	obsoleted by ExtraSamples tag
MaxSampleValue	281	R/W	
MinSampleValue	280	R/W	
Model	272	R/W	
NewSubFileType	254	R/W	called SubFileType in spec
NumberOfInks	334	R/W	
Orientation	274	R/W	
PageName	285	R/W	
PageNumber	297	R/W	
PhotometricInterpretation	262	R/W	used by Group 3 and JPEG codecs
PlanarConfiguration	284	R/W	data i/o
Predictor	317	R/W	used by LZW and Deflate codecs
PrimaryChromacities	319	R/W	
ReferenceBlackWhite	532	R/W	
ResolutionUnit	296	R/W	used by Group 3 codec
RowsPerStrip	278	R/W	data i/o
SampleFormat	339	R/W	
SamplesPerPixel	277	R/W	lots
SMinSampleValue	340	R/W	
SMaxSampleValue	341	R/W	

Software	305	R/W	
StoNits	37439	R/W	
StripByteCounts	279	R/W	data i/o
StripOffsets	273	R/W	data i/o
SubFileType	255	R/W	called OSubFileType in spec
TargetPrinter	337	R/W	
Thresholding	263	R/W	
TileByteCounts	324	R/W	data i/o
TileDepth	32998	R/W	tile/strip calculations
TileLength	323	R/W	data i/o
TileOffsets	324	R/W	data i/o
TileWidth	322	R/W	data i/o
TransferFunction	301	R/W	
WhitePoint	318	R/W	
XPosition	286	R/W	
XResolution	282	R/W	
YCbCrCoefficients	529	R/W	used by TIFFRGBAImage support
YCbCrPositioning	531	R/W	tile/strip size calculations
YCbCrSubsampling	530	R/W	
YPosition	286	R/W	
YResolution	283	R/W	used by Group 3 codec

PSEUDO TAGS

In addition to the normal TIFF tags the library supports a collection of tags whose values lie in a range outside the valid range of TIFF tags. These tags are termed *pseudo-tags* and are used to control various codec-specific functions within the library. The table below summarizes the defined pseudo-tags.

Tag Name	*Codec*	*R/W*	*Library Use/Notes*
TIFFTAG_FAXMODE	G3	R/W	general codec operation
TIFFTAG_FAXFILLFUNC	G3/G4	R/W	bitmap fill function
TIFFTAG_JPEGQUALITY	JPEG	R/W	compression quality control
TIFFTAG_JPEGCOLORMODE	JPEG	R/W	control colorspace conversions
TIFFTAG_JPEGTABLESMODE	JPEG	R/W	control contents of *JPEGTables* tag
TIFFTAG_ZIPQUALITY	Deflate	R/W	compression quality level
TIFFTAG_PIXARLOGDATAFMT	PixarLog		R/Wuser data format
TIFFTAG_PIXARLOGQUALITY	PixarLog		R/Wcompression quality level
TIFFTAG_SGILOGDATAFMT	SGILog	R/W	user data format

TIFFTAG_FAXMODE

Control the operation of the Group 3 codec. Possible values (independent bits that can be combined by or'ing them together) are: FAXMODE_CLASSIC (enable old-style format in which the RTC is written at the end of the last strip), FAXMODE_NORTC (opposite of FAXMODE_CLASSIC; also called FAXMODE_CLASSF), FAXMODE_NOEOL (do not write EOL codes at the start of each row of data), FAXMODE_BYTEALIGN (align each encoded row to an 8-bit boundary), FAXMODE_WORDALIGN (align each encoded row to an 16-bit boundary), The default value is dependent on the compression scheme; this pseudo-tag is used by the various G3 and G4 codecs to share code.

TIFFTAG_FAXFILLFUNC

Control the function used to convert arrays of black and white runs to packed bit arrays. This hook can be used to image decoded scanlines in multi-bit depth rasters (e.g. for display in colormap mode) or for other purposes. The default value is a pointer to a builtin function that images packed bilevel data.

TIFFTAG_IPTCNEWSPHOTO
Tag contains image metadata per the IPTC newsphoto spec: Headline, captioning, credit, etc... Used by most wire services.

TIFFTAG_PHOTOSHOP
Tag contains Photoshop captioning information and metadata. Photoshop uses in parallel and redundantly alongside IPTCNEWSPHOTO information.

TIFFTAG_JPEGQUALITY
Control the compression quality level used in the baseline algorithm. Note that quality levels are in the range 0-100 with a default value of 75.

TIFFTAG_JPEGCOLORMODE
Control whether or not conversion is done between RGB and YCbCr colorspaces. Possible values are: JPEGCOLORMODE_RAW (do not convert), and JPEGCOLORMODE_RGB (convert to/from RGB) The default value is JPEGCOLORMODE_RAW.

TIFFTAG_JPEGTABLESMODE
Control the information written in the *JPEGTables* tag. Possible values (independent bits that can be combined by or'ing them together) are: JPEGTABLESMODE_QUANT (include quantization tables), and JPEGTABLESMODE_HUFF (include Huffman encoding tables). The default value is JPEGTABLESMODE_QUANT|JPEGTABLESMODE_HUFF.

TIFFTAG_ZIPQUALITY
Control the compression technique used by the Deflate codec. Quality levels are in the range 1-9 with larger numbers yielding better compression at the cost of more computation. The default quality level is 6 which yields a good time-space tradeoff.

TIFFTAG_PIXARLOGDATAFMT
Control the format of user data passed *in* to the PixarLog codec when encoding and passed *out* from when decoding. Possible values are: PIXARLOGDATAFMT_8BIT for 8-bit unsigned pixels, PIXARLOGDATAFMT_8BITABGR for 8-bit unsigned ABGR-ordered pixels, PIXARLOGDATAFMT_11BITLOG for 11-bit log-encoded raw data, PIXARLOGDATAFMT_12BITPICIO for 12-bit PICIO-compatible data, PIXARLOGDATAFMT_16BIT for 16-bit signed samples, and PIXARLOGDATAFMT_FLOAT for 32-bit IEEE floating point samples.

TIFFTAG_PIXARLOGQUALITY
Control the compression technique used by the PixarLog codec. This value is treated identically to TIFFTAG_ZIPQUALITY; see the above description.

TIFFTAG_SGILOGDATAFMT
Control the format of client data passed *in* to the SGILog codec when encoding and passed *out* from when decoding. Possible values are: SGILOGDATAFMT_FLTXYZ for converting between LogLuv and 32-bit IEEE floating valued XYZ pixels, SGILOGDATAFMT_16BITLUV for 16-bit encoded Luv pixels, SGILOGDATAFMT_32BITRAW and SGILOGDATAFMT_24BITRAW for no conversion of data, SGILOGDATAFMT_8BITRGB for returning 8-bit RGB data (valid only when decoding LogLuv-encoded data), SGILOGDATAFMT_FLTY for converting between LogL and 32-bit IEEE floating valued Y pixels, SGILOGDATAFMT_16BITL for 16-bit encoded L pixels, and SGILOGDATAFMT_8BITGRY for returning 8-bit greyscale data (valid only when decoding LogL-encoded data).

DIAGNOSTICS

All error messages are directed through the *TIFFError* routine. By default messages are directed to **stderr** in the form: *module: message\n.* Warning messages are likewise directed through the *TIFFWarning* routine.

SEE ALSO

fax2tiff(1), **gif2tiff**(1), **pal2rgb**(1), **ppm2tiff**(1), **rgb2ycbcr**(1), **ras2tiff**(1), **raw2tiff**(1), **sgi2tiff**(1), **tiff2bw**(1), **tiffdither**(1), **tiffdump**(1), **tiffcp**(1), **tiffcmp**(1), **tiffgt**(1), **tiffinfo**(1), **tiffmedian**(1), **tiffsplit**(1), **tiffsv**(1).

Tag Image File Format Specification — Revision 6.0, an Aldus Technical Memorandum.

The Spirit of TIFF Class F, an appendix to the TIFF 5.0 specification prepared by Cygnet Technologies.

Libtiff library home page: **http://www.simplesystems.org/libtiff/**

BUGS

The library does not support multi-sample images where some samples have different bits/sample.

The library does not support random access to compressed data that is organized with more than one row per tile or strip.