APPENDIX

2

Image File Types and Associated Attributes

File Types

The file types that are supported by the IMGOP function and by the Image Data Model class are described in Table A2.1 on page 773. The file type of the image determines which attributes can be used in reading or writing the image. The attributes that you can specify for each file type are described in the following sections:

"Attributes for Reading Image Files" on page 774

"Attributes for Writing Image Files" on page 776

"Attributes for Reading Images from Kodak DC40 Cameras" on page 778

"Attributes for Reading Images from HP ScanJet and TWAIN Scanners" on page 779

"Attributes for Reading Images from TWAIN Scanners and Cameras" on page 780

Table A2.1   Supported Image File Types

File Type	Description
BMP (Microsoft Windows Device Independent Bitmap)	Supports color-mapped and true color images that are stored as uncompressed or run-length encoded data. BMP was developed by Microsoft Corporation.
CAT (SAS Catalog IMAGE entry)	
DIB (Microsoft Windows Device Independent Bitmap)	See the description of BMP. DIB is supported only under the Windows 95, Windows 98, Windows NT, and OS/2 operating systems.
EMF (Microsoft NT Enhanced Metafile)	Supported only under Windows 95, Windows 98, and Windows NT.
EPSI (Encapsulated PostScript Interchange)	An extended version of the standard PostScript (PS) format. Files that use this format can be printed on PostScript printers and can also be imported into other applications. Notice that EPSI files can be read, but PS files cannot be.

File Type	Description
GIF (Graphics Interchange Format)	Supports only color-mapped images. GIF is owned by CompuServe, Inc. (available if licensed).
JFIF (JPEG File Interchange Format)	Supports JPEG image compression. JFIF software is developed by the Independent JPEG Group.
MET (OS/2 Metafile)	Supported only under OS/2.
PBM (Portable Bitmap Utilities)	Supports gray, color, RGB, and bitmap files. The Portable Bitmap Utilities are a set of free utility programs that were developed primarily by Jef Poskanzer.
PCD (Photo CD reader)	Photo CD is owned by and licensed from Eastman Kodak Company.
PCX (PC Paintbrush)	Supports bitmapped, color-mapped, and true color images. PCX and PC Paintbrush are owned by Zsoft Corporation.
PICT (The QuickDraw Picture Format)	Supports 256-color images and bitmaps. The QuickDraw Picture Format is owned by Apple Computer, Inc. and is supported only in the Macintosh environment.
PNG (Portable Networks Graphics)	The PNG Reader and Writer use 'libpng' in their implementations. Permission to use is freely granted. Copyright (c) 1995, 1996 Guy Eric Schalnat, Group 42, Inc.
PS (PostScript Image File Format)	The Image classes use only PostScript image operators. A level II PS printer is required for color images. PostScript was developed by Adobe Systems, Inc.
TGA (Targa)	Supports both true color images and color-mapped images; however, the current release of the Image classes supports only true color TGA files. Targa is owned by Truevision, Inc.
TIFF (Tagged Image File Format)	Internally supports a number of compression types and image types, including bitmapped, color-mapped, gray-scaled, and true color. TIFF was developed by Aldus Corporation and Microsoft Corporation and is used by a wide variety of applications. (available if licensed)
WMF (Microsoft Windows Metafile)	Supported only under MicroSoft Windows operating systems.
XBM (X Window Bitmaps)	Supports bitmapped images only. XBM is owned by MIT X Consortium.
XPM (X Window Pixmap)	Is an extended version of XBM that supports color bitmaps; supported only under UNIX operating systems.
XWD (X Window Dump)	Supports all X visual types (bitmapped, color-mapped, and true color). XWD is owned by MIT X Consortium.

Attributes for Reading Image Files

Table A2.2 on page 775 describes the attributes that you can specify for the image readers.

When you are reading images, include the FORMAT= attribute in the method if any of the following conditions are true:

☐ You are reading a format that is supported only on certain hosts.

☐ The images reside in SAS catalogs.

☐ The images are being read from a system pipe.

FORMAT= is not required in other cases, but it is always more efficient to specify it.

Table A2.2 Reader Attributes for Supported File Types

File Type	Reader Attributes	Comment
BMP	FORMAT=BMP	
	COMPRESS=NONE	Default.
	COMPRESS=RLE	Run-length encoded data.
CAT	FORMAT=CAT	
DIB	FORMAT=DIB	Supported only under the Windows 95, Windows 98, Windows NT, and OS/2 operating systems.
EMF	FORMAT=EMF	Supported only under Windows 95, Windows 98, and Windows NT.
EPSI	FORMAT=EPSI	
	DPI=*num*	Number of dots per inch specified when the output file was created.
GIF	FORMAT=GIF	
JFIF	FORMAT=JFIF	Required for reading JPEG files that use the JPEG File Interchange Format (JFIF).
	DCT=*mode*	Specifies which type of Discrete Cosine Transform (DCT) to use when processing the image. *Mode* can be
		INT an integer DCT
		FAST a faster and less accurate integer DCT
		FLOAT a slightly more accurate method that can be much slower unless the host has very fast floating-point hardware.
		The results of the floating-point method can vary across host machines, whereas the integer methods should give the same results on all hosts.
	GRAYSCALE	Produces a gray-scale image even if the JPEG file is in color. This is useful for viewing on monochrome displays. The reader runs noticeably faster in this mode.
	VERSION	Writes to the SAS log the version number and copyright messages for the Independent JPEG Group's JFIF software.
	FAST	Enables certain recommended processing options for fast, low quality output. Specifying FAST is equivalent to enabling ONEPASS, DITHER=ORDERED, COLORS=216, NOSMOOTH, and DCT=FAST.
	NOSMOOTH	Uses a faster, lower quality, upsampling routine.
	ONEPASS	Uses a one-pass color quantization instead of the standard two-pass quantization. The one-pass method is faster and requires less memory, but it produces a lower-quality image. This attribute is ignored unless you also specify the COLORS attribute. ONEPASS is always enabled for gray-scale output.
	COLORS=*n*	Reduces the number of colors in the image to at most *n* colors; *n* must be between 2 and 256, inclusive.
	SCALE_RATIO=*n*	Scales the output image by a factor of $1/n$. Currently the scale factor must be 1/1, 1/2, 1/4, or 1/8. This is useful when you are processing a large image and only a smaller version is needed, because the reader is much faster when the output is scaled down.
	DITHER=*mode*	Specifies which type of dithering to use for color quantization. *Mode* can be
		FS Floyd-Steinberg dithering

File Type	Reader Attributes	Comment	
		ORDERED	ordered dithering
		NONE	no dithering.
MET	FORMAT=MET	Supported only under OS/2.	
PBM	FORMAT=PBM		
PCD	FORMAT=PCD	RES= specifies the image resolution to be read. Photo CD images have multiple resolution images in each image. Values are	
		BASE/64	64x96
		BASE/16	128x192
		BASE/4	256x384
		BASE	512x768 (default)
		4BASE	1024x1536
		16BASE	2048x3072
PCX	FORMAT=PCX		
PICT	FORMAT=PICT	Supported only in the Macintosh environment.	
PNG	FORMAT=PNG		
TGA	FORMAT=TGA		
TIFF	FORMAT=TIFF		
WMF	FORMAT=WMF	Supported only under MicroSoft Windows operating systems.	
XBM	FORMAT=XBM		
XPM	FORMAT=XPM	Supported only by the X Window System under UNIX.	
XWD	FORMAT=XWD		

Attributes for Writing Image Files

Table A2.3 on page 777 describes the attributes that you can specify for the image writers.

When you are writing images, you must specify the FORMAT= attribute. You can specify this attribute either directly as an argument for the WRITE command or as part of the *image-path* (if you use the LNAMEMK function to specify the pathname). For example:

```
/* Specify the FORMAT= attribute directly */
/* as an argument to the WRITE command.   */
rc=imgop(task-id,'WRITE','/user/images/sign.tif', 'format=tiff');

/* Use the LNAMEMK function to specify the image-path, */
/* and include the FORMAT= attribute as part of the path. */
path=lnamemk(5,'mine.images.sign','format=cat');
rc = imgop(task-id,'WRITE',path);
```

Table A2.3 Writer Attributes for Supported File Types

File Type	Writer Attributes	Comment
BMP	FORMAT=BMP	
CAT	FORMAT=CAT	
	COMPRESS=G3FAX	FAX CCITT Group 3 for monochrome black-and-white images (depth of 1) only.
	COMPRESS=G4FAX	FAX CCITT Group 4 for monochrome black-and-white images (depth of 1) only.
	DESC=*desc*	*Desc* is a catalog description.
DIB	FORMAT=DIB	Supported only under the Windows 95, Windows 98, Windows NT, and OS/2 operating systems.
EMF	FORMAT=EMF	Supported only under Windows 95, Windows 98, and Windows NT.
EPSI	FORMAT=EPSI	
GIF	FORMAT=GIF	
JFIF	FORMAT=JFIF	Required for writing JPEG files that use the JPEG File Interchange Format.
	DCT=*mode*	Specifies which type of Discrete Cosine Transform (DCT) to use when processing the image. *Mode* can be
		INT an integer DCT
		FAST a faster and less accurate integer DCT
		FLOAT a slightly more accurate method that can be much slower unless the host has very fast floating-point hardware.
		The results of the floating-point method can vary across host machines, whereas the integer methods should give the same results on all hosts.
	GRAYSCALE	Produces a gray-scale image even if the JPEG file is in color. This option is useful for viewing on monochrome displays. The reader runs noticeably faster in this mode.
	VERSION	Writes to the SAS log the version number and copyright messages for the Independent JPEG Group's JFIF software.
	BASELINE	Generates a baseline JPEG file even for low-quality settings.
	OPTIMIZE	Optimizes the entropy encoding parameters. This usually results in a smaller JPEG file, but writer processing is longer and more memory is needed. Image quality and speed of decompression are not affected.
	PROGRESSIVE	Produces a progressive JPEG file in which the data is stored in multiple scans of increasing quality. This option is useful if the file is being transmitted over a slow communications link and the decoder can display each scan as it is received.
	QUALITY=*n*	Scales the quantization tables to adjust for image quality. *N* must be in the range 0...100. 0 is worst; 100 is best; the default is 75. This option lets you trade file size for quality of the reconstructed image. Normally, you want to use the lowest quality setting that results in an image that is visually indistinguishable from the original image. The optimal value will vary from image to image.
	SMOOTH=*n*	Specifies the strength of the smoothing filter to eliminate dithering noise. *N* must be in the range 0...100. The default is 0, which disables smoothing. A smoothing factor that is too large blurs the image.
MET	FORMAT=MET	Supported only under OS/2.

File Type	Writer Attributes	Comment
PBM	FORMAT=PBM	
	COMPRESS=NONE	Text PBM file (default).
	COMPRESS=BINARY	Binary PBM file.
	COMPRESS=RAW	Binary PBM file.
PCL	FORMAT=PCL	
	DPI=*num*	Number of dots per inch to be used in the output file.
	EPS	Does not reset the printer margins. You can use this option to embed an image into another PCL document.
PICT	FORMAT=PICT	Supported only in the Macintosh environment.
PNG	FORMAT=PNG	
PS	FORMAT=PS	
	COMPRESS=NONE	Default for color images.
	COMPRESS=RLE	Run-length encoded; default for gray-scale images.
	DPI=*num*	Number of dots per inch to be used in the output file.
	EPS	Does not reset the printer margins. You can use this option to embed an image in another PCL document.
	PREVIEW	Specifies whether a scaled-down, 1-bit, black-and-white preview image is written into the encapsulation header. The preview image enables this file to be read by software (such as SAS) that does not support a real PostScript reader.
	PREWIDTH=*x*PREHEIGHT=*y*	Size of the preview image in pixels if PREVIEW is specified (default: 25% of original size).
	XSCALE	Directly sets width scaling (default: calculate it).
	YSCALE	Directly sets height scaling (default: calculate it).
	PAGEX	Sets the output page width in pixels (default: 612, typical 8.5-inch page).
	PAGEY	Sets the output page height in pixels (default: 792, typical 11-inch page).
	NOFIT	Turns off the default of scaling down an oversized image to fit the page. Must be used with XSCALE and YSCALE.
TIFF	FORMAT=TIFF	
	COMPRESS=NONE	Default.
	COMPRESS=G3FAX	FAX CCITT Group 3 for monochrome black-and-white (depth of 1) images only.
	COMPRESS=G4FAX	FAX CCITT Group 4 for monochrome black-and-white (depth of 1) images only.
WMF	FORMAT=WMF	Supported only under MicroSoft Windows operating systems.
XBM	FORMAT=XBM	Supported for writing only from interactive windows under UNIX.
XPM	FORMAT=XPM	Supported only on the X Window System under UNIX.

Attributes for Reading Images from Kodak DC40 Cameras

The image command READ supports reading from Kodak DC 40 digital cameras only under Windows 95 and Windows 98 cameras and scanners. When you read images from these devices, you must include the DEVICE= attribute with the command.When

you use DEVICE=CAMERA, you must also specify either TAKEPIC or PICNUM=. For example:

```
rc=imgop(taskid,'READ','kodakdc40','device=camera takepic');
```

The TAKEPIC and PICNUM commands are mutually exclusive. The DELLAST and DELALL commands are also mutually exclusive.

You can specify the RESET or RES command only if the camera is empty. Use the DELALL command to empty the camera.

You can use the FLASH and EXPOSE options to control the flash unit and exposure. You can also change the flash and exposure settings manually on the camera itself.

Any changes that you make by specifying the RES, FLASH, and EXPOSE commands will be in effect until you change them again.

Table A2.4 Attributes for Reading Images from Kodak DC40 Cameras

Attribute	Description
DELLAST	Deletes the last image as the picture is returned from the camera. Specifying this option limits the number of images the camera can hold.
DELALL	Deletes all of the images in the camera (empties the camera).
EXPOSE=*shift*	Shifts the exposure under or over the automatic exposure setting. You can specify **+1**, **+.5**, **0**, **−.5**, or **−1**.
FLASH=*setting*	Sets the flash unit to **AUTO**, **ON**, or **OFF**.
PICNUM=*n*	Gets picture number *n*.
PORT=*n*	Specifies the serial port number of the camera. The default is to search for and automatically detect the camera.
RES=*resolution*	Sets the resolution. You can specify **HIGH** or **LOW**. You cannot change the resolution after pictures have been taken.
RESET	Resets the camera to default values.
TAKEPIC	Takes a photo and returns it.
THUMB	Returns a thumbnail-sized image instead of a full-sized image.

Attributes for Reading Images from HP ScanJet and TWAIN Scanners

Table A2.5 on page 779 describes the attributes that are supported the under Windows 95, Windows 98, and Windows NT operating systems for the HP ScanJet scanners and TWAIN scanners. They are supported under HP/UX operating systems for HP ScanJet scanners only. You must specify DEVICE=SCANNER. For example:

```
rc=imgop(taskid,'READ','hpscan','device=scanner dpi=100');
```

Table A2.5 Device Attributes for HP ScanJet and TWAIN Scanners

Attribute	Description	Default
BRIGHT=*n*	Sets the brightness setting.	0
CONTRAST=*n*	Sets the contrast setting. This option is ignored with bi-tonal images.	0

Attribute	Description	Default
DPI=*n*	Sets the number of dots per inch.	200
FEEDER | NOFEEDER	Specifies how the document is scanned. FEEDER assumes that there is a document feeder and produces an error if there is no document feeder. NOFEEDER scans from the bed and ignores the feeder if one is attached.	Use the feeder if it is attached; otherwise, use scan from the bed.
TYPE=*type*	Sets the type of image to generate. You can specify BITONAL, RGB, or GRAY. For HP/UX scanners, you can also specify CMAP.	For HP/UX scanners, BITONAL; for TWAIN scanners, the highest resolution (bits/pixel) that is supported by the device.
UNITS=*units*	Sets the size units for the SIZE and START options. You can specify IN, CM, MM, or PIXEL.	IN
XDPI=*n*	Sets the dots per inch for the width only.	200
XSIZE=*d*	Sets the width to scan (decimal value).	8.5 inches
XSTART=*d*	Sets the starting point of the scan along the width.	0
YDPI=*n*	sets DPI for height only	200
YSIZE=*d*	Sets the height to scan (decimal value).	11 inches
YSTART=*d*	Sets the starting point of the scan along the height.	0

Attributes for Reading Images from TWAIN Scanners and Cameras

Table A2.6 on page 780 describes the attributes that are supported for TWAIN scanners and cameras under the Windows 95, Windows 98, and Windows NT operating systems.

Table A2.6   Device Attributes for TWAIN Scanners and Cameras

Attribute	Description
SELSRC	Displays the TWAIN Select Source window. The default source is highlighted, but you can select a different source. If you do not specify SELSRC, then the application uses the default source.
SETCAP	Displays the data source's capability window.
SCNAME=*product*	Sets the default source. Specify the product name (as displayed in the TWAIN Select Source window) of the scanner. (This product name may not be the same as the name of the scanner.) If *product* matches more than one scanner's product name, then the first match is selected.
	If you do not specify SCNAME, then the source defaults either to the last source used or to the first source in the list (if the application has not been run yet).