

# Aperio TIFFComp ActiveX Control (.OCX)

## Programmer's Reference

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ImageServer is intended for use with the SVS file format (the native format for digital slides created by scanning glass slides with the ScanScope scanner). Educators will use Aperio software to view and modify digital slides in Composite WebSlide (CWS) format.

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# TIFFComp ActiveX Control (.OCX) Programmer's Reference

The Aperio **TIFFComp** ActiveX control (.OCX) is used to crop, scale, rotate, and compress image files. Features include:

- Support for TIFF input files with various compression schemes (raw, LZW lossless, YUYV, JPEG lossy, and JPEG2000 lossy), and organizations (raster, stripped, blocked).
- Support for JPEG input files (JFIF, lossy).
- Support for “compound” input files. A compound file is a text file (.aci or .txt) that describes a mosaic of image files that are composited together to form the source image. Each line in the text file contains an image filename and the X, Y, and Z offsets within the compound image at which the image is positioned.
- Support for Composite WebSlides (CWS)<sup>1</sup>. A composite webslide is a directory that contains many small JPEG files and one or more INI files which contain image information.
- Generates TIFF output files with various compression schemes (raw, LZW lossless, YUYV, JPEG lossy, and JPEG2000 lossy), and with configurable block size (or no block size = stripped), OR
- Generates JPEG output files (JFIF, lossy).
- Generates Composite WebSlides (CWS); directories containing many JPEG files and one or more INI files which contain image information.
- Optionally generates thumbnail image of specified dimensions (stored in output TIFF file as second image, or as separate output JPEG file).
- Optionally supports multiple image layers (essentially, 3D images).
- Optionally generates one or more intermediate resolution images spaced integral zoom multiples between the baseline image and the thumbnail image (stored in output TIFF file as third, fourth, etc. images).
- Optionally imports label image and stores in output TIFF file.
- Optionally imports macro image and stores in output TIFF file.
- Support for large images (up to 250,000+ pixels in width and height).
- Support for adjusting image color (“gamma”) via brightness/contrast, color adjustments, or editing color curves. Adjustment sets may be saved and restored.
- Support for cropping subregion from image.
- High-fidelity scaling routines for down- or up-sampling images to desired dimensions. Asymmetrical scaling is supported.
- Enables orthogonal transforms of image (90° rotations, mirroring).
- Optionally applies a 5x5 convolution filter to image after adjustment, cropping, scaling, and/or rotation.
- Optionally embeds, applies or ignores the ICC<sup>2</sup> profile of the input image.

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<sup>1</sup>A Composite WebSlide, also known as a CWS slide, is a proprietary format created by Bacus Laboratories, Inc. (“Bacus”). WebSlide is a registered trademark of Bacus Laboratories, Inc.

<sup>2</sup>ICC is the International Color Consortium [www.color.org](http://www.color.org).

**TIFFComp** is designed to be called from Visual Basic and other ActiveX-compatible programs in a fashion to enable progress reporting to users for long-running processes, such as overall compression of an image.

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The attributes and behaviors of the control are manipulated via its methods and properties, which are listed below (please see "Typical Use" on page 10 for a description of how these methods and properties are generally used).

## Read-only Properties

Property	Type	Description
Active	Bool	Remains <b>true</b> after successful Start() until processing is complete, otherwise <b>false</b> .
CacheUsed	Long	Current amount of memory cache used, in MB.
CacheUsedHWM	Long	High water mark for memory cache, in MB.
CacheAvailMem	Long	Current available free memory in computer, in MB.
CacheTotalMem	Long	Total memory in computer, in MB.
CacheMax	Long	Current cache maximum size, in MB. This value is dynamically adjusted based on available memory.
CacheBuffers	Long	Current number of buffers stored in cache.
CacheBuffersHWM	Long	High water mark for buffers stored in cache.
CacheSearches	Long	Number of cache searches.
CacheHits	Long	Number of cache hits.
Compression Codec	BSTR	Description of currently selected codec (set with Compression property); may include version.
Compression Ratio	Float	Current compression ratio (or projected, if not active)
ErrorCode	Short	Error code corresponding to most recent error. This property is set to zero during initialization and at start of OpenInput(), OpenOutput(), and Start() methods.

<b>Property</b>	<b>Type</b>	<b>Description</b>
ErrorMessage	BSTR	Text string describing most recent error.
HasLabel	Bool	T/F whether input image has label
HasMacro	Bool	T/F whether input image has macro image
HasThumbnail	Bool	T/F whether input image has thumbnail
ImageBitDepth	Long	Number of bits per pixel (e.g. RGB = 24)
ImageChannels	Long	Number of color channels per pixel (e.g. RGB = 3)
ImageDepth	Long	Image depth of entire input image (Z-dimension). Given in pixels based on image resolution. Two-dimensional images have depth = 1.
ImageHeight	Long	Image height of entire input image, in pixels
ImageWidth	Long	Image width of entire input image, in pixels
ImageSize	Float	Size of image, in bytes. Includes all layers.
InputFilename	BSTR	Filename of input image
LabelHeight	Long	Height of imported label image (if any)
LabelWidth	Long	Width of imported label image (if any)
LabelImage	LPPICTUREDISP	Returns label image as an ActiveX picture, or NULL if image has no associated label.
LayerOffset (short layer)	Long	Returns layer Z-offset, in pixels (based on image resolution). Closest layer is at offset 0.
LevelHeight (short level)	Long	Returns intermediate level image height, in pixels.
LevelWidth (short level)	Long	Returns intermediate level image width, in pixels.
MacroHeight	Long	Height of imported macro image (if any)
MacroWidth	Long	Width of imported macro image (if any)
MacroImage	LPPICTUREDISP	Returns macro image as an ActiveX picture, or NULL if image has no associated macro image.
OutputFilename	BSTR	Filename of output image.
OutputImageSize	Float	Size of output image, in bytes (uncompressed).
Preview	LPPICTUREDISP	Returns thumbnail image corresponding to currently generated output image, as ActiveX picture. Returns NULL if no output image generated yet.
ProjectedSize	Float	Projected size of output file, in bytes. Computed initially and updated during processing.
Thumbnail	LPPICTUREDISP	Returns thumbnail image associated with input image as an ActiveX picture, or NULL if image has no associated thumbnail. This differs from <b>Preview</b> , which returns the thumbnail generated from the output compression processing.
ThumbRegion (long X, long Y, long width, long height, bool transform)	LPPICTUREDISP	Returns specified portion of thumbnail image associated with input image as an ActiveX picture. Coordinates are relative to input thumbnail. The transform parameter determines whether the current image transform (Rotate property) is applied.

Property	Type	Description
Tile	Long	Current tile number (zero based).
Tiles	Long	Total number of tiles to be generated.
TileX	Long	Current tile X index (zero based).
TileY	Long	Current tile Y index (zero based).
TileZ	Long	Current tile Z layer (zero based).
Version	BSTR	Text string giving OCX version.
XTiles	Long	Total number of tile columns to be generated.
YTiles	Long	Total number of tile rows to be generated.
ZTiles	Long	Total number of image layers to be generated

## Modifiable Properties

Property	Type	Description
AuthToken	BSTR	DataServer authtoken to use when opening an image through ImageServer.
CacheMemory	Long	Maximum size of in-core memory cache, in MB. The default is the available memory in the machine.
CacheMRU	Bool	Cache priority routine; <b>true</b> = MRU (default), <b>false</b> = "view".
Compression	Short	Image compression type (and output file type): 0 – raw TIFF (uncompressed) – TIF file (TIFF) 1 – LZW (lossless) – TIF file (TIFF) 2 – JPEG (lossy) – SVS file (TIFF) 3 – JPEG2000 (lossy) – SVS file (TIFF) 7 – YUYV – SVS file (TIFF) 8 – JPEG (lossy) – JPG file (JFIF) 10 – JPEG (lossy) – CWS directory with JFIF and INI files 12 – JPEG2000 (lossy) – JP2 file
Compression Quality	Short	Compression quality factor for JPEG2000 and JPEG compression, 0-100. A quality factor of 30 typically results in acceptable image quality at 30:1 compression (JPEG2000) or 15:1 compression (JPEG).
Description	BSTR	Text string giving image description, if any. This value is stored in the output file for subsequent display by viewers.
FalseColor	Bool	T/F whether false coloring is enabled. Only valid for monochrome images where ImageChannels = 1.
FalseHue	Long	The false color hue, range 0-255.
Filter	Bool	Enable filtering operation using 5x5 convolution matrix.
FilterMatrix (int x, int y)	Short	Filter convolution matrix value, $-2 \leq x \leq 2$ and $-2 \leq y \leq 2$ . (0,0) value gives pixel weight.
FilterOffset	Short	Filter offset; sets bias for filtered pixel values. Default is zero.
FilterScale	Short	Filter scale factor; re-computed each time a FilterMatrix value is updated to be the sum of all matrix elements.

Property	Type	Description
FilterType	Short	Designate predefined filter, or custom (default=0): 0 – use custom filter (FilterMatrix, FilterScale, FilterOffset) 1 – unsharp mask, SD = 0.6 2 – unsharp mask, SD = 0.7 3 – unsharp mask, SD = 0.8 4 – unsharp mask, SD = 0.9 5 – unsharp mask, SD = 1.0 6 – edge enhance K1 7 – edge enhance K2 (softer)
FixAspect	Bool	Hold output image aspect ratio fixed to the same as the input image aspect ratio.
Gamma	Bool	Whether to perform gamma processing. See <i>SetGamma()</i> and <i>GetGammaR()</i> , <i>GetGammaG()</i> , and <i>GetGammaB()</i> methods.
InputHeight	Long	Height of source image region in pixels. This defaults to the entire input image (ImageHeight property) but may be set to “crop” image.
InputLeft	Long	Offset from left edge of input image to image region, in pixels. Default is zero.
InputTop	Long	Offset from top edge of input image to image region in pixels. Default is zero.
InputWidth	Long	Width of source image region in pixels. This defaults to the entire input image (ImageWidth property) but may be set to “crop” image.
Label	Bool	T/F whether to generate label image into output file. Default is <b>true</b> . (Label is only generated if present for import.)
LabelRotate	Short	A code indicating desired orientation for label image. See <i>Rotate</i> property for a description of possible values.
Layers	Short	Number of layers to generate (Z-dimension). This value defaults to the number of layers in the input image. It may be modified to cause new layers to be created via interpolation.
Levels	Short	Number of intermediate images to generate (between baseline image and thumbnail). This value may be “corrected”; setting it to a particular value doesn't guarantee that the specified number of levels will actually be generated. The default value is computed based on target inter-level image ratios of 4:1.
Log	Bool	T/F whether logging is enabled. When enabled, processing messages are written to a file named viewport.log, located in the current directory. Default is <b>false</b> .
LogPath	BSTR	Path to tiffcomp.log file; default is “.” (current directory).
Macro	Bool	T/F whether to generate macro image into output file. Default is <b>true</b> . (Macro image is only generated if present for import.)
MacroRotate	Short	A code indicating desired orientation for macro image. See <i>Rotate</i> property for a description of possible values.
OutputHeight	Long	Height of desired output image, in pixels. This defaults to InputHeight but may be set to “scale” image.

Property	Type	Description
OutputSize	Float	Returns current size of output file, in MB. This value is updated continuously during compression processing (e.g., and to compute actual compression ratio).
OutputWidth	Long	Width of desired output image, in pixels. This defaults to InputWidth but may be set to "scale" image.
OutputDepth	Long	Depth of desired output image, in pixels. This defaults to ImageDepth but may be set to change Z-axis "scale."
Password	BSTR	Password to use when opening an image through ImageServer (see <i>Username</i> )
Prefetch	Bool	T/F whether to enable prefetching thread on input image. This usually increases performance. Default is <b>true</b> .
Rotate	Short	A code indicating the desired orthogonal transformation: 0 – do nothing (original orientation) 1 – rotate 90° to right (clockwise) 2 – rotate 180° 3 – rotate 90° to left (counter-clockwise) 4 – flip vertically 5 – rotate 90° to right, then flip 6 – flip horizontally 7 – rotate 90° to left, then flip
Threads	Short	Number of concurrent threads to use while compressing. Multiple threads increase performance on multi-CPU machines and/or machines which support hyper-threading. The default is the number of CPUs present.
Thumb	Bool	T/F whether to generate thumbnail image into output file. Default is <b>true</b> .
ThumbHeight	Long	Height of thumbnail image, in pixels. A default value is computed based on target thumbnail size of 1024x768 pixels, holding aspect ratio same as input region.
ThumbWidth	Long	Width of thumbnail image, in pixels. A default value is computed based on target thumbnail size of 1024x768 pixels, holding aspect ratio same as input region.
TileHeight	Long	Height of tiles generated in output image file. This value may be "corrected"; i.e., setting it to a particular value doesn't guarantee it will be used. The default value is 240 pixels. If set to zero, the output file will be stripped <sup>3</sup> .
TileWidth	Long	Width of tiles generated in output image file. This value may be "corrected"; i.e., setting it to a particular value doesn't guarantee it will be used. The default value is 240 pixels. If set to zero, the output file will be stripped <sup>2</sup> .
Username	BSTR	Username to use when opening an image through ImageServer (see <i>Password</i> ).

<sup>3</sup>Stripped output files have some restrictions. The maximum output width and height are 30,000 pixels. JPEG2000 compression cannot be used (must be none or LZW). Intermediate levels cannot be generated for stripped files.

Property	Type	Description
WrtProfileEmbed	Bool	Embed (copy) ICC Profile from input image into output image. ICC Profile options are to embed, apply or neither embed nor apply. Embed is the default state.
WrtProfileApply	Bool	Apply the ICC Profile of the input image to the output image. See WrtProfileEmbed.

## Methods

Method Prototype	Description
void ClearError()	Reset any error which may have been set
void CloseInput()	Close current input image.
void CloseOutput()	Close current output image.
BSTR GetGammaR()	Returns string of length 256 with current Green channel gamma values.
BSTR GetGammaG()	Returns string of length 256 with current Red channel gamma values.
BSTR GetGammaB()	Returns string of length 256 with current Blue channel gamma values.
bool OpenInput (LPCSTR filename)	Open specified input image. Returns <b>true</b> if successful, else <b>false</b> .
bool OpenOutput (LPCSTR filename)	Open specified output image. This file need not exist, if it does, it will be deleted and re-created. Returns <b>true</b> if successful, else <b>false</b> . Note that most output file errors occur <i>during</i> compression processing (after OpenOutput).
bool OpenOutputNodup (LPCSTR filename)	Open specified output image <i>but fail if duplicate</i> (don't overwrite existing file).
void Pause()	Pause compression processing.
bool Resume()	Resume compression processing. Returns <b>true</b> if successful, else <b>false</b> .
void SetImageAttribute (LPCSTR name, LPCSTR value)	Set image attribute; stored in the form "name=value". Image attributes may contain any application information and are not validated. The first attribute with a given name is used.
void SetGamma(BSTR R, BSTR G, BSTR B)	Set color channel gamma values. The strings R, G, and B are assumed to be of length 256, and to contain the color mappings for the Red, Green, and Blue color channels. Note that the Gamma property must be <b>true</b> for these to be used.
bool Start()	Start compression processing. Returns <b>true</b> if successful, else <b>false</b> . The Active property may be monitored to determine when compression ends; the ErrorCode property gives status (and if an error occurs, the ErrorMessage property will be set). Progress may be monitored by comparing Tile to Tiles, and/or by comparing TileX to XTiles and TileY to YTiles (depending on the organization of the input file, output is generated either row-first or column-first).

Method Prototype	Description
void Stop()	Stop compression processing.

## Typical Use

This section briefly describes typical use of the **TIFFComp** OCX. The following steps are generally performed, and in this order:

1. Enable logging with Log property, if desired.
2. Call OpenInput() method to open input image. If error (returns **false**) use ErrorMessage property to determine cause.
3. Call OpenOutput() method to open output image. If error (returns **false**), use ErrorMessage property to determine cause.
4. Set various processing parameters:
  - The InputLeft, InputTop, InputWidth, and InputHeight properties may be used to “crop” the input image (define the input region).
  - The OutputWidth and OutputHeight properties may be used to “scale” the input region (default the output image dimensions). The FixAspect property determines whether the output image’s aspect ratio is the same as the input region’s ratio.
  - The Gamma property and SetGamma() method may be used to set color adjustments to be applied to the input image.
  - The Rotate property may be used to rotate or mirror the input region. Note: when odd values of the Rotate property are set, the input region proportions are perpendicular to the output region proportions. All input region properties remain relative to the input image, and all output region properties remain relative to the output image. For example, assume an input region of 2000 x 1000 pixels is rotated 90° (Rotate = 1). The output region would be 1000 x 2000 pixels. To scale to 50%, set OutputWidth to 500 pixels, with FixAspect true; the output region will be 500 x1000 pixels.
  - The Filter property determines whether a 5x5 convolution matrix is applied to each pixel. If **true**, the FilterMatrix values give the convolution matrix, and the FilterScale and FilterOffset values are used to normalize the computed values.
  - The Thumb property determines whether a thumbnail image will be generated, and if so the ThumbWidth and ThumbHeight properties determine the dimensions of the thumbnail image.
  - The Levels property determines whether intermediate level images will be generated. After setting Levels, the LevelWidth and LevelHeight parameterized properties may be used to determine the computed dimensions of each intermediate level image.
  - The Label property determines whether a label image will be imported. The LabelRotate property may be used to set the orientation of the label.
  - The Compression property determines what type of compression will be use in the output image, if any, and the type of output file (TIFF or JFIF file, or CWS directory). If specified as JPEG, JPEG2000, or CWS, the CompressionQuality property determines the target quality (and by extension, the target compression ratio).

- The TileWidth and TileHeight properties determine the target block size in the output file. Generally the default values computed for these properties are acceptable.
  - The Description property gives a text string describing the image which is stored in the output image file.
5. Call Start() to initiate processing. The number of threads given by the Threads property are started to perform compression processing.
    - The Active property remains **true** until compression ends; the ErrorCode property gives status (and if an error occurs, the ErrorMessage property will be set).
    - The Tile property gives current block being generated, and the Tiles property gives total blocks to generate. These properties may be used for progress reporting.
    - The TileX and TileY properties give the column and row indices of the current block. The XTiles and YTiles properties give the total number of columns and rows to be generated. These properties may be used for progress reporting.
    - The OutputSize property gives the current size of the generated output image. This property may be used for progress reporting.
  6. Optional: Call Pause() to temporarily stop processing, and Resume() to restart processing.
  7. Optional: Call Stop() to terminate processing.
  8. Call CloseOutput() to close the output image file.
  9. Call CloseInput() to close the input image file.

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