

# Advanced Media Framework – Video Converter

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## Programming Guide

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## 1 Introduction

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This document provides a complete description of the AMD Advanced Media Framework (AMF) Video Converter Component. This component performs the following functions:

- Color space conversion
- Color format conversion
- Gamma correction
- Scaling

## 2 AMF Video Converter Component

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The Video Converter accepts input frames stored in `AMFSurface` objects wrapping DirectX 9 surfaces, DirectX 11 textures, OpenGL or OpenCL surfaces. The output is placed in `AMFSurface` objects wrapping DirectX 9 surfaces, DirectX 11 textures, OpenGL or OpenCL surfaces, depending on the component configuration.

Include `public/include/components/VideoConverter.h`

### 2.1 Component Initialization

The AMF Video Converter component should be initialized using the following sequence:

1. Create an AMF Context and initialize it for one of the following:
  - i. DirectX 11.1
  - ii. DirectX 9
  - iii. OpenGL
  - iv. OpenCL
2. Configure the Converter component by setting the necessary properties using the `AMFPropertyStorage::SetProperty` method on the converter object.
3. Call the `AMFComponent::Init` method of the converter object.

### 2.2 Configuring the Converter

The `format`, `width` and `height` parameters of the `AMFComponent::Init` method describe the input stream. Parameters of the output stream are set using the following properties:

Name (prefix "AMF_VIDEO_CONVERTER_")	Type
OUTPUT_FORMAT	amf_int64
MEMORY_TYPE	AMF_MEMORY_TYPE
OUTPUT_SIZE	AMFSize

Name (prefix "AMF_VIDEO_CONVERTER_")	Type
OUTPUT_RECT	AMFRect
KEEP_ASPECT_RATIO	amf_bool
FILL	amf_bool
FILL_COLOR	amf_bool
SCALE	amf_int64
FORCE_OUTPUT_SURFACE_SIZE	amf_bool
COLOR_PROFILE	amf_int64

Table 1. AMF Video Converter parameters which configure input and output

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**Name:** AMF\_VIDEO\_CONVERTER\_OUTPUT\_FORMAT

**Values:** AMF\_SURFACE\_UNKNOWN , AMF\_SURFACE\_NV12 , AMF\_SURFACE\_BGRA , AMF\_SURFACE\_YUV420P (progressive only)

**Default Value:** AMF\_SURFACE\_UNKNOWN

**Description:** Specifies the output color format/space.

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**Name:** AMF\_VIDEO\_CONVERTER\_MEMORY\_TYPE

**Values:** AMF\_MEMORY\_DX11 , AMF\_MEMORY\_DX9 , AMF\_MEMORY\_UNKNOWN (retain the same memory type as input (no interop))

**Default Value:** AMF\_MEMORY\_UNKNOWN

**Description:** Specifies the memory type of output surfaces (surfaces are allocated internally by the Converter component).

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**Name:** AMF\_VIDEO\_CONVERTER\_OUTPUT\_SIZE

**Values:** Width in pixels. default means no scaling.

**Default Value:** 0,0

**Description:** Output image resolution specified as AMFSize . Scaling will be performed when this property is set.

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**Name:** AMF\_VIDEO\_CONVERTER\_OUTPUT\_RECT

**Values:** Rectangle in pixels

**Default Value:** 0, 0, 0, 0 , default means no rect

**Description:** Specifies the target rectangle in the output surface to scale the image into as AMFRect .

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**Name:** AMF\_VIDEO\_CONVERTER\_KEEP\_ASPECT\_RATIO

**Values:** true , false

**Default Value:** false

**Description:** Force the scaler to keep the aspect ratio of the input image when the output size specified by the `AMF_VIDEO_CONVERTER_OUTPUT_SIZE` property has a different aspect ratio.

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**Name:** `AMF_VIDEO_CONVERTER_FILL`

**Values:** true , false

**Default Value:** false

**Description:** Specifies whether the output image outside the region of interest, which does not fill the entire output surface should be filled with a solid color. The fill color is specified using the `AMF_VIDEO_CONVERTER_FILL_COLOR` property.

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**Name:** `AMF_VIDEO_CONVERTER_FILL_COLOR`

**Values:** true , false

**Default Value:** false

**Description:** Fill color specified as `AMFColor` to fill the area outside the output rectangle. Applicable only when the `AMF_VIDEO_CONVERTER_FILL` property is set to true .

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**Name:** `AMF_VIDEO_CONVERTER_SCALE`

**Values:** `AMF_VIDEO_CONVERTER_SCALE_ENUM` : `AMF_VIDEO_CONVERTER_SCALE_INVALID` , `AMF_VIDEO_CONVERTER_SCALE_BILINEAR` , `AMF_VIDEO_CONVERTER_SCALE_BICUBIC`

**Default Value:** `AMF_VIDEO_CONVERTER_SCALE_BILINEAR`

**Description:** Specifies scaling method.

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**Name:** `AMF_VIDEO_CONVERTER_FORCE_OUTPUT_SURFACE_SIZE`

**Values:** true , false

**Default Value:** false

**Description:** Instructs the Converter component to use the dimensions of the output surface as output size instead of the size specified by the `AMF_VIDEO_CONVERTER_OUTPUT_SIZE` property when a custom allocator is set through the `AMFComponent::SetOutputDataAllocatorCB` callback.

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**Name:** `AMF_VIDEO_CONVERTER_COLOR_PROFILE`

**Values:** `AMF_VIDEO_CONVERTER_COLOR_PROFILE_ENUM` :

- `AMF_VIDEO_CONVERTER_COLOR_PROFILE_601` – for ITU-R BT.601 (SDTV), 16 ... 235 color range
- `AMF_VIDEO_CONVERTER_COLOR_PROFILE_709` – for ITU-R BT.709 (HDTV) , 16 ... 235 color range
- `AMF_VIDEO_CONVERTER_COLOR_PROFILE_2020` – for ITU-R BT.2020 (UHDTV) , 16 ... 235 color range
- `AMF_VIDEO_CONVERTER_COLOR_PROFILE_JPEG` – for the full 0 ... 255 color range
- `AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_601` – for ITU-R BT.601 (SDTV), 0 ... 255 full color range
- `AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_709` – for ITU-R BT.709 (HDTV) , 0 ... 255 full color range

- `AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_2020` – for ITU-R BT.2020 (UHDTV) , `0 ... 255` full color range

**Default Value:** `AMF_VIDEO_CONVERTER_COLOR_PROFILE_UNKNOWN`

**Description:** Sets the color profile for color space conversion.

The `COLOR_PROFILE` parameter can fully describe a surface in SDR use case. For HDR use case the `TRANSFER_CHARACTERISTIC` , `COLOR_PRIMARIES` and `NOMINAL_RANGE` parameters describe the surface.

Name (prefix "AMF_VIDEO_CONVERTER_")	Type
INPUT_TRANSFER_CHARACTERISTIC	amf_int64
INPUT_COLOR_PRIMARIES	amf_int64
INPUT_COLOR_RANGE	amf_int64
INPUT_HDR_METADATA	AMFBufferPtr
OUTPUT_TRANSFER_CHARACTERISTIC	amf_int64
OUTPUT_COLOR_PRIMARIES	amf_int64
OUTPUT_COLOR_RANGE	amf_int64
OUTPUT_HDR_METADATA	AMFBufferPtr
USE_DECODER_HDR_METADATA	amf_bool

Table 2. AMF Video Converter parameters which configure input and output

**Name:** `AMF_VIDEO_CONVERTER_INPUT_TRANSFER_CHARACTERISTIC`

**Values:** `AMF_COLOR_TRANSFER_CHARACTERISTIC_ENUM` : `AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT709` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_UNSPECIFIED` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_RESERVED` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_GAMMA22` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_GAMMA28` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE170M` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE240M` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_LINEAR` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_LOG` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_LOG_SQRT` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_IEC61966_2_4` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT1361_ECG` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_IEC61966_2_1` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT2020_10` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT2020_12` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE2084` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE428` , `AMF_COLOR_TRANSFER_CHARACTERISTIC_ARIB_STD_B67`

**Default Value:** `AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED`

**Description:** Characteristic transfer function of the input surface used to perform the mapping between linear light components (tristimulus values) and a nonlinear RGB signal. Used (alongside `COLOR_PRIMARIES` and `NOMINAL_RANGE` parameters) to describe surface in HDR use case.

**Name:** `AMF_VIDEO_CONVERTER_INPUT_COLOR_PRIMARIES`

**Values:** `AMF_COLOR_PRIMARIES_ENUM` : `AMF_COLOR_PRIMARIES_UNDEFINED` , `AMF_COLOR_PRIMARIES_BT709` , `AMF_COLOR_PRIMARIES_UNSPECIFIED` , `AMF_COLOR_PRIMARIES_RESERVED` , `AMF_COLOR_PRIMARIES_BT470M` , `AMF_COLOR_PRIMARIES_BT470BG` , `AMF_COLOR_PRIMARIES_SMPTE170M` , `AMF_COLOR_PRIMARIES_SMPTE240M` , `AMF_COLOR_PRIMARIES_FILM` , `AMF_COLOR_PRIMARIES_BT2020` , `AMF_COLOR_PRIMARIES_SMPTE428` , `AMF_COLOR_PRIMARIES_SMPTE431` , `AMF_COLOR_PRIMARIES_SMPTE432` , `AMF_COLOR_PRIMARIES_JEDEC_P22` , `AMF_COLOR_PRIMARIES_CCCS`

**Default Value:** AMF\_COLOR\_PRIMARIES\_UNDEFINED

**Description:** Color space primaries for the input surface which are the maximum red, green, and blue value permitted within the color space. Used (alongside TRANSFER\_CHARACTERISTIC and NOMINAL\_RANGE parameters) to describe surface in HDR use case.

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**Name:** AMF\_VIDEO\_CONVERTER\_INPUT\_COLOR\_RANGE

**Values:** AMF\_COLOR\_RANGE\_ENUM : AMF\_COLOR\_RANGE\_UNDEFINED , AMF\_COLOR\_RANGE\_STUDIO , AMF\_COLOR\_RANGE\_FULL

**Default Value:** AMF\_COLOR\_RANGE\_UNDEFINED

**Description:** Input color range.

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**Name:** AMF\_VIDEO\_CONVERTER\_INPUT\_HDR\_METADATA

**Values:** AMFBuffer

**Default Value:** NULL

**Description:** AMFBuffer containing AMFHDRMetadata .

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**Name:** AMF\_VIDEO\_CONVERTER\_OUTPUT\_TRANSFER\_CHARACTERISTIC

**Values:** AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_ENUM : AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_UNDEFINED , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_BT709 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_UNSPECIFIED , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_RESERVED , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_GAMMA22 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_GAMMA28 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_SMPTE170M , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_SMPTE240M , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_LINEAR , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_LOG , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_LOG\_SQRT , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_IEC61966\_2\_4 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_BT1361\_ECG , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_IEC61966\_2\_1 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_BT2020\_10 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_BT2020\_12 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_SMPTE2084 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_SMPTE428 , AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_ARIB\_STD\_B67

**Default Value:** AMF\_COLOR\_TRANSFER\_CHARACTERISTIC\_UNDEFINED

**Description:** Characteristic transfer function of the input surface used to perform the mapping between linear light components (tristimulus values) and a nonlinear RGB signal. Used (alongside COLOR\_PRIMARIES and NOMINAL\_RANGE parameters ) to describe surface in HDR use case.

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**Name:** AMF\_VIDEO\_CONVERTER\_OUTPUT\_COLOR\_PRIMARIES

**Values:** AMF\_COLOR\_PRIMARIES\_ENUM : AMF\_COLOR\_PRIMARIES\_UNDEFINED , AMF\_COLOR\_PRIMARIES\_BT709 , AMF\_COLOR\_PRIMARIES\_UNSPECIFIED , AMF\_COLOR\_PRIMARIES\_RESERVED , AMF\_COLOR\_PRIMARIES\_BT470M , AMF\_COLOR\_PRIMARIES\_BT470BG , AMF\_COLOR\_PRIMARIES\_SMPTE170M , AMF\_COLOR\_PRIMARIES\_SMPTE240M , AMF\_COLOR\_PRIMARIES\_FILM , AMF\_COLOR\_PRIMARIES\_BT2020 , AMF\_COLOR\_PRIMARIES\_SMPTE428 , AMF\_COLOR\_PRIMARIES\_SMPTE431 , AMF\_COLOR\_PRIMARIES\_SMPTE432 , AMF\_COLOR\_PRIMARIES\_JEDEC\_P22 , AMF\_COLOR\_PRIMARIES\_CCS

**Default Value:** AMF\_COLOR\_PRIMARIES\_UNDEFINED

**Description:** Color space primaries for the input surface which are the maximum red, green, and blue value permitted within the color space. Used (alongside TRANSFER\_CHARACTERISTIC and NOMINAL\_RANGE parameters) to describe surface in HDR use case.

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**Name:** `AMF_VIDEO_CONVERTER_OUTPUT_COLOR_RANGE`

**Values:** `AMF_COLOR_RANGE_ENUM` : `AMF_COLOR_RANGE_UNDEFINED` , `AMF_COLOR_RANGE_STUDIO` , `AMF_COLOR_RANGE_FULL`

**Default Value:** `AMF_COLOR_RANGE_UNDEFINED`

**Description:** Output color range.

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**Name:** `AMF_VIDEO_CONVERTER_OUTPUT_HDR_METADATA`

**Values:** `AMFBuffer`

**Default Value:** `NULL`

**Description:** `AMFBuffer` containing `AMFHDRMetadata` .

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**Name:** `AMF_VIDEO_CONVERTER_USE_DECODER_HDR_METADATA`

**Values:** `true` , `false`

**Default Value:** `true`

**Description:** Enables use of decoder / surface input color properties above.

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## 2.3 Submitting Input and Retrieving Output

Once the Converter component is successfully initialized, you may start submitting input samples to it. Input samples must be submitted as `AMFBuffer` objects.

At the same time poll for output by calling `AMFComponent::QueryOutput` on the Converter object. Polling for output samples can be done either from the same thread or from another thread.

Suspend submission of input samples briefly when `AMFComponent::SubmitInput` returns `AMF_INPUT_FULL` . Continue to poll for output samples and process them as they become available.

## 2.4 Terminating the Converter Component

To terminate the Converter component, call the `Terminate` method, or simply destroy the object. Ensure that the context used to create the Converter component still exists during termination.

## 3 Sample Applications

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A sample application demonstrating the use of the Converter component in AMF is available as part of the AMF SDK in `public/samples/CPPSample/SimpleConverter` . The sample fills `100` frames in a `1920x1080` BGRA surface with an alternating color, submits it as input to the Converter object configured to scale it down to `1280x720` NV12 surface and writes the output to a file.

To run the sample, execute the `SimpleConverter.exe` command at the command prompt.