Advanced Micro Devices

Advanced Media Framework – Video Converter

Programming Guide

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Contents

1 Introduction

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

The Video Converter accepts input frames stored in `AMFSurface` objects wrapping DirectX 9 surfaces, DirectX 11 textures, DirectX 12 textures, Vulkan surfaces, OpenGL or OpenCL surfaces. The output is placed in `AMFSurface` objects wrapping DirectX 9 surfaces, DirectX 11 textures, DirectX 12 textures, Vulkan surfaces, 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
    v. DirectX 12
    vi. Vulkan
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

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

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

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Name: `AMF_VIDEO_CONVERTER_OUTPUT_FORMAT`

Values: 8-bit formats: `AMF_SURFACE_NV12`, `AMF_SURFACE_BGRA`, `AMF_SURFACE_ARGB`, `AMF_SURFACE_RGBA`, `AMF_SURFACE_YUV420P` (progressive only), `AMF_SURFACE_YV12`, `AMF_SURFACE_YUY2`, `AMF_SURFACE_UYVY`, `AMF_SURFACE_AYUV`

10-bit formats: `AMF_SURFACE_P010`, `AMF_SURFACE_Y210`, `AMF_SURFACE_Y410`, `AMF_SURFACE_R10G10B10A2`

12-bit formats: `AMF_SURFACE_P012`

16-bit formats: `AMF_SURFACE_P016`, `AMF_SURFACE_Y416`, `AMF_SURFACE_RGBA_F16`

Other: `AMF_SURFACE_UNKNOWN`

Default Value: `AMF_SURFACE_UNKNOWN`

Description: Specifies the output color format/space. Support is hardware dependent.

Name: `AMF_VIDEO_CONVERTER_MEMORY_TYPE`

Values: `AMF_MEMORY_DX11`, `AMF_MEMORY_DX9`, `AMF_MEMORY_DX12`, `AMF_MEMORY_VULKAN`, `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).

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.

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`.

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.

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.

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`.

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.

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.

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.

Name: `AMF_VIDEO_CONVERTER_COMPUTE_DEVICE`

Values: `AMF_MEMORY_TYPE` (device type)

Default Value: `AMF_MEMORY_UNKNOWN` (auto)

Description: Specifies the compute device type to use for video conversion.

Name: `AMF_VIDEO_CONVERTER_INPUT_TONEMAPPING`

Values: `AMF_VIDEO_CONVERTER_TONEMAPPING_ENUM`:

- `AMF_VIDEO_CONVERTER_TONEMAPPING_UNDEFINED` – Undefined/unspecified tone mapping
- `AMF_VIDEO_CONVERTER_TONEMAPPING_COPY` – Copy without tone mapping
- `AMF_VIDEO_CONVERTER_TONEMAPPING_AMD` – AMD proprietary tone mapping algorithm
- `AMF_VIDEO_CONVERTER_TONEMAPPING_LINEAR` – Linear tone mapping
- `AMF_VIDEO_CONVERTER_TONEMAPPING_GAMMA` – Gamma-based tone mapping
- `AMF_VIDEO_CONVERTER_TONEMAPPING_REINHARD` – Reinhard tone mapping
- `AMF_VIDEO_CONVERTER_TONEMAPPING_2390` – ITU-R BT.2390 tone mapping

Default Value: `AMF_VIDEO_CONVERTER_TONEMAPPING_UNDEFINED`

Description: Specifies the tone mapping algorithm to apply to HDR input content when converting to SDR output formats.

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

Name (prefix "AMF_VIDEO_CONVERTER_")	Type
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

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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.

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.

Name: `AMF_VIDEO_CONVERTER_INPUT_HDR_METADATA`

Values: `AMFBuffer`

Default Value: `NULL`

Description: `AMFBuffer` containing `AMFHDRMetadata`.

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.

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_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.

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.

Name: `AMF_VIDEO_CONVERTER_OUTPUT_HDR_METADATA`

Values: `AMFBuffer`

Default Value: `NULL`

Description: `AMFBuffer` containing `AMFHDRMetadata`.

Name: `AMF_VIDEO_CONVERTER_USE_DECODER_HDR_METADATA`

Values: `true`, `false`

Default Value: `true`

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

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

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.