visual engineering
LIGHTWARE

Application Notes

Easy EDID Creator
Advanced EDID Editor

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Document Information

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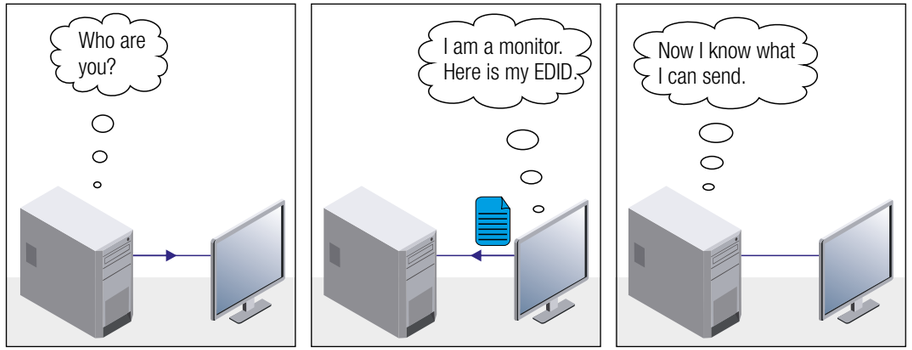
Introduction

The EDID can cause many headaches for beginner system integrators, so it is important to understand the main aspects of the EDID data structure. However, the Lightware factory EDIDs are designed to cover the most practical cases, in some circumstances the editing or creation of a new EDID cannot be avoided.

1.1. About the EDID

EDID is the abbreviation of Extended DisplayIDentification Data and it is a 128-byte data structure, which defines the capabilities of a sink device. If the support for a format is not indicated in the display device's EDID then according to the standard the source is strictly forbidden to send this type of signal. This is very convenient for the home users – this behavior guarantees the best interoperability between the different devices – but it can make a lot of trouble for system integrators with more sources and sinks at same time.



EDID communication

Unfortunately, the standard is very complicated and it is not easy to understand the cross references and relations between the different versions even for the experienced users. Please also refer to the official standards for more details: the VESA E-EDID and DMT (Display Monitor Timing) standards can be ordered from www.vesa.org, while the DVI and HDMI standards can be downloaded free of charge from www.hdmi.org.

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Easy EDID Creator (EEC)

As you will see, creating a new EDID according to specific requirements is often a complex task with lots of possible pitfalls. It is a usual assignment in real life when you want to force a specific video and audio format to your source as quickly as possible but you do not want to worry about the different descriptors and timing standards. In this case, Easy EDID Creator can be very useful.

2.1. Preparation

Easy EDID Creator is a part of **Lightware Device Controller** (LDC). Install the software, start the application and select the EDID menu. To start Easy EDID Creator, press the **Create** button. You have to complete four steps to creating a new EDID. You can move between the different steps with the **Back** and the **Next** buttons. Of course, after finishing the process you have the opportunity to fine-tune the details or add other formats by using the **Advanced EDID Editor**.

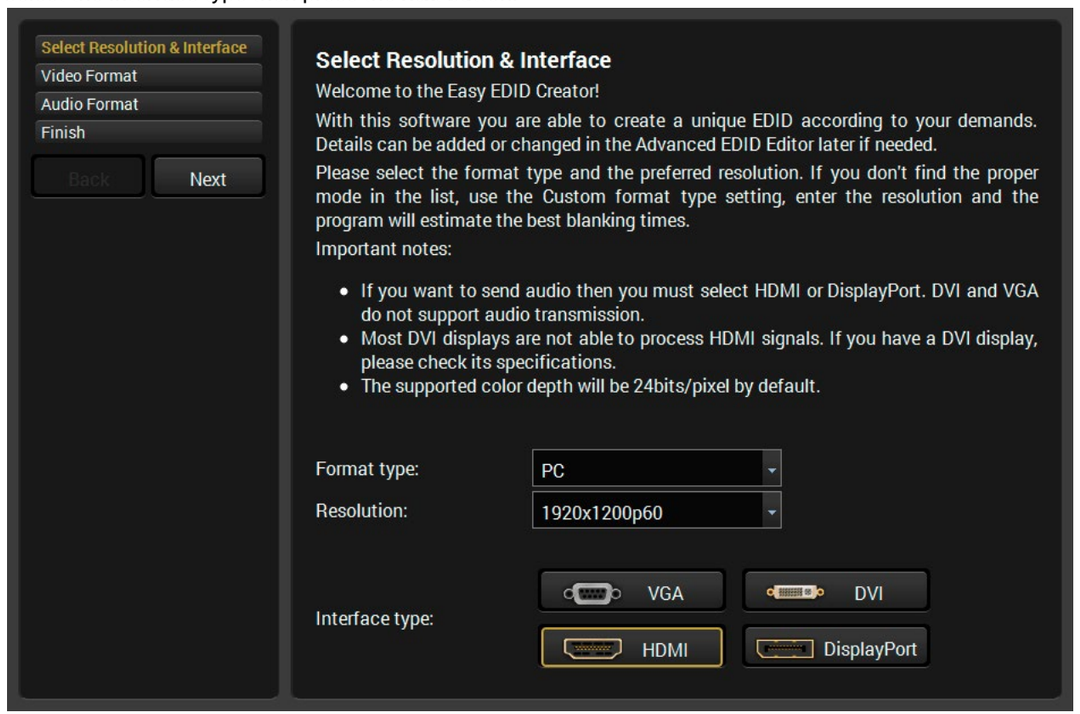
2.2. Step 1 – Select Resolution & Interface

The Format type determines the content of the drop-down list showing the resolutions which fit the best for PC or Broadcast application. The desired resolution can be defined by:

- Selecting a value from the **drop-down list** where the most common resolutions are listed, or
- Selecting **Custom** as a format type and set the parameters manually.

> INFO: The use of audio, non-RGB color spaces and deep color requires the HDMI mode. If HDMI support is left unchecked, your source will be forced to send DVI signal. (According to the standard, HDMI capable sources are backwards compatible with DVI displays.)

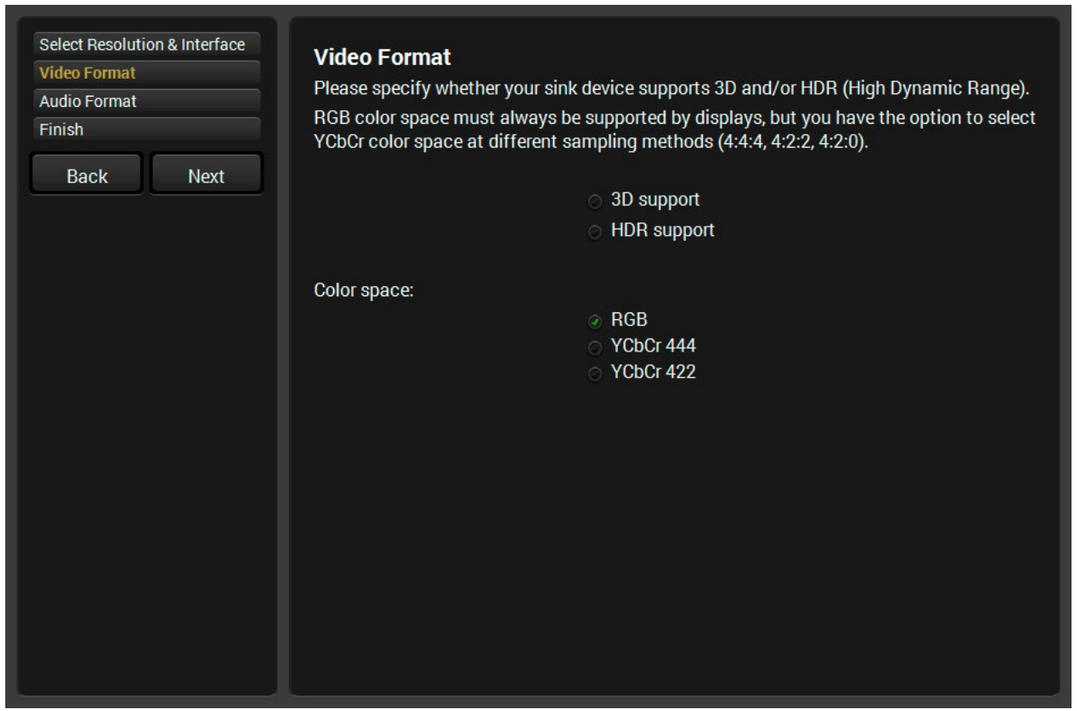
Select the Interface type then press the **Next** button.



Step 1 – Select Resolution and Interface

2.3. Step 2 – Video Format

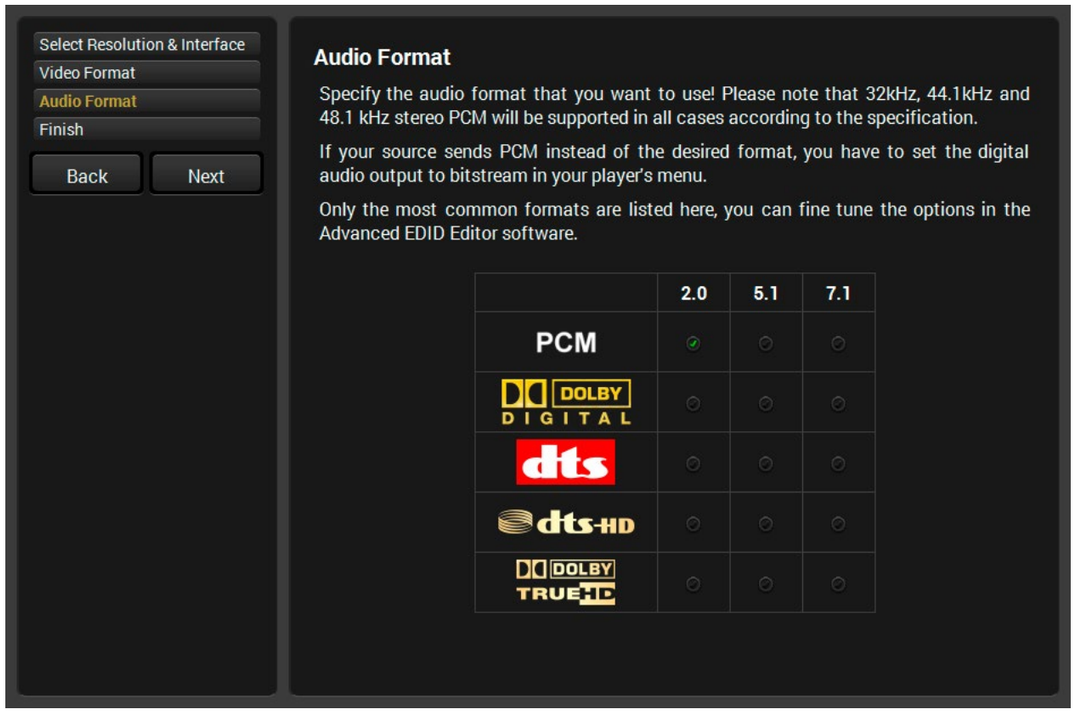
You have to decide if 3D or HDR support is necessary and the supported color space can be also set.



Step 2 – Video Format

2.4. Step 3 – Audio Format

The desired audio formats can be specified in the third step.



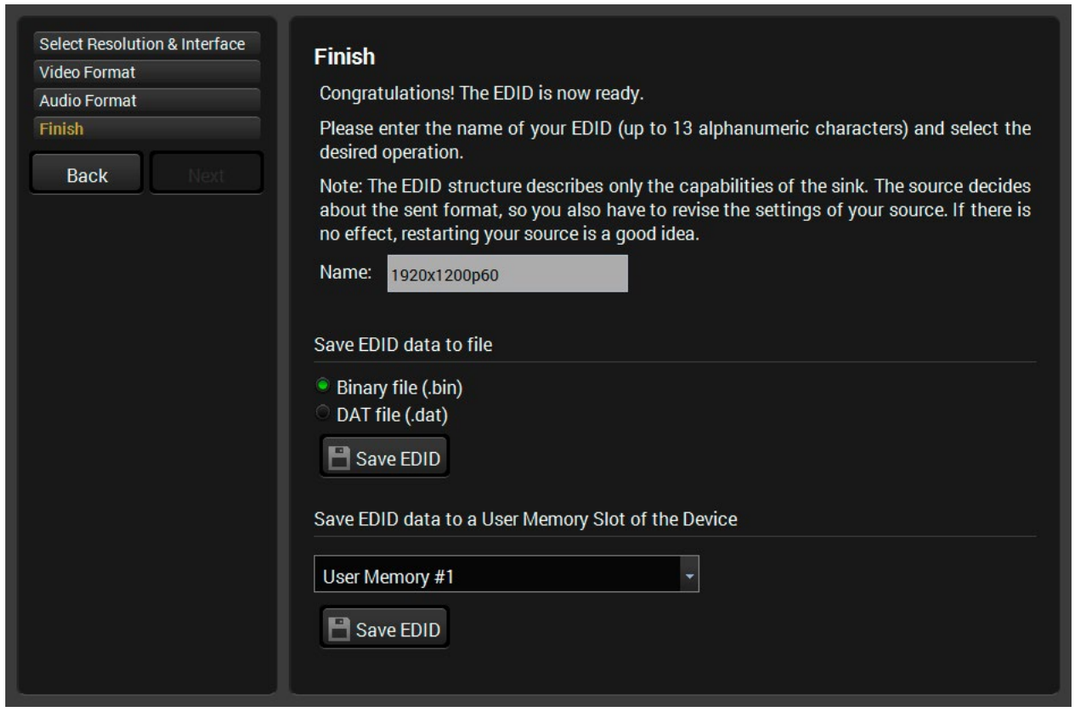
Step 3 – Audio Format

2.5. Step 4 – Finish

You have to give a name to your new EDID as last step. This name will be fit into the display product descriptor, so it can be up to 13 alphanumeric characters long. You also have to select the desired operation:

- Save the EDID as a ***.bin** or ***.dat** file, or
- Save the EDID to a memory slot in the actually used Lightware product.

By clicking on the **Finish** button, the new EDID will be generated and the selected operations will be performed.



Step 4 – Finish

3

The Advanced EDID Editor

This powerful tool is essential for AV professionals. The Advanced EDID Editor makes possible to manage every setting in the EDID on an intuitive user interface. The editor can read and write all descriptors, which are defined in the standards, including the additional CEA extensions.

3.1. EDID Editor – Integrated in the LDC

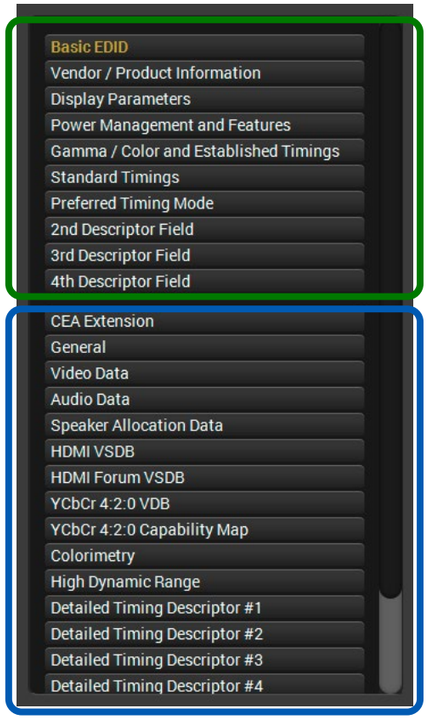
The software resolves the raw EDID and displays it as readable information to the user. All descriptors can be edited and saved in an EDID file, or uploaded to the device's memory. By clicking on the **Edit** button, the editor area opens in a new window.

3.2. Main Menu

The layout of the main menu on the left side follows the structure of the EDID. It has two main parts:

- The first 128 bytes are the actual EDID data,
- The second optional 128 bytes are a so-called CEA extension.

Usually (but not exclusively) the Digital Televisions and HDMI capable devices have CEA extension, while DVI computer displays only have the first 128 bytes.



By clicking on the EDID or the CEA in the main menu, you will get direct access to the raw 128-byte long data structures. You are also able to edit these hexadecimal values; this can be useful for experienced users.

The last byte of a 128-byte data structure is the checksum: it has to be calculated properly in order to get a valid data, which is performed automatically while you edit the raw data. If there is no CEA extension present, then you will not be able to edit the second part. In that case the software will offer adding a new extension.

The other menus of the EDID and CEA show the logical parts of the data structure. The EDID has four descriptor fields, which contain various data. The first field has to be a detailed timing descriptor (this is the most important field of an EDID, since it defines the native pixel resolution of the DVI or HDMI signal), while the 2nd, 3rd and 4th field may have numerous different contents, however there are some explicit requirements.

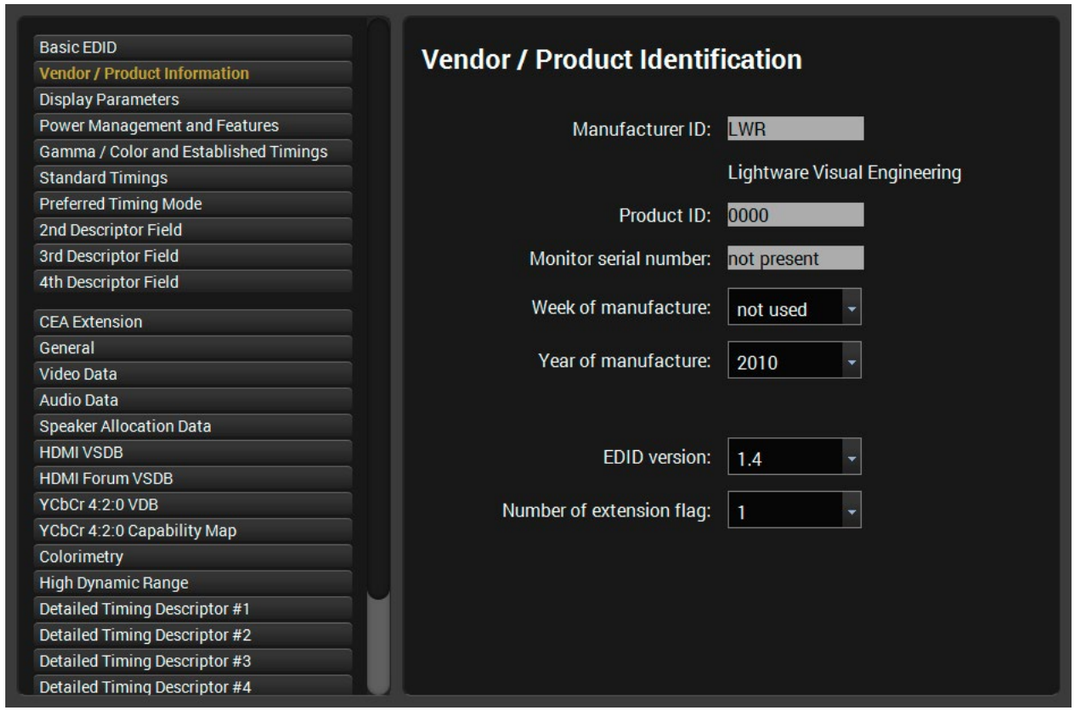
A range limit descriptor and a monitor name descriptor are mandatory in the EDID v1.3 and recommended in the EDID v1.4 of the standard. If the space is not enough in the first 128 bytes, additional detailed timings can be also defined in the CEA extension. The size of other data (such as video, audio, speaker allocation) limits the number of detailed timings, for example if you have a lot of audio formats, you can use only five or fewer additional timing descriptors.

Do not be confused about the unknown notions, they will be explained later.

3.3. The First 128 Bytes

3.3.1. Vendor / Product Information

By clicking on the Vendor/Product information, you can set the basic identifiers of your display, such as manufacturer, product ID, serial number, production date.



Vendor / Product information Tab

Manufacturer ID: This is the 3-character ISA PNPID identifier of the manufacturer. Only English capitalized letters are allowed.

Product ID: 2-byte hexadecimal code, numbers and letters A-F are allowed.

Serial number: A Unique identifier of the device. Only numbers are allowed, enter **0** if not used.

EDID version: We strongly recommend the usage of 1.3 or 1.4 version, but if you get compatibility issues with very old sources, you may try other versions.

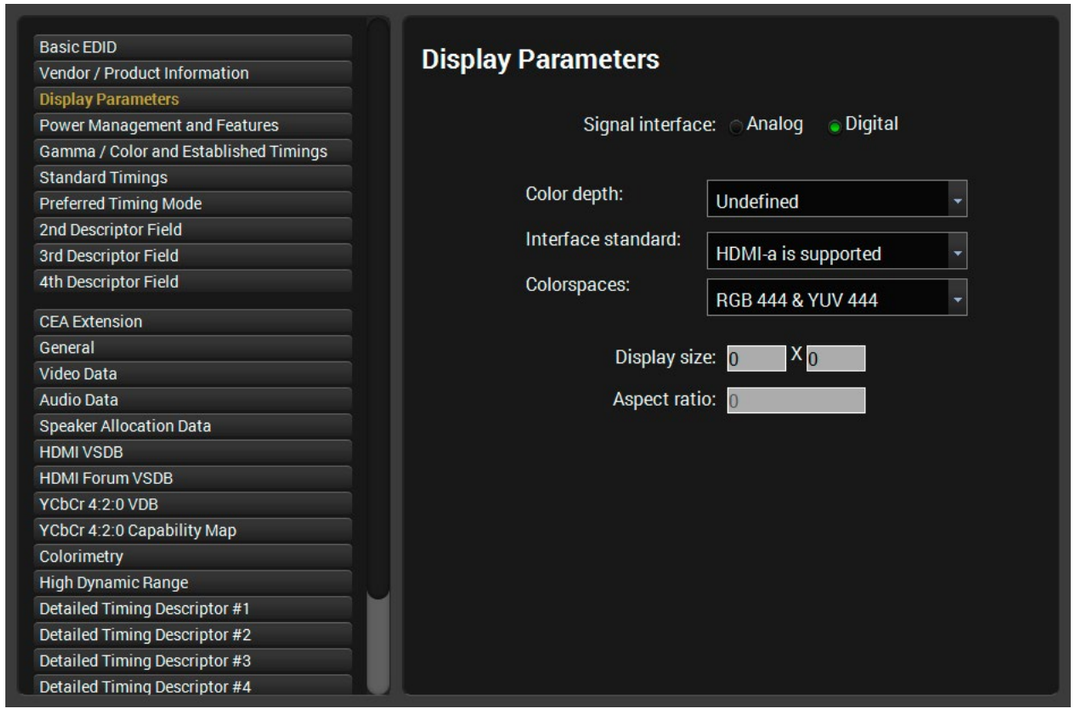
Extension flag: Indicates whether the CEA extension is present or not. Set this field to zero if you don't want to use the second 128 bytes.

3.3.2. Display Parameters

Some basic information can be set here. These settings are present in the EDID data structure for historical reasons and usually they have no effect. We strongly recommend that you set the signal interface to Digital.

24bit RGB 4:4:4 is always sent when using DVI, so the color bit depth and color spaces have no effect. If you use HDMI, the proper color space and supported depths have to be defined in the CEA block.

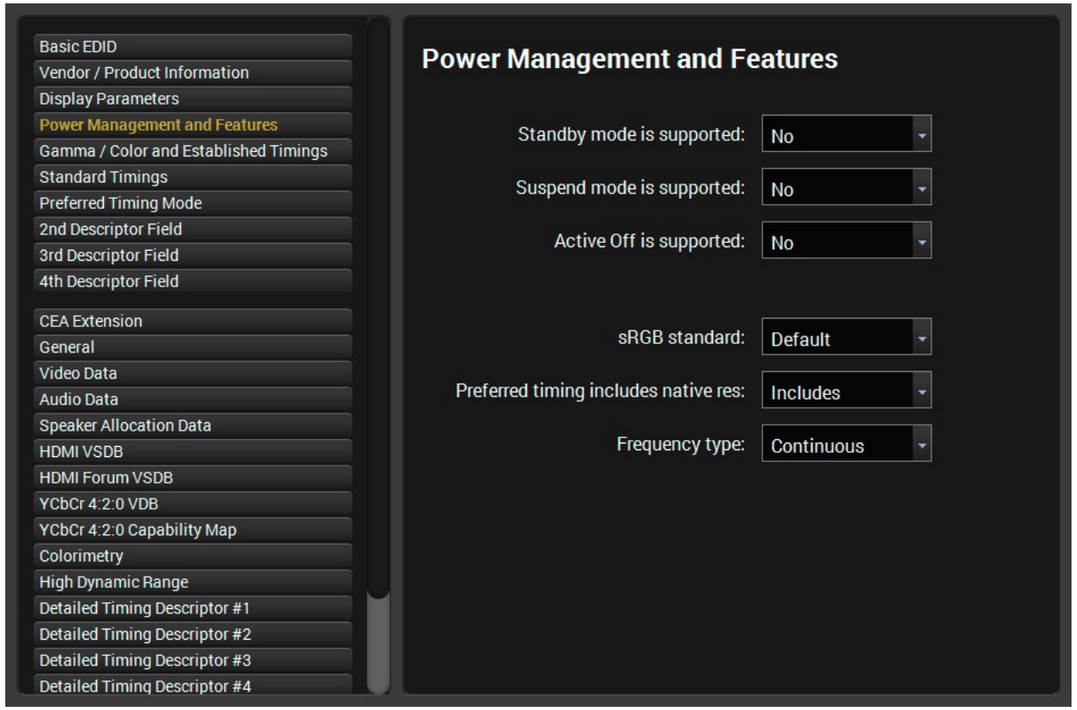
You can set the display size here by entering the horizontal and vertical lengths in centimeters separated by space, but most sources will not check this field.



Display Parameters Tab

3.3.3. Power management and features

Standby mode, **Suspend** mode and **Active off** are energy saving methods which can be implemented in the display devices. Active off means the display will automatically turn off when the signal from the input is removed and turned on, when the video comes back again.



Power management and features tab

If the **sRGB** standard has been set to default, the display uses sRGB as its primary color space. If a display is sRGB-compliant, then the color information described in next section shall match the sRGB standard values.

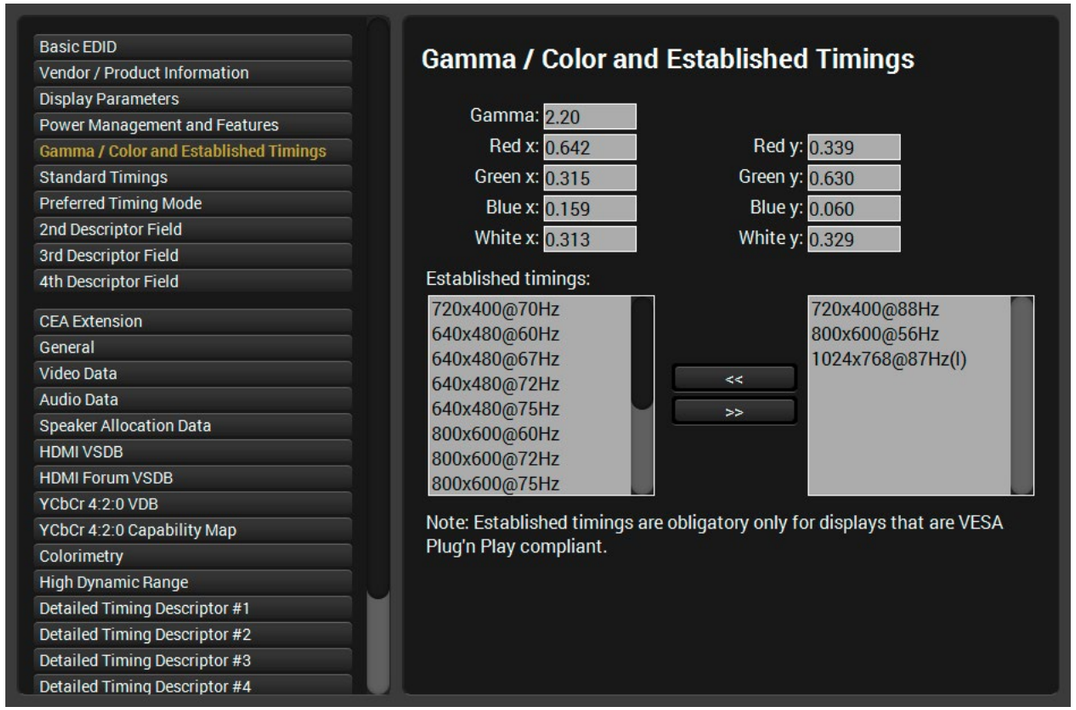
Setting the **preferred timing mode** to **Includes** means that the resolution specified in the 1st descriptor block (see later) is the native resolution of your display module (e.g. number of pixels in the LCD panel).

It is important to understand the **frequency type** field, since there is a lot of confusion about that. Its meaning is different in the 1.3 and 1.4 versions of EDID standard. In the 1.3 version this option indicates whether the display supports GTF (Generalized Timing Formula). If GTF is supported, then all video modes are accepted which are compliant with the GTF and which are within the Display Range Limit Descriptor boundaries. A GTF calculator spreadsheet can be downloaded for free from the https://vesa.org/vesa-standards/ web address after registration.

If you use the 1.4 revision of the EDID structure, continuous timing frequency means supporting every possible video mode within the Display Range Limits Descriptor. In this case, it is mandatory to define this descriptor. If this option is set to Non-continuous then the source is permitted to send only the signals that are explicitly defined in the base EDID structure or in specific extension blocks. We advise you to use Non-continuous mode if you want to force a specific resolution onto your source, and use continuous mode, if you want to give the freedom to your source to select the video mode within the defined boundaries.

3.3.4. Gamma / Color and Established Timings

The display x,y chromacity coordinates are required elements in the EDID 1.4 version. These fields provide chromacity and white point information and the sources with advanced color profile management will use them. Please note that most of the displays use the sRGB standard as default.



Gamma / color and established timings tab

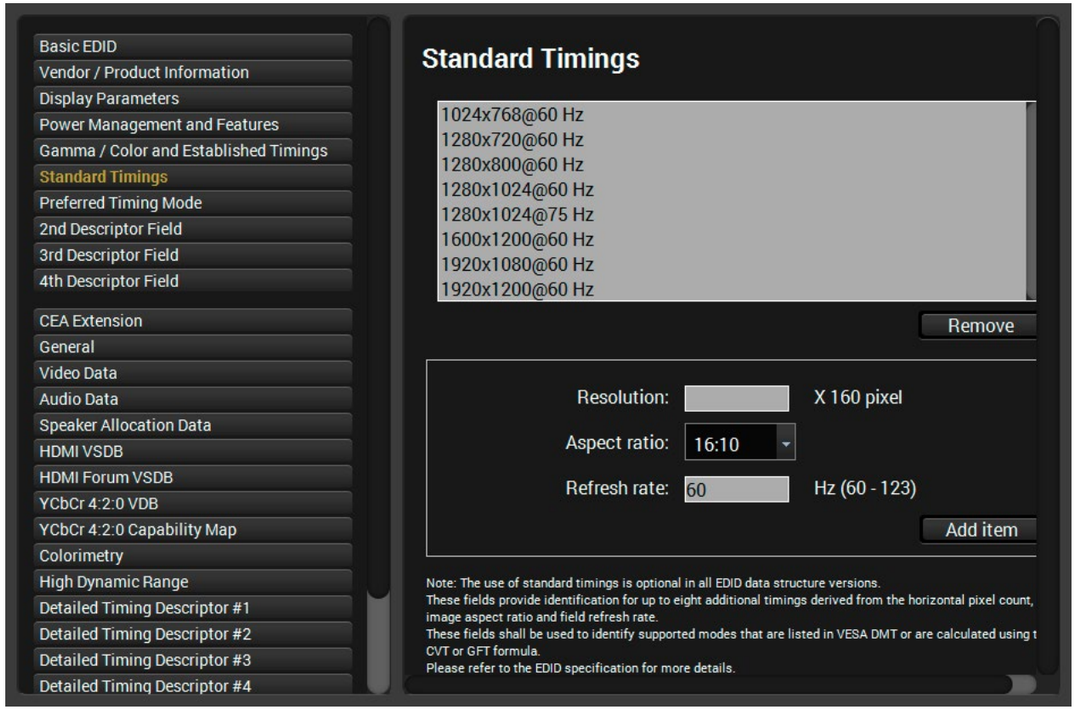
The Established timings section can define up to 17 predefined resolutions which have emphasized importance due to historical reasons. Nonetheless this field is optional, you have to indicate the 640x480@60Hz resolution here if you want to create a VESA Plug and Play compliant EDID. This is important for example during booting personal computers while most of the computers that have old BIOS can only operate with VESA compliant devices.

You will see the selected resolutions in the left column and the available resolutions in the right column. You can select one element from a list and move it by clicking on the appropriate button between the columns. We strongly advise you to support at least 640x480@60Hz in order to avoid compatibility issues.

3.3.5. Standard Timings

The use of standard timings is optional in all EDID versions. This field provides identification for up to eight additional timings derived from the horizontal pixel count, the image aspect ratio and field refresh rate.

These items do not specify the exact timings for the source (e.g. sizes of blanking intervals), so there are a few rules to determine them. If a resolution is present in the VESA DMT standard then the source has to use the timing parameters described here. If the resolution is not present in this standard and CVT (Coordinated Video Timing) is not supported either by the sink or the source, the GTF formula shall be used to calculate the exact parameters. If CVT is supported, then it must be used instead of GTF.



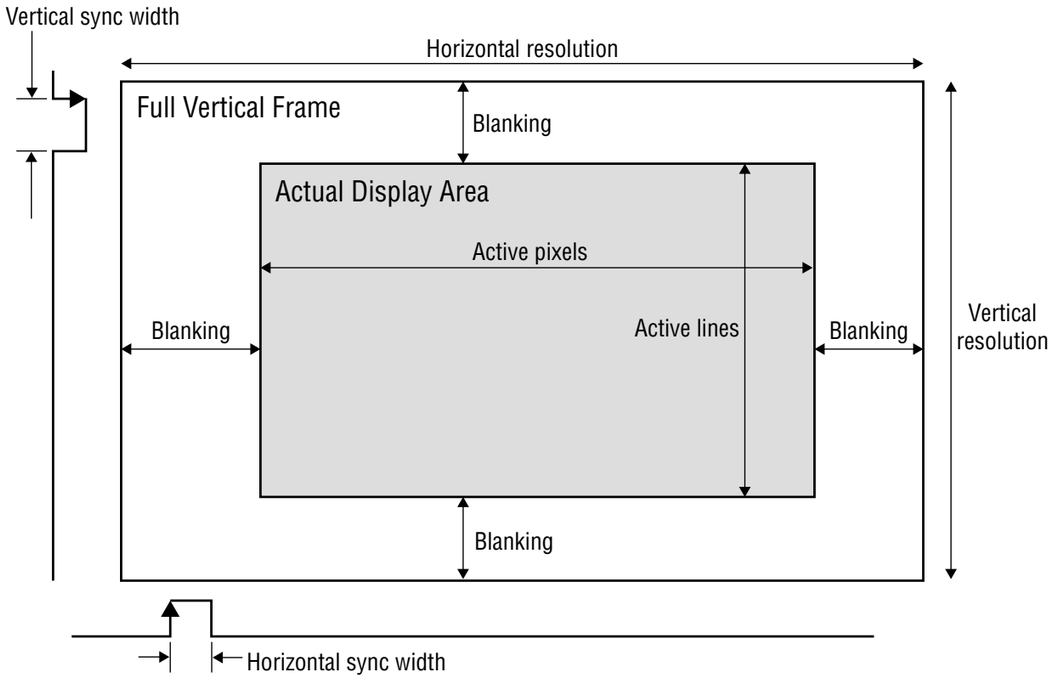
Standard Timings Tab

To add a new item to the list you have to enter the horizontal resolution (it should be between 256 and 2288, in increments of 8 pixels) and the refresh rate (accepted range is 60-123), select the corresponding aspect ratio and click on the **Add item** button. The vertical resolution will be calculated automatically. To remove an item from the list, select it and click on the **Remove** button. We advise you to use detailed timing descriptor (e.g. preferred timing descriptor described in the next chapter) instead of standard timings if you want to force a specific resolution onto your source. However, this field can be useful when you don't have enough space for detailed descriptors to describe all the resolution you want.

3.3.6. Preferred Timing Mode

The first descriptor block in the base EDID structure has to contain a Detailed Timing Descriptor. Most DVI sources will determine their default resolution according to this field, so it is worth to understand it in more detail.

The most important parameter of every video signal is the pixel clock frequency (often referred to as f_{pclk}), the horizontal sync (Hsync) frequency and the vertical sync (Vsync) frequency. The ratio of pixel clock and Hsync frequency will determine the number of pixels per line, the ratio of Vsync and Hsync frequencies determine the number of lines per frame. The number of lines and pixels are not equal to the actual active video area due to the presence of blanking intervals. These intervals usually are a significant part of the full frame but they will not be shown on the display, so the width and height of the active video area is another very important parameter (we usually mean these values when we say 'resolution').



A full Video Frame

The Hsync and Vsync signals determine the beginning of a new line and a new frame, but not the active video frame. The vertical back porch is the time (usually measured in lines) between the Vsync pulse and the first line of the active video area. Vertical front porch is the time between the last active line and the next Vsync pulse. The horizontal back porch and horizontal front porch can be interpreted similarly. Both the Hsync and Vsync signals can use either positive or negative logic levels and the length of the pulses are determined by the video format.

You have to distinguish the progressive and interlaced formats. An interlaced video consists only of the even or the odd lines in a single frame, so the number of the active lines is half of the effective lines. For example a 1080i resolution has only 540 lines, which means lower pixel clock at the same Vsync frequency.

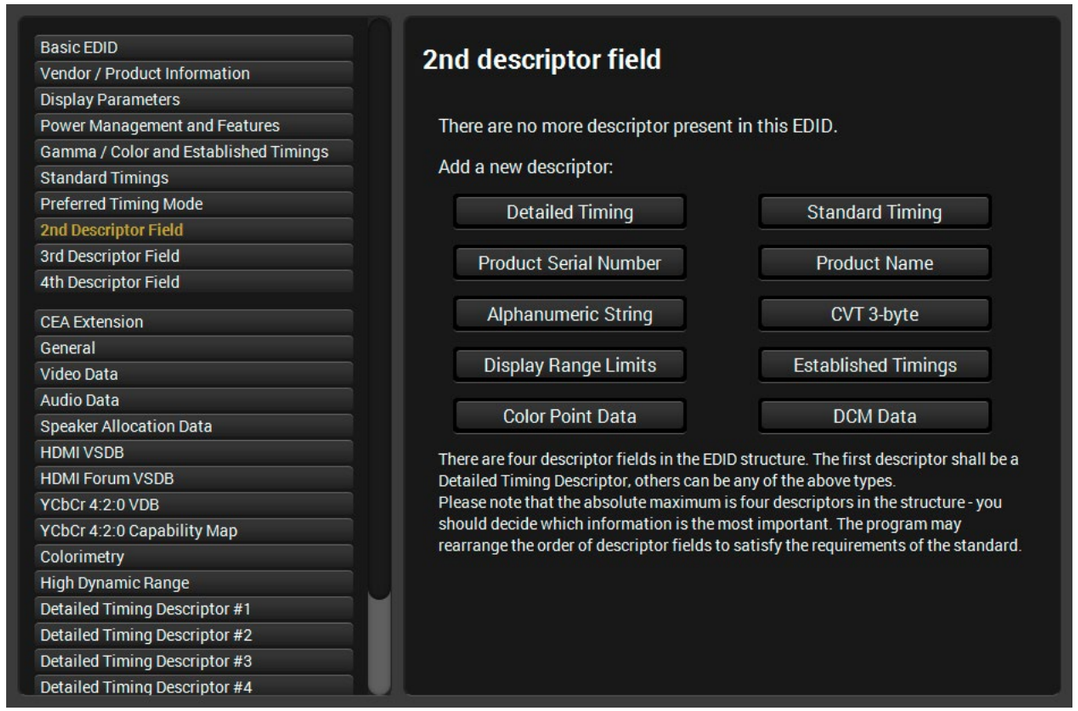
Preferred Timing Mode

While editing a detailed timing descriptor (such as preferred timing mode) you can determine the parameters discussed above. By selecting a standard timing value from the drop-down list, you have the opportunity to select one of the predefined formats and the software will fill the fields with the accurate values, however you also have the opportunity to change all values. In the first line next to the Pixel clock you will see the calculated frame rate based on the entered numbers.

Blanking means the sum of the horizontal and the back porches, while the sync offset is equal to the back porch. The border and the size of the picture shall be given but usually it has no effect on the sent video signal. While using digital signals (e.g. DVI, HDMI or DisplayPort) you have to select the proper Digital Separate Sync option from the list.

3.3.7. Descriptor Fields

The 2nd, 3rd and 4th descriptor can contain any other descriptor however it is strongly recommended to have one product name and one display range limits descriptor.

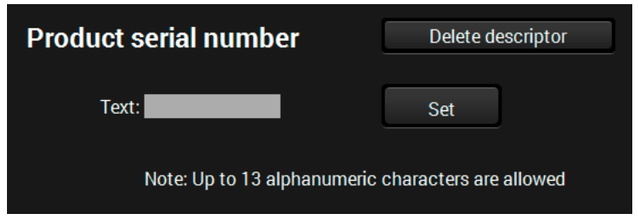


An empty descriptor field

By clicking on an empty descriptor in the left-side menu, the software will offer adding a new one. When selecting an existing descriptor field, a **Delete** button appears in the top right corner which enables you to remove the unnecessary elements.

Product serial number descriptor

You can specify a serial number in the EDID. The serial number can consist only of the letters of the alphabet and numbers, the maximum length is 13 characters.



Alphanumeric string descriptor

An arbitrary 13 characters long text can be defined here, such as comments or copyright notes. Only alphanumeric characters are allowed.

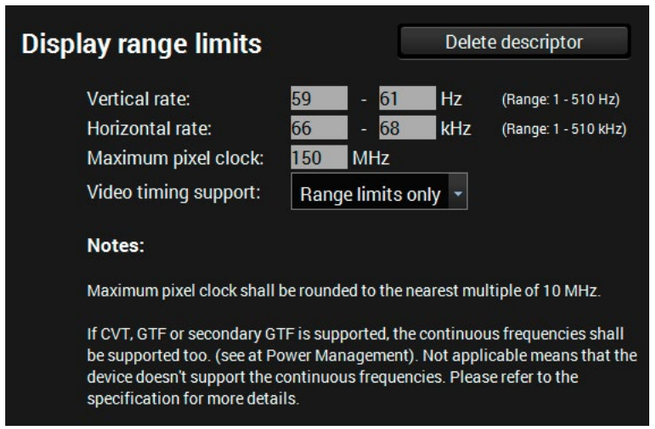
Product name descriptor

This kind of descriptor is a mandatory requirement in the 1.3 version of EDID structure and it is optional but strongly recommended in the 1.4 version. The name of the sink device can be defined here, which some source will use to identify the display device. The Lightware EDID router window and the front panel LCD also.

Display range limits descriptor

This descriptor has to be defined if the frequency type at the Power Management and Features tab has been set to continuous mode. You have to specify the valid range for the vertical and horizontal refresh rate and specify the maximum of the pixel clock. The pixel clock shall be rounded to the nearest multiple of 10MHz.

If continuous frequency is supported, you have to specify whether the GTF, secondary GTF or CVT standard shall be used to determine the timing parameters. We advise to indicate the CVT support since nowadays almost all display devices support it, giving the source the highest possible freedom.

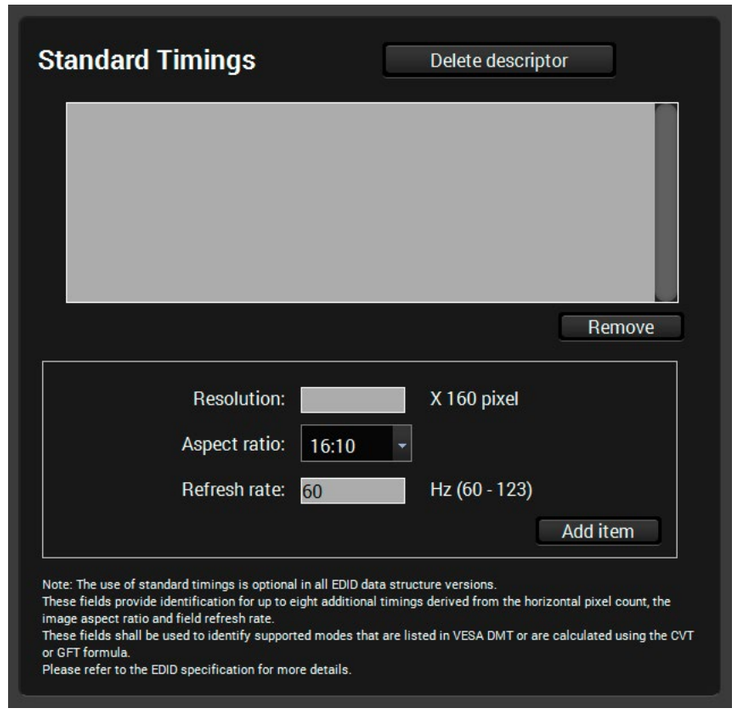


Color point data

Chromacity coordinates (x,y) for up to two additional sets of white points may be stored in the color point descriptor. In addition, gamma values associated with each white point may also be defined. This descriptor is almost never used.

Standard timing identifier definition descriptor

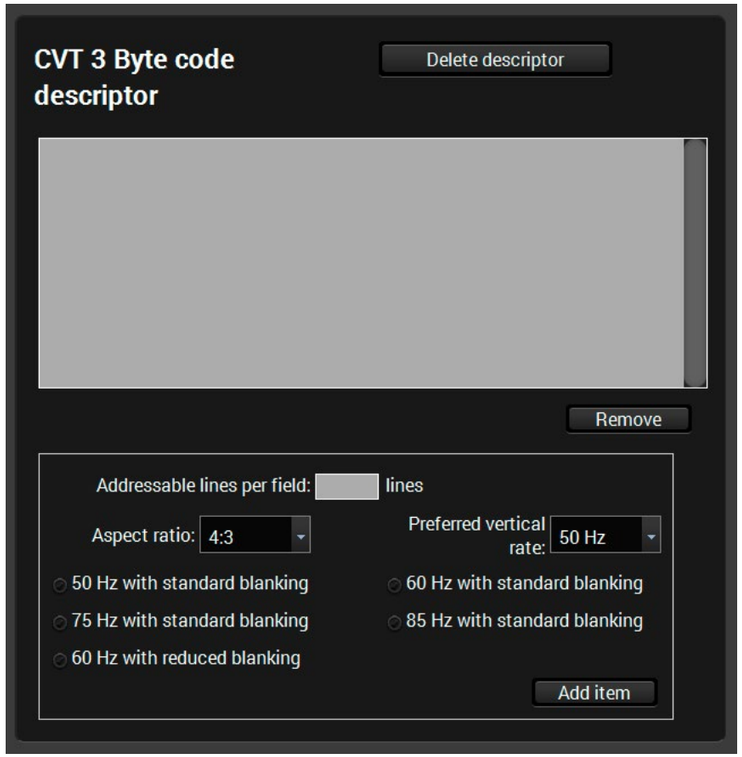
If the eight possible standard timings are not enough, you can add more standard timings with this descriptor. One descriptor field can have up to six additional timings, while the graphical interface is the same as discussed at the standard timings.



Standard timing identifier definition descriptor

CVT 3 Byte Code descriptor

In the CVT 3 Byte Code Descriptor you can define Coordinated Video Timings (CVT) that are not defined in the VESA DMT version 1.0 Revision 10 document. This descriptor section may be divided to support up to 4 timing sub-blocks.



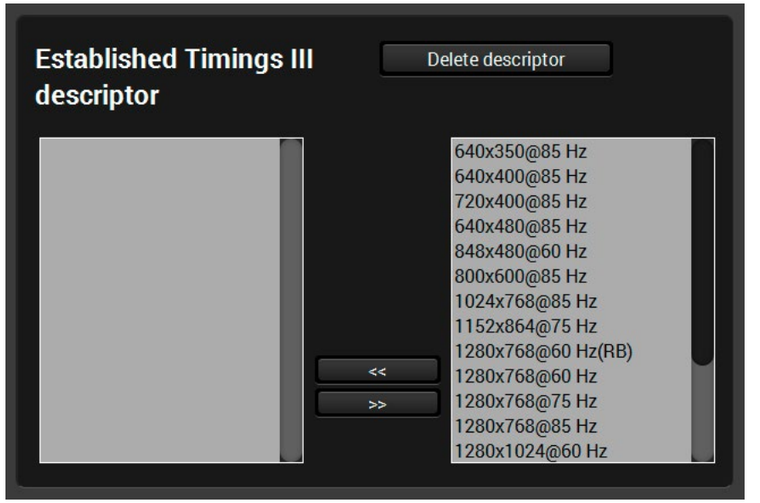
CVT 3 Byte code descriptor

To add a new item you have to specify the number of the lines, the aspect ratio and the preferred vertical refresh rate. In addition you have to add other refresh rates.

This descriptor is almost never used and it has no significance today.

Established timings III descriptor

This descriptor defines Display Monitor Timings (DMTs) that are defined in the VESA Monitor Timing Standard but are not included in the Established timings. There are 44 DMT defined standards here which can be moved between the two lists. This is a table of supported DMTs and cannot define the video timing priority (in order of importance).



Established timings III descriptor

Display color management (DCM) data descriptor

Color management data may be listed in this descriptor. This requires the storage of the Display Color Management polynomial coefficients. More information on deriving the DCM coefficients is available in the VESA DCM Standard. This descriptor is almost never used.

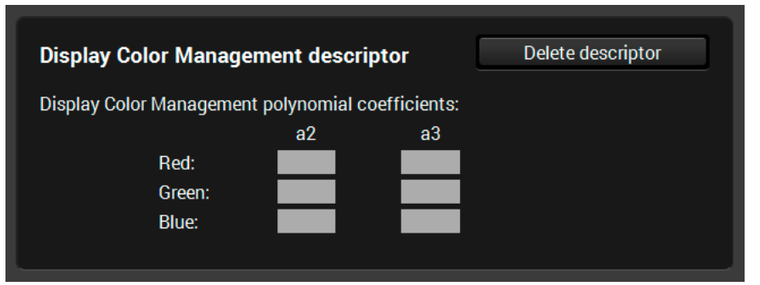


Figure DCM data descriptor

3.4. The CEA Extension

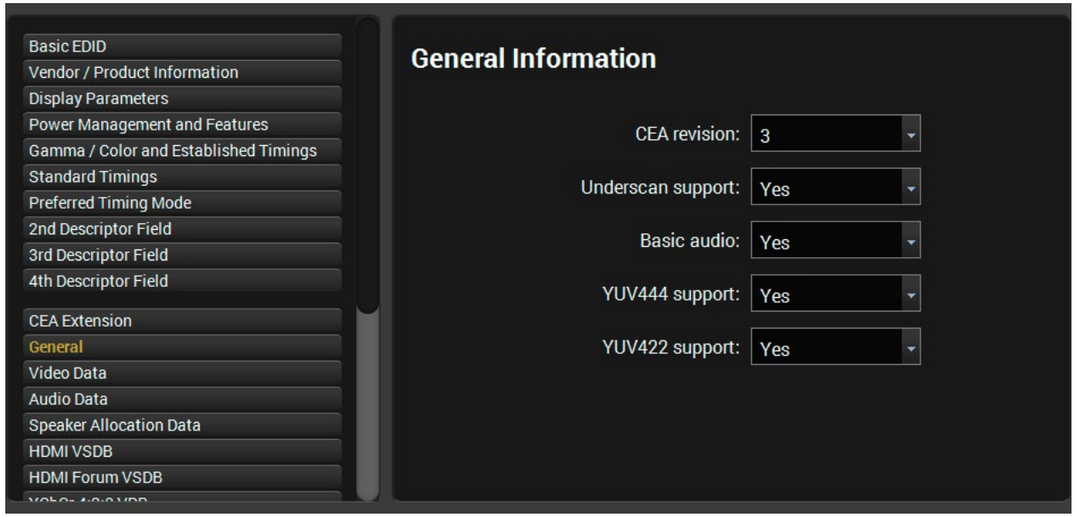
The CEA extension is an additional optional 128-byte long element for the EDID data structure. This extension was defined in the CEA-861 standard and – like the EDID – it has more versions. All HDMI compliant devices must have at least CEA extension version 3, but not all devices are HDMI compliant that have it.

CEA extension may hold up to 6 additional detailed timing descriptors – the number depends on the size of other data – so if there is not enough space in the basic EDID, you may place additional timings here.

3.4.1. General CEA Settings

The CEA revision number can be selected under the General tab. We strongly advise to use CEA revision 3, because version 2 and 1 are deprecated and shall not be included in DTV monitors. The new version is backwards compatible so old sources have to interpret them accordingly (however we have seen exceptions…).

Digital Televisions usually use underscan by default which means that they crop a small border from the active video area and rescale the picture. If you indicate the underscan support here then some VGA cards will try to compensate this and they will also rescale the picture from the original size to a smaller one. In order to get the highest quality, we advise to disable the underscan both in the CEA extension and both in the setup menu of your display device. This method ensures the avoiding of picture rescale and making the performance better.



General CEA information field

If your display device supports audio then set the basic audio support to Yes. YUV444 and YUV422 support can also be indicated here. These settings have an effect only if you use HDMI signal.

You can also check the free space in the CEA extension; an additional detailed timing descriptor needs at least 18 bytes.

3.4.2. Video data

The CEA-861 standard defines 59 resolutions for the DTV devices. The exact timing parameters of these resolutions are defined in the CEA-861 document and they are referenced only with their ordinal number in the CEA extension. You can enumerate up to 31 different formats here in priority order. The elements at the beginning of the list have higher priority than others. It can be also indicated whether a resolution is native or not.

Short video descriptor field

Most HDMI sources (such as DVD and Blu-ray players, game consoles) decide about the resolution based on short video descriptors (and ignore the preferred timing mode), so you have to fill this field with special care. To add a new mode select one from the drop-down list and check whether it is a native format then click on **Add** button. You can reorder the items by clicking on one and pressing the arrows on the right side. To delete an item, select it and click on the **Remove** button.

Please note that some resolutions have two different definitions in the list (such as 720x480p60 format). However the resolution and the frame rate is the same, the timing parameters are different. If you don't know what to do, we suggest adding both versions to the list.

3.4.3. Audio data

Specifying the correct audio format is an essential part of the system design. According to the HDMI standard, an HDMI Sink that is capable of accepting any audio format is required to accept two channel L-PCM audio at sample rates of 32 kHz, 44.1 kHz, and 48 kHz. If an HDMI Source supports any HDMI audio transmission, then it shall support 2 channel L PCM with either 32kHz, 44.1kHz or 48kHz sampling rate and a sample size of 16 bits or more. These two rules ensure that 2 channel L-PCM is a common working solution in all case.

Short audio descriptor field

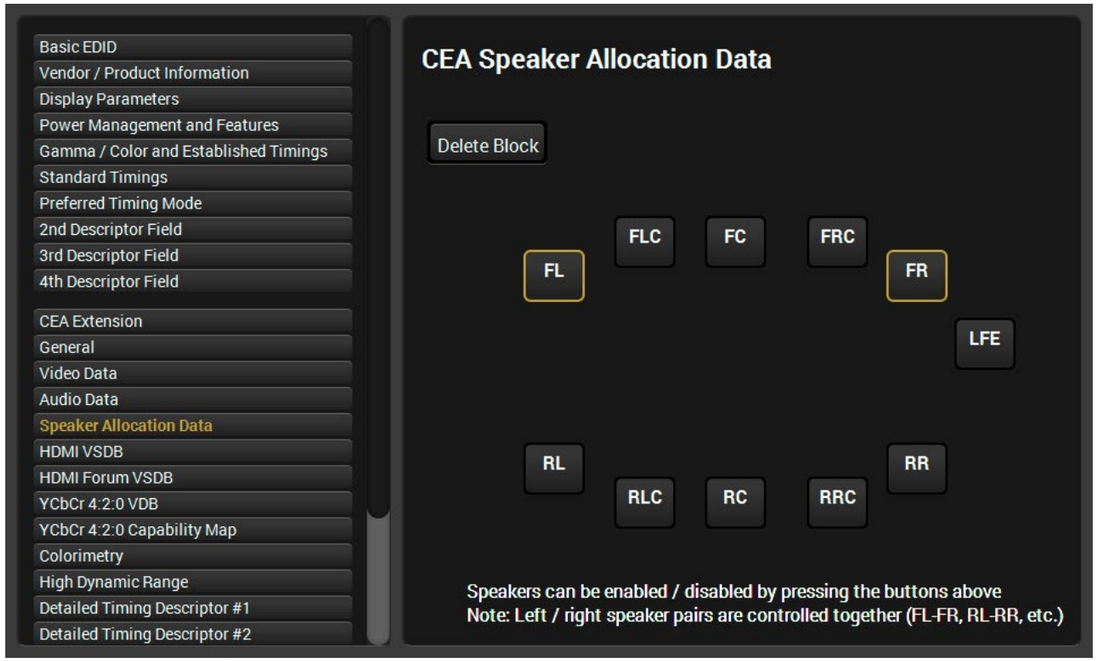
You can set up to 13 different audio formats in the audio data block while the number of existing audio formats is higher – so unfortunately it is not possible to include all formats. To add a new format to the list, select it from the drop-down list and fill the parameters (they can vary depending on the selected format), then click on the **Add** button. To delete an audio format, select it from the list then click on the **Remove** button.

There is a lot of misunderstanding about the audio formats. Please note that just indicating the capability to decode a format will not force the source to send it, while the 2 channel PCM is always allowed according to the HDMI standard. If you want to send compressed formats then you also have to set your source accordingly. For example you have to select bitstream audio output instead of PCM and select the correct audio track. However most players are able to decode the compressed formats to PCM, they will not encode the content into another format. There are exceptions: e.g. DTS-HD Master Audio holds a normal DTS audio in one substream and some players are able to send DTS instead of DTS-HD if the CEA extension signals only DTS support.

Please note that Dolby True-HD format is called MLP in the software, since it uses the Meridian Lossless Packing method. However the DTS-HD and MLP are also lossless formats, we suggest using multichannel PCM with a high sampling frequency to avoid interoperability issues. The PCM carries uncompressed signal without quality loss and while the bandwidth is no problem on the HDMI links, it has absolutely the same result as compressed lossless formats.

3.4.4. Speaker allocation

If you have specified any multi-channel LPCM digital audio before, you have to set up the speaker allocation block correctly by selecting the correct checkboxes.



Speaker allocation field

The abbreviations are:

RLC/RRC	Rear left center / Rear right center
FLC/FRC	Front left center / Front right center
RC	Rear center
RL/RR	Rear left / Rear right
FC	Front center
LFE	Low frequency effect (subwoofer)
FL/FR	Front left / Front right

3.4.5. HDMI VSDB

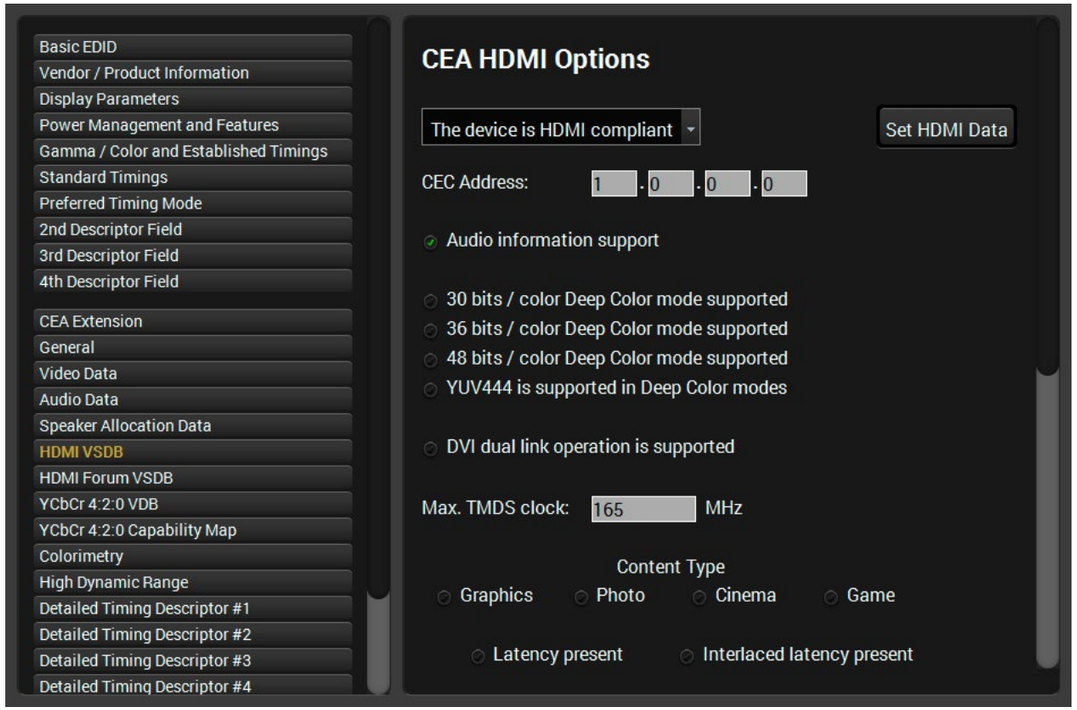
The letters VSDB stand for Vendor Specific Data Block which has been introduced in HDMI standard 1.4. HDMI support and related settings can be done here. If you want to create an HDMI compliant EDID, you have to set this field correctly – otherwise the color space, audio and speaker settings will have no effect.

Basic settings

CEC address is for the consumer electronics control. While this function is intended for home usage, professional devices – such as matrices, splitters – usually don't support it, so it has no significance.

Audio information – often referred to as AI in the standard – holds data about copy protection (not about HDCP!). We suggest setting this option to Supported, if you are unsure.

HDMI 1.3 has deep color support as a new feature that can be indicated by ticking the settings. Please note that 48 bits/color is not supported by the Lightware matrices, so we strongly advise to skip this feature. While the Lightware matrices are able to convert between color depths on the outputs depending on the display capabilities, selecting 30 and 36 bits/color cannot cause compatibility problems. Please note that higher color depths need higher bandwidth, so if you get noise on the input, it is a good idea to disable the 30 and 36 bpp support.



HDMI options, Basic settings

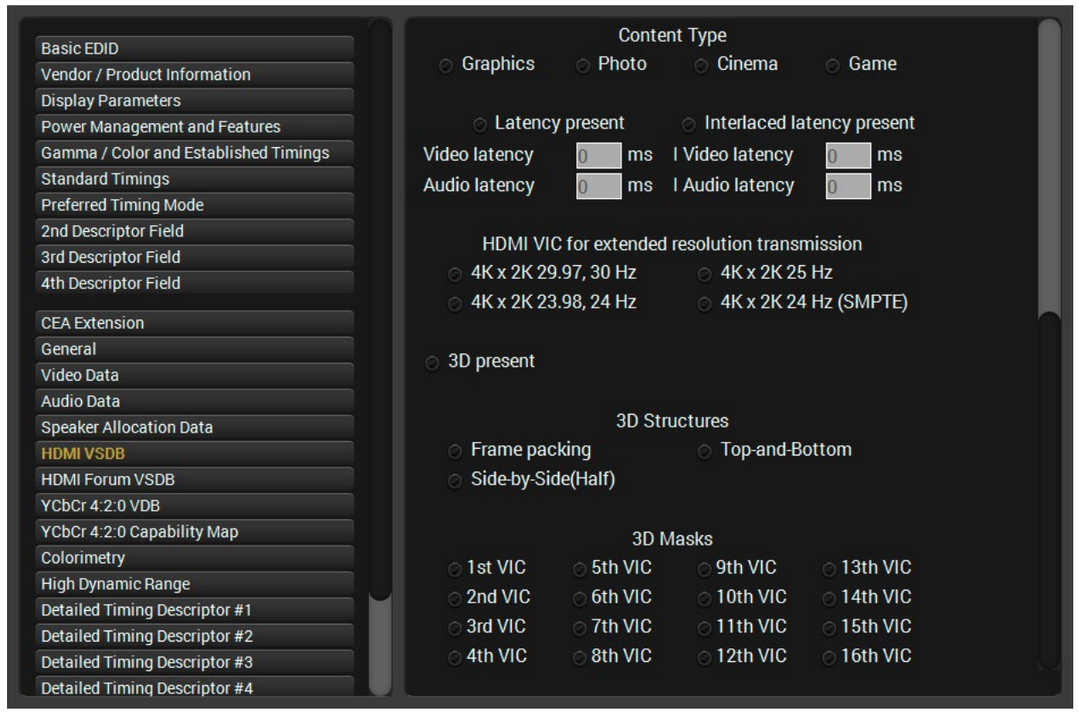
By default, only RGB is allowed in deep color modes, except if you select the YUV444 checkbox here. There is no way to get YUV422 in deep color mode (see HDMI standard).

If there is deep color support you have to specify the maximum TMDS clock frequency, in other cases you are allowed to set this field to zero. Please note that the frequency of the TMDS clock and the pixel clock are not equal in deep color modes. For example, a 36bits/pixel 1920x1080p60 signal has a TMDS clock frequency of around 223MHz.

If latency fields present, their values can be set on this tab. Content type setting is optional; it has an importance if the sink has specific processing for certain content. HDMI VIC (Video format Identification Code) setting is also optional for extended resolution transmission.

3D settings

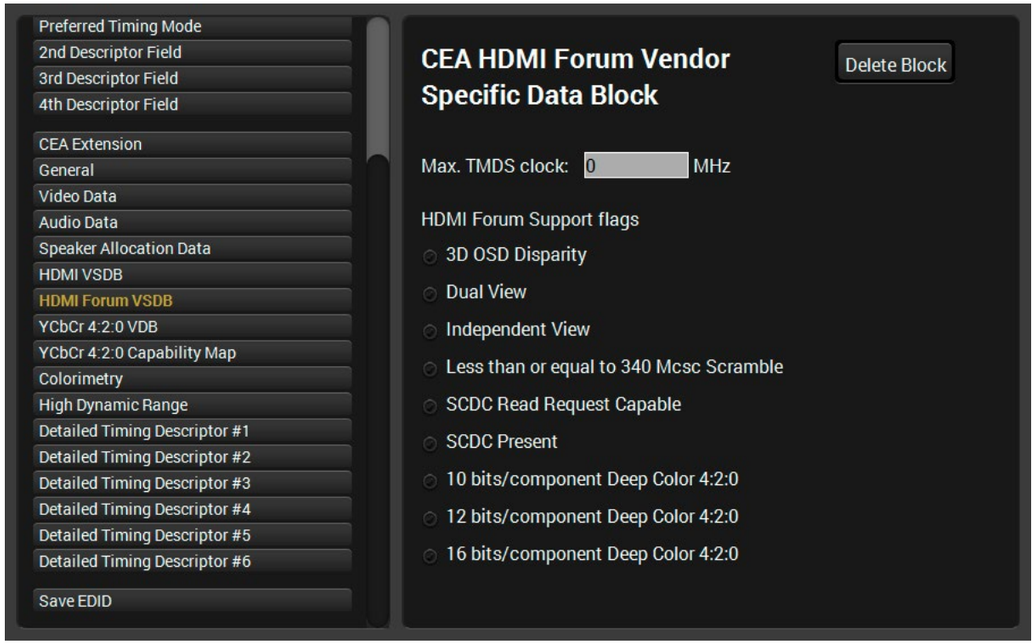
Scroll down to display the 3D settings: the 3D capability of the sink. If 3D present setting is true, the sink supports mandatory 3D formats, shown in 3D Structure and 3D Mask All lists. Further extensions can be added by selecting the 2D_VIC_order and the 3D_Structure from the drop-down menus and clicking on Add 3D Extension button.



HDMI options, 3D settings

3.4.6. HDMI Forum VSDB

This block has been introduced by the HDMI 2.0 standard and further display capabilities can be set here.



HDMI forum VSDB

3.4.7. YCbCr 4:2:0 VDB

This Video Data Block contains settings about YCbCr sampling. The 4:2:0 sampling requires half bandwidth than the 4:4:4 sampling and in this block you can define resolutions separately with 4:2:0 support. It contains Short Video Descriptors (SVD) like the Video Data Block. The priority of these timings can be set in the Video Format Preference Data Block.

YCbCr 4:2:0 Video Data Descriptors

3.4.8. YCbCr 4:2:0 Capability Map

You can add a resolution in this block that supports the 4:2:0 sampling as well as other sampling method(s).

YCbCr 4:2:0 Capability Map

3.4.9. Colorimetry

The tab indicates support of specific extended colorimetry standards and gamut related, as yet undefined, metadata:

xvYCC 601: YCbCr, full range (as xvYCC 709, but using BT.601 for YCbCr encoding); Standard Definition Colorimetry based on IEC 61966-2-4

xvYCC 709: YCbCr, full range (wide gamut Rec. 709), High Definition Colorimetry based on IEC 61966-2-4

yYCC604: Limited and full range (= sRGB but using BT.601 YCbCr encoding), Colorimetry based on IEC 61966-2-1/Amendment1

Adobe YCC 601: Limited and full range, Colorimetry based on IEC 61966-2-5, Annex A

AdobeRGB: Limited and full range, Colorimetry based on IEC 61966-2-5

BT2020cYCC: YcCbcCrc support, limited range (constant luminance)

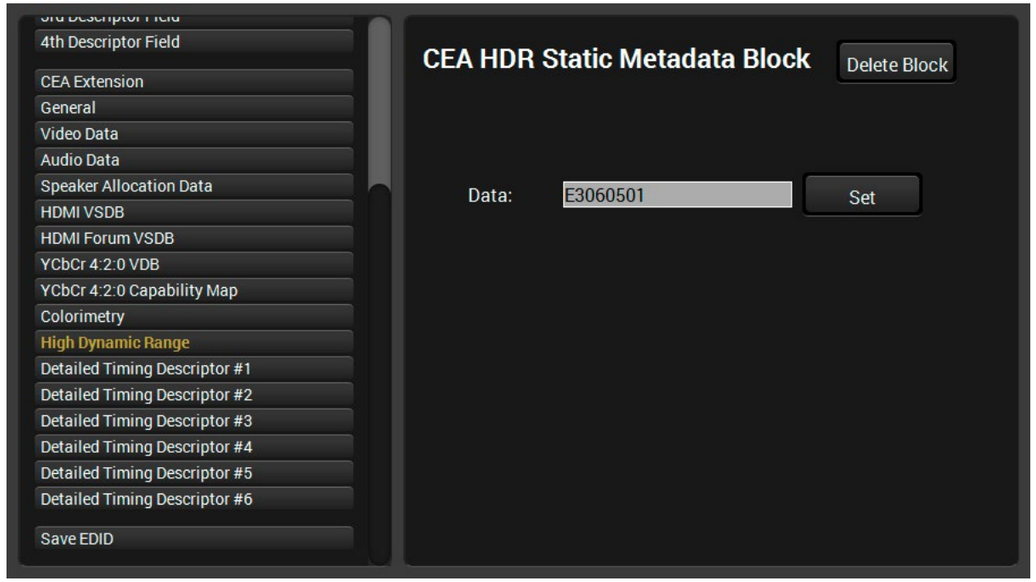
BT2020 YCbCr: limited range

BT2020 RGB: limited range

Colorimetry options

3.4.10. High Dynamic Range

This data block provides dynamic information that can be employed by the display to adapt the delivered HDR imagery to the capability of the display device based on the SMPTE ST 2094-1 and SMPTE ST 2094-10 standards..



CEA HDR Static Metadata Block

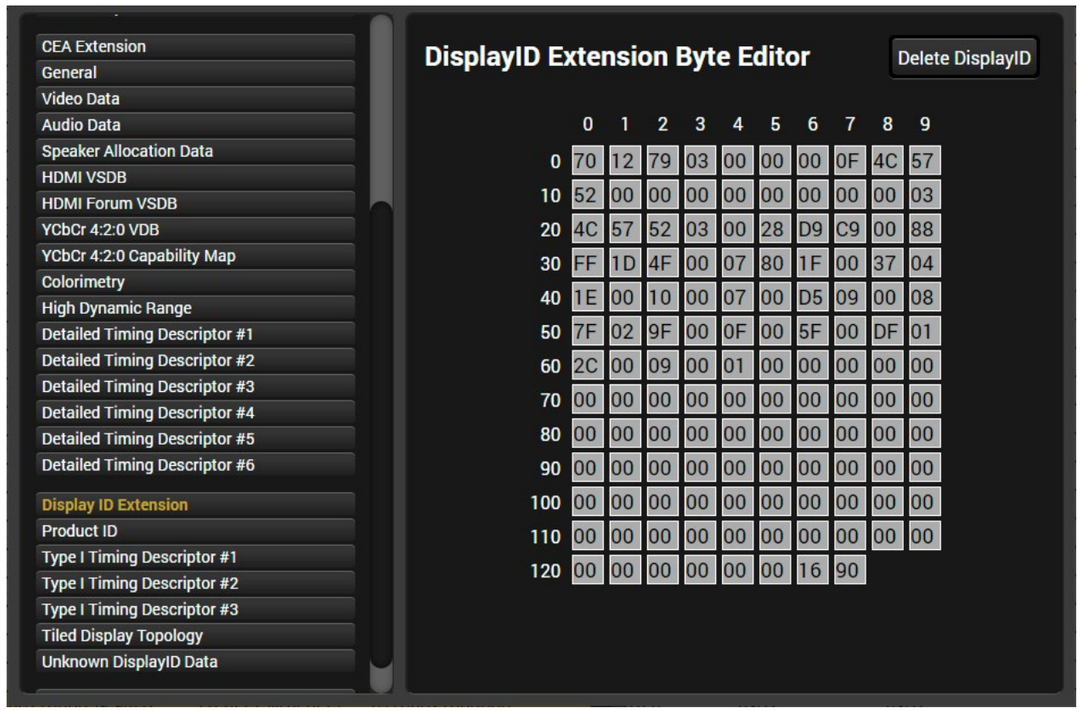
3.5. The DisplayID Extension

The DisplayID is defined by a VESA standard, that contains extended display possibilities than the EDID structure. The Advanced EDID editor gets a DisplayID section where additional metadata is stored for the video sources about the display capabilities.

> INFO: EDID has only 11 bit for active resolution dimensions, it means that the maximum pixel number is 4095.

DisplayID extension supports high resolution displays and tile mode. This interface provides the easy and user-friendly input of the DisplayID information.

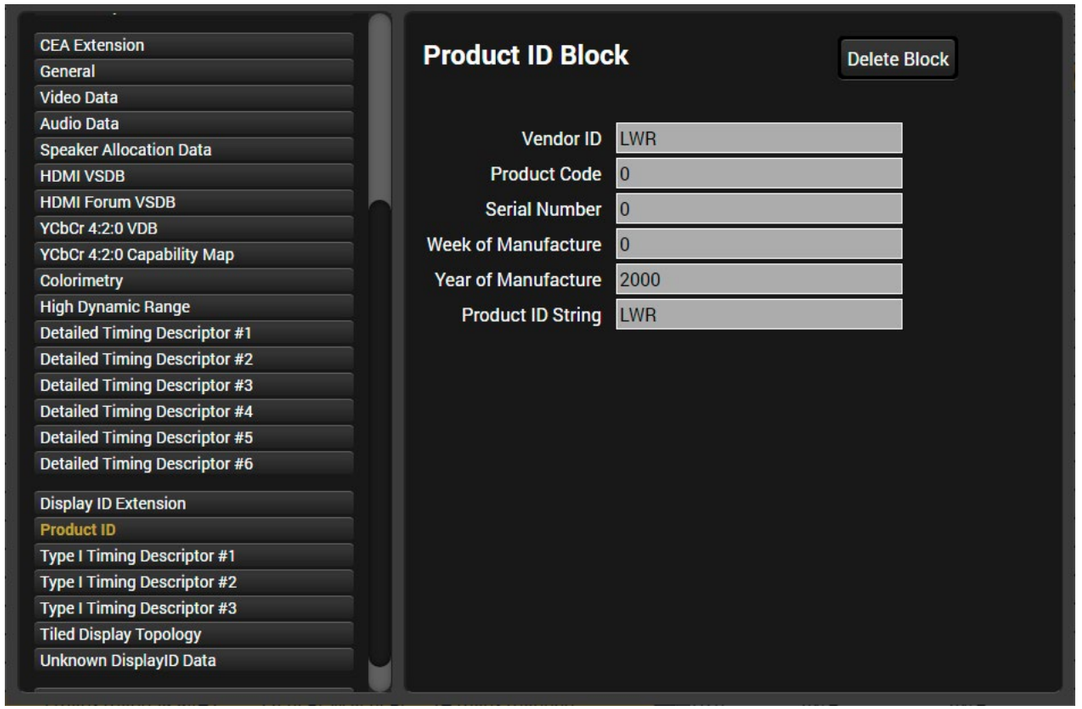
Delete DisplayID button empties the whole DisplayID structure (Do not forget to verify it by clicking save the EDID tab).



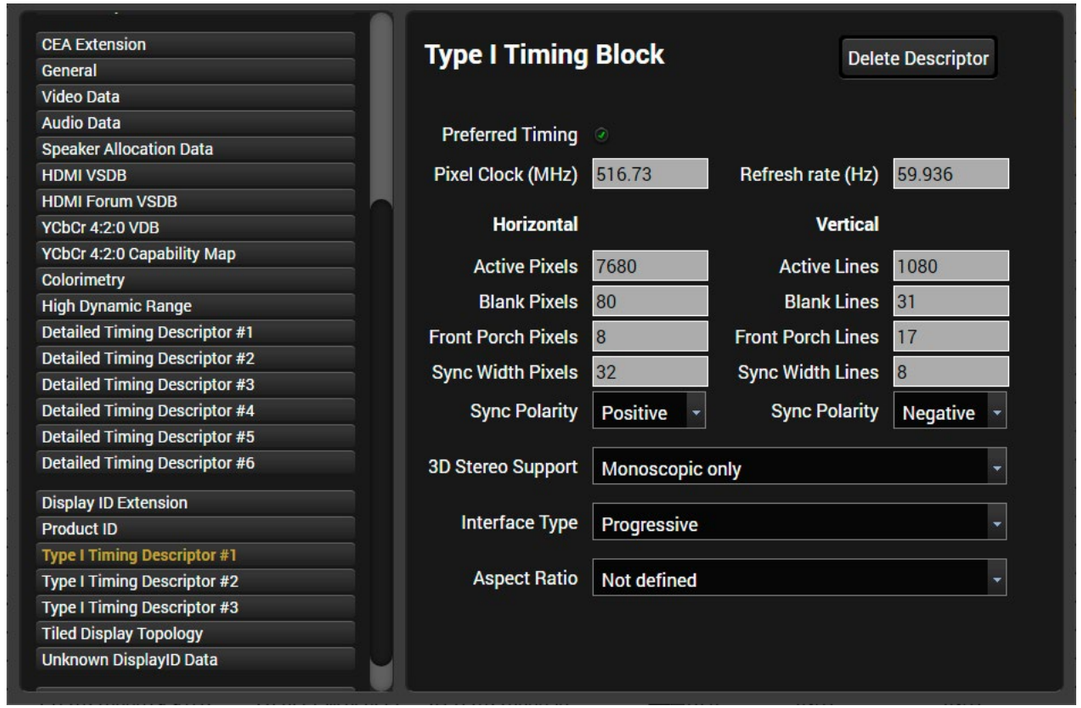
3.5.1. Product ID

Product identification block contains standard vendor and product IDs, serial number, date of manufacture and product name.

Delete Block button empties this section. (Do not forget to verify it by clicking save the EDID tab.)



3.5.2. Type I Timing Descriptor #1-3



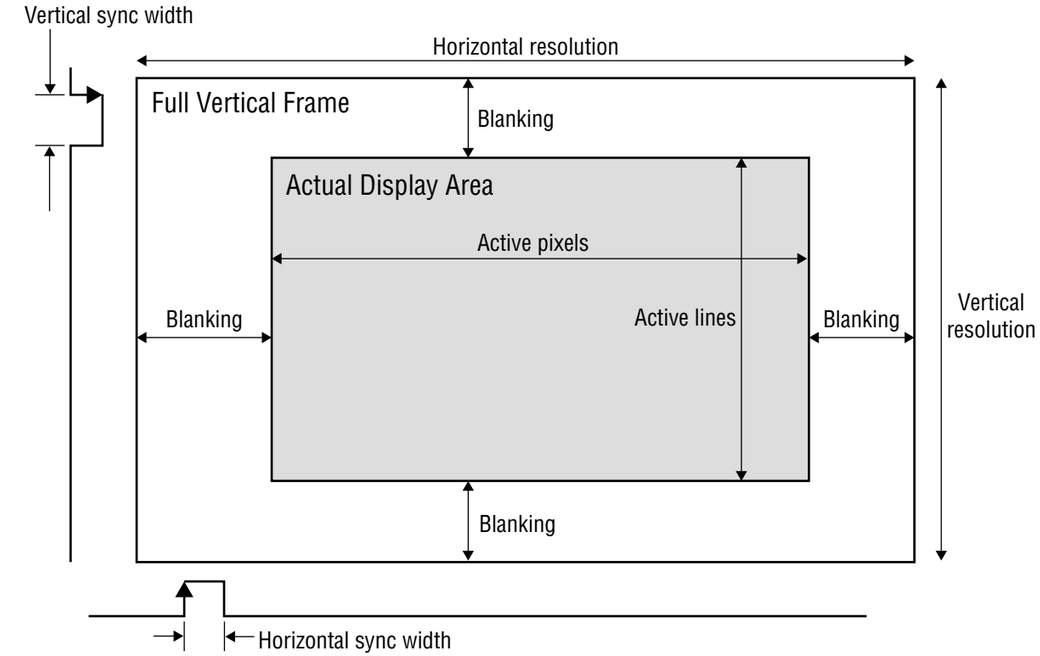
Active pixels of horizontal and vertical values can be between 1 and 65536 (without DisplayID extension, this value is between 1-4095).

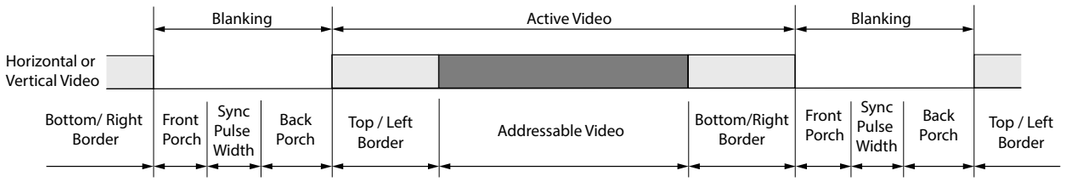
Refresh rate and pixel clock values calculated automatically based on the filled fields, using the formula below:

Refresh rate = Pixel clock / ((horizontal active + horizontal blank) * (vertical active + vertical blank))

Pixel clock = Refresh rate * ((horizontal active + horizontal blank) * (vertical active + vertical blank))

The picture below helps identify the horizontal and vertical parameters:

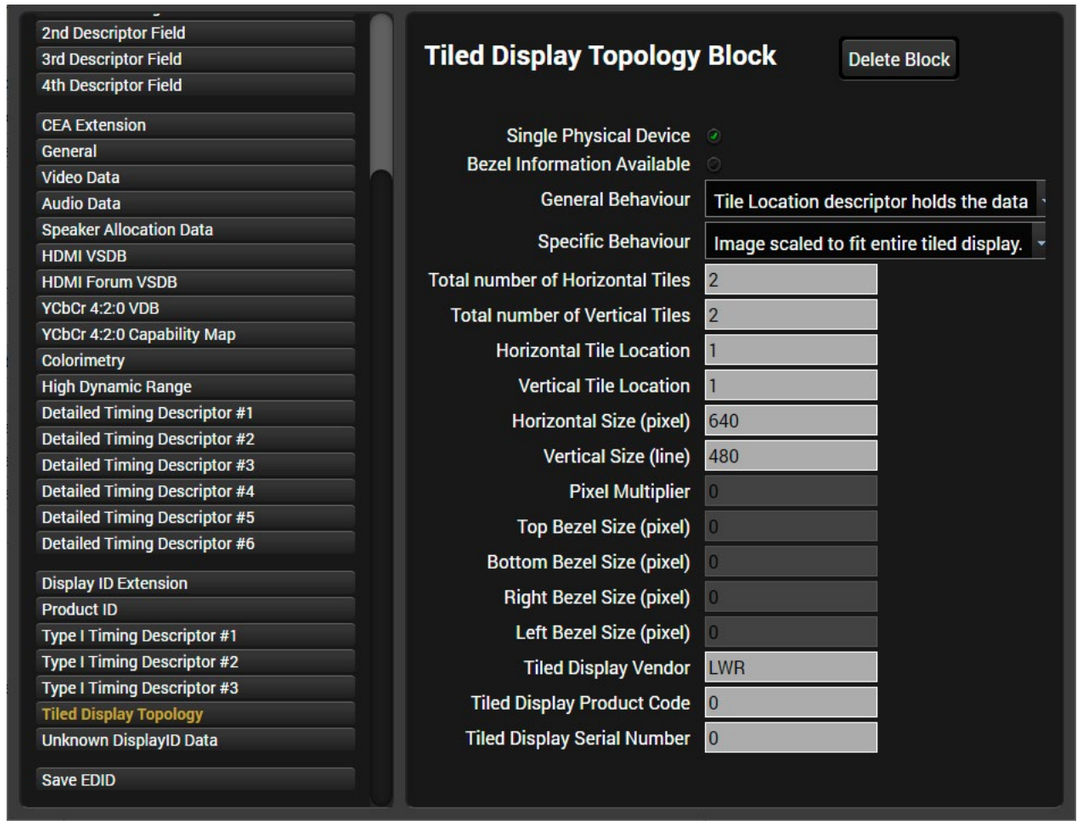




Choose the drop-down menu from the following options:

- 3D stereo support: Monoscopic only /stereo only /stereo based on user interaction
- Interface type: Progressive / Interlaced
- Aspect ratio: 5:4 / 4:3 / 15:9 / 16:9 / 16:10 / 64:27 / 256:135 /Not defined

3.5.3. Tiled Display Topology



Choose the following options:

- Single physical device
- Bezel Information available (enables modifying bezel properties)
- **General behaviour**: when more than 1 tile and less than total number of tiles are driven
  Can not be described / Tile location descriptor holds the data
- **Specific behaviour**: when only one tile receiving image
  Can not be described / Image being displayed is based on tile location descriptor / Image scaled to fit entire tiled display / Image is cloned to all tiles

Certain monitors has more than one input and they receive the parts of the whole picture on separated inputs. For example, a 8k60 monitor compiles the picture from 4 pcs 4k60 HDMI inputs or 5k60Hz monitor has 2 pcs HDMI 2.0 or DP 1.2 inputs. In this case, the EDID describes the tile location and size.

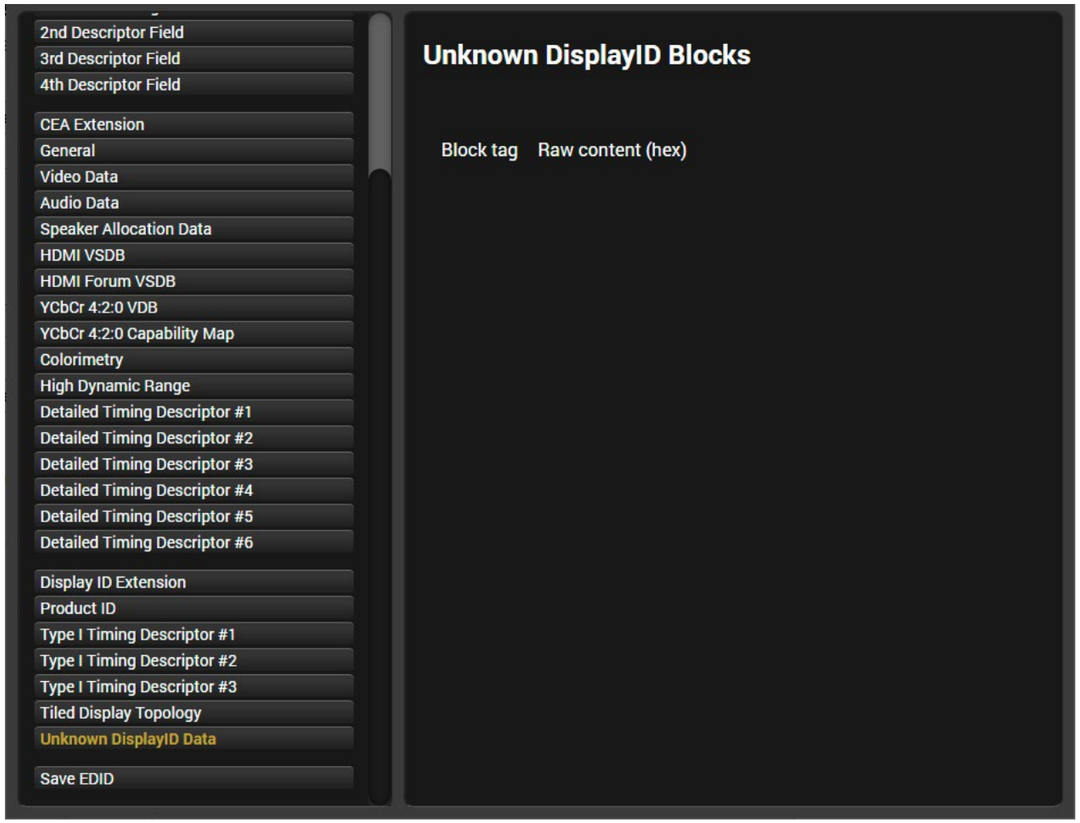
VGA cards identify the ports that belongs together by the same Tiled display vendor/Product code/Serial number.

Display ID block describes the whole size, the number of interfaces (Total Number of Vertical and Horizontal Tiles) and the actual position (Horizontal Tile, Vertical Tile Location). The size of the tiles should be equal.

Differences between the Display ID tiles and multi-monitor (where the operation system is responsible the arrangement of the monitors):

- Multi-monitor detects one monitor with two inputs to one piece.
- Different programs or applications behave different way when full-screen mode is applied.
- When using Display ID tiles, the connection order of the cables does not matter: the VGA card identifies the positions and do the output configuration based on the EDID settings.

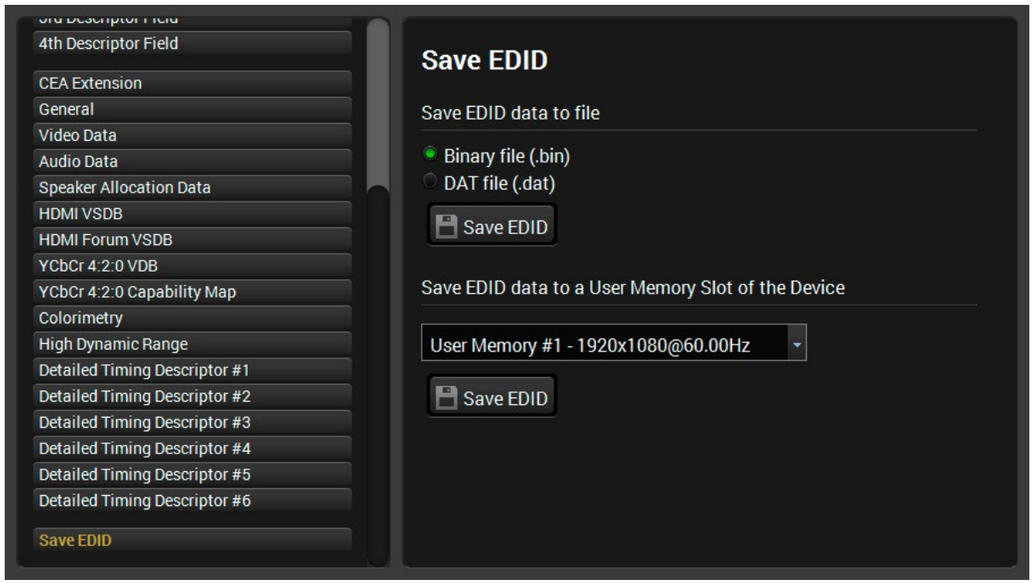
3.5.4. Unknown DisplayID Data



3.6. Save EDID

The final EDID can be saved by:

- Save the EDID as a ***.bin** or ***.dat** file, or
- Save the EDID to a memory slot in the actually used Lightware product.



Save EDID