

visual engineering
LIGHTWARE

User's Manual



DA2DVI-HDCP-Pro

Multimedia Signal Distribution Amplifier

Important Safety Instructions

Class II apparatus construction.

The equipment should be operated only from the power source indicated on the product.

To disconnect the equipment safely from power, remove the power cord from the rear of the equipment, or from the power source. The MAINS plug is used as the disconnect device, the disconnect device shall remain readily operable.

There are no user-serviceable parts inside of the unit. Removal of the cover will expose dangerous voltages. To avoid personal injury, do not remove the cover. Do not operate the unit without the cover installed.

The appliance must be safely connected to multimedia systems. Follow instructions described in this manual.

Ventilation

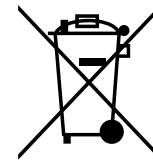
For the correct ventilation and to avoid overheating ensure enough free space around the appliance. Do not cover the appliance, let the ventilation holes free and never block or bypass the ventilators (if any).

WARNING

To prevent injury, the apparatus is recommended to securely attach to the floor/wall or mount in accordance with the installation instructions. The apparatus shall not be exposed to dripping or splashing and that no objects filled with liquids, such as vases, shall be placed on the apparatus. No naked flame sources, such as lighted candles, should be placed on the apparatus.

Waste Electrical & Electronic Equipment (WEEE)

This marking shown on the product or its literature, indicates that it should not be disposed with other household wastes at the end of its working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources. Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take this item for environmentally safe recycling. Business users should contact their supplier and check the terms and conditions of the purchase contract. This product should not be mixed with other commercial wastes for disposal.



Common Safety Symbols



Direct current



Alternating current



Protective conductor terminal



On (Power)



Off (Power)



Double insulation



Caution, possibility of electric shock



Caution

Symbol Legend

The following symbols and markings are used in the document:

WARNING! Safety-related information which is highly recommended to read and keep in every case!


ATTENTION! Useful information to perform a successful procedure; it is recommended to read.


INFO: A notice which may contain additional information. Procedure can be successful without reading it.


DEFINITION: The short description of a feature or a function.


TIPS AND TRICKS: Ideas which you may have not known yet but can be useful.

Navigation Buttons

 Go back to the previous page. If you clicked on a link previously, you can go back to the source page by the button.

 Navigate to the Table of Contents.

 Step back one page.

 Step forward to the next page.

Document Information

This User's Manual applies to the following versions of the mentioned software, firmware, and hardware:

| Item | Version |
|--|----------|
| Lightware Device Controller (LDC) software | 1.16.05b |
| Lightware Bootloader Software | 3.3.3 |
| Controller firmware | 1.2.2 |
| Hardware | v1.1 |

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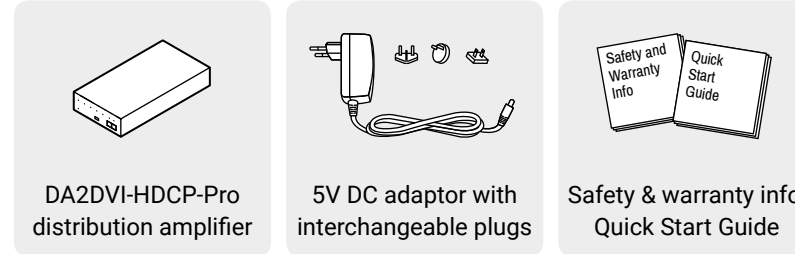
1

Introduction

Thank You for choosing Lightware's DA2DVI-HDCP-Pro device. In the first chapter we would like to introduce the device highlighting the most important features in the below listed sections:

- ▶ [BOX CONTENTS](#)
- ▶ [DESCRIPTION](#)
- ▶ [MODEL DENOMINATION](#)
- ▶ [FEATURES](#)
- ▶ [TYPICAL APPLICATIONS](#)

1.1. Box Contents



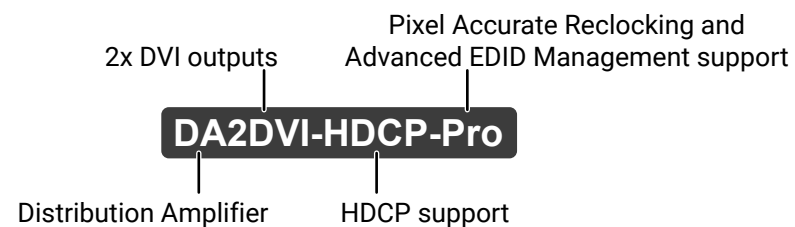
1.2. Description

Lightware DA2DVI-HDCP-Pro is a multifunctional distribution amplifier with built-in EDID Management and Pixel Accurate Reclocking, supporting DVI and HDMI 1.3a signals with or without HDCP encryption. It automatically compensates for up to 60 meters of DVI copper cable, hence no adjustment is needed by the user. The Output signal is reclocked and stabilized using Lightware's Pixel Accurate Reclocking technology to remove jitter caused by long cables or poor quality DVI sources.

Thanks to the Advanced EDID Management, DA2DVI-HDCP-Pro can emulate any DVI or HDMI display for continuous video output, even if the attached display is disconnected or powered down. The EDID memories from 01 to 49 are factory presets, the memories from 51 to 98 are user programmable. Memory 00 is transparent for OUTPUT 1 and Memory 99 is for OUTPUT 2, which means that the attached display device's EDID (monitor or projector) will be reported to the source. With the Easy EDID Creator (PC software) the users can create their own EDID by completing four simple steps. More experienced users can use the Advanced EDID Editor software to manage every possible setting in the EDID, which they can upload to the memory of the DA2DVI-HDCP-Pro.

DA2DVI-HDCP-Pro can be rack mounted or used standalone. The unit is equipped with the highest grade gold plated connectors to ensure reliable connection.

1.3. Model Denomination



1.4. Features



Advanced EDID Management

The user can emulate any EDID on the device's input by using the 49 factory or 48 user presets. Any attached monitor's EDID can be read out, edited and stored as user presets by the Lightware Device Controller software.



60 meter Input Cable Compensation

Using 22AWG high quality DVI cable, the input is automatically compensated for up to 60 meter cable length, which extends installation possibilities even on highest HDTV or computer resolutions. In case of lower pixel resolutions, this length can be even higher.



Pixel Accurate Reclocking

Removes jitter and skew caused by long cable, each output has a clean, jitter free signal, eliminating signal instability and distortion caused by long cables or connector reflections.



Various Status Indicator LEDs

See the status of the device in one second: Source 5V, Input signal present, Monitor 1 and 2 hotplug, EDID emulation status.



Front Panel Control

EDID ADDRESS selection with two decimal rotary switches, LEARN EDID button is available for Advanced EDID Management, and Power LED.



USB Control

The DA2DVI-HDCP-Pro is controllable via the Lightware Device Controller PC software. Advanced EDID Management and firmware upgrades are available.



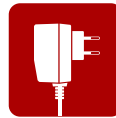
Supports All HDTV Resolutions

Supports HDCP encrypted and unencrypted HDTV signals up to 225 MHz pixel clock frequency regardless of the resolution being passed through. (720p, 1080i and 1080p etc.)



Power over video port

Self-powered DVI fiber cables using 5V from DVI sources (VGA cards, etc.) usually consuming more than 50 mA (maximum suggested by DVI 1.0 standard). Lightware devices support 5V 500 mA constant current output on both of its outputs to power long distance fiber optical cables, like our DVI-OPT-TX110.

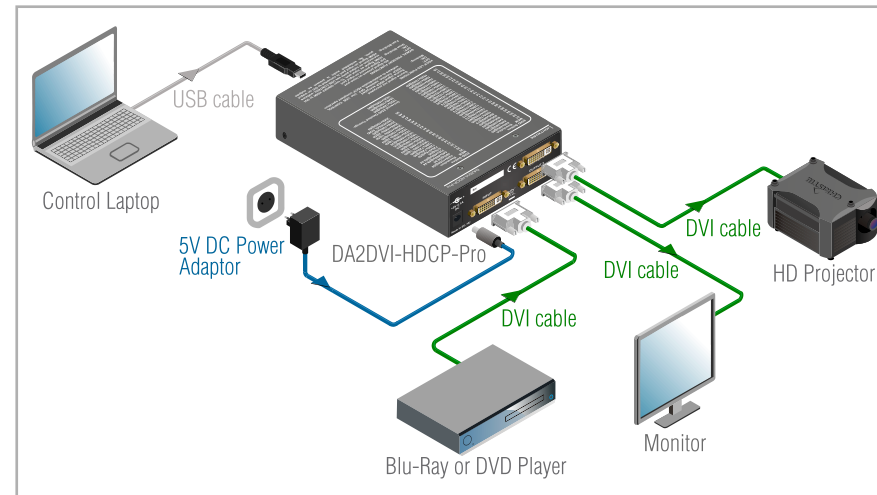


Universal Power Supply

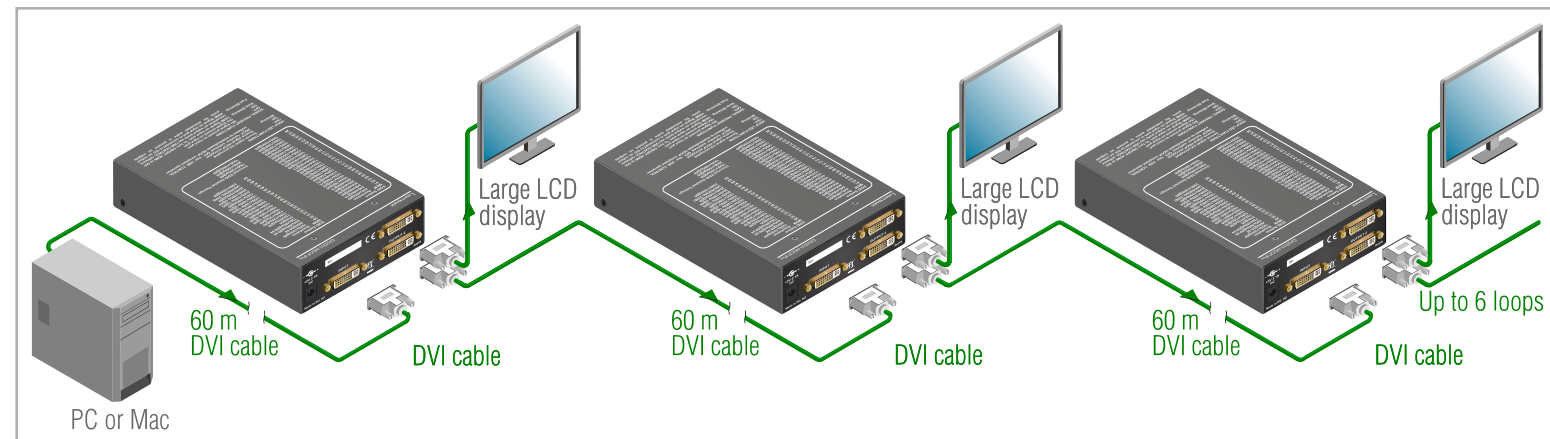
DA2DVI-HDCP-Pro is equipped with a universal 5V power adaptor, which accepts AC voltages from 100 to 240 Volts with 50 or 60 Hz line frequency. Special plug of wall adaptor ensures safe power supply. This type of connector prevents unwanted extractions.

1.5. Typical Applications

Standalone Application



Daisy-chain Application



2

Installation

The chapter is about the installation of the device and connecting to other appliances, presenting also the mounting options and further assembly steps:

- ▶ MOUNTING OPTIONS
- ▶ CONNECTING STEPS

2.1. Mounting Options

To mount the distribution amplifier Lightware supplies an optional accessory 1U high rack shelf. The device has two mounting holes with inner thread on the bottom side. Fasten the device by the screws enclosed to the accessory.

WARNING! Always use the supplied screws. Using different (e.g. longer) ones may cause damage to the device.

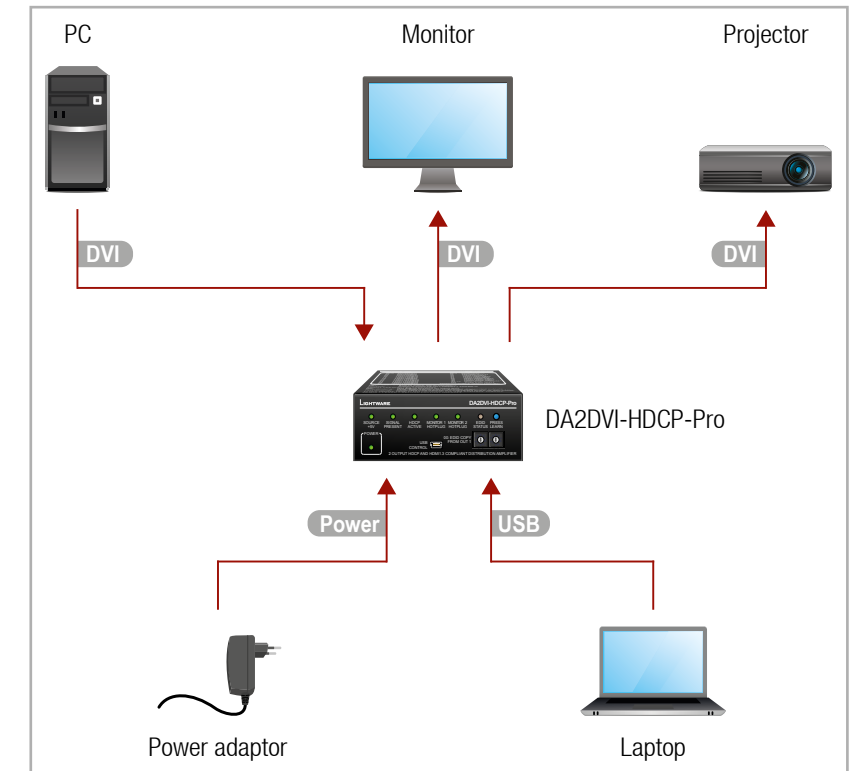


Mounting with 1U-high Rack Shelf

1U-high rack shelf provides mounting holes for fastening four quarter-rack sized units. To order mounting accessories please contact sales@lightware.com.

INFO: The distribution amplifier is quarter-rack sized.

2.2. Connecting Steps



- DVI** Connect the source device (e.g. a PC) to the distribution amplifier's input port by a DVI cable.
- DVI** Connect the sink device(s) to the distribution amplifier's output port(s) by a DVI cable.
- USB** Optionally connect the amplifier to a controller device (e.g. a laptop) by a USB cable.
- POWER** Firstly connect the power adaptor to the DC input on the device, then to the AC power socket.

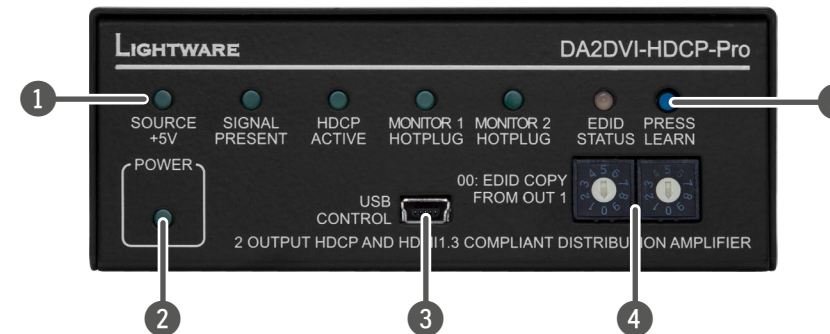
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Product Overview

The following sections are about the physical structure of the device, input/output ports and connectors:

- ▶ [FRONT VIEW](#)
- ▶ [REAR VIEW](#)
- ▶ [ELECTRICAL CONNECTIONS](#)

3.1. Front View

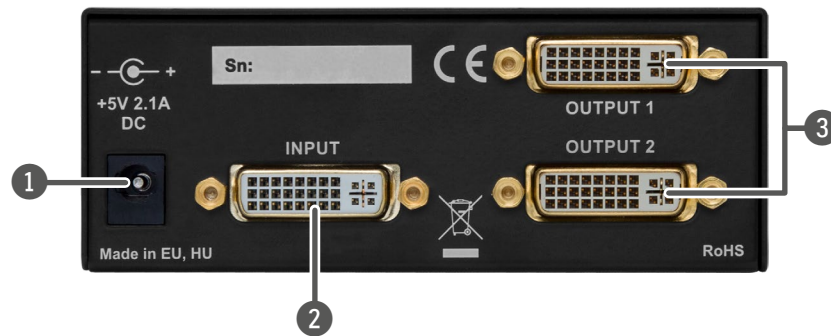


- ① **Status LEDs** Displaying the current state of the input and output connections. See the details below.
- ② **Power LED** Indicates if the device is powered on.
- ③ **USB Control** Advanced EDID management and firmware upgrades are available via the USB interface.
- ④ **Rotary Switches** The rotary switches select one of the EDID memory addresses. For more information see the [EDID Management](#) section.
- ⑤ **Learn Button** Stores the EDID of the display device attached to OUTPUT 1 in the selected memory address. To learn the EDID, select an appropriate address with the rotary switches and press and hold the LEARN button for three seconds. For more information see the [Learning the EDID](#) section.

Status LEDs

- Source +5V** Indicates if +5V power signal is sent to pin 14 of the INPUT connector by the DVI source (PC, Laptop, etc).
- Signal Present** BLINKING (slow): HDMI signal is present on INPUT and OUTPUT ports.
BLINKING (fast): HDMI to DVI conversion is enabled. See more information in [Output Port Properties](#) section.
- HDCP Active** BLINKING (green): HDCP is disabled. For more information see [HDCP Management](#) section.
- Monitor Hotplug** A powered sink (or matrix switcher, repeater, etc.) is connected to the OUTPUT connector and sends a valid hotplug signal on pin 16 through the DVI cable.
- EDID Status LED** **EDID status (green)**: the selected EDID is valid;
EDID status (red): the selected EDID is invalid.
- FW version display**: During startup it displays the firmware version.
- EDID read status (BLINKING green)**: the EDID is valid;
EDID read status (red): the EDID is invalid or missing. The function is available for both outputs and saves the EDID to the Last attached Monitor's EDID memory.
- EDID learn process (BLINKING green)**: succeed
EDID learn process (BLINKING red): failed
- Firmware upgrade (BLINKING red and green)**: The LED blinks red and green during the upgrade.

3.2. Rear View



- 1 **DC 5V in** Connect the OUTPUT of the supplied +5V power adaptor. The Power LED indicates the proper supply voltage.
- 2 **DVI Input** Connect one Single-Link DVI cable (only digital pins are connected internally) between the DVI source and DA2DVI-HDCP-Pro.
- 3 **DVI Outputs** Connect one Single-Link DVI-D or DVI-I cable (only digital pins are connected internally) between DA2DVI-HDCP-Pro and display device. The OUTPUT connector is able to supply 500 mA current on pin 14 to power fiber optical DVI extenders like DVI-OPT-TX110. See more information in [DVI-I Connector](#) section.

3.3. Electrical Connections

3.3.1. USB Connector

The device provides a standard USB 2.0 mini B-type connector for software control and firmware upgrade purpose. You can find more details about software control in [Software Control – Lightware Device Controller](#) section and in [Programmer's Reference](#) section. For more information about firmware upgrade see the [Firmware Upgrade](#) section.



3.3.2. DVI-I Connector

DA2DVI-HDCP-Pro provides 29 pole „digital only” DVI-I Dual-Link connectors (only digital pins are internally connected). This way, users can plug in any DVI connector, but keep in mind that analog signals (such as VGA or RGBHV) are not processed.

Always use high quality DVI cable for connecting sources and displays.



| Pin | Signal | Pin | Signal |
|-----|-------------------|-----|-------------------|
| 1 | TMDS Data2- | 16 | Hot Plug Detect |
| 2 | TMDS Data2+ | 17 | TMDS Data0- |
| 3 | TMDS Data2 Shield | 18 | TMDS Data0+ |
| 4 | nc | 19 | TMDS Data0 Shield |
| 5 | nc | 20 | nc |
| 6 | DDC Clock | 21 | nc |
| 7 | DDC Data | 22 | TMDS Clock Shield |
| 8 | nc | 23 | TMDS Clock+ |
| 9 | TMDS Data1- | 24 | TMDS Clock- |
| 10 | TMDS Data1+ | C1 | nc |
| 11 | TMDS Data1 Shield | C2 | nc |
| 12 | nc | C3 | nc |
| 13 | nc | C4 | nc |
| 14 | +5V Power | C5 | GND |
| 15 | GND (for +5V) | | |

DVI Output

Monitor hotplug is detected on the OUTPUT ports (Monitor hotplug LED lights green). After a hotplug event, the DA2DVI-HDCP-Pro tries to read the EDID of the connected device.

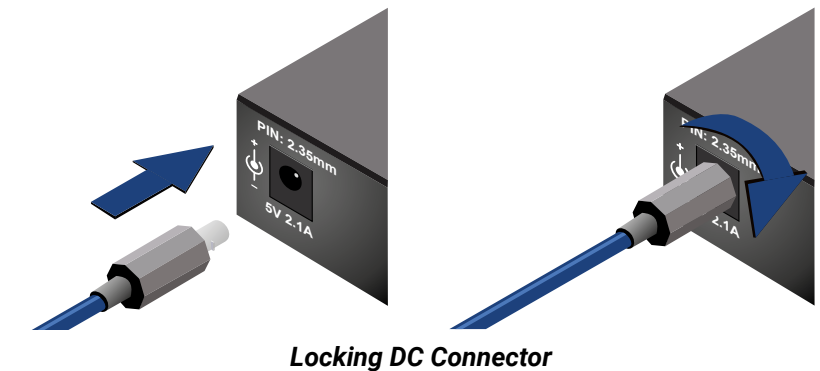
Fiber Cable Powering

As a special feature, the device is able to supply 500 mA current on DDC +5V output (pin 14 on OUTPUT connector) to power fiber optical DVI transmitters. Standard DVI outputs or VGA cards supply only 55 mA current on +5V output, thus unable to power directly a fiber optical cable.

INFO: The device does not check if the connected sink (monitor, projector or other equipment) supports hotplug or EDID signals but outputs the input signal directly.

3.3.3. DC 5V Connection

The device has a locking DC connector to establish robust and safe power connection. After plugging it in, turn the plug clockwise as you can see in the picture below.



Do not forget to turn the plug clockwise direction before disconnecting the power adaptor.

WARNING! Always use the supplied 5V power adaptor or Lightware's rack mountable power supply. Warranty void if damage occurs due to use of a different power source.

DVI Input

The input has a built-in signal detection circuit with a LED indicator. The DVI Signal present LED lights green, if the INPUT connector senses an active DVI signal.

Cable Length at Inputs

The unit has an advanced built-in cable equalization circuit, which automatically provides cable length compensation. This circuit extends the maximum usable cable length to 60 meters using high quality 22AWG copper cable at WUXGA 1920x1200 graphics resolution.

4

Operation

This chapter is about the powering and operating of the device describing the functions which are available by the front/rear controls:

- ▶ [POWERING ON](#)
- ▶ [EDID MANAGEMENT](#)
- ▶ [HDCP MANAGEMENT](#)

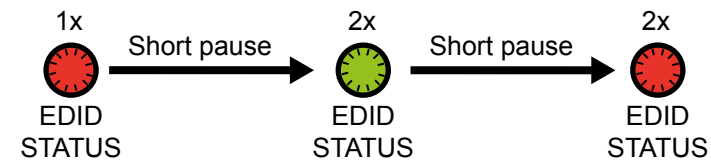
4.1. Powering On

ATTENTION! When building an electronic system, make sure that all of the devices are powered down before connecting them. Powered on devices may have dangerous voltage levels that can damage sensitive electronic circuits.

- Step 1.** After the system is complete, connect the OUTPUT of the 5V power adaptor to the DA2DVI-HDCP-Pro. The unit is immediately powered ON.
- Step 2.** After the DA2DVI-HDCP-Pro is initialized, the attached DVI source and monitor can be powered on.

Startup Process

- Step 1.** After being powered on, the DA2DVI-HDCP-Pro displays its firmware version using the **EDID Status LED**. The following example shows this process for a firmware version of 1.2.2:



- Step 2.** After indicating the firmware version, the Status LED turns green if the selected EDID is valid, or turns red, if the selected EDID is invalid.
- Step 3.** If a display device is connected to an OUTPUT, the DA2DVI-HDCP-Pro reads the EDID from the attached monitor's EDID memory.
- Step 4.** The normal function of the LED is in effect.

WARNING! If none of the LEDs light up upon power-up, the unit is most likely damaged and further use is not advised. Please contact support@lightware.com.

DA2DVI-HDCP-Pro ensures HDCP functionality, when the HDCP pass-through is enabled. If a new sink device (monitor) is connected while HDCP is enabled, the DA2DVI-HDCP-Pro virtually reconnects the source device to ensure HDCP functionality.

Switching the Hotplug signal off and on again indicates to the source device, that the sink is ready to communicate. This may cause the picture disappear for a few seconds.

If HDCP pass-through is disabled, connecting or reconnecting a display device does not affect the input. This way the signal on the OUTPUT will be continuous.

If HDCP is not necessary turn off the HDCP pass-through; see more information in [HDCP Management](#) section.

4.2. EDID Management

4.2.1. About the EDID Memory

Lightware factory preloaded EDIDs are specially provided to force graphic cards to output only the exact pixel resolution and refresh rate.

Universal EDID (address 49#) allows multiple resolutions including all common VESA defined resolutions. In addition, it also features audio support. The use of universal EDID is advised for fast and easy system setup.

DA2DVI-HDCP-Pro contains a 97 block non-volatile memory bank. EDID memory is structured as follows:

| Rotary switch state | Memory bank number | Description |
|---------------------|--------------------|------------------------------|
| #01..#49 | F01..F49 | Factory EDID (read-only) |
| #50 | Reserved | |
| #51..#98 | U01..U48 | User programmable slots |
| #00 and #99 | D01 and D99 | Last attached monitor's EDID |

For more information see the [Factory EDID List](#) section.

INFO: The device can handle both 128 Byte EDID and 256 Byte extended EDID structures.

INFO: The attached monitor's EDID is stored automatically, until a new monitor is connected to the OUTPUTs. In case of powering the unit off, the last attached monitor's EDID remains in non-volatile memory.

4.2.2. Switching the EDID

WARNING! Use a flat head screwdriver that fits into the actuator. Avoid the use of keys, coins, knives and other sharp objects because they might cause permanent damage to the rotary switches.

Step 1. Use a flat head screwdriver to change the memory address on the Rotary switches on the front side of the DA2DVI-HDCP-Pro. The left switch sets the tens value, the right switch gives the ones value of the EDID.



Location #17 is selected by the rotary switches

Step 2. After either one of the rotary switches has been rotated, the unit waits approximately two seconds before the selected EDID becomes active.

Step 3. Check the state of the device:

- The EDID Status LED illuminated green: The selected EDID is valid.
- The EDID status LED illuminated red: The selected EDID memory is invalid (wrong address / empty user memory).

The address #00 has a special function. If a monitor is connected to OUTPUT 1, then its EDID is copied to the INPUT connector. If no monitor is connected to the OUTPUT then the EDID copied to the INPUT connector is the EDID of the last connected monitor. Address #99 has the same function with OUTPUT 2.

ATTENTION! If an invalid EDID is selected, the DA2DVI-HDCP-Pro does NOT give a HOT PLUG signal to the source connected to INPUT.

INFO: After every EDID change, DA2DVI-HDCP-Pro toggles the HOT PLUG signal for approximately 2 seconds. Some graphics cards or DVD players do not sense the HOT PLUG signal, and even if EDID has been changed, the set resolution is not affected. In this case the source device must be restarted, or powered OFF and ON again.

4.2.3. Learning the EDID

ATTENTION! The factory preset EDIDs cannot be changed by the user. Only addresses from #51 to #98 are user programmable.

Step 1. After connecting the sink device to OUTPUT 1, use a screwdriver to select a user programmable memory address on the rotary switches. If the EDID Status LED is illuminated red, then the memory slot is empty and ready to be programmed. If it is green, the memory was already used before, but still available for reprogramming.

Step 2. Push the LEARN button on the front panel of the DA2DVI-HDCP-Pro and hold it down for approximately 2 seconds. If the teaching is successful, the Status LED blinks four times green, if the teaching is unsuccessful, the Status LED blinks four times red.

Step 3. The normal function of the LEDs is in effect.

INFO: If the DA2DVI-HDCP-Pro is unable to read the monitor's EDID or there is no currently attached monitor, the last attached monitor's valid EDID will be stored in the user memory.

4.3. HDCP Management

DA2DVI-HDCP-Pro can work as a HDCP compliant device, or act as a non-HDCP compliant sink. The HDCP capability can be disabled or enabled on input port. This function helps to apply encryption only when it is mandatory.

Some video sources send encrypted signal when they are connected to a HDCP capable device even if the content is not protected. This way even the unprotected content cannot be displayed on non-HDCP displays if the signal travels through a HDCP compliant matrix or repeater.

However HDCP encryption is not required all the time (e.g. computer desktop image) some video cards still do that if they detect that the sink is HDCP capable.

Avoiding Unnecessary HDCP Encryption

If HDCP is disabled on an input port, the connected source will detect that the sink is not HDCP capable, and turn off authentication. The source will not be able to communicate with any of the devices (displays, repeaters, etc.) that are connected to the DA2DVI-HDCP-Pro's output, therefore it could not see if they are HDCP capable or not.

That forces the source to send unprotected signal only. If HDCP capability is disabled on an input port, the connected source cannot send protected content to any display. If HDCP function is enabled on an input port and the source sends encrypted signal, the non-HDCP compliant devices cannot display the video.

INFO: In HDCP disable mode, protected content (i.e. Blu-ray disc) will not be displayed, thus maintaining the rules set by the HDCP standard.

Step 1. Check the state of the device. The HDCP LED is:

- ON: HDCP encrypted signal on INPUT (HDCP function is enabled).
- BLINKING: HDCP function is disabled.
- OFF: HDCP function is disabled.

Step 2. To enable or disable the HDCP function, use Lightware Device Controller software or turn the Rotary switches to address #01, and press and hold the LEARN button for approximately 3 seconds. The status change appears on the HDCP Active LED. For more information about HDCP enable/disable by the LDC see the [I/O Parameters Menu](#) section.

5

Software Control – Lightware Device Controller

The device can be controlled by a computer through the USB port Lightware Device Controller (LDC). The software can be installed on a Windows PC or Mac OS X. The application and the User's Manual can be downloaded from www.lightware.com. The Windows and the Mac versions have the same look and functionality.

- ▶ [INSTALL AND UPGRADE](#)
- ▶ [ESTABLISHING THE CONNECTION](#)
- ▶ [I/O PARAMETERS MENU](#)
- ▶ [EDID MENU](#)
- ▶ [SETTINGS MENU](#)
- ▶ [TERMINAL WINDOW](#)

5.1. Install and Upgrade

Installation in the Case of Windows OS

Run the installer. If the User Account Control drops a pop-up message click **Yes**.

During the installation you will be prompted to select the type of the installation: **normal** and the **snapshot** install:

| Normal install (recommended) | Snapshot install |
|--|--|
| Available for Windows and Mac OS X | Available for Windows |
| The installer can update only this instance | Cannot be updated |
| Only one updateable instance can exist for all users | More than one different version can be installed for all users |

Comparison of installation types

Installation in the Case of Mac OS X

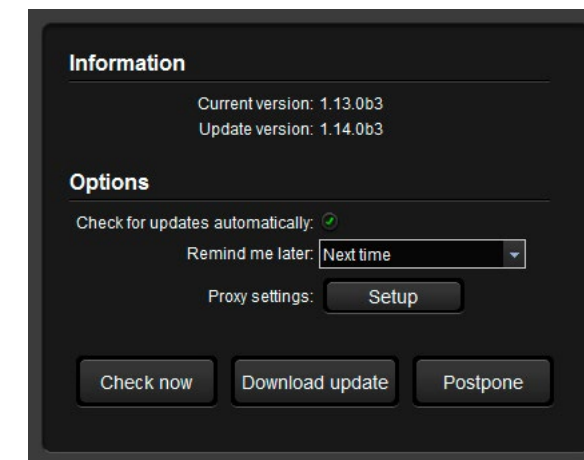
INFO: After the installation, the Windows and the Mac application has the same look and functionality. This type of the installer is equal with the Normal install in case of Windows and results an updateable version with the same attributes.


Mount the DMG file with double clicking on it and drag the LDC icon over the Applications icon to copy the program into the Applications folder. If you want to copy the LDC into another location just drag the icon over the desired folder.

Upgrading of LDC

Step 1. Run the application.

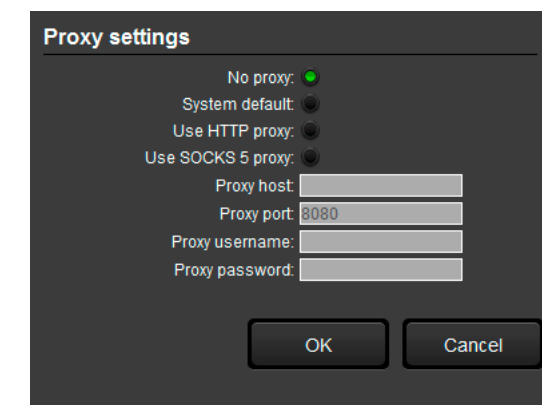
The **Device Discovery** window appears automatically and the program checks the available updates on Lightware's website and opens the update window if the LDC found updates.



The current and the update version number can be seen at the top of the window and they are shown in this window even with the snapshot install. The **Update** window can also be opened by clicking the **About** icon and the **Update** button. 

Step 2. Set the desired update setting in the **Options** section.

- If you do not want to check for the updates automatically, uncheck **the circle**, which contains the green tick.
- If you want to postpone the update, a reminder can be set with different delays from the **drop down list**.
- If the proxy settings traverse the update process, set the proper values then click the **OK** button.



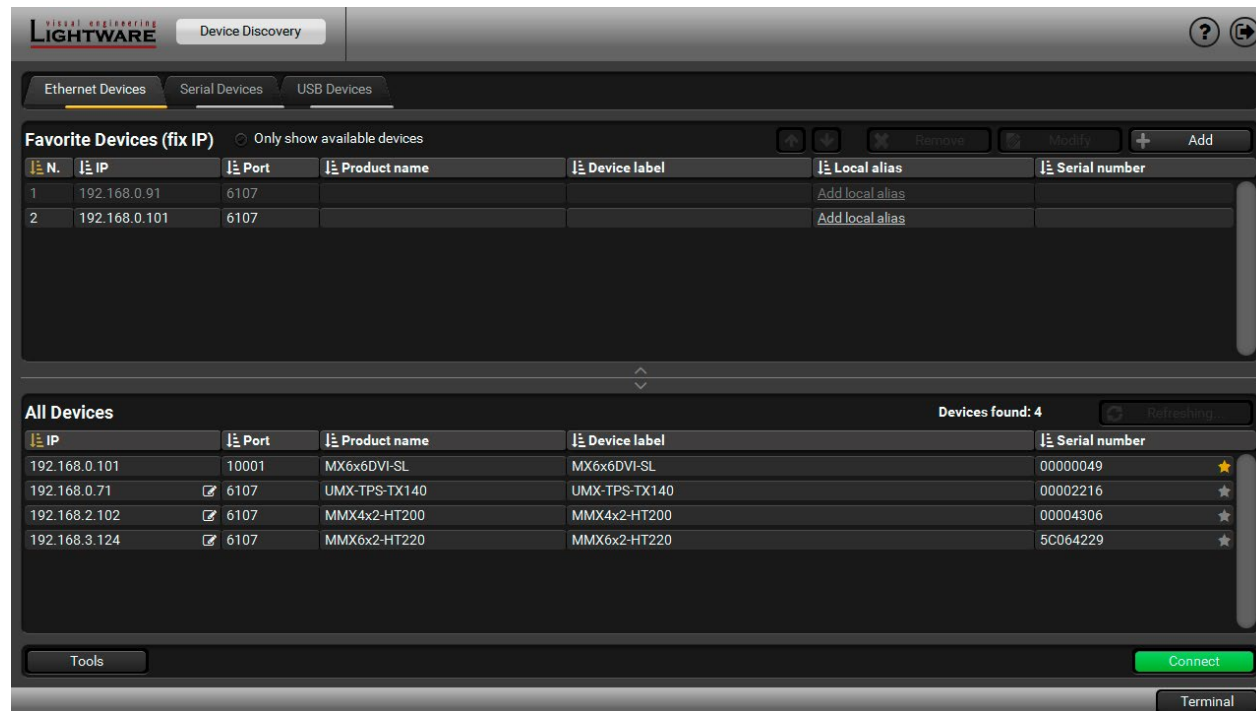
Step 3. Click the **Download update** button to start the upgrading.

The updates can be checked manually by clicking the **Check now** button.

5.2. Establishing the Connection

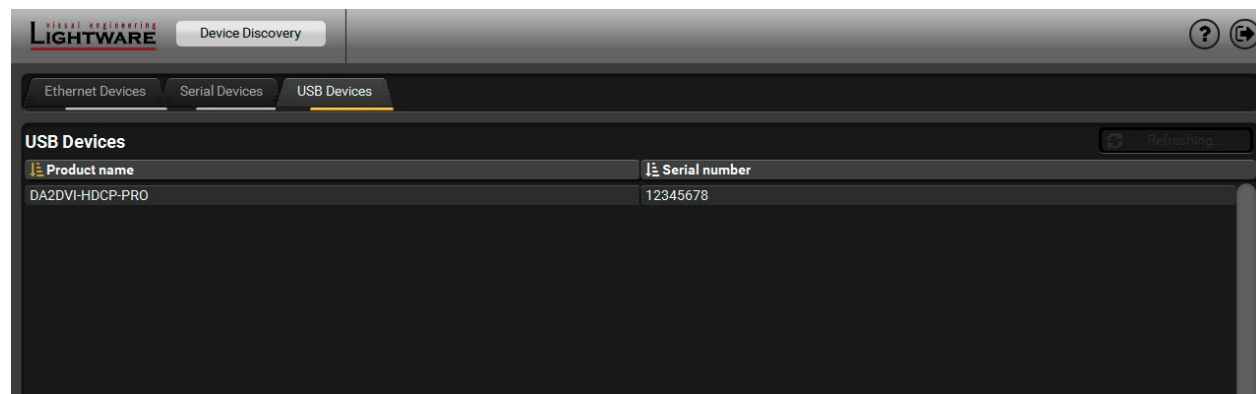
Step 1. Connect the device to a computer via USB.

Step 2. Run the controller software; device discovery window appears automatically.



Device Discovery Window in LDC

Step 3. Select the USB Devices tab and pick the unit from the discovered USB devices. Double click on the name of the device or select it and click on the **Connect** button.



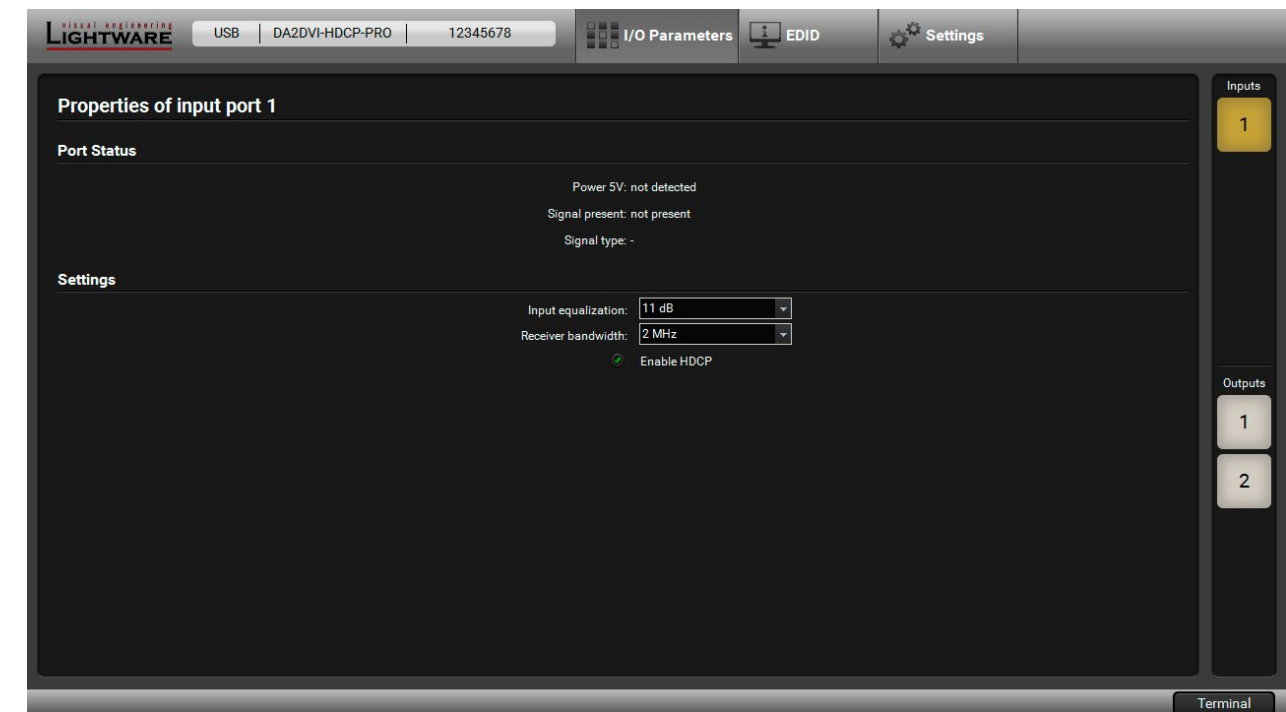
The USB Devices Tab in the Device Discovery Window

5.3. I/O Parameters Menu

The most important information and settings are available in the menu. There are three buttons on the right side of the panel: the input port and the two output ports properties window can be accessed by selecting them.

5.3.1. Input Port Properties

The state of the incoming signal is displayed.



Input Port Properties Tab

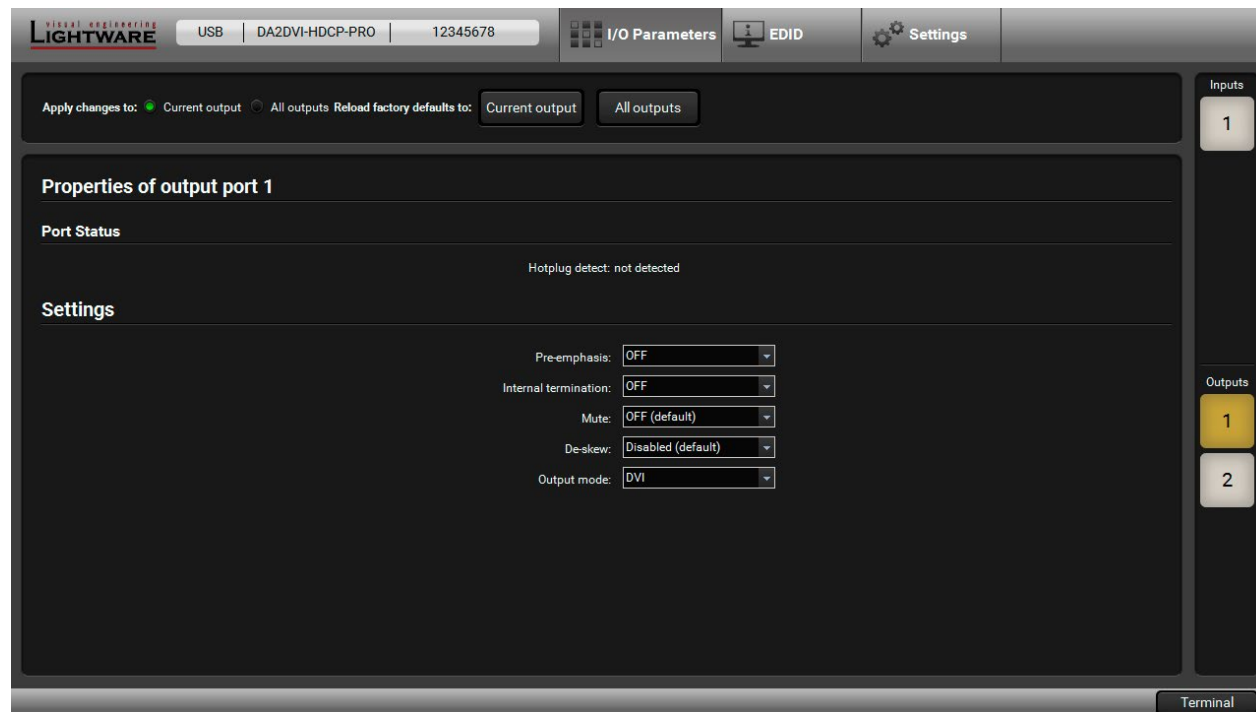
The Port Status parameters (Power 5V, Signal Present, Signal Type) are shown in the panel.

The following settings are available for the input port:

- **Input equalization:** The device has a built-in automatic cable equalization between 0 and 40 db. User is able to choose an additional equalization applying 5 db (this is the factory default value) or 11 db for longer input DVI cables.
- **Receiver bandwidth:** The factory default setting (2 MHz) gives good results in most cases. Modify only if encountering problems with input signal.
- **HDCP enable:** HDCP enable function turns on/off HDCP capability on the input port. For more information see the [HDCP Management](#) section.

5.3.2. Output Port Properties

Click on any of the output buttons to display its properties.



Output Port Properties Tab

The upper section contains the following settings:

Current output: this option means the modified parameters are applied only to the currently selected port displayed in the header.

All outputs: this option means that the modified parameters are applied to all output ports.

INFO: After closing this window, the Current Output option will be selected regardless of which was active at the time of closing. It is to avoid setting All Outputs by mistake.

Reload Factory Defaults

Current output: Reloads the default values to the currently selected output.

All outputs: Loads the factory default values to all outputs.

Settings

The factory default settings give good results in most cases. Modify only if encountering problems with output signals.

- **Pre-emphasis:** ON is recommended. Use OFF setting if the cable between the OUTPUT port and the display device is very short.
- **Internal termination:** Always use ON.
- **Mute:** The specific OUTPUT port can be switched off. No signal will be on the OUTPUT.
- **De-skew:** Adjust setting if the output signal is noisy. Default setting gives good result in most cases.
- **Output Mode:** This setting is used to determine the output signal. DVI and HDMI 1.3 signals are all supported, with optional DVI to HDMI or HDMI to DVI conversion.

ATTENTION! HDMI YUV to RGB colorspace conversion is not supported. If the two outputs' signal is different (e.g. OUTPUT 1 distributes HDMI signal, OUTPUT 2 DVI signal), the input HDMI signal has to be in RGB color format. To avoid conversion issues set an EDID which supports RGB colorspace or set the source device to send the signal with RGB colorspace.

INFO: Auto output mode function determines the output signal by the connected device's EDID on the OUTPUT.

INFO: Modifying the Pre-emphasis, Internal termination or De-skew parameters on an output channel switches the other output channel's settings together.

5.4. EDID Menu

Advanced EDID Management can be accessed by selecting the EDID menu. There are two panels: left one contains Source EDIDs, right one contains Destination places where the EDIDs can be emulated or copied.

The screenshot shows the EDID Menu interface with the following components:

- Source Panel:** Includes tabs for Factory, User, Dynamic, and Emulated. Below is a table of EDIDs:

| Memory | Manuf. | Resolution | Monitor Name |
|------------|--------|------------------|--------------|
| Factory 1 | DVG | 640x480@60.0Hz | 640x480@60 |
| Factory 2 | DVG | 640x480@75.0Hz | 640x480@75 |
| Factory 3 | DVG | 848x480@60.0Hz | 848x480@60 |
| Factory 4 | DVG | 800x600@50.0Hz | 800x600@50 |
| Factory 5 | DVG | 800x600@60.30Hz | 800x600@60 |
| Factory 6 | DVG | 800x600@74.99Hz | 800x600@75 |
| Factory 7 | DVG | 1024x768@49.98Hz | 1024x768@50 |
| Factory 8 | DVG | 1024x768@60.0Hz | 1024x768@60 |
| Factory 9 | DVG | 1024x768@75.2Hz | 1024x768@75 |
| Factory 10 | DVG | 1152x864@75.0Hz | 1152x864@75 |
| Factory 11 | DVG | 1280x768@50.0Hz | 1280x768@50 |
| Factory 12 | DVG | 1280x768@59.92Hz | 1280x768@60 |
| Factory 13 | DVG | 1280x768@75.0Hz | 1280x768@75 |
| Factory 14 | DVG | 1360x768@60.1Hz | 1360x768@60 |
| Factory 15 | DVG | 1364x768@50.0Hz | 1364x768@50 |
| Factory 16 | DVG | 1364x768@59.93Hz | 1364x768@60 |
| Factory 17 | DVG | 1364x768@74.98Hz | 1364x768@75 |

- Destination Panel:** Includes tabs for Emulated and User. Below is a table of EDIDs:

| Memory | Manuf. | Resolution | Monitor Name |
|--------|--------|------------------|--------------|
| U1#51 | DVG | 640x480@60.0Hz | 640x480@60 |
| U2#52 | LWR | 1920x1080@60.0Hz | Univ_HDML_DC |
| U3#53 | LWR | 1920x1080@60.0Hz | Univ_HDMLDC |
| U4#54 | | | |
| U5#55 | | | |
| U6#56 | | | |
| U7#57 | LWR | 1920x1080@60.0Hz | Univ_HDMLDC |
| U8#58 | | | |
| U9#59 | | | |
| U10#60 | | | |
| U11#61 | | | |
| U12#62 | | | |
| U13#63 | | | |
| U14#64 | | | |
| U15#65 | | | |
| U16#66 | | | |
| U17#67 | LWR | 1920x1080@60.0Hz | Univ_HDML_DC |

- Control Buttons:** Save, Upload, Info, Edit, Create, Transfer (right arrow), Delete selected, Select All, Deselect All, Terminal.

EDID Menu

Control Buttons

| | | | | |
|--|--------|---|--|--|
| | Save | Exporting an EDID (save to a file) | | Executing EDID emulation or copying (Transfer button) |
| | Upload | Importing an EDID (load from a file) | | Deleting EDID (from User memory) |
| | Info | Display EDID Summary window | | Selecting all memory places in the right panel |
| | Edit | Opening Advanced EDID Editor with the selected EDID | | Selecting none of the memory places in the right panel |
| | Create | Opening Easy EDID Creator | | |

5.4.1. EDID Operations

Changing Emulated EDID

- Step 1.** Choose the desired **EDID list** on the source panel and select an **EDID**.
- Step 2.** Press the **Emulated** button on the top of the Destination panel.
- Step 3.** Select the desired **port** on the right panel (one or more ports can be selected); the EDID(s) will be highlighted with a yellow cursor.
- Step 4.** Press the **Transfer** button to change the emulated EDID.

Learning an EDID

The process is the same as changing the emulated EDID; the only difference is the Destination panel: press the **User** button. Thus, one or more EDIDs can be copied into the user memory either from the factory memory or from a connected sink (Dynamic).

Exporting an EDID

ATTENTION! This function is working on Windows and Mac OS X operating systems and under Firefox or Chrome web browsers only.

Source EDID can be downloaded as a file (*.bin, *.dat or *.edid) to the computer.

- Step 1.** Select the desired **EDID** from the Source panel (line will be highlighted with yellow).
- Step 2.** Press the **Export** button to open the dialog box and save the file to the computer.

Importing an EDID

Previously saved EDID (*.bin, *.dat or *.edid file) can be uploaded to the user memory:

- Step 1.** Press the **User** button on the top of the Source panel and select a **memory** slot.
- Step 2.** Press the **Upload** button below the Source panel.
- Step 3.** Browse the file in the opening window then press the **Open** button. Browsed EDID is imported into the selected User memory.

ATTENTION! The imported EDID overwrites the selected memory place even if it is not empty.

Deleting EDID(s)

The EDID(s) from User memory can be deleted as follows:

- Step 1.** Press **User** button on the top of the Destination panel.
- Step 2.** Select the desired **memory** slot(s); one or more can be selected (“Select All” and “Select None” buttons can be used). The EDID(s) will be highlighted with yellow.
- Step 3.** Press the **Clear selected** button to delete the EDID(s).

5.4.2. EDID Summary Window

Select an EDID from Source panel and press **Info** button to display EDID summary.

General

| | |
|------------------------|--------------------------------|
| EDID version: | 1 |
| EDID revision: | 3 |
| Manufacturer ID: | SAM (Samsung Electric Company) |
| Product ID: | 8E09 |
| Monitor serial number: | Not present |
| Year of manufacture: | 2012 |
| Week of manufacture: | 9 |
| Signal interface: | Digital |
| Separate Sync H&V: | - |
| Composite sync on H: | - |
| Sync on green: | - |
| Serration on VS: | - |
| Color depth: | Undefined |
| Interface standard: | Not defined |
| Color spaces: | RGB 4:4:4 & YCrCb 4:4:4 |
| Aspect ratio: | 0.56 |
| Display size: | 52 cm X 29 cm |

5.4.3. Editing an EDID

Select an EDID from Source panel and press Edit button to display Advanced EDID Editor window. The editor can read and write all descriptors, which are defined in the standards, including the additional CEA extensions. Any EDID from the device's memory or a saved EDID file can be loaded into the editor. 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 User memory. For more details about EDID Editor please visit our website (www.lightware.com) and download EDID Editor user's manual.

Basic EDID

- Vendor / Product Information
- Display Parameters
- Power Management and Features
- Gamma / Color and Established Timings
- Standard Timings
- Preferred Timing Mode
- 2nd Descriptor Field
- 3rd Descriptor Field
- 4th Descriptor Field
- CEA Extension
- General
- Video Data
- Audio Data
- Speaker Allocation Data
- HDMI
- Colorimetry
- Detailed Timing Descriptor #1
- Detailed Timing Descriptor #2
- Detailed Timing Descriptor #3
- Detailed Timing Descriptor #4
- Detailed Timing Descriptor #5
- Detailed Timing Descriptor #6
- Save EDID

EDID Byte Editor

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|----|----|----|----|----|----|----|----|----|----|
| 0 | 00 | FF | FF | FF | FF | FF | FF | 00 | 4C | 2D |
| 10 | 8E | 09 | 00 | 00 | 00 | 09 | 16 | 01 | 03 | |
| 20 | 80 | 34 | 1D | 78 | 0A | 7D | D1 | A4 | 56 | 50 |
| 30 | A1 | 28 | 0F | 50 | 54 | BD | EF | 80 | 71 | 4F |
| 40 | 81 | C0 | 81 | 00 | 81 | 80 | 95 | 00 | A9 | C0 |
| 50 | B3 | 00 | 01 | 01 | 02 | 3A | 80 | 18 | 71 | 38 |
| 60 | 2D | 40 | 58 | 2C | 45 | 00 | 09 | 25 | 21 | 00 |
| 70 | 00 | 1E | 66 | 21 | 56 | AA | 51 | 00 | 1E | 30 |
| 80 | 46 | 8F | 33 | 00 | 09 | 25 | 21 | 00 | 00 | 1E |
| 90 | 00 | 00 | 00 | FD | 00 | 18 | 4B | 1A | 51 | 17 |
| 100 | 00 | 0A | 20 | 20 | 20 | 20 | 20 | 20 | 00 | 00 |
| 110 | 00 | FC | 00 | 54 | 32 | 34 | 42 | 33 | 30 | 31 |
| 120 | 0A | 20 | 20 | 20 | 20 | 01 | 6C | | | |

5.4.4. Creating an EDID - Easy EDID Creator

Since above mentioned Advanced EDID Editor needs more complex knowledge about EDID, Lightware introduced a wizard-like interface for fast and easy EDID creation. With Easy EDID Creator it is possible to create custom EDIDs in four simple steps. By clicking on the **Create** button below Source panel, **Easy EDID Creator** is opened in a new window. For more details about EDID Editor please visit our website (www.lightware.com) and download EDID Editor user's manual.

Step 1 - Select Resolution

Step 2 - Signal Type

Step 3 - Select Audio

Step 4 - Finish

Back Next

Select Resolution

Welcome to the Easy EDID Creator!

With this program you are able to create a unique EDID according to your demands by answering three simple questions. Details can be added or changed later if needed.

Please select the preferred resolution, scan mode and frame rate. If you don't find the proper mode in the list, then enter it and the program will estimate the best blanking times.

Preferred resolution:

Set up a secondary resolution

Advanced settings

Use VESA DMT whenever possible

Timing standard:

Easy EDID Creator Window

5.5. Settings Menu

5.5.1. Device Information Tab

LIGHTWARE USB DA2DVI-HDCP-PRO 12345678 I/O Parameters EDID Settings

Device information Log

Device Information

Device: DA2DVI-HDCP-PRO

Serial Number: 12345678

Installed Cards

| Slot Name | Card Name | Firmware Version | Hardware Version | Serial number |
|-----------------|-----------------|------------------|------------------|---------------|
| DA2DVI-HDCP-PRO | DA2DVI-HDCP-PRO | FW:1.2.2r | | |
| MOTHERBOARD | DA2DVI-HDCP-PRO | | SCH_1.1 PCB_1.1 | |

Terminal

Device Information Tab in the Settings Menu

The serial number, installed firmware version and the hardware revision of the device is shown under the Device Information tab.

6

Programmer's Reference

The device can be controlled by a command set of protocol commands to ensure the compatibility with other Lightware products. The supported commands are described in this chapter.

Lightware devices can be controlled with external devices which can communicate according to the amplifier protocol. Lightware distribution amplifiers have a special protocol, but to interoperate with third-party devices, a secondary protocol is also provided.

- ▶ [PROTOCOL DESCRIPTION](#)
- ▶ [STATUS COMMANDS](#)
- ▶ [SYSTEM COMMANDS](#)
- ▶ [EDID ROUTER COMMANDS](#)
- ▶ [COMMANDS - QUICK SUMMARY](#)

6.1. Protocol Description

The protocol description hereinafter stands for Lightware protocol. The device accepts commands surrounded by curly brackets - {} - and responds data surrounded by round brackets - () - only if a command was successfully executed. All input commands are converted to uppercase, but respond commands can contain upper and lower case letters as well. Legend for control commands:

| | | |
|--------------------|---|---|
| <loc> | = | location number in 1, 2 or 3 digit ASCII format |
| <id> | = | id number in 1 or 2 digit ASCII format |
| <id ² > | = | id number in 2 digit ASCII format |
| CrLf | = | Carriage return, Line feed (0x0D, 0x0A) |
| • | = | space character (0x20) |
| → | = | each command issued by the controller |
| ← | = | each response received from the router |

6.2. Status Commands

6.2.1. View Product Type

Description: Identification of the device. Type 'i' or 'I' then the device responds its name.

| Format | Example |
|-------------------------------|------------------------|
| Command {I} | → {i} |
| Response (<PRODUCT_TYPE>)CrLf | ← (I: DA2DVI-HDCP-PRO) |

Explanation: The connected device is a DA2DVI-HDCP-Pro.

6.2.2. View Serial Number

Description: The device responds its 8-digit serial number.

| Format | Example |
|------------------------------|-----------------|
| Command {S} | → {s} |
| Response (SN:<SERIAL_N>)CrLf | ← (SN:3C019935) |

Legend: < SERIAL_N > shows the serial number of the device.

Explanation: The connected device's serial number is 3C019935.

6.2.3. View Firmware Version

Description: View the CPU firmware revision. To view other controller's firmware version see the {FC} command.

| Format | Example |
|----------------------------|---------------|
| Command {F} | → {f} |
| Response (FW:<FW_VER>)CrLf | ← (FW:1.2.2r) |

Explanation: The firmware version is 1.2.2r.

Legend:

| <type> | Description | Response length | Value | Description |
|--------|------------------|-----------------|-------|-----------------|
| U | User saved EDIDs | 48 | '0' | invalid EDID |
| D | Dynamic EDIDs | 2 | '1' | valid EDID |
| E | Emulated EDIDs | 1 | '2' | deleted EDID |
| | | | '3' | changed EDID |
| | | | '4' | empty EDID slot |

Each number represents the EDID validity state for the corresponding memory location.

INFO: If a changed EDID is queried by the {WH} command (see the next section), its value returns to '1'. The status of a deleted EDID returns to '0' after query.

6.4.4. View EDID Header

Description: Shows basic information about EDIDs in the memory.

| Format | Example |
|---------------------------------------|--|
| Command {WH<loc>} | → {whu14} |
| Response (EH#<loc>•<EDID_HEADER>)CrLf | ← (EH#U14 NEC 1280x1024@60 LCD1970NXp) |

Explanation: Shows the EDID from U14 memory slot which is the EDID saved by the user to the location 14.

| <loc> | Result | Response |
|-------|--------------------------|---------------------------------------|
| Fxx | Factory EDID query | header for one EDID |
| Uxx | User EDID query | |
| Dxx | Dynamic EDID query | |
| Exx | Emulated EDID query | |
| F* | All Factory preset EDIDs | headers for all Factory EDIDs |
| U* | All User saved EDIDs | headers for 50 user EDIDs |
| D* | All Dynamic EDIDs | headers from all outputs (frame size) |
| E* | All Emulated EDIDs | headers from all inputs (frame size) |

Legend: Depending on <loc> the query can be for one EDID or all EDID in the block.

<EDID_HEADER> consists of 3 fields separated by spaces:

| <loc> | Result |
|----------------------|--|
| PNPID code | The three letter abbreviation of the manufacturer |
| Preferred resolution | The resolution and refresh rate stored in the preferred detailed timing block. |
| Name | The name of the display device stored in product descriptor. |

The <EDID_HEADER> is '-' for invalid EDIDs.

6.4.5. Delete EDID from Memory

Description: Clear EDID from memory location <loc>.

| Format | Example |
|-------------------------------------|-----------------------|
| Command {DE<loc>} | → {deu*} |
| Response (DE_OK)CrLf (E_S_C)CrLf | ← (DE_OK) ← E_S_C) |

Explanation: All user EDIDs are cleared from memory.

Legend: Depending on <loc>, one EDID or all EDIDs in a block can be cleared.

| <loc> | Result |
|-------|---|
| Fxx | Not valid! Factory EDID cannot be deleted. No response. |
| Uxx | Specified User EDID is deleted. |
| Dxx | Specified Dynamic EDID is deleted. It will be empty until a new monitor is connected. |
| Exx | Specified Emulated EDID cleared. By default F49 EDID is copied to it. |
| F* | Not valid! Factory EDID cannot be deleted. No response. |
| U* | All User EDIDs are deleted. |
| D* | All Dynamic EDIDs are deleted. They will be empty until a new monitor is connected. |
| E* | All Emulated EDIDs are cleared. By default F49 EDID is copied to them. |

6.4.6. Download EDID Content

Description: EDID hex bytes can be read directly. The router will issue the whole content of the EDID present on memory location <loc> (256 bytes).

| Format | Example |
|---|--|
| Command {WE<loc>} | → {wef1} |
| Response (EB#<loc>•<B1> •<B2>•...•<B256>)CrLf | ← (EB#F1 00 FF FF FF FF FF FF 00 32 F2 00 00 00 00 00) |

Legend: <B1>..

Explanation: Full EDID from memory location F1 is downloaded.

6.4.7. Upload EDID Content to the Router

Description: EDID hex bytes can be written directly to the user programmable memory locations. The sequence is the following:

Step 1. Prepare the router to accept EDID bytes to the specified location <loc> with command {WL#<loc>}

Step 2. Router responds that it is ready to accept EDID bytes with (E_L_S)CrLf

Step 3. Send 1 block of EDID (1 block consist of 8 bytes of hex data represented in ASCII format) with command {WB#<num>●<B1>●<B2>●<B3>●<B4> ●<B5>●<B6>●<B7>●<B8>}

Step 4. The router acknowledges with response (EL#<num>)

Step 5. Repeat steps 3 and 4 to send the remaining 31 blocks of EDID (32 altogether)

Step 6. After the last acknowledge, the router indicates that the EDID status changed by sending (E_S_C) CrLf

Legend: <num> represents the sequential number of every 8 byte part of EDID. <num> is between 1 and 32.

| Format | Example |
|---|-----------------------------------|
| Command {WL#<loc>} | → {wl#U3} |
| Response (E_L_S)CrLf | ← (E_L_S) CrLf |
| Command {WB#1●<B1>●<B2>●<B3>●<B4>●<B5>●<B6>●<B7> ●<B8>} | → {WB#1 00 FF FF FF FF FF FF 00} |
| Response (EL#<num>)CrLf | ← (EL#1) CrLf |
| Command {WB#2●<B9>●<B10>●<B11>●<B12>●<B13> ●<B14>●<B15>●<B16>} | → {WB#2 38 A3 8E 66 01 01 01 01} |
| Response (EL#<num>) CrLf | ← (EL#2) CrLf |
| ... | ... |
| Command {WB#32●<B249>●<B250>●<B251>●<B252>●<B253>●<B254>●<B255>●<B256>} | → {WB#32 36 59 42 0A 20 20 00 96} |
| Response (EL#<num>) CrLf | ← (EL#32) CrLf |
| Response (E_S_C) CrLf | ← (E_S_C) CrLf |

<B1>..<<B256> are the bytes of EDID.

Explanation: Full EDID uploaded to memory location U3.

6.5. Commands - Quick Summary

Status Commands

| Operation | See in section | Command |
|------------------------|----------------|---------|
| View Product Type | 6.2.1 | {i} |
| View Serial Number | 6.2.2 | {S} |
| View Firmware Version | 6.2.3 | {F} |
| Compile Time | 6.2.4 | {CT} |
| View Installed Board | 6.2.5 | {IS} |
| View Board Information | 6.2.6 | {FC} |

System Commands

| Operation | See in section | Command |
|--------------------|----------------|---------|
| Restart the Device | 6.3.1 | {i} |

EDID Router Settings

| Operation | See in section | Command |
|-----------------------------------|----------------|-----------------|
| Save EDID to User Memory | 6.4.1 | {<loc1>:<loc2>} |
| View Emulated EDID on Input | 6.4.2 | {VEDID} |
| Watch EDID Validity Table | 6.4.3 | {WV<type>} |
| View EDID Header | 6.4.4 | {WH<loc>} |
| Delete EDID from Memory | 6.4.5 | {DE<loc>} |
| Download EDID Content | 6.4.6 | {WE#<loc>} |
| Upload EDID Content to the Router | 6.4.7 | {WL#<loc>} |

7

Firmware Upgrade

This chapter is meant to help customers perform firmware upgrades on our products by giving a few tips on how to start and by explaining the features of the Bootloader software. To get the latest software and firmware pack please contact support@lightware.com.

WARNING! All EDIDs in the User Memory will be lost after the firmware upgrade. Save the user EDIDs before processing the upgrade.

- ▶ [UPGRADING STEPS IN A NUTSHELL](#)
- ▶ [DETAILED INSTRUCTIONS](#)

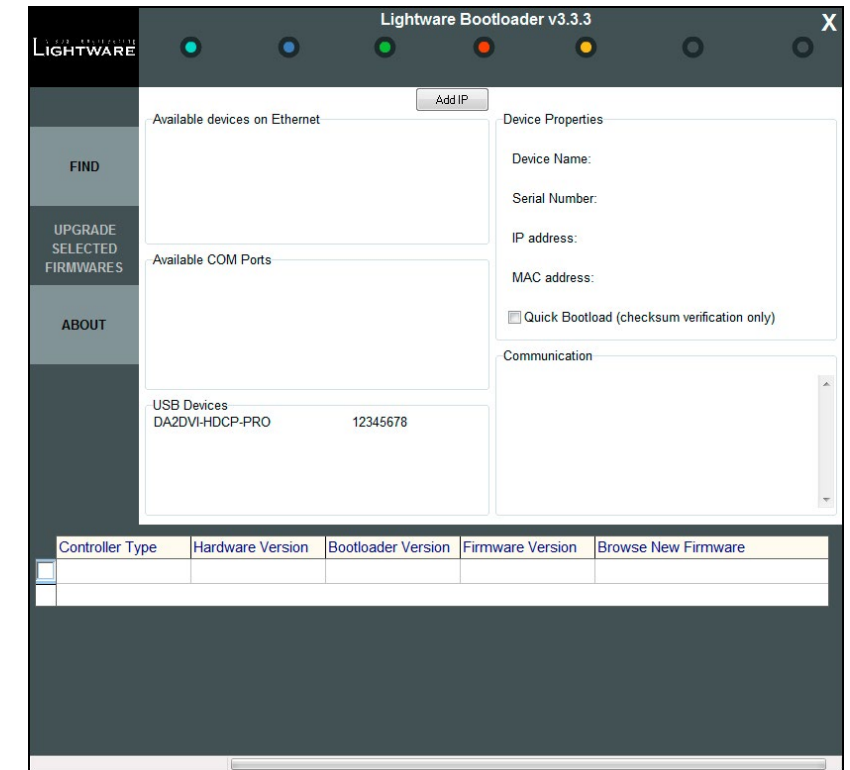
7.1. Upgrading Steps in a Nutshell

- Step 1.** Installing the Lightware Bootloader Software.
- Step 2.** Downloading and saving all the firmware files that you want to upgrade.
- Step 3.** Connecting the Lightware device and the computer via USB port.
- Step 4.** Starting the Lightware Bootloader application.
- Step 5.** Establishing the connection with the device.
- Step 6.** Selecting firmware to upgrade.
- Step 7.** Starting the upgrade process.
- Step 8.** Restarting the device.

7.2. Detailed Instructions

Use the Lightware Bootloader application to upgrade the device's firmware. The distribution amplifier can only be upgraded via USB, so connect the device directly to the Windows based computer with an USB cable.

- Step 1.** Installing the bootloader application with "Installer_LW_bootloader.exe"
- Step 2.** Downloading and saving all the firmware files that you want to upgrade. If you have a zipped archive, extract it.
- Step 3.** Connecting the Lightware device and the computer via USB port.
- Step 4.** Starting the Lightware Bootloader application.
- Step 5.** Establishing the connection with the device.

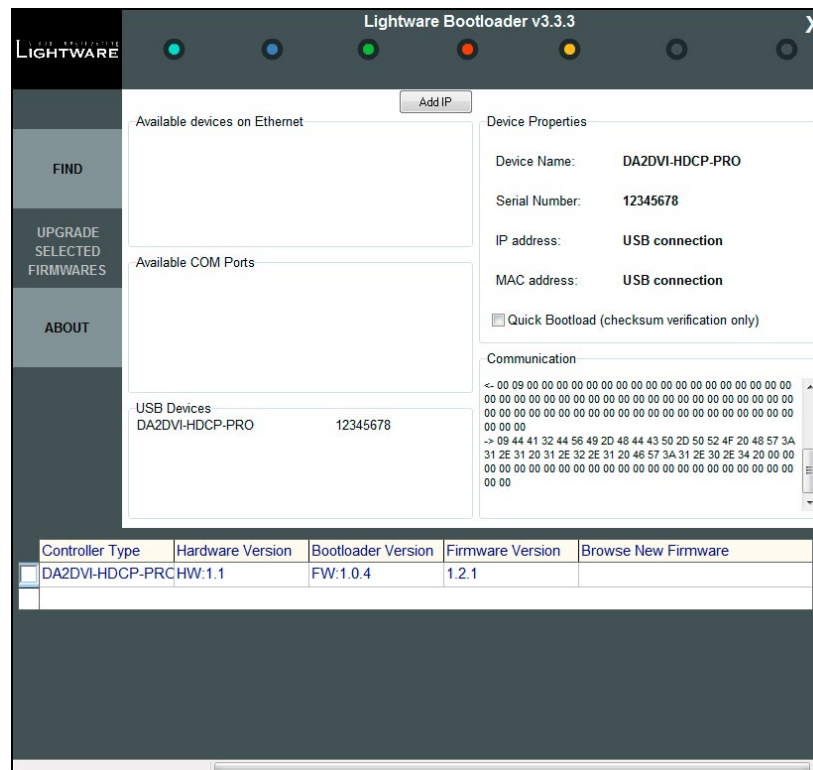


Check the **USB Devices** panel to find your device. Double click on the name, then click **YES** to establish connection with the amplifier. It will take few seconds to get all information from the device.

ATTENTION! The Bootloader software will restart the device when it establishes the connection. All connected DVI sources and monitors will act as if the device was powered down.

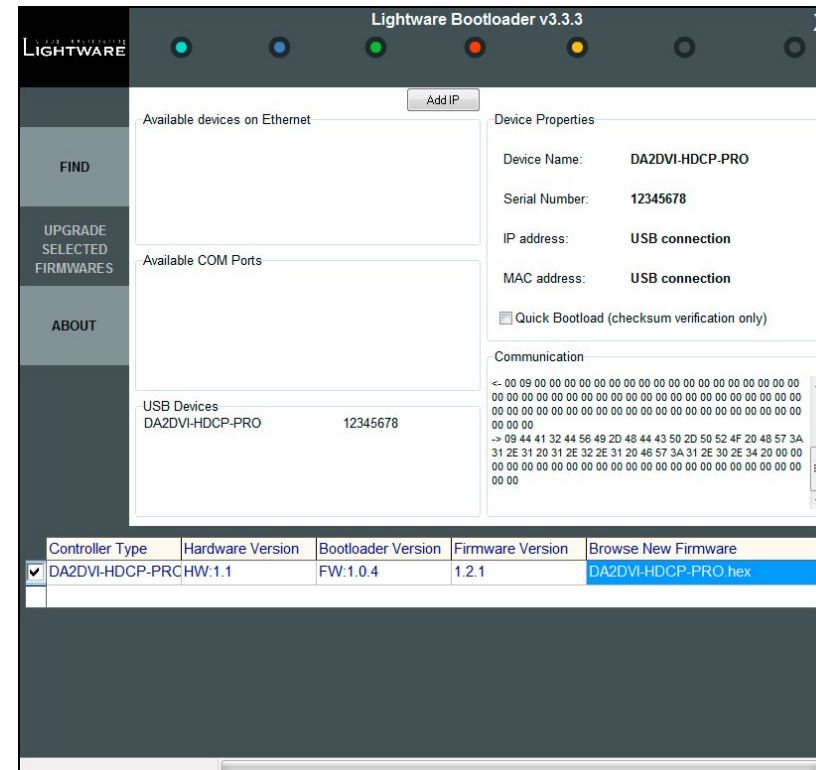
Review the Firmware Versions

After the connection is made, the device properties, and the installed controller module is displayed.



Step 6. Browse for the new firmware.

Click the corresponding cell in the **Browse New Firmware** column. A dialog pops up, to confirm if you really want to modify the path. Now you can browse for the new firmware file to upload. After opening the new file, the new firmware field will contain the name of the firmware file.



Step 7. Upgrade firmware.

Click **Upgrade selected firmwares** button. A confirmation message appears. After clicking the **Yes** button the selected controllers are being reprogrammed, with the firmware you selected. If you select a file that does not fit for the selected controller, you will get an information message about which file is wrong. If you selected a controller to upgrade, but you had not selected a file for it, then you will also get an information message about which file is missing.

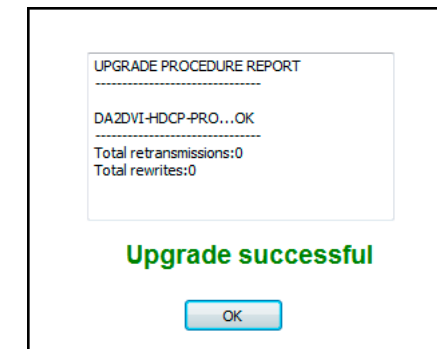
Quick Bootload mode can be switched on or off any time. It makes the bootloader software faster by only checking the checksum of the controller. No data verification is done after writing if the checksum was correct.

A progress bar will show the current state of the reprogramming. With some controller type an erasing process will take place first, and then the programming is done, so the progress bar runs up twice.

When the reprogramming is finished, a **Done!** message will appear in the bottom left corner. The application closes the connection, and the device restarts.

Step 8. Done!

If the upgrade was successful, the following window pops up:



Now you can close the application, or you can select another device to upgrade. After closing the bootloader application, switch the upgraded devices off and then on. Now the distribution amplifier is ready to be used with the new firmware!

8

Troubleshooting

Usually, if the system seems not to transport the signal as expected, the best strategy for troubleshooting is to check signal integrity through the whole signal chain starting from source side and moving forward to receiver end.

General Problems – Check the Device

Check whether the DA2DVI-HDCP-Pro is properly powered and one of the Power LED is green. Try performing a reset by unplugging and reconnecting the power adaptor.

Pictogram Legend



Link to connections/cabling section.






Link to front panel operation section.



Link to LDC software section.



Link to LW2 protocol commands section.

| Symptom | Root cause | Action | Refer to |
|--|--|--|---|
| Picture is not displayed or distorted | Cable connections do not fit well | Due to the high data rates, the cables must fit very well. DVI connectors have to be locked with screws, no tensions or breaches are allowed. | |
| | Different interface is selected | If your source or display as more connectors then make sure that the proper interface is selected. | |
| | Analog signal sent to a digital port | Although the device is equipped with DVI-I connectors, analog signals are not supported. You cannot use VGA cables with DVI-VGA adapter plugs. |  3.3.2 |
| | Transmitted signal and supported formats do not meet | Try emulating your display device's EDID to the source by selecting 00# on the front panel rotary switches. |  4.2.2 |
| | Source is not configured properly | The HDMI output can be turned off on most DVD players. If the source is a computer, then verify that the DVI output is selected and active. Try restarting your computer; if you get a picture during the booting process, you have to review the driver settings. | |
| | HDCP-protected content sent to a non-HDCP capable sink | Disable the HDCP if the content allows. |  4.3 |

9

Technologies

The following sections contain descriptions and useful technical information how the devices work in the background. The content is based on experiences and cases we met in the practice. These sections help to understand features and technical standards like the followings:

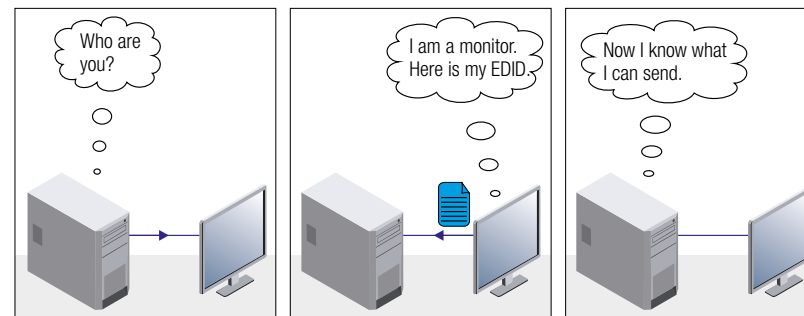
- ▶ EDID MANAGEMENT
- ▶ HDCP MANAGEMENT
- ▶ PIXEL ACCURATE RECLOCKING

9.1. EDID Management

9.1.1. Understanding the EDID

The Extended Display Identification Data (EDID) is the passport of display devices (monitors, TV sets, projectors). It contains information about the capabilities of the display, such as supported resolutions, refresh rates (these are called Detailed Timings), the type and manufacturer of the display device, etc.

After connecting a source to a display (DVI, HDMI, DP), the source reads out the EDID to determine the resolution and refresh rate of the image to be transmitted.



EDID Communication

Most DVI computer displays have 128-byte long EDID structure. However, Digital Televisions and HDMI capable displays may have another 128 bytes, which is called E-EDID and defined by CEA (Consumer Electronics Association). This extension contains information about additional Detailed Timings, audio capabilities, speaker allocation and HDMI capabilities. It is important to know that all HDMI capable devices must have CEA extension, but not all devices with CEA extension are HDMI capable.

Common Problems Related to EDID

Problem: “My system consists of the following: a computer, a Lightware device, a WUXGA (1920x1200) LCD monitor, and an SXGA (1280x1024) projector. I would like to see the same image on the monitor and the projector. What EDID should I choose on the Lightware device?”

Solution: If you want to see the image on both displays, you need to select the resolution of the smaller display (in this case SXGA), otherwise the smaller display may not show the higher resolution image.

Problem: “I have changed to a different EDID on an input port of the Lightware device to have a different resolution but nothing happens.”

Solution: Some graphics cards and video sources read out the EDID only after power-up and later they do not sense that EDID has been changed. You need to restart your source to make it read out the EDID again.

9.1.2. Advanced EDID Management

Each DVI sink (e.g. monitors, projectors, plasma displays, etc...) must support the EDID data structure. Source BIOS and operating systems are likely to query the sink using DDC2B protocol to determine what pixel formats and interface are supported. DVI standard uses EDID data structure to identify the monitor type and capabilities. Most DVI sources (VGA cards, set top boxes, etc.) will output DVI signal after accepting the connected sink's EDID information. In the case of EDID readout failure or missing EDID, the source will not output DVI video signal.

Lightware devices provide the Advanced EDID Management function that helps system integration. The built-in EDID Router can store and emulate factory pre-programmed- and User programmable EDIDs. The EDID of the attached monitors or projectors for each output are stored in a non-volatile memory. This way the EDID of a monitor is available when the monitor is unplugged or switched off.

Any EDID can be emulated on any input. An emulated EDID can be copied from the EDID router's memory (static EDID emulation), or from the last attached monitor's memory (dynamic EDID emulation). For example, the Lightware device can be set up to emulate a sink device, which is connected to one of the outputs. In this case, the EDID automatically changes, if the monitor is replaced with another display device (as long as it has a valid EDID).

EDID is independently programmable for all inputs without affecting each other. All inputs have their own EDID circuit.

INFO: The user is not required to disconnect the video cable to change an EDID as opposed to other manufacturer's products. EDID can be changed even if a source is connected to the input and powered ON.

INFO: When EDID has been changed, the router toggles the HOTPLUG signal for 2 seconds. Some sources do not sense this signal. In such cases, the source device must be restarted or powered OFF and ON again.

9.2. HDCP Management

Lightware Visual Engineering is a legal HDCP adopter. Several functions have been developed which helps to solve HDCP related problems. Complex AV systems often have both HDCP and non-HDCP components. The matrix allows transmitting HDCP encrypted and unencrypted signals. The devices will be still HDCP compliant as they will never output an encrypted signal to a non-HDCP compliant display device. If an encrypted signal is switched to a non-compliant output, a red screen alert or muted screen will appear.

9.2.1. Protected and Unprotected Content

Many video sources send HDCP protected signal if they detect that the sink is HDCP capable – even if the content is not copyrighted. This can cause trouble if an HDCP capable device is connected between the source and the display. In this case, the content cannot be viewed on non-HDCP capable displays and interfaces like event controllers. Rental and staging technicians often complain about certain laptops, which are always sending HDCP encrypted signals if the receiver device (display, matrix router, etc.) reports HDCP compliancy. However, HDCP encryption is not required all the time e.g. computer desktop image, certain laptops still do that. To avoid unnecessary HDCP encryption, Lightware introduced the HDCP enabling/disabling function: the HDCP capability can be disabled in the Lightware device. If HDCP is disabled, the connected source will detect that the sink is not HDCP capable, and turn off authentication.

9.2.2. Disable Unnecessary Encryption

HDCP Compliant Sink

All the devices are HDCP-compliant, no manual setting is required, both protected and unprotected contents are transmitted and displayed on the sink.



Not HDCP-compliant Sink 1.

Not-HDCP compliant sink is connected to the matrix. Some sources (e.g. computers) always send HDCP encrypted signals if the receiver device reports HDCP compliancy, however, HDCP encryption is not required all the time (e.g. computer desktop image). If HDCP is enabled in the matrix, the image will not be displayed on the sink.



Setting the HDCP parameter to Auto on the output port and disable HDCP on the input port, the transmitted signal will not be encrypted if the content is not protected. Thus, non-HDCP compliant sinks will display non-encrypted signal.

Not HDCP-compliant Sink 2.



The layout is the same as in the previous case: non-HDCP compliant display device is connected to the matrix but the source would send protected content with encryption. If HDCP is enabled on the input port of the matrix, the source will send encrypted signal. The sink is not HDCP compliant, thus, it will not display the video signal (but blank/red/muted/etc. screen). If HDCP is disabled on the input port of the matrix, the source will not send the signal. The solution is to replace the display device to an HDCP-capable one.

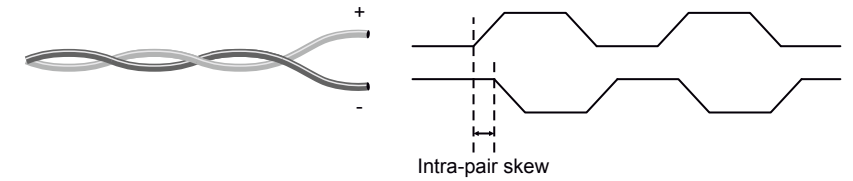
9.3. Pixel Accurate Reclocking

Signal reclocking is an essential important procedure in digital signal transmission. After passing the reclocking circuit, the signal becomes stable, jitter-free, and can be transmitted over more equipment like processors, or event controllers. Without reclocking, sparkles, noise, and jaggies appear on the image.

Lightware's sophisticated Pixel Accurate Reclocking technology fixes more problems than general TMDS reclocking. It removes not only intra-pair skew but inter-pair skew as well. The Pixel Accurate Reclocking circuit eliminates the following errors:

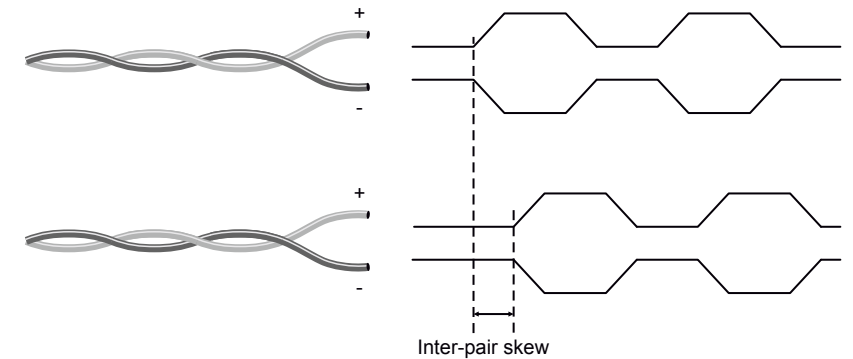
Intra-pair Skew

Skew between the + and - wires within a differential wire pair (e.g. Data2- and Data2+). It's caused by different wire lengths or slightly different wire construction (impedance mismatch) in DVI cable. It results in jitter.



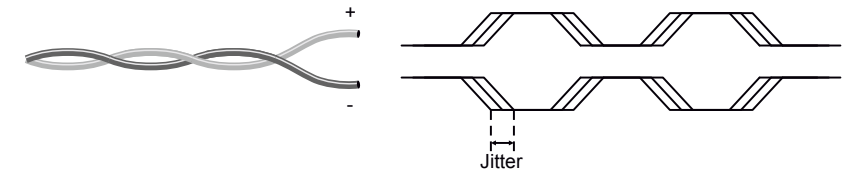
Inter-pair Skew

Skew between two differential wire pairs in a cable. It is caused by different wire pair lengths or different number of twists in the DVI cable. Too much inter-pair skew results color shift in the picture or sync loss.



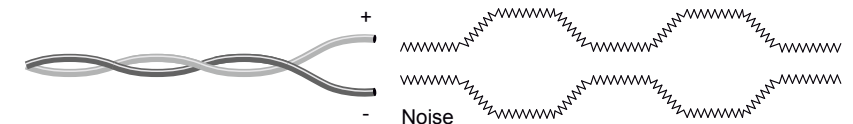
Jitter

Signal instability in the time domain. The time difference between two signal transitions should be a fixed value, but noise and other effects cause variations.



Noise

Electromagnetic interference between other electronic devices such as mobile phones, motors, etc. and the DVI cable are coupled onto the signal. Too much noise results in increased jitter.



10

Appendix

Tables, drawings, and technical details as follows:

- ▶ [SPECIFICATIONS](#)
- ▶ [MECHANICAL DRAWINGS](#)
- ▶ [FACTORY EDID LIST](#)
- ▶ [FURTHER INFORMATION](#)

10.1. Specifications

General

| | |
|---------------------------------|----------------------------|
| Compliance | CE |
| EMC compliance (emission) | EN 55032:2015 |
| EMC compliance (immunity) | EN 55024:2011 |
| Warranty | 3 years |
| Cooling | Convection only |
| Operating temperature | 0 to +50°C (+32 to +122°F) |
| Operating humidity | 10% to 90%, non-condensing |

Power

| | |
|-------------------------|--|
| Power supply | External power adaptor |
| Power adaptor | In 100-240 V AC 50/60 Hz, Out 5V DC, 1 A |
| Power connector | Locking DC connector (2.35 mm pin) |
| Power consumption | 4 W (typ) |

Enclosure

| | |
|--------------------------|--------------------------------|
| Rack mountable | Yes, with rack shelf (1U high) |
| Material | 1 mm steel |
| Dimensions in mm | 110 W x 180 D x 42 H mm |
| Dimensions in inch | 4.33 W x 7.08 D x 1.65 H |
| Weight | 680 g (1.499 lbs) |

Input

| | |
|--------------------------------|----------------------------|
| Connector | 29-pole DVI-I digital only |
| Input cable equalization | Automatic, +40dB max |
| EDID emulation | Yes |
| Input cable equalization | Yes |

Output

| | |
|-------------------------|----------------------------|
| Connector | 29-pole DVI-I digital only |
| Reclocking | Yes |
| 5V output current | 500 mA |

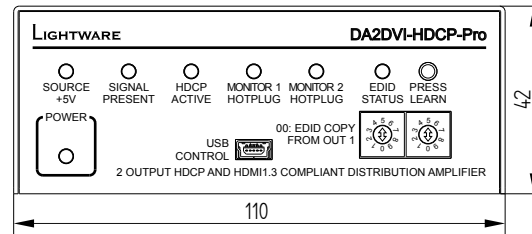
Digital Video Signal

| | |
|----------------------------------|--|
| Data rate | all between 25 Mbps and 2.25 Gbps / TMDS channel |
| Channels | 1x TMDS Clock + 3x TMDS Colors |
| Resolutions | all between 640x480 and 1920x1200@60Hz or 2048x1080@60Hz |
| Color depth | maximum 36 bits, 12 bit/color |
| Color format | RGB, YCbCr 4:4:4 |
| HDTV resolutions | 720p, 1080i, 1080p |
| HDMI 1.3a audio compatible | Yes (embedded audio) |
| HDCP compliant | Yes |

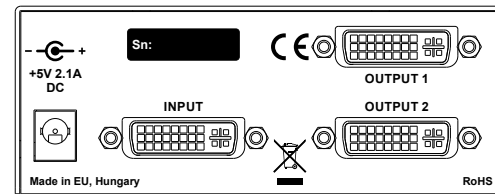
10.2. Mechanical Drawings

The following drawings present the physical dimensions of the device. Dimensions are in mm.

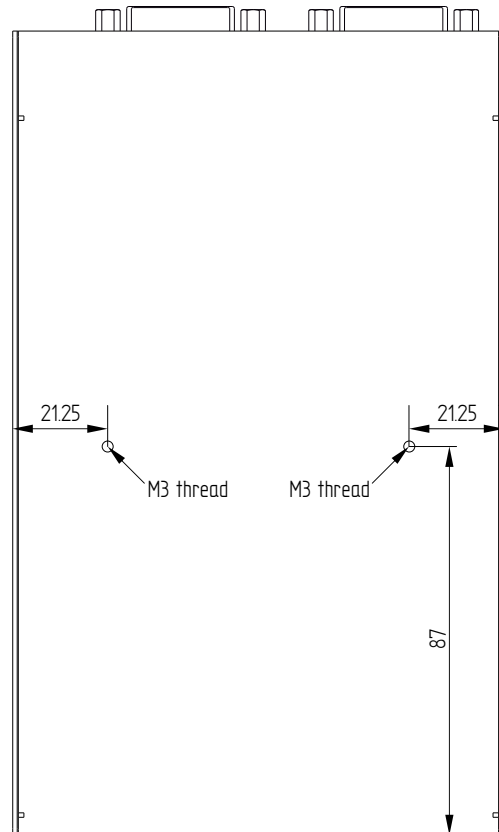
Front View



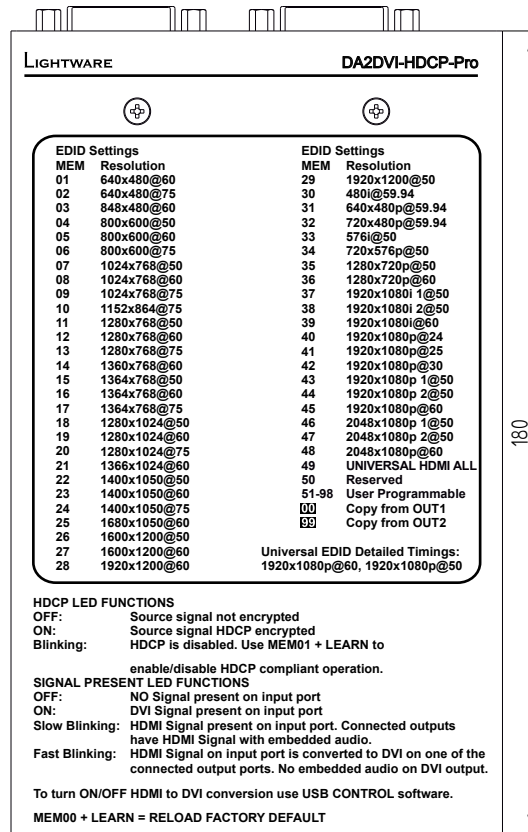
Rear View



Bottom View



Top View



10.3. Factory EDID List

INFO: Minor changes in the factory EDID list may be applied in farther firmware versions.

| Mem. | Resolution | Type | Mem. | Resolution | Type |
|------|------------------------|------|------|------------------------|------|
| F1 | 640 x 480 @ 60.00 Hz | D | F35 | 1280 x 720 @ 50.00 Hz | H |
| F2 | 640 x 480 @ 75.00 Hz | D | F36 | 1280 x 720 @ 60.00 Hz | H |
| F3 | 848 x 480 @ 60.00 Hz | D | F37 | 1920 x 540 @ 50.30 Hz | H |
| F4 | 800 x 600 @ 50.00 Hz | D | F38 | 1920 x 540 @ 50.00 Hz | H |
| F5 | 800 x 600 @ 60.30 Hz | D | F39 | 1920 x 540 @ 60.50 Hz | H |
| F6 | 800 x 600 @ 74.99 Hz | D | F40 | 1920 x 1080 @ 24.00 Hz | H |
| F7 | 1024 x 768 @ 49.98 Hz | D | F41 | 1920 x 1080 @ 24.99 Hz | H |
| F8 | 1024 x 768 @ 60.00 Hz | D | F42 | 1920 x 1080 @ 30.00 Hz | H |
| F9 | 1024 x 768 @ 75.20 Hz | D | F43 | 1920 x 1080 @ 50.00 Hz | H |
| F10 | 1152 x 864 @ 75.00 Hz | D | F44 | 1920 x 1080 @ 49.99 Hz | H |
| F11 | 1280 x 768 @ 50.00 Hz | D | F45 | 1920 x 1080 @ 60.00 Hz | H |
| F12 | 1280 x 768 @ 59.92 Hz | D | F46 | 2048 x 1080 @ 49.99 Hz | H |
| F13 | 1280 x 768 @ 75.00 Hz | D | F47 | 2048 x 1080 @ 50.00 Hz | H |
| F14 | 1360 x 768 @ 60.10 Hz | D | F48 | 2048 x 1080 @ 59.99 Hz | H |
| F15 | 1364 x 768 @ 50.00 Hz | D | F49 | 1920 x 1200 @ 59.55 Hz | H |
| F16 | 1364 x 768 @ 59.93 Hz | D | F50 | Reserved | |
| F17 | 1364 x 768 @ 74.98 Hz | D | | | |
| F18 | 1280 x 1024 @ 50.00 Hz | D | | | |
| F19 | 1280 x 1024 @ 60.10 Hz | D | | | |
| F20 | 1280 x 1024 @ 75.10 Hz | D | | | |
| F21 | 1366 x 1024 @ 59.99 Hz | D | | | |
| F22 | 1400 x 1050 @ 49.99 Hz | D | | | |
| F23 | 1400 x 1050 @ 59.99 Hz | D | | | |
| F24 | 1400 x 1050 @ 75.00 Hz | D | | | |
| F25 | 1680 x 1050 @ 59.99 Hz | D | | | |
| F26 | 1600 x 1200 @ 50.00 Hz | D | | | |
| F27 | 1600 x 1200 @ 60.00 Hz | D | | | |
| F28 | 1920 x 1200 @ 59.55 Hz | D | | | |
| F29 | 1920 x 1200 @ 50.00 Hz | D | | | |
| F30 | 1440 x 240 @ 60.30 Hz | H | | | |
| F31 | 640 x 480 @ 59.94 Hz | H | | | |
| F32 | 720 x 480 @ 59.92 Hz | H | | | |
| F33 | 1440 x 288 @ 50.60 Hz | H | | | |
| F34 | 720 x 576 @ 50.00 Hz | H | | | |

10.4. Further Information

Limited Warranty Statement

1. Lightware Visual Engineering LLC (Lightware) warrants to all trade and end user customers that any Lightware product purchased will be free from manufacturing defects in both material and workmanship for three (3) years from purchase unless stated otherwise below. The warranty period will begin on the latest possible date where proof of purchase/delivery can be provided by the customer. In the event that no proof can be provided (empty 'Date of purchase' field or a copy of invoice), the warranty period will begin from the point of delivery from Lightware.

1.1. 25G and MODEX product series will be subject to a seven (7) year warranty period under the same terms as outlined in this document.

1.2. If during the first three (3) months of purchase, the customer is unhappy with any aspect of a Lightware product, Lightware will accept a return for full credit.

1.3. Any product that fails in the first six (6) months of the warranty period will automatically be eligible for replacement and advanced replacement where available. Any replacements provided will be warranted for the remainder of the original unit's warranty period.

1.4. Product failures from six (6) months to the end of the warranty period will either be repaired or replaced at the discretion of Lightware. If Lightware chooses to replace the product then the replacement will be warranted for the remainder of the original unit's warranty period.

2. The above-stated warranty and procedures will not apply to any product that has been:

2.1. Modified, repaired or altered by anyone other than a certified Lightware engineer unless expressly agreed beforehand.

2.2. Used in any application other than that for which it was intended.

2.3. Subjected to any mechanical or electrical abuse or accidental damage.

2.4. Any costs incurred for repair/replacement of goods that fall into the above categories (2.1., 2.2., 2.3.) will be borne by the customer at a pre-agreed figure.

3. All products to be returned to Lightware require a return material authorization number (RMA) prior to shipment and this number must be clearly marked on the box. If an RMA number is not obtained or is not clearly marked on the box, Lightware will refuse the shipment.

3.1. The customer will be responsible for in-bound and Lightware will be responsible for out-bound shipping costs.

3.2. Newly repaired or replaced products will be warranted to the end of the originally purchased products warranty period.

Document Revision History

| Rev. | Release date | Changes | Editor |
|------|--------------|---|-----------------|
| 1.0 | 21-03-2012 | Initial version | Szabolcs Turi |
| 1.1 | 07-07-2015 | Lightware Device Updater added; Bootloader upgraded; Typographical corrections and minor changes in the formatting. | Laszlo Zsedenyi |
| 1.2 | 15-12-2015 | Safety instructions updated, CE page pulled out | Laszlo Zsedenyi |
| 2.0 | 06-01-2017 | Minor updates to Software Control (LDC) section, programmer's reference chapter added | Tamas Forgacs |
| 2.1 | 06-04-2017 | Updated mechanical drawings and specification | Tamas Forgacs |
| 3.0 | 19-09-2017 | New document format introduced | Laszlo Zsedenyi |

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