visual engineering
LIGHTWARE

User's Manual

MX2-8X8-HDMI20-AUDIO

IMPORTANT SAFETY INSTRUCTIONS

Class I Apparatus Construction.

This equipment must be used with a mains power system with a protective earth connection. The third (earth) pin is a safety feature, do not bypass or disable it. 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.

Replacing the AC Fuse

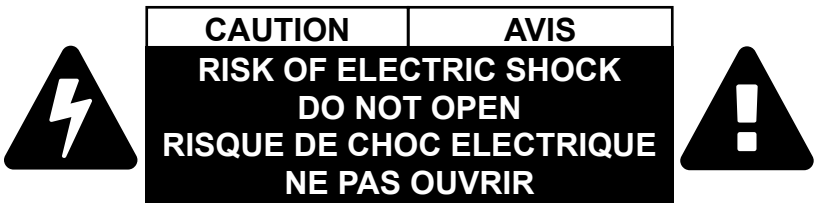
Unplug the AC power cord from the device. Locate the AC fuse on the rear panel. Replace only the AC fuse as indicated on the rear panel. Connect the power cord to the switcher and to the AC power source. Make sure the switcher is working properly.

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



Common Safety Symbols

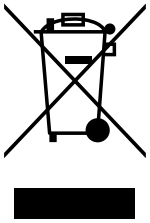

Alternating current


Protective conductor terminal


Caution, possibility of eletric shock


Caution

WEEE (Waste Electrical & Electronic Equipment)



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.

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.

In the case of any questions, please call your local representative or contact Lightware at:

Lightware Sales:
sales@lightware.eu
+36 1 255 3800

Lightware Support:
support@lightware.eu
+36 1 255 3810

Lightware Visual Engineering

Peterdy 15, Budapest H-1071, Hungary

TABLE OF CONTENTS

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	1.17.1b3
Lightware Device Updater (LDU) software	1.5.0b8
Controller firmware	1.1.5
Hardware	1.1

Document revision: **1.3**

Release date: 17-08-2017

Editor: Tamas Forgacs

SYMBOL LEGEND

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

ATTENTION!
An attention which is recommended to read! Procedure can be unsuccessful without reading it.

WARNING!
Important warning which is highly recommended to read and keep in every case!

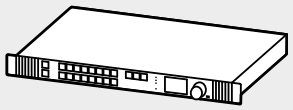
TIPS AND TRICKS
Tips and tricks which you may have not known yet but can be useful.

Printer icon
Lightware Visual Engineering supports green technologies and eco-friend mentality. Thus, this document is made for digital usage primarily. If you need to print out few pages for any reason, we indicated some summary sheets with a printer-friendly icon which can be found at the left bottom corner of the actual page.

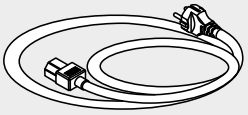
1. Introduction

Thank You for choosing Lightware Matrix Routers. The MX2-8x8-HDMI20-Audio is the first Lightware HDMI2.0 standalone matrix switcher that supports uncompromised 4K UHD resolution at 60Hz 4:4:4. Thanks to its compact size and silent design, it is particularly suitable for offices and meeting rooms, for 4K live events, and for futureproof operation centers.

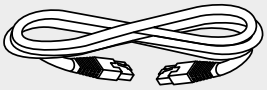
1.1. Box Contents



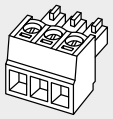
Matrix switcher



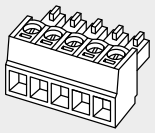
IEC power cable



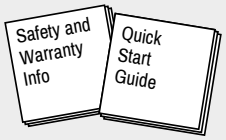
LAN cross-link cable, CAT5e type, 3m length



Phoenix combicon 3-pole connector



Phoenix combicon 5-pole connector (16x)



Safety and Warranty info, Quick Start Guide

1.2. Description

The MX2-8x8-HDMI20-Audio is the first Lightware HDMI2.0 standalone matrix switcher that supports uncompromised 4K UHD resolution at 60Hz 4:4:4. Thanks to its compact size and silent design, it is particularly suitable for offices and meeting rooms, for 4K live events, and for futureproof operation centers. It is also a perfect choice for home theater enthusiasts who demand the highest quality along with HDMI2.0 and 4K@60Hz video signals.

This flagship product has 8 HDMI2.0 inputs and 8 HDMI2.0 outputs transmitting up to 4K at 60Hz in 4:4:4 format, while supporting 3D, Dolby TrueHD, and DTS-HD Master Audio. Each input port has audio connectors for embedding analog audio into the HDMI stream. Likewise, the audio connectors next to the output ports can provide de-embedded audio* for amplifiers and audio systems.

* Please note that only stereo LPCM can be de-embedded from the HDMI signal.

1.3. Features

Maximum A/V Compatibility

The matrix is compatible with the latest HDMI 2.0 standard as well as with HDMI 1.x and DVI 1.0 standards.

4K Video without Compression

HDMI 2.0 signal switching with 4k@60Hz and RGB 4:4:4 colorspace, 18 Gbit/sec bandwidth.

HDCP Compliant

MX2-8x8-HDMI20 matrix fulfills the HDCP standard. HDCP capability on the HDMI inputs can be disabled when non-protected content is extended.

Audio Embedding and De-embedding

Each input port has audio connectors for embedding analog audio to the HDMI stream. Likewise, the audio connectors next to the output ports can provide de-embedded audio for amplifiers and audio systems.

Advanced EDID Management

The user can emulate any EDID on the input ports, read out and store any monitor's EDID in the internal memory or apply factory pre-programmed EDIDs.

Pixel Accurate Reclocking

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

Graphic Display and Rotary Jog Dial Control Knob

Easy setting and menu navigation are assured by the color graphic display and the comfortable jog dial control.

HDMI 2.0 to 2x HDMI 1.4 Splitting

The device supports vertical splitting of an HDMI2.0 4k@60Hz 4:4:4 input signal to left and right halves allowing for the transmission of an 18 Gbps HDMI 2.0 signal over two HDMI1.4 compliant links. The two halves can then be recombined at the signal destination.

Unique Front-to-Back Cooling Airflow Design

MX2-8x8-HDMI20-Audio includes a groundbreaking new cooling design with front-to-back airflow. Inside the chassis, the airflow travels along guiding panes assuring that the most warm areas receive ample amount of cooling air volume.

Front Panel Control

Every source and destination have their own button on the front panel. Single switches can be executed or crosspoint presets can be saved and reloaded. The most important settings can be configured through the front panel LCD menu.

Ethernet Control

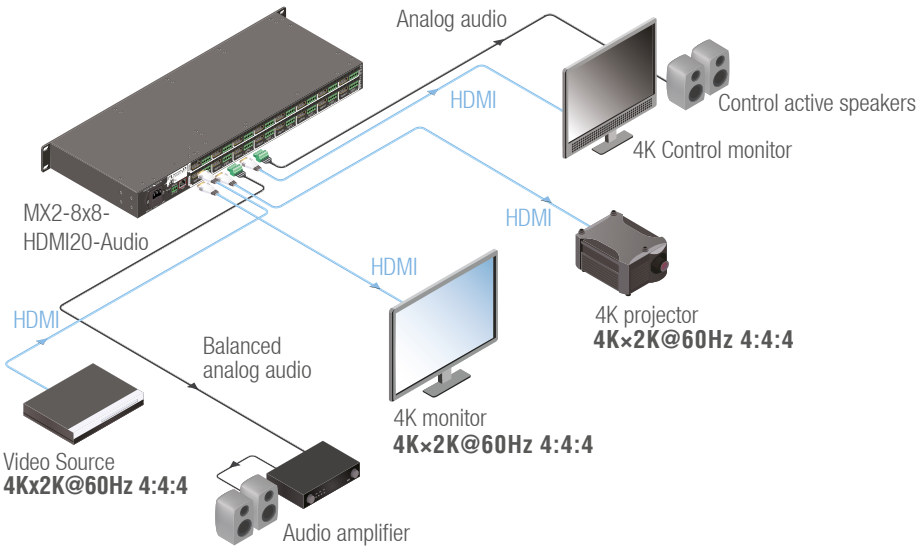
Multiple simultaneous TCP/IP connections are available with a simple ASCII-based protocol for controlling, configuring the matrix router or perform a firmware upgrade.

Non-Volatile Memory

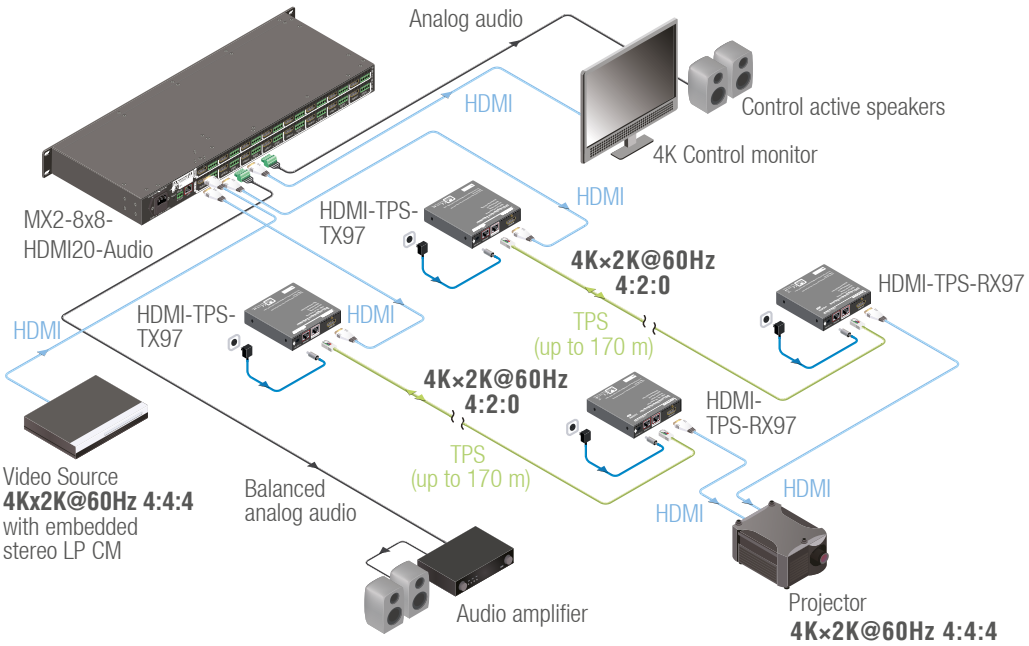
The matrix router starts with its latest configuration settings when powered on or after a power failure. Every setting is stored in a non-volatile memory.

1.4. Typical Applications

The following figures show different modes of the application:



4K@60 4:4:4 Signal Routing

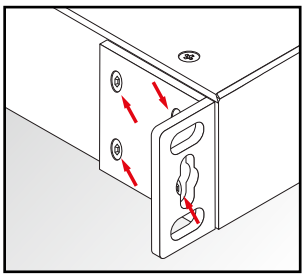


HDMI 2.0 to 2x HDMI 1.4 Splitting

2. Installation

2.1. Mounting Options

The matrix can be mounted in several ways by the supplied two rack ears. Allen head screws fix them to the housing:



WARNING!
M4x8 size is the longest allowed screw for fixing the ears to the housing. A longer screw may touch internal parts.

Mounting with Front and Rear Rack Ears

ATTENTION!
Two rack ears are assembled on the matrix as default, thus, you will need two more rack ears for this kind of installation, which can be purchased separately.

The matrix can be easily mounted under the desk by rack ears. This mounting option means **the top of the matrix is parallel with the base surface**. Please do the following steps:

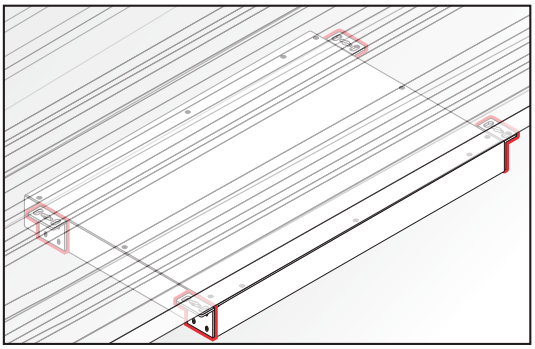
Step 1. Release and remove the fixing screws of the rack ears on the matrix (both sides).

Step 2. Rotate the rack ears by 90° to the desired direction.

Step 3. Insert the screws into the holes and fix the front ears to the matrix.

Step 4. Fix the two additional rear ears (not supplied with the product) by the screws on both sides of the matrix.

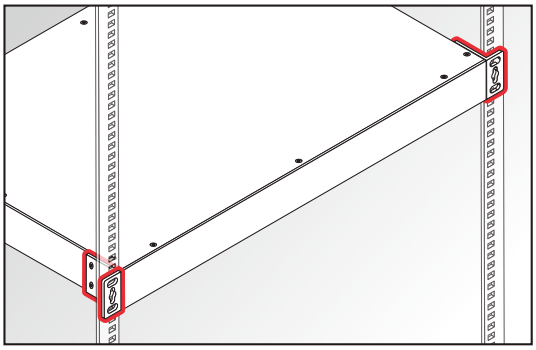
Step 5. Fix the matrix through the holes of the rack ears to the desired surface (screws are not supplied).



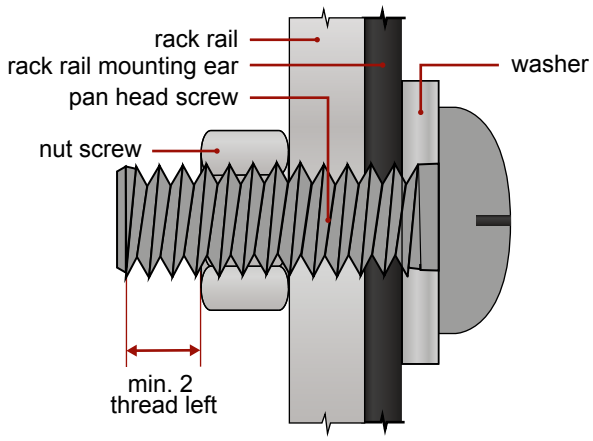
INFO
The method is the same when the matrix would be mounted to a wall.

Standard Rack Installation (Default)

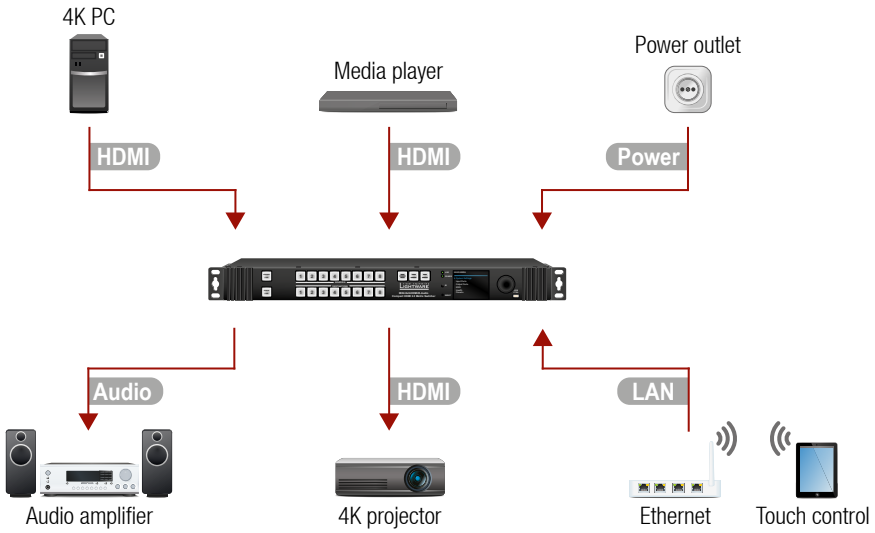
Two rack ears are supplied with the product, which are fixed on left and right side as shown in the picture. The default position allows mounting the device as a standard rack unit installation.



ATTENTION!
Always use all the four screws for fixing the rack shelf ears to the rack rail. Choose properly sized screws for mounting. Keep minimum two thread left after the nut screw.



2.2. Connecting Steps



HDMI	Connect the desired sources to the **HDMI input ports**.
Audio	Optionally connect an audio source to the **Audio input port** which is located next to the connected HDMI input port.
HDMI	Connect the sink devices to the **HDMI output ports**.
Audio	Optionally connect an audio device (e.g. audio amplifier) to the **Phoenix Audio output port** which is located next to the connected HDMI output port.
LAN	In order to control the matrix via Ethernet, connect the device to a LAN switch/ router, and connect a controller (e.g. a Touch panel).
Power	Connect the power cord to the AC power socket and to the matrix.

2.3. Audio Cable Wiring Guide

Inputs and outputs of audio devices are usually symmetric or asymmetric. The main advantage of the symmetric lines is the better protection against the noise, therefore it is used widely in the professional audio industry. Symmetric audio is most often referred to as balanced audio, as opposed to asymmetric, which is referred to as unbalanced audio. Ligthware products are usually built with 5-pole Phoenix connectors so we would like to help users assembling their own audio cables. See the most common cases below.

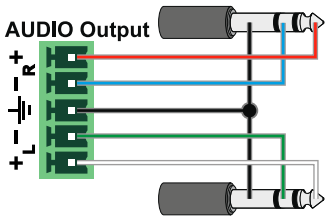
See more information about the Analog Audio ports in section 3.3 on page 16.

ATTENTION!
Symmetric and asymmetric lines can be linked with passive accessories (e.g. special cables), but in this case, the half of the line level can be lost.

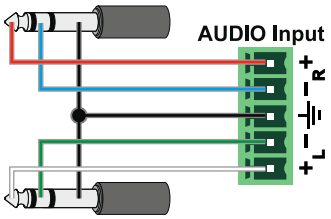
ATTENTION!
There are numerous types of regularly used connector and cable types to connect audio devices. Please always make sure the desired cable types and connectors will fit well to your system.

From Balanced Output to Balanced Input

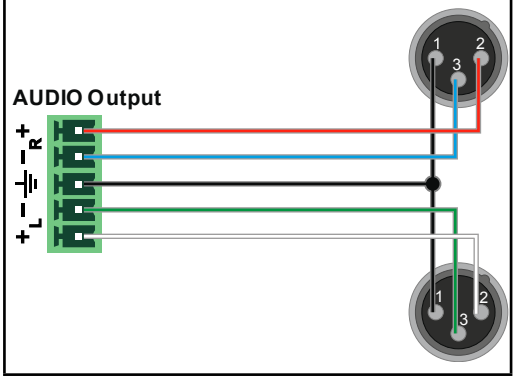
Phoenix - 2x6.3 (1/4") TRS



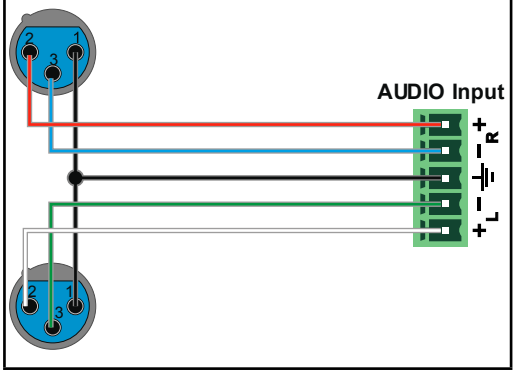
2x6.3 (1/4") TRS - Phoenix



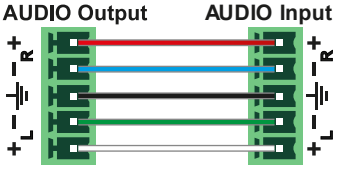
Phoenix - 2x XLR



2x XLR - Phoenix

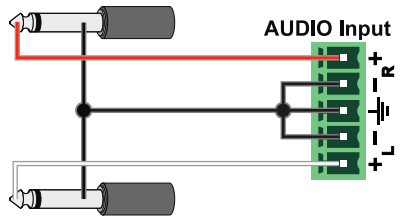


Phoenix - Phoenix

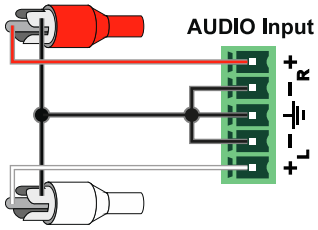


From Unbalanced Output to Balanced Input

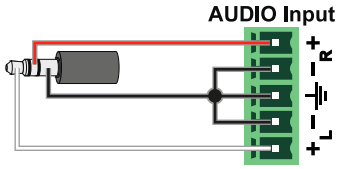
2x6.3 (1/4") TS - Phoenix



2xRCA - Phoenix

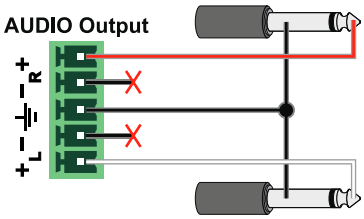


3.5 (1/8") TRS - Phoenix

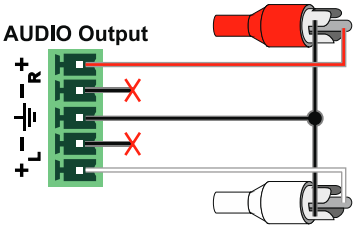


From Balanced Output to Unbalanced Input

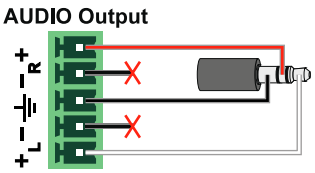
Phoenix - 2x 6.3 (1/4") TS



Phoenix - 2x RCA



Phoenix - 3.5 (1/8") TRS -

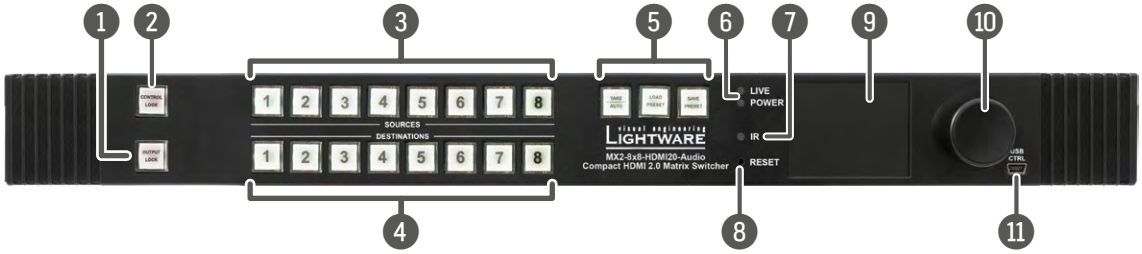


ATTENTION!
Never join the phase-inverted (negative, cold or -) poles (both right and left) to the ground or to each other on the output side! It can damage the unit.

INFO
Use a galvanic isolation in the case of a ground loop.

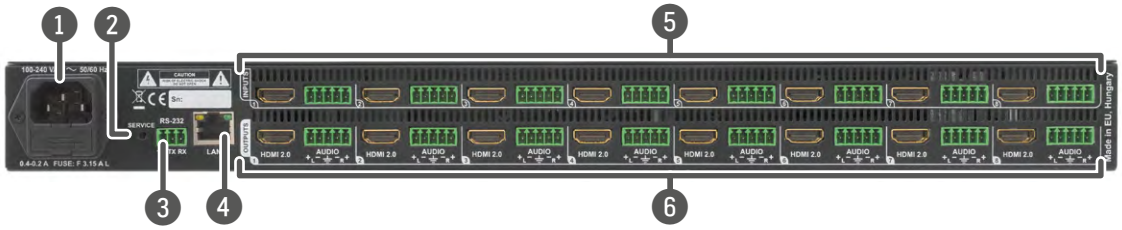
3. Product Overview

3.1. Front View



1	**Output Lock**	Locking one or more outputs.
2	**Control Lock**	Disable or enable front panel operations. Red light means the switching and function buttons are disabled.
3	**Sources**	Buttons to select an input, to select a preset number or to view the state of the selected input port.
4	**Destinations**	Buttons to select an output or to view the state of an output.
5	**Function Buttons**	Switching between working modes (Take / Autotake) and performing Preset operations.
6	**Status LEDs**	Blinking LIVE LED indicates normal operation; POWER LED is dark in the case of an internal voltage problem.
7	**IR Detector**	Reserved for future developments.
8	**Reset Button**	Reboots the matrix (the same as disconnecting from the power source and reconnecting again).
9	**Color Display**	LCD screen showing the most important settings and parameters in the front panel menu.
10	**Jog Dial Control Knob**	Easy setting and menu navigation by the jog dial control. Keep dial and click while getting feedback on the LCD.
11	**USB Control**	USB connector for local control functions (e.g. Lightware Device Controller software).

3.2. Rear View



1	**AC Connector**	Standard IEC connector accepting 100-240 V, 50 or 60 Hz.
2	**Service Button**	Hidden button for special operations.
3	**RS-232 Port**	3-pole Phoenix connector for RS-232 serial port.
4	**LAN Port**	RJ45 connector to control the matrix via LAN/Ethernet.
5	**Input Ports**	**HDMI** input ports for sources. **Audio** input ports (5-pole Phoenix) for balanced analog audio input signal.
6	**Output Ports**	**HDMI** output ports for connecting sink devices. **Audio** output ports (5-pole Phoenix) with balanced analog audio output signal. The signal is de-embedded from the given HDMI port.

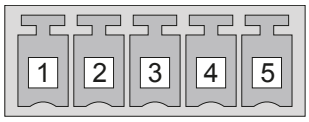
3.3. Electrical Connections

HDMI Input and Output Ports

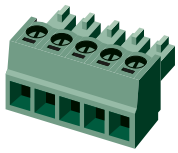
The matrix switchers are assembled with standard 19-pole HDMI connectors for inputs and outputs. The outputs are able to supply 500 mA current on DDC +5V output (pin 18) which is sufficient to supply power to certain devices (e.g. DA2-HDMI-4K-Plus-A).

Symmetrical Analog Stereo Audio

5-pole Phoenix connector is used for balanced analog audio (line in/out). Some I/O boards use this connector as a configurable input or output. Unbalanced audio signals can be connected as well. For asymmetrical output, connect only + and ground. For asymmetrical input connect + and ground to the source and connect – to the ground.



Pin nr.	Signal
1	Left +
2	Left -
3	Ground
4	Right -
5	Right +



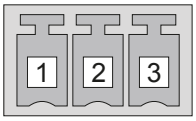
Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch), type: MC 1.5/5-ST-3.5.

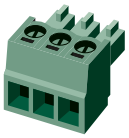
See more information about the most common audio cable wiring modes in section 2.3 on page 12.

RS-232 Port

The 3-pole Phoenix connector is used for the local RS-232 serial connection.



Pin nr.	Signal
1	Ground
2	Tx data
3	Rx data

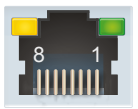


Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch, 3-pole), type: MC 1.5/3-ST-3.5.

Ethernet (LAN) Port

The matrix contains an RJ-45 connector for Ethernet/LAN connection. The Ethernet port can be connected to a LAN hub, switch or router by a CATx cable. However, both cable types (straight or cross) are supported and handled by the device, below pin assignment is recommended.



Pin	TIA/EIA T568 A
1	white/green stripe
2	green solid
3	white/orange stripe
4	blue solid
5	white/blue stripe
6	orange solid
7	white/brown stripe
8	brown solid

	LED 1, Amber	LED 2, Green
OFF	10 Mbps	No link
Blinking	N/A	Activity
ON	100 Mbps	Link is active

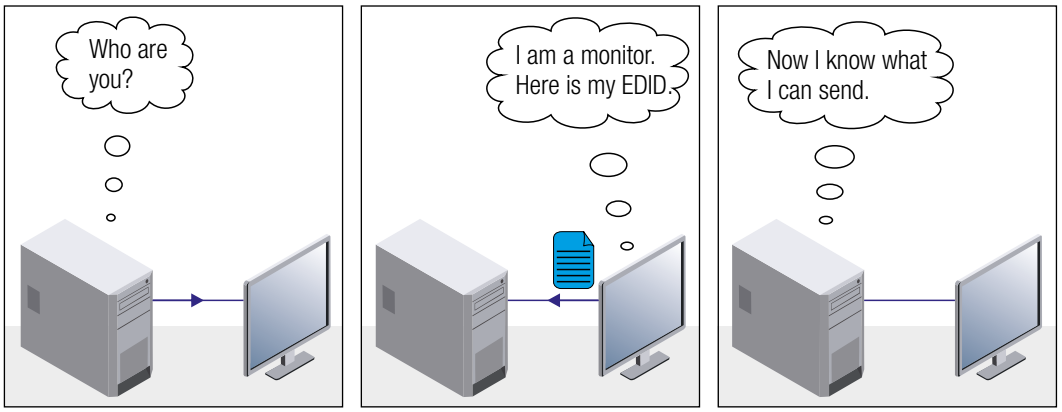
4. Technologies

4.1. EDID Management

4.1.1. Understanding the EDID

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

After connecting a DVI source to a DVI display, 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 are HDMI capable which have the extension.

Common Problems Related to EDID

Problem: My system consists of the following: a computer, a Lightware matrix, 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 chose on the router?"

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 matrix 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.

4.1.2. 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 makes use of EDID data structure for the identification of 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.

The matrix switchers provide Lightware's 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 router stores the EDID of all attached monitors or projectors for each output in a non-volatile memory. This way the EDID from 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 router can be set up to emulate a 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 input has its own EDID circuit. EDID Router can be controlled via serial port or Ethernet.

INFO
The user is not required to disconnect the DVI 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 observe this signal. In such cases, the source device must be restarted or powered OFF and ON again.

4.2. HDCP Management

Lightware Visual Engineering is a legal HDCP adopter. Several functions have been developed which help 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 be shown.

4.2.1. 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 always send 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 matrix. If HDCP is disabled, the connected source will detect that the sink is not HDCP capable, and turn off authentication.

4.2.2. Disable Unnecessary Encryption

HDCP-compliant Sink

All the devices are HDCP-compliant, no manual setting is required, both protected and unprotected content is 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.

4.2.3. HDCP v2.2

HDCP v2.2 is the latest evolution of copy protection. It is designed to create a secure connection between a source and a display. The 2.x version of HDCP is not a continuation of HDCPv1, and is rather a completely different link protection. One of the main differences is the number of the allowed devices within a closed A/V system: HDCP v2.2 allows 32 devices (HDCP v1.4 allows 128 devices). Further limit is that up to four level is allowed which means the protected signal can be transmitted over at most four repeater/matrix/switcher device. HDCP content protection is activated only if an active video stream is transmitted from the source to the display. The encryption is not activated without a video signal.

HDCP v2.2 standard allows to apply a previous version of HDCP (e.g. HDCP v1.4) between the source and the display if the source content allows it. According to the standard if the image content is protected with HDCP, the highest supported content protection level has to be applied. However, if the highest level of protection is not justified by the source content the level may be decreased to avoid compatibility problems; this case is determined by the source.

HDCP v2.2 Source and HDCP v1.4 Sink

In this case the signal of an HDCP v2.2 compliant source is switched to an HDCP v1.4 compliant sink device. The signal is encrypted with HDCP v2.2 on the input and encrypted with HDCP v1.4 on the output of the matrix. A lower level of encryption may be applied only if the source device/content allows it - according to the HDCP standard. In this case the HDCP setting on the input port has to be set to **"HDCP 1.4"** and **"Depends on input"** on the output port. See the corresponding section 7.4.1 on page 41.

HDCP v1.4 Source and HDCP v2.2 Sink

The below example is the 'reverse' of the previous case. An HDCP v1.4 compliant source sends a signal with HDCP v1.4 encryption. The signal is switched to an HDCP v2.2 compliant sink device. In this case the outgoing signal has to be encrypted with the highest supported encryption level towards the sink, as the matrix and the sink are both HDCP v2.2 compliant. The HDCP v2.2 standard **does not allow** keeping the original HDCP v1.4 encryption level on the output.

What Kind of Signal will be on the Output of the Matrix?

See the below table that summarizes the possible cases:

Incoming Signal	HDCP v1.4 Compatible Sink on the Output	HDCP v2.2. Compatible Sink on the Output
HDCP v1.4	HDCP v1.4	HDCP v2.2
HDCP v2.2 (convertable)*	HDCP v1.4	HDCP v2.2
HDCP v2.2 (not convertable)*	Red screen	HDCP v2.2

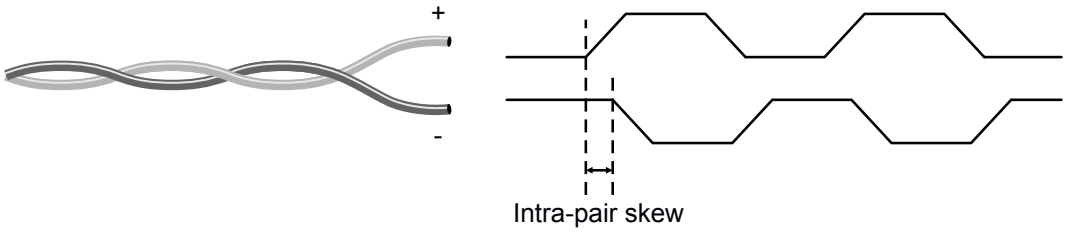
* The incoming video signal contains an information if the encryption level of the signal can be converted to a lower level of encryption. That information is encoded in the video stream.

4.3. Pixel Accurate Reclocking

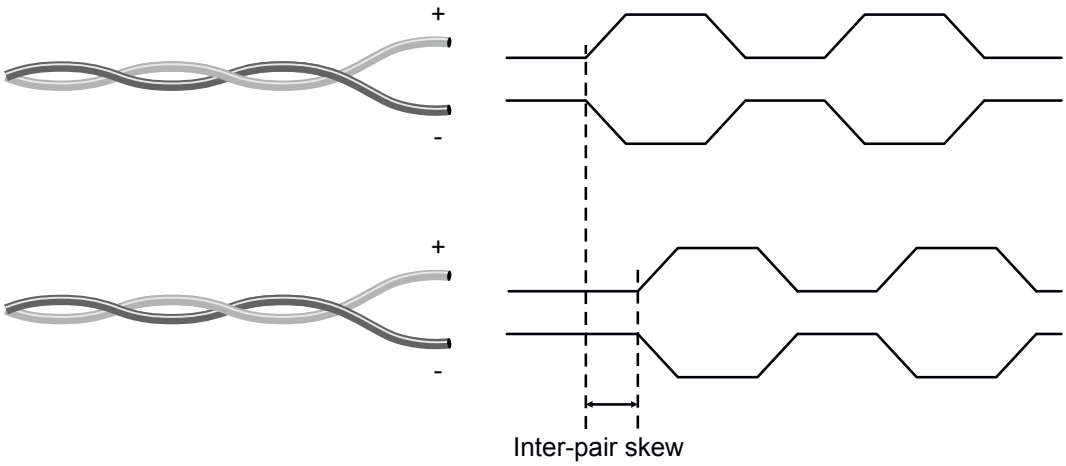
Signal reclocking is an essential important procedure in digital signal transmission. After passing the reclocking circuit, the signal becomes stable, jitter-free, and can be transmitted over more equipment like processors, or event controllers. Without reclocking sparkles, noise, and jaggies can be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

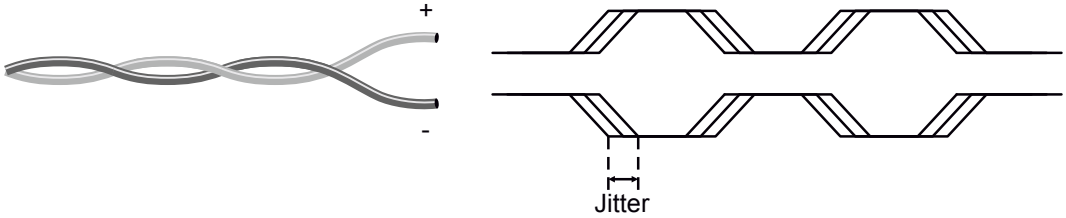
Intra-pair skew: skew between the + and - wires within a differential wire pair (e.g. Data2- and Data2+). It's caused by different wire lengths or slightly different wire construction (impedance mismatch) in DVI cable. It results in jitter.



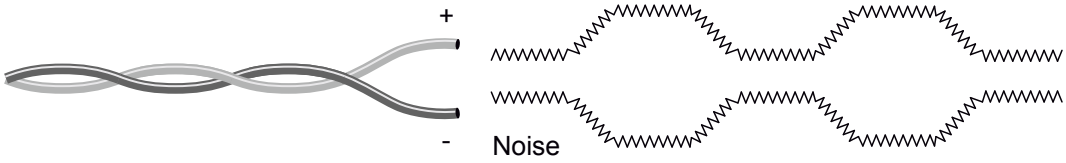
Inter-pair skew: skew between two differential wire pairs in a cable. It is caused by different wire pair lengths or a different number of twists in the DVI cable. Too much inter-pair skew results a color shift in the picture or sync loss.



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.



5. Operation

5.1. Powering on

Connect the power cord to the AC input connector; the matrix is immediately powered on. After the self-test (about 30 seconds), the last configuration is loaded automatically.

INFO
The router has an internal emergency memory that stores all current settings and tie configurations. This memory is independent from presets and invisible for the user. This built-in feature helps the system to be ready immediately in case of power failure or accidental power down.

5.2. Front Panel Operations

Take / Autotake Mode

The router has two different switching modes: **Take** and **Autotake**. If the **Take** button is unlit, **Take** mode is active. When the **Take** button continuously illuminates green, **Autotake** mode is selected. Press and hold the **Take** button for two seconds to change between **Take** and **Autotake** modes.

5.2.1. View Crosspoint State

The current switching status can be checked on the front panel by using the front panel buttons. The crosspoint state is displayed slightly different in **Take** or **Autotake** modes because of the different switching methods.

INFO
View mode does not mean, that the router has to be switched in different modes, viewing and switching can be done after each other, without pressing any special buttons.

View Current State in Take Mode

If the router is in **Take** mode, the user can verify both input and output connections. In **Take** mode no accidental change can be done unless **Take** button is pressed.

Press and release a **source button**. Now the selected source button and all destination buttons which are currently connected to the selected source will light up. This informative display will remain active for three seconds, then all buttons turn to dark.

Sample drawing shows that Input 1 is currently connected to the Output 2, 3, and 5 ports.

If every source, destination, and **Take** buttons are unlit (the unit is in **Take** mode, and no input was selected in the last 3 seconds), press and release a **destination button** to see its current state. Now the source button, which is connected to the selected destination, will light up.

Sample drawing shows that Output 3 is connected to the Input 1.

View Current State in Autotake Mode

In **Autotake** mode only states of destinations can be viewed.

Press and release the required **destination button**. Now the source button, which is connected to the selected destination, will light up.

5.2.2. Switching Operations

Switching in Take Mode

Take mode allows the user to connect or disconnect multiple outputs to an input at once. This mode is useful when the time delay is not allowed between multiple switching. The commands are only realized when the **Take** button is pressed.

Step 1. First, press and release the desired **source button**. The pressed source button and all destination buttons which are currently connected to the source lights up.

Step 2. Press and release the desired **destination buttons** which have to be (dis) connected to/from the selected source. The preselected destination buttons will blink. If no button is pressed for three seconds, the buttons will turn to dark.

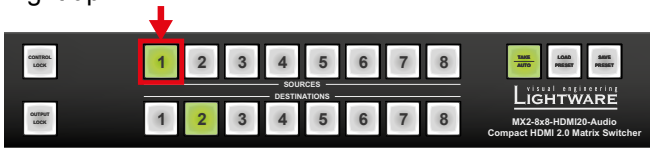
Step 3. Press and release **Take** button; the selected input is switched to the selected output(s).

Switching in Autotake Mode

Autotake mode is useful when immediate actions must be done or fast switching is needed between sources on a particular destination. In this mode switching occurs immediately upon pressing one of the input selector buttons.

Step 1. Press and release the desired **destination button**. The pressed destination button and the actually connected source button light up green. If no source is connected (the output is muted) no source button will light up.

Step 2. Press and release the desired **source button**. The switch action will be executed immediately. Switching between sources to the selected destination can be done directly.



5.2.3. Output Lock

ATTENTION!
However, the front panel buttons allow to lock only the output ports, the input ports can also be locked by using Lightware Device Controller software (see section 7.4.1 on page 41) or sending LW3 protocol command (see section 9.7.4 on page 76).

Using Lightware routers it is possible to lock a destination. This feature prevents an accidental switching to the locked destination in case of an important signal. Locking a destination means that no input selection or muting action can be executed on that particular destination.

Destinations can be independently locked or unlocked. Locking a destination does not affect other destinations.

Output Lock in Take Mode

Step 1. Press and release the **Output Lock** button; it starts to blink and all the buttons of any locked destinations light up (view state).

Step 2. Press and release a **destination button**; it starts to blink (more destinations can be selected sequentially).

Step 3. Press and release **Take** button. The selected destinations are now locked.

Output Lock in Autotake Mode

Step 1. Press and release the required **destination button**. Now the selected destination button and the currently configured source button light up (view mode).

Step 2. Press and release the **Output Lock** button; it lights up in red, and lock function is activated at once. No source can be changed at the locked destination.

5.2.4. Control Lock

Front panel button operation can be enabled or disabled using **Control Lock** button, while the remote control is still enabled. If the button is unlit, front panel button operation is enabled. If the button is continuously illuminated in red the front panel operations are not possible. Press and keep the **Control Lock** button pressed for three seconds to toggle between the control lock states.

5.2.5. Save or Load a Preset

The matrix can store user-programmable presets. Each preset stores a configuration regarding all input connections for all outputs. All presets are stored in a non-volatile memory; the router keeps the presets even in the case of a power down. Please note, that preset operations can be followed on the LCD during front panel preset operations.

ATTENTION!
Eight of the memory slots are available by the Source buttons; see the corresponding section 5.3.6 on page 32.

Saving a Preset in Take Mode

Step 1. Press and release **Save Preset** button.

Step 2. Press and release the desired **source (memory address) button** (source 1 to 8).

Step 3. Press and release the **Take** button. Now the current configuration is stored in the selected memory.

ATTENTION!
Preset save action always stores the current configuration for all outputs.

Loading a Preset in Take Mode

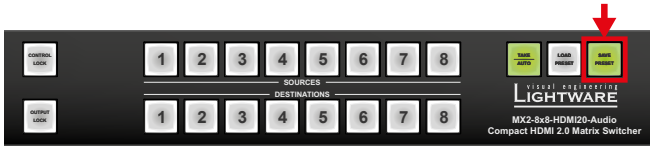
Step 1. Press and release the **Load preset** button.

Step 2. Press and release the desired **source (memory address) button** (source 1 to 8).

Step 3. Press and release the **Take** button. Now the selected preset is loaded.

Saving a Preset in Autotake Mode

Step 1. Press and release the **Save Preset** button.

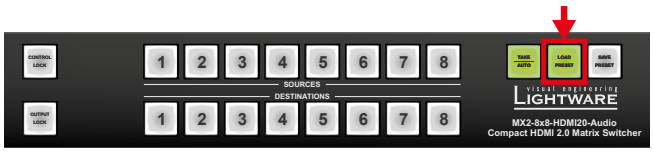


Step 2. Press and release the desired source (memory address) button (source 1 to 8). Now the current configuration is stored in the selected memory.

ATTENTION!
Preset save action always stores the current configuration for all outputs.

Loading a Preset in Autotake Mode

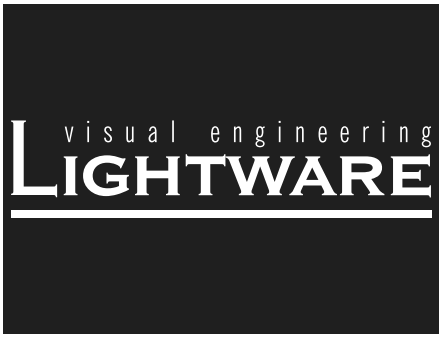
Step 1. Press and release **Load Preset** button.



Step 2. Press and release the desired source (memory address) button (source 1 to 8). Now the selected preset is loaded.

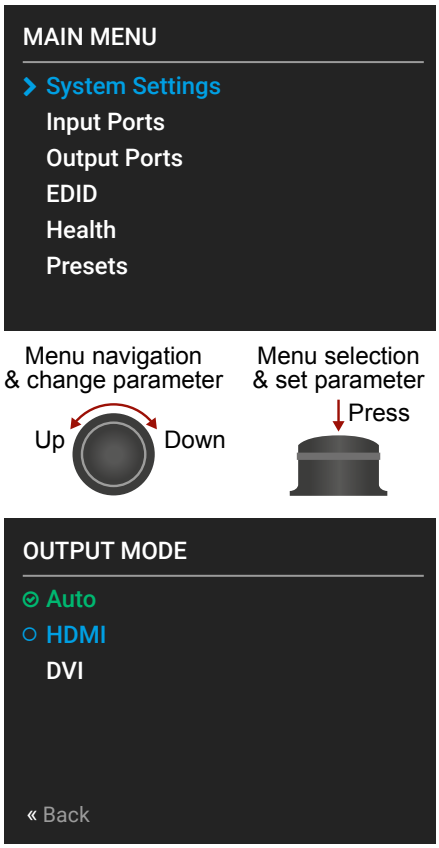
5.3. Front Panel LCD Menu Operations

The company logo is displayed on the screen during the boot-up. The main menu is displayed after about 30 seconds later and the device is ready to use.



Menu Structure

The front panel has a color LCD that shows the most important settings and parameters structured in a menu. The jog dial control knob can be used to navigate between the menu items or change the value of a parameter. The knob can be pressed to enter a menu or edit/set a parameter.



- **System Settings**
  - Network
  - RS-232
  - Time and Date
  - Display Brightness
  - Buzzer
  - Device Info
  - Enter Standby Mode
  - Restore Factory Defaults
- **Input Ports**
  - Port 1..8
    - Video Status
    - Video Settings
    - Audio
- **Output Ports**
  - Port 1..8
    - Video Status
    - Video Settings
    - Audio
- **EDID**
  - View
  - Switch
  - Save
- **Health**
  - Uptime
  - Control Panel
  - Motherboard
  - IO ports
- **Presets**
  - Load Preset
  - Save Preset

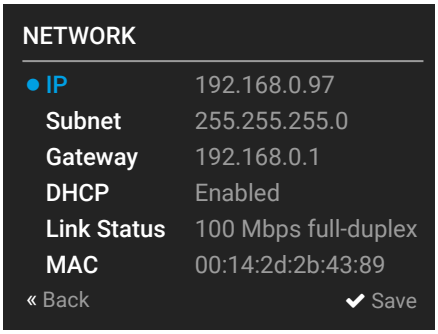
Parameter Selection

The **blue** colored line means the selected menu/parameter, the **green** one means the current setting.

TIPS AND TRICKS
The faster you rotate the jog dial, the faster the parameter list is scrolled.

5.3.1. System Settings Menu

Network Submenu

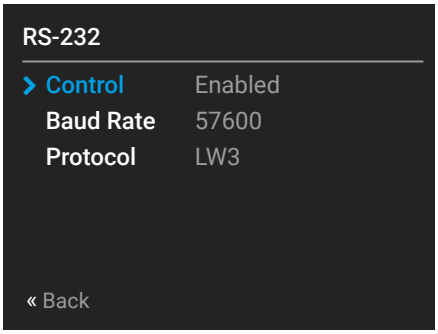


The parameters of the network connection can be set in this submenu. The first three lines (IP, Subnet, and Gateway parameters) show the current settings. If the DHCP option is disabled, three more parameters are listed which can be set for a static IP address:

- **Static IP,**
- **Static Subnet,**
- **Static Gateway.**

ATTENTION!
If you change the network settings, always press the Save option under Network menu (not only in the submenu of the parameter) to apply the new settings.

RS-232 Submenu



Adjustable parameters of the local RS-232 port:

- **Control** (enable/disable the device control),
- **Baud Rate** (9600, 19200, 38400, 57600, 115200),
- **Protocol** (LW2, LW3 or P#2 protocol).

Time and Date

The internal clock and date can be set in this submenu which is used for logging events.

Display Brightness

The brightness of the LCD can be set from 1 to 10 on a scale.

ATTENTION!
The lowest value of the brightness parameter is 1 when setting via the front panel. The setting is available in Lightware Device Controller software as well, but in that case, the lowest value is 0, which means the display is switched off; see section 7.7.4 on page 53.

INFO
When the matrix is in Standby mode, the display is switched off.

Buzzer

There is a buzzer in the matrix which sounds in certain cases (during booting, network or parameter change, etc.). It can be enabled/disabled in this submenu.

Device Info

The following information is available in the submenu:

- **Frame Serial Number**,
- **Hardware Versions** of the PCB components,
- **Firmware Versions** of the installed boards.

Enter Standby Mode

The device can be switched to standby mode. In this case, the video transmission is disabled and the LCD is switched off. Remote connections (LAN, RS-232) remain enabled. Press the jog dial button on the front panel to wake up the matrix (or see the related settings in LDC, see section 7.3.1 on page 37.)

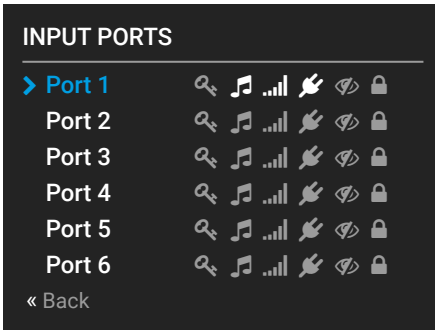
Restore Factory Defaults

The default settings can be reloaded in this submenu, see section 12.4 on page 100.

5.3.2. Input Ports Menu

When entering the menu the available video input ports are listed. The icons display information about the port and the incoming signal (see below table). Select the desired input port and enter to see the submenu.

Icon	Icon is grey	Icon is white
	Signal is **not** encrypted with HDCP	Signal is encrypted with HDCP
	No audio signal in the video stream	Audio is embedded in the video stream
	Signal is **not** present	Signal is present
	Source is **not** connected	Source is connected
	The port is unmuted	The port is muted
	The port is unlocked	The port is locked



Video Status Submenu

The most important properties of the incoming signal can be checked in this submenu:

- **Video Bandwidth**
- **DVI/HDMI State**
- **Color Space**
- **Color Depth**
- **HDCP State**
- **Audio Present**
- **Resolution**
- **HDMI scrambling**
- **TMDS Clock Rate**

Video Settings Submenu

HDCP

The encryption towards the source can be set as follows:

- **Disable HDCP on input**: The connected source will detect that the sink is not HDCP-compliant and turn off authentication if the content allows it.
- **Allow HDCP 1.4 only:** The connected source will detect that the sink is compliant with HDCP 1.4 but not compliant with HDCP 2.2.
- **Allow HDCP 1.4 and 2.2:** The connected source will detect that the sink is compliant with HDCP 2.2 (factory default setting).
- **High Value mode**: Any version of HDCP is allowed on the input but the incoming signal is upconverted to HDCP 2.2 content and thus cannot be switched to HDCP 1.4 sinks.

See more information about HDCP in section on 4.2 page 18.

Hotplug

The hotplug signal towards the source can be set to **Auto**, **Forced On**, or **Forced Off**.

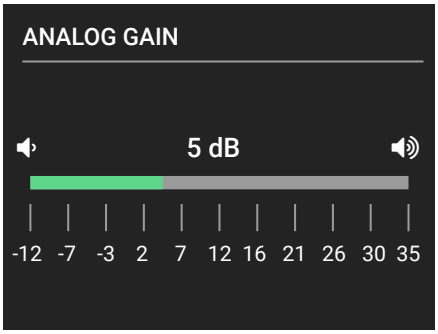
Output Mode

The signal format can be set to **HDMI**, **DVI**, or **Auto**.

Audio Submenu

Information about the Analog Audio input and the (HDMI) embedded audio signal is displayed in this submenu.

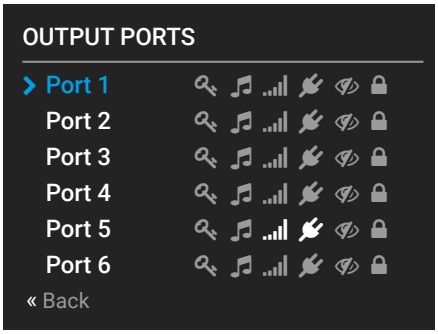
- **Audio Present** and **Audio Type**,
- **Audio Source**: HDMI, Analog Input, or Disable,
- **Audio Gain**: adjustable from -12 dB to +35 dB,
- **Analog Volume**: adjustable from 0 to 100%,
- **Analog Balance**: adjustable from -100 % to + 100% (0 = center).



5.3.3. Output Ports Menu

When entering the menu the available video output ports are listed. The icons display information about the port and the outgoing signal (see below table). Select the desired output port and enter to see the submenu.

Icon	Icon is grey	Icon is white
	Signal is **not** encrypted with HDCP	Signal is encrypted with HDCP
	No audio signal in the video stream	Audio is embedded in the video stream
	Signal is **not** present	Signal is present
	Sink is **not** connected	Sink is connected
	The port is unmuted	The port is muted
	The port is unlocked	The port is locked



Video Status Submenu

The most important properties of the incoming signal can be checked in this submenu:

- **Video Bandwidth**
- **DVI/HDMI State**
- **Color Space**
- **Color Depth**
- **HDCP State**
- **Audio Present**
- **Resolution**
- **HDMI scrambling**
- **TMDS Clock Rate**

Video Settings Submenu

Conversion

The outgoing signal can be routed to the outputs with or without conversion as follows:

- **Passthrough:** no signal conversion.
- **4:4:4 to 4:2:0 :** the signal is converted to the indicated color depth. This feature is supported in the case of HDMI 2.0 signals.
- **Left part** and **Right part**: The device supports vertical splitting of an HDMI 2.0 4k@60Hz 4:4:4 input signal to left and right halves allowing for the transmission of an 18Gbps HDMI2.0 signal over two HDMI1.4 compliant links. The two halves can then be recombined at the signal destination. To apply the feature route the same input signal to 2 output ports. Set the conversion to **Left part** on one output port and **Right part** on the other output port. See the application diagram in section 1.4 on page 7.

Output Mode

The output signal format can be set to **HDMI**, **DVI**, or **Auto**.

HDCP

- **Depends on input:** the encryption level is determined according to the settings on the input port and the source content/device. If the incoming signal is not encrypted, then the outgoing signal will not be encrypted either.
- **Maximum possible:** the highest supported level of encryption (between the matrix and the sink) is applied (up to HDCP v2.2).

See more information about HDCP in section 4.2 on page 18.

Scrambling

HDMI 2.0 standard introduced the **Scrambling** to the TMDS encoding which helps to decrease the energy peaks and hence the Electro Magnetic Interference (EMI). To maintain backward compatibility, HDMI 2.0 only requires the use of scrambling with data rates of above 3.4 Gbps per lane. The feature can be set on the output ports to **Auto** / **Forced On** / **Forced Off**.

INFO
*The **Auto** setting (recommended) allows the pseudo-random conversion at frequencies above the threshold. **Forced on** and **Forced off** settings override this operation.*

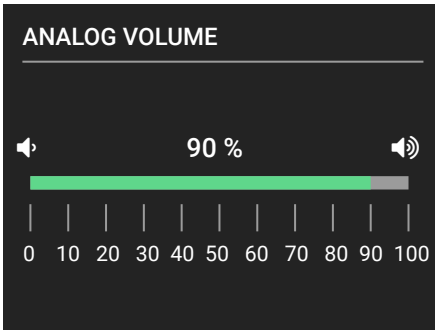
TMDS Clock Rate

However, the clock rate can be set to **1/10** or **1/40** if necessary, using the **Auto** setting is recommended.

Audio Submenu

Information about the Analog and the Embedded Audio signal are displayed in this submenu.

- **Audio Present** and **Audio Type** (signal info),
- **Audio Mode**: **Off / HDMI Only / Analog Only / HDMI and Analog**.
- **Analog Mute**
- **Analog Volume**: adjustable from 0 to 100%,
- **Analog Balance**: adjustable from -100% to + 100% (0 = center).



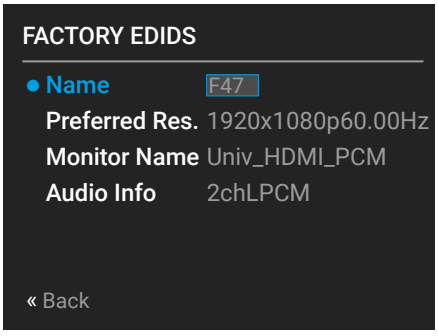
5.3.4. EDID Menu

Advanced EDID Management is available in the front panel LCD menu which allows to view an EDID, switch, or save it to the User EDID memory. See more information about EDID technology in section 4.1 on page 17. The EDID memory structure of the device can be found in section 7.6.1 on page 49.

View Submenu

Select the desired EDID memory block: **Factory EDIDs, Last Attached EDIDs, User EDIDs,** or **Emulated EDIDs**. Select the **Name** item and press the knob. Use the jog dial to step between the EDIDs. The following information can be checked:

- **Preferred Resolution**
- **Monitor Name**
- **Audio Info**



Switch Submenu

The submenu looks similar as the View submenu but in this case, the Destination is also listed. To change an EDID do the followings:

Step 1. Navigate to the **EDID/Switch** submenu.

Step 2. Select the **Name** item and press the knob. Use the jog dial to select the desired **EDID** (F1-F144, U1-U100, or D1-D8) and press the knob.

Step 3. Select the **Destination** item and press the knob. Use the jog dial to select the desired **EDID memory** (E1-E8, All) and press the knob.

Step 4. Navigate to the **Switch** option and press the knob.

Save Submenu

The EDID of a connected sink can be saved to the User EDID memory as follows:

Step 1. Navigate to the EDID/Save submenu.

Step 2. Select the **Name** item and press the knob. Use the jog dial to select the desired **EDID** (D1-D8) and press the knob.

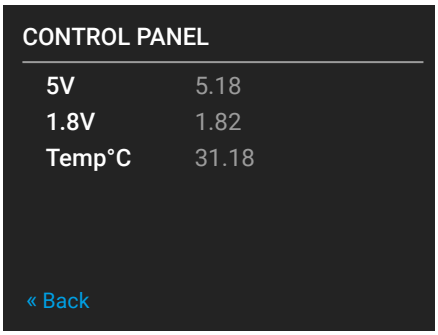
Step 3. Select the **Destination** item and press the knob. Use the jog dial to select the desired **EDID memory** (U1-U100) and press the knob.

Step 4. Navigate to the **Save** option and press the knob.

5.3.5. Health Menu

The following information is displayed about the matrix in this menu:

- **Uptime**: the elapsed time since the last booting.
- **Control Panel**: Internal Voltage and temperature values about the front panel board.
- **Motherboard**: Internal Voltage and temperature values about the motherboard.
- **IO ports**: Internal Voltage and temperature values about the Input/Output ports.



5.3.6. Presets Menu

The router can store presets and the followings are stored in each slot: Input/output crosspoint state, muted/unmuted states.

ATTENTION!
When factory default settings are restored, presets are deleted.

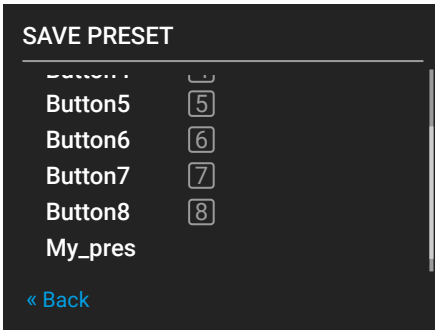
Save a Preset

Step 1. Create the desired I/O layout.

Step 2. Navigate to the **Presets / Save Preset** submenu and press the **knob**.

Step 3. Select the desired **memory slot** (Button1.. Button8 mean the eight **Source buttons**) and press the **knob**. If any other preset had been saved previously they would be also listed. See the corresponding section 7.5 on page 47.

Step 4. Confirm your selection by pressing the **Yes**.



Load a Preset

ATTENTION!
The Preset loading has an effect on all ports, except the locked ones.

Step 1. Navigate to the **Presets / Load Preset** submenu and press the **knob**.

Step 2. The previously save presets are listed. Button1..8 mean the presets which are also available by the front panel **Source buttons**. Select the desired **memory slot** and press the **knob**. If any other preset had been saved previously they would be also listed.

Step 3. Confirm your selection by pressing the **Yes**.

INFO
Eight memory slots are available by the front panel buttons, see section 5.2.5 on page 25.

6. Software Control – Using the Built-in Web

The built-in website of the matrix allows to connect and control the matrix via a web browser. The range of the controlling features are not so wide as in the case of Lightware Device Controller, but numerous information is displayed and many settings are available.

System Requirements

Operating System: Microsoft Windows XP, Windows Vista, Windows 7, Windows 10, Mac OS X, Linux.

Web Browser: Mozilla Firefox, Google Chrome, Apple Safari.

ATTENTION!
The EDID export function works only in Windows and Mac OS X operating systems under Mozilla Firefox or Google Chrome web browsers.

6.1. Establishing the Connection

ATTENTION!
Please be sure that the computer is in the same network as the matrix. If the computer has multiple Ethernet connections (for example Wi-Fi and LAN connections are used simultaneously) you will have to know the IP address for the one that is used for controlling the matrix.

Step 1. Connect the matrix and the computer either via

- Ethernet, with LAN patch cable (to a Hub, Switch or Router), or
- Ethernet, with LAN cross cable (directly to Computer).

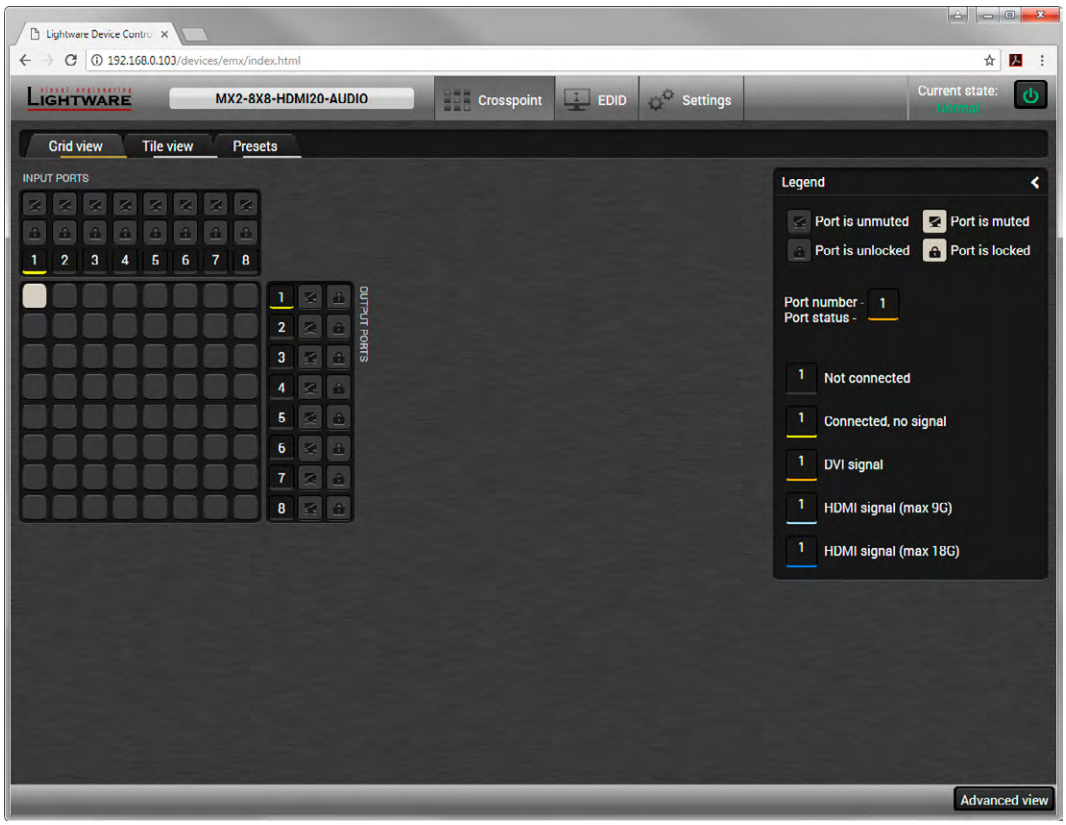
Step 2. Change to the desired IP settings if it is needed.

Step 3. Type the IP address to the address bar of the web browser and press enter (factory default address is dynamic).

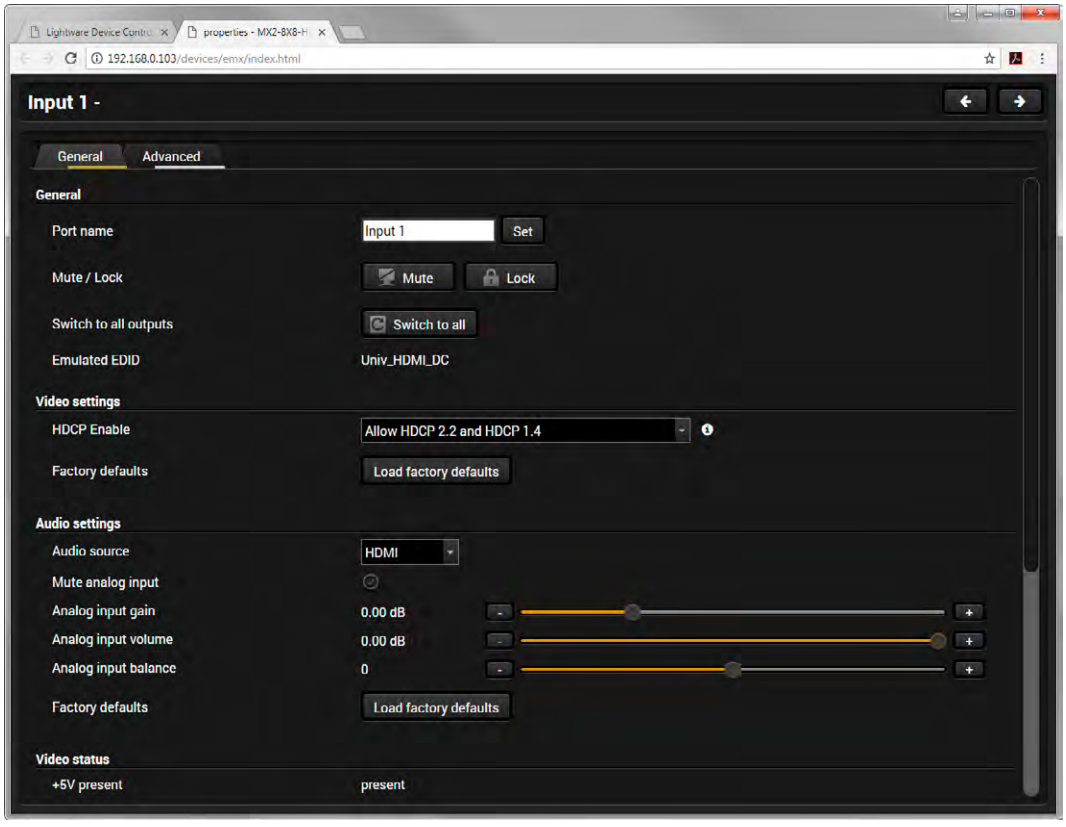
6.2. The Layout of the Built-in Web

The built-in web page allows almost the same controlling functions which are available via the Lightware Device Controller. Select a menu item on the left side; the default screen is the Crosspoint menu with Grid view. One of the differences: the web page can be reloaded by clicking on the information ribbon.

ATTENTION!
Please enable the pop-up windows in your browser; certain contents are displayed in new window.



Built-in Webpage Displaying the Crosspoint Menu (Grid View)



Built-in Webpage Displaying the Input Port Properties Window

7. Software Control – Using Lightware Device Controller

The matrix can be controlled by a computer through the LAN or USB ports using Lightware Device Controller (LDC). The software can be installed on a Windows PC or Mac OS X. The application can be downloaded from www.lightware.eu. The Windows and the Mac versions have the same look and functionality.

7.1. Install and Upgrade

Installation in the Case of Windows OS

Step 1. Run the installer. If the User Account Control drops a pop-up message click Yes.

Step 2. During the installation you will be prompted to select the type of the installation: **normal** and the **snapshot** install:

Normal install	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	Different versions can be installed for all users

Comparison of the Installation Types

ATTENTION!
Using the Normal install as the default value is highly recommended.

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 the 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.

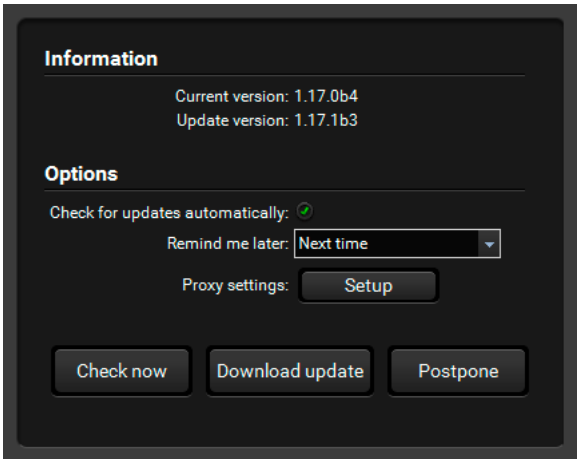
The Upgrading of the LDC

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 be opened manually by clicking the **question mark** and the **Update** button.



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

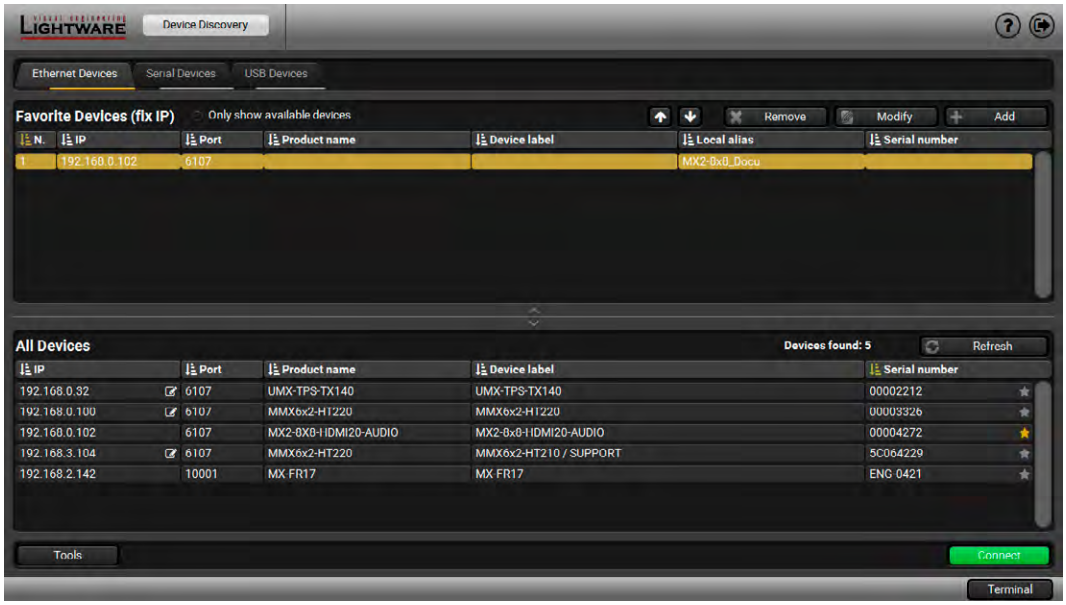
- When the **Check for updates automatically** option is marked, the LDC tries to find a new version after startup.
- If you want to postpone the update, set the reminder by the **drop down list**.
- If necessary, the proxy settings are available by clicking the **Setup** button.

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

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

7.2. Device Discovery Window

There are three tabs for the different type of interfaces, select the Ethernet or USB tab.



Device Discovery window

The **Ethernet** tab consists of two lists:

- **Favorite Devices:** You can add any Lightware device that is connected via Ethernet and no need to browse all the available devices. Devices can be added by pressing the **Add** button or marking the desired device by the ★ symbol in the **All Devices** list.
- **All Devices:** The Lightware devices are listed which are available in the connected network.

Establishing the Connection

Select the unit from the discovered Ethernet devices; double click on the device or select it and click on the green **Connect** button.

Further Tools

The **Tools** menu contains the following options:

- **Log Viewer:** The tool can be used for reviewing log files which have been saved previously.
- **Create EDID:** This tool opens the Easy EDID Creator wizard which can be used for creating unique EDIDs in a few simple steps. Functionality is the same as the Easy EDID Creator, for the detailed information see section 7.6.5 on page 51.
- **Demo Mode:** This is a virtual MX-FR17 matrix router with full functionality built into the LDC. Functions and options are the same as a real MX-FR17 device.

The **Terminal** window is also available by pressing its button on the bottom.

IP Address Configuration

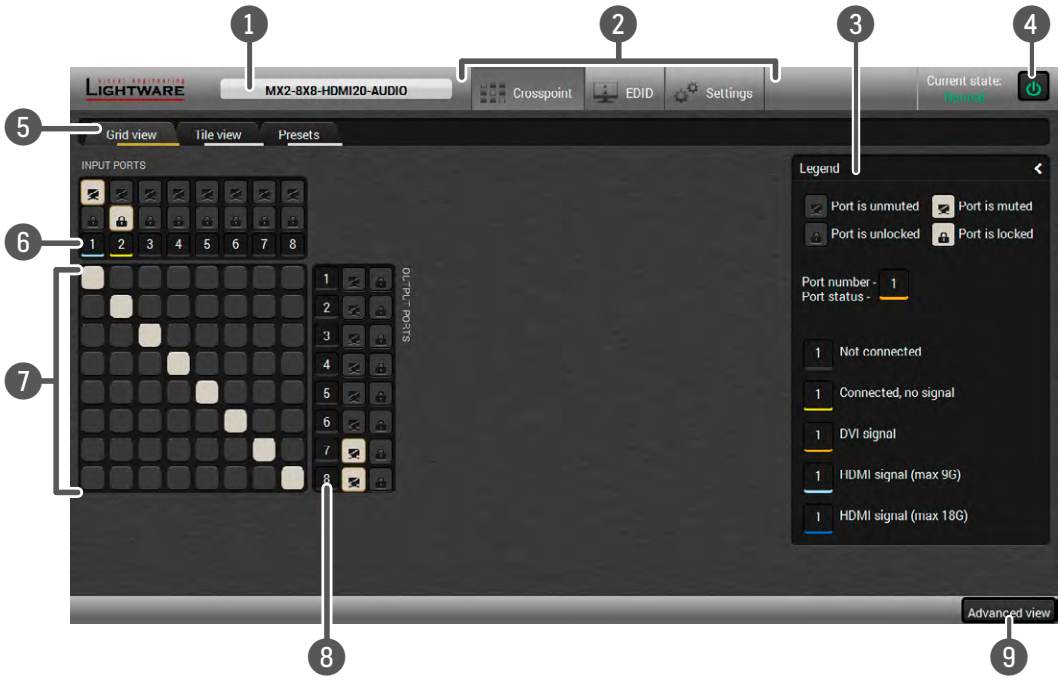
The IP settings of a device can be changed without establishing the connection to the LDC. If the feature is supported by the device an icon is displayed next to the IP address:

Press the icon to open the IP configuration window and set the necessary parameters then press the **Apply** button (or **Cancel** to discard and exit).

7.3. Crosspoint Menu

7.3.1. Grid View

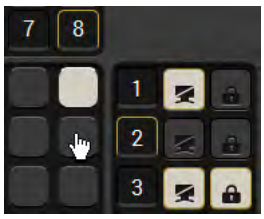
Grid view is a user-friendly graphical interface displaying the crosspoint state of the matrix router. This is an easy way to change between the input sources and output sinks.



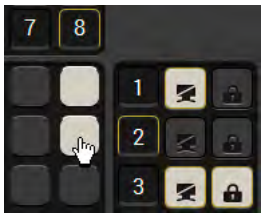
1	**Device Label**	The **Device Discovery** window can be opened by clicking on this ribbon. The Device Label is displayed which is not the same as the Product Name. The Product name is displayed in a hint box when the mouse cursor is above the box. See more information in section 7.7.1 on page 52, and section 9.5.1 and 9.5.2 on page 73.
2	**Main Menu**	The available menu items are displayed. The active one is highlighted with a dark grey background color
3	**Legend Panel**	The mute/lock icons and the applied colors of the input/ output ports are described in this panel.
4	**Standby Switch**	The device can be switched to **Standby Mode** or wake up from this mode by the button. When the matrix is in standby mode the video transmission is disabled and the LCD is switched off. Remote connections (LAN, RS-232) remain enabled.
5	**Tab Selector Ribbon**	Select the desired **Grid View, Tile View**, or **Presets** tab.
6	**Input Ports**	Each number represents an input port. Click on the port to display the **Port Properties** window.
7	**Connections**	**Grey** square means the port is available but there is no connection. **White** square means there is a connection between the input and the output port.
8	**Output Ports**	Each number represents an output port. Click on the port to display the **Port Properties** window.
9	**Advanced View**	Displaying the **Advanced view** page, showing the Terminal window and the LW3 protocol tree.

Crosspoint Operations

Switching

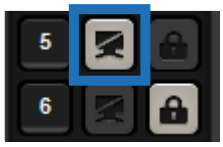


For making a connection click on the desired square. If there is no connection between the desired input and output (the square is dark grey), the mouse pointer becomes a hand (link pointer) before the clicking. If the output port is not locked, the connection is made, the square becomes white and the cursor changes back to a pointer.



For example, Input 8 is not connected to Output 2 as shown on the first picture. If the connection is established the square becomes white. Input and output ports can be disconnected when clicking on a white square.

Muting Outputs



Outputs can be easily muted by clicking on the button represented by a crossed monitor beside the output. That means no signal is present on the given output. If mute is active, the color of the button's background changes to white.

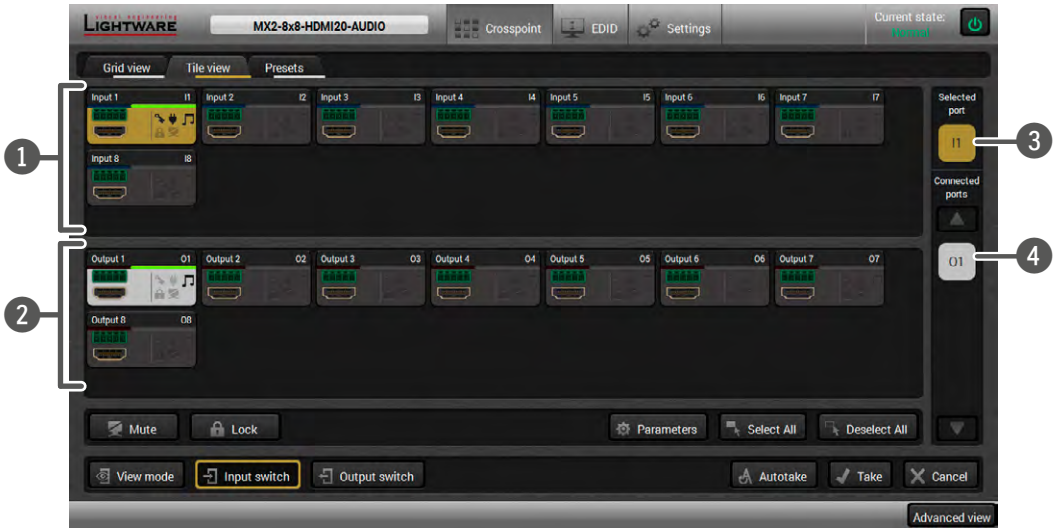
Locking Outputs

Outputs can be locked to any input. After locking an output to an input, no switching is permitted to this output unless it is unlocked again. If output lock is active, the color of the button's background changes to white.

INFO
Loading a preset does not change either the lock state or the switch state of a locked output. If an output is locked to an input before preset loading it will also be locked to that input after preset loading, so locked outputs ignore the preset.

7.3.2. Tile View

The tiles represent input or output ports and additionally show the most important port and signal information. Thus, the user can check the status of many ports at the same time.



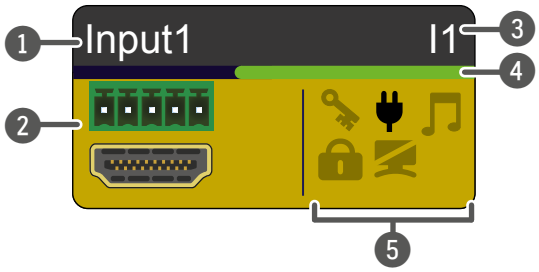
1	**Input Ports**	Each tile represents an input port.
2	**Output Ports**	Each tile represents an output port.
3	**Selected Port**	Last selected port is displayed with a yellow background on the port bar. Press the button to open the port settings window.
4	**Connected Port(s)**	The ports with white background are currently connected to the selected port. Press the button to open the port settings window.

Control Buttons

Mute	Mute or unmute selected output port(s)	Parameters	Open port properties window
Lock	Lock or unlock selected output port(s)	Select All	Select all ports (only in output switch mode)
View mode	Activate View mode	Deselect All	Deselect all ports (only in output switch mode)
Input switch	Activate Input switch mode	Autotake	Toggle Autotake mode ON/OFF
Output switch	Activate Output switch mode	Take	Execute crosspoint changes in Take mode

Port Tiles

The colors of the port tiles and the displayed icons represent different states and information about the selected port:



1. Port name
2. Background color:
   grey: not connected
   yellow: selected
   white: connected
3. Port number
4. Signal present indicator:
   green: present
   grey: not present
5. State indicators

State Indicators

Following icons display different states of the input/output ports/signal:

Icon	Icon is grey	Icon is black
	Signal is **not** encrypted with HDCP	Signal is encrypted with HDCP
	Source/sink is **not** connected	Source/sink is connected (+5V / Hotplug detected)
	Audio is **not** embedded in the video stream	Audio is embedded in the video stream
	Port is unlocked	Port is locked
	Port is unmuted	Port is muted

Display Modes

View Mode

This mode was designed to display the crosspoint state of a selected and its connected port(s). Crosspoint settings cannot be changed in View mode but port settings are available.

Input Switch Mode

The mode can also be named as 'Input priority-mode': an input port has to be selected at first then the connected output ports are shown. Thus, the output ports connected to the input port can be changed.

Output Switch Mode

This mode can also be named as 'Output priority-mode': an output port has to be selected at first then connected input port is shown. Thus, the output port connected to the input port can be changed.

Switching Operations

Take Mode

If the Autotake button is outlined with black color Take mode is active. In Take mode any crosspoint change – (dis)connecting ports to/from the previously selected port – is executed only after pressing the Take button. Following steps describe the process of the switching:

Step 1. Press the desired **Input switch** or **Output switch** button to select the switching mode.

Step 2. Select the desired port; it will be highlighted with yellow color and displayed also on the port bar on the right.

Step 3. Connected ports are highlighted with white color and displayed also on the port bar on the right.

Step 4. Create the desired crosspoint settings by (de)selecting the ports; they will start to blink.

Step 5. Press the **Take** button to execute changes or **Cancel** to discard.

INFO
Take mode remains active until it is switched off. Selecting another view mode or menu item does not change the Take/Autotake mode state.

Autotake Mode

If the Autotake button is outlined with yellow color Autotake mode is active. In this mode, any crosspoint change – (dis)connecting ports to/from the previously selected port – is executed immediately after pressing the port button. Following steps describe the process of the switching:

Step 1. Press the desired **Input switch** or **Output switch** button to select switching mode.

Step 2. Select the desired port; it will be highlighted with yellow color and displayed also on the port bar on the right.

Step 3. Connected ports are highlighted with white color and displayed also on the port bar on the right.

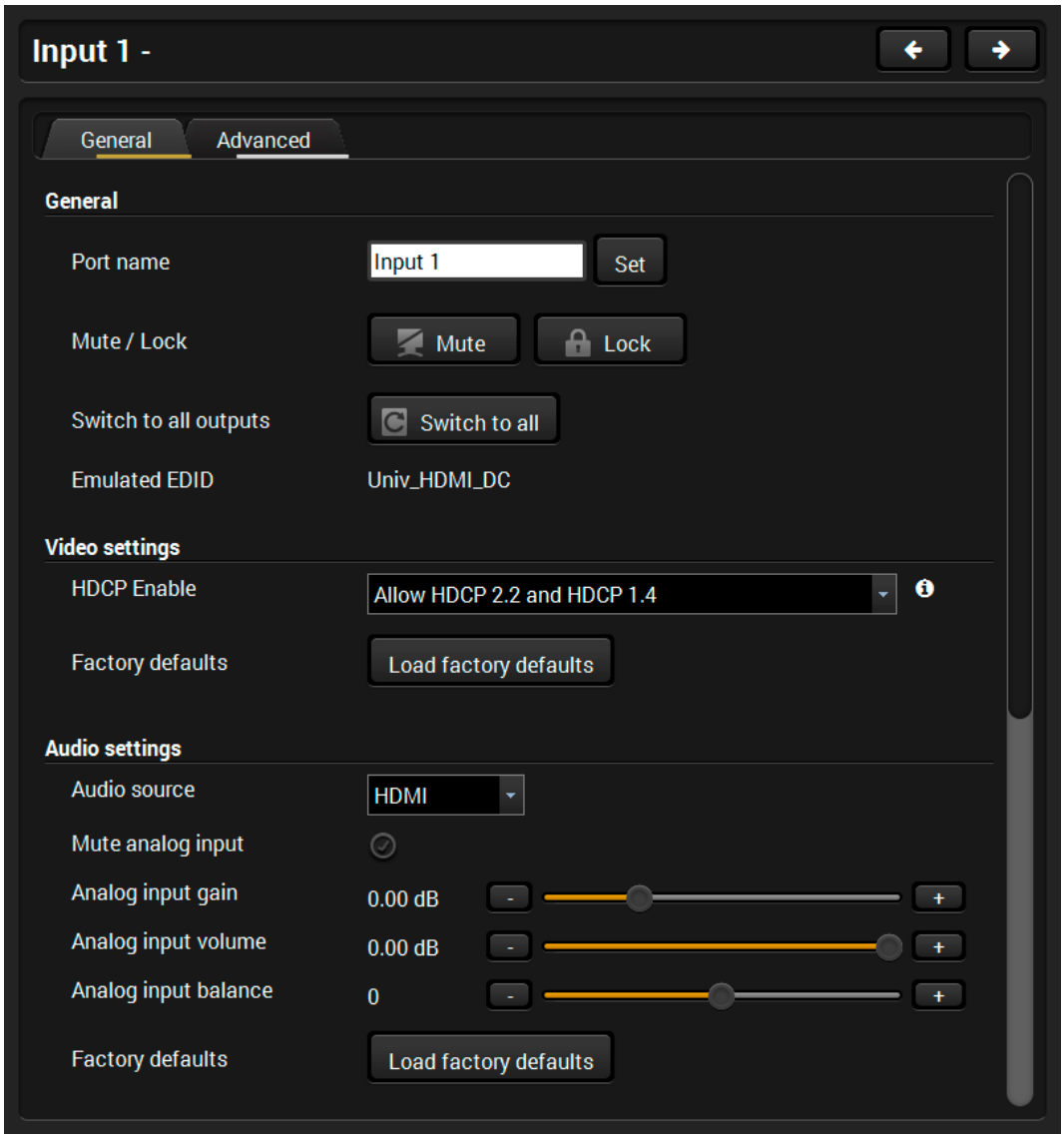
Step 4. Create the desired crosspoint settings by (de)selecting the ports; the changes are executed immediately.

INFO
Autotake mode remains active until it is switched off. Selecting another view mode or menu item does not change the Take/Autotake mode state.

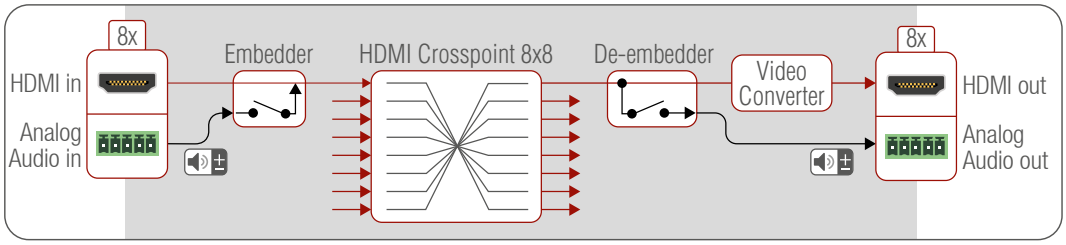
7.4. Port Properties

7.4.1. Input Port Properties Window

Click on a port to display its properties; Signal status information and the most important parameters are displayed.



Port Diagram



Audio Options

The outgoing HDMI signal can carry:

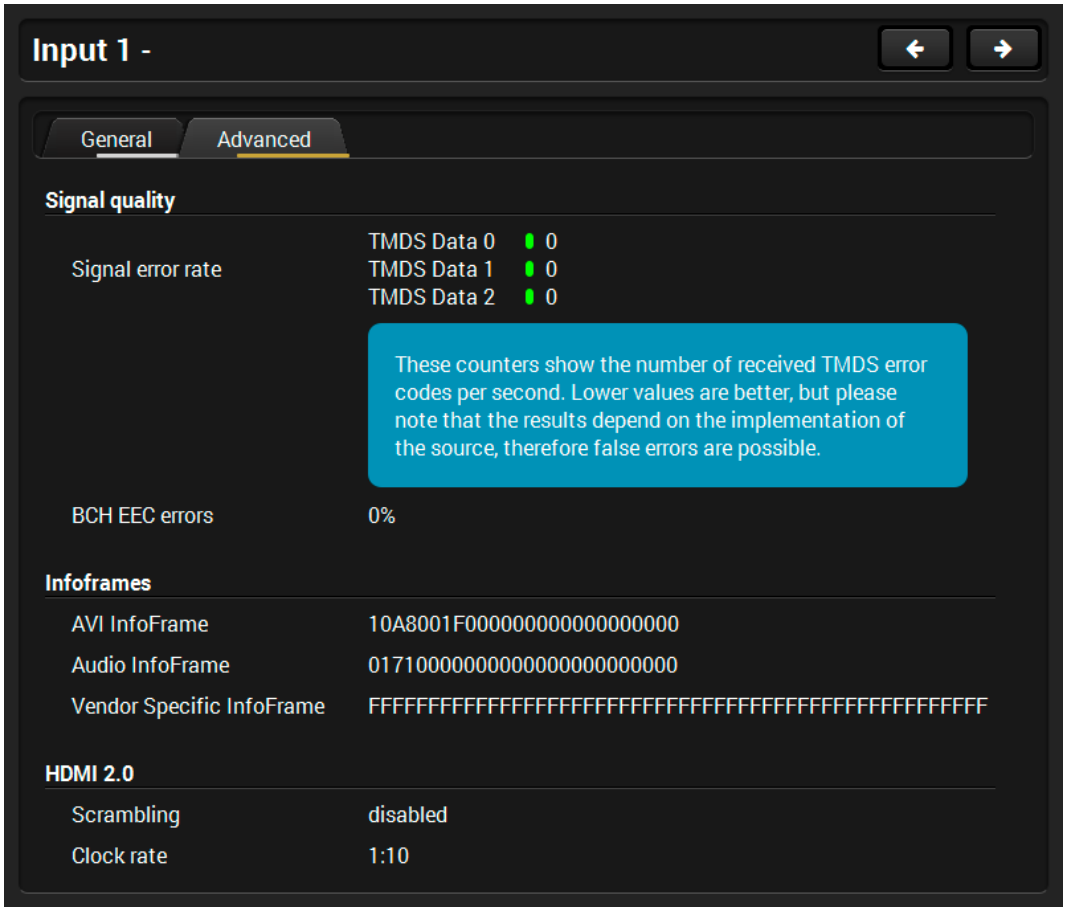
- The original audio of the HDMI input signal, or the Analog Audio signal coming from the 5-pole Phoenix input port.
- The 5-pole Phoenix audio connectors next to the HDMI output ports can provide de-embedded audio for amplifiers and audio systems.

Input Port Legend

General Tab

General section	
Port name	The name of a port can be changed by typing the new name and clicking on the **Set** button. The following characters are allowed when naming: Letters (A-Z) and (a-z), hyphen (-), underscore (_), numbers (0-9), and dot (.). Max length: 63 characters.
Mute	The incoming signal can be muted/unmuted by pressing the button. If the port is muted, button text is **Unmute**. In this case, no signal is transmitted from the input port.
Lock	The port can be locked to the currently connected output ports by the button. If the port is locked, button text is **Unlock**. In this case the mute state cannot be changed.
Switch to all	The input port will be switched to all output ports.
Emulated EDID	The name of the currently emulated EDID (**Monitor Name** in the EDID menu).
Video settings	
HDCP Enable	**Disable:** The connected source will detect that the matrix is not HDCP-compliant and turn off authentication if the content allows it. **Allow HDCP 1.4 only:** The connected source will detect that the matrix is compliant with HDCP 1.4 but not compliant with HDCP 2.2. **Allow HDCP 2.2 and HDCP 1.4:** The connected source will detect that the matrix is compliant with HDCP 2.2. **High Value mode (limit switching to HDCP 2.2 sinks)**: Any version of HDCP is allowed on the input but the incoming signal is always internally upconverted to HDCP 2.2 content and thus cannot be switched to HDCP 1.4 sinks.
Factory defaults	Resetting the default values: **HDCP** = "**HDCP 2.2 or HDCP 1.4**".
Audio settings	
Audio source	**Off**: audio is not embedded in the video stream. **HDMI**: the audio of the incoming HDMI stream is embedded in the video. **Analog input**: the analog audio input signal is embedded in the video.
Mute analog input	The analog audio input signal can be muted by this option.
Analog input gain	Setting the value between -12 dB and +35 dB.
Analog input volume	Setting the value between -95.62 dB dB and 0 dB.
Analog input balance	Setting the value between -100 and +100 (0 = center).
Factory defaults	Resetting the default values: **Audio source** = off, **Analog input** = unmuted, **Analog input gain** = 0 dB, **Analog input volume** = 0, **Analog input balance** = 0 (center).
Video status and Embedded audio sections	
The signal format and the detected parameters are described in these sections.	
HDCP status	The currently applied HDCP encryption level on the input (e.g. HDCP 1.4).
HDCP stream type	**non HDCP signal:** the signal is not encrypted. **HDCP 1.4 stream:** the signal is encrypted with HDCP v1.4 **HDCP 2.2 stram (HDCP 1.4 convertable):** the signal is encrypted with HDCP 2.2 but can be converted to be encrypted with HDCP v1.4. See the corresponding section 4.2.3 on page 20 (the first figure). **HDCP 2.2 stream (non HDCP 1.4 convertable):** the signal is encrypted with HDCP 2.2 and not allowed to convert and encrypt with HDCP v1.4. In this case the signal can be displayed only on a HDCP v2.2 compliant sink device.

Advanced Tab

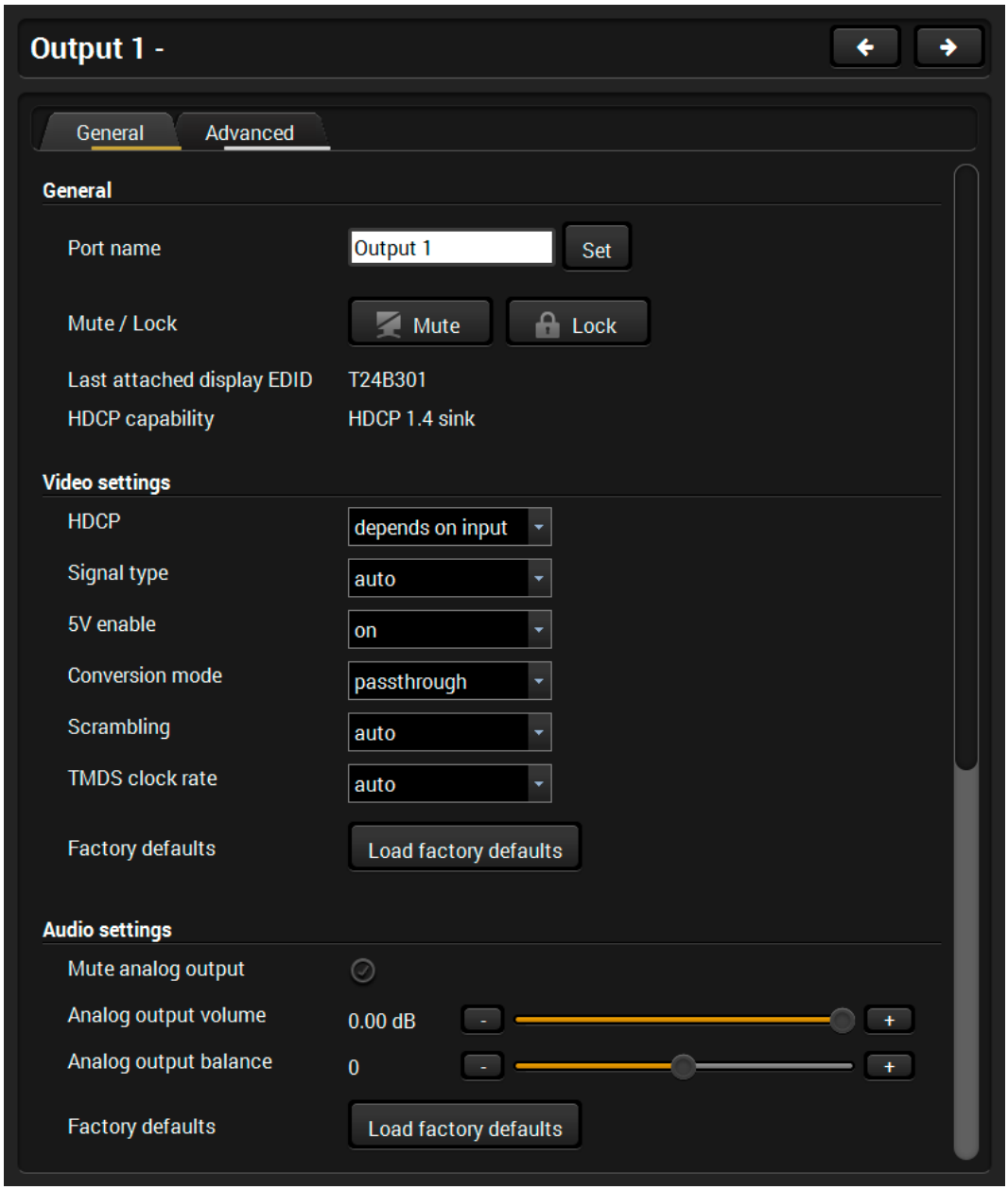


Signal information is available on this tab which can be used for cable diagnostic purpose. The following information are displayed:

- Signal error rate
- BCH EEC errors
- AVI Infoframe
- Audio InfoFrame
- Vendor Specific Infoframe
- HDMI 2.0 related information:
  - Scrambling
  - Clock rate

7.4.2. Output Port Properties Window

Click on a port to display its properties.



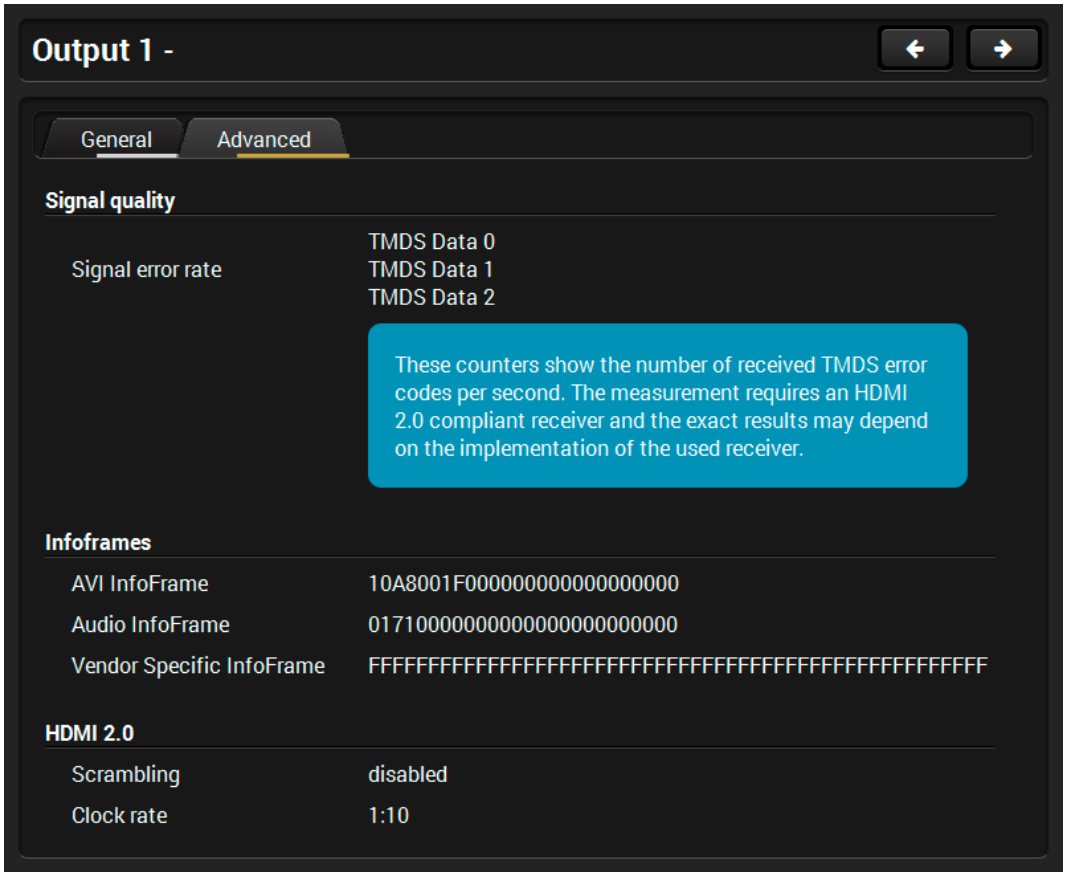
Output Port Legend

General Tab

General section	
Port name	The name of a port can be changed by typing the new name and clicking the **Set** button. The following characters are allowed when naming: Letters (A-Z) and (a-z), hyphen (-), underscore (_), numbers (0-9), and dot (.). Max length: 63 characters.
Mute	The incoming signal can be muted/unmuted by pressing the button. If the port is muted, button text is **Unmute**. In this case, no signal is transmitted to the output port.
Lock	The output port can be locked to the currently connected input port by the button. If the port is locked, button text is **Unlock**. In this case the mute state cannot be changed.
Last attached display EDID	The name of the last attached monitor's EDID is displayed (shown as **Monitor Name** in the EDID menu).
HDCP capability	Shows if the last attached display was HDCP-compliant.

Video settings	
HDCP	**Depends on input:** the encryption level depends on the settings of the input port and the source content/device. If the incoming signal is not encrypted, then the outgoing signal will not be encrypted either. **Maximum possible:** the highest supported level of encryption (between the matrix and the sink) is applied (up to HDCP v2.2).
Signal type	The outgoing signal format can be selected by a drop-down list: **HDMI, DVI, Auto**.
5V enable	**Always on**: +5V power is always sent thus the sink and the port are always connected. **Always off:** +5V power is not sent towards the sink, thus the sink does not sense the connection.
Conversion mode	**Passthrough:** no signal conversion. **4:4:4 to 4:2:0 :** the signal is converted to the the indicated color depth. **LEFT part** and **RIGHT part**: The device supports vertical splitting of an HDMI 2.0 4k@60Hz 4:4:4 input signal to left and right halves allowing for the transmission of a 18Gbps HDMI2.0 signal over two HDMI1.4 compliant links. The two halves can then be recombined at the signal destination. To apply the feature route the same input signal to 2 output ports. Set the conversion to **Left** on one output port and **Right** on the other output port. See the application diagram in section 1.4 on page 7.
Scrambling	HDMI 2.0 standard introduced scrambling to the TMDS encoding which helps to decrease the energy peaks and hence the Electro Magnetic Interference (EMI). To maintain backwards compatibility, HDMI 2.0 only requires the use of scrambling with data rates of above 3.4 Gbps per lane. The feature can be set on the output ports to **Forced On / Forced Off,** or **Auto** (recommended).
TMDS clock rate	Setting the value to **1:10, 1:40,** or **Auto** (recommended).
Factory defaults	Resetting the default values: **HDCP** = auto, **Signal type** = auto, **Conversion mode** = passthrough, **Scrambling** = auto, **TMDS clock rate** = auto.
Audio settings	
Mute analog output	The analog audio output signal can be muted by this option.
Analog output volume	Setting the value between -95.62 dB and 0 dB.
Analog output balance	Setting the value between -100 and +100 (0 = center).
Factory defaults	Resetting the default values: **Analog output** = unmuted, **Analog output volume** = 0, **Analog output balance** = 0 (center).
Video status and Embedded audio	
The signal format and the detected parameters are described in these sections.	
HDCP status	The currently applied HDCP encryption level (e.g. HDCP 1.4).
HDCP stream type	**non HDCP signal:** the signal is not encrypted. **HDCP 1.4 stream:** the signal is encrypted with HDCP v1.4 **HDCP 2.2 stram (HDCP 1.4 convertable):** the signal is encrypted with HDCP 2.2 but can be converted to be encrypted with HDCP v1.4. See the corresponding section 4.2.3 on page 20 (the first figure). **HDCP 2.2 stream (non HDCP 1.4 convertable):** the signal is encrypted with HDCP 2.2 and not allowed to convert and encrypt with HDCP v1.4. In this case the signal can be displayed only on a HDCP v2.2 compliant sink device.

Advance Tab



Signal information is available on this tab which can be used for cable diagnostic purpose. The following information are displayed:

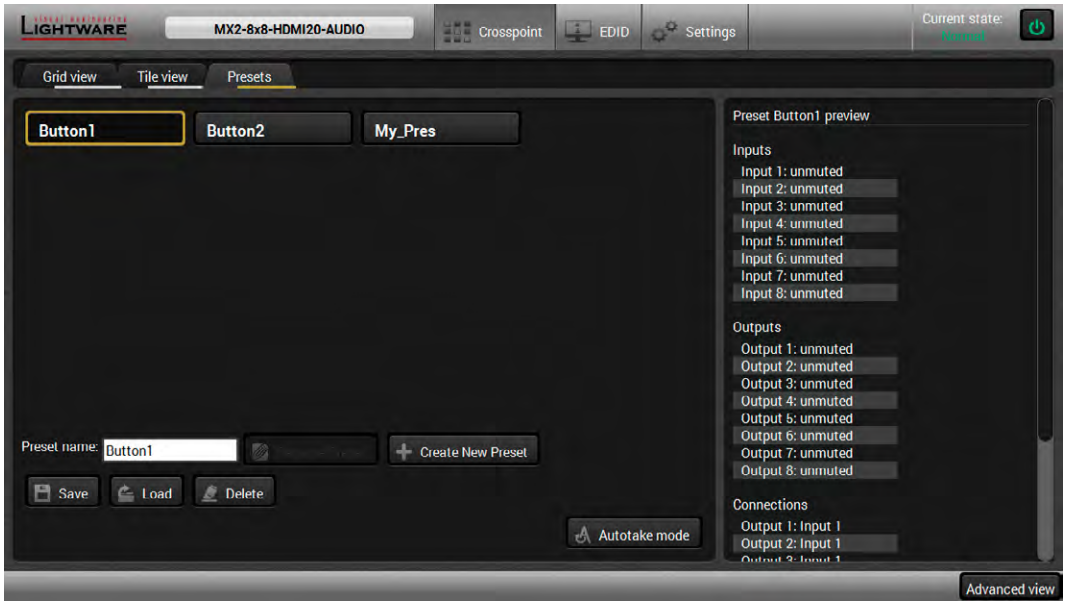
- Signal error rate
- AVI Infoframe
- Audio InfoFrame
- Vendor Specific Infoframe
- HDMI 2.0 related information:
  - Scrambling
  - Clock rate

7.5. Presets

The router can store presets and the followings are stored in each slot: input/output crosspoint state, muted/unmuted states. Preset loading has an effect on all ports, except the locked ones.

ATTENTION!
When factory default settings are restored presets are deleted.

ATTENTION!
The Preset loading has an effect on all ports, except the locked ones.



Presets Tab

Loading a Preset

Step 1. Select the **Presets** tab from the **Crosspoint** menu.

Step 2. Select the desired preset; check the **Preview** panel and press the **Load** button. Press **Yes** in the confirmation window.

INFO
Presets which were saved by the front panel buttons previously are listed with names Button1..Button8 as default. See the corresponding section 5.2.5 on page 25.

Autotake mode

When the **Autotake** button is highlighted with green, the mode is active. In this case, confirmation is **not** required: the selected preset is loaded immediately when the button is pressed.

Saving a Preset to an Empty Slot

Step 1. Arrange the desired crosspoint connections in **Tile view** or **Grid view**.

Step 2. Select the **Presets** tab from the **Crosspoint** menu and type the desired **Preset name** in the indicated text field up to 16 characters. The followings are allowed when naming: letters (A-Z and a-z), hyphen (-), underscore (_), and numbers (0-9).

Step 3. Press the **Create New Preset** button to store the configuration.

Overwriting an Existing Preset

Step 1. Arrange the desired crosspoint connections in **Tile view** or **Grid view**.

Step 2. Select an existing preset, press the **Save** button and **Yes** to confirm.

Renaming a Preset

Step 1. Select the desired preset you want to rename.

Step 2. Type the desired name and press the **Rename Preset** button.

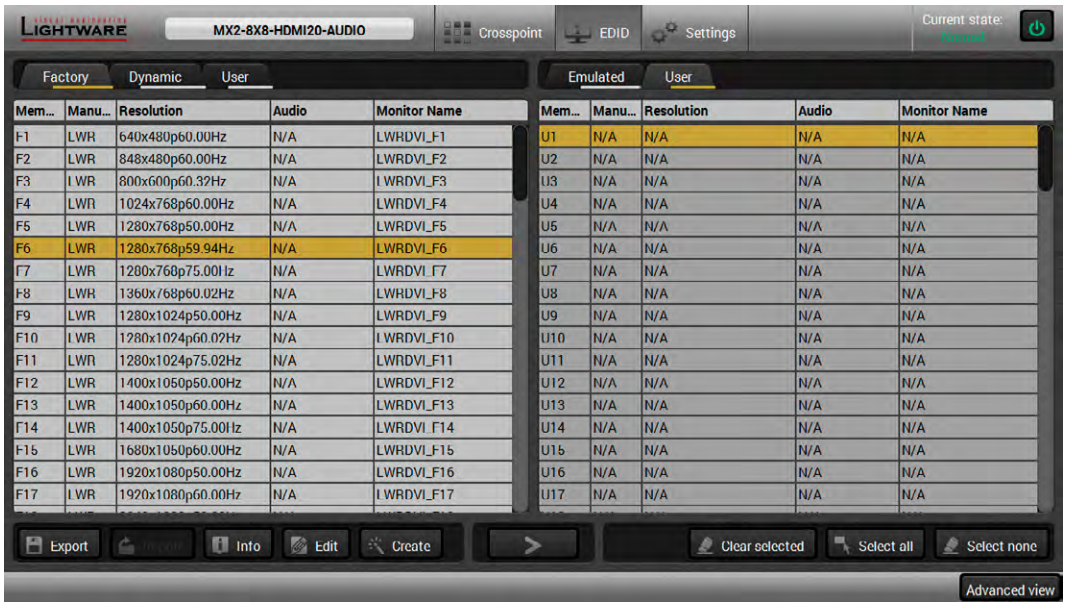
Deleting a Preset

Step 1. Select the desired preset you want to delete.

Step 2. Press the **Delete** button and **Yes** to confirm.

7.6. 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** slots where the EDIDs can be emulated or copied.



EDID Menu

Control buttons

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

7.6.1. Sources and Destinations

The EDID memory consists of four parts:

- **Factory** EDID list (F1-F144) the pre-programmed EDIDs, see section 12.3 on page 99.
- **Dynamic** EDID list (D1-D8): the EDID of the last attached display device. The matrix stores the last EDID from the previously connected sink on each output port. Thus, an EDID can be shown even if there is no device is connected to the output port at that moment.
- **User memory** locations (U1 – U100): they can be used to save custom EDIDs. Any EDID from the User/Factory/Dynamic EDID lists can be copied to the user memory.
- **Emulated** EDID list (E1-E8): the currently emulated EDID for the input. The source column displays the memory location that the current EDID was routed from. The source reads the EDID from the Emulated EDID memory on the input port.

There are two types of emulation: **static** and **dynamic**.

- **Static EDID emulation:** an EDID from the Factory or User EDID list is selected. Thus, the Emulated EDID remains the same until the user emulates another EDID.
- **Dynamic EDID emulation:** it can be enabled by selecting D1-D8 EDID memory. The attached monitor's EDID is copied to the input; if a new monitor is attached to the output, the emulated EDID is changed automatically.

7.6.2. EDID Operations

Changing the Emulated EDID

Step 1. Choose the desired tab (**Factory, Dynamic**, or **User** EDID list) on the left panel and select an **EDID**.

Step 2. Select the **Emulated** tab on the right panel.

Step 3. Select the **target 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 works only in Windows and Mac OS X operating systems under Mozilla Firefox or Google Chrome web browsers.

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

Step 1. Select the desired **EDID** from the **left panel** (the 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. Select the **User** tab in the left panel and select a memory slot.

Step 2. Press the **Import** 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:

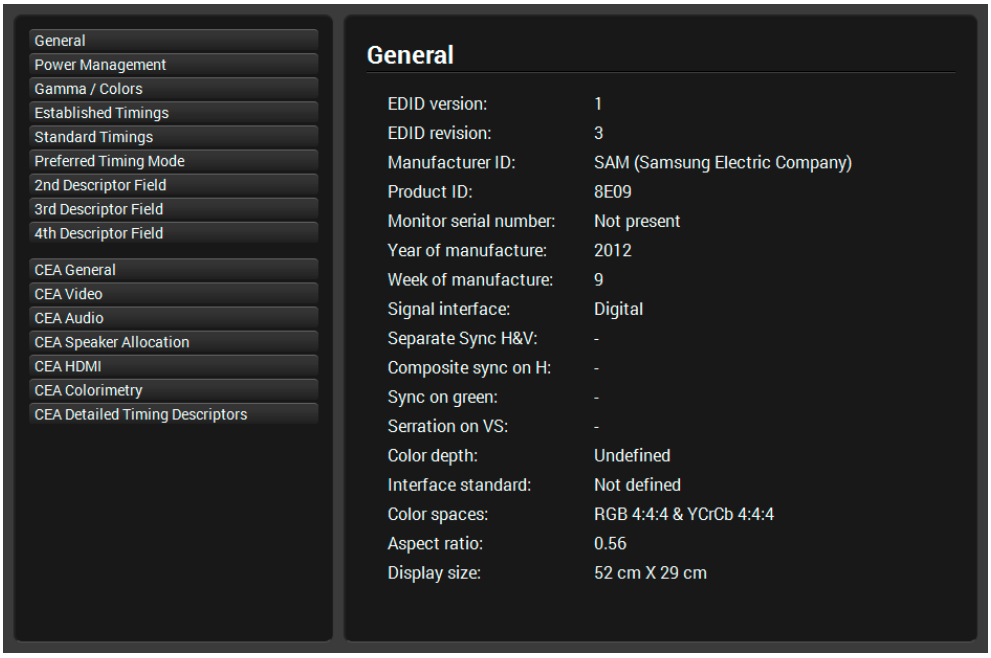
Step 1. Select the **User** tab in the left panel.

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).

7.6.3. EDID Summary Window

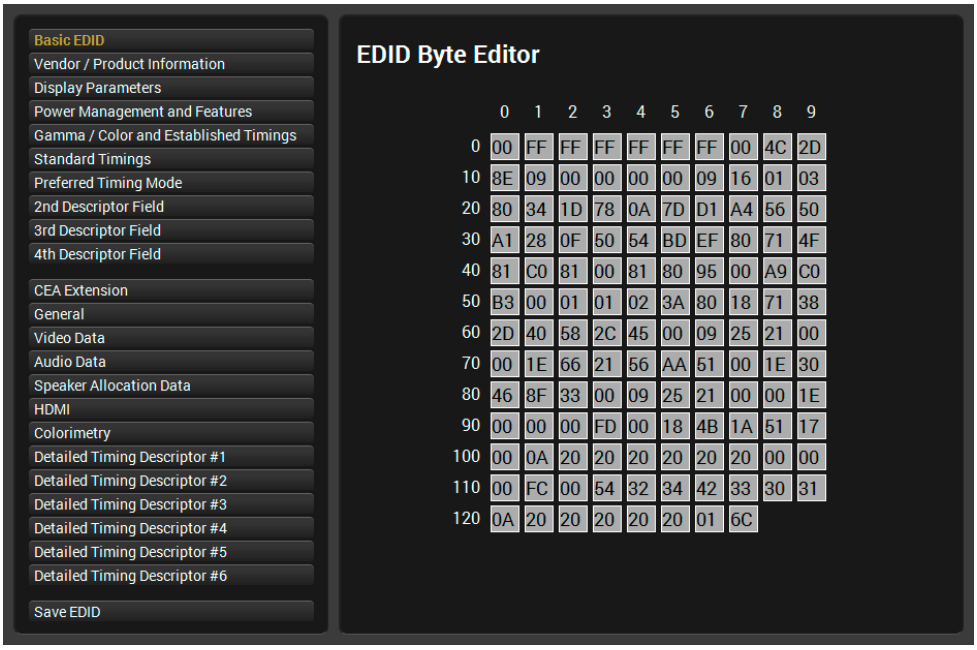
Select an EDID from Source panel and press the **Info** button to display EDID summary.



EDID Summary Window

7.6.4. Editing an EDID

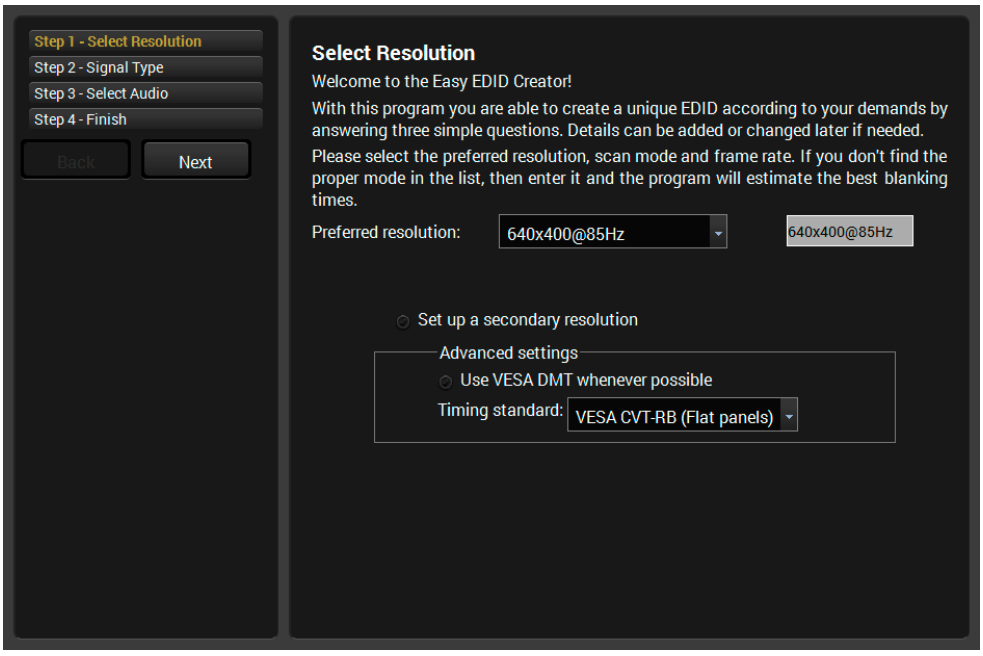
Select an EDID from the left panel and press the **Edit** button to display Advanced EDID Editor window. The editor can read and write all descriptors, which are defined in the standards, including the additional CEA extension. Any EDID from the device's memory or a saved EDID file can be loaded into 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.eu) and download the EDID Editor User's Manual.



EDID Editor Window

7.6.5. Creating an EDID

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 the left panel, Easy EDID Creator is opened in a new window.



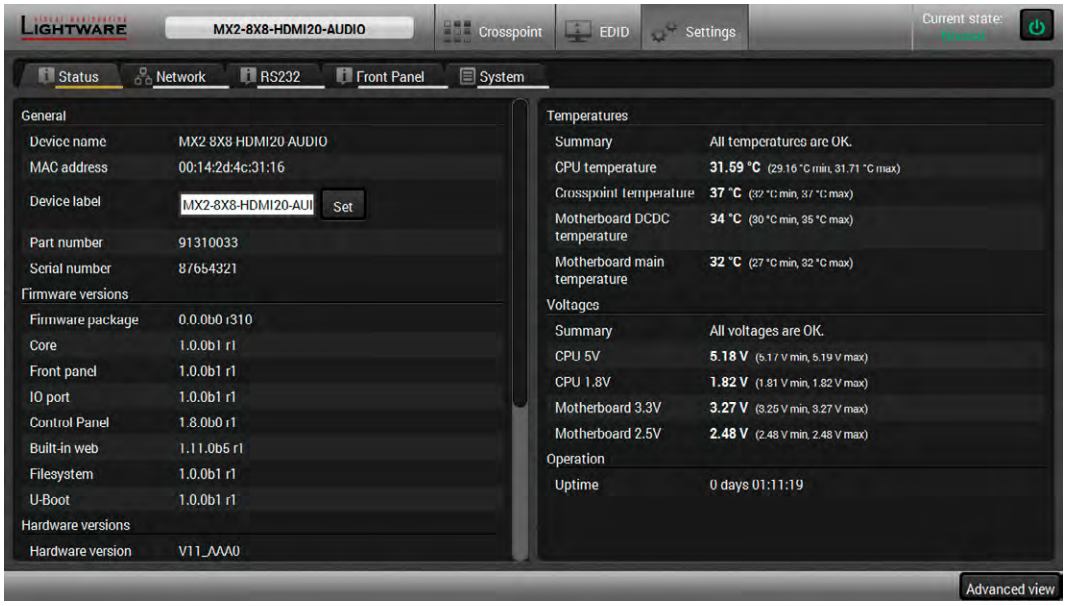
Easy EDID Creator Wizard

7.7. Settings Menu

7.7.1. Status Tab

General information about the product is displayed in this tab:

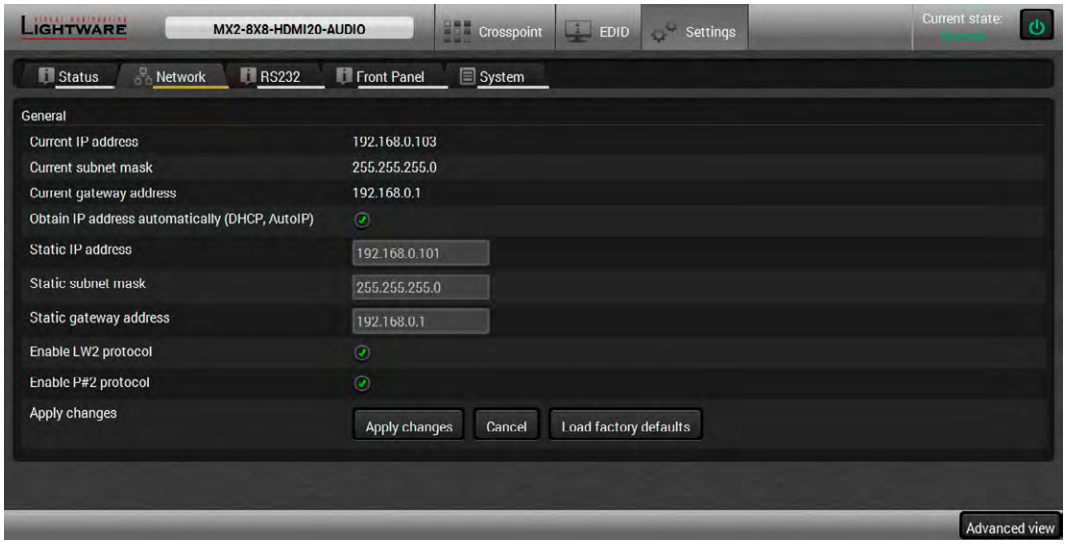
- Device name (read-only), Device label (editable), Part number and Serial number,
- Hardware and firmware version numbers,
- Hardware health, voltage and temperature values.



Status Tab in the Settings Menu

7.7.2. Network Tab

Network-related settings are available on the tab.



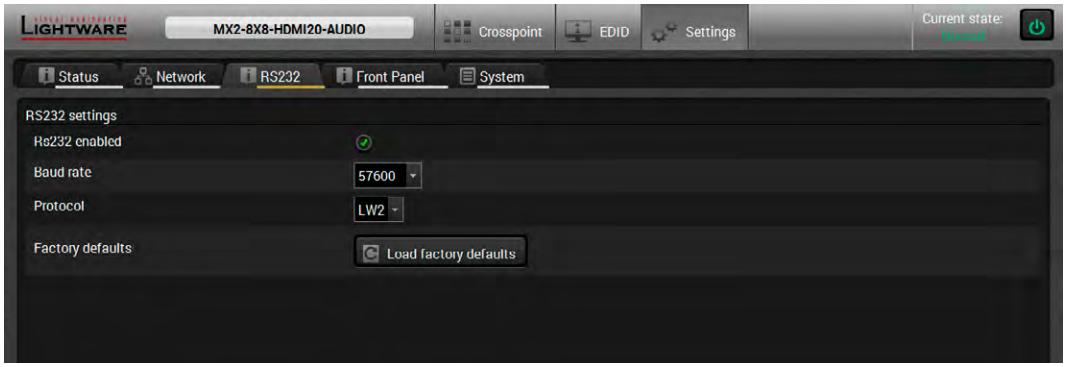
Network Tab in the Settings Menu

When dynamic IP address is used, the DHCP option is ticked; the IP settings of the matrix is shown in the first three lines. When static IP address is used, the DHCP option shall be unticked and below three lines can be used to define the IP settings. The device can be controlled by LW3, LW2 protocols, or P#2 protocol.

ATTENTION!
Connecting to the matrix via Ethernet and using LW2 port no. (default is 10001) the device accepts LW2 protocol commands. Using LW3 port no. (default is 6107) the device accepts LW3 protocol commands.

7.7.3. RS-232 Tab

The local RS-232 port settings are available on this tab.

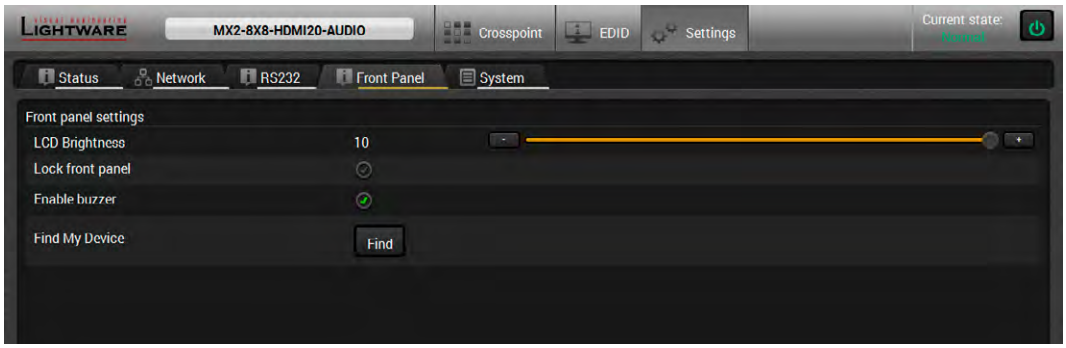


RS-232 Tab in the Settings Menu

7.7.4. Front Panel Tab

Certain settings in connection with the front panel LCD are available in the LDC as well.

- **LCD brightness:** the slider can be set to 0 contrary to the front panel menu. When the value is 0, the LCD is totally dark.
- **Lock front panel:** the same as the Control lock button on the front panel.
- **Enable buzzer:** enable/disable the built-in beeper.
- **Find my device:** the matrix buzzer beeps shortly three times.



Front Panel Tab in the Settings Menu

7.7.5. System Tab

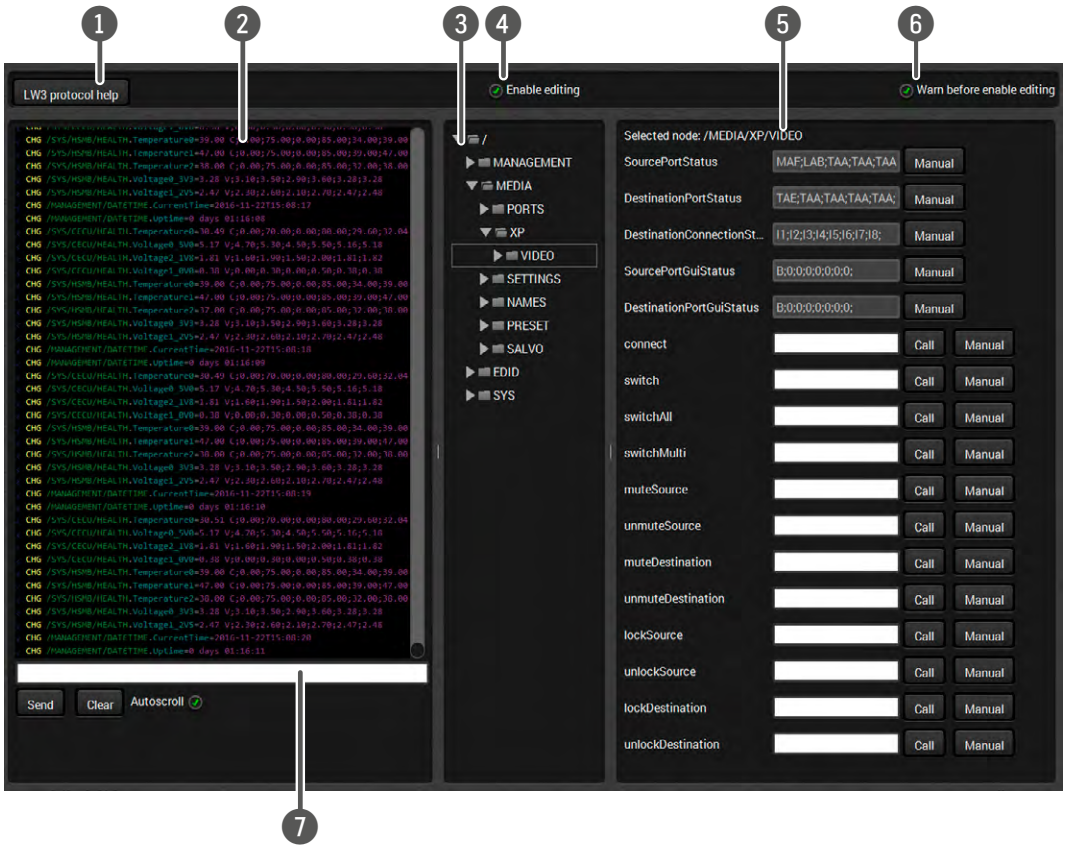
The following settings are available on this tab:

- Loading factory default settings,
- Rebooting the device,
- Setting the time (internal clock) of the matrix which is used for logging events.

ATTENTION!
The internal clock is supplied by a button cell when the device is switched off. If the set time is changed unintentionally or you met any weird behavior in connection with the internal clock, please contact support@lightware.eu.

7.8. Advanced View

Advanced view is the surface for displaying the LW3 protocol tree. Commands and specific parameters (which are not available on the graphical user interface of the LDC) can be run and set by the controlling tools.



1	**LW3 Protocol Help**	Short description about the command types and LW3 Protocol. (Brief from chapter 11.)
2	**Terminal Window**	Commands and responses. Sent command starts with **">"** character, received response starts with **"<"** character. The content of the window can be emptied by the **Clear** button. If the **Autoscroll** option is ticked, the list is scrolled automatically when a new line is added. Place the mouse cursor on a line to display the date and time stamp in a Hint field.
3	**Protocol Tree**	LW3 protocol tree; select an item to see its content.
4	**Edit Mode**	The default appearance is the **Edit mode**. If the option is unticked the values or parameters cannot be changed.
5	**Node List**	Parameters and nodes of the selected item are shown.
6	**Warn Option**	The LDC can be set to warn the user before enable the **Edit mode**.
7	**Command Line**	Type the desired command and execute it by the **Send** button.

8. LW2 Programmers' Reference

The device can be controlled through a reduced command set of LW2 protocol commands to ensure the compatibility with other Lightware products. The supported LW2 commands are described in this chapter.

8.1. LW2 Protocol Description

The device accepts commands surrounded by curly brackets - { } - and responds data surrounded by round brackets - ( ) - only if a command was successfully executed.

Format	Explanation
<in>	Input number in 1 or 2 digit ASCII format (01, 5, 07, 16, etc.)
<out>	Output number in 1 or 2 digit ASCII format
<in²>	Input number in 2 digit ASCII format (01, 02, 10, 12 etc.)
<out²>	Output number in 2 digit ASCII format (01, 02, 10, 12 etc.)
<loc>	Location number in 1, 2 or 3 digit ASCII format
<id>	id number in 1 or 2 digit ASCII format
<id²>	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

8.2. Router Status Commands

8.2.1. 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:MX2-8X8-HDMI20-AUDIO)CrLf

8.2.2. View Serial Number

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

Format	Example
Command {S}	→ {s}
Response (SN:<SERIAL_N>)CrLf	← (SN:00004272)CrLf

8.2.3. View the Installed Firmware

Description: View the installed firmware package version. To view the firmware version of the controller see the {FC} command.

Format	Example
Command {F}	→ {f}
Response (FW:<FW_VER><s>)CrLf	← (FW:1.1.0b3)CrLf

8.2.4. View CPU Firmware Compile Time

Description: Shows the CPU firmware compile time.

Format		Example	
Command	{CT}	→	{ct}
Response	(Compiled:<DATE>●<TIME>) CrLf	←	(Compiled: Jan 31 2017 18:46:02)CrLf

Legend:

Identifier	Parameter
<DATE>	Month, day and year
<TIME>	Hours, minutes and seconds

Explanation: The firmware was made on 31st January, 2017 at 18:46:02.

8.2.5. View Firmware of the Controller

Description: Shows the firmware version of the installed controller.

Format		Example	
Command	{FC}	→	{fc}
Response	(CF●<DESC>)CrLf	←	(CF MX-CPU2 FW:1.1.0b4 r13)CrLf

Explanation: The firmware of the MX-CPU2 processor is shown.

8.2.6. View Installed Motherboard

Description: Shows the hardware name and revision of the installed motherboard.

Format		Example	
Command	{IS}	→	{is}
Response	(SL#●0●<MB_DESC>)CrLf (SL●END)CrLf	←	(SL# 0 MX2-8X8-HDMI20-AUDIO V11_AAA0)CrLf (SL END)

Explanation: The matrix reports its motherboard.

8.2.7. View Crosspoint Size

Description: Shows the physical crosspoint size.

Format		Example	
Command	{GETSIZE}	→	{getsize}
Response	(SIZE=<size>)CrLf	←	(SIZE=8x8)CrLf

Explanation: The matrix reports that it has an 8x8 crosspoint.

8.2.8. View Router's Health

Description: Queries health status. The response depends on the frame type.

Format		Example	
Command	{ST}	→	{st}
Response	(ST●<DESC>)CrLf	←	(ST CPU 3.3V 5.00V 3.00V 5.00V)CrLf

Explanation: Internal voltages, temperature and fan speeds shown

8.2.9. Query Control Protocol (RS-232)

Description: The matrix can be controlled by different control protocols on the RS-232 port. This command queries the active protocol for the used control interface.

ATTENTION!
Be aware that different control interfaces can use different protocols. E.g. the Ethernet interface can use the LW3 protocol while the Serial interface uses P#2 protocol at the same time.

Format	Example
Command {P_?}	→ {p_?}
Response (CURRENT●PROTOCOL●=●#<protocol>)CrLf	← (CURRENT PROTOCOL = #1)CrLf

Explanation: The matrix communicates with LW2 protocol via the RS-232 port.

Possible settings:

<protocol>	Control protocol
1	LW2 protocol
2	P#2 protocol

ATTENTION!
The response shows only the active protocol for the interface that was used to send the command!

8.3. Crosspoint Operations

8.3.1. Switch an Input to an Output

Description: Switch input <in> to output <out>.

Format	Example
Command {<in>@<out>}	→ {1@1}
Response (O<out²>●I<in²>)CrLf	← (O01 I01)CrLf

Explanation 1: Input 1 is switched to output 1.

Format	Example
Command {<in>@<out>}	→ {2@4}
Response (1LO<out²>)CrLf	← (1LO04)CrLf

Explanation 2: Input 2 to output 4 switch is not made because output 4 is locked.

INFO
The response for this command does not show if the output is muted. To check the mute status a separate query has to be used like {VC}. See section 8.3.4 on page 59.

INFO
To achieve multiple switches executed together, see the next section.

8.3.2. Batch Switch Outputs

Description: The matrix is able to switch multiple outputs exactly at the same time. To do this, the normal switch commands have to be used. If the switch commands arrive at the router with less than 10 milliseconds delay, then the router collects the commands and changes the output connections together.

Required circumstances:

- Switch commands have this format: {<in>@<out>}{<in>@<out>}
- The delay between two '}' characters must be below 10 milliseconds
- No other command or junk character is allowed between switch commands
- Affected outputs must not be locked

If any of the above circumstances fail, then the commands will be processed separately and the output connections will change on by one.

ATTENTION!
The delay timeout applies for the receiving time of characters. Please note that if LAN connection is used then the network may cause additional delays. This could result that batch switching does not occur.

Below example shows a command that resulted batch switching:

One by one commands	Batch commands
→ {02@01} ← (O01 I02)CrLf	→ {02@01}{05@04} ← (O01 I02)CrLf
→ {05@04} ← (O04 I05)CrLf	← (O04 I05)CrLf

The below example shows a command that does not resulted batch switching because another command has been inserted:

One by one commands	Batch commands
→ {02@01} ← (O01 I02)CrLf	→ {02@01}{+06}{05@04} ← (O01 I02)CrLf
→ {+06} ← (0MT06)CrLf	← (0MT06)CrLf
→ {05@04} ← (O04 I05)CrLf	← (O04 I05)CrLf

INFO
The response does not show if batch switching happened or not. This assures that a third party controller does not get unknown responses.

8.3.3. View the Connection of an Output Port

Description: See the connected input port number of an output port.

Format	Example
Command {?<out>}	→ {?1}
Response (O<out²> ●I<in²>)CrLf	← (O01 I03)CrLf

Explanation: Input 3 is switched to output 1.

8.3.4. View Connections of all Outputs

Description: Viewing all outputs' connection showing the connected inout port.

Legend 1: All <Ox> indexes show the corresponding output's connection state. If value <O5> equals 04 it means that output 5 is connected to input 4. All <Ox> indexes are two digit ASCII characters (01, 02, 04, etc.).

Format		Example 1
Command	{VC}	→ {vc}
Response	(ALL●<O1>●<O2>●<O3> ●<O4>●<O5>●<O6>●<O7> ●<O8>)CrLf	← (ALL 02 02 02 05 05 05 08 08)CrLf

Explanation 1: Viewing connection for all outputs. Input 2 is connected to outputs 1, 2 and 3. Input 5 is connected to outputs 4, 5 and 6. Input 8 is connected to outputs 7 and 8.

INFO
If an output is locked, muted, or both locked and muted, the response format changes. If outputs are muted you get a letter 'M', if locked a letter 'L' and if muted and locked at the same time 'U' before the 2 digit numbers.

Format		Example 2
Command	{VC}	→ {vc}
Response	(ALL●<O1>●<O2>●<O3> ●<O4>●<O5>●<O6>●<O7> ●<O8>)CrLf	← (ALL M02 L02 U02 05 05 05 08 08)CrLf

Legend 2: Any <Ox> indexes can be a two digit number, or there can be a leading character showing the mute and/or lock state for the corresponding output.

Index	Legend	Explanation
<Ox>	<in²>	<Ox> is connected to <in²>, <Ox> neither muted nor locked.
<Ox>	M<in²>	<Ox> is connected to <in²>, <Ox> is muted, and unlocked.
<Ox>	L<in²>	<Ox> is connected to <in²>, <Ox> is not muted, but locked.
<Ox>	U<in²>	<Ox> is connected to <in²>, <Ox> is muted and locked.

Explanation 2: Viewing connection for all outputs. Input 2 is connected to outputs 1, 2 and 3. Output 1 is muted. Output 2 is locked. Output 3 is muted and locked. Input 5 is connected to outputs 4, 5 and 6. Input 8 is connected to outputs 7 and 8.

8.3.5. View Mutes on all Outputs

Description: Viewing all outputs' mute states.

Legend: All <Mx> indexes are one digit numbers, showing the mute state for the corresponding output. If <Mx> equals 0 the output x is unmuted. If <Mx> equals 1, the output x is muted.

Format		Example
Command	{VM}	→ {vm}
Response	(MUT●<M1>●<M2>●<M3> ●<M4>●<M5>●<M6>●<M7> ●<M8>)CrLf	← (MUT 1 0 1 1 0 0 0 0)CrLf

Explanation: Output 1, 3 and 4 are muted, the other outputs are not muted.

8.3.6. Mute Specified Output

Description: Mute output <out>. The output signal is turned off.

Format	Example
Command {#<out>}	→ {#03}
Response (1MT<out²>)CrLf	← (1MT03)CrLf

Explanation: Output 3 is muted. No signal is present on output 3 now.

INFO
Muting does not change the crosspoint's state but disables the output itself. This way the last connection can be easily restored with an unmute command.

INFO
Switching a muted output does not unmute the output.

8.3.7. Unmute Specified Output

Description: Unmute output <out>.

Format	Example
Command {+<out>}	→ {+03}
Response (0MT<out²>)CrLf	← (0MT03)CrLf

Explanation: Output 3 is unmuted. Now output 3 is switched to the input it was connected to prior to the mute command.

ATTENTION!
Unmuting an output makes the previous connection active as the crosspoint's state has not been changed with the muting command, only the output was disabled.

8.3.8. Lock Specified Output

Description: Lock output <out>. Output's state cannot be changed until unlocking.

Format	Example
Command {#><out>}	→ {#>05}
Response (1LO<out²>)CrLf	← (1LO05)CrLf

Explanation: Output 5 is locked.

8.3.9. Unlock a Specified Output

Description: Unlock output <out>. The connection on output can be changed.

Format	Example
Command {+<<out>}	→ {+<05}
Response (0LO<out²>)CrLf	← (0LO05)CrLf

Explanation: Output 5 is unlocked.

INFO
The matrix issues the above response regardless of the previous state of the output (either it was locked or unlocked).

8.4. Commands - Quick Summary

Router Status Commands

Operation	See in section	Command
View Product Type	8.2.1	{i}
View Serial Number	8.2.2	{S}
View the Installed Firmware	8.2.3	{F}
View CPU Firmware Compile Time	8.2.4	{CT}
View Firmware of the Controller	8.2.5	{FC}
View Installed Motherboard	8.2.6	{IS}
View Crosspoint Size	8.2.7	{GETSIZE}
Query Control Protocol (RS-232)	8.2.9	{P_?}
View Router's Health	8.2.8	{ST}

Crosspoint Operations

Operation	See in section	Command
Switch an Input to an Output	8.3.1	{<in>@<out>}
Batch Switch Outputs	8.3.2	{<in>@<out>}{<in>@<out>}
View Connections of all Outputs	8.3.4	{VC}
View the Connection of an Output Port	8.3.3	{?<out>}
View Mutes on all Outputs	8.3.5	{VM}
Mute Specified Output	8.3.6	{#<out>}
Unmute Specified Output	8.3.7	{+<out>}
Lock Specified Output	8.3.8	{#><out>}
Unlock a Specified Output	8.3.9	{+<<out>}

9. LW3 Programmers' Reference

9.1. Overview

The Lightware 3 protocol (LW3) is an ASCII-based, tree-structured protocol that provides outstanding flexibility. The protocol is easy to handle and programmatically still ease to parse, which is suitable for different products with a different feature list.

All commands are terminated with a carriage return (Cr, '\r') and line feed (Lf, '\n') pair. In order to implement a flexible, easy-to-use protocol that is straightforward to adapt to new devices and provides outstanding scalability and sustainability, we decided to organize all settings, parameters and properties of the device to a tree structure with **nodes, properties,** and **methods**.

9.1.1. Elements of the Tree Structure

ATTENTION!
All names and values are case-sensitive. The space character is replaced by the '●' character in the elements and commands descriptions.

9.1.1.1. Node

- The basic building block of the tree structure is the 'node'.
- The node can have multiple child nodes, but only one parent.
- The tree has only one root the 'root node'.
- The leaves of the tree are also nodes, which do not have child nodes.
- The nodes are separated by a slash ('/') character.
- All the slashes are 'right slashes', no backslash is used.
- The identifier of the root node is a slash ('/')
- The node name can contain the elements of the English alphabet and numbers.
- Recommended convention for case sensitivity:
  - Fix nodes (that cannot be altered) are capitalized.
  - User created nodes can contain both lowercase and capital letters, no restrictions.
- The path of a node has to contain all parent nodes from the root node.

Format: (the root node): nX●/

Path: nX●/[nodeName]/[nodeName]/[nodeName]

Legend:

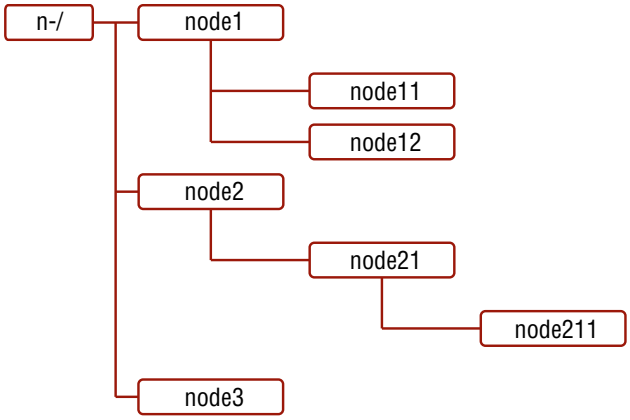
n: node

'X' can be:

'-': default for a node.
'm': this is a manual for the node.
'E': this is an error message for the node.
's': this is a symlink node.
'v': this node has virtual children.
'r': this is a remote node.

INFO
All parent nodes must be listed in the path of a node.

Following example presents the structure of the tree traversal:



Path of the nodes:

n- /node1
n- /node1/node11
n- /node1/node12
n- /node2
n- /node2/node21
n- /node2/node21/node211
n- /node3

Tree structure of the nodes

9.1.1.2. Property

The 'property' in the LW3 protocol is basically a leaf, which has a well-defined value.

- A property has a value.
- A property cannot have child nodes or child properties. It is always a leaf.
- A node can have any number of properties (may not have any).
- A property is referenced with a dot ('.') after the node name.
- The properties' name can contain the elements of the English alphabet, numbers and underscore ('_') character.
- By convention, properties are beginning with a capital letter, all other characters are lowercase ones. In the case of compound words, all words are beginning with a capital letter (CamelCase).
- The value of the property can contain any readable ASCII character.
- A property can be read-only or read/write.

Format: pX●/[nodeName].[propertyName]=[propertyValue]

Legend:

p: property

'X' can be:

'r': if the property is read-only.
'w': if the property is readable, writable.
'm': the manual of the property.
'E': error message for the property.
'v': virtual node property: contains a node path to a node which will be linked to the property's parent node.

Example:

The following two ones are read-only properties:

pr●/node1/node12.ReadOnlyProperty=value1

pr●/.DeviceName=MX2-8x8-HDMI20-Audio

The following two ones are read-write properties:

pw●/node1/node12.ReadWriteProperty=value2

pw●/.DeviceNickName=John

9.1.1.3. Method

The ‘method’ in the LW3 protocol is also a leaf. It cannot have a value, such as the properties, but it can be invoked with a parameter with the help of a special ‘CALL’ command.

- A method cannot have child nodes or child methods. It is always a leaf.
- A node can have any number of methods (may not have any).
- A method is referenced with a colon (‘:’) after the node.
- The methods’ name can contain the elements of the English alphabet, numbers and underscore (‘_’) character.
- By convention, methods are beginning with a lowercase letter. In the case of compound words, the very first letter is lowercase, and the first letter of each other words are capitalized (lowerCamelCase).
- The parameter of the method can contain any readable ASCII character.
- The method always has a return ‘state’ if the method could be executed. The state could be either ‘OK’ or ‘FAILED’.
- The method does not necessarily have a return ‘value’. If it does, it can contain additional information, which is always specific to the current case (the return value can specify why the execution failed).
- When the method cannot be executed (e.g. the parameter list is illegal), there is an error message.

Format: mX●/[nodeName]:[methodName]=[returnValue]

Legend:

m: method

‘X’ can be:

‘O’: when the execution of the method was successful (OK).

‘F’: when the execution of the method failed.

‘m’: the manual of the method.

‘E’: error message for the method.

Example:

mO●/node1/node12:method1

mO●/MEDIA/XP/VIDEO:switch

mE●%E001:Syntax error

mm●/MEDIA/XP/VIDEO:lockSource:Lock one or more source ports

9.1.2. Escaping

Property values and method parameters can contain characters that are used as control characters in the protocol. They must be escaped. The escape character is the backslash (‘\’) and escaping means injecting a backslash before the character that should be escaped (like in C language).

Control characters are the followings: \ { } # % ( ) \r \n \t

Example:

The original text: John●(Doe).●#3:●5%2=1●node1\node11

The escaped text: John●\(Doe\).●\#3:●5\%2=1●node1\\node11

9.1.3. Error Messages

There are several error messages defined in the LW3 protocol, all of them have a unique error number.

Format: XE●[primitive]●%EYYY:●[Error message]

Legend:

'X' can be:
'-': syntax error. Cannot parse the command at all.
'n': node error.
'p': property error.
'm': method error.

YYY: error code, which can be one of the followings:

Error code	Name	Default text
000	Lw3ErrorCodes_None	
001	Lw3ErrorCodes_Syntax	Syntax error
002	Lw3ErrorCodes_NotFound	Not found
003	Lw3ErrorCodes_AlreadyExists	Already exists
004	Lw3ErrorCodes_InvalidValue	Invalid value
005	Lw3ErrorCodes_IllegalParamCount	Illegal parameter count
006	Lw3ErrorCodes_IllegalOperation	Illegal operation
007	Lw3ErrorCodes_AccessDenied	Access denied
008	Lw3ErrorCodes_Timeout	Timeout
009	Lw3ErrorCodes_CommandTooLong	Command too long
010	Lw3ErrorCodes_InternalError	Internal error
011	Lw3ErrorCodes_NotImplemented	Not implemented
012	Lw3ErrorCodes_Node_Disabled	Node disabled or standby mode active

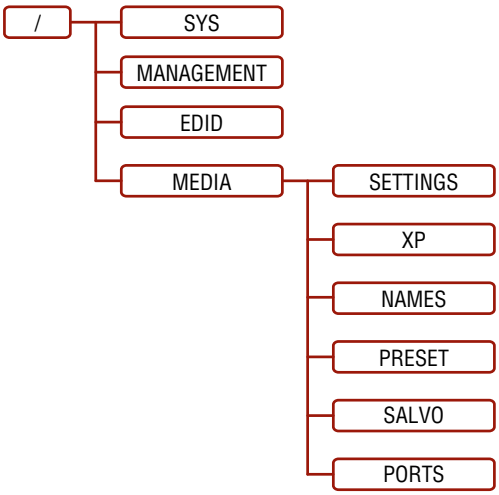
9.1.4. Prefix Summary

The following prefixes are defined in the LW3 protocol:

'n-': a node,
'nE': an error for a node,
'nm': a manual for a node,
'pr': a read-only property,
'pw': read-write property,
'pE': an error for the property,
'pm': a manual for the property,
'm-': a method,
'mO': a response to a success method execution,
'mF': a response to a failed method execution,
'mE': an error for a method,
'mm': a manual for a method.

9.2. The Tree Structure

The /SYS node is used for system-related settings such as front panel settings and health status parameters. The /MANAGEMENT node contains network-related parameters, date-time settings, and version numbers. The /EDID node contains all EDID-related settings such as factory pre-programmed EDIDs and User EDIDs. All input and output port settings, crosspoint state, etc... are under the /MEDIA node.



The tree structure is available in the **Advanced view** of LDC, see section 7.8 on page 54.

9.3. LW3 commands

9.3.1. Get Command

The 'GET' command can be used to get the child nodes, properties and methods of a specific node. It can also be used to get the value of a property.

The response format

The first two characters of a response unambiguously identify the type of the element that the response line concerns. The first character is the type of the element (node, property or method), the second is for miscellaneous information (e.g. read/write rights).

The defined prefixes are:

'n-': node
'pr': property - only readable
'pw': property - writable, readable
'm-': method executable

After the prefix, the response contains the full path of the node, property or method after a space character.

Get all children of a node

Get all of the child nodes of a parent node, with one GET command.

Command format: GET●[nodePath]

Response format: n-●[nodePath]

Example:

```
> GET /MEDIA
< n- /MEDIA/SETTINGS
< n- /MEDIA/XP
< n- /MEDIA/NAMES
< n- /MEDIA/PRESET
< n- /MEDIA/SALVO
< n- /MEDIA/PORTS
```

Get all child nodes, properties and methods of a node

Get all child nodes, properties and methods of a node with one command, without using a wild card.

Command format: GETALL●[nodePath]

Response format: (for nodes)

n-●[nodePath]

Response format: (for properties)

pX●[nodePath].[propertyName]=[parameter]

Legend:

X can be:

'r':	read-only
'w':	read-write

Response format: (for methods)

m-●[nodePath]:[methodName]

Example:

```
> GETALL /EDID
< n- /EDID/F
< n- /EDID/D
< n- /EDID/U
< n- /EDID/E
< pr /EDID.EdidStatus=F49;F49;F49;F49;F49;F49;F49;F49;
< m- /EDID:copy
< m- /EDID:delete
< m- /EDID:reset
< m- /EDID:switch
< m- /EDID:switchAll
```

Get all properties and methods of a node

Get all properties and methods of a node, with one GET command and asterisk character.

Command format: GET●[nodePath].*

Response format: (for properties)

pX●[nodePath].[propertyName]=[parameter]

Legend:

X can be:

'r':	read-only
'w':	read-write

Response format: (for methods)

m-●[nodePath]:[methodName]

Example:

```
> GET /EDID.*
< pr /EDID.EdidStatus=F49;F49;F49;F49;F49;F49;F49;F49;
< m- /EDID:copy
< m- /EDID:delete
< m- /EDID:reset
< m- /EDID:switch
< m- /EDID:switchAll
```

9.3.2. Set Command

The setter command can be used to modify the value of a property.

Command format: SET●[nodePath].[propertyName]=[newPropertyValue]

Response format:

The response for setting a property to a new value is the same as the response for the 'GET' command. The value in the response is the new value if the execution of the 'SET' command was successful, otherwise the unmodified 'old value' with an error message.

pw●[nodePath].[propertyName]=[newPropertyValue]

Example:

```
> SET /MANAGEMENT/SERIAL.Protocol=LW2
< pw /MANAGEMENT/SERIAL.Protocol=LW2
```

Error response format:

If there were errors during setting a property, an error message follows the unmodified property value.

pE●[nodePath].[propertyName]=[umodifiedValue]●%EXXX:Error message

Legend: XXX: error number.

Examples:

```
> SET /MANAGEMENT/SERIAL.Protocol=1
< pE /MANAGEMENT/SERIAL.Protocol %E004: Invalid value
```

```
> SET /MANAGEMENT/NETWORK.MacAddress=192.168.0.80
<  pE /MANAGEMENT/NETWORK.MacAddress %E007: Access denied
```

9.3.3. Invocation

A method can be invoked with the help of the 'CALL' command.

Command format: CALL●[nodePath]:[methodName]([parameter])

Response format:

The response for a method execution is a state and a value. The state is mandatory and always defined if the method could be executed. It can be either a success or a failure. The value is optional and it can contain additional information, such as the reason why the state is a failure or a specific value when the state is a success that the client can process. It is also possible to get an error message when the method could not be executed – e.g. the parameter was illegal - and hence not even the state of the execution could be specified.

mX●[nodePath]:[methodName]=Y

Legend:

X can be:

'O':	if the execution is successful.
'F':	if the execution is failed, but the method could be executed.
'E':	if the method could not be executed: e.g. illegal parameter count.

Y can be:

- The return value of the method if any.
- It is valid that a method does not have any return value. In this case, the equal sign ('=') can be omitted.

Example:

```
> CALL /EDID:switch(D1:E1)
< mO /EDID:switch
```

Error response format:

If there were errors during the execution, an error message is received, which follows the method name.

mE●[nodePath]:[methodName]●%EXXX:Error message

Example:

```
> CALL /EDID:switch(D1:R1)
< mE /EDID:switch %E004: Invalid value
```

9.3.4. Manual

For every node, property and method in the tree there is a manual. The manual is a human-readable text that describes the syntax and provides a hint for how to use the primitives.

Command format:

for nodes:	MAN●[nodePath]
for property:	MAN●[nodePath].[propertyName]
for method:	MAN●[nodePath]:[methodName]

Response format:

The human readable manual is separated by a space (' ') character from the primitives.

for nodes:	nm●[nodePath]●Human readable manual
for property:	pm●[nodePath].[propertyName]●Human readable manual
for method:	mm●[nodePath]:[methodName]●Human readable manual

Example: (for a property)

```
> MAN /MANAGEMENT/SERIAL.Protocol
< pm /MANAGEMENT/SERIAL.Protocol ["LW3" | "LW2" | "P#2"] The used
  protocol: LW3, LW2 or P#2
```

Example: (for a method)

```
> MAN /SYS:factoryDefaults
< mm /SYS:factoryDefaults Restores factory default state. Erase every
  changes made by the user.
```

9.3.5. Signature

For some command, the response can contain multiple lines. Each line is terminated with a carriage return (Cr, '\r') and line feed (Lf, '\n') characters. In several cases the number of the lines in the response cannot be determined in advance, e.g. the client is intended waiting for the whole response and also wants to be sure, that the received lines belong together and to the same command. In these cases, a special feature the 'signature' can be used.

The signature is a four digit long hexadecimal value that can be optionally placed before every command. In that case, the response to that particular command will also be preceded by the signature, and the corresponding lines will be between brackets.

Command format: XXXX#[command]

Legend: xxxx: 4-digit long hexadecimal value.

Response format:

{XXXX

[command lines]

}

Example:

```
> 1103#GET /MEDIA/XP.*
< {1103
< m /MEDIA/XP:MultiLayer_Connect
< m /MEDIA/XP:MultiLayer_Switch
< m /MEDIA/XP:MultiLayer_SwitchAll
< m /MEDIA/XP:MultiLayer_SwitchMulti
< }
```

INFO
The lines of the signature are also Cr and Lf terminated.

9.3.6. Subscription

A user can subscribe to any node. Subscribe to a node means that the user will get a notification if any of the properties of the node is changed. These notifications are asynchronous messages - such as the ones described above - and hence, they are useful to keep the client application up-to-date, without receiving any unwanted information. When the user does not want to be informed about the changes anymore, he can simply unsubscribe from the node.

ATTENTION!
The subscriptions are handled separately for connections. Hence, if the connection is terminated all registered subscriptions are deleted. After closing a connection the subscribe command has to be sent in order to get the notifications of the changes on that connection.

Subscribe to a node

Command format: OPEN●[nodePath]

Response format: o-●[nodePath]

Example:

```
> OPEN /MEDIA/XP
< o- /MEDIA/XP
```

Subscribe to multiple nodes

In order to subscribe to multiple nodes, the asterisk wild card can be used.

Command format: OPEN●[nodePath]/*

Response format: o-●[nodePath]/*

Example:

```
> OPEN /MEDIA/XP/*
< o- /MEDIA/XP/*
```

Get the active subscriptions for the current connection

Command format: OPEN

Response format: o-●[nodePath]

Example:

```
> OPEN
< o- /MEDIA/XP
< o- /MEDIA/XP/*
```

Unsubscribe from a node

Command format: CLOSE●[nodePath]

Response format: c-●[nodePath]

Example:

```
> CLOSE /MEDIA/XP
< c- /MEDIA/XP
```

Unsubscribe from multiple nodes

Command format: CLOSE●[nodePath]/*

Response format: c-●[nodePath]/*

Example:

```
> CLOSE /MEDIA/XP/*
< c- /MEDIA/XP/*
```

9.3.7. Notifications about the Changes of the Properties

When the value of a property is changed and the user is subscribed to the node, which the property belongs to, an asynchronous notification is generated. This is notification is called as the 'change message'. The format of such a message is very similar to the response for the 'GET' command.

Format: CHG●[nodePath].[propertyName]=[newPropertyValue]

Example:

```
< CHG /EDID.EdidStatus=F49;F49;F49;F49;F49;F49;F49;F49
```

A short example of how to use the subscription

In the following, an example is presented, how the subscriptions are working and how to use them. In the example, there are two independent users controlling the device through two independent connections (‘Connection #1’ and ‘Connection #2’). The events in the rows occur after each other.

Conn. #1	> OPEN /MEDIA/XP/VIDEO
	< o- /MEDIA/XP/VIDEO
	> GET /MEDIA/XP/VIDEO.DestinationConnectionStatus
	< pr /MEDIA/XP/VIDEO.DestinationConnectionStatus=I1;I1;I1;I1;I1;I1;I1;I1
Conn. #2	> GET /MEDIA/XP/VIDEO.DestinationConnectionStatus
	< pr /MEDIA/XP/VIDEO.DestinationConnectionStatus=I1;I1;I1;I1;I1;I1;I1;I1
	> CALL /MEDIA/XP/VIDEO:switch(I2:O1)
	< mO /MEDIA/XP/VIDEO:switch=OK
Conn. #1	< CHG /MEDIA/XP/VIDEO.DestinationConnectionStatus=I1;I1;I1;I1;I1;I1;I1;I1

Explanation: The first user (Connection #1) set a subscription to a node. Later the other user (Connection #2) made a change, and thanks for the subscription, the first user got a notification about the change.

9.4. Formal Definitions

Method parameters and property values are specified in a modified version of Backus-Naur Form (BNF). The syntax is the following:

“literal”	literals are quoted
<expression1>|<expression2>	vertical bars denote alternatives
[<expression>]	expressions in square brackets are optional
<number>*[<expression>]	expression is repeated at least <number> times
*[<expression>]	<number> may be omitted, in this case number defaults to 0
<number>*{<expression>}	expressions in curly brackets are repeated exactly <number> times
In	Input port number
Om	Output port number

9.5. System Commands

9.5.1. Query the Product Name

The name of the product is a read-only parameter and cannot be modified.

Command format: GET●/.ProductName

Response format: pr●/.ProductName=<Product_name>

Example:

```
> GET /.ProductName
< pr /.ProductName=MX2-8X8-HDMI20-AUDIO
```

9.5.2. Set the Device Label

ATTENTION!
The device label can be changed to a custom text which is displayed in many windows of the LDC. This writable parameter is not the same as the ProductName parameter.

Command format: SET●/MANAGEMENT/UID/DeviceLabel=<Custom_name>

Response format: pw●/MANAGEMENT/UID/DeviceLabel=<Custom_name>

The Device Label can be 39 character length and ASCII characters are allowed. Longer names are truncated.

Example:

```
> SET /MANAGEMENT/UID.DeviceLabel=MX2_Control_room
< pw /MANAGEMENT/UID.DeviceLabel=MX2_Control_room
```

9.5.3. Query the Serial Number

Command format: GET●/.SerialNumber

Response format: pr●/.SerialNumber=<serial_nr>

Example:

```
> GET /.SerialNumber
< pr /.SerialNumber=87654321
```

9.5.4. Resetting the Matrix

The matrix can be restarted – the current connections (LAN, RS-232) will be terminated.

Command format: CALL●/SYS:softReset()

Response format: mO●/SYS:softReset=

Example:

```
> CALL /SYS:softReset()
< mO /SYS:softReset=
```

9.5.5. Restore the Factory Default Settings

Command format: CALL●/SYS:factoryDefaults()

Response format: mO●/SYS:factoryDefaults=

Example:

```
> CALL /SYS:factoryDefaults()
< mO /SYS:factoryDefaults=
```

The device is restarted, current connections are terminated, and the default settings are restored. See the complete list in section 12.4 on page 100.

9.5.6. Switch to Standby Mode

The video transmission is disabled, the LCD is switched off, but remote connections (LAN, RS-232) remain enabled in standby mode. See section 5.3.1 on page 28 and the next section.

Command format: CALL●/MANAGEMENT/POWER:standby()

Response format: mO●/MANAGEMENT/POWER:standby=

Example:

```
> CALL /MANAGEMENT/POWER:standby()
< mO /MANAGEMENT/POWER:standby=
```

9.5.7. Switch to Normal Mode

If the matrix is in Standby mode, it can be switched back to Normal mode as follows:

Command format: CALL●/MANAGEMENT/POWER:wakeUp()

Response format: mO●/MANAGEMENT/POWER:wakeUp=

Example:

```
> CALL /MANAGEMENT/POWER:wakeUp()
< mO /MANAGEMENT/POWER:wakeUp=
```

9.6. Switching and Crosspoint Settings

INFO
The current setting can be queried by using the GET command, see section 9.3.1.

9.6.1. Query the Video Crosspoint State

Command format: GET●/MEDIA/XP/VIDEO.DestinationConnectionStatus

Response format: pr●/MEDIA/XP/VIDEO.DestinationConnectionStatus=<O1_state>;<O2_state>;...;<O8_state>

Example:

```
> GET /MEDIA/XP/VIDEO.DestinationConnectionStatus
< pr /MEDIA/XP/VIDEO.DestinationConnectionStatus=I1;I1;I1;I1;I1;I1;I1;I1;
```

Explanation: I1 input port is connected to all output ports.

9.6.2. Switching an Input to an Output

Command format: CALL●/MEDIA/XP/VIDEO:switch(<In>:<Om>)

Response format: mO●/MEDIA/XP/VIDEO:switch=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:switch(I4:O1)
< mO /MEDIA/XP/VIDEO:switch=OK
```

9.6.3. Switching an Input to All Outputs

Command format: CALL●/MEDIA/XP/VIDEO:switchAll(<In>)

Response format: mO●/MEDIA/XP/VIDEO:switchAll=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:switch(I1)
< mO /MEDIA/XP/VIDEO:switchAll=OK
```

TIPS AND TRICKS
All output ports can be disconnected by the '0' value: CALL /MEDIA/XP/VIDEO:switchAll(0).

9.6.4. Multiple Switching

The whole crosspoint can be set by sending one command as follows.

Command format: CALL●/MEDIA/XP/VIDEO:switchMulti(<O1_source>;<O2_source>;...;<O8_source>)

Response format: mO●/MEDIA/XP/VIDEO:switchMulti=OK

The source is not required to set on all output ports (see **Example2**).

Example1:

```
> CALL /MEDIA/XP/VIDEO:switchMulti(I1;I2;I3;I4;I5;I6;I7;I8)
< mO /MEDIA/XP/VIDEO:switchMulti=OK
```

Example2:

```
> CALL /MEDIA/XP/VIDEO:switchMulti(I1;I2;;;I5)
< mO /MEDIA/XP/VIDEO:switchMulti=OK
```

9.7. Video Input Port Settings

INFO
The current setting can be queried by using the GET command, see section 9.3.1.

9.7.1. The Status of the Input Ports

Command format: GET●/MEDIA/XP/VIDEO.SourcePortStatus

Response format: pr●/MEDIA/XP/VIDEO.SourcePortStatus=<I1_state>;<I2_state>;…;<I8_state>

The responses contain one letter and a 1-byte long HEX code showing the current state of the input ports.

Example:

```
> GET /MEDIA/XP/VIDEO.SourcePortStatus
< pr /MEDIA/XP/VIDEO.SourcePortStatus=TEF;TAA;TAA;TAA;TAA;TAA;TAA;TAA
```

Legend:

Letter	Byte 1			
BIT 7-0 (ASCII)	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0
Mute / Lock state	**Embedded audio**	**HDCP status**	**Signal present**	**Connection status**
T: unlocked, unmuted	0 0 – Unknown			
L: locked, unmuted	0 1 – Reserved			
M: muted, unlocked	1 0 – No embedded audio	1 0 – Not encrypted	1 0 – No signal	1 0 – Not connected
U: locked, muted	1 1 – Embedded audio presents	1 1 – Encrypted	1 1 – Signal presents	1 1 – Connected

T	E		F	
T: unlocked, unmuted	1 1	1 0	1 1	1 1

Explanation:

Cable is connected to Input 1, signal is present, not HDCP-encrypted, audio is embedded in the video. The port is unlocked, unmuted.

9.7.2. Mute an Input Port

Command format: CALL●/MEDIA/XP/VIDEO:muteSource(<In>;..;<Im>)

Response format: mO●/MEDIA/XP/VIDEO:muteSource=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:muteSource(I1)
< mO /MEDIA/XP/VIDEO:muteSource=OK
```

9.7.3. Unmute an Input Port

Command format: CALL●/MEDIA/XP/VIDEO:unmuteSource(<In>;..;<Im>)

Response format: mO●/MEDIA/XP/VIDEO:unmuteSource=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:unmuteSource(I1;I3)
< mO /MEDIA/XP/VIDEO:unmuteSource=OK
```

9.7.4. Lock an Input Port

Command format: CALL●/MEDIA/XP/VIDEO:lockSource(<In>;..;<Im>)

Response format: mO●/MEDIA/XP/VIDEO:lockSource=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:lockSource(I1)
< mO /MEDIA/XP/VIDEO:lockSource=OK
```

9.7.5. Unlock an Input Port

Command format: CALL●/MEDIA/XP/VIDEO:unlockSource(<In>;..;<Im>)

Response format: mO●/MEDIA/XP/VIDEO:unlockSource=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:unlockSource(I1;I3)
< mO /MEDIA/XP/VIDEO:unlockSource=OK
```

9.7.6. HDCP Setting

This setting allows to send non-encrypted content to a non-HDCP compliant display. See more information in section 4.2 on page 18.

Command format: SET●/MEDIA/PORTS/VIDEO/<I_n>/SETTINGS.HdcpVersion=0|1|2|3

Response format: pw●/MEDIA/PORTS/VIDEO/<I_n>/SETTINGS.HdcpVersion=0|1|2|3

Legend:

Value	Description
0	HDCP encryption is disabled
1	HDCP 1.4 encryption is enabled
2	HDCP 2.2 is enabled
3	High value mode: Any version of HDCP is allowed on the input but the incoming signal is always internally upconverted to HDCP 2.2 content and thus cannot be switched to HDCP 1.4 sinks.

Example:

```
> SET /MEDIA/PORTS/VIDEO/I1/SETTINGS.HdcpVersion=3
< pw /MEDIA/PORTS/VIDEO/I1/SETTINGS.HdcpVersion=3
```

9.8. Preset Handling

The router can store presets and the followings are stored in each slot: input/output crosspoint state, muted/unmuted states. Preset loading has an effect on all ports, except the locked ones.

9.8.1. Create a New Preset

Command format: CALL●/MEDIA/PRESET:create(<Preset_name>,VIDEO)

Response format: mO●/MEDIA/PRESET:create=

Legend: Up to 16 characters are allowed to name a Preset. Letters (A-Z and a-z), hyphen (-), underscore (_), and numbers (0-9) are accepted.

Example:

```
> CALL /MEDIA/PRESET:create(My_pres,VIDEO)
< mO /MEDIA/PRESET:create=
```

Explanation: The preset is stored as a new node (My_pres) under the /MEDIA/PRESET/ node.

9.8.2. Save the Settings to an Existing Preset

Command format: CALL●/MEDIA/PRESET/<Pres_name>:save(1)

Response format: mO●/MEDIA/PRESET/My_Pres:save=Ok

Example:

```
> CALL /MEDIA/PRESET/My_Pres:save(1)
< mO /MEDIA/PRESET/My_Pres:save=Ok
```

Explanation: The existing "My_pres" has been overwritten with the current settings.

9.8.3. Load a Preset

Command format: CALL●/MEDIA/PRESET/<Pres_name>:load(1)

Response format: mO●/MEDIA/PRESET/My_Pres:load=Ok

Example:

```
> CALL /MEDIA/PRESET/My_Pres:load(1)
< mO /MEDIA/PRESET/My_Pres:load=Ok
```

Explanation: "My_pres" preset has been loaded and applied.

9.8.4. Rename a Preset

Command format: CALL●/MEDIA/PRESET:rename(<Old_name>,<New_name>)

Response format: mO●/MEDIA/PRESET:rename=

Example:

```
> CALL /MEDIA/PRESET:rename(My_Pres,Your_Pres)
< mO /MEDIA/PRESET:rename=
```

Explanation: The preset has been renamed to "Your_Pres".

9.9. Audio Input Port Settings

INFO
The current setting can be queried by using the GET command, see section 9.3.1.

9.9.1. Audio Mode Setting

Command format: SET●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.AudioMode=OFF|HDMI|ANALOG

Response format: pw●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.AudioMode=OFF|HDMI|ANALOG

Example:

```
> SET /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.AudioMode=ANALOG
< pw /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.AudioMode=ANALOG
```

9.9.2. Analog Audio Input Level Settings

Balance (Setting the Exact Value)

Command format: SET●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.Balance=<value>

Response format: pw●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.Balance=<value>

Legend: The Balance value can be set between -100 and 100 (0=center).

Example:

```
> SET /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Balance=50
< pw /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Balance=50
```

Balance (Setting by Step Value)

Command format: CALL●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO:stepBalance(<step_value>)

Response format: mO●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO:stepBalance=<step_value>

Example:

```
> CALL /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO:stepBalance(10)
< mO /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO:stepBalance=10
```

Explanation: The balance of the audio signal has been increased (right channel became higher). Positive and negative values are accepted.

Mute

Command format: SET●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.Mute=true|false

Response format: pw●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.Mute=true|false

Example:

```
> SET /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Mute=true
< pw /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Mute=true
```

Gain

Command format: SET●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.Gain=<value>

Response format: pw●/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.Gain=<value>

Legend: Values between -12dB and +35dB are accepted and rounded automatically.

Example:

```
> SET /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Gain=5
< pw /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Gain=5
```

9.10. Video Output Port Settings

INFO
The current setting can be queried by using the GET command, see section 9.3.1.

9.10.1. The Status of the Output Ports

Command format: GET●/MEDIA/XP/VIDEO.DestinationPortStatus

Response format: pr●/MEDIA/XP/VIDEO.DestinationPortStatus=<I1_state>;<I2_state>;…; <I8_state>

The responses contain one letter and a 1-byte long HEX code showing the current state of the input ports.

Example:

```
> GET /MEDIA/XP/VIDEO.DestinationPortStatus
< pr /MEDIA/XP/VIDEO.DestinationPortStatus=MEF;TAA;TAA;TAA;TAA;TAA;
  TAA;TAA
```

Legend:

Letter	Byte 1			
BIT 7-0 (ASCII)	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0
Mute / Lock state	**Embedded audio**	**HDCP status**	**Signal present**	**Connection status**
T: unlocked, unmuted	0 0 – Unknown			
L: locked, unmuted	0 1 – Reserved			
M: muted, unlocked	1 0 – No embedded audio	1 0 – Not encrypted	1 0 – No signal	1 0 – Not connected
U: locked, muted	1 1 – Embedded audio presents	1 1 – Encrypted	1 1 – Signal presents	1 1 – Connected

M	E		F	
M: unlocked, muted	1 1	1 0	1 1	1 1

Explanation:

Cable is connected to Input 1, signal is present, not HDCP-encrypted, audio is embedded in the video. The port is unlocked, but muted.

9.10.2. Signal Type (HDMI mode)

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.ForcedSignalType=DVI|HDMI|AUTO

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.ForcedSignalType=DVI|HDMI|AUTO

Legend:

- **DVI:** The outgoing signal format is forced to be **DVI**.
- **HDMI:** The outgoing signal format is forced to be **HDMI**.
- **Auto:** The outgoing signal format is set **automatically** according to the audio presence in the video stream: if audio is present, the signal format is HDMI.

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.ForcedSignalType=HDMI
< pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.ForcedSignalType=HDMI
```

9.10.3. Mute an Output

Command format: CALL●/MEDIA/XP/VIDEO:muteDestination(<On>;..;<Om>)

Response format: mO●/MEDIA/XP/VIDEO:muteDestination=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:muteDestination(O1;O3)
< mO /MEDIA/XP/VIDEO:muteDestination=OK
```

9.10.4. Unmute an Output

Command format: CALL●/MEDIA/XP/VIDEO:unmuteDestination(<On>;..;<Om>)

Response format: mO●/MEDIA/XP/VIDEO:unmuteDestination=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:unmuteDestination(O1)
< mO /MEDIA/XP/VIDEO:unmuteDestination=OK
```

9.10.5. Lock an Output

Command format: CALL●/MEDIA/XP/VIDEO:lockDestination(<On>;..;<Om>)

Response format: mO●/MEDIA/XP/VIDEO:lockDestination=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:lockDestination(O1)
< mO /MEDIA/XP/VIDEO:lockDestination=OK
```

9.10.6. Unlock an Output

Command format: CALL●/MEDIA/XP/VIDEO:unlockDestination(<On>;..;<Om>)

Response format: mO●/MEDIA/XP/VIDEO:unlockDestination=OK

Example:

```
> CALL /MEDIA/XP/VIDEO:unlockDestination(O1;O2;O4)
< mO /MEDIA/XP/VIDEO:unlockDestination=OK
```

9.10.7. Conversion Mode

ATTENTION!
The signal conversion can be set on the input and output ports as well, but the desired signal is recommended to set on the output ports. The signal conversion on the input side is mainly for testing purposes.

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.Conversion=
OFF|420|LEFT|RIGHT

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.Conversion=
OFF|420|LEFT|RIGHT

Legend:

- **Off:** no signal conversion.
- **420 :** the signal is converted to the indicated color depth.
- **LEFT** and **RIGHT**: The device supports vertical splitting of an HDMI 2.0 4K@60Hz 4:4:4 input signal to left and right halves allowing for the transmission of an 18Gbps HDMI2.0 signal over two HDMI1.4 compliant links. The two halves can then be recombined at the signal destination. To apply the feature route the same input signal to 2 output ports. Set the conversion to **LEFT** on one output port and **RIGHT** on the other output port.

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.Conversion=420
< pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.Conversion=420
```

9.10.8. Scrambling

The scrambling to the TMDS encoding which helps to decrease the energy peaks and hence the Electro Magnetic Interference (EMI). To maintain backward compatibility, HDMI 2.0 only requires the use of scrambling with data rates of above 3.4 Gbps per lane. The option can be set on the output ports to **Auto** / **Forced On** / **Forced Off**.

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.ForcedScrambling=AUTO|ON|OFF

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.ForcedScrambling=AUTO|ON|OFF

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.ForcedScrambling=AUTO
< pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.ForcedScrambling=AUTO
```

9.10.9. HDCP Setting (Output Port)

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.HdcpMode=AUTO|ALWAYS

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/SETTINGS.HdcpMode=AUTO|ALWAYS

Legend:

- **Auto:** the setting is the same as on the input port. The encryption of the signal on the output is the same as on the input.
- **Always:** the outgoing signal is always encrypted on the output.

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.HdcpMode=AUTO
< pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.HdcpMode=AUTO
```

9.11. Audio Output Port Settings

INFO
The current setting can be queried by using the GET command, see section 9.3.1.

9.11.1. Audio Mode Setting

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.AudioMode=OFF|HDMI|ANALOG|HDMI+ANALOG

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.AudioMode=OFF|HDMI|ANALOG|HDMI+ANALOG

Legend:

- **Off:** Audio is present neither in the HDMI stream nor on the Analog Audio output port.
- **HDMI:** Audio is present only in the HDMI stream.
- **Analog:** Audio is present only on the Analog Audio output port
- **HDMI+Analog**: Audio is present in the HDMI stream and on the Analog Audio output port.

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.AudioMode=HDMI
< pw /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.AudioMode=HDMI
```

9.11.2. Analog Audio Output Level Settings

Volume (Setting the Exact Value)

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.VolumedB=<value>

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.VolumedB=<value>

Legend: The Volume value can be set between -95.62 dB and 0 dB.

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.VolumedB=-10
< pw /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.VolumedB=-10.00
```

Volume (Setting by Step Value)

Command format: CALL●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO:stepVolumedB(<step_value>)

Response format: mO●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO:stepVolumedB=<step_value>

Example:

```
> CALL /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepVolumedB(-2)
< mO /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepVolumedB=-2
```

Legend: The volume of the audio signal has been decreased by 2 dB. Positive and negative values are accepted.

INFO
The Volume can also be set by the following method and property: ***VolumePercent****,* ***StepVolumePercent****.*

Balance (Setting the Exact Value)

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.Balance=<value>

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.Balance=<value>

Legend: The Balance value can be set between -100 and +100 (0=center).

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Balance=10
< pw /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Balance=10
```

Balance (Setting by Step Value)

Command format: CALL●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO:stepBalance(<step_value>)

Response format: mO●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO:stepBalance=<step_value>

Example:

```
> CALL /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepBalance(-10)
< mO /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepBalance=-10
```

Legend: The balance of the audio signal has been decreased (left channel became louder). Positive and negative values are accepted.

Mute

Command format: SET●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.Mute=true|false

Response format: pw●/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.Mute=true|false

Example:

```
> SET /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Mute=true
< pw /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Mute=true
```

9.12. RS-232 Port Settings

INFO
The current setting can be queried by using the GET command, see section 9.3.1.

9.12.1. Protocol Setting

Command format: SET●/MANAGEMENT/SERIAL.Protocol=LW2|LW3|P#2

Response format: pw●/MANAGEMENT/SERIAL.Protocol=LW2|LW3|P#2

Example:

```
> SET /MANAGEMENT/SERIAL.Protocol=LW3
< pw /MANAGEMENT/SERIAL.Protocol=LW3
```

9.12.2. Baud Rate Setting

Command format: SET●/MANAGEMENT/SERIAL.Baudrate=<value>

Response format: pw●/MANAGEMENT/SERIAL.Baudrate=<value>

Legend: The following values are accepted: 9600, 19200, 38400, 57600, 115200.

Example:

```
> SET /MANAGEMENT/SERIAL.Baudrate=57600
< pw /MANAGEMENT/SERIAL.Baudrate=57600
```

9.13. Network Settings

ATTENTION!
When any parameter of the network settings is modified, always apply the new settings by using the following command: ***CALL /MANAGEMENT/NETWORK:applySettings()***

INFO
The current setting can be queried by using the GET command, see section 9.3.1.

9.13.1. Query the Current IP Address

Command format: GET●/MANAGEMENT/NETWORK.IpAddress

Response format: pr●/MANAGEMENT/NETWORK.IpAddress=<IP_address>

Example:

```
> GET /MANAGEMENT/NETWORK.IpAddress
< pr /MANAGEMENT/NETWORK.IpAddress=192.168.0.101
```

9.13.2. Set a Dynamic IP Address

Command format: SET●/MANAGEMENT/NETWORK.DhcpEnabled=true|false

Response format: pw●/MANAGEMENT/NETWORK.DhcpEnabled=true|false

Example:

```
> SET /MANAGEMENT/NETWORK.DhcpEnabled=true
< pw /MANAGEMENT/NETWORK.DhcpEnabled=true
```

9.13.3. Set a Static IP Address

ATTENTION!
To set a static IP address set the DhcpEnabled node to ***false*** *– see the previous section.*

IP Address Setting

Command format: SET●/MANAGEMENT/NETWORK.StaticIpAddress=<IP_address>

Response format: pw●/MANAGEMENT/NETWORK.StaticIpAddress=<IP_address>

Example:

```
> SET /MANAGEMENT/NETWORK.StaticIpAddress=192.168.0.80
< pw /MANAGEMENT/NETWORK.StaticIpAddress=192.168.0.80
```

Subnet Mask Setting

Command format: SET●/MANAGEMENT/NETWORK.StaticNetworkMask=<Net_mask>

Response format: pw●/MANAGEMENT/NETWORK.StaticNetworkMask=<Net_mask>

Example:

```
> SET /MANAGEMENT/NETWORK.StaticNetworkMask=255.255.0.0
< pw /MANAGEMENT/NETWORK.StaticNetworkMask=255.255.0.0
```

Gateway Setting

Command format: SET●/MANAGEMENT/NETWORK.StaticGatewayAddress=<Gateway_address>

Response format: pw●/MANAGEMENT/NETWORK.StaticGatewayAddress=<Gateway_address>

Example:

```
> SET /MANAGEMENT/NETWORK.StaticGatewayAddress=192.168.0.1
< pw /MANAGEMENT/NETWORK.StaticGatewayAddress=192.168.0.1
```

9.14. EDID Management

9.14.1. Query the Emulated EDIDs

Command format: GET●/EDID.EdidStatus

Response format: pr●/EDID.EdidStatus=<E1_EDID>;<E2_EDID>;...;<E8_EDID>

Legend: E1..E8: the emulated EDID on each input port.

Example:

```
> GET /EDID.EdidStatus
< pr /EDID.EdidStatus=U1;U1;D2;D2;F49;F49;F49;F49
```

Explanation: The U1 (User memory) EDID is emulated on Input1 and Input 2. Dynamic (D2) EDID is emulated on Input3 and Input4, and F49 (Factory) EDID is emulated on the other input ports.

9.14.2. Set the Emulated EDID

Command format: CALL●/EDID:switch(<Source>:<Destination>)

Response format: mO●/EDID:switch=

Legend: <source>: Source EDID memory place (F# / D# / U#).

<destination>: The emulated EDID memory of the desired input port (E1..E8).

More than one emulation can be set at the same time by using semicolons (see **Example2**).

Example1:

```
> CALL /EDID:switch(U1:E4)
< mO /EDID:switch=
```

Example2:

```
> CALL /EDID:switch(F49:E1;F29:E5)
< mO /EDID:switch=
```

9.14.3. Copy an EDID into Another Slot

ATTENTION!
The (User) EDID memory slot will be overwritten without notification even if it was not empty.

Command format: CALL●/EDID:copy(<Source>:<Destination>)

Response format: mO●/EDID:copy=

Legend: <source>: Source EDID memory place (F# / D# / U#).

<destination>: The desired User EDID memory slot (U1..U100).

Many copy operations can be performed at the same time by using semicolons (see **Example2**).

Example1:

```
> CALL /EDID:copy(D2:U2)
< mO /EDID:copy=
```

Example2:

```
> CALL /EDID:copy(D2:U5;D3:U6)
< mO /EDID:copy=
```

9.15. LW3 Commands – Quick Summary

System Commands

	Operation / Path
9.5.1	Query the Product Name
	/.ProductName
9.5.2	Set the Device Label
	/MANAGEMENT/UID/DeviceLabel=<Custom_name>
9.5.3	Query the Serial Number
	/.SerialNumber
9.5.4	Resetting the Matrix
	/SYS:softReset()
9.5.5	Restore the Factory Default Settings
	/SYS:factoryDefaults()
9.5.6	Switch to Standby Mode
	/MANAGEMENT/POWER:standby()
9.5.7	Switch to Normal Mode
	/MANAGEMENT/POWER:wakeUp()

Switching and Crosspoint Settings

	Operation / Path
9.6.1	Query the Video Crosspoint State
	/MEDIA/XP/VIDEO.DestinationConnectionStatus
9.6.2	Switching an Input to an Output
	/MEDIA/XP/VIDEO:switch(<In>:<Om>)
9.6.3	Switching an Input to All Outputs
	/MEDIA/XP/VIDEO:switchAll(<In>)
9.6.4	Multiple Switching
	/MEDIA/XP/VIDEO:switchMulti(<O1_source>;<O2_source>;...;<O8_source>)

Video Input Port Settings

	Operation / Path
9.7.1	The Status of the Input Ports
	/MEDIA/XP/VIDEO.SourcePortStatus
9.7.2	Mute an Input Port
	/MEDIA/XP/VIDEO:muteSource(<In>)
9.7.3	Unmute an Input Port
	/MEDIA/XP/VIDEO:unmuteSource(<In>)
9.7.4	Lock an Input Port
	/MEDIA/XP/VIDEO:lockSource(<In>)
9.7.5	Unlock an Input Port
	/MEDIA/XP/VIDEO:unlockSource(<In>)
9.7.6	HDCP Setting
	/MEDIA/PORTS/VIDEO/<In>/SETTINGS.HdcpVersion=0|1|2|3

Preset Handling

Operation / Path	
9.8.1	Create a New Preset
	/MEDIA/PRESET:create(<Preset_name>,VIDEO)
9.8.2	Save the Settings to an Existing Preset
	/MEDIA/PRESET/<Pres_name>:save(1)
9.8.3	Load a Preset
	/MEDIA/PRESET/<Pres_name>:load(1)
9.8.4	Rename a Preset
	/MEDIA/PRESET:rename(<Old_name>,<New_name>)

Audio Input Port Settings

Operation / Path	
9.9.1	Audio Mode Setting
	/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO.AudioMode=OFF|HDMI|ANALOG
9.9.2	Analog Audio Input Level Settings
	/MEDIA/PORTS/VIDEO/<In>/ANALOGAUDIO

Video Output Port Settings

Operation / Path	
9.10.1	The Status of the Output Ports
	/MEDIA/XP/VIDEO.DestinationPortStatus
9.10.2	Signal Type (HDMI mode)
	/MEDIA/PORTS/VIDEO/<On>/SETTINGS.ForcedSignalType=DVI|HDMI|AUTO
9.10.3	Mute an Output
	/MEDIA/XP/VIDEO:muteDestination(<On>)
9.10.4	Unmute an Output
	/MEDIA/XP/VIDEO:unmuteDestination(<On>)
9.10.5	Lock an Output
	/MEDIA/XP/VIDEO:lockDestination(<On>)
9.10.6	Unlock an Output
	/MEDIA/XP/VIDEO:unlockDestination(<On>)
9.10.7	Conversion Mode
	/MEDIA/PORTS/VIDEO/<On>/SETTINGS.Conversion=OFF|420|LEFT|RIGHT
9.10.8	Scrambling
	/MEDIA/PORTS/VIDEO/<On>/SETTINGS.ForcedScrambling=AUTO|ON|OFF
9.10.9	HDCP Setting (Output Port)
	/MEDIA/PORTS/VIDEO/<On>/SETTINGS.HdcpMode=AUTO|ALWAYS

Audio Output Port Settings

Operation / Path	
9.11.1	Audio Mode Setting
	/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO.AudioMode
9.11.2	Analog Audio Output Level Settings
	/MEDIA/PORTS/VIDEO/<On>/ANALOGAUDIO

RS-232 Port Settings

Operation / Path	
9.12.1	Protocol Setting
	/MANAGEMENT/SERIAL.Protocol=LW2|LW3|P#2
9.12.2	Baud Rate Setting
	/MANAGEMENT/SERIAL.Baudrate=<value>

Network Settings

Operation / Path	
9.13.1	Query the Current IP Address
	/MANAGEMENT/NETWORK.IpAddress
9.13.2	Set a Dynamic IP Address
	/MANAGEMENT/NETWORK.DhcpEnabled
9.13.3	Set a Static IP Address
	/MANAGEMENT/NETWORK.StaticIpAddress

EDID Management

Operation / Path	
9.14.1	Query the Emulated EDIDs
	/EDID.EdidStatus
9.14.2	Set the Emulated EDID
	/EDID:switch(<Source>:<Destination>)
9.14.3	Copy an EDID into Another Slot
	/EDID:copy(<Source>:<Destination>)

10. Firmware Upgrade

The matrix switcher can be upgraded by using the Lightware Device Updater (LDU) software over LAN. The application and the User's manual can be downloaded from www.lightware.eu. In order to get the firmware pack with the necessary components (*.lfp file) for your specific product, please contact support@lightware.eu.

10.1. About the Firmware Package (LFP File)

The firmware files are packed in an LFP package. You need only this file to do the upgrade on your device.

- This allows using the same LFP package for different devices.
- The package contains all the necessary components, binary, and other files; You do not have to get further files.
- There is a descriptor file in the package that contains each firmware with version number and a list showing the compatible devices. The descriptor is displayed after loading the LFP file in the LDU.

10.2. Short Instructions

Step 1. Get the firmware pack and the Lightware Device Updater (LDU) application.

Step 2. Install the LDU application.

Step 3. Establish the connection between the computer and the device(s).

Step 4. Start the LDU and follow the instructions shown on the screen.

10.3. Install and Upgrade

Installation for Windows

INFO
The application can be installed under Windows XP or above.

Run the installer. If the User Account Control displays a pop-up message click **Yes**. During the installation you will be prompted to select the type of the installation:

Normal install	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 versions can be installed for all users

Comparison of install types

ATTENTION!
Using the Normal install as the default value is highly recommended.

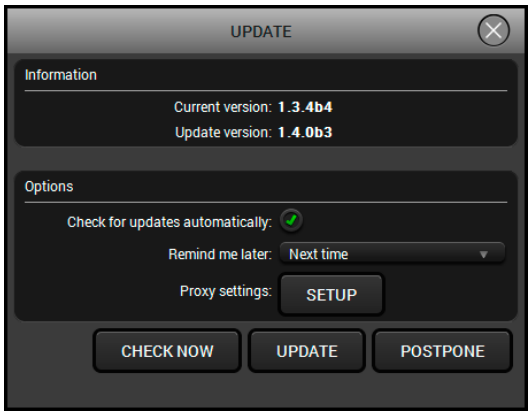
Installation for Mac OS X

INFO
The Windows and the Mac application has the same look and functionality.

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

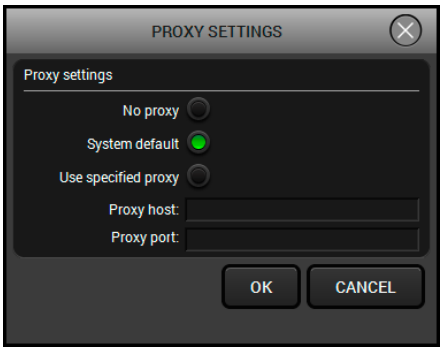
LDU Upgrade

Step 1. Run the application. In the welcome screen click on the ? button in the top right corner; the About window will appear. Click on the **Check now** button. The program checks for available updates on the Lightware website and shows the available version.



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

- If you do not want to check for updates automatically, uncheck the **Check for updates automatically** option.
- If you want to postpone the update, a reminder can be set with different delays from the **drop down list**.
- If the proxy settings do not range with the required settings, set the proper values then click the **OK** button.



Step 3. Press the **Update** button to download the new version; the installer will start.

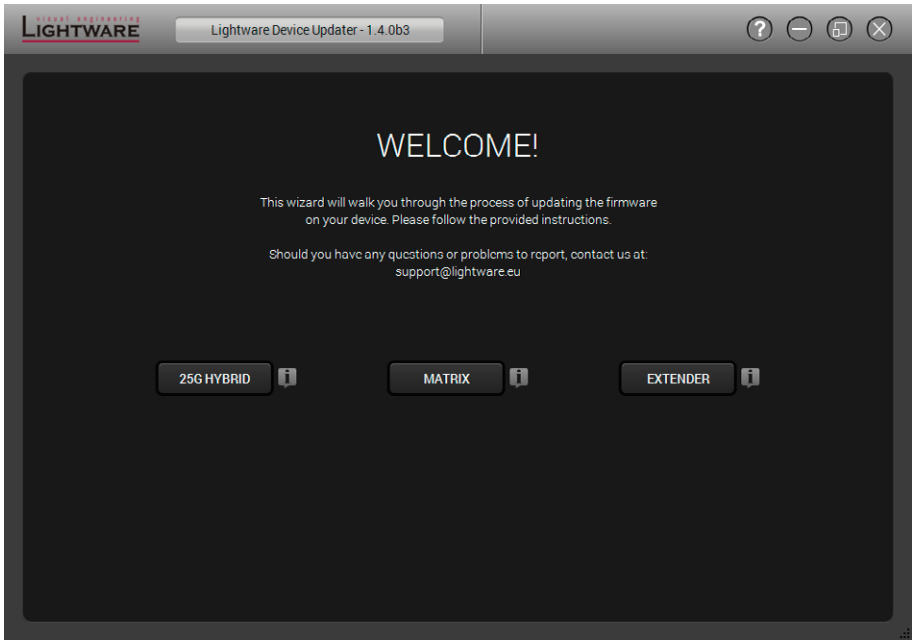
10.4. Detailed Instructions

10.4.1. Establish the Connection between the Computer and the Device

Make sure that the computer and the device are connected via an Ethernet cable and the connection is established between them.

10.4.2. Start the LDU and Follow the Instructions

After launching LDU welcome screen appears:

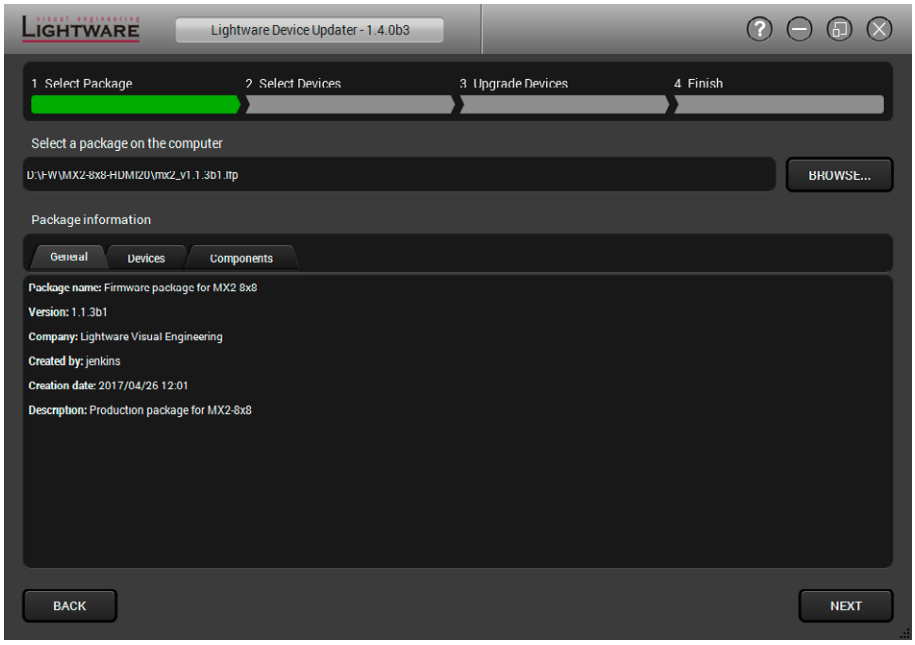


After pressing the i button a list will appear showing the supported devices:

Click on the **Extender** button on the main screen.

Step 1. Select the package.

Click on the Browse button and select the ".lfp" file that will be used for the upgrade.

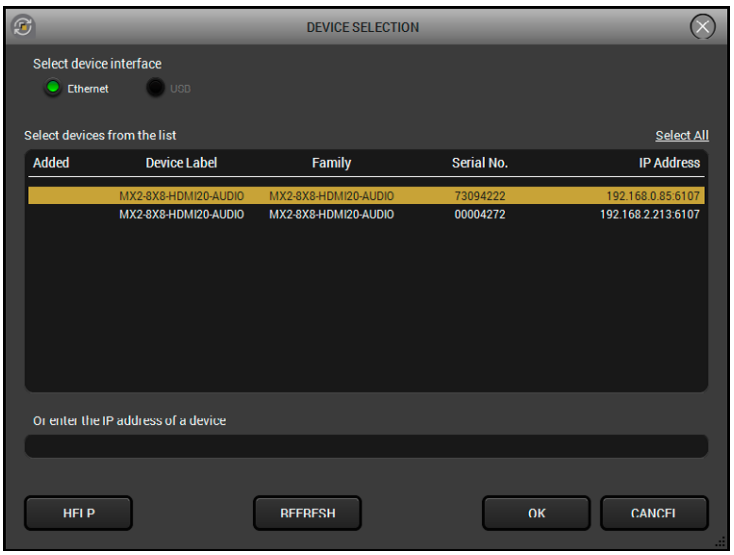


The package information is displayed:

- **General** version info, creation date, short description,
- **Devices** which are compatible with the firmware,
- **Components** in the package with release notes.

TIPS AND TRICKS
Files with ".lfp" extension are associated to LDU during installation. If you double click on the ".lfp" file, the application is launched, the package is loaded automatically and the screen above is shown.

Step 2. Select the device.

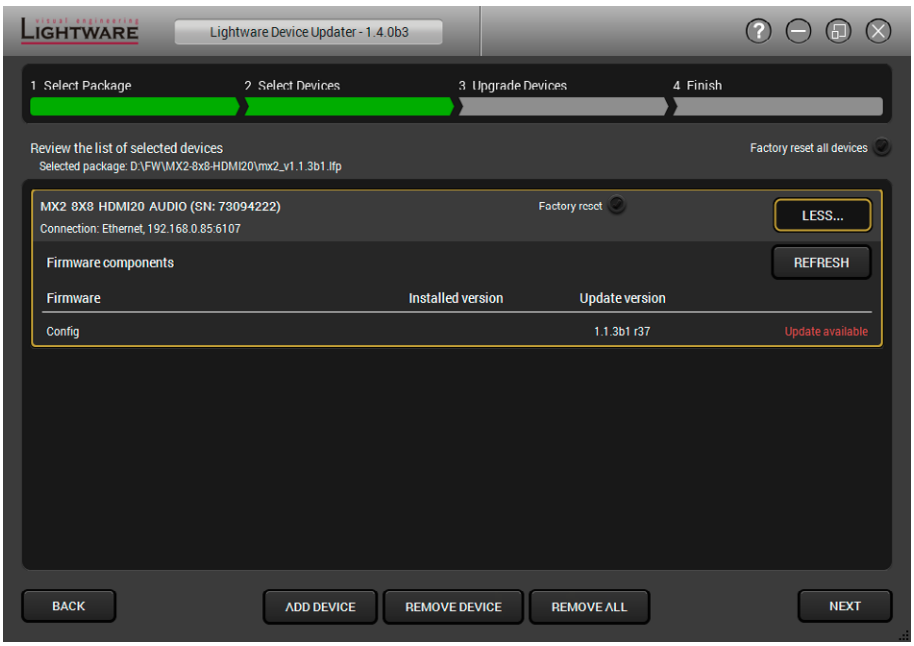


The next step is to select the desired device(s). The available and supported devices are searched for and listed automatically. If the desired device is not listed, update the list by clicking the **Refresh** button. Select the desired device by highlighted them: highlight them with a **yellow cursor,** then click **OK**.

A tick mark can be seen in the **Added** column if the device was added by the user previously.

Firmware Components

The components of the installed and update firmware version for the selected devices are listed on the following screen. (Update version will be uploaded to the device.)



Add a device by clicking on the **Add device** button. The previous screen will be shown; select the desired device(s) and click **OK**.

Remove a device by selecting it (highlight with yellow) and clicking on the **Remove device** button, or by clicking on **Remove all** button to clear the list.

Enabling **Factory reset** will perform factory default values for all settings in the device. Three different status can exist:

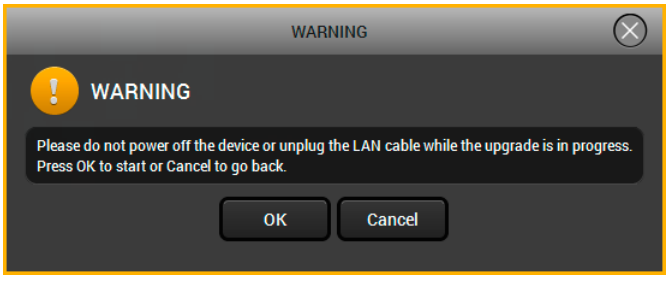
- **Enabled by user**: all settings will set to factory default values.
- **Disabled by user**: your settings will be saved and restored after upgrading.
- **Enabled by default and not changeable by user**: firmware upgrade must perform a factory reset to apply all changes coming with the new firmware version.

Click on the **Next** button to continue.

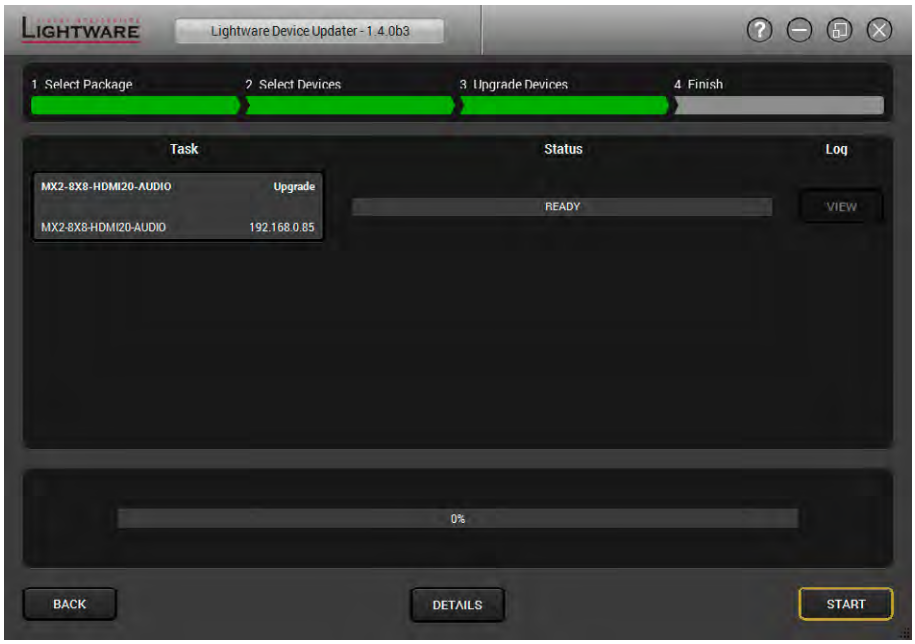
Step 3. Upgrade the device.

A warning window will pop up before upgrading the device:

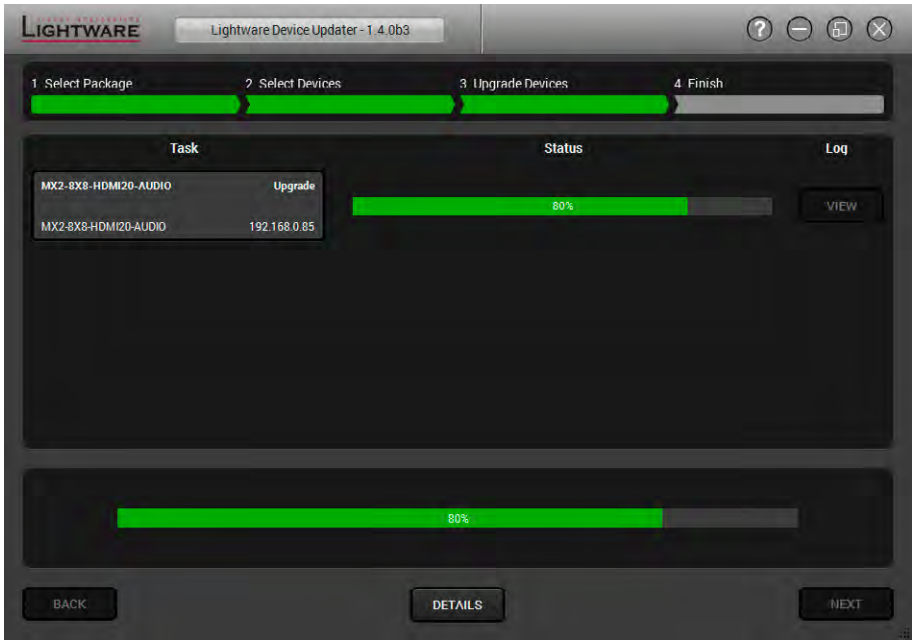
- Do not unplug the power cable and the LAN cable while the upgrade is in progress. Click **OK** to continue.



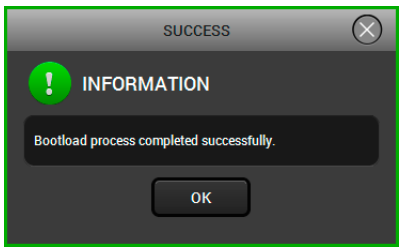
Click on the **Start** button to start the upgrade process.



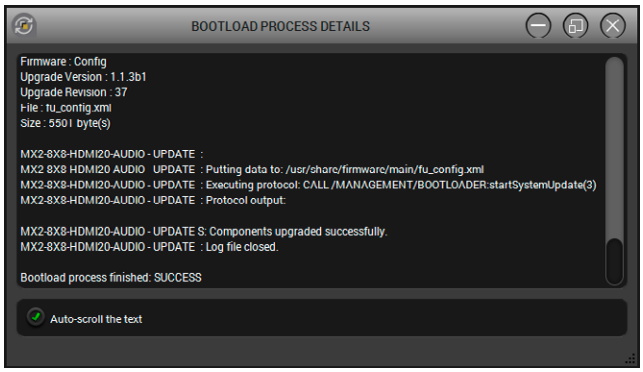
After you confirmed the warnings and clicked on the Start button, the upgrade process starts immediately.



When the upgrade process is done once, a pop-up window appears which means the procedure was successful. Click **OK** to continue.

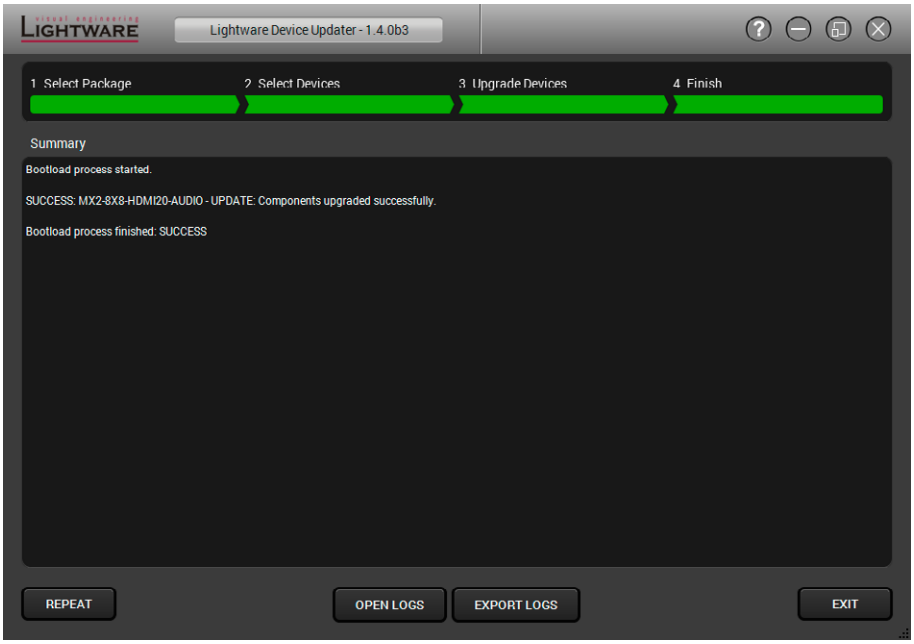


Details button opens a new window where the process is logged – see below.



Step 4. Finish.

If the upgrade of a device is finished, the log can be opened by the **View** button on the right. When all the tasks are finished, a window appears. Click **OK** to close and **Next** to display the summary page.



Clicking on the **Repeat** button starts the process again with the selected device(s).

The **Open logs** button opens the temporary folder where the logs can be found.

Export logs by saving the files as a zipped file.

Press **Exit** to close the program.

If the upgrade fails, the progress bar of the device turns to red. Restart the device and repeat the process.

Post Operation of the Upgrade in the Matrix

After the part of LDU software upgrade process is finished, the matrix starts the self-upgrade procedure. It is an automatic action and no any user interruption is needed during the operation. The crosspoint buttons show the status of the process.

When all the 16 buttons light in green, the upgrade is finished and the device restarts.

11. 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.

At first, check front panel LEDs and take the necessary steps according to their states. For more information about front and rear panel LEDs of the matrix refer to section 3.1 on page 14 and section 3.2 on page 15.

Pictogram Legend

- Section to connections/cabling.
- Section to front panel operation.
- Section to LDC software.
- Section to LW2 protocol commands.
- Section to LW3 protocol commands.

Symptom	Root cause	Action	Refer to
Video signal			
No picture on the video output	Device(s) not powered properly	Check the matrix and the other devices if they are properly powered; try to unplug and reconnect them.	3.3
	Cable connection problem	Cables must fit very well, check all the connectors.	3.3
	No incoming signal	No video signal is present on the HDMI input ports. Check the source device and the HDMI cables.	3.3
	Not the proper video port is the active one	Check the video crosspoint settings.	5.2.1 7.3 8.3.4 9.6.1
	Not the proper interface is the active one	If the source/display has more connectors, check if the proper interface is selected.	
	Output port is muted	Check the mute state of output ports.	7.4.2 8.3.5 9.10.1
	Display is not able to receive the video format	Check the emulated EDID and select another (e.g. emulate the display's EDID on the input port).	5.3.4 7.6 9.14
	HDCP is disabled	Enable HDCP on input port(s) of the matrix.	7.4.1 9.7.6

Symptom	Root cause	Action	Refer to
Audio signal			
No audio is present on output	Other audio port is switched to the output	Check the audio crosspoint settings.	5.2 7.3.1 8.3.4 9.9.1
	Output port is muted	Check the output port properties.	5.3.3 7.4.2 8.3.5 9.10.1
	Analog audio input: volume is set very low	Check the Analog audio input port settings (Volume).	5.3.2 7.4.1 9.9.2
	Analog audio output: volume is set very low	Check the Analog audio output port settings (Volume).	5.3.3 7.4.2 9.11.2
HDMI output signal contains no audio	HDMI mode was set to DVI	Check the properties of the output port and set to HDMI or Auto.	5.3.3 7.4.2 9.10.2
	DVI EDID is emulated	Check the EDID and select an HDMI EDID to emulate.	5.3.4 7.6 9.14
RS-232 signal			
Connected serial device cannot be controlled	Cable connection problem	Check the connectors to fit well; check the wiring of the plugs.	3.3
	Serial settings are different	Check the port settings of the matrix and the connected serial device(s). Pay attention to link and/or local ports.	7.7.3 9.12
Ethernet			
No LAN connection can be established	Incorrect IP address is set (direct connect)	Disable DHCP server and set the IP addresses to be in the same subnet.	7.7.2 9.13
		Restore the factory default settings (with fix IP).	7.7.5 9.5.5
	IP address conflict	Change the IP address to a not reserved one or enable DHCP if DHCP server exists in the network.	5.3.1 7.7.2 9.13

12. Appendix

12.1. Specifications

General

Compliance ..... CE
EMC compliance (emission) ..... EN 55032:2015
EMC compliance (immunity) ..... EN 55024:2011
RoHS compliance ..... Yes
Warranty ..... 3 years
Cooling ..... by cooling fans, air flows from front to rear
Operating temperature ..... 0 to +55 °C (+32 to +122°F)
Operating humidity ..... 10% to 90%, noncondensing

Power

Power source ..... 100-240V AC, 50~60Hz
Power consumption (standby mode / typical / max) ..... 10 W / 50 W / 75 W

Enclosure

Front panel buttons ..... Yes
Display ..... Color LCD (320x240 pixels)
Rack mountable ..... Yes, 1U high (rack ears supplied)
Material ..... 1 mm steel
Dimensions in mm ..... 442 (482*) W x 43.7 H x 177.5 D
Dimensions in inch ..... 17.4 (18.9*) W x 1.72 H x 6.9 D
Weight ..... 3210 g

* with rack-mounting ears

RS-232 Control Port

Serial port connector ..... 3-pole Phoenix connector
Available Baud rates 9600, 19200, 38400, 57600, 115200

Video Input/Output Ports

Port connector type ..... 19-pole HDMI type A receptacle (500 mA on pin 18)
Standard ..... DVI 1.0, HDMI 1.4, HDMI 2.0
Max. video resolution ..... 4096x2160@60Hz at RGB 4:4:4 (up to 600MHz pixel clock)
Audio formats ..... all formats in line with HDMI 2.0 standard
Reclocking ..... Pixel Accurate Reclocking
HDCP compliant ..... Yes, HDCP 2.2

Audio Input/Output Ports

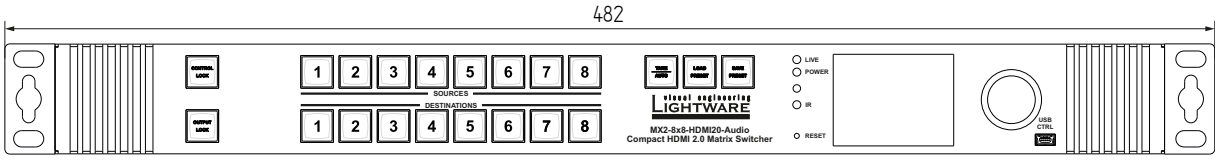
Signal transmission ..... Balanced or Unbalanced audio
Gain (input) ..... from -12dB to +35 dB

EDID management

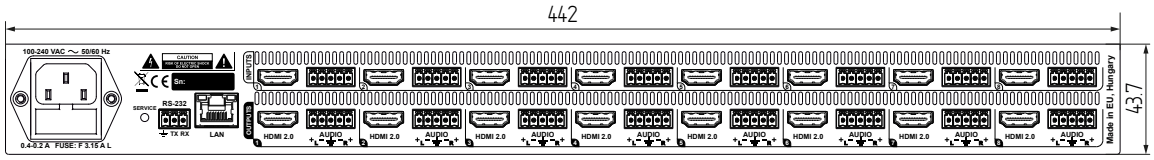
EDID emulation ..... Yes
EDID memory ..... 144 factory presets, 100 user-programmable

12.2. Mechanical Drawings

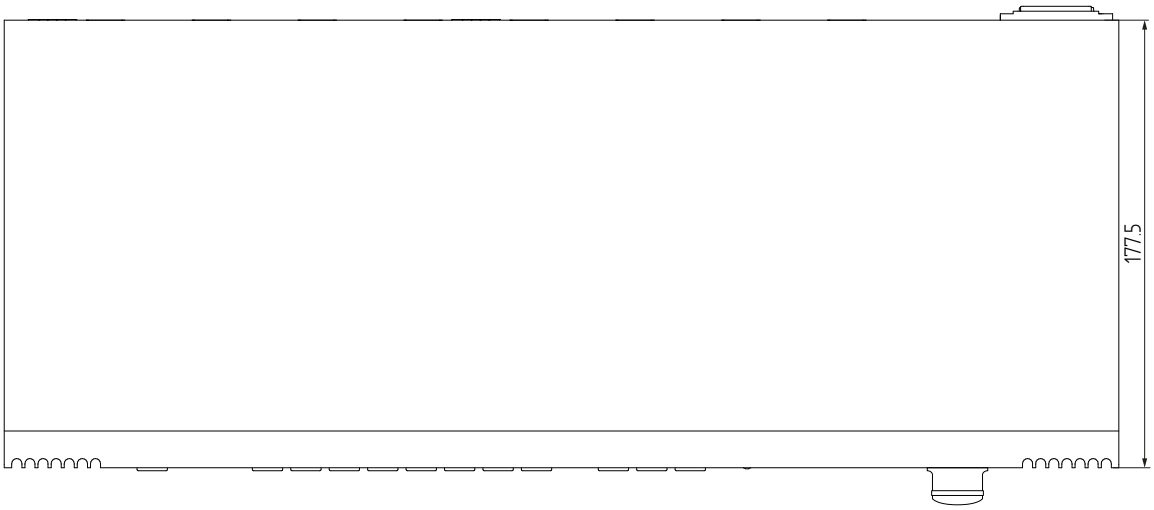
Front view



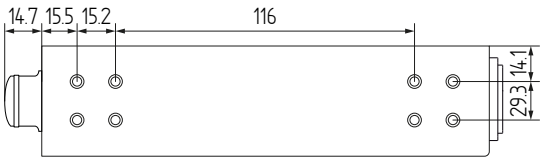
Rear view



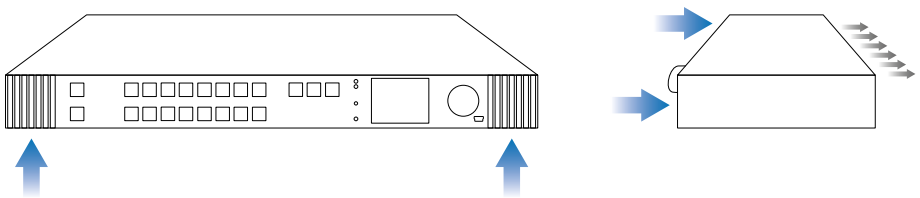
Top view



Side view



Direction of the airflow



ATTENTION!

The ventilators are controlled automatically according to the internal temperature of the device and cannot be adjusted manually by the user.

12.3. Factory EDID List

Mem.	Resolution	Type
F1	640 x 480 @ 60.00 Hz	DVI
F2	848 x 480 @ 60.00 Hz	DVI
F3	800 x 600 @ 60.32 Hz	DVI
F4	1024 x 768 @ 60.00 Hz	DVI
F5	1280 x 768 @ 50.00 Hz	DVI
F6	1280 x 768 @ 59.94 Hz	DVI
F7	1360 x 768 @ 75.00 Hz	DVI
F8	1360 x 768 @ 60.02 Hz	DVI
F9	1280 x 1024 @ 50.00 Hz	DVI
F10	1280 x 1024 @ 60.02 Hz	DVI
F11	1280 x 1024 @ 75.02 Hz	DVI
F12	1400 x 1050 @ 50.00 Hz	DVI
F13	1400 x 1050 @ 60.00 Hz	DVI
F14	1400 x 1050 @ 75.00 Hz	DVI
F15	1680 x 1050 @ 60.00 Hz	DVI
F16	1920 x 1080 @ 50.00 Hz	DVI
F17	1920 x 1080 @ 60.00 Hz	DVI
F18	2048 x 1080 @ 50.00 Hz	DVI
F19	2048 x 1080 @ 60.00 Hz	DVI
F20	1600 x 1200 @ 50.00 Hz	DVI
F21	1600 x 1200 @ 60.00 Hz	DVI
F22	1920 x 1200 @ 50.00 Hz	DVI
F23	1920 x 1200 @ 59.56 Hz	DVI
F24	2048 x 1200 @ 59.96 Hz	DVI
F25-F28	Reserved	
F29	Universal DVI EDID	
F30	1440 x 480i @ 60.05 Hz	HDMI
F31	1440 x 576i @ 50.08 Hz	HDMI
F32	640 x 480 @ 59.95 Hz	HDMI
F33	720 x 480 @ 59.94 Hz	HDMI
F34	720 x 576 @ 50.00 Hz	HDMI
F35	1280 x 720 @ 50.00 Hz	HDMI
F36	1280 x 720 @ 60.00 Hz	HDMI
F37	1920 x 1080i @ 50.04 Hz	HDMI
F38	1920 x 1080i @ 50.00 Hz	HDMI
F39	1920 x 1080i @ 60.05 Hz	HDMI
F40	1920 x 1080i @ 60.05 Hz	HDMI
F41	1920 x 1080 @ 24.00 Hz	HDMI
F42	1920 x 1080 @ 25.00 Hz	HDMI
F43	1920 x 1080 @ 30.00 Hz	HDMI
F44	1920 x 1080 @ 50.00 Hz	HDMI
F45	1920 x 1080 @ 60.00 Hz	HDMI
F46	1920 x 1080 @ 60.00 Hz	HDMI
F47	Universal HDMI EDID; PCM audio	
F48	Universal HDMI EDID; all audio	

Mem.	Resolution	Type
F49	Universal HDMI EDID; all audio, deep color	
F50-F97	Reserved	
F98	1280 x 720 @ 60.00 Hz	HDMI
F99	1920 x 1080 @ 60.00 Hz	HDMI
F100	1024 x 768 @ 60.00 Hz	HDMI
F101	1280 x 1024 @ 50.00 Hz	HDMI
F102	1280 x 1024 @ 60.02 Hz	HDMI
F103	1280 x 1024 @ 75.02 Hz	HDMI
F104	1600 x 1200 @ 50.00 Hz	HDMI
F105	1600 x 1200 @ 60.00 Hz	HDMI
F106	1920 x 1200 @ 59.56 Hz	HDMI
F107	2560 x 1440 @ 59.95 Hz	HDMI
F108	2560 x 1600 @ 59.86 Hz	HDMI
F109	3840 x 2400 @ 24.00 Hz	HDMI
F110	3840 x 2160 @ 24.00 Hz	HDMI
F111	3840 x 2160 @ 25.00 Hz	HDMI
F112	3840 x 2160 @ 30.00 Hz	HDMI
F113-F117	Reserved	
F118	Universal HDMI EDID; 4K, PCM audio	
F119	Universal HDMI EDID; 4K, all audio	
F120	3840 x 2160 @ 60.00 Hz	HDMI
F121	1440 x 1080 @ 59.91 Hz	HDMI
F122	2560 x 2048 @ 59.98 Hz	HDMI
F123	1280 x 800 @ 59.91 Hz	HDMI
F124	1440 x 900 @ 59.90 Hz	HDMI
F125	1368 x 768 @ 59.85 Hz	HDMI
F126	1600 x 900 @ 59.98 Hz	HDMI
F127	2048 x 1080 @ 60.00 Hz	HDMI
F128	2560 x 1080 @ 60.00 Hz	HDMI
F129	3440 x 1440 @ 24.99 Hz	HDMI
F130	3440 x 1440 @ 29.99 Hz	HDMI
F131	4096 x 2160 @ 25.00 Hz	HDMI
F132	4096 x 2160 @ 30.00 Hz	HDMI
F133	4096 x 2160 @ 60.00 Hz	HDMI
F134	3440 x 1440 @ 23.99 Hz	HDMI
F135	4096 x 2160 @ 24.00 Hz	HDMI
F136	3840 x 2400 @ 29.99 Hz	HDMI
F137	3840 x 2160 @ 60.00 Hz	HDMI 2.0
F138	3840 x 2160 @ 50.00 Hz	HDMI 2.0
F139	Universal HDMI 2.0 EDID; UHD, PCM audio	
F140	Universal HDMI 2.0 EDID; UHD, all audio	
F141	4096 x 2160 @ 60.00 Hz	HDMI 2.0
F142	4096 x 2160 @ 50.00 Hz	HDMI 2.0
F143	Universal HDMI EDID; 4K, PCM audio	
F144	Universal HDMI EDID; 4K, all audio	

12.4. Factory Default Settings

Parameter	Setting / Value
Network Settings	
IP address	Dynamic (DHCP is enabled)
RS-232 Port	
Port setting	57600 BAUD, 8, N, 1
Control protocol	LW3 protocol
Video Input/Output Ports	
Crosspoint setting	Input 1 on all outputs
HDCP mode	Input port: enabled (v1.4) Output port: Auto
Color space / color range	Auto / Auto
Video conversion	Off
Scrambling	Auto
TMDS clock rate	Auto
HDMI mode	Auto
Emulated EDID	F49 - (Universal HDMI, all audio formats with deep color support) on all inputs
Presets (saved by the User)	Erased
Audio Input/Output Ports	
Audio source	Embedded audio
Analog audio output	Enabled (de-embedding from HDMI signal)
Analog Audio Input Levels	Balance: 0 (center) Gain: 0 dB
Analog Audio Output Levels	Balance: 0 (center) Volume: 0 dB

13. Document Revision History

Document	Release date	Changes	Editor
Rev. 1.0	20-12-2016	Initial Version	Laszlo Zsedenyi
Rev 1.1	21-02-2017	"Installation and Controls" chapter splitted; Mounting options extended; HDCP v2.2 support: Technologies, Front panel and LDC chapters updated; Preset handling added (Front panel LCD, LW3 Prog. ref.).	Laszlo Zsedenyi
Rev 1.2	11-07-2017	Updated safety information, updated LW3 Prog. Ref chapter, added Firmware Upgrade and Troubleshooting chapters	Tamas Forgacs
Rev 1.3	17-08-2017	Major updates for firmware v1.1.5, updated HDCP settings in LCD menu and LDC Port Properties sections, updated LW3 prog. ref. chapter	Tamas Forgacs