visual engineering

LIGHTWARE

User's Manual

MX2-8X8-HDMI20-AUDIO

Multimedia Matrix Switcher

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.

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

CAUTION	AVIS
RISK OF ELECTRIC SHOCK DO NOT OPEN RISQUE DE CHOC ELECTRIQUE NE PAS OUVRIR	
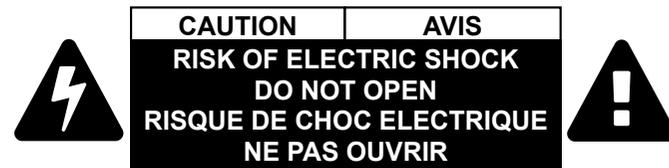
Replacing the AC fuse

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.

Waste Electrical & Electronic Equipment WEEE

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

Common Safety Symbols

Symbol	Description
∿	Alternating current
⏚	Protective conductor terminal
⚡	Caution, possibility of eletric shock
⚠	Caution

Symbol Legend

The following symbols and markings are used in the document:

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

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

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

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

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

Navigation Buttons

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

Navigate to the Table of Contents.

Step back one page.

Step forward to the next page.

Document Information

All presented functions refer to the indicated products. The descriptions have been made during testing these functions in accordance with the indicated Hardware/Firmware/Software environment:

Item	Version
Lightware Device Controller (LDC) software	1.20.0b5
Lightware Device Updater (LDU) software	1.5.0b3
Controller firmware	1.2.0b7
Hardware	1.1

Document revision: **2.4**

Release date: 12-06-2018

Editor: Laszlo Zsedenyi

Table of Contents

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 uncompressed 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 future-proof operation centers. In the first chapter we would like to introduce the device highlighting the most important features in the below listed sections:

- ▸ DESCRIPTION
- ▸ BOX CONTENTS
- ▸ FEATURES OF THE DEVICE
- ▸ TYPICAL APPLICATIONS

1.1. Description

The MX2-8x8-HDMI20-Audio is the first Lightware HDMI2.0 standalone matrix switcher that supports uncompressed 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 future-proof 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.

Model Denomination

8 input and 8 output ports   Digital audio embedding and de-embedding function

MX2-8x8-HDMI20-AUDIO

New generation of Lightware matrix switchers   HDMI 2.0 compatible

1.2. 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
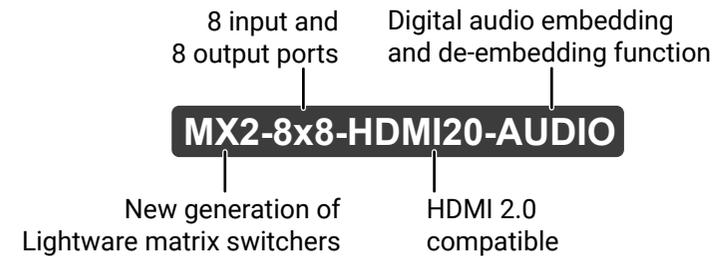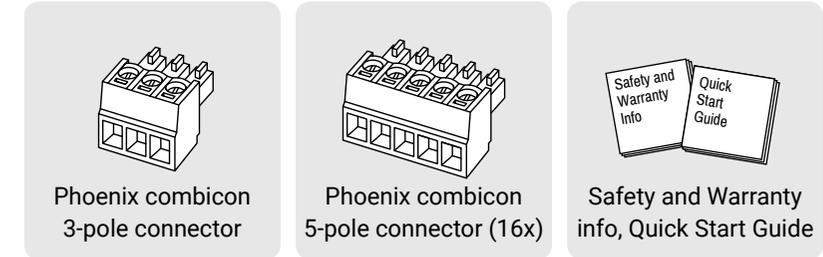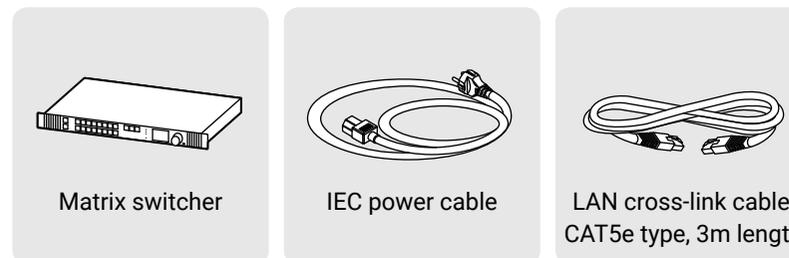
1.3. Features of the Device
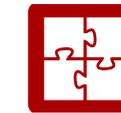
Maximum A/V Compatibility

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 color space, 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 inputs independently, read out and store any attached monitor's EDID in 100 internal memory locations, upload and download EDID files using Lightware Device Controller software.

Pixel Accurate Reclocking

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

Frame Detector and Signal Analysis

The exact video and audio signal format can be determined such as timing, frequencies, scan mode, HDCP encryption, color range, color space and audio sample rate.

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.

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.

Consumer Electronic Control

Supports transmitting standard CEC commands in order to remote control the source or sink device.

1.4. Typical Applications

The following figures show different modes of the application:
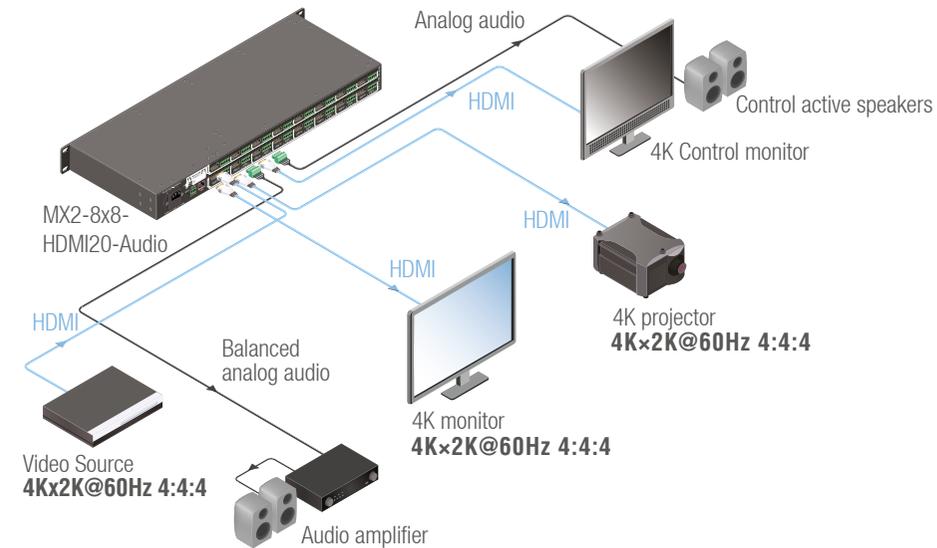
4K@60 4:4:4 Signal Routing
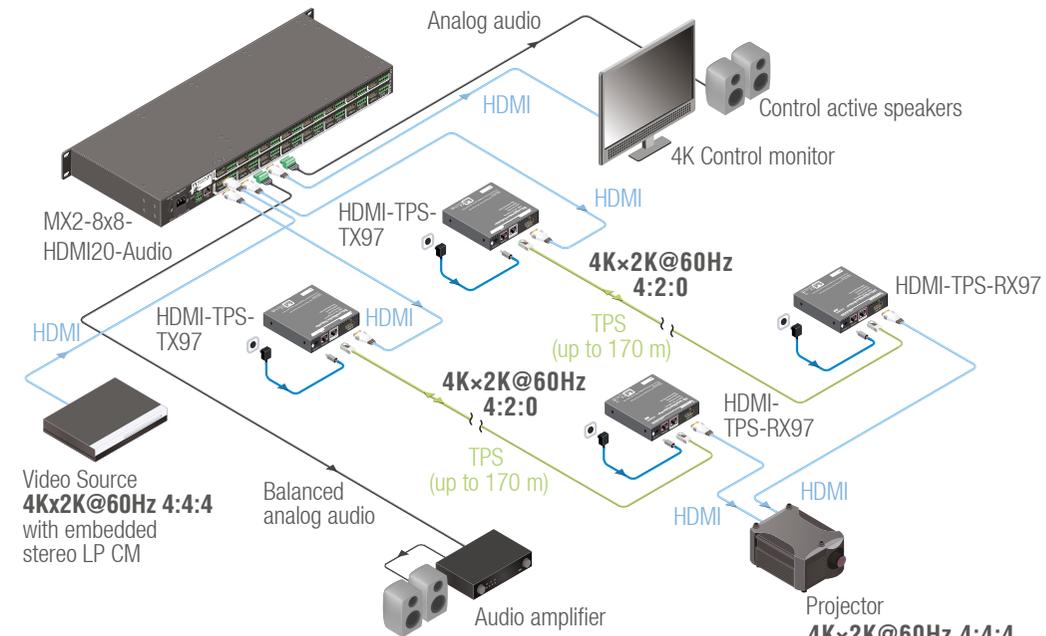
HDMI 2.0 to 2x HDMI 1.4 Splitting

2

Installation

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

- ▶ MOUNTING OPTIONS
- ▶ CONNECTING STEPS

2.1. Mounting Options

The matrix can be mounted in several ways by the supplied two rack ears. Allen head screws fix them to the housing:
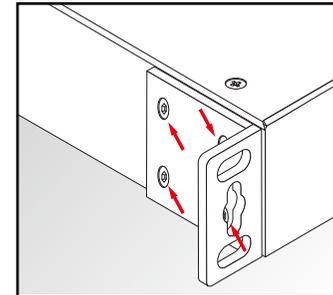
WARNING! **M4x8 size is the longest allowed screw for fixing the ears to the housing. A longer screw may touch internal parts.**

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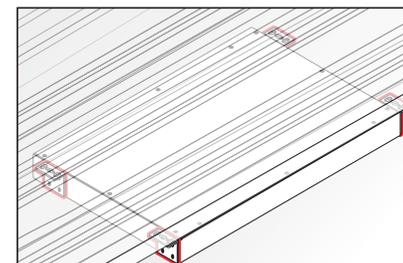
INFO: The method is the same when the matrix would be mounted to a wall.

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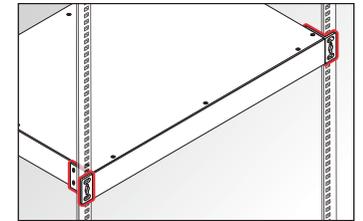
ATTENTION! Always use all the four screws for fixing the rack shelf ears to the rack rail. Choose properly sized screws for mounting. Keep minimum two thread left after the nut screw.
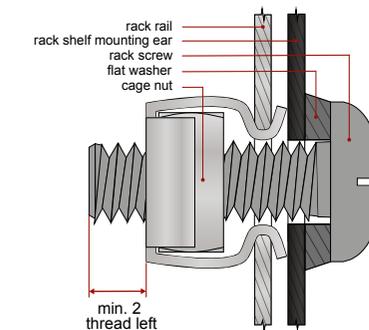
Mounting the device to the rack rail

2.2. Connecting Steps

4K PC

Media player

Power outlet

HDMI   **HDMI**   **Power**

Audio   **HDMI**   **LAN**

Audio amplifier   4K projector   Ethernet   Touch control
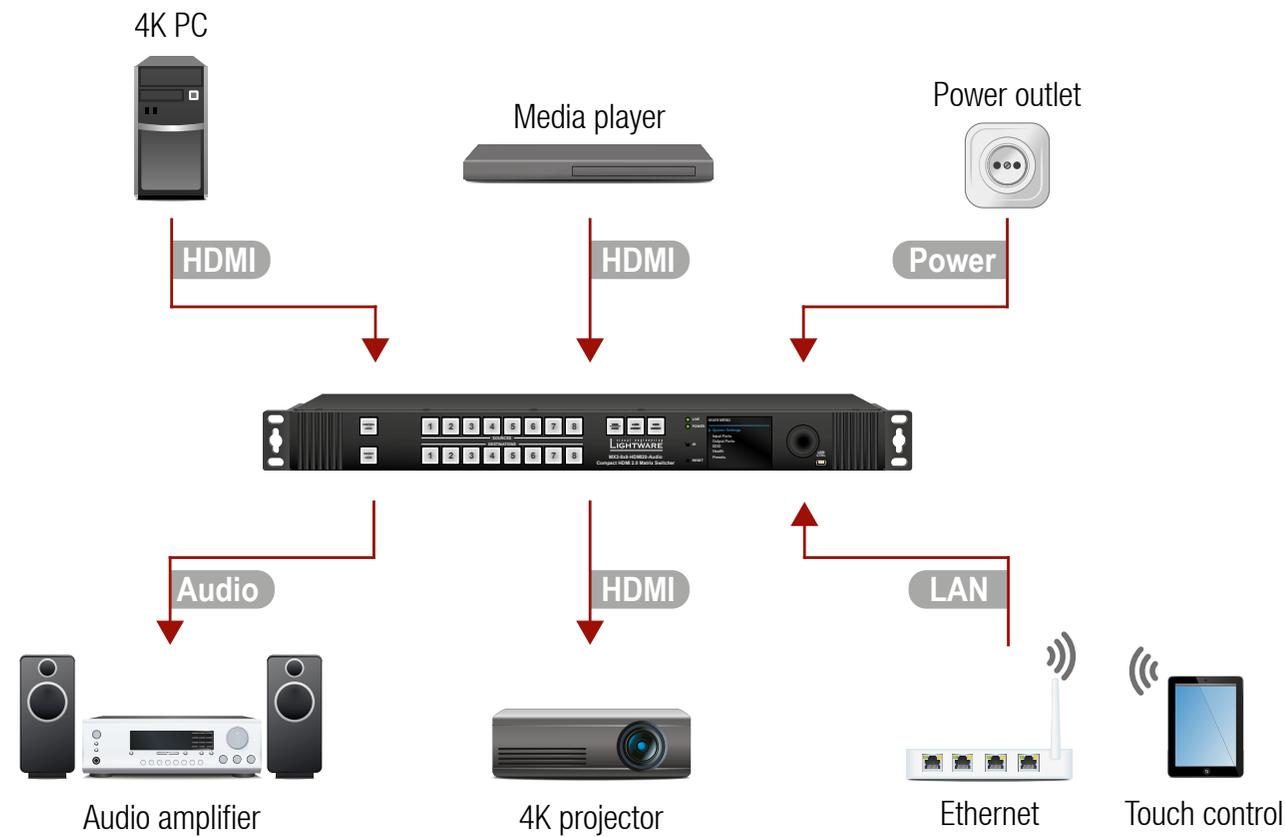
HDMI Connect the desired sources to the **HDMI input ports**.

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.

3

Product Overview

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

3.1. MX2-8x8-HDMI20-Audio - 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. MX2-8x8-HDMI20-Audio - Rear View
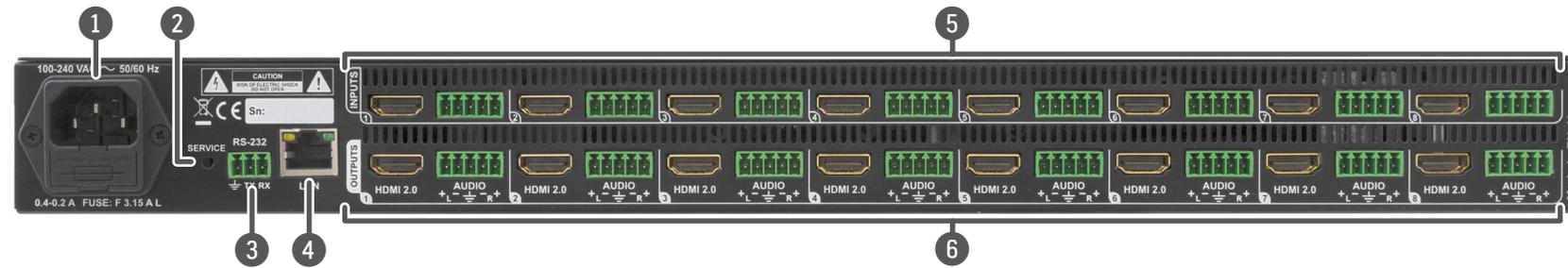
①	**AC Connector**	Standard IEC connector accepting 100-240 V, 50 or 60 Hz.
②	**Service Button**	Hidden button for special operations.
③	**RS-232 Port**	3-pole Phoenix connector for RS-232 serial port.
④	**LAN Port**	RJ45 connector to control the matrix via LAN/Ethernet.
⑤	**Input Ports**	**HDMI** input 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.

Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch), type: MC 1.5/5-ST-3.5.
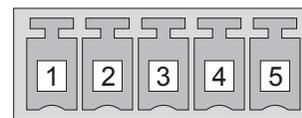
Pin nr.	Signal
1	Left +
2	Left -
3	Ground
4	Right -
5	Right +
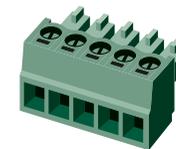
See more information about the most common audio cable wiring modes in Audio Cable Wiring Guide section.

RS-232 Port

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

Compatible Plug Type
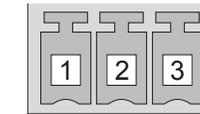
Pin nr.	Signal
1	Ground
2	Tx data
3	Rx data
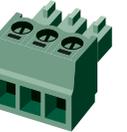
Phoenix® Combicon series (3.5mm pitch, 3-pole), type: MC 1.5/3-ST-3.5.

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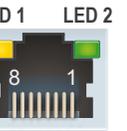
	LED 1, Amber	LED 2, Green
OFF	10 Mbps	No link
Blinking	N/A	Activity
ON	100 Mbps	Link is active

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

3.4. Port Diagram
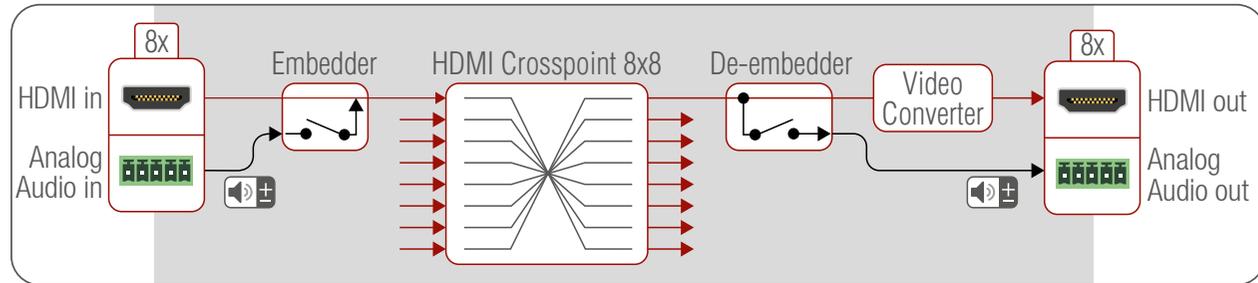
Audio Options

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.

4

Operation

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

4.1. 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.

4.2. 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.

4.2.1. 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.

4.2.2. 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.

4.2.3. 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 Input Port Properties Window section) or sending LW3 protocol command (see Locking an Input Port section).

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.

4.2.4. 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.

4.2.5. 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 Presets section for the details.

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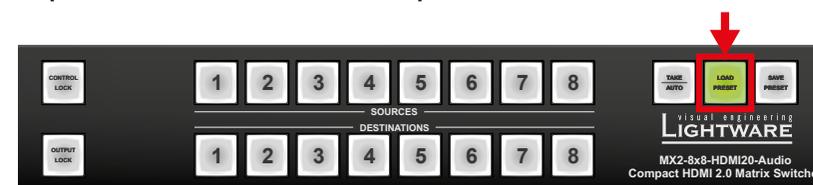
Step 2. Press and release the desired **source (memory address) button** (source 1 to 8).

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.

4.3. 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.
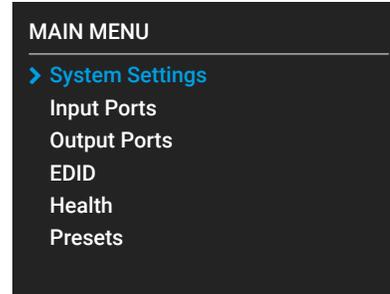
Menu Structure

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.

```
MAIN MENU
❯ System Settings
  Input Ports
  Output Ports
  EDID
  Health
  Presets
```

```
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
```

Menu navigation & change parameter

Up   Down

Menu selection & set parameter

Press
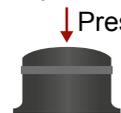
Parameter Selection

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.

```
OUTPUT MODE
⊘ Auto
○ HDMI
  DVI

« Back
```
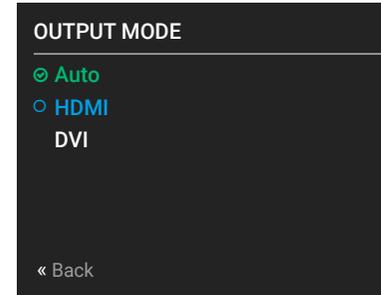
4.3.1. System Settings Menu

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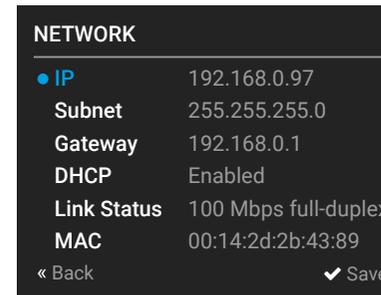
ATTENTION! If you change the network settings, always press the Save option under Network menu (not only in the submenu of the parameter) to apply the new settings.

```
NETWORK
● IP          192.168.0.97
  Subnet      255.255.255.0
  Gateway     192.168.0.1
  DHCP        Enabled
  Link Status 100 Mbps full-duplex
  MAC         00:14:2d:2b:43:89
« Back                    ✔ Save
```

RS-232 Submenu

Adjustable parameters of the port:

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

```
RS-232
❯ Control      Enabled
  Baud Rate    57600
  Protocol     LW3

« Back
```
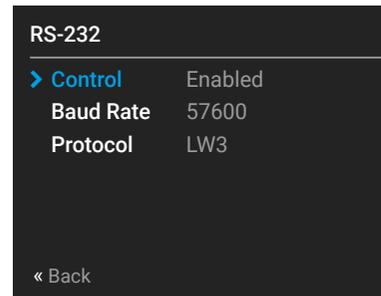
Time and Date

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 Front Panel Tab section.

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

Buzzer

There is a buzzer (beeper) 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 Grid View section).

Restore Factory Defaults

The default settings can be reloaded in this submenu, for details see Factory Default Settings.

4.3.2. 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.
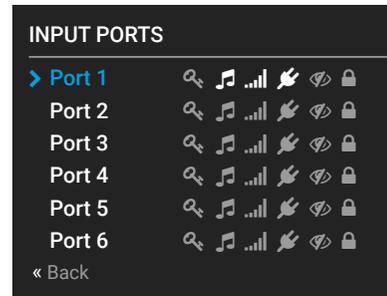
INPUT PORTS

> Port 1
Port 2
Port 3
Port 4
Port 5
Port 6

« Back

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 converted to HDCP 2.2 level encryption, thus, it cannot be switched to HDCP 1.4 sinks.

See more information about HDCP in HDCP Management section.

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.

ANALOG GAIN

🔉   5 dB   🔊

-12 -7 -3 2 7 12 16 21 26 30 35

- **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).
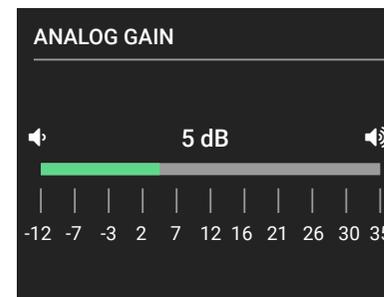
4.3.3. Output Ports Menu

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 Typical Applications section.

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 HDCP Management section.

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.

```
ANALOG VOLUME

🔈           90 %          🔊

| | | | | | | | | | |
0  10 20 30 40 50 60 70 80 90 100
```

- **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).
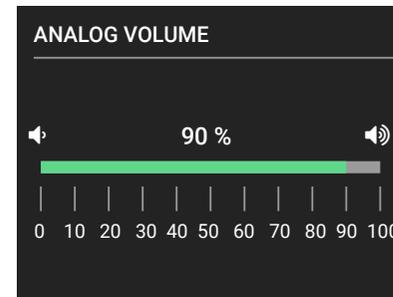
4.3.4. EDID Menu

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 EDID Management. The EDID memory structure of the device can be found in the Sources and Destinations section.

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.

4.3.5. Health Menu

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

```
CONTROL PANEL

5V        5.18
1.8V      1.82
Temp°C    31.18

« Back
```

- **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.

4.3.6. Presets Menu

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

SAVE PRESET

Button5   ⑤
Button6   ⑥
Button7   ⑦
Button8   ⑧
My_pres

« Back

> **ATTENTION!** When factory default settings are restored, presets are deleted.
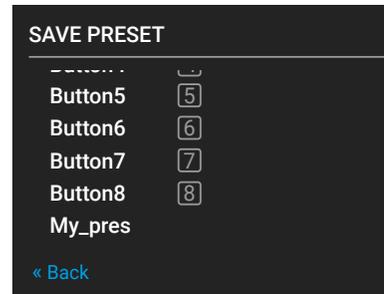
Save a Preset

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 Presets section.

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 Save or Load a Preset section.

5

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.

▸ ESTABLISHING THE CONNECTION
▸ THE LAYOUT OF THE BUILT-IN WEB

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.

5.1. 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).

5.2. 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.

MX2-8X8-HDMI20-AUDIO

ATTENTION! Please enable the pop-up windows in your browser; certain contents are displayed in a new window.
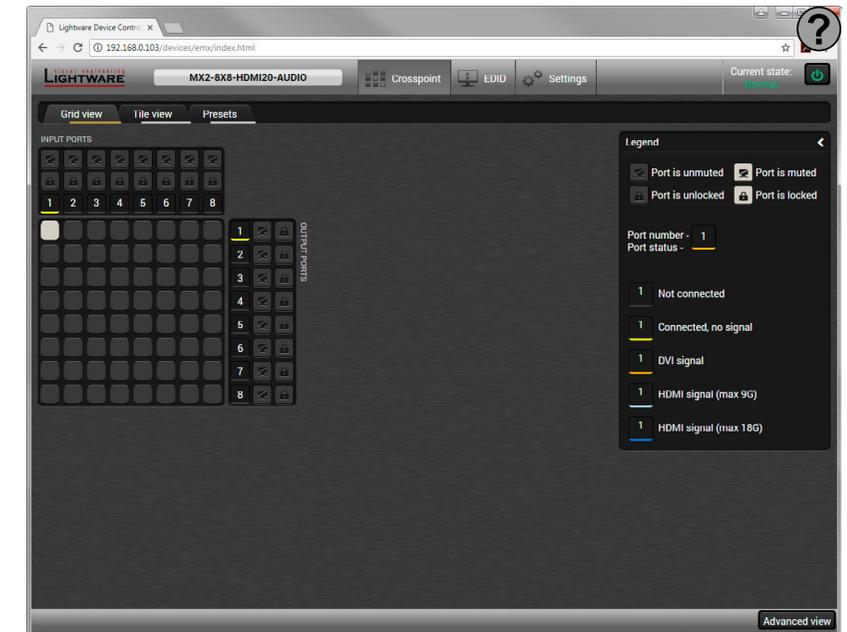
Built-in Webpage Displaying the Crosspoint Menu (Grid View)
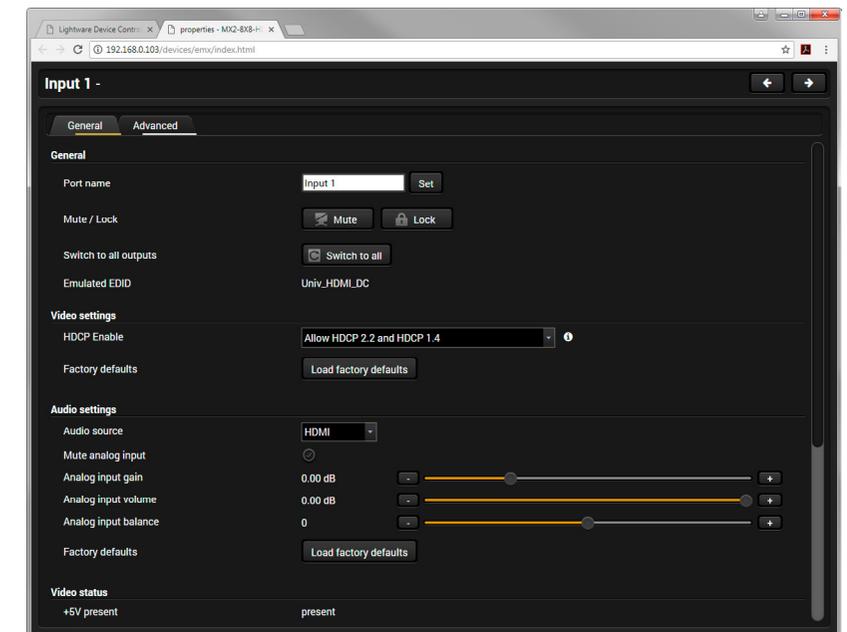
Built-in Webpage Displaying the Input Port Properties Window

6

Software Control – 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.com. The Windows and the Mac versions have the same look and functionality.

▶ INSTALL AND UPGRADE
▶ DEVICE DISCOVERY WINDOW
▶ CROSSPOINT MENU
▶ PRESETS
▶ EDID MENU
▶ SETTINGS MENU
▶ ADVANCED VIEW

6.1. Install and Upgrade

Installation for 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 for 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.
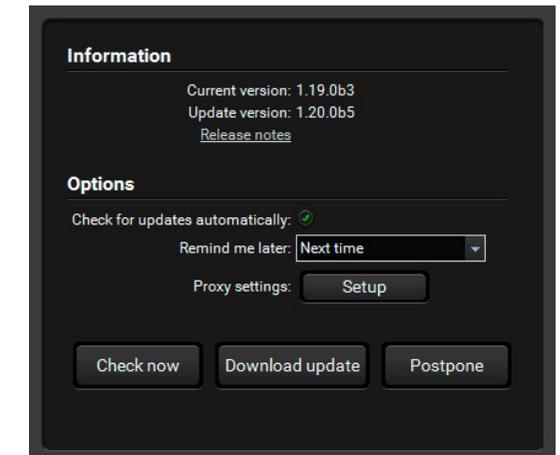
6.2. Device Discovery Window

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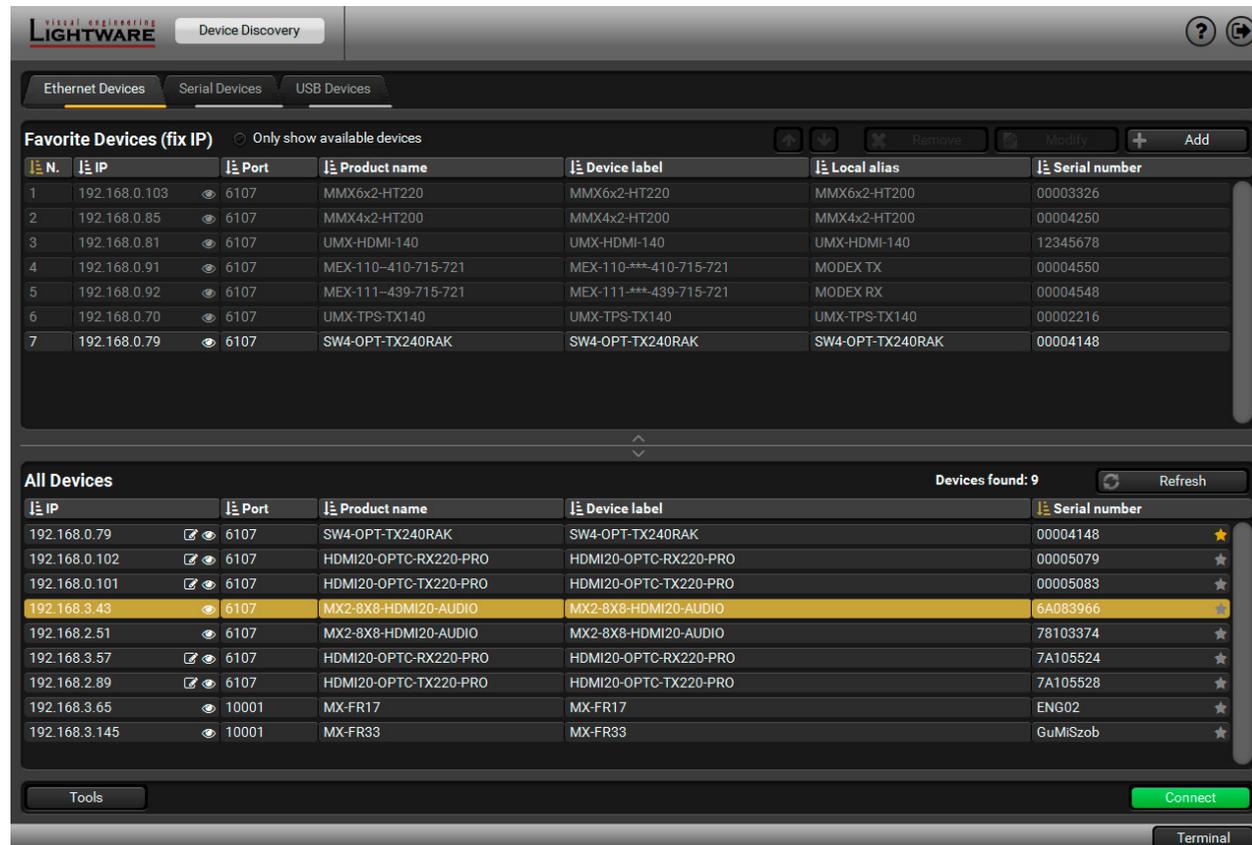
Device Discovery window

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 Creating an EDID section.
▪ **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).
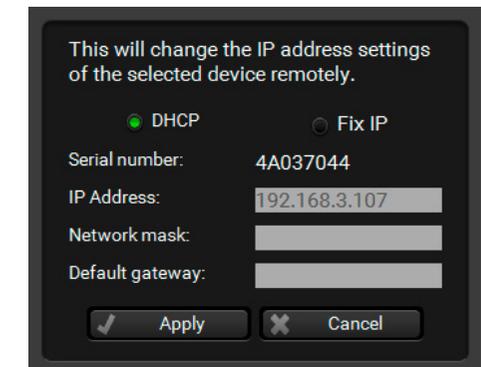
6.3. Crosspoint Menu

6.3.1. 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.
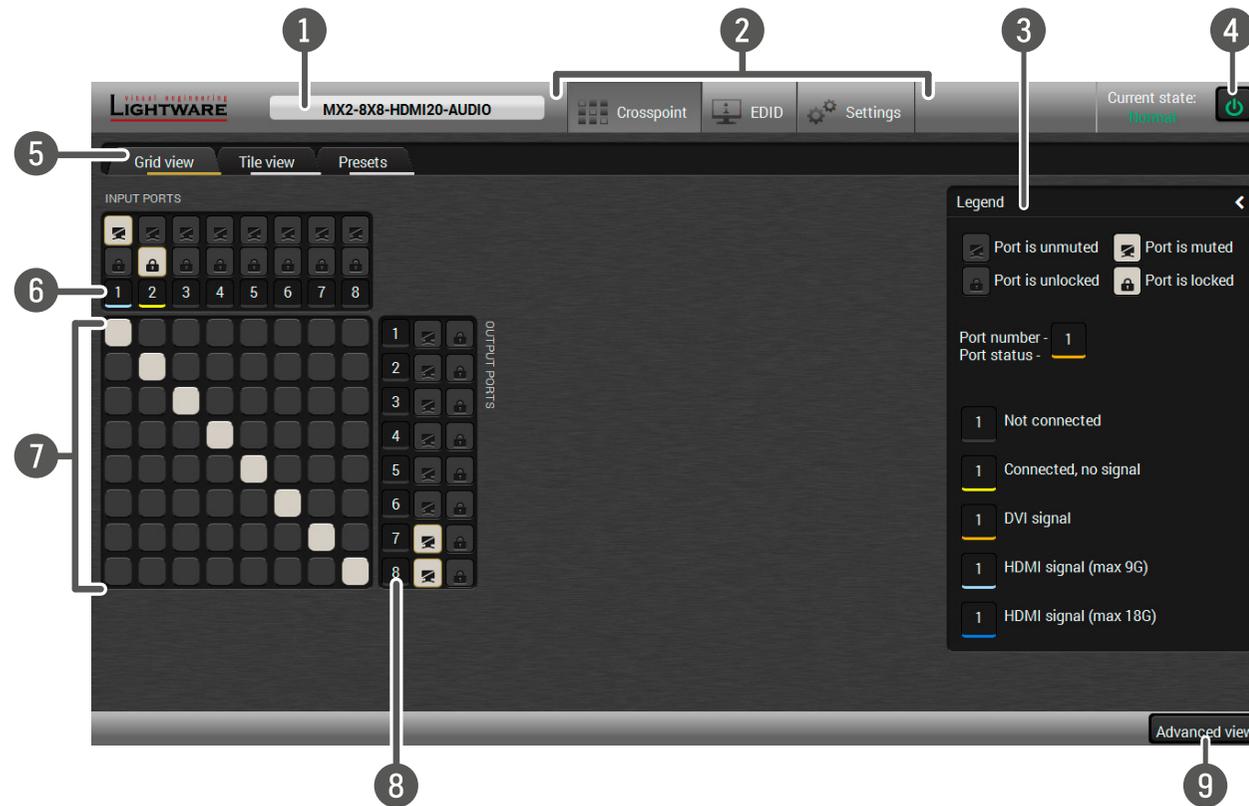
①	**Device Label**	The **Device Discovery** window can be opened by clicking on this ribbon. The Device Label is displayed which is not the same as the Product Name. The Product name is displayed in a hint box when the mouse cursor is above the box. See more information in Status Tab section, and Setting the Device Label section.
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.

6.3.2. 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.

Control Buttons

Button	Description
Mute	Mute or unmute selected output port(s)
Lock	Lock or unlock selected output port(s)
View mode	Activate View mode
Input switch	Activate Input switch mode
Output switch	Activate Output switch mode
Parameters	Open port properties window
Select All	Select all ports (only in output switch mode)
Deselect All	Deselect all ports (only in output switch mode)
Autotake	Toggle Autotake mode ON/OFF
Take	Execute crosspoint changes in Take mode
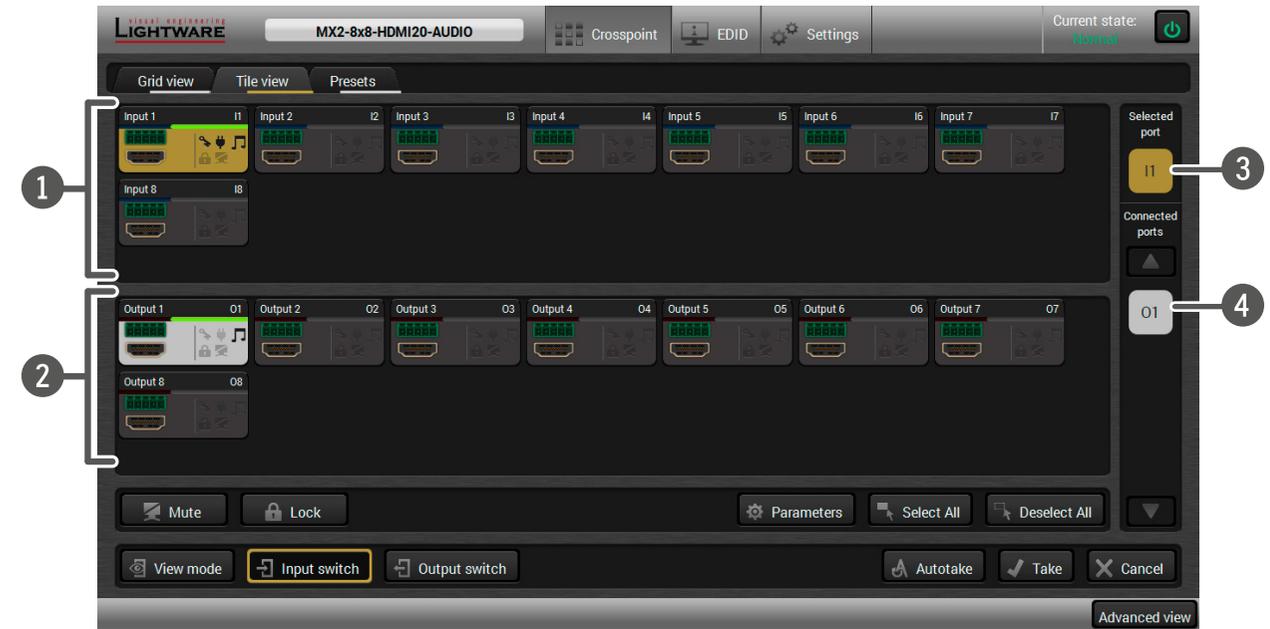
① **Input Ports**   Each tile represents an input port.

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.

Port Tiles

The colors of the port tiles and the displayed icons represent different states and information about the selected port:
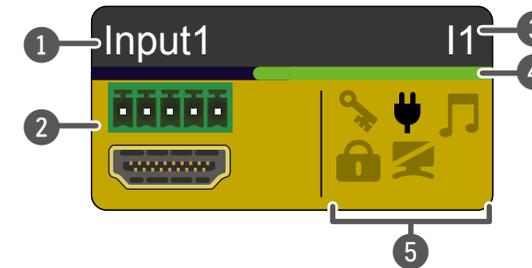
① Port name

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.

👁 View mode

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.

🔲 Input switch

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.

🔲 Output switch

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:

🔳 Autotake

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:

🔳 Autotake

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.

6.3.3. Input Port Properties Window

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

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 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 stream (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 in HDCP v2.2 (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.

CEC Tab

The MX2-8x8-HDMI20-Audio is able to send and receive Consumer Electronic Control (CEC) commands. This feature is for remote control of the source or sink device. CEC is a bi-directional communication via HDMI cable, in this case between the source and the input port of the matrix switcher.
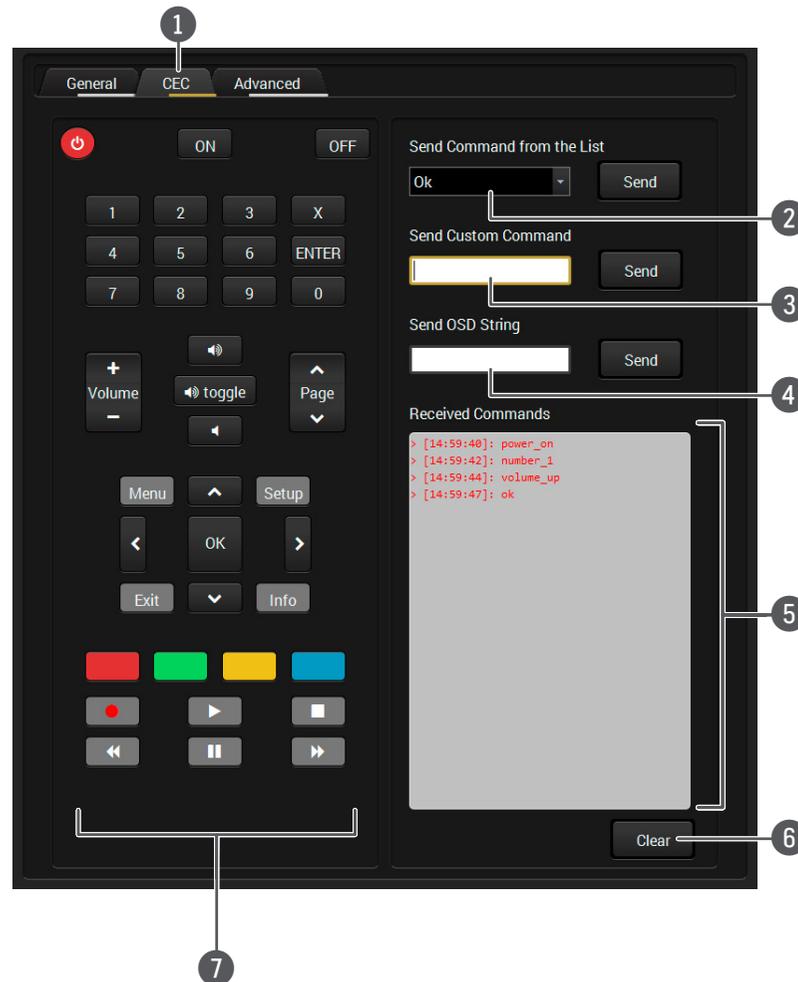
Layout of CEC panel in Lightware Device Contoller

① Tab selector   Select the **CEC** tab for managing CEC commands.

② Drop-down command list   This list contains the basic CEC commands, most of them are displayed on the graphical interface, too (on the left side). Click on the **Send** button to execute sending the command.

③ Custom command textbox   The text field is for sending hexadecimal commands to the source. The maximum length of the message could be 30 character-long (15 bytes). Click on the **Send** button to confirm sending the command.

④ OSD string textbox   A max. 14 character-long text can be shown on the source device. The send OSD (On-screen display) command textbox is the input field of the string. Alphanumeric characters, glyphs and space are accepted. Click on the **Send** button to execute the command.

⑤ Received Command box   This window displays all the sent (in red) CEC commands and the received answers (in blue) with a timestamp.
Legend of the received message:
< [10:33:17] ACK
Answer for the acknowledged command.
< [10:35:01] NACK
Answer for the not acknowledged command.
< [10:33:17] IN PROGRESS
The command is in progress at the moment.
< [10:33:17] FAILED
Answer for other failure.
< [10:35:40] feature_abort_<>*
This is the most common answer from the third-party devices when the command is delivered, but the execution is refused. The cause of the refuse stands after 'feature_abort' expression.

⑥ Clear button   Click on the **Clear** button to erase the content of the terminal window.

⑦ CEC command button panel   This panel provides the quick and easy management of CEC commands. The buttons are pre-programmed with basic functions and send command towards the source. The communication is displayed in the Received Command box. For the list of commands, see Sending a CEC Command in Text Format section. Both the layout and functionality are similar to the design of a remote control.

INFO: The first 2x2 bit of the CEC commands contains identification data of the source and destination address. In this case that is always 04.

ATTENTION! Make sure that the controlled unit is CEC-capable and this function is enabled.

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: number of the faulty charatcers per second

INFO: If the signal error rate is zero, it refers to the perfect data transmission. However, some sources send character errors consciously during their regular operation.

- BCH ECC errors: Bose–Chaudhuri–Hocquenghem Error Correction Codes errors means the error rate of the data packages.
- AVI Infoframe
- Audio InfoFrame
- Vendor Specific Infoframe
- HDMI 2.0 related information: Scrambling / Clock rate

6.3.4. 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.

Video settings	
Conversion mode	**Passthrough:** no signal conversion. **4:4:4 to 4:2:0 :** the signal is converted to 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 the Typical Applications chapter.
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 stream (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 in HDCP v2.2 (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.

CEC Tab

The MX2-8x8-HDMI20-Audio is able to send and receive Consumer Electronic Control (CEC) commands. This feature is for remote control of the source or sink device. CEC is a bi-directional communication via HDMI cable, in this case between the output port of the matrix switcher and the sink.
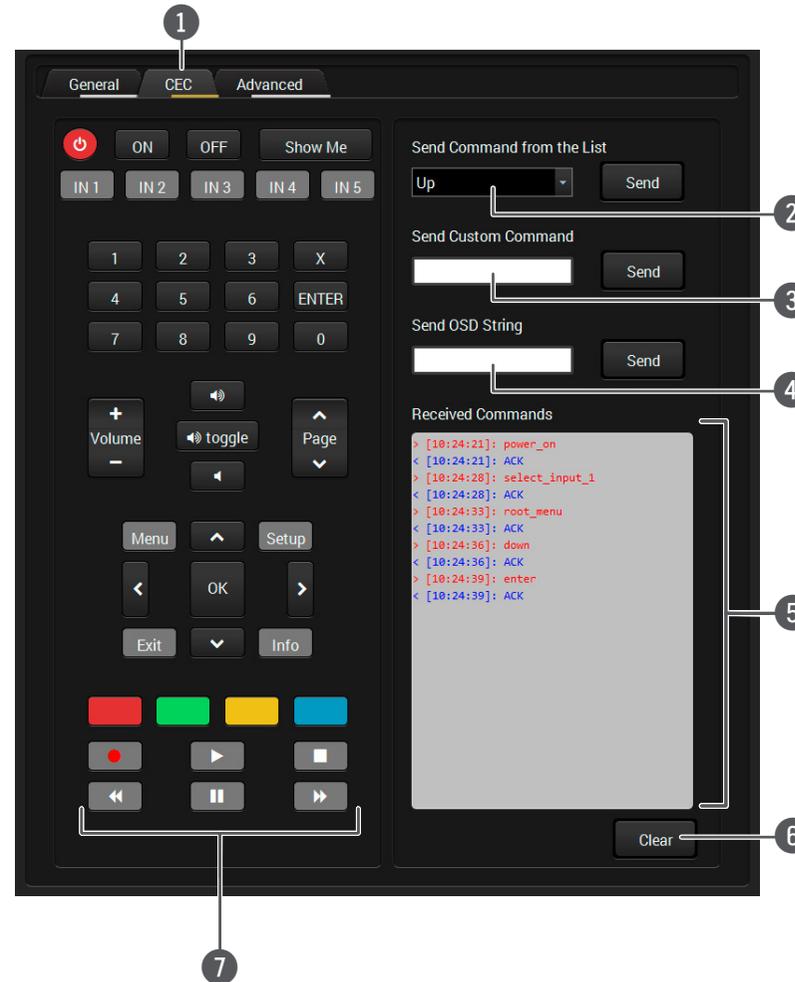
Layout of CEC panel in Lightware Device Contoller

1   **Tab selector ribbon**   Select the **CEC** tab for managing CEC commands.

2   **Drop-down command list**   This list contains the basic CEC commands, most of them are displayed on the graphical interface, too (on the left side). Click on the **Send** button to execute sending the command.

3   **Custom command textbox**   The text field is for sending hexadecimal commands to the source. The maximum length of the message could be 30 characters (15 bytes). Click on the **Send** button to execute sending the command.

4   **OSD string textbox**   A max. 14 character-long text can be shown on the sink device. The send OSD (On-screen display) command textbox is the input field of the string. Alphanumeric characters, glyphs and space are accepted. Click on the **Send** button to execute the command.

5   **Received Command box**   Displays all the sent (in red) CEC commands and the received answers (in blue) with a timestamp.
Legend of the received message:
< [10:33:17] ACK
Answer for the acknowledged command.
< [10:35:01] NACK
Answer for the not acknowledged command.
< [10:33:17] IN PROGRESS
The command is in progress at the moment.
< [10:33:17] FAILED
Answer for other failure.
< [10:35:40] feature_abort_<*>
This is the most common answer from the third-party devices when the command is delivered, but the execution is refused. The cause of the refuse stands after 'feature_abort' expression.

6   **Clear button**   Click on the **Clear** button to erase the content of the terminal window.

7   **CEC command button panel**   This panel provides the quick and easy management of CEC commands. These buttons are pre-programmed with basic functions and sends commands towards the sink. The communication is displayed in the Received Command box. For the list of the commands see Sending a CEC Command in Text Format section. Both the layout and functionality are similar to the design of a remote control.

It can occur that the third-party device can receive, but not execute the command because it is not supported by the product. Check the accepted commands in the documentation of the device.

INFO: The first 2x2 bit of the CEC commands contains identification data of the source and destination address. In this case that is always 40.

ATTENTION! Make sure that the controlled unit is CEC-capable and this function is enabled.

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: number of the faulty charatcers per second

INFO: If the signal error rate is zero, it refers to the perfect data transmission. However, some sources send character errors consciously during their regular operation.

▪ BCH ECC errors: Bose–Chaudhuri–Hocquenghem Error Correction Codes errors means the error rate of the data packages.
▪ AVI Infoframe

▪ Audio InfoFrame
▪ Vendor Specific Infoframe
▪ HDMI 2.0 related information: Scrambling / Clock rate

6.4. 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.
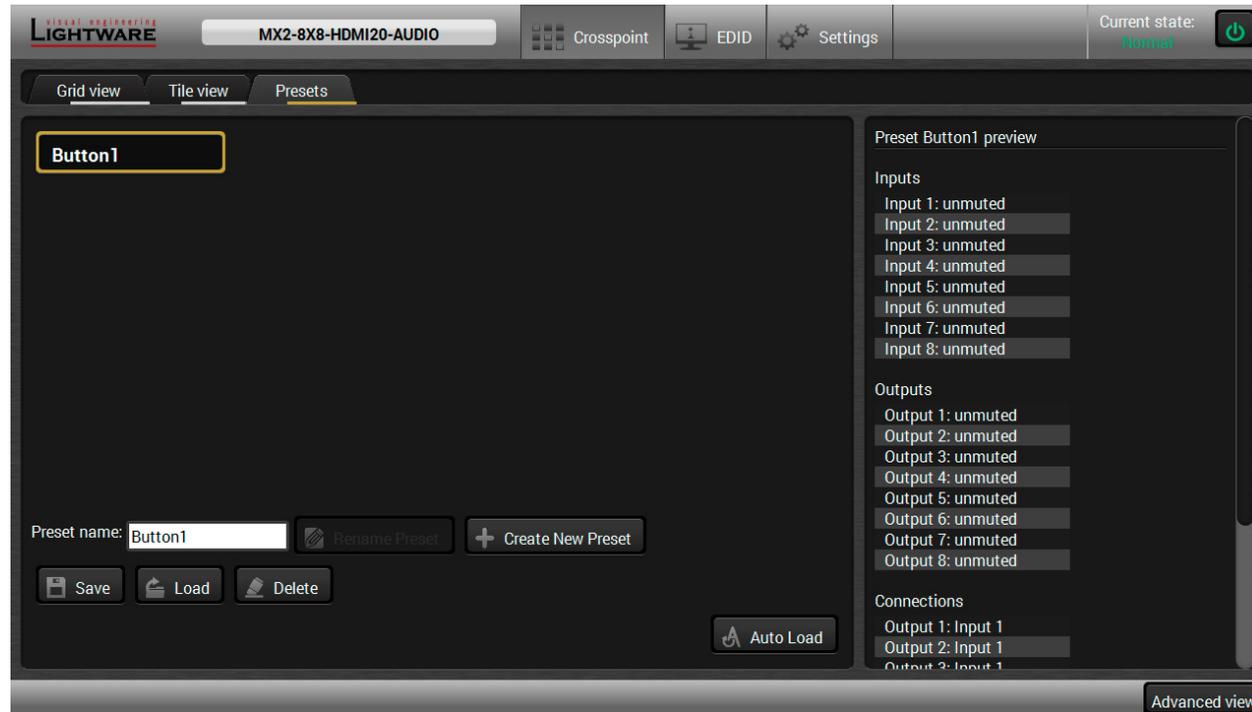
Presets Tab

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 Save or Load a Preset section.

Auto load mode

When the **Auto load** 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.

6.5. 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.

Control buttons

Button	Description	Button	Description
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		

6.5.1. Sources and Destinations

The EDID memory consists of four parts:

- **Factory** EDID list (F1-F148) the pre-programmed EDIDs, see the Factory EDID List in the Appendix section.
- **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.

6.5.2. 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

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).

6.5.3. EDID Summary Window

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

General		
Power Management		
Gamma / Colors		
Established Timings		
Standard Timings		
Preferred Timing Mode		
2nd Descriptor Field		
3rd Descriptor Field		
4th Descriptor Field		
CEA General		
CEA Video		
CEA Audio		
CEA Speaker Allocation		
CEA HDMI		
CEA Colorimetry		
CEA Detailed Timing Descriptors		

General

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

6.5.4. 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.com) and download the EDID Editor User's Manual.

EDID Byte Editor

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

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

EDID Editor Window

6.5.5. 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

6.6. Settings Menu

6.6.1. 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

6.6.2. Network Tab

Network-related settings are available on the tab.
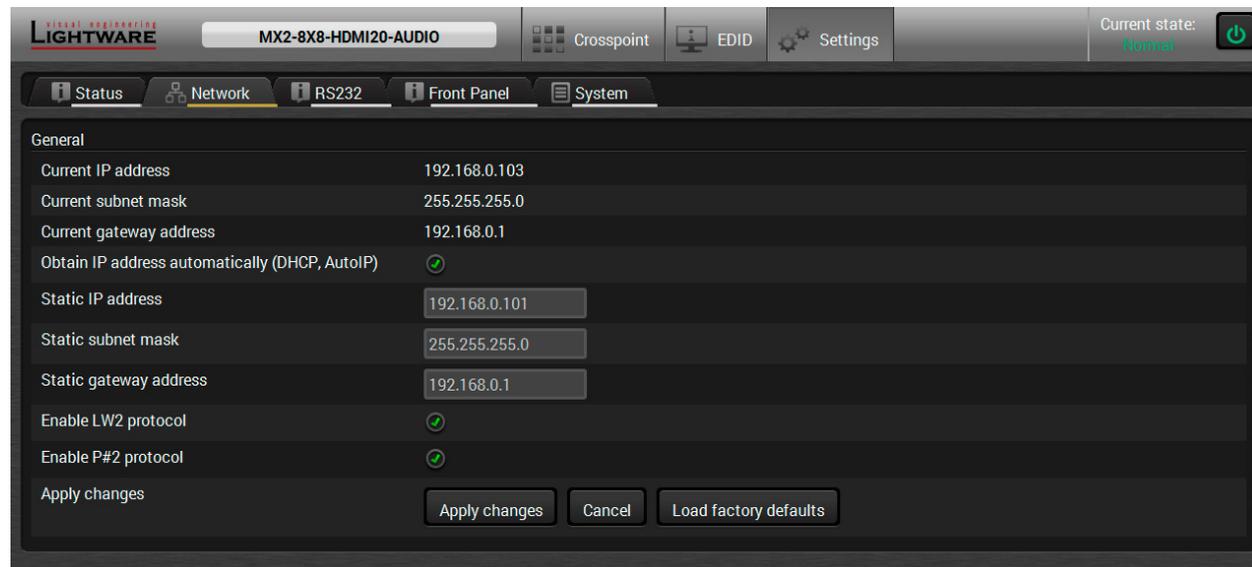
Network Tab in the Settings Menu

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.

6.6.3. RS-232 Tab

The local RS-232 port settings are available on this tab.
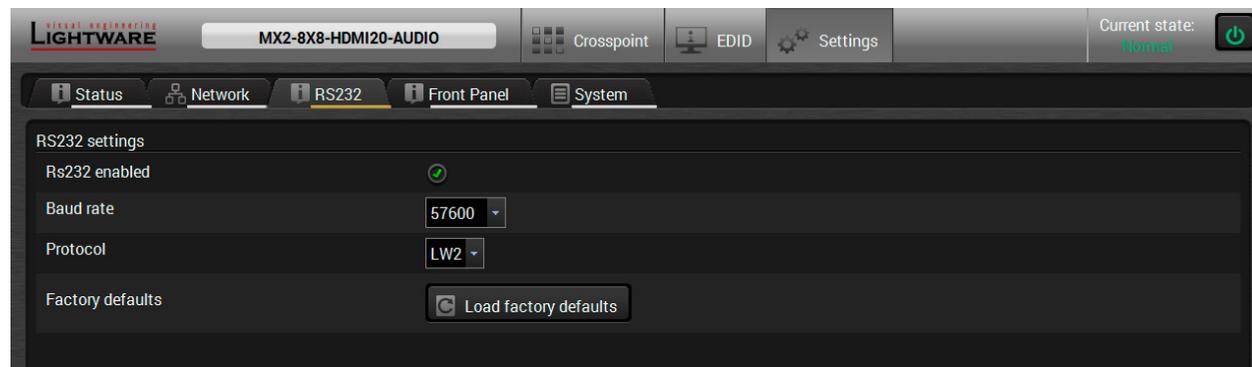
RS-232 Tab in the Settings Menu

6.6.4. 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.
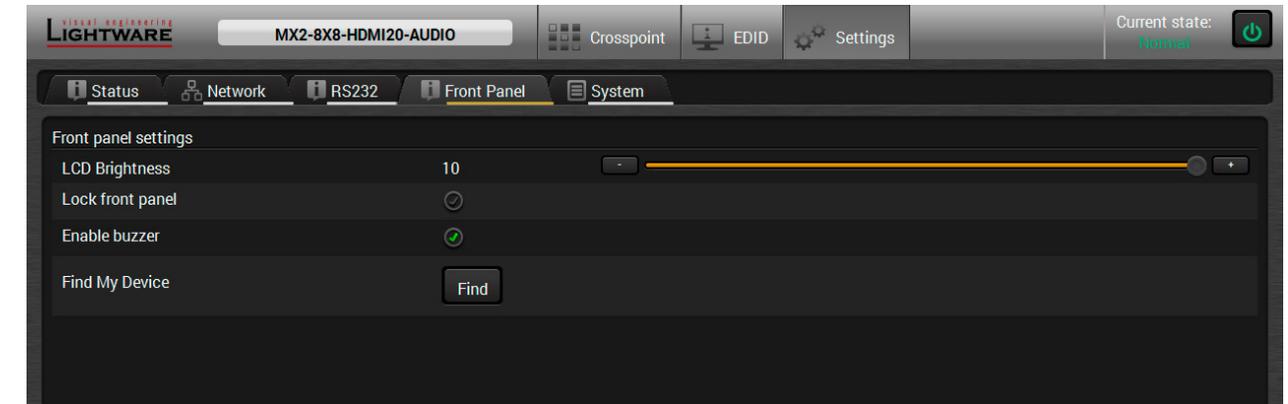
Front Panel Tab in the Settings Menu

6.6.5. 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.com.

6.7. 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.
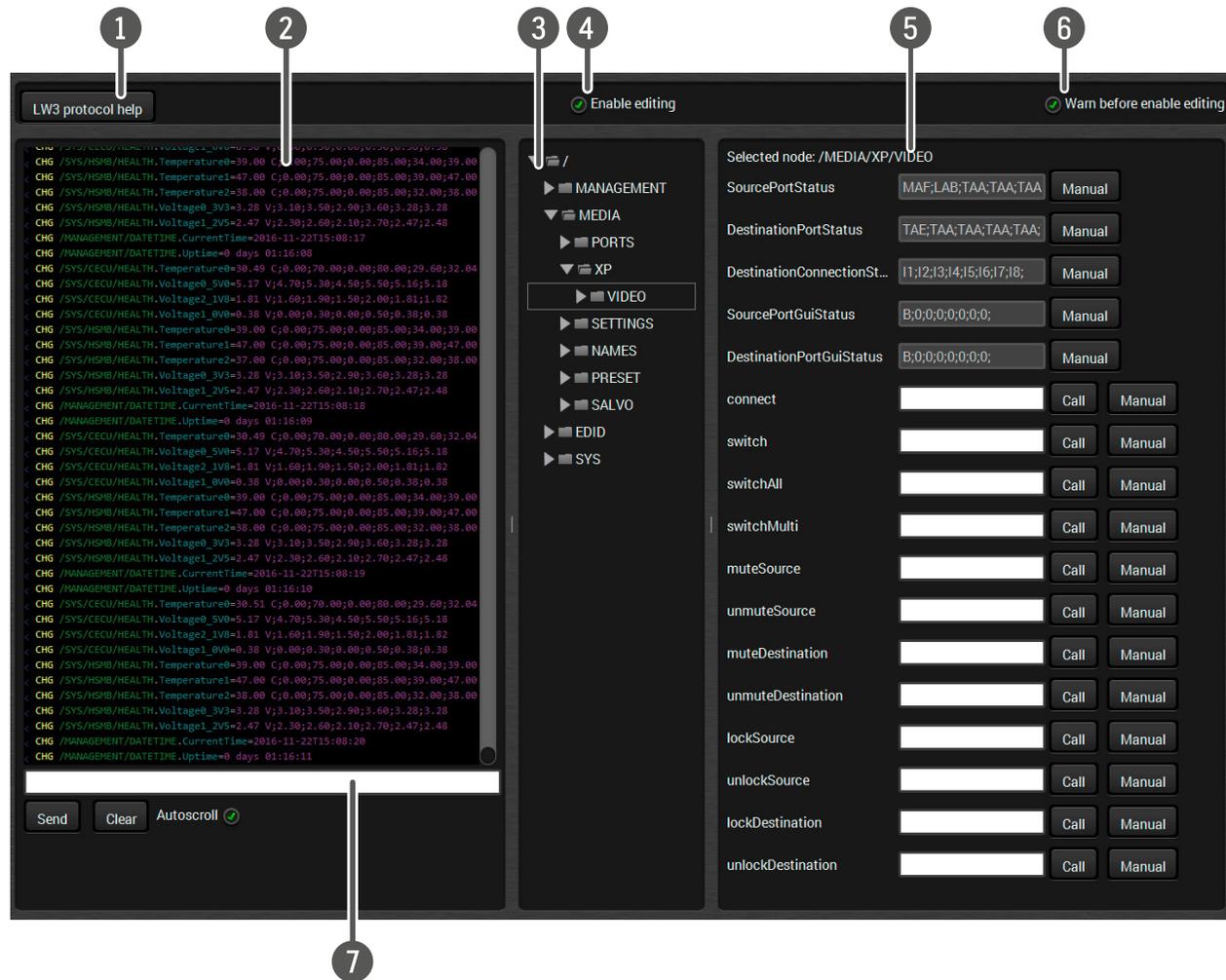
1	**LW3 Protocol Help**	Short description about the command types and LW3 Protocol. (LW3 Commands – Quick Summary is a brief summary)
2	**Terminal Window**	Commands and responses. Sent command starts with **">"** character, received response starts with **"<"** character. The content of the window can 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.

7

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.

- ▸ LW2 PROTOCOL DESCRIPTION
- ▸ ROUTER STATUS COMMANDS
- ▸ CROSSPOINT OPERATIONS
- ▸ PRESET HANDLING
- ▸ COMMANDS - QUICK SUMMARY

7.1. LW2 Protocol Description

Communication

Below listed command can be sent to the device in RAW format via the **TCP/IP port no. 10001**.

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

7.2. Router Status Commands

7.2.1. 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-HDMI2-AUDIO)CrLf

7.2.2. 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

7.2.3. 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:1.1.5b1)CrLf

7.2.4. 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.

7.2.5. 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: 1.1.5b1)CrLf

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

7.2.6. 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.

7.2.7. 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.

7.2.8. 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

7.2.9. 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!

7.3. Crosspoint Operations

7.3.1. 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 View Connections of all Outputs section.

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

7.3.2. Switch an Input to All Outputs

Description: Switching a certain input to all outputs.

Format		Example
Command	{<in>@O}	→ {1@O}
Response	(ALL●<O1>●<O2>●<O3>●<O4>●<O5>●<O6>●<O7>●<O8>●)CrLf	← (ALL 01 01 01 01 01 01 01 01)

Explanation: Input 1 is switched to all the outputs. <O1> - <O8> mean the output ports and the displayed two-digit number (01 in the example) shows the port number of the currently switched input port.

7.3.3. 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}	→ {02@01}{05@04}
← (O01 I02)CrLf	← (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}	→ {02@01}{+06}{05@04}
← (O01 I02)CrLf	← (O01 I02)CrLf
→ {+06}	→ (0MT06)CrLf
← (0MT06)CrLf	← (O04 I05)CrLf
→ {05@04}	
← (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.

7.3.4. 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.

7.3.5. View Connections of all Outputs

Description: Viewing all outputs' connection showing the connected input 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.

7.3.6. 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.

7.3.7. 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.

7.3.8. 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.

7.3.9. 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.

7.3.10. 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).

7.4. Preset Handling

7.4.1. Load a Preset

Description: Recall a saved preset.

Format	Example
Command {%<preset>}	→ {%Meeting_1}
Response (%<preset>)CrLf	← (%Meeting_1)CrLf

Explanation: Preset called "Meeting_1" has been loaded and applied.

7.5. Commands - Quick Summary

Router Status Commands

Operation	See in section	Command
View Product Type	7.2.1	{i}
View Serial Number	7.2.2	{S}
View the Installed Firmware	7.2.3	{F}
View CPU Firmware Compile Time	7.2.4	{CT}
View Firmware of the Controller	7.2.5	{FC}
View Installed Motherboard	7.2.6	{IS}
View Crosspoint Size	7.2.7	{GETSIZE}
View Router's Health	7.2.8	{ST}
Query Control Protocol (RS-232)	7.2.9	{P_?}

Crosspoint Operations

Operation	See in section	Command
Switch an Input to an Output	7.3.1	{<in>@<out>}
Switch an Input to All Outputs	7.3.2	{<in>@O}
Batch Switch Outputs	7.3.3	{<in>@<out>}{<in>@<out>}
View the Connection of an Output Port	7.3.4	{?<out>}
View Connections of all Outputs	7.3.5	{VC}
View Mutes on all Outputs	7.3.6	{VM}
Mute Specified Output	7.3.7	{#<out>}
Unmute Specified Output	7.3.8	{+<out>}
Lock Specified Output	7.3.9	{#><out>}
Unlock a Specified Output	7.3.10	{+<<out>}

Preset Handling

Operation	See in section	Command
Load a Preset	7.4.1	{%<preset_name>}

8

LW3 Programmers' Reference

The device can be controlled through Lightware 3 (LW3) protocol commands to ensure the compatibility with other Lightware products. The supported LW3 commands are described in this chapter.

8.1. Overview

The Lightware Protocol #3 (LW3) is implemented in almost all new Lightware devices (matrix switchers, signal extenders and distribution amplifiers) since 2012. The protocol is ASCII-based and all commands are terminated with a carriage return (Cr, '\r') and line feed (Lf, '\n') pair. It is organized as a tree structure that provides outstanding flexibility and user-friendly handling with 'nodes', 'properties' and 'methods'. The **Advanced View** of the Lightware Device Controller software is the perfect tool for browsing and learning how the LW3 protocol can be used in practice.

8.2. Protocol Rules

8.2.1. LW3 Tree Structure and Command Structure (examples)
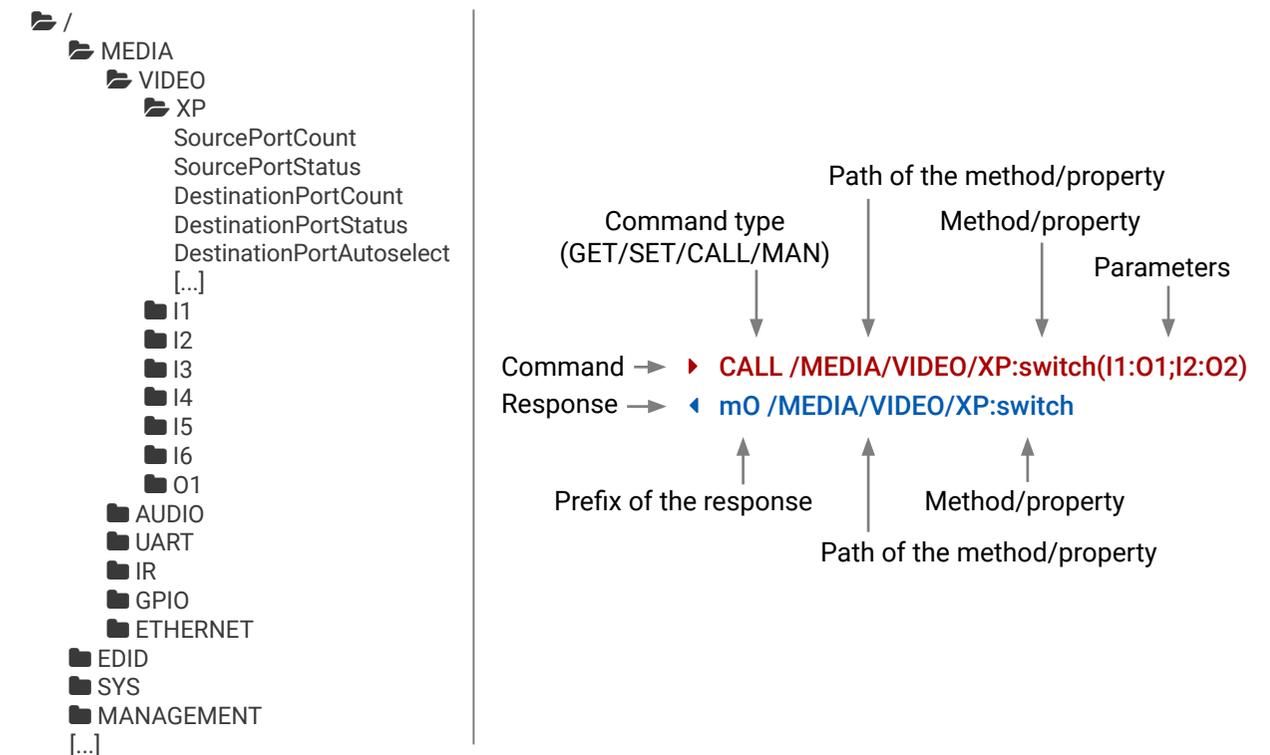
8.2.2. General Rules

- All names and parameters are **case-sensitive**.
- The nodes are separated by a slash ('/') character.
- The node name can contain the elements of the English alphabet and numbers.
- Use the **TCP port no. 6107** when using LW3 protocol over Ethernet.
- When a command is issued by the device, the received response cannot be processed by the CPU.
- The path of a node has to contain all parent nodes from the root node.

8.2.3. Command Types

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. Use the dot character (.) when addressing a property:

▶ GET /.SerialNumber

◀ pr /.SerialNumber=87654321

GETALL command

The **GETALL** command can be used to get all child nodes, properties and methods of a node with one command.

▶ GETALL /MEDIA/UART

◀ ns /MEDIA/UART/P1

◀ ns /MEDIA/UART/P2

◀ pr /MEDIA/UART.PortCount=2

◀ pr /MEDIA/UART.PortUi=P1:12209;P2:12224

◀ pr /MEDIA/UART.P1=Local RS-232

◀ pr /MEDIA/UART.P2=TPS out RS-232

SET command

The **SET** command can be used to modify the value of a property. Use the dot character (.) when addressing the property:

▶ SET /MEDIA/VIDEO/I1.ColorSpaceMode=0

◀ pw /MEDIA/VIDEO/I1.ColorSpaceMode=0

CALL command

A method can be invoked by the **CALL** command. Use the colon character (:) when addressing the method:

▶ CALL /MEDIA/VIDEO/XP:switch(I1:O1)

◀ mO /MEDIA/VIDEO/XP:switch

MAN command

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

▶ MAN /MEDIA/VIDEO/O1.Pwr5vMode

◀ pm /MEDIA/VIDEO/O1.Pwr5vMode ["0" | "1" | "2"] 0 - Auto, 1 - Always On, 2 - Always Off

8.2.4. Prefix Summary

▌ DEFINITION: The prefix is a 2-character long code that describes the type of the response.

The following prefixes are defined in the LW3 protocol:

Prefix	Description	Prefix	Description
n-	a node	pm	a manual for the property
nE	an error for a node	m-	a method
nm	a manual for a node	mO	a response after a success method execution
ns	a child node of a node	mF	a response after a failed method execution
pr	a read-only property	mE	an error for a method
pw	read-write property	mm	a manual for a method
pE	an error for the property		

8.2.5. Error Messages

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

▶ CALL /MEDIA/VIDEO/XP:switch(IA:O1)

◀ mE /MEDIA/VIDEO/XP:switch %E004:Invalid value

8.2.6. Escaping

▌ DEFINITION: An escape sequence is a sequence of characters that does not represent itself when used inside a character or string literal, but is translated into another character or a sequence of characters.

Property values and method parameters can contain characters which 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

The **original** message: CALL /MEDIA/UART/P1:sendMessage(Set(01))

The **escaped** message: CALL /MEDIA/UART/P1:sendMessage(Set\(01\))

8.2.7. Signature

DEFINITION: The signature is a four-digit-long hexadecimal value that can be optionally placed before every command to keep a command and the corresponding responses together as a group.

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. In these cases, the response to that particular command will also be preceded by the signature, and the corresponding lines will be between brackets:

▶ 1700#GET /EDID.*

◀ {1700

◀ pr /EDID.EdidStatus=F89:E1;D1:E2;D1:E3;D1:E4;F89:E5

◀ m- /EDID:copy

◀ m- /EDID:delete

◀ m- /EDID:reset

◀ m- /EDID:switch

◀ m- /EDID:switchAll

◀ }

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

8.2.8. Subscription

DEFINITION: Subscribe to a node means that the user will get a notification if any of the properties of the node is changed.

A user can subscribe to any node. These notifications are asynchronous messages and 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

▶ OPEN /MEDIA/VIDEO

◀ o- /MEDIA/VIDEO

Get the Active Subscriptions

▶ OPEN

◀ o- /MEDIA/VIDEO

◀ o- /EDID

◀ o- /DISCOVERY

Subscribe to Multiple Nodes

▶ OPEN /MEDIA/VIDEO/*

◀ o- /MEDIA/VIDEO/*

Unsubscribe from a Node

▶ CLOSE /MEDIA/VIDEO

◀ c- /MEDIA/VIDEO

Unsubscribe from Multiple Nodes

▶ CLOSE /MEDIA/VIDEO/*

◀ c- /MEDIA/VIDEO/*

8.2.9. 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:

◀ CHG /EDID.EdidStatus=F48:E1

A Short Example of How to Use the Subscription

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.

▶ OPEN /MEDIA/VIDEO/QUALITY

◀ o- /MEDIA/VIDEO/QUALITY

▶ GET /MEDIA/VIDEO/Quality.QualityMode   **Connection #1**

◀ pm /MEDIA/VIDEO/QUALITY.QualityMode=graphic

▶ GET /MEDIA/VIDEO/Quality.QualityMode

◀ pm /MEDIA/VIDEO/QUALITY.QualityMode=graphic   **Connection #2**

▶ SET /MEDIA/VIDEO/Quality.QualityMode=video

◀ pw /MEDIA/VIDEO/QUALITY.QualityMode=video

◀ CHG /MEDIA/VIDEO/QUALITY.QualityMode=video   → **Connection #1**

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.

8.2.10. Legend for the Control Commands

Format	Description
<in>	Input port number
<out>	Output port number
<port>	Input or output port number
<loc>	Location number
<parameter>	Variable, which is defined and described in the command
<expression>	Batched parameters: the underline means that more expressions or parameters can be placed by using a semicolon, e.g. **I2;I4;I5** or **F27:E1;F47:E2**
▶	Sent command
◀	Received response
•	Space character

8.3. System Commands

8.3.1. Querying the Product Name

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

Command and Response

▶ GET•/.ProductName
◀ pr•/.ProductName=<Product_name>

Parameters

The <Product_name> is the type of the device: read-only parameter and cannot be modified.

Example

▶ GET /.ProductName
◀ pr /.ProductName=MX2-8X8-HDMI20-AUDIO

8.3.2. Setting the Device Label

The device label can be changed to a custom text which is displayed in many windows of the LDC.

▌ **ATTENTION!** This writable parameter is not the same as the **ProductName** parameter.

Command and Response

▶ SET•/MANAGEMENT/UID/DeviceLabel=<Custom_name>
◀ pw•/MANAGEMENT/UID/DeviceLabel=<Custom_name>

Parameters

The <Custom_name> may consist of ASCII characters and can be 32 characters length. Longer names are truncated.

Example

▶ SET /MANAGEMENT/UID.DeviceLabel=MX2_Control_room
◀ pw /MANAGEMENT/UID.DeviceLabel=MX2_Control_room

8.3.3. Querying the Serial Number

Command and Response

▶ GET•/.SerialNumber
◀ pr•/.SerialNumber=<serial_nr>

Example

▶ GET /.SerialNumber
◀ pr /.SerialNumber=87654321

8.3.4. Resetting the Matrix

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

Command and Response

▶ CALL•/SYS:softReset()
◀ mO•/SYS:softReset=

Example

▶ CALL /SYS:softReset()
◀ mO /SYS:softReset=

8.3.5. Restoring the Factory Default Settings

The device is restarted, current connections are terminated, and the default settings are restored. See the complete list in Factory Default Settings section.

Command and Response

▶ CALL•/SYS:factoryDefaults()
◀ mO•/SYS:factoryDefaults=

Example

▶ CALL /SYS:factoryDefaults()
◀ mO /SYS:factoryDefaults=

8.3.6. Switching 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 the System Settings Menu and the next section.

Command and Response

▶ CALL•/MANAGEMENT/POWER:standby()
◀ mO•/MANAGEMENT/POWER:standby=

Example

▶ CALL /MANAGEMENT/POWER:standby()
◀ mO /MANAGEMENT/POWER:standby=

8.3.7. Switching to Normal Mode

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

Command and Response

▶ CALL•/MANAGEMENT/POWER:wakeUp()
◀ mO•/MANAGEMENT/POWER:wakeUp=

Example

▶ CALL /MANAGEMENT/POWER:wakeUp()
◀ mO /MANAGEMENT/POWER:wakeUp=

8.4. Switching and Crosspoint Settings

▌ INFO: The current setting can be queried by using the GET command.

8.4.1. Query the Video Crosspoint State

Command and Response

▶ GET•/MEDIA/XP/VIDEO.DestinationConnectionStatus
◀ pr•/MEDIA/XP/VIDEO.DestinationConnectionStatus=<out1_state>;<out2_state>;...;<out8_state>

Parameters

The <out#_state> parameters mean the O1-O8 output ports one after the other. The value of the parameter shows the input port switched to the given output port.

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.

8.4.2. Switching an Input to an Output

Command and Response

▶ CALL•/MEDIA/XP/VIDEO:switch(<in>:<out>)
◀ mO•/MEDIA/XP/VIDEO:switch=OK

Example

▶ CALL /MEDIA/XP/VIDEO:switch(I4:O1)
◀ mO /MEDIA/XP/VIDEO:switch=OK

8.4.3. Switching an Input to All Outputs

Command and Response

▶ CALL•/MEDIA/XP/VIDEO:switchAll(<in>)
◀ 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).

8.4.4. Multiple Switching

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

Command and Response

▶ CALL•/MEDIA/XP/VIDEO:switchMulti(<out1_source>;<out2_source>;...;<out8_source>)
◀ mO•/MEDIA/XP/VIDEO:switchMulti=OK

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

Parameters

The <out#_source> parameters mean the O1-O8 output ports one after the other. The value of the parameter shows the input port switched to the given output port.

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

8.5. Video Input Port Settings

> INFO: The current setting can be queried by using the GET command.

8.5.1. Querying the Status of the Source Ports

Command and Response

- ▶ GET•/MEDIA/XP/VIDEO.SourcePortStatus
- ◀ pr•/MEDIA/XP/VIDEO.SourcePortStatus=<in1_state>;<in2_state>;…;<in8_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

Parameters

Letter (Character 1)		
	Mute state	**Lock state**
T	Unmuted	Unlocked
L	Unmuted	Locked
M	Muted	Unlocked
U	Muted	Locked

T A F

Letter → Mute / Lock status
Byte 1 {
 Signal present / Connection status
 Embedded audio / HDCP status
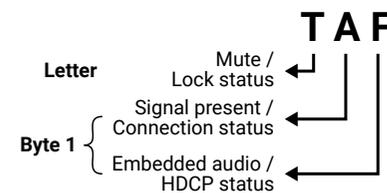
	Byte 1			
	Character 2		Character 3	
	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0
	Embedded audio status	**HDCP status**	**Signal present status**	**Connection status**
0 0	Unknown			
0 1	Reserved			
1 0	No embedded audio	Not encrypted	No signal	Not connected
1 1	Embedded audio presents	Encrypted	Signal presents	Connected

Example and Explanation (TEF)

T	E		F	
Unlocked, Unmuted	1 1	1 0	1 1	1 1
	Embedded audio presents	Not encrypted	Signal presents	Connected

The Most Common Received Port Status Responses

	T	A		A	
T00AA	Unlocked, Unmuted	1 0	1 0	1 0	1 0
		No embedded audio	Not encrypted	No signal	Not connected

	T	A		B	
T00AB	Unlocked, Unmuted	1 0	1 0	1 0	1 1
		No embedded audio	Not encrypted	No signal	Connected

	T	A		F	
T00AF	Unlocked, Unmuted	1 0	1 0	1 1	1 1
		No embedded audio	Not encrypted	Signal presents	Connected

	T	E		F	
T00EF	Unlocked, Unmuted	1 1	1 0	1 1	1 1
		Embedded audio presents	Not encrypted	Signal presents	Connected

	T	B		F	
T00BF	Unlocked, Unmuted	1 0	1 1	1 1	1 1
		No embedded audio	Encrypted	Signal presents	Connected

	T	F		F	
T00FF	Unlocked, Unmuted	1 1	1 1	1 1	1 1
		Embedded audio presents	Encrypted	Signal presents	Connected

8.5.2. Muting an Input Port

Command and Response

- ▶ CALL•/MEDIA/XPVIDEO:muteSource(<in>)
- ◀ mO•/MEDIA/XP/VIDEO:muteSource=OK

Example

- ▶ CALL /MEDIA/XP/VIDEO:muteSource(I1)
- ◀ mO /MEDIA/XP/VIDEO:muteSource=OK

8.5.3. Unmuting an Input Port

Command and Response

▸ CALL•/MEDIA/XP/VIDEO:unmuteSource(<u><in></u>)

◂ mO•/MEDIA/XP/VIDEO:unmuteSource=OK

Example

▸ CALL /MEDIA/XP/VIDEO:unmuteSource(I1;I3)

◂ mO /MEDIA/XP/VIDEO:unmuteSource=OK

8.5.4. Locking an Input Port

Command and Response

▸ CALL•/MEDIA/XP/VIDEO:lockSource(<u><in></u>)

◂ mO•/MEDIA/XP/VIDEO:lockSource=OK

Example

▸ CALL /MEDIA/XP/VIDEO:lockSource(I1;I2;I3)

◂ mO /MEDIA/XP/VIDEO:lockSource=OK

8.5.5. Unlocking an Input Port

Command and Response

▸ CALL•/MEDIA/XP/VIDEO:unlockSource(<u><in></u>)

◂ mO•/MEDIA/XP/VIDEO:unlockSource=OK

Example

▸ CALL /MEDIA/XP/VIDEO:unlockSource(I1;I3)

◂ mO /MEDIA/XP/VIDEO:unlockSource=OK

8.5.6. Sending CEC Commands Towards the Source

> INFO: The hidden first 2 bit of the CEC command is static (always 04), it refers to the logical address of the sender and the addressee. **0:** sender is a **TV**; **4:** the addressee is the **Playback Device 1**.

8.5.6.1. Sending an OSD String

Sending the OSD string consists of two steps. First, set the CEC.OsdString property with the desired text, after that, call the CEC.send(set_osd) method.

Step 1 – Setting the CEC.OsdString Property

Command and Response

▸ SET•/MEDIA/PORTS/<in>/CEC.OsdString=<text>

◂ pw•/MEDIA/PORTS/<in>/CEC.OsdString=<text>

The following characters are allowed as <text> parameter: Letters (A-Z) and (a-z), hyphen (-), underscore (_), numbers (0-9), and dot (.). Max length: 14 characters.

Example

▸ SET /MEDIA/PORTS/VIDEO/I1/CEC.OsdString=Lightware

◂ pw /MEDIA/PORTS/VIDEO/I1/CEC.OsdString=Lightware

Step 2 – Call the CEC.send(set_osd) method

Command and Response

▸ CALL•/MEDIA/PORTS/VIDEO/<in>/CEC:send(set_osd)

◂ mO•/MEDIA/PORTS/VIDEO/<in>/CEC:send=OK

Example

▸ CALL /MEDIA/PORTS/VIDEO/I1/CEC:send(set_osd)

◂ mO /MEDIA/PORTS/VIDEO/I1/CEC:send=OK

8.5.6.2. Sending a CEC Command in Text Format

Command and Response

▸ CALL•/MEDIA/PORTS/VIDEO/<in>/CEC:send(<command>)

◂ mO•/MEDIA/PORTS/VIDEO/<in>/CEC:send=OK

Example

▸ CALL /MEDIA/PORTS/VIDEO/I1/CEC:send(power_on)

◂ mO /MEDIA/PORTS/VIDEO/I1/CEC:send=OK

The followings are accepted as <command>:

- image_view_on / standby
- ok/ back
- up/ down/ left/ right
- root_menu/ setup_menu/ contents_menu/ favorite_menu/media_top_menu/ media_context_menu
- number_0/.../number_9
- dot/ enter/ clear
- channel_up/ channel_down
- sound_select/ input_select
- display_info/ power_legacy
- page_up/ page_down
- volume_up/ volume_down
- mute_toggle/ mute/ unmute
- play/ stop/ pause/ record/ rewind/ fast_forward/ eject/ skip_forward/ skip_backward
- 3d_mode
- stop_record/ pause_record
- play_forward/play_reverse
- select_next_media/ select_media_1/.../ select_media_5
- power_toggle/ power_on/ power_off
- f1/.../f4 / stop_function

8.5.6.3. Sending a CEC Command in Hexadecimal Format

Command and Response

▸ CALL•/MEDIA/PORTS/VIDEO/<in>/CEC:sendHex(<hex_command>)

◂ mO•/MEDIA/PORTS/VIDEO/<in>/CEC:sendHex=OK

Accepted <hex_command> is max. 30 character (15 byte) long in hexadecimal format.

Example

▸ CALL /MEDIA/PORTS/VIDEO/I1/CEC:sendHex(87 00 E0 91)

◂ mO /MEDIA/PORTS/VIDEO/I1/CEC:sendHex=OK

8.5.7. Setting the HDCP State

This setting allows to send non-encrypted content to a non-HDCP compliant display. See more information in the HDCP Management section.

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<in>/SETTINGS.HdcpVersion=<HDCP_ver>

◂ pw•/MEDIA/PORTS/VIDEO/<in>/SETTINGS.HdcpVersion=<HDCP_ver>

Parameters

Identifier	Parameter description	Parameter values
<HDCP_ver>	HDCP setting	**0:** HDCP encryption is disabled **1:** HDCP 1.4 encryption is enabled **2:** HDCP 2.2 is enabled **3:** High value mode: Any HDCP version is allowed on the input but the incoming signal is internally converted up to HDCP 2.2 always, thus, the signal 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

8.6. 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.

8.6.1. Creating a New Preset

Command and Response

▸ CALL•/MEDIA/PRESET:create(<preset_name>,VIDEO)

◂ mO•/MEDIA/PRESET:create=

Parameters

Up to 16 characters are allowed as <preset_name>. Letters (A-Z and a-z), hyphen (-), underscore (_), and numbers (0-9) are accepted. '**VIDEO**' is a mandatory parameter.

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.

8.6.2. Saving the Settings to an Existing Preset

Command and Response

▸ CALL•/MEDIA/PRESET/<preset_name>:save(1)

◂ mO•/MEDIA/PRESET/<preset_name>: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.

8.6.3. Loading a Preset

Command and Response

▸ CALL•/MEDIA/PRESET/<preset_name>:load(1)

◂ mO•/MEDIA/PRESET/<preset_name>: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.

8.6.4. Renaming a Preset

Command and Response

▸ CALL•/MEDIA/PRESET:rename(<Old_name>,<New_name>)

◂ 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**'.

8.7. Audio Input Port Settings

▌ INFO: The current setting can be queried by using the GET command in all cases.

8.7.1. Audio Mode Setting

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.AudioMode=<audio_mode>

◂ pw•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.AudioMode=<audio_mode>

Parameters

Identifier	Parameter description	Parameter values
<audio_mode>	The current audio mode	**OFF:** no audio in the video stream **HDMI:** the original audio is embedded in the video stream **ANALOG:** the analog audio of the input port is embedded in the video stream

Example

▸ SET /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.AudioMode=ANALOG

◂ pw /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.AudioMode=ANALOG

8.7.2. Analog Audio Input Level Settings

8.7.2.1. Setting the Balance (the Exact Value)

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Balance=<bal_value>

◂ pw•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Balance=<bal_value>

Parameters

The <bal_value> can be set between -100 and 100 (0=center, +100=right, -100=left).

Example

▸ SET /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Balance=50

◂ pw /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Balance=50

8.7.2.2. Setting the Balance (by a Step Value)

Command and Response

▸ CALL•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO:stepBalance(<step_value>)

◂ 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.

8.7.2.3. Setting the Mute State

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Mute=<mute_state>

◂ pw•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Mute=<mute_state>

Parameters

If the <mute_state> parameter is **0** (or **false**) the port is not muted. If the value is **1** (or **true**) the port is muted.

Example

▸ SET /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Mute=true

◂ pw /MEDIA/PORTS/VIDEO/I1/ANALOGAUDIO.Mute=true

8.7.2.4. Setting the Gain

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Gain=<gain_value>

◂ pw•/MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Gain=<gain_value>

Parameters

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

8.8. Video Output Port Settings

8.8.1. Querying the Status of the Output Ports

Command and Response

▸ GET•/MEDIA/XP/VIDEO.DestinationPortStatus

◂ pr•/MEDIA/XP/VIDEO.DestinationPortStatus=<out1_state>;<out2_state>;...; <out8_state>

The <in#_state> parameters mean the O1-O8 output ports one after the other. The value of the parameter is one letter and a 1-byte long HEX code showing the current state of the output port.

Example

▸ GET /MEDIA/XP/VIDEO.DestinationPortStatus

◂ pr /MEDIA/XP/VIDEO.DestinationPortStatus=MEF;TAA;TAA;TAA;TAA;TAA;TAA;TAA

Parameters

See the Video Input Port Settings section.

Explanation

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

8.8.2. Setting the Signal Type (HDMI mode)

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<out>/SETTINGS.ForcedSignalType=<sig_type>

◂ pw•/MEDIA/PORTS/VIDEO/<out>/SETTINGS.ForcedSignalType=<sig_type>

Parameters

Identifier	Parameter description	Parameter values
<sig_type>	The video signal type	**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

8.8.3. Muting an Output

Command and Response

▸ CALL•/MEDIA/XP/VIDEO:muteDestination(<out>)

◂ mO•/MEDIA/XP/VIDEO:muteDestination=OK

Example

▸ CALL /MEDIA/XP/VIDEO:muteDestination(O1;O3)

◂ mO /MEDIA/XP/VIDEO:muteDestination=OK

8.8.4. Unmuting an Output

Command and Response

▸ CALL•/MEDIA/XP/VIDEO:unmuteDestination(<out>)

◂ mO•/MEDIA/XP/VIDEO:unmuteDestination=OK

Example

▸ CALL /MEDIA/XP/VIDEO:unmuteDestination(O1;O2)

◂ mO /MEDIA/XP/VIDEO:unmuteDestination=OK

8.8.5. Locking an Output

Command and Response

▸ CALL•/MEDIA/XP/VIDEO:lockDestination(<out>)

◂ mO•/MEDIA/XP/VIDEO:lockDestination=OK

Example

▸ CALL /MEDIA/XP/VIDEO:lockDestination(O1;O4)

◂ mO /MEDIA/XP/VIDEO:lockDestination=OK

8.8.6. Unlocking an Output

Command and Response

▸ CALL•/MEDIA/XP/VIDEO:unlockDestination(<out>)

◂ mO•/MEDIA/XP/VIDEO:unlockDestination=OK

Example

▸ CALL /MEDIA/XP/VIDEO:unlockDestination(O1;O2;O4)

◂ mO /MEDIA/XP/VIDEO:unlockDestination=OK

8.8.7. Setting the Signal Conversion Mode

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

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<out>/SETTINGS.Conversion=<conv_mode>

◂ pw•/MEDIA/PORTS/VIDEO/<out>/SETTINGS.Conversion=<conv_mode>

Legend

Identifier	Parameter description	Parameter values
<conv_mode>	The video conversion mode	**OFF:** there is 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

8.8.8. 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 backward compatibility, HDMI 2.0 only requires the use of scrambling with data rates of above 3.4 Gbps per lane.

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<out>/SETTINGS.ForcedScrambling=<scr_mode>

◂ pw•/MEDIA/PORTS/VIDEO/<out>/SETTINGS.ForcedScrambling=<scr_mode>

Parameters

The option can be set on the output ports to **AUTO / FORCED ON / FORCED OFF**.

Example

▸ SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.ForcedScrambling=AUTO

◂ pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.ForcedScrambling=AUTO

8.8.9. Setting the HDCP Mode (Output Port)

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/<On>/SETTINGS.HdcpMode=<HDCP_mode>

◂ pw•/MEDIA/PORTS/VIDEO/<On>/SETTINGS.HdcpMode=<HDCP_mode>

Parameters

Identifier	Parameter description	Parameter values
<HDCP_mode>	The HDCP mode at the output port	**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

8.8.10. Sending CEC Commands Towards the Sink

> INFO: The hidden first 2x2 bit of the CEC command is static (always 40), it refers to the logical address of the sender and the addressee. **4:** sender is a **Playback Device 1**. ; **4:** the addressee is the **TV**.

8.8.10.1. Sending an OSD String

Sending the OSD string consists of two steps. First, set the **CEC.OsdString** property with the desired text, after that, call the **CEC.send(set_osd)** method.

Step 1 – Setting the CEC.OsdString Property

Command and Response

▶ SET•/MEDIA/PORTS/<out>/CEC.OsdString=<text>
◀ pw•/MEDIA/PORTS/<out>/CEC.OsdString=<text>

Parameters

The following characters are allowed in the text: Letters (A-Z) and (a-z), hyphen (-), underscore (_), numbers (0-9), and dot (.). Max length: 14 characters.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/CEC.OsdString=Lightware
◀ pw /MEDIA/PORTS/VIDEO/O1/CEC.OsdString=Lightware

Step 2 – Calling the CEC.send(set_osd) Method

Command and Response

▶ CALL•/MEDIA/PORTS/VIDEO/<out>/CEC:send(set_osd)
◀ mO•/MEDIA/PORTS/VIDEO/<out>/CEC:send=OK

Example

▶ CALL /MEDIA/PORTS/VIDEO/O1/CEC:send(set_osd)
◀ mO /MEDIA/PORTS/VIDEO/O1/CEC:send=OK

8.8.10.2. Sending a CEC Command in Text Format

Command and Response

▶ CALL•/MEDIA/PORTS/VIDEO/<out>/CEC:send(<command>)
◀ mO•/MEDIA/PORTS/VIDEO/<out>/CEC:send=OK

Example

▶ CALL /MEDIA/PORTS/VIDEO/O1/CEC:send(power_on)
◀ mO /MEDIA/PORTS/VIDEO/O1/CEC:send=OK

The followings are accepted as a <command>:

- ok/ back
- up/ down/ left/ right
- root_menu/ setup_menu/ contents_menu/ favorite_menu
- media_top_menu/ media_context_menu
- number_0/.../number_9
- dot/ enter/ clear
- channel_up/ channel_down
- sound_select/ input_select
- display_info
- page_up/ page_down
- power_legacy
- volume_up/ volume_down
- mute_toggle/ mute/ unmute
- play/ stop/ pause/ record/ rewind/ fast_forward/ eject
- skip_forward/ skip_backward
- 3d_mode
- stop_record/ pause_record
- play_forward/play_reverse
- stop_function
- select_next_media
- select_media_1/.../ select_media_5
- select_next_input
- select_input_1/.../ select_input_6
- power_toggle/ power_on/ power_off
- f1/.../f4
- standby

8.8.10.3. Sending a CEC Command in Hexadecimal Format

Command and Response

▶ CALL•/MEDIA/PORTS/VIDEO/<out>/CEC:sendHex(<hex_command>)
◀ mO•/MEDIA/PORTS/VIDEO/<out>/CEC:sendHex=OK

Parameters

Accepted <hex_command> value is max. 30 character long (15 byte) in hexadecimal format. The codes are separated with a space character.

Example

▶ CALL /MEDIA/PORTS/VIDEO/O1/CEC:sendHex(87 00 E0 91)
◀ mO /MEDIA/PORTS/VIDEO/O1/CEC:sendHex=OK

8.9. Audio Output Port Settings

▌ INFO: The current setting can be queried by using the GET command in all cases.

8.9.1. Audio Mode Setting

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO.AudioMode=\<audio_mode\>

◂ pw•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO.AudioMode=\<audio_mode\>

Parameters

Identifier	Parameter description	Parameter values
\<audio_mode\>	The audio working mode	**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

8.9.2. Analog Audio Output Level Settings

8.9.2.1. Setting the Volume (Exact Value)

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO.VolumedB=\<vol_value\>

◂ pw•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO.VolumedB=\<vol_value\>

Parameters

The \<vol_value\> parameter 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

8.9.2.2. Setting the Volume (by Step Value)

Command and Response

▸ CALL•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO:stepVolumedB(\<step_value\>)

◂ mO•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO:stepVolumedB=\<step_value\>

Example

▸ CALL /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepVolumedB(-2)

◂ mO /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepVolumedB=-2

Explanation

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.**

8.9.2.3. Setting the Balance (Exact Value)

Command and Response

▸ SET•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO.Balance=\<bal_value\>

◂ pw•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO.Balance=\<bal_value\>

Parameters

The \<bal_value\> parameter can be set between -100 and +100 (0=center, +100=right, -100=left).

Example

▸ SET /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Balance=10

◂ pw /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Balance=10

8.9.2.4. Setting the Balance (by Step Value)

Command and Response

▸ CALL•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO:stepBalance(\<step_value\>)

◂ mO•/MEDIA/PORTS/VIDEO/\<out\>/ANALOGAUDIO:stepBalance=\<step_value\>

Example

▸ CALL /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepBalance(-10)

◂ mO /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO:stepBalance=-10

Explanation

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

8.9.2.5. Setting the Mute State

Command and Response

▶ SET•/MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO.Mute=<mute_state>

◀ pw•/MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO.Mute=<mute_state>

Parameters

If the <mute_state> parameter is **0** (or **false**) the port is not muted. If the value is **1** (or **true**) the port is muted.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Mute=true

◀ pw /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.Mute=true

8.10. RS-232 Port Settings

INFO: The current setting can be queried by using the GET command.

8.10.1. Setting the Current Command Protocol

Command and Response

▶ SET•/MANAGEMENT/SERIAL.Protocol=<prot_mode>

◀ pw•/MANAGEMENT/SERIAL.Protocol=<prot_mode>

Parameters

Identifier	Parameter description	Parameter values
<prot_mode>	The applied protocol of the RS-232 port	**LW2:** Lightware Protocol #2 is applied. **LW3:** Lightware Protocol #3 is applied. **P#2:** The additional P#2 protocol is applied.

Example

▶ SET /MANAGEMENT/SERIAL.Protocol=LW3

◀ pw /MANAGEMENT/SERIAL.Protocol=LW3

8.10.2. Setting the Baud Rate

Command and Response

▶ SET•/MANAGEMENT/SERIAL.Baudrate=<BAUD_value>

◀ pw•/MANAGEMENT/SERIAL.Baudrate=<BAUD_value>

Parameters

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

Example

▶ SET /MANAGEMENT/SERIAL.Baudrate=57600

◀ pw /MANAGEMENT/SERIAL.Baudrate=57600

8.11. Network Settings

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

8.11.1. Querying the Current IP Address

Command and Response

▶ GET•/MANAGEMENT/NETWORK.IpAddress

◀ pr•/MANAGEMENT/NETWORK.IpAddress=<IP_address>

Example

▶ GET /MANAGEMENT/NETWORK.IpAddress

◀ pr /MANAGEMENT/NETWORK.IpAddress=192.168.0.101

8.11.2. Setting a Dynamic IP Address

Command and Response

▶ SET•/MANAGEMENT/NETWORK.DhcpEnabled=<DHCP_state>

◀ pw•/MANAGEMENT/NETWORK.DhcpEnabled=<DHCP_state>

Parameters

If the <DHCP_state> parameter is **0** (or **false**) the device is set to apply a static IP address. If the value is **1** (or **true**) the device is set to get a dynamic IP address from the DHCP server in the network.

Example

▶ SET /MANAGEMENT/NETWORK.DhcpEnabled=true

◀ pw /MANAGEMENT/NETWORK.DhcpEnabled=true

8.11.3. Static IP Address Settings

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

8.11.3.1. Setting an IP address

Command and Response

▶ SET•/MANAGEMENT/NETWORK.StaticIpAddress=<IP_address>

◀ pw•/MANAGEMENT/NETWORK.StaticIpAddress=<IP_address>

Example

▶ SET /MANAGEMENT/NETWORK.StaticIpAddress=192.168.0.80

◀ pw /MANAGEMENT/NETWORK.StaticIpAddress=192.168.0.80

8.11.3.2. Subnet Mask Setting

Command and Response

‣ SET•/MANAGEMENT/NETWORK.StaticNetworkMask=<Net_mask>

◂ pw•/MANAGEMENT/NETWORK.StaticNetworkMask=<Net_mask>

Example

‣ SET /MANAGEMENT/NETWORK.StaticNetworkMask=255.255.0.0

◂ pw /MANAGEMENT/NETWORK.StaticNetworkMask=255.255.0.0

8.11.3.3. Gateway Setting

Command and Response

‣ SET•/MANAGEMENT/NETWORK.StaticGatewayAddress=<Gateway_address>

◂ pw•/MANAGEMENT/NETWORK.StaticGatewayAddress=<Gateway_address>

Example

‣ SET /MANAGEMENT/NETWORK.StaticGatewayAddress=192.168.0.1

◂ pw /MANAGEMENT/NETWORK.StaticGatewayAddress=192.168.0.1

8.12. EDID Management

8.12.1. Querying the Emulated EDIDs

Command and Response

‣ GET•/EDID.EdidStatus

◂ pr•/EDID.EdidStatus=<E1_EDID>;<E2_EDID>;...;<E8_EDID>

Parameters

The <E#_EDID> parameters mean the I1-I8 (E1-E8) input ports one after the other. The value of the parameter shows the location of the currently emulated EDID at the given input port.

Example

‣ GET /EDID.EdidStatus

◂ pr /EDID.EdidStatus=U1;U1;D2;D2;F49;F49;F49;F49

Explanation

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

8.12.2. Setting the Emulated EDID

Command and Response

‣ CALL•/EDID:switch(<Source>:<Destination>)

◂ mO•/EDID:switch=

Parameters

Identifier	Parameter description	Parameter values
<source>	Source EDID memory place	**F1-F148:** Factory presets. **D1-D8:** Dynamic EDID from the sink connected to the output port. **U1-U100:** User EDID memory.
<destination>	Emulated EDID memory place	**E1-E8:** The emulated EDID memory location of the input port.

Example

‣ CALL /EDID:switch(F49:E1;F29:E5)

◂ mO /EDID:switch=

8.12.3. Copying an EDID into the User EDID Memory

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

Command and Response

‣ CALL•/EDID:copy(<source>:<destination>)

◂ mO•/EDID:copy=

Parameters

Identifier	Parameter description	Parameter values
<source>	Source EDID memory place	**F1-F148:** Factory presets. **D1-D8:** Dynamic EDID from the sink connected to the output port. **U1-U100:** User EDID memory.
<destination>	User EDID memory	**U1-U100:** The destination User EDID memory slot.

Example

‣ CALL /EDID:copy(D2:U5;D3:U6)

◂ mO /EDID:copy=

8.13. LW3 Commands – Quick Summary

System Commands

Operation / Path	
8.3.1	Querying the Product Name /.ProductName
8.3.2	Setting the Device Label /MANAGEMENT/UID.DeviceLabel
8.3.3	Querying the Serial Number /.SerialNumber
8.3.4	Resetting the Matrix /SYS:softReset()
8.3.5	Restoring the Factory Default Settings /SYS:factoryDefaults()
8.3.6	Switching to Standby Mode /MANAGEMENT/POWER:standby()
8.3.7	Switching to Normal Mode /MANAGEMENT/POWER:wakeUp()

Switching and Crosspoint Settings

Operation / Path	
8.4.1	Query the Video Crosspoint State /MEDIA/XP/VIDEO.DestinationConnectionStatus
8.4.2	Switching an Input to an Output /MEDIA/XP/VIDEO:switch
8.4.3	Switching an Input to All Outputs /MEDIA/XP/VIDEO:switchAll
8.4.4	Multiple Switching /MEDIA/XP/VIDEO:switchMulti

Video Input Port Settings

Operation / Path	
8.5.1	Querying the Status of the Source Ports /MEDIA/XP/VIDEO.SourcePortStatus
8.5.2	Muting an Input Port /MEDIA/XP/VIDEO:muteSource
8.5.3	Unmuting an Input Port /MEDIA/XP/VIDEO:unmuteSource
8.5.4	Locking an Input Port /MEDIA/XP/VIDEO:lockSource

Operation / Path	
8.5.5	Unlocking an Input Port /MEDIA/XP/VIDEO:unlockSource
8.5.6	Sending CEC Commands Towards the Source
8.5.6.1	Sending an OSD String /MEDIA/PORTS/<in>/CEC.OsdString and /MEDIA/PORTS/VIDEO/<in>/CEC:send(set_osd)
8.5.6.2	Sending a CEC Command in Text Format /MEDIA/PORTS/VIDEO/<in>/CEC:send
8.5.6.3	Sending a CEC Command in Hexadecimal Format /MEDIA/PORTS/VIDEO/<in>/CEC:sendHex
8.5.7	Setting the HDCP State /MEDIA/PORTS/VIDEO/<in>/SETTINGS.HdcpVersion

Preset Handling

Operation / Path	
8.6.1	Creating a New Preset /MEDIA/PRESET:create
8.6.2	Saving the Settings to an Existing Preset /MEDIA/PRESET/<preset_name>:save(1)
8.6.3	Loading a Preset /MEDIA/PRESET/<pres_name>:load(1)
8.6.4	Renaming a Preset /MEDIA/PRESET:rename

Audio Input Port Settings

Operation / Path	
8.7.1	Audio Mode Setting /MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.AudioMode
8.7.2	Analog Audio Input Level Settings /MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO
8.7.2.1	Setting the Balance (the Exact Value) /MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Balance
8.7.2.2	Setting the Balance (by a Step Value) /MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.StepBalance
8.7.2.3	Setting the Mute State /MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Mute
8.7.2.4	Setting the Gain MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO.Gain

Video Output Port Settings

Operation / Path	
8.8.1	Querying the Status of the Output Ports /MEDIA/XP/VIDEO.DestinationPortStatus
8.8.2	Setting the Signal Type (HDMI mode) /MEDIA/PORTS/VIDEO/<out>/SETTINGS.ForcedSignalType
8.8.3	Muting an Output /MEDIA/XP/VIDEO:muteDestination(<out>)
8.8.4	Unmuting an Output /MEDIA/XP/VIDEO:unmuteDestination(<out>)
8.8.5	Locking an Output /MEDIA/XP/VIDEO:lockDestination(<out>)
8.8.6	Unlocking an Output /MEDIA/XP/VIDEO:unlockDestination(<out>)
8.8.7	Setting the Signal Conversion Mode /MEDIA/PORTS/VIDEO/<out>/SETTINGS.Conversion
8.8.8	Scrambling /MEDIA/PORTS/VIDEO/<out>/SETTINGS.ForcedScrambling
8.8.9	Setting the HDCP Mode (Output Port) /MEDIA/PORTS/VIDEO/<out>/SETTINGS.HdcpMode
8.8.10	Sending CEC Commands Towards the Sink
8.8.10.1	Sending an OSD String /MEDIA/PORTS/<out>/CEC.OsdString and /MEDIA/PORTS/VIDEO/<out>/CEC:send(set_osd)
8.8.10.2	Sending a CEC Command in Text Format /MEDIA/PORTS/VIDEO/<out>/CEC:send
8.8.10.3	Sending a CEC Command in Hexadecimal Format /MEDIA/PORTS/VIDEO/<out>/CEC:sendHex

Audio Output Port Settings

Operation / Path	
8.9.1	Audio Mode Setting /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO.AudioMode
8.9.2	Analog Audio Output Level Settings /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO
8.9.2.1	Setting the Volume (Exact Value) /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO.VolumedB
8.9.2.2	Setting the Volume (by Step Value) /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO:stepVolumedB

Operation / Path	
8.9.2.3	Setting the Balance (Exact Value) /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO.Balance
8.9.2.4	Setting the Balance (by Step Value) /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO:stepBalance
8.9.2.5	Setting the Mute State /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO.Mute

RS-232 Port Settings

Operation / Path	
8.10.1	Setting the Current Command Protocol /MANAGEMENT/SERIAL.Protocol
8.10.2	Setting the Baud Rate /MANAGEMENT/SERIAL.Baudrate

Network Settings

Operation / Path	
8.11.1	Querying the Current IP Address /MANAGEMENT/NETWORK.IpAddress
8.11.2	Setting a Dynamic IP Address /MANAGEMENT/NETWORK.DhcpEnabled
8.11.3	Static IP Address Settings /MANAGEMENT/NETWORK
8.11.3.1	Setting an IP address /MANAGEMENT/NETWORK.StaticIpAddress
8.11.3.2	Subnet Mask Setting /MANAGEMENT/NETWORK.StaticNetworkMask
8.11.3.3	Gateway Setting /MANAGEMENT/NETWORK.StaticGatewayAddress

EDID Management

Operation / Path	
8.12.1	Querying the Emulated EDIDs /EDID.EidStatus
8.12.2	Setting the Emulated EDID /EDID:switch
8.12.3	Copying an EDID into the User EDID Memory /EDID:copy

9

Firmware Upgrade

This chapter is meant to help customers perform firmware upgrades on our products by giving a few tips on how to start and by explaining the features of the Lightware Device Updater (LDU) software. To get the latest software and firmware pack can be downloaded from www.lightware.com.

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.com.

9.1. 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.

9.2. 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.

9.3. 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.
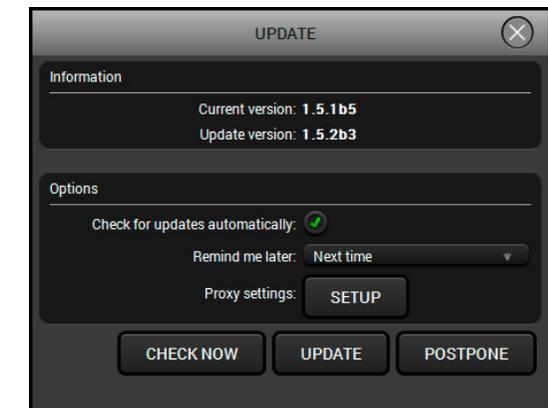
Step 2. Set the desired update settings in the **Options** section.
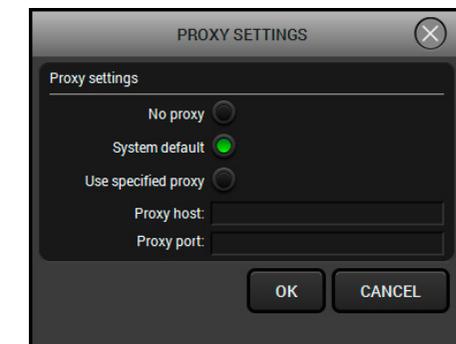
- ▪ If you do not want to check for updates automatically, uncheck the **Check for updates automatically** option.
- ▪ If you want to postpone the update, a reminder can be set with different delays from the **drop down list**.
- ▪ If the proxy settings do not range with the required settings, set the proper values then click the **OK** button.

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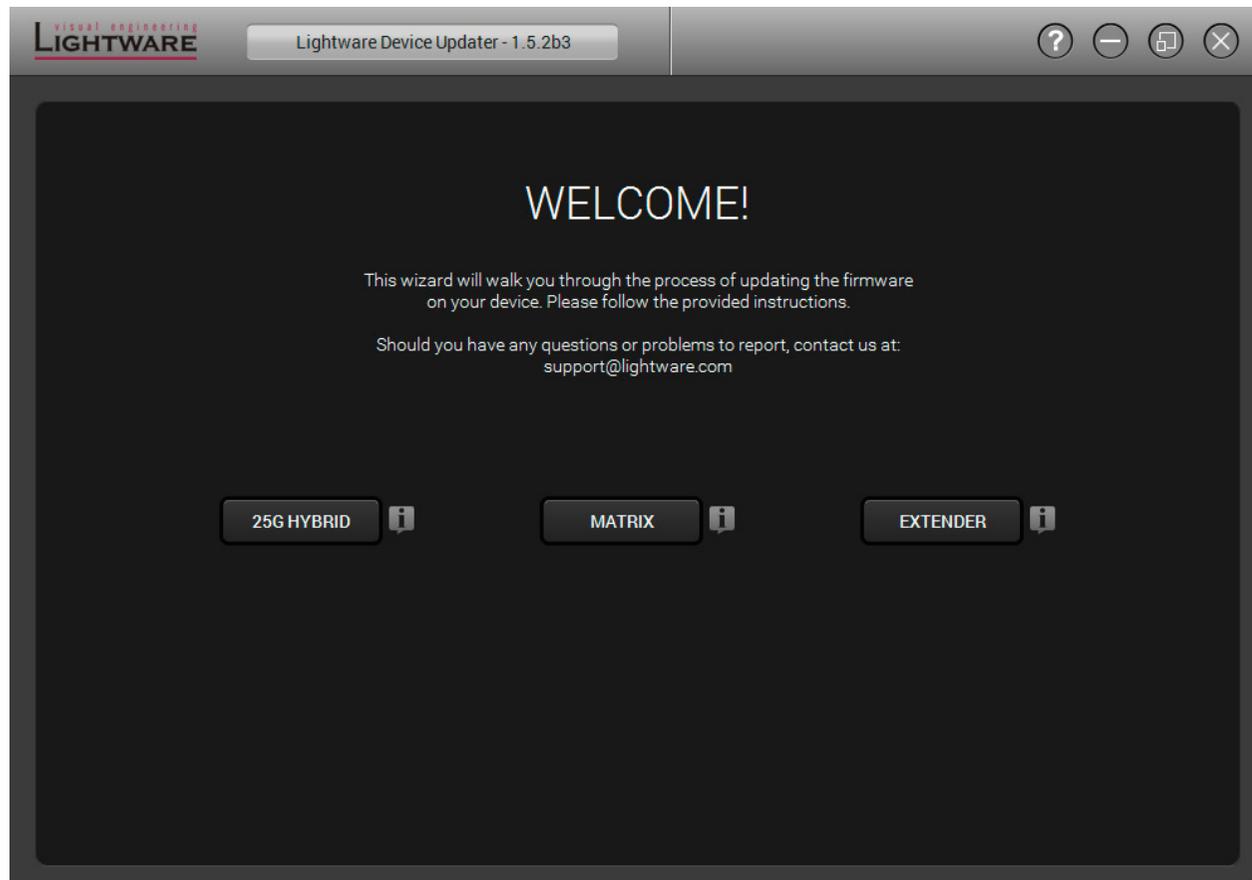
9.4. Detailed Instructions

9.4.1. 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.

9.4.2. Start the LDU and Follow the Instructions
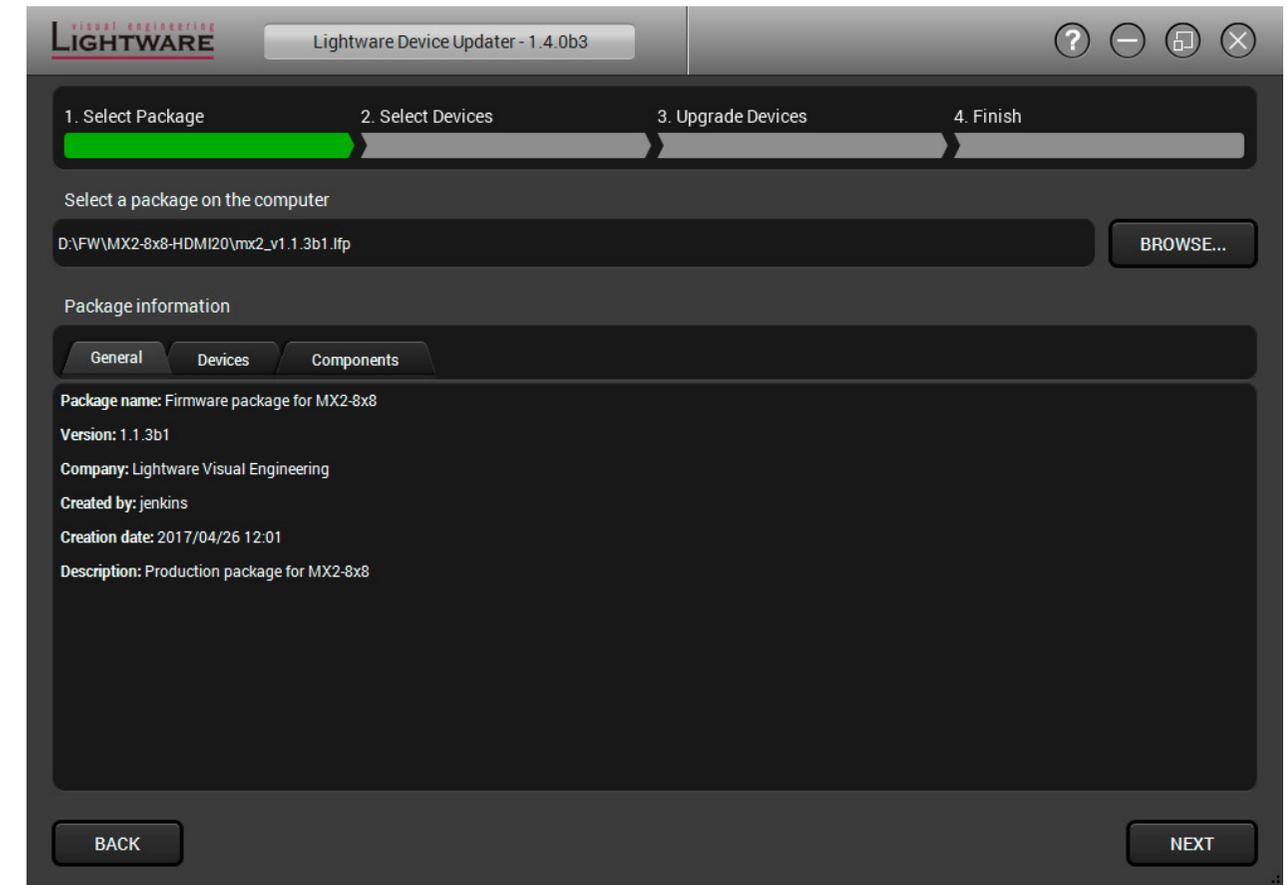
After launching LDU welcome screen appears:

After pressing the 🛈 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.
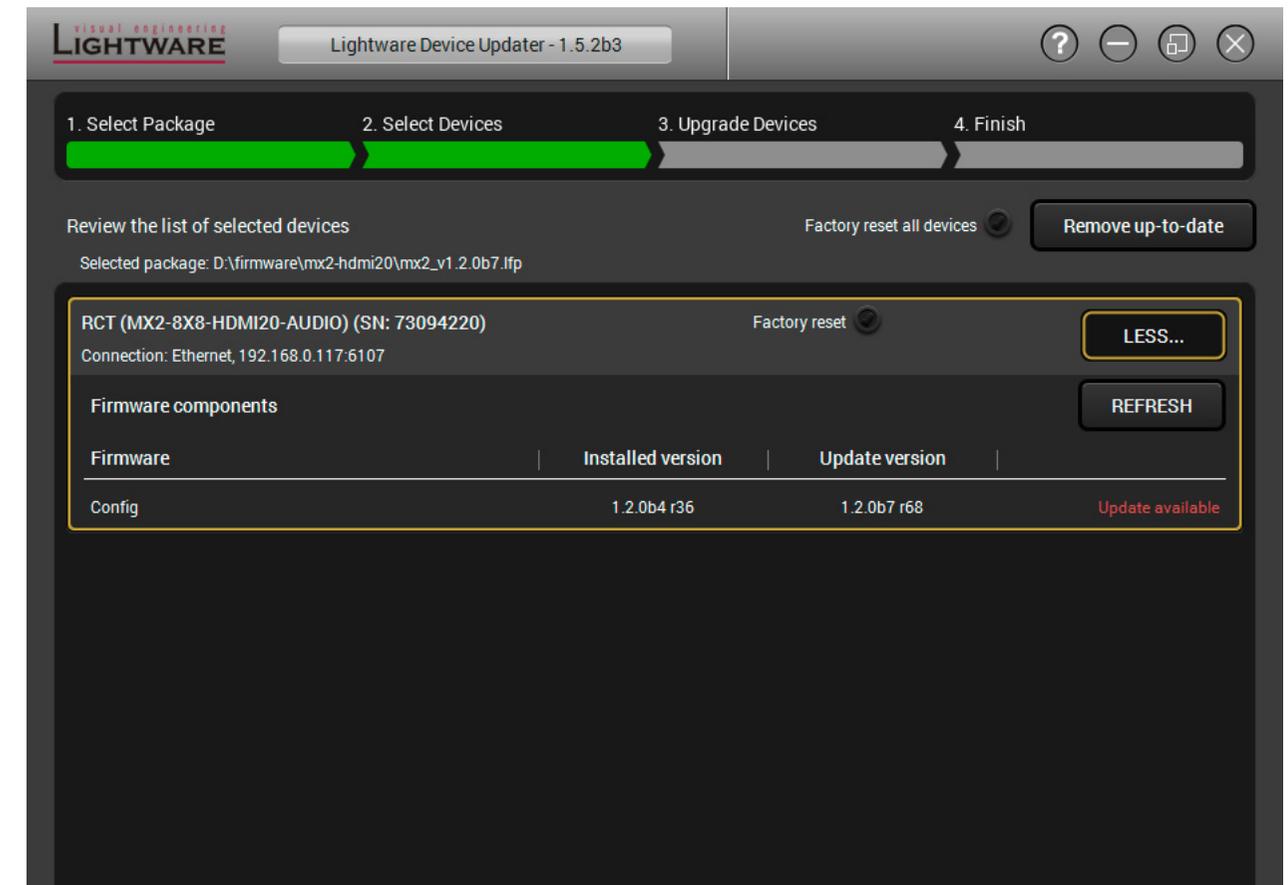
Step 2. Select the device.
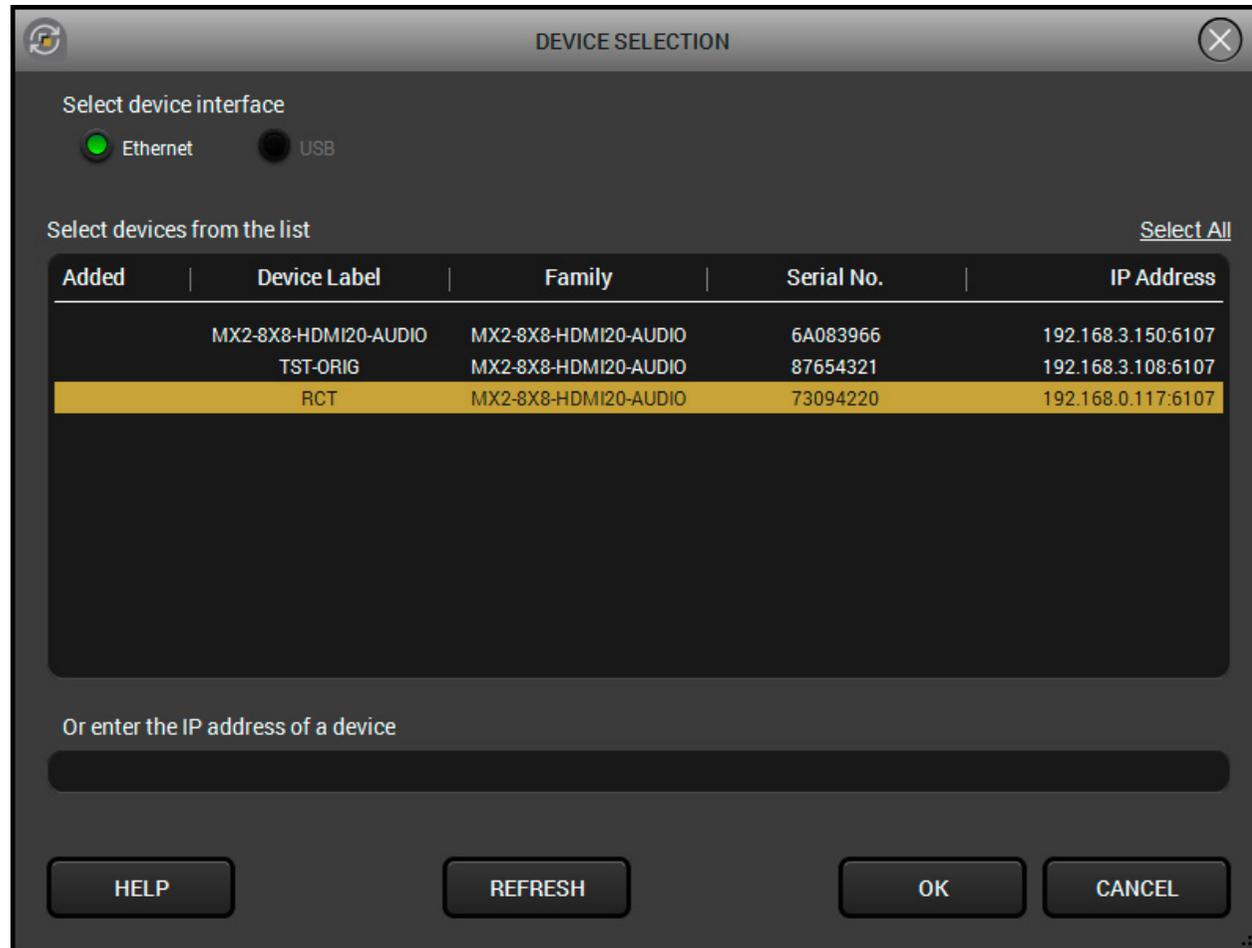
The next step is to select the desired device(s). The available and supported devices are searched for and listed automatically. If the desired device is not listed, update the list by clicking the **Refresh** button. Select the desired device by highlighted them: highlight them with a **yellow cursor,** 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.
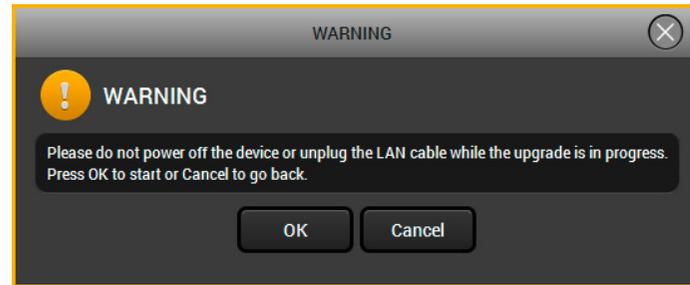
Click on the **Start** button to start the upgrade process.
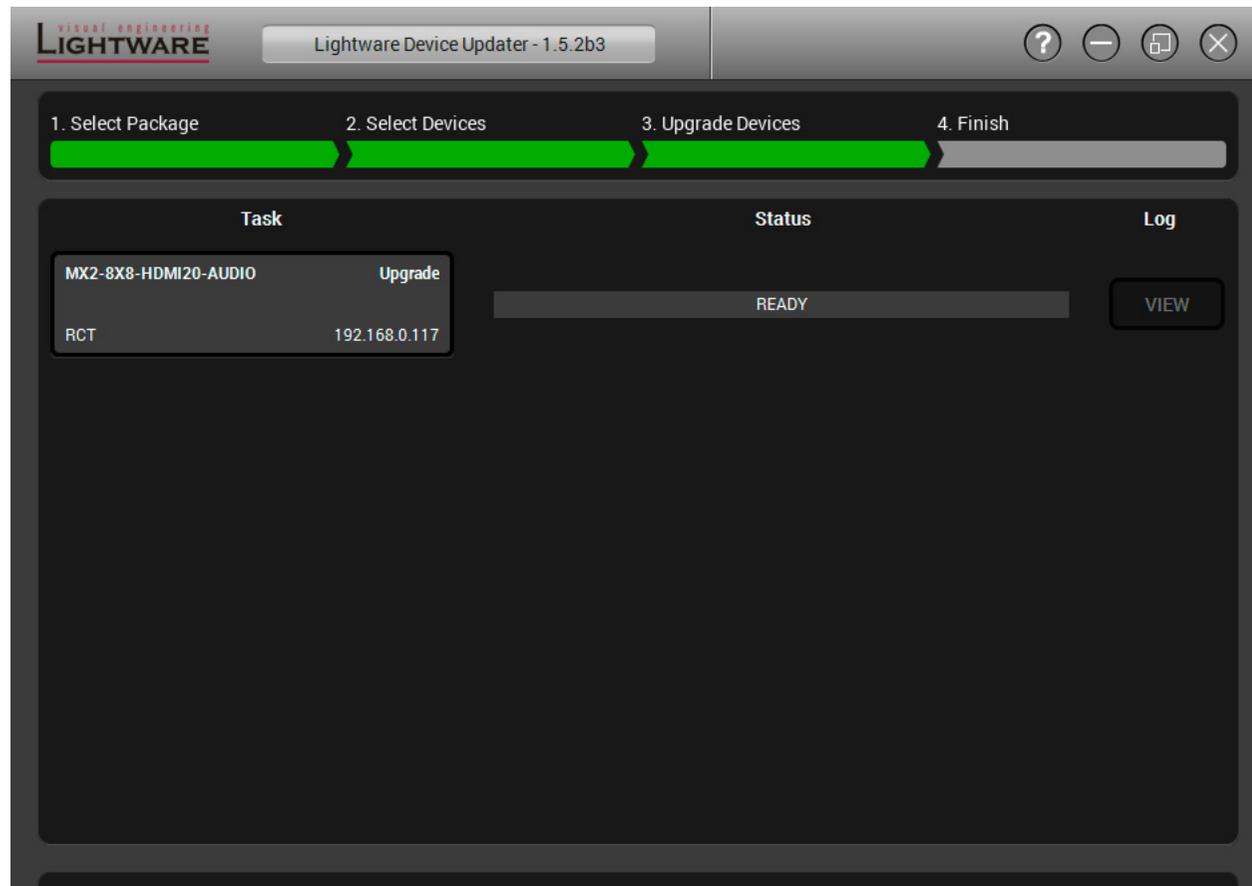
After you confirmed the warnings and clicked on the **Start** button, the upgrade process starts immediately.
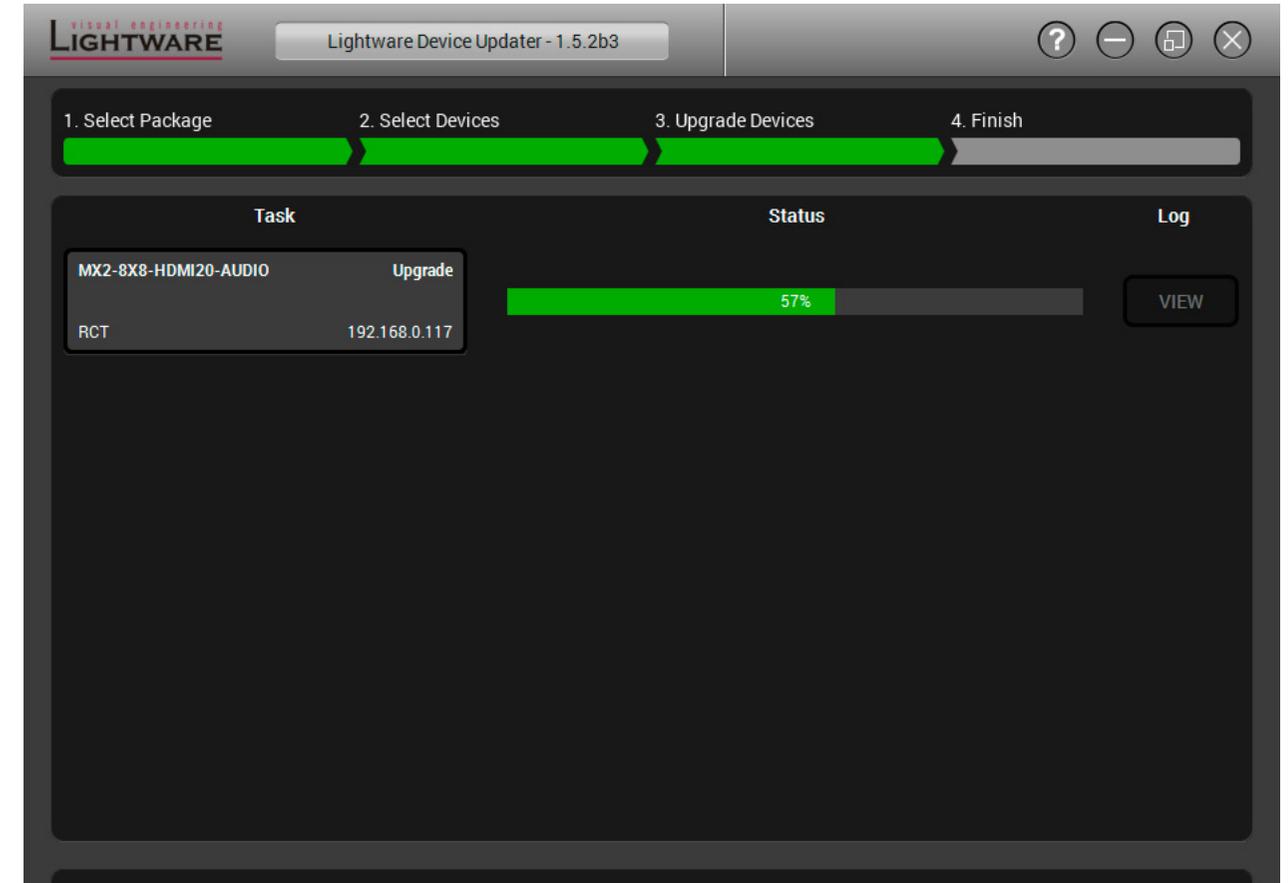
When the upgrade process is done once, a pop-up window appears which means the procedure was successful. Click **OK** to continue.

Details button opens a new window where the process is logged – see below.
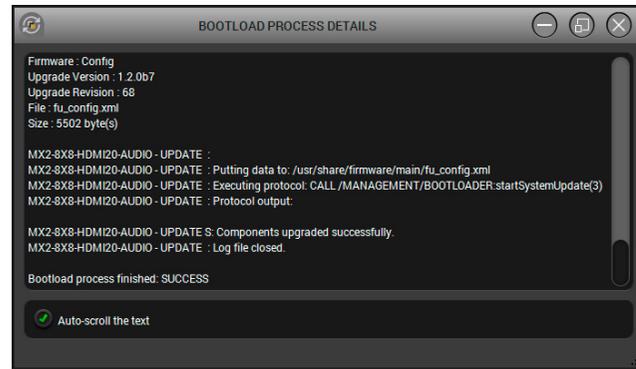
Step 4. Finish.

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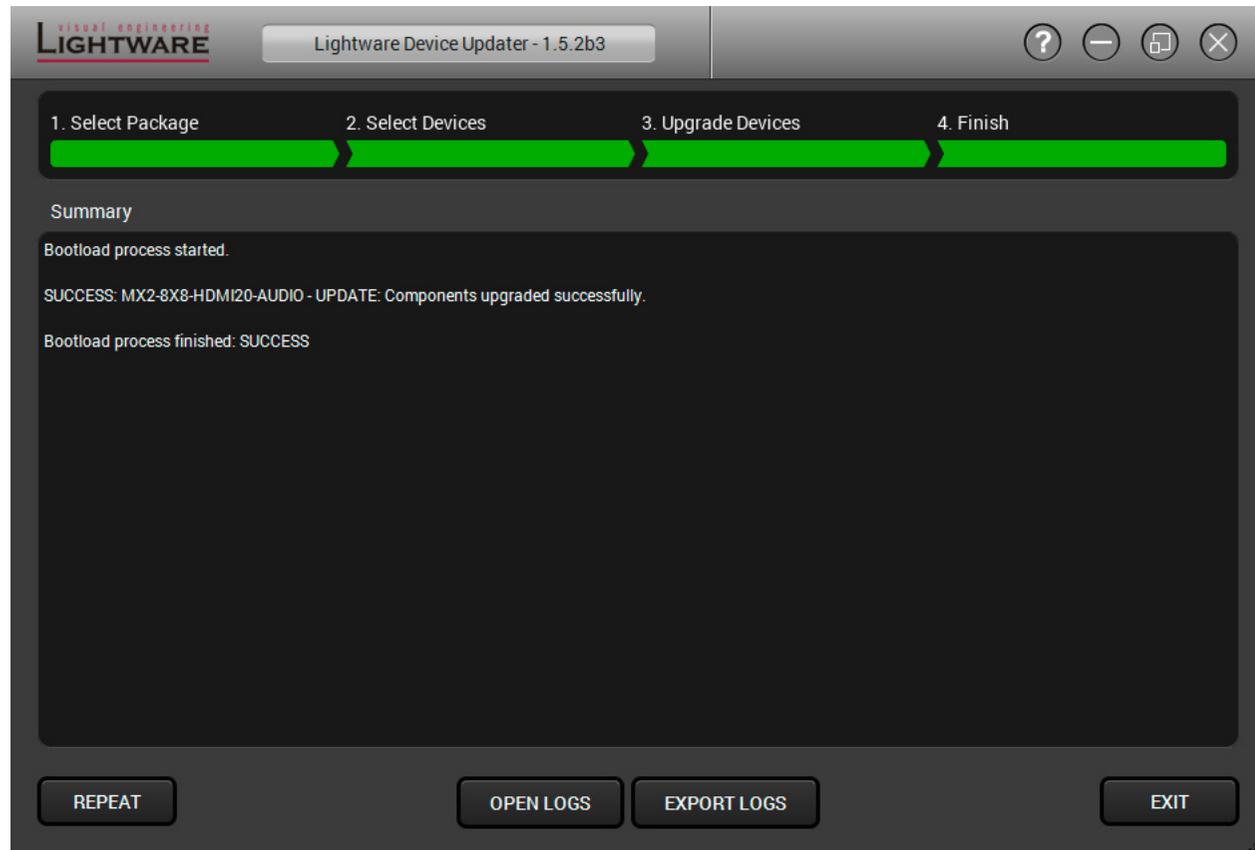
Clicking on the **Repeat** button starts the process again with the selected device(s).

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

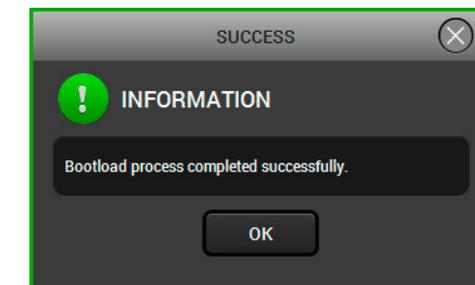**Export logs** by saving the files as a zipped file.

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.

10

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 MX2-8x8-HDMI20-Audio - Front View and MX2-8x8-HDMI20-Audio - Rear View section.

Pictogram Legend

🔌 Section to connections/cabling.

🖥 Section to front panel operation.

▦ Section to LDC software.

LW2 Section to LW2 protocol commands.

LW3 Section to LW3 protocol commands.

10.1. Use Case Studies

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.	🖥	4.2.1
			▦	6.3
			LW2	7.3
			LW3	8.4.1
	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.	▦	6.3.4
			LW2	7.3.6
			LW3	8.8.1
	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).	🖥	4.3.4
			▦	6.5
			LW3	8.12
	HDCP is disabled	Enable HDCP on input port(s) of the matrix.	▦	6.4.1
			LW3	8.5.7
No picture on the video output + signal error rate is high, HDMI2.0 scrambling is disabled, clock rate is set 1:10	The source sends 4K signals, but the emulated EDID is not supported this resolution.	Check the emulated EDID and select another (e.g. F139 EDID on the input port).	🖥	4.3.4
			▦	6.5
			LW3	8.12

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.		4.2
				6.3.1
			LW2	7.3.5
			LW3	8.7.1
	Output port is muted	Check the output port properties.		4.3.3
				6.3.4
			LW2	7.3.6
			LW3	8.8.1
	Analog audio input: volume is set very low	Check the Analog audio input port settings (Volume).		4.3.2
				6.3.3
			LW3	8.7.2
	Analog audio output: volume is set very low	Check the Analog audio output port settings (Volume).		4.3.3
				6.3.4
			LW3	8.9.2
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.		4.3.3
				6.3.4
			LW3	8.8.2
	DVI EDID is emulated	Check the EDID and select an HDMI EDID to emulate.		4.3.4
				6.6
			LW3	8.12
Symptom	**Root cause**	**Action**	**Refer to**	
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.		6.6.3
			LW3	8.10

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.		6.6.2
			LW3	8.11
		Restore the factory default settings (with fix IP).		6.6.5
			LW3	8.3.5
	IP address conflict	Change the IP address to a not reserved one or enable DHCP if DHCP server exists in the network.		4.3.1
				6.6.2
			LW3	8.11

10.2. How to Speed Up the Troubleshooting Process

Lightware's technical support team is always working hard to provide the fastest support possible. Our team's response time is one of the best in the industry and in the toughest of cases we can directly consult with the hardware or software engineer who designed the product to get the information from the most reliable source.
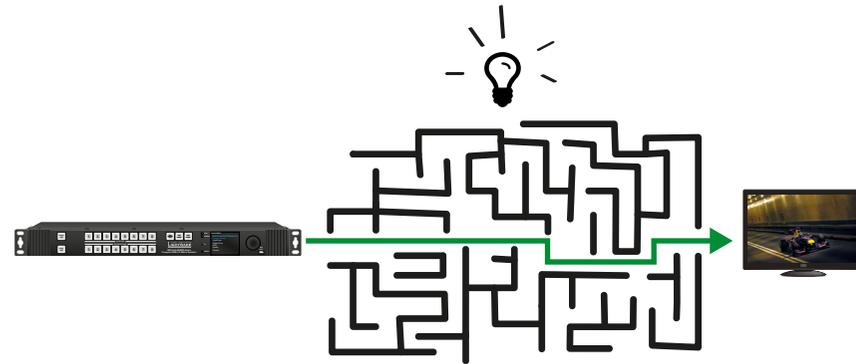
However, the troubleshooting process can be even faster... with your help.

There are certain pieces of information that push us in the right direction to finding the root cause of the problem. If we receive most of this information in the first e-mail or it is gathered at the time when you call us, then there is a pretty high chance that we will be able to respond with the final solution right away.

This information is the following:

- Schematic (a pdf version is preferred, but a hand drawing is sufficient).
- Serial number(s) of the device(s) (it is either printed somewhere on the box or you can query it in the Device Controller software or on the built-in website).
- Firmware versions of the devices (please note that there may be multiple CPUs or controllers in the device and we need to know all of their firmware versions, a screenshot is the best option).
- Cable lengths and types (in our experience, it's usually the cable).
- Patch panels, gender changers or anything else in the signal path that can affect the transmission.
- Signal type (resolution, refresh rate, color space, deep color).
- Emulated EDID(s) (please save them as file and send them to us).
- Actions to take in order to re-create the problem (if we cannot reproduce the problem, it is hard for us to find the cause).
- Photo or video about the problem ('image noise' can mean many different things, it's better if we see it too).
- Error logs from the Device Controller software.
- In the case of Event Manager issue the event file and/or backup file from the Device Controller software.

The more of the above information you can give us the better. Please send these information to the Lightware Support Team (support@lightware.com) to speed up the troubleshooting process.

11

Technologies

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

▸ EDID Management
▸ HDCP Management
▸ Pixel Accurate Reclocking

11.1. EDID Management

11.1.1. Understanding the EDID

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

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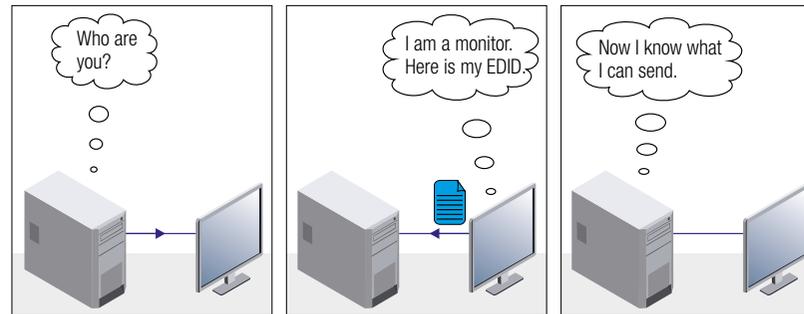
EDID Communication

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

Common Problems Related to EDID

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

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

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

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

11.1.2. Advanced EDID Management

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

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

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

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

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

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

11.2. HDCP Management

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

11.2.1. Protected and Unprotected Content

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

To avoid unnecessary HDCP encryption, Lightware introduced the HDCP enabling/disabling function: the HDCP capability can be disabled in the Lightware device. If HDCP is disabled, the connected source will detect that the sink is not HDCP capable, and turn off authentication.

11.2.2. Disable Unnecessary Encryption

HDCP Compliant Sink

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

Not HDCP-compliant Sink 1.

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

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

Not HDCP-compliant Sink 2.

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

11.2.3. 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 device 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 Lightware device. 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.

HDCP v1.4 Source and HDCP v2.2 Sink

The below example is the reversal 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 Lightware device 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.

HDCP 1.4   HDCP 2.2

HDCP 1.4
compliant source   MX2-8x8-HDMI20 series matrix   HDCP 2.2
compliant sink

What Kind of Signal Will be on the Output of the Lightware Device?

See 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

* Stream type 0: the video stream allows to convert the signal to apply a lower level of encryption.

** Stream type 1: the video stream does not allow to convert the signal.

11.3. Pixel Accurate Reclocking

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

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

Intra-pair skew

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


Intra-pair skew
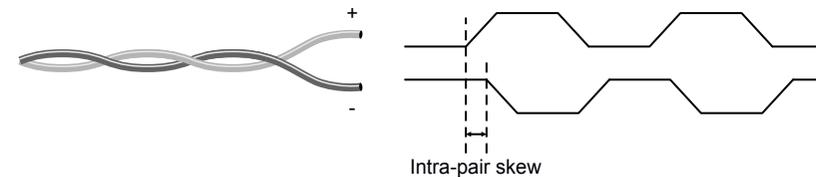
Inter-pair skew

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

Inter-pair skew
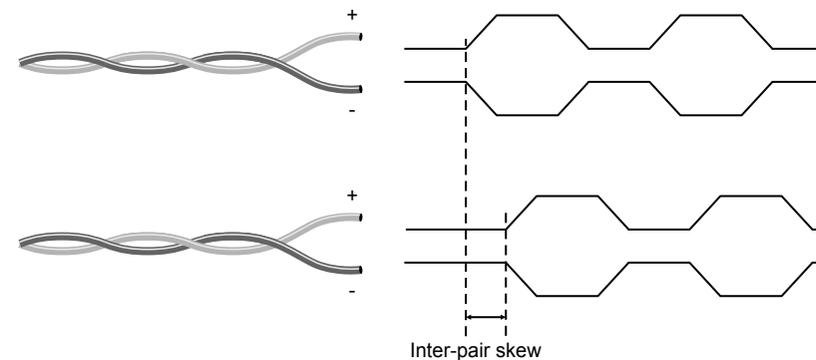
Jitter

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.
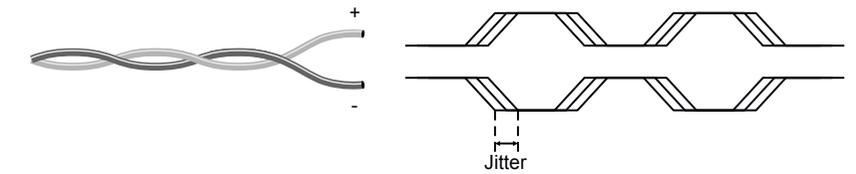
Jitter

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.
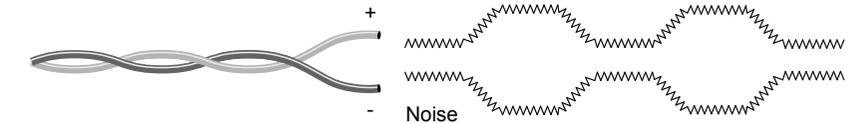
Noise

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 +50 °C (+32 to +122°F)

Operating humidity .... 10% to 90%, non-condensing

Power

Power source .... 100-240V AC, 50~60Hz

AC fuse F3.15A

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

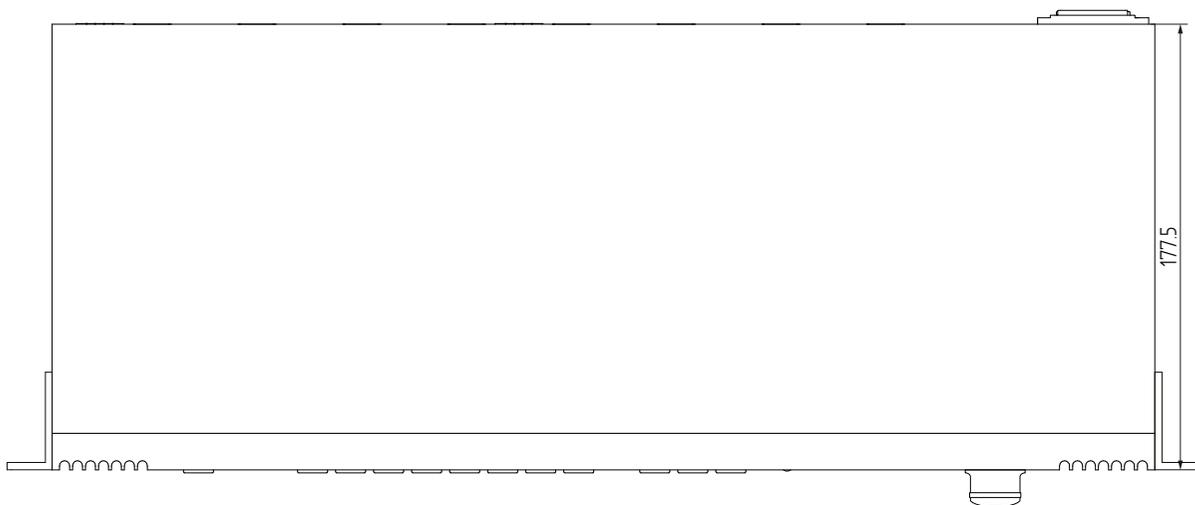## 12.2. Mechanical Drawings

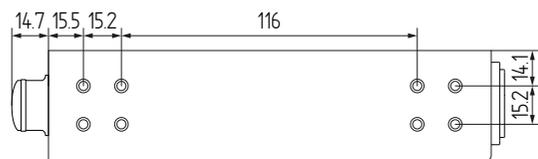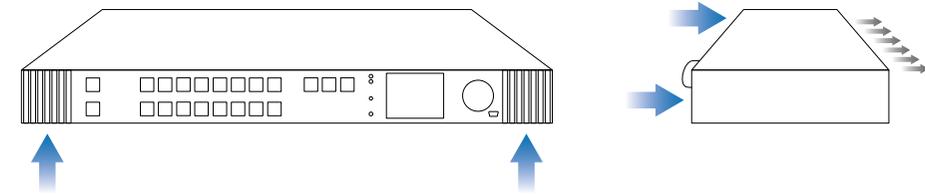**Front View**
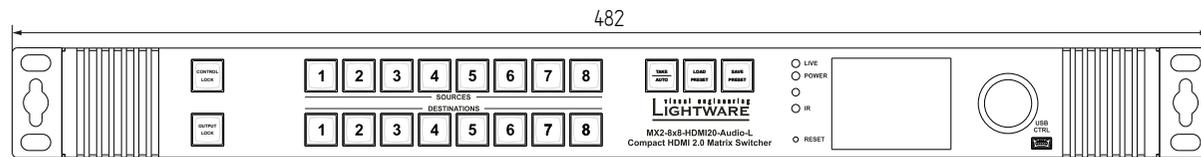
Rear View
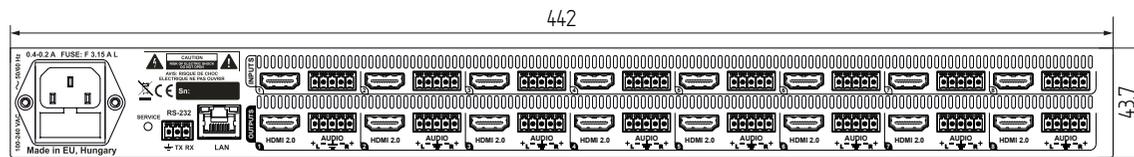
Top View

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 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

12.4. Factory EDID List

Mem.	Resolution	Type
F1	640 x 480 @ 60.00 Hz	D
F2	848 x 480 @ 60.00 Hz	D
F3	800 x 600 @ 60.32 Hz	D
F4	1024 x 768 @ 60.00 Hz	D
F5	1280 x 768 @ 50.00 Hz	D
F6	1280 x 768 @ 59.94 Hz	D
F7	1280 x 768 @ 75.00 Hz	D
F8	1360 x 768 @ 60.02 Hz	D
F9	1280 x 1024 @ 50.00 Hz	D
F10	1280 x 1024 @ 60.02 Hz	D
F11	1280 x 1024 @ 75.02 Hz	D
F12	1400 x 1050 @ 50.00 Hz	D
F13	1400 x 1050 @ 60.00 Hz	D
F14	1400 x 1050 @ 75.00 Hz	D
F15	1680 x 1050 @ 60.00 Hz	D
F16	1920 x 1080 @ 50.00 Hz	D
F17	1920 x 1080 @ 60.00 Hz	D
F18	2048 x 1080 @ 50.00 Hz	D
F19	2048 x 1080 @ 60.00 Hz	D
F20	1600 x 1200 @ 50.00 Hz	D
F21	1600 x 1200 @ 60.00 Hz	D
F22	1920 x 1200 @ 50.00 Hz	D
F23	1920 x 1200 @ 59.56 Hz	D
F24	2048 x 1200 @ 59.96 Hz	D
F29	Universal DVI	
F30	1440 x 480 @ 60.05 Hz	H
F31	1440 x 576 @ 50.08 Hz	H
F32	640 x 480 @ 59.95 Hz	H
F33	720 x 480 @ 59.94 Hz	H
F34	720 x 576 @ 50.00 Hz	H

Mem.	Resolution	Type
F35	1280 x 720 @ 50.00 Hz	H
F36	1280 x 720 @ 60.00 Hz	H
F37	1920 x 1080 @ 50.04 Hz	H
F38	1920 x 1080 @ 50.00 Hz	H
F39	1920 x 1080 @ 60.05 Hz	H
F40	1920 x 1080 @ 60.05 Hz	H
F41	1920 x 1080 @ 24.00 Hz	H
F42	1920 x 1080 @ 25.00 Hz	H
F43	1920 x 1080 @ 30.00 Hz	H
F44	1920 x 1080 @ 50.00 Hz	H
F45	1920 x 1080 @ 60.00 Hz	H
F46	1920 x 1080 @ 60.00 Hz	H
F47	Universal HDMI with PCM audio	
F48	Universal HDMI with All audio	
F49	Universal HDMI, all audio, deep color	
F91	1024 x 2400 @ 60.01 Hz	H
F98	1280 x 720 @ 60.00 Hz	H
F99	1920 x 1080 @ 60.00 Hz	H
F100	1024 x 768 @ 60.00 Hz	H
F101	1280 x 1024 @ 50.00 Hz	H
F102	1280 x 1024 @ 60.02 Hz	H
F103	1280 x 1024 @ 75.02 Hz	H
F104	1600 x 1200 @ 50.00 Hz	H
F105	1600 x 1200 @ 60.00 Hz	H
F106	1920 x 1200 @ 59.56 Hz	H
F107	2560 x 1440 @ 59.95 Hz	H
F108	2560 x 1600 @ 59.86 Hz	H
F109	3840 x 2400 @ 24.00 Hz	H
F110	3840 x 2160 @ 24.00 Hz	H
F111	3840 x 2160 @ 25.00 Hz	H

Mem.	Resolution	Type
F112	3840 x 2160 @ 30.00 Hz	H
F118	Universal HDMI, 4K, PCM audio	
F119	Universal HDMI, 4K, all audio	
F120	3840 x 2160 @ 60.00 Hz	H
F121	1440 x 1080 @ 59.91 Hz	H
F122	2560 x 2048 @ 59.98 Hz	H
F123	1280 x 800 @ 59.91 Hz	H
F124	1440 x 900 @ 59.90 Hz	H
F125	1366 x 768 @ 60.00 Hz	H
F126	1600 x 900 @ 59.98 Hz	H
F127	2048 x 1080 @ 60.00 Hz	H
F128	2560 x 1080 @ 60.00 Hz	H
F129	3440 x 1440 @ 24.99 Hz	H
F130	3440 x 1440 @ 29.99 Hz	H
F131	4096 x 2160 @ 25.00 Hz	H
F132	4096 x 2160 @ 30.00 Hz	H
F133	4096 x 2160 @ 60.00 Hz	4:2:0
F134	3440 x 1440 @ 23.99 Hz	H
F135	4096 x 2160 @ 24.00 Hz	H
F136	3840 x 2400 @ 29.99 Hz	H
F137	3840 x 2160 @ 60.00 Hz	H2
F138	3840 x 2160 @ 50.00 Hz	H2
F139	Universal HDMI 2.0, UHD, PCM audio	
F140	Universal HDMI 2.0, UHD, all audio	
F141	4096 x 2160 @ 60.00 Hz	4:4:4
F142	4096 x 2160 @ 50.00 Hz	4:4:4
F143	Universal HDMI 2.0, 4K, PCM audio	
F144	Universal HDMI 2.0, 4K, all audio	
F146	3840 x 2160 @ 60.00 Hz	HDR
F147	3840 x 2160 @ 60.00 Hz	RB, PCM

Mem.	Resolution	Type
F148	3840 x 2160 @ 60.00 Hz	RB, ALL

Legend

D: DVI EDID

H: HDMI EDID

U: Universal EDID (supporting many common EDIDs)

4:2:0 : EDID with chroma color subsampling

4:4:4 : EDID without color subsampling

H2: HDMI2.0-compatible EDID

HDR: EDID with High Dynamic Range mode support

RB: Reduced blanking interval

PCM: With PCM audio support

ALL: All type of audio support (within the HDMI standard)

Please note that minor changes in the factory EDID list may be applied in farther firmware versions.

12.5. Audio Cable Wiring Guide

Inputs and outputs of audio devices are symmetric or asymmetric. The main advantage of the symmetric lines is the better protection against the noise therefore, they are widely used 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. Lightware 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.

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

ATTENTION! There are numerous types of regularly used connector and cable types to connect audio devices. Please always make sure that a connector or cable fits your system before use.

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

INFO: Use a galvanic isolation in case of a ground loop.
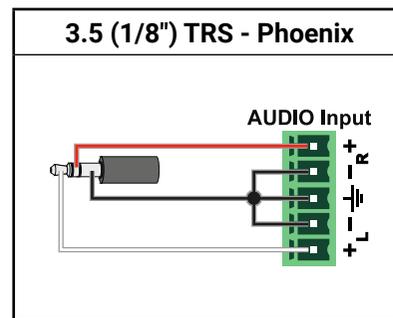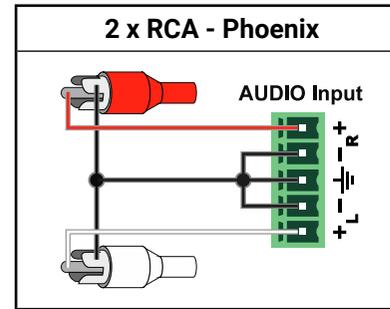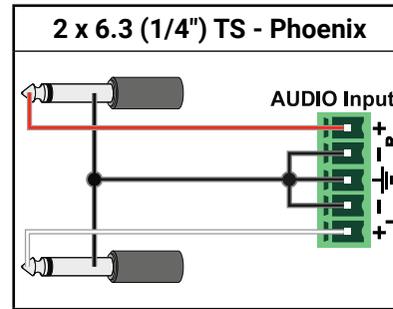
The Pinout of the 5-pole Phoenix Connector
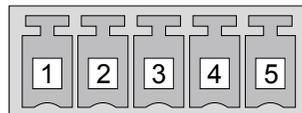
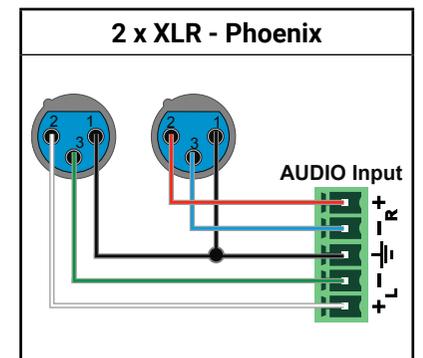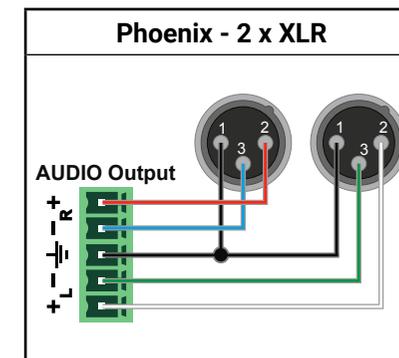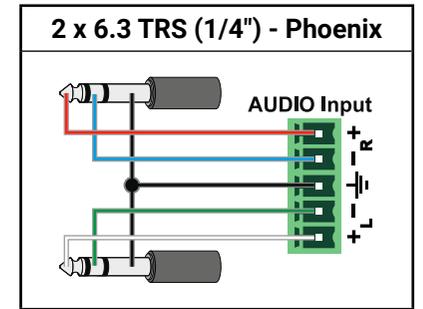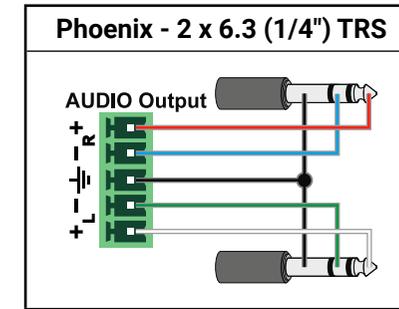| Pin nr.	Signal
1	Left+
2	Left-
3	Ground
4	Right-
5	Right+
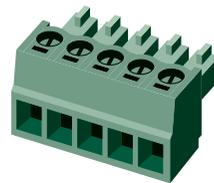
Compatible Plug Type

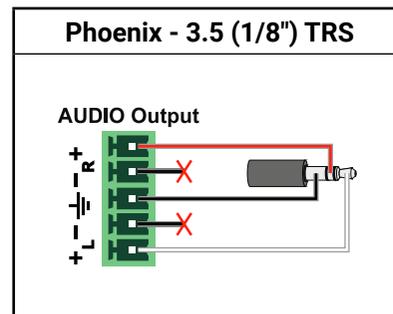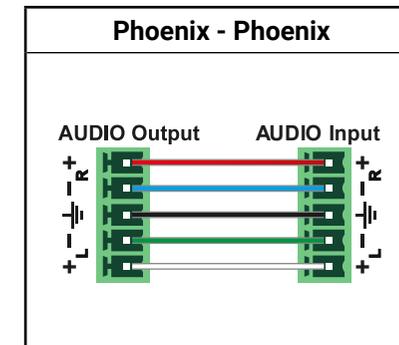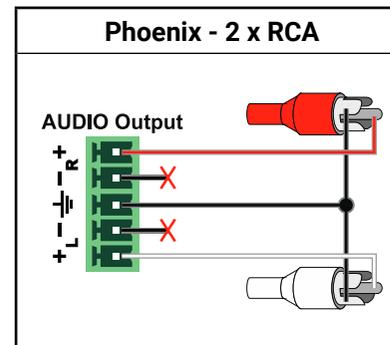Phoenix® Combicon series (3.5mm pitch, 5-pole), type: MC 1.5/5-ST-3.5.

From Unbalanced Output to Balanced Input

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

2 x RCA - Phoenix

3.5 (1/8") TRS - Phoenix

From Balanced Output to Unbalanced Input

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

Phoenix - 2 x RCA

Phoenix - 3.5 (1/8") TRS

From Balanced Output to Balanced Input

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

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

Phoenix - 2 x XLR

2 x XLR - Phoenix

Phoenix - Phoenix
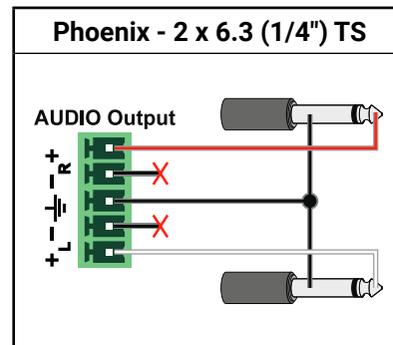
12.6. Further Information

Limited Warranty Statement

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

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

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

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

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

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

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

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

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

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

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

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

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

Document Revision History

Rev.	Release date	Changes	Editor
1.0	20-12-2016	Initial Version	Laszlo Zsedenyi
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
1.2	11-07-2017	Updated safety information, updated LW3 Prog. Ref chapter, added Firmware Upgrade and Troubleshooting chapters	Tamas Forgacs
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
2.0	19-09-2017	New document format	Judit Barsony
2.1	11-10-2017	Major updates for firmware v1.1.6, added preset loading command in LW2 prog. ref.	Tamas Forgacs
2.2	30-11-2017	Major updates for firmware v1.2.0 (added CEC description to LDC chapter and CEC related commands to LW3 Prog. ref. chapter).	Judit Barsony
2.3	14-03-2018	LW2 prog.ref updated, LDC/EDID menu section updated, Factory EDID list updated, Mechanical drawing corrected.	Laszlo Zsedenyi
2.4	12-06-2018	LW3 prog.ref revised, Minor corrections.	Laszlo Zsedenyi

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