visual engineering
LIGHTWARE

User's Manual

MX2-4x4-HDMI20-CA, MX2-8x4-HDMI20-CA,
MX2-8x8-HDMI20-L, -CA, -Audio -Audio-L; MX2-8x8-DH-4DPi-A; MX2-8x8-DH-4DPio-A,
MX2-8x8-DH-8DPi-A; MX2-8x8-DH-8DPio-A; MX2-16x8-HDMI20-Audio-R,
MX2-16x16-HDMI20, -R, -Audio, -Audio-R; MX2-16x16-DH-8DPi-A-R;
MX2-24x24-HDMI20, -R, -Audio, -Audio-R; MX2-24x24-DH-12DPi-R; -A-R
MX2-24x24-DH-24DPio-A-R ; MX2-32x32-HDMI20-A-R; MX2-32x32-DH-16DPi-A-R;
MX2-48x48-HDMI20-A-R; MX2-48x48-DH-48DPi-A-R, MX2-48x48-DH-24DPio-A-R

Multimedia Matrix Switcher

v2.19   04-11-2022

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	
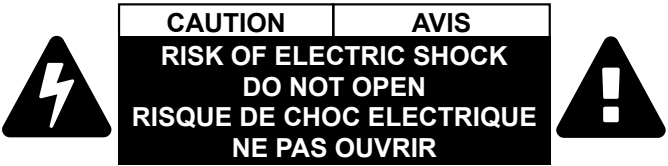
Replacing the AC fuse

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, leave the ventilation holes free and never block or bypass the ventilators (if there are any).

WARNING

To prevent injury, the apparatus is recommended to be securely attached to the floor/wall or mounted in accordance with the installation instructions. The apparatus shall not be exposed to dripping or splashing, and no objects filled with liquids, such as vases, shall be placed on the apparatus. No naked flame sources, such as lit 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.
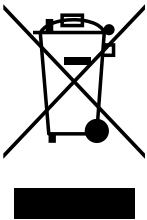
Common Safety Symbols

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 that is highly recommended to read and keep in every case!

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

DIFFERENCE: Feature or function that is available with a specific firmware/hardware version or product variant.

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 that 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 pressing 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 while testing these functions in accordance with the indicated Hardware/Firmware/Software environment:

| Item	Version
Lightware Device Controller (LDC) software	2.6.2b3
Lightware Device Updater V2 (LDU2) software	2.17.0b2
Controller firmware	1.9.0

Document revision: **v2.19**

Release date: **04-11-2022**

Editor: Tamas Forgacs

About Printing

Lightware Visual Engineering supports green technologies and eco-friendly mentality. Thus, this document is primarily made for digital use. If you need to print out a few pages for any reason, follow the recommended printing settings:

- Page size: A4
- Output size: Fit to page or Match page size
- Orientation: Landscape

TIPS AND TRICKS: Thanks to the size of the original page, the border around the content (grey on the second picture below) makes it possible to organize the pages better. After punching holes in the printed pages, they can easily be placed into a ring folder.
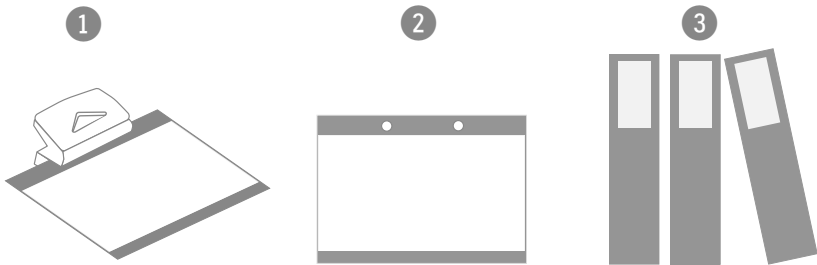
Hashtag (#) Keywords in the Document

This user's manual contains keywords with hashtags (#) to help you find the relevant information as quick as possible.

The format of the keywords is the following:

#<keyword>

The usage of the keywords: use the **Search** function (Ctrl+F / Cmd+F) of your PDF reader application, type the # (hashtag) character and the wished keyword.

The **#new** special keyword indicates a new feature/function that has just appeared in the latest firmware or software version.

Example

#dhcp

This keyword is placed at the DHCP setting command in the LW3 Programmer's reference section.

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Introduction

Thank you for choosing Lightware MX2 series matrix switcher. In the first chapter we would like to introduce the device, highlighting the most important features in the sections listed below:

▶ DESCRIPTION
▶ BOX CONTENTS
▶ FEATURES FOR ALL MODELS
▶ DISPLAYPORT FEATURES
▶ TYPICAL APPLICATION
▶ MODEL COMPARISON

1.1. Description

The MX2-HDMI20 series is the Lightware HDMI 2.0 standalone matrix switcher family that supports uncompromised 4K UHD resolution at 60Hz 4:4:4, and allows de-embedding audio from, and embedding audio to the HDMI stream. It has an outstanding port density that makes it particularly suitable for rental and fix install applications, as well as for future-proof operation centers. It is a perfect choice for installations where HDMI 2.0 compliant input and output ports are required.

This flagship product has HDMI2.0 inputs and 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.

DisplayPort Parameters are displayed in unprecedented detail, and also allow adjustment in various aspects, such as link data rate and link lane count. Plus, the Restart Link Training feature allows users to reset link training within the software to ensure correct link profiling, without the need to physically unplug/re-plug a device.

MX2 matrix switchers are available with 32x32 and 48x48 crosspoint sizes, with or without analog audio add-ons, and some versions are also available with redundant power sources, paired with rugged power connectors and reinforced control ports. All models feature a front panel, color LCD screen with great visibility, and a jog-dial, multi-function button, enabling the users to manage every device feature and service directly.

Further product variants have been developed to better serve various target application requirements, in 8x8, 8x4 and 4x4 crosspoint sizes. The new compact variants are excellent choices for not only Rental & Staging, but also for various corporate and other collaborative environments.

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

About the Serial Number

Lightware devices contain a label indicating the unique serial number of the product. The structure is the following:

Model Denomination

Digital audio embedding and de-embedding function

Number of the outputs
Number of the inputs

New generation of
Lightware matrix switchers

MX2-48x48-DH-24DPio-A-R

Add-ons
A - Audio
CA - Compact Audio
R -Redundancy

Port types
HDMI20 - HDMI 2.0 only
DP - DisplayPort 1.2 only
DH - Combined DP and HDMI

Nr. of DisplayPort I/O Ports
DPi - DP in and HDMI out
DPio - DP in and DP out

7A000941 — 6-digit running sequence number

| | 1: Jan | 4: Apr | 7: Jul | A: Oct |
Month of the manufacturing: | 2: Feb | 5: May | 8: Aug | B: Nov |
| | 3: Mar | 6: Jun | 9: Sep | C: Dec |

Year of the manufacturing: | 7=2017 | A=2020 | D=2023 |
(3-9, A-Y) | 8=2018 | B=2021 | E=2024 |
| 9=2019 | C=2022 | F=2025 |

1.2. Box Contents

The optional (not-supplied) accessories can be purchased and used with the device; please contact sales@lightware.com.

	Supplied device	Supplied accessories							Optional accessories
	Matrix switcher	Safety and Warranty Info, QSG	IEC power cable	Neutrik powerCON power cable	Serial data cable (male-female)	Phoenix® Combicon 3-pole connector	Phoenix® Combicon 5-pole connector	Handle pair with 4 pcs M5 flat head screws	Room Automation Device series (RAP-B511 / RAC-B501)
MX2-4x4-HDMI20-CA	✓	✓	✓	-	-	✓	2x	-	✓
MX2-8x4-HDMI20-CA	✓	✓	✓	-	-	✓	4x	-	✓
MX2-8x8-HDMI20-CA	✓	✓	✓	-	-	✓	4x	-	✓
MX2-8x8-HDMI20-L	✓	✓	✓	-	-	✓	-	-	✓
MX2-8X8-HDMI20-Audio	✓	✓	✓	-	-	✓	16x	-	✓
MX2-8X8-HDMI20-Audio-L	✓	✓	✓	-	-	✓	16x	-	✓
MX2-8x8-DH-4DPi-A	✓	✓	✓	-	-	✓	2x	-	✓
MX2-8x8-DH-4DPio-A	✓	✓	✓	-	-	✓	16x	-	✓
MX2-8x8-DH-8DPi-A	✓	✓	✓	-	-	✓	8x	-	✓
MX2-8x8-DH-8DPio-A	✓	✓	✓	-	-	✓	16x	-	✓
MX2-16x8-HDMI20-Audio-R	✓	✓	-	2x	✓	✓	12x	-	✓
MX2-16x16-HDMI20	✓	✓	✓	-	-	✓	-	-	✓
MX2-16x16-HDMI20-Audio	✓	✓	✓	-	-	✓	12x	-	✓
MX2-16x16-HDMI20-R	✓	✓	-	2x	✓	-	-	-	✓
MX2-16x16-HDMI20-Audio-R	✓	✓	-	2x	✓	-	12x	-	✓
MX2-16x16-DH-8DPi-A-R	✓	✓	-	2x	✓	-	16x	-	✓

	Supplied device	Supplied accessories							Optional accessories
	Matrix switcher	Safety and Warranty Info, QSG	IEC Power Cable	Neutrik powerCON Power cable	Serial data cable (male-female)	Phoenix® Combicon 3-pole Connector	Phoenix® Combicon 5-pole Connector	Handle pair with 4 pcs M5 flat head screws	Room Automation Device series (RAP-B511 / RAC-B501)
MX2-24x24-HDMI20	✓	✓	✓	-	-	✓	-	-	✓
MX2-24x24-HDMI20-Audio	✓	✓	✓	-	-	✓	16x	-	✓
MX2-24x24-HDMI20-R	✓	✓	-	2x	✓	-	-	-	✓
MX2-24x24-HDMI20-Audio-R	✓	✓	-	2x	✓	-	16x	-	✓
MX2-24x24-DH-12DPi-R	✓	✓	-	2x	✓	-	-	-	✓
MX2-24x24-DH-12DPi-A-R	✓	✓	-	2x	✓	-	20x	-	✓
MX2-24x24-DH-24DPio-A-R	✓	✓	-	2x	✓	-	20x	-	✓
MX2-32x32-HDMI20-A-R	✓	✓	-	2x	✓	-	32x	✓	✓
MX2-32x32-DH-16DPi-A-R	✓	✓	-	2x	✓	-	28x	✓	✓
MX2-48x48-HDMI20-A-R	✓	✓	-	2x	✓	-	32x	✓	✓
MX2-48x48-DH-24DPio-A-R	✓	✓	-	2x	✓	-	32x	✓	✓
MX2-48x48-DH-48DPi-A-R	✓	✓	-	2x	✓	-	32x	✓	✓
MX2-48x48-DH-48DPio-A-R	✓	✓	-	2x	✓	-	32x	✓	✓

1.3. Features for All Models

Maximum AV 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-HDMI20 matrix switchers fulfill the HDCP standard. HDCP capability on the HDMI inputs can be disabled when non-protected content is extended.

Audio Embedding and De-embedding

In the **-A** or **-Audio** suffixed models, 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.

Built-in Website

Easy access from a web browser to control and configure the devices – even with a mobile device.

Unique Front-to-Back Cooling Airflow Design

The matrix includes a groundbreaking new cooling design with front-to-back airflow. Inside the chassis, the airflow travels along guiding panes, ensuring 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 performing a firmware update.

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.

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.

DIFFERENCE: Only the MX2-8X8-HDMI20-AUDIO-L model is able the split the video signal. The availability of the splitting feature also depends on the hardware version of the output board (V1x_). The hardware version can be found in Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

1.4. DisplayPort Features

DIFFERENCE: DisplayPort inputs are available in certain models, **-D** letter the model name indicates that (see the Model Comparison table).

Restart Link Training

Allows the DisplayPort Link Training to be restarted in case of no signal or bad quality, without unplugging the cable

DisplayPort Diagnostics and Management

Provides detailed DisplayPort-specific connectivity information: AUX handshaking, 1/2/4 lane count, RBR/HBR/HBR2 datarates. DisplayPort AUX-channel analyzer helps debugging and analyzing handshaking problems

1.5. Typical Application

MX2-8x8-HDMI20-Audio

The following figures show different modes of the application:

4K@60 4:4:4 Signal Routing

MX2-8x8-HDMI20-Audio

HDMI 2.0 to 2x HDMI 1.4 Splitting

MX2-24x24-DH-12DPi-A-R

Legend:
- HDMI
- DP
- OPT
- Analog Audio
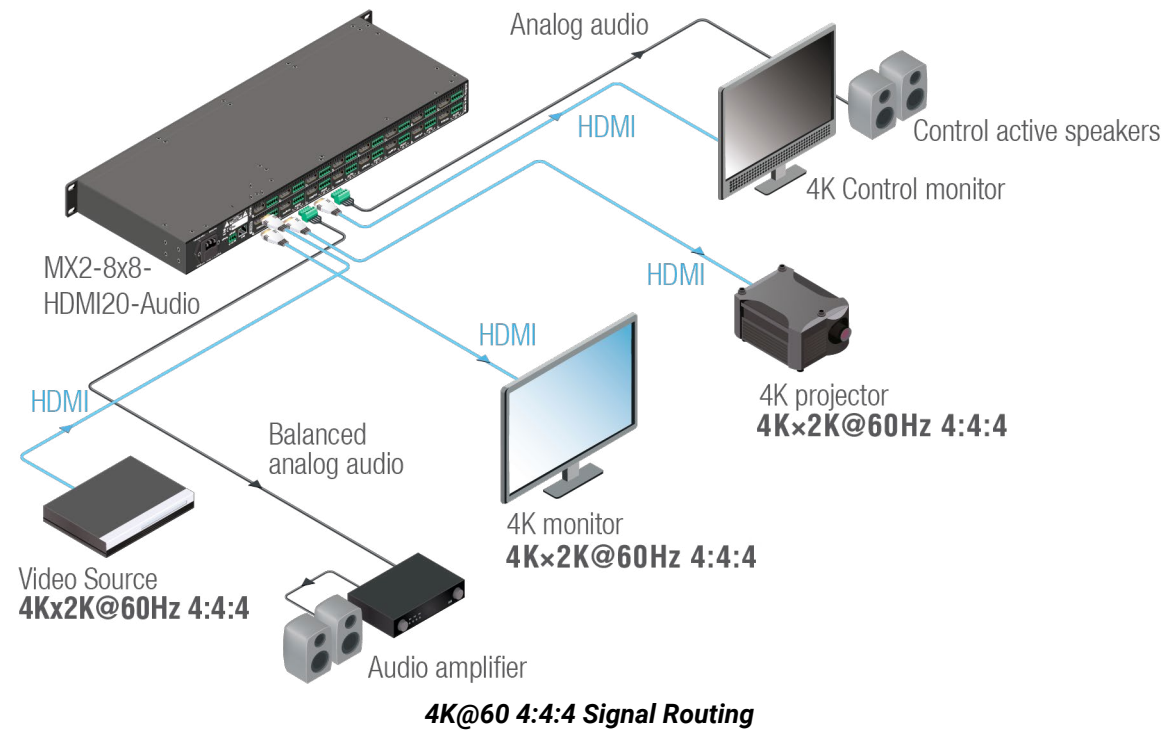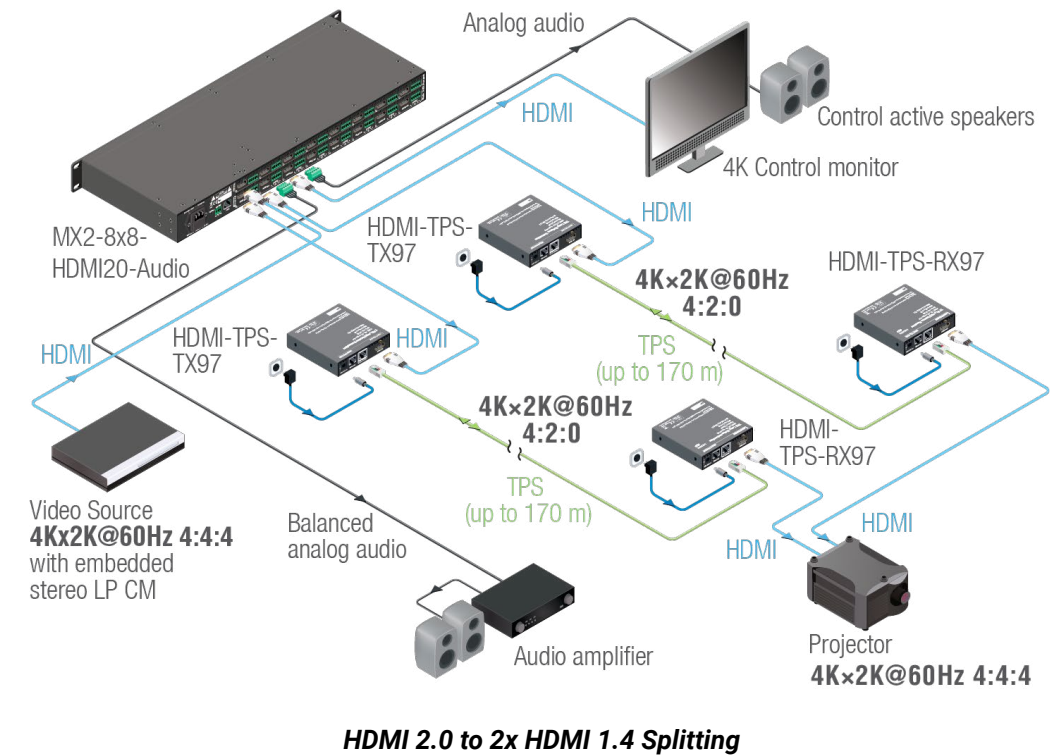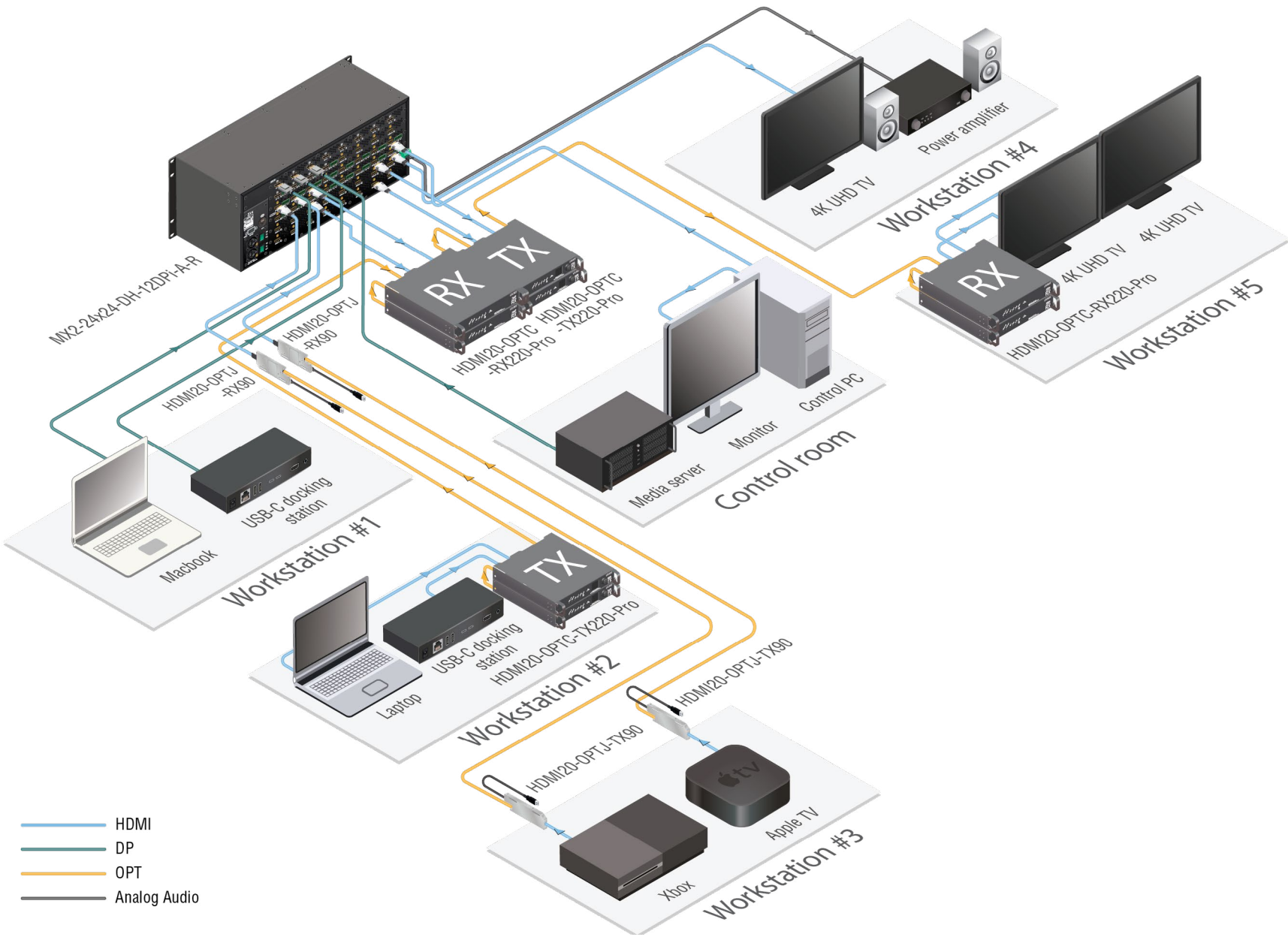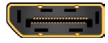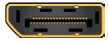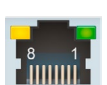
1.6. Model Comparison

	Inputs			Outputs				Redundant power supply	Control Ports				Front panel I/O buttons	Front panel LCD menu	Enlosure
	HDMI	DP	Audio	HDMI	DP	Audio	Audio (independent)	powerCON	RJ45	etherCON	3-pole Phoenix	D-SUB			
MX2-4x4-HDMI20-CA	4*	-	-	4*	-	2 HDMI	-	-	✓	-	✓	-	-	✓	1 RU
MX2-8x4-HDMI20-CA	8*	-	2 HDMI	4*	-	2 HDMI	-	-	✓	-	✓	-	-	✓	1 RU
MX2-8x8-HDMI20-CA	8*	-	2 HDMI	8*	-	2 HDMI	-	-	✓	-	✓	-	-	✓	1 RU
MX2-8x8-HDMI20-L	8*	-	2 HDMI	8*	-	2 HDMI	-	-	✓	-	✓	-	✓	✓	1 RU
MX2-8X8-HDMI20-Audio	8*	-	8 HDMI	8*	-	8 HDMI	-	-	✓	-	✓	-	✓	✓	1 RU
MX2-8X8-HDMI20-Audio-L	8*	-	8 HDMI	8*	-	8 HDMI	-	-	✓	-	✓	-	✓	✓	1 RU
MX2-8x8-DH-4DPi-A	4*	4	-	8*	-	2 HDMI	-	-	✓	-	✓	-	✓	✓	1 RU
MX2-8x8-DH-4DPio-A	4*	4	4 HDMI + 4 DP	4*	4	4 HDMI + 4 DP	-	-	✓	-	✓	-	✓	✓	1 RU
MX2-8x8-DH-8DPi-A	-	8	4 DP	8*	-	4 HDMI	-	-	✓	-	✓	-	✓	✓	1 RU
MX2-8x8-DH-8DPio-A	-	8	4 DP	-	8	8 DP	-	-	✓	-	✓	-	✓	✓	1 RU
MX2-16x8-HDMI20-Audio-R	16	-	4 HDMI	8	-	4 HDMI	4	✓	-	✓	-	✓	-	✓	3 RU
MX2-16x16-HDMI20	16	-	-	16	-	-	-	-	✓	-	✓	-	✓	✓	3 RU
MX2-16x16-HDMI20-Audio	16	-	4 HDMI	16	-	8 HDMI	-	-	✓	-	✓	-	-	✓	3 RU
MX2-16x16-HDMI20-R	16	-	-	16	-	-	-	✓	-	✓	-	✓	-	✓	3 RU
MX2-16x16-HDMI20-Audio-R	16	-	4 HDMI	16	-	4 HDMI	4	✓	-	✓	-	✓	-	✓	3 RU
MX2-16x16-DH-8DPi-A-R	8	8	8 HDMI	16	-	4 HDMI	4	✓	-	✓	-	✓	✓	✓	3 RU

* 1 RU matrix models are assembled **without HDMI flange screws**.

	Inputs			Outputs				Redundant power supply	Control Ports				Front panel I/O buttons	Front panel LCD menu	Enlosure
	HDMI	DP	Audio	HDMI	DP	Audio	Audio (independent)	powerCON	RJ45	etherCON	3-pole Phoenix	D-SUB			
MX2-24x24-HDMI20	24	-	-	24	-	-	-	-	✓	-	✓	-	✓	✓	4 RU
MX2-24x24-HDMI20-Audio	24	-	8 HDMI	24	-	8 HDMI	-	-	✓	-	✓	-	-	✓	4 RU
MX2-24x24-HDMI20-R	24	-	-	24	-	-	-	✓	-	✓	-	✓	✓	✓	4 RU
MX2-24x24-HDMI20-Audio-R	24	-	8 HDMI	24	-	8 HDMI	-	✓	-	✓	-	✓	-	✓	4 RU
MX2-24x24-DH-12DPi-R	12	12	-	24	-	-	-	✓	-	✓	-	✓	✓	✓	4 RU
MX2-24x24-DH-12DPi-A-R	12	12	8 HDMI + 4 DP	24	-	8 HDMI	-	✓	-	✓	-	✓	✓	✓	4 RU
MX2-24x24-DH-24DPio-A-R	-	24	8 DP	-	24	24 HDMI	-	✓	-	✓	-	✓	✓	✓	4 RU
MX2-32x32-HDMI20-A-R	32	-	16 HDMI	32	-	8 HDMI	8	✓	-	✓	-	✓	✓	✓	8 RU
MX2-32x32-DH-16DPi-A-R	16	16	8 HDMI + 4 DP	32	-	8 HDMI	8	✓	-	✓	-	✓	✓	✓	8 RU
MX2-48x48-HDMI20-A-R	48	-	16 HDMI	48	-	16 HDMI	-	✓	-	✓	-	✓	✓	✓	8 RU
MX2-48x48-DH-24DPio-A-R	24	24	8 HDMI + 8 DP	24	24	8 HDMI + 24 DP	-	✓	-	✓	-	✓	✓	✓	8 RU
MX2-48x48-DH-48DPi-A-R	-	48	16 DP	48	-	16 HDMI	-	✓	-	✓	-	✓	✓	✓	8 RU
MX2-48x48-DH-48DPio-A-R	-	48	16 DP	-	48	48 DP	-	✓	-	✓	-	✓	✓	✓	8 RU

2

Product Overview

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

▸ FRONT VIEW
▸ REAR VIEW

2.1. Front View

MX2-24x24-DH-24DPio-A-R
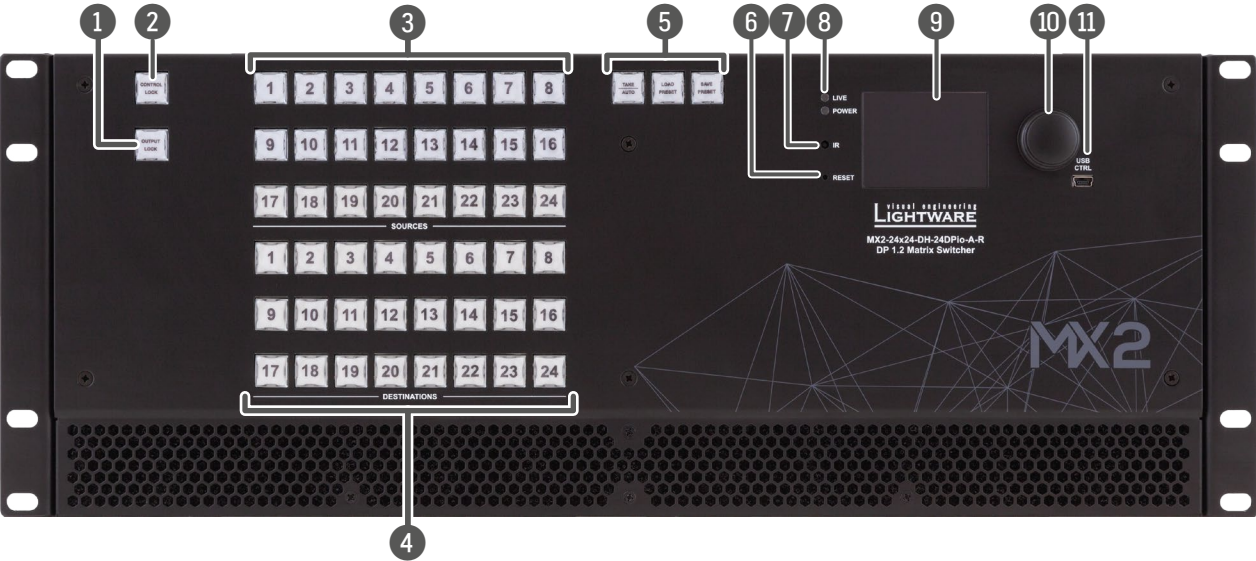
① **Output Lock *** — Locking one or more outputs.

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 **Reset Button** — Reboots the matrix (the same as disconnecting from the power source and reconnecting again).

⑦ **IR Detector** — Reserved for future developments.

⑧ **LIVE LED** — blinking slow   The unit is on and operates properly.

   POWER LED — on   POWER LED indicates that the unit is powered on.

   off   The unit is powered off or it has an internal voltage problem.

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. Turn and click the knob while getting feedback on the LCD.

⑪ **USB Control** — USB connector for local control functions (e.g. Lightware Device Controller software).

* All models have front panel LCD and jog dial knob on the front, but some models are not supplied with front panel buttons. See the details about the difference in the models in the Model Comparison table.

2.2. Rear View

MX2-24x24-DH-24DPio-A-R
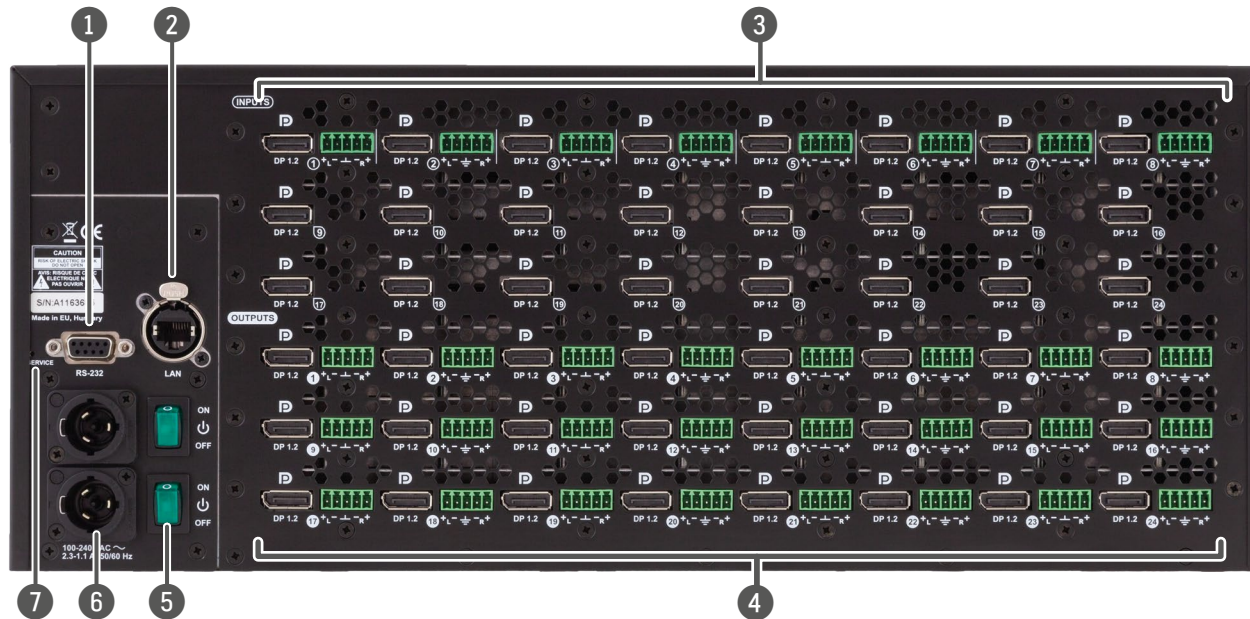
1   RS-232 Port
- **-R** suffixed models: 9-pole D-SUB connector.
- Other models: 3-pole Phoenix connector.

2   LAN Port
- **-R** suffixed models: Neutrik etherCON connector for Ethernet/LAN connection.
- Other models: RJ45 connector to control the matrix via LAN/Ethernet.

3   Input Ports

HDMI input ports are able to receive HDMI 2.0 video signal. **-H** in the model name indicates that the matrix has a HDMI connector.
-D in the model name means that the matrix has a DisplayPort input connector for accepting DP1.2 video signal.
Audio input ports (5-pole Phoenix) for balanced analog audio input signal (in **-A** and **-Audio** suffixed models).
See the details about the difference in the models in the Model Comparison table.

4   Output Ports

HDMI or DP output ports for connecting sink devices.
Audio output ports (5-pole Phoenix) for balanced analog audio output signal. The signal is de-embedded from the given video port (in **-A** suffixed models).

5   Power Switch
- The matrix can be switched on/off by the power switch.
- The 1U-high matrix switchers are not supplied with a power switch.

6   AC Connector
- **-R** suffixed models: two Neutrik powerCON connector accepting 100-240 V, 50 or 60 Hz. For more details about the redundant supply, see the Front Panel Buttons Operations section.
- In the other models: Standard IEC connector accepting 100-240 V, 50 or 60 Hz.

7   Service Button   Hidden button for special operations.

3

Front Panel Control

This chapter is about the operation of the device, describing the functions that are available by the front/rear controls:

- ▶ FRONT PANEL BUTTONS OPERATIONS
- ▶ FRONT PANEL LCD MENU OPERATIONS

3.1. Front Panel Buttons Operations

DIFFERENCE: Some models have buttons on the front side (see the details about it in the Model Comparison table). They have the same functionality, only the number of source and destination buttons is different.

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 shines green, **Autotake** mode is selected. Press and hold the **Take** button for two seconds to change between **Take** and **Autotake** modes.   *#button #crosspoint #switch #takemode #autotakemode*

3.1.1. 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 differently 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 that are currently connected to the selected source will light up. This informative display will remain active for three seconds, then all buttons turn dark.
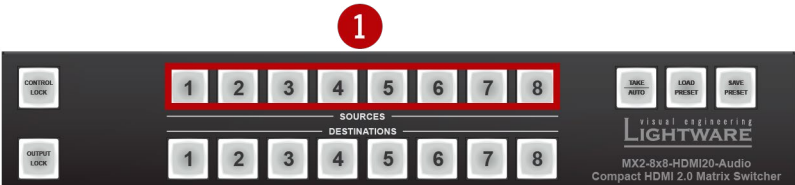
If every source, destination, and **Take** buttons are unlit (the unit is in **Take** mode, and no input was selected in the last 3 seconds), press and release a **destination button** to see its current state. Now the source button that is connected to the selected destination will light up.
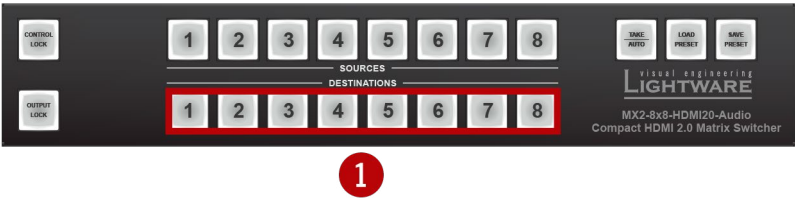
View Current State in Autotake Mode

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

Press and release the required **destination button**. Now the source button that is connected to the selected destination will light up.
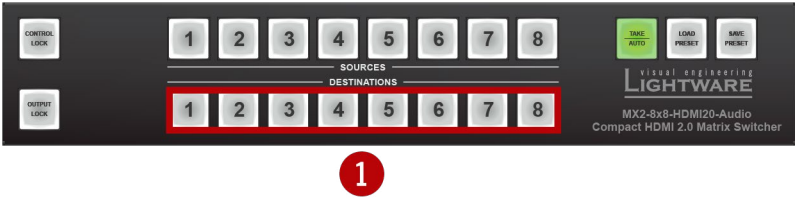
3.1.2. Switching Operations

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 that are currently connected to the source light up.

Step 2. Press and release the desired **destination buttons** that 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 dark.
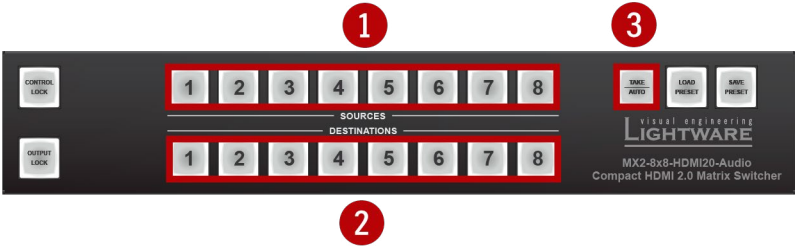
Step 3. Press and release **Take** button; the selected input is switched to the selected output(s).

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 currently connected source button will 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
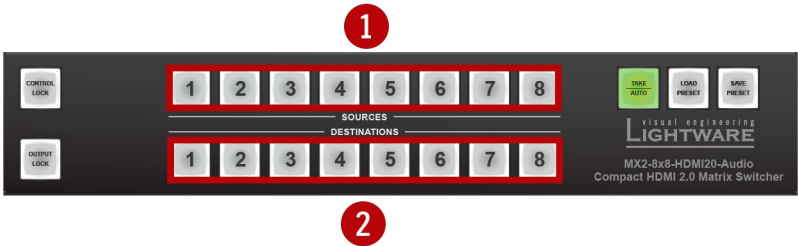
between sources to the selected destination can be done directly.

3.1.3. Output Lock

ATTENTION! While the front panel buttons allow locking only the output ports, the input ports can also be locked by using Lightware Device Controller software (see the HDMI Inputs section) or sending an LW3 protocol command (see the Locking an Input Port section).

Using Lightware routers, it is possible to lock a destination. This feature prevents 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   *#outputlock*

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.
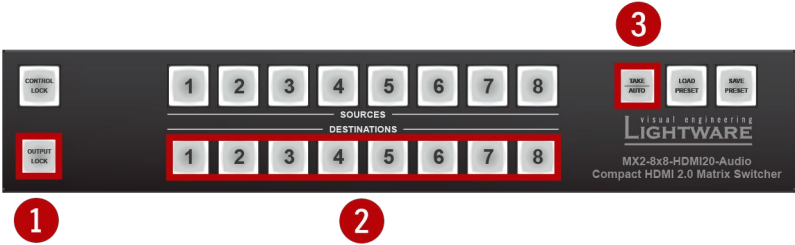
Output Lock in Autotake Mode

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.
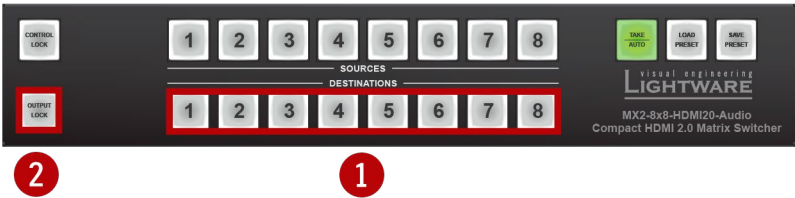
3.1.4. Control Lock

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 shining 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.   *#controllock*

3.1.5. 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   *#preset*
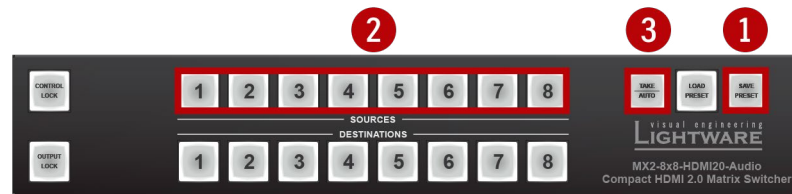
Step 1. Press and release **Save Preset** button.

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.
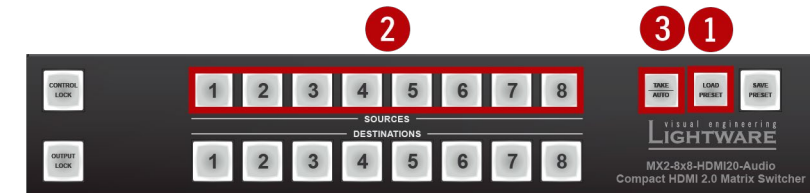
Saving a Preset in Autotake Mode

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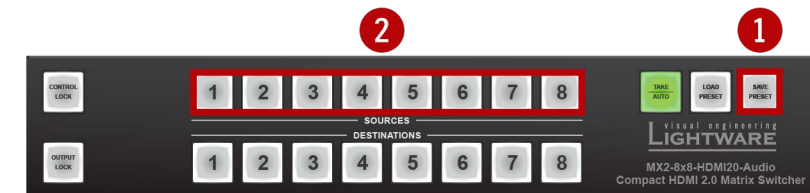
▌ **ATTENTION!** Preset save action always stores the current configuration for all outputs.

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.
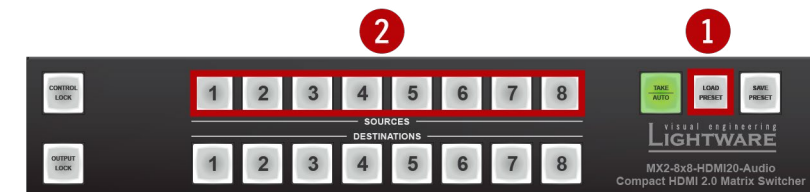
3.2. Front Panel LCD Menu Operations

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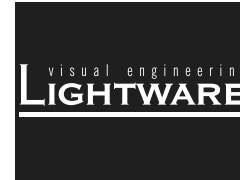
Menu Structure

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

System Settings
— Network
— RS-232
— Time and Date
— Display Brightness
— Buzzer
— Power redundancy
— Device Info
— Enter Standby Mode
— Restore Factory Defaults

Input Ports
— Port
    — Video Status
    — Video Settings
    — Analog audio

Output Ports
— Port
    — Video Status
    — Video Settings
    — Analog audio

EDID
— View
— Switch
— Save

Health
— Uptime
— Control Panel
— Motherboard
— IO ports

Presets
— Load Preset
— Save Preset

Menu navigation & change parameter

Up   Down
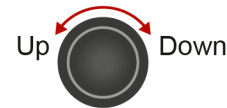
Menu selection & set parameter

Press

MAIN MENU
> System Settings
  Input Ports
  Output Ports
  EDID
  Health
  Presets
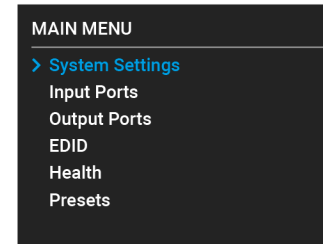
Parameter Selection

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.

Enter the menu/ submenu

> Icon before the line indicates the additional submenus. Click with the rotary to enter.

Blue dot shows that there is no submenu or setting possibility.

OUTPUT MODE
⊘ Auto
○ HDMI
  DVI

« Back

DEVICE INFO
· Frame serial number   95144905
  Hardware versions
  Firmware versions

« Back

DEVICE INFO
  Frame serial number   95144905
> Hardware versions
  Firmware versions

« Back
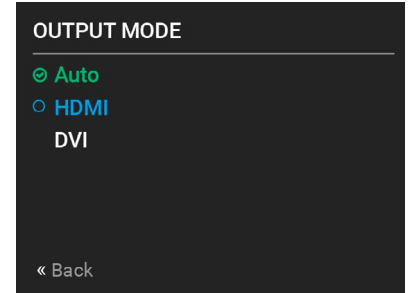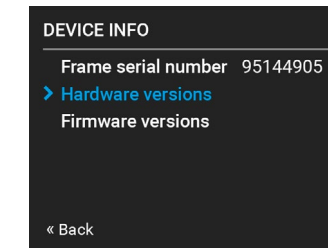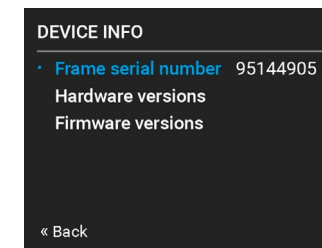
3.2.1. System Settings Menu

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 that 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   #ipaddress #dhcp*

Network security feature can be enabled or disabled in this submenu.

NETWORK
● IP   192.168.0.97
  Subnet   255.255.255.0
  Gateway   192.168.0.1
  DHCP   Enabled
  Link Status   100 Mbps full-duplex
  Security   Disabled
« Back   ✔ Save
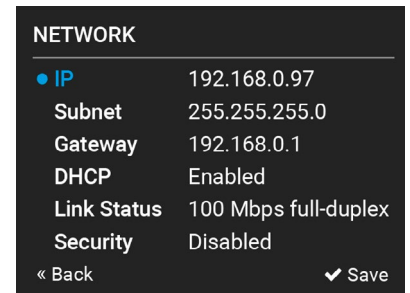
RS-232 Submenu

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). *#rs232 #rs-232 #serial*

RS-232

> Control   Enabled
  Baud Rate   57600
  Protocol   LW3

« Back
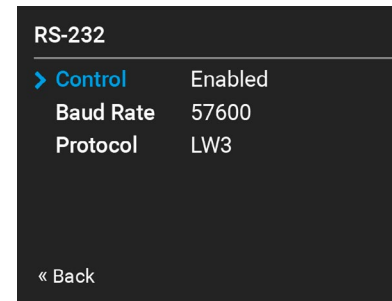
Time and Date

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

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 the Front Panel Tab section.

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

DISPLAY BRIGHTNESS

☼   9   ☼

0 1 2 3 4 5 6 7 8 9 10

« Back   ✔ Save
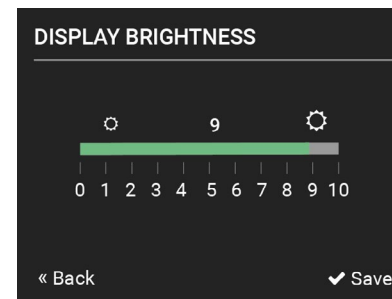
Buzzer

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

Power Redundancy   *#power #redundancy*

> **DIFFERENCE:** This submenu appears when the model has a redundant power supply (**-R** suffix in the model name shows this feature).

- PSU1: running / stopped
- PSU2: running / stopped

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   *#standby*

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 the Grid View section).

Restore Factory Defaults *#factory*

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

3.2.2. 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 the table below). Select the desired input port and enter to see the submenu.
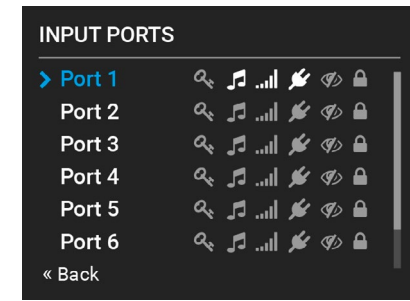
INPUT PORTS

> 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

DisplayPort Status Submenu (Input)

> **DIFFERENCE:** This submenu appears only when the selected port is DisplayPort. See the Model Comparison table on which model has DP input.

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

Link Status

- 5V present
- Signal present
- Signal type
- Bandwidth
- Lane counts
- HDCP

Video Status

- ▪ Resolution
- ▪ Color depth
- ▪ Color space

Embedded audio status

- ▪ Audio type
- ▪ Sampling frequency

Advanced

- ▪ Pixel clock
- ▪ Total resolution

DisplayPort Settings Submenu (Input)

DIFFERENCE: This submenu appears only when the selected port is DisplayPort. See the Model Comparison table on which model has DP input.

HDCP   *#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.
- ▪ **HDCP 1.4 only:** The signal is encrypted with HDCP v1.4
- ▪ **Allow HDCP 2.2 or HDCP 1.4:** The connected source will detect that the sink is compliant with HDCP 2.2 (factory default setting).
- ▪ **High Value mode**: If the highest level of protection is not justified by the source content, the level may be decreased. (e.g. the signal is encrypted with HDCP 2.2, but can be converted to be encrypted with HDCP v1.4)

See more information about HDCP in the HDCP Management section.

PORT 1 STATUS

	Link Status
• 5V present	present
Signal present	present
Signal type	DP
Bandwidth	HBR2
Lane counts	4

« Back

Other Settings

- ▪ **Max Lane Count** (1, 2, 4): One lane is able to transmit 5.4 Gbps data and four lanes are available (a maximum of 21.6 Gbps data rate). The maximum number of lanes can be set here.
- ▪ **Max Bandwidth** (RBR, HBR, HBR2): This defines the data speed per lane: RBR uses 1.62Gbps; HBR uses 2.70 Gbps; HBR2 uses 5.40 Gbps.
- ▪ **Power enable** (enable / disable): DisplayPort can supply 1.5 W (500 mA, 3.3V) towards the source.
- ▪ **Testpattern** (off / on): When the testpattern is enabled, it sends a yellow picture to the output (independently of the active video signal on the selected port).   *#nosyncscreen #testpattern*

TIPS AND TRICKS: Enabling the testpattern makes it possible to transmit the analog audio without any active video signal on the DP input port beside it (only in the **-A** or **-Audio** suffixed models).

- ▪ **Conversion** (Off / RGB to YUV422 / RGB to YUV420):

  Off means that the video signal is transmitted without changing anything; in case of **YUV422,** the video converter subsamples the 4:4:4 signal to 4:2:2; **YUV420** means that the video converter subsamples the 4:4:4 signal to 4:2:0. *#colorspace*

- ▪ **Audio source** (Disable / Video / Analog input *): The de-embedded audio can be turned on and off. *#audio #analogaudio #volume #balance #gain*

* Analog input option appears when there is an analog audio input beside the chosen video port. **-A** or **-Audio** suffix in the model name refers to the analog audio feature.

HDMI Status Submenu (Input)

Link Status

- ▪ 5V present
- ▪ Signal present
- ▪ Signal type
- ▪ Bandwidth
- ▪ HDCP

Video Status

- ▪ Resolution
- ▪ Color depth
- ▪ Color space

PORT 13 STATUS

	Link Status
• 5V present	present
Signal present	present
Signal type	HDMI
Bandwidth	4.45 Gbps
HDCP	no HDCP

« Back

Embedded audio status

- Audio type
- Sampling frequency

Advanced

- Pixel clock
- Total resolution
- Scrambling

HDMI Settings Submenu (Input)

HDCP *#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 matrix is compliant with HDCP 1.4 but not compliant with HDCP 2.2.
- **Allow HDCP 2.2 or HDCP 1.4:** 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 the HDCP Management section.

*The availability of this setting depends on the hardware version of the input board (V1x_) only in MX2-8x8-HDMI20 model. The hardware version can be found in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

Hotplug

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

Audio Source

The source of the embedded audio can be set in this menu:

Disable/ Video /Analog input *

* Analog option appears when there is an analog audio input beside the chosen video port. **-A** or **-Audio** suffix in the model name refers to the analog audio feature.

PORT 13 SETTINGS

❯ HDCP	Disable
Hotplug	AUTO
Audio source	Video

« Back
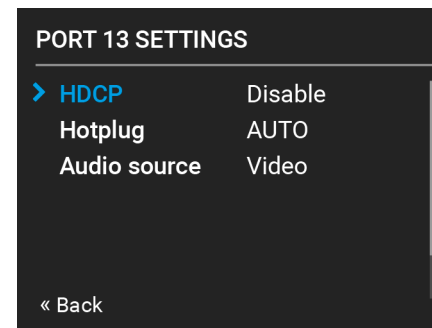
Analog Audio Submenu

> **DIFFERENCE:** Analog Audio submenu appears when there is an analog audio input beside the chosen video port. **-A** or **-Audio** suffix in the model name refers to the analog audio feature (see the Model Comparison table about the analog audio availability).

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

- **Audio Source**: Disable/ Video/ Analog Input
- **Audio Gain**: adjustable from -12 dB to +35 dB,
- **Analog Volume**: adjustable from 0 (-95dB) to 100% (0dB),
- **Analog Balance**: adjustable from -100 % (Left) to + 100% (Right), 0 means the center.
  #audio #analogaudio #volume #balance #gain

ANALOG GAIN

🔈   5 dB   🔊

-12 -7 -3 2   7 12 16 21 26 30 35
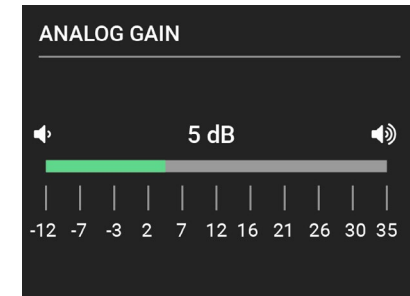
3.2.3. Output Ports Menu

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

OUTPUT 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
🔌	Sink is **not** connected	Sink is connected
🚫👁	The port is unmuted	The port is muted
🔒	The port is unlocked	The port is locked
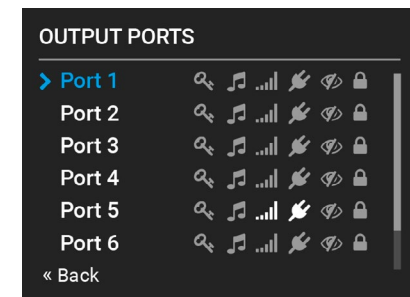
Displayport Status Submenu (Output)

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

Link Status

- HPD present
- Signal present
- Signal type
- Bandwidth
- Lane counts
- HDCP

Video Status

- Resolution
- Color depth
- Color space

Embedded audio status

- Audio type
- Sampling frequency

Advanced

- Pixel clock
- Total resolution

PORT 22 STATUS

Link Status
- HPD present   HPD present
  Signal present   present
  Signal type   DP
  Bandwidth   HBR2
  Lane counts   4

« Back

DP Settings Submenu (Output)

- **Power enable:** DisplayPort is able to provide 1.5 W (500 mA @ 3.3V) power towards the sink. For more details about it, see the DisplayPort Output Settings section.
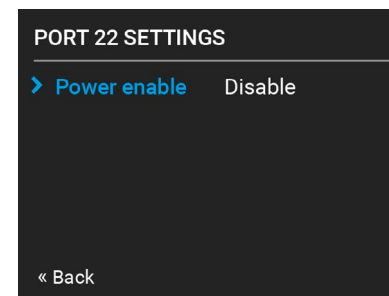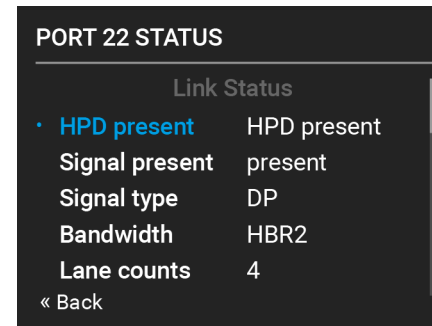
PORT 22 SETTINGS

❯ Power enable   Disable

« Back

HDMI Status Submenu (Output)

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

Link Status

- HPD present
- Signal present
- Signal type
- Bandwidth
- HDCP

Video Status

- Resolution
- Color depth
- Color space

Embedded audio status

- Audio type
- Sampling frequency

Advanced

- Pixel clock
- Total resolution
- Scrambling

PORT 1 STATUS

Link Status
- HPD present   present
  Signal present   present
  Signal type   HDMI
  Bandwidth   4.45 Gbps
  HDCP   no HDCP

« Back

HDMI Settings Submenu (Output)

> **DIFFERENCE:** Only the MX2-8X8-HDMI20-AUDIO-L model is able the **4:4:4 to 4:2:0 conversion** and the split function. The availability of this setting depends on the hardware version of the output board (V1x_), only in the MX2-8x8-HDMI20 model. The hardware version can be found in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

Conversion   #colorspace

> **DIFFERENCE:** The availability of **4:4:4 to 4:2:2 conversion** depends on the hardware version of the output board (V2x_). The matrix switcher accepts video signals in 8, 10 and 12 bit color depth, but the sampling pattern conversion is always made in 8 bit. The hardware version can be checked in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

PORT1 SETTINGS

❯ Conversion   Passthrough
  Signal Type   Auto
  HDCP   Depends on input
  Scrabling   Auto
  TMDS Clock Rate   Auto

« Back

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 (RGB to YUV).
- **4:4:4 to 4:2:2:** the signal is converted to the indicated color depth. This feature is supported in case of HDMI 2.0 signals.
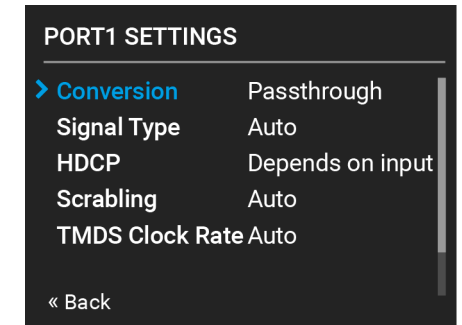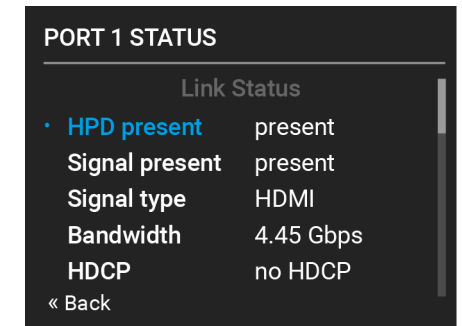
▌ **ATTENTION! 10 bit** 4:4:4- video signal is converted to **12 bit** 4:2:2.

- ▪ **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 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 Application section.

Signal Type

- ▪ **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.
- ▪ **HDMI**: the outgoing signal format is forced to be HDMI.
- ▪ **DVI**: the outgoing signal format is forced to be DVI.

HDCP   *#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.
- ▪ **Max. 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 the HDCP Management section.

Scrambling   *#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.
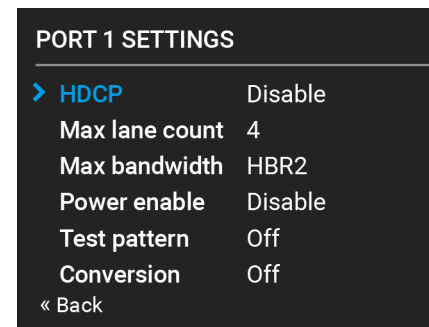
Analog Audio Submenu

▌ **DIFFERENCE:** Analog Audio submenu appears when there is an analog audio output beside the chosen video port. **-A** or **-Audio** suffix in the model name refers to the analog audio feature (see the Model Comparison table about the analog audio availability).

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

- ▪ **Audio Present** and **Audio Type** (signal info),
- ▪ **Audio Mode**: **Off / DP or HDMI Only / Analog Only / DP or HDMI and Analog**.
- ▪ **Analog Mute**
- ▪ **Analog Volume**: adjustable from 0 (-96dB) to 100% (0dB),
- ▪ **Analog Balance**: adjustable from -100% to + 100% (0 = center).
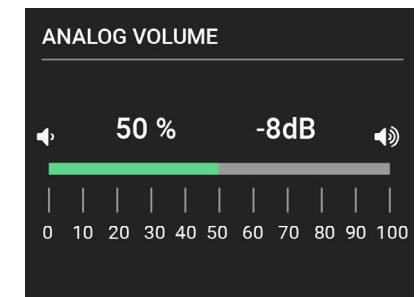
3.2.4. EDID Menu

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   *#edid*

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**
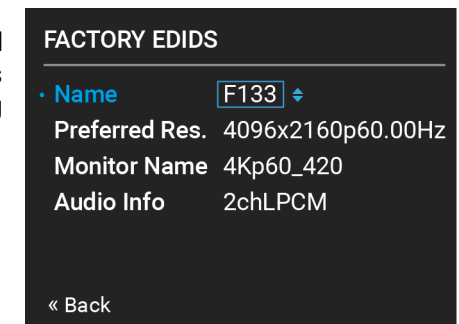
Switch Submenu   *#edid*

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

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.
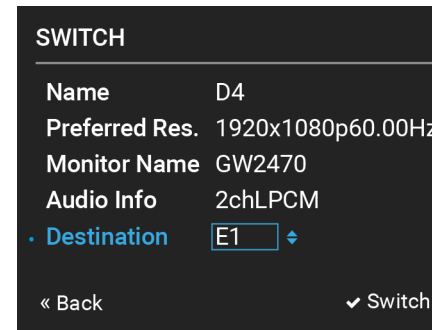
Save Submenu   *#edid*

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.
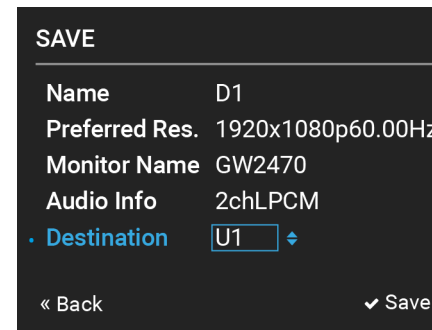
3.2.5. Health Menu

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

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

SWITCH

Name	D4
Preferred Res.	1920x1080p60.00Hz
Monitor Name	GW2470
Audio Info	2chLPCM
· Destination	E1 ⬍

« Back   ✔ Switch

SAVE

Name	D1
Preferred Res.	1920x1080p60.00Hz
Monitor Name	GW2470
Audio Info	2chLPCM
· Destination	U1 ⬍

« Back   ✔ Save

CONTROL PANEL

5V	5.18
1.8V	1.82
Temp°C	31.18

« Back
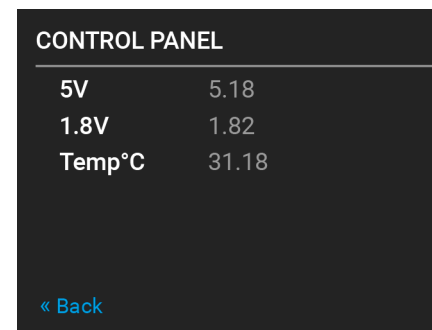
3.2.6. Presets Menu

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

> **ATTENTION!** When factory default settings are restored, presets are deleted.   *#preset*

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 saved 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 the Save or Load a Preset section.
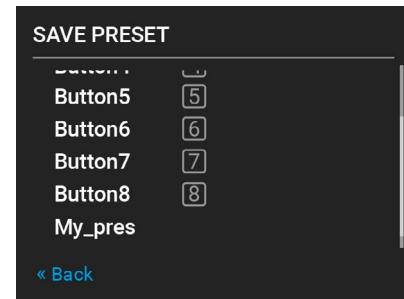
Save a Preset

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 **Yes**.

SAVE PRESET

Button4	4
Button5	5
Button6	6
Button7	7
Button8	8
My_pres	

« Back

4

Installation

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

▶ MOUNTING OPTIONS
▶ ELECTRICAL CONNECTIONS
▶ CONNECTING STEPS

4.1. 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.**

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

▌ INFO: More details about the accessories and the mounting can be found in the Mounting Assembly Guide.

Standard Rack Installation (Default)

▌ INFO: All models can be mounted into the rack cabinet.

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 the mounting of the device as a standard rack unit installation.
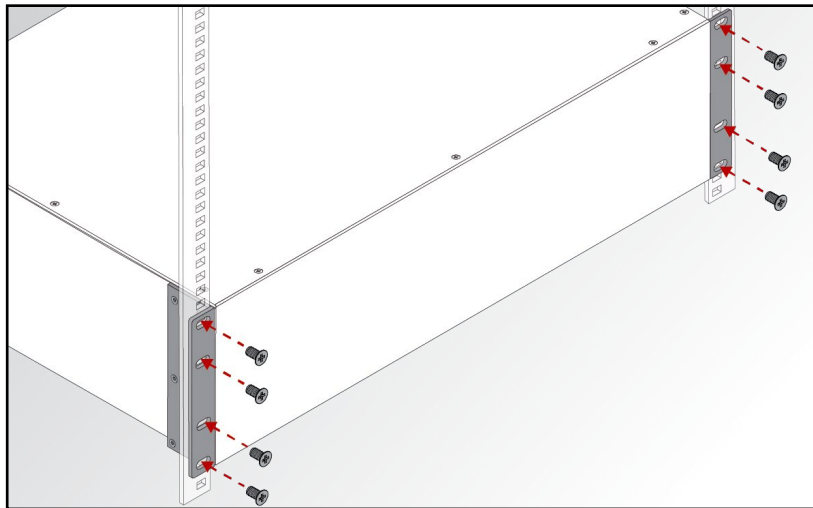
▌ **ATTENTION!** Always use all four screws for fixing the rack shelf ears to the rack rail. Choose properly sized screws for mounting. Keep a minimum of two threads left after the nut screw.

Mounting with Front and Rear Rack Ears

▌ **DIFFERENCE:** Under-desk mounting is available for the 1U-high models.

▌ **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).
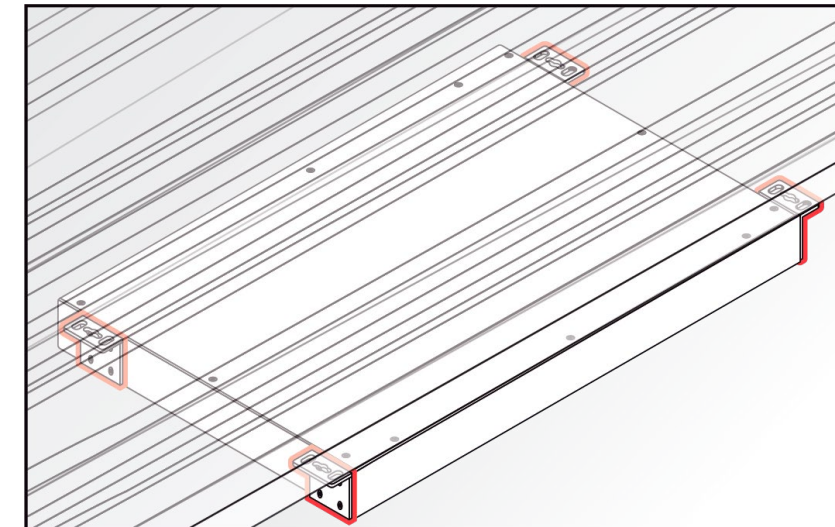
Fixing the Handles

> **DIFFERENCE:** The handles are available for MX2-32x32-HDMI20-A-R, MX2-32x32-DH-16DPi-A-R, and MX2-48x48-HDMI20-A-R models.

Two handles can be mounted on the rack ears of the matrix. Fasten the 2 x 2 pcs of fixing screws to fix the handles to the rack ears.
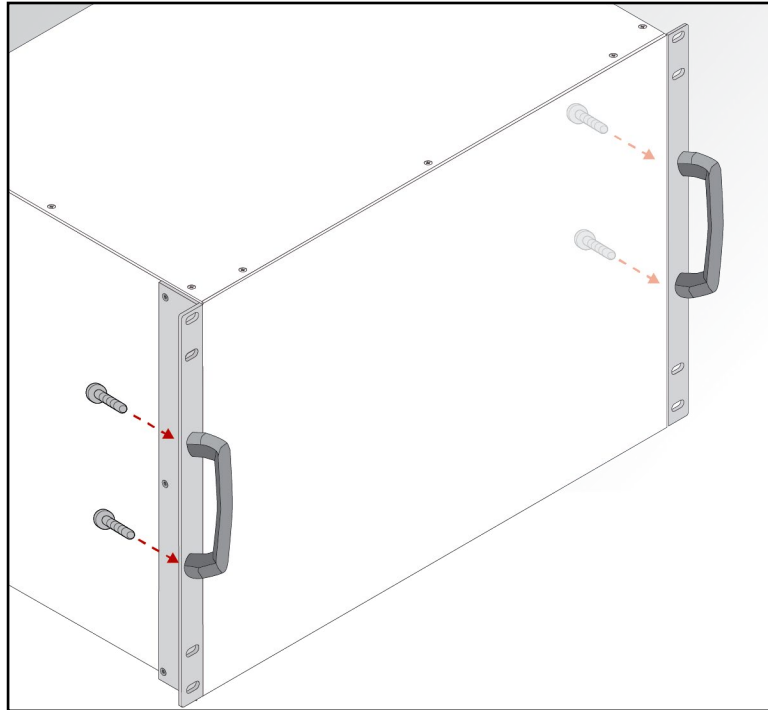
4.2. Electrical Connections

4.2.1. HDMI Connector

The matrix switchers are assembled with standard 19-pole HDMI connector for input or output. 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).

4.2.2. DisplayPort Connector

> **DIFFERENCE:** Certain models provide standard 20-pole DisplayPort connector for input or output. See the details in the Model Comparison table.
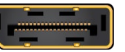
DisplayPort ports are capable of providing about 1.5 W (500 mA @ 3.3V) power on the DP_PWR pin. Always use high quality DP cable for connecting DisplayPort devices!

4.2.3. Symmetrical Analog Stereo Audio

> **DIFFERENCE:** Certain models use this connector as an analog audio input or output. See the details about it in the Model Comparison table.

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

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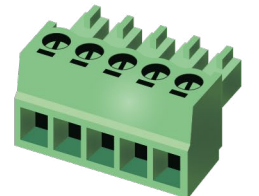
Compatible Plug Type

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

See more information about the most common audio cable wiring modes in the Cable Wiring Guide section.

4.2.4. RS-232 Port

3-pole Phoenix Connector

▌ **DIFFERENCE:** Certain models are supplied with 3-pole Phoenix connector for RS-232 communication.
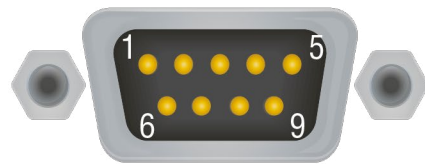
Pin nr.	Signal
1	NC (not connected)
2	RX data receive (input)
3	TX data transmit (output)
4	DTR (internally connected to pin6)
5	GND signal ground (shield)
6	DSR (internally connected to pin4)
7	RTS (internally connected to pin8)
8	CTS (internally connected to pin7)
9	NC (not connected)
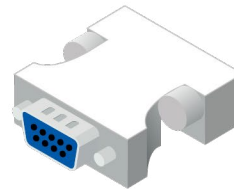
Compatible Plug Type

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

D-SUB Connector

▌ **DIFFERENCE:** The **-R** suffixed models have female D-SUB connector for RS-232 data communication.
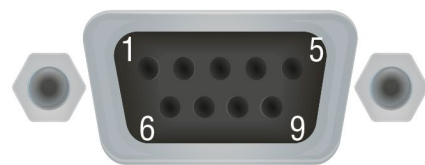
Pin nr.	Signal
1	NC (not connected)
2	RX data receive (input)
3	TX data transmit (output)
4	DTR (internally connected to pin6)
5	GND signal ground (shield)
6	DSR (internally connected to pin4)
7	RTS (internally connected to pin8)
8	CTS (internally connected to pin7)
9	NC (not connected)
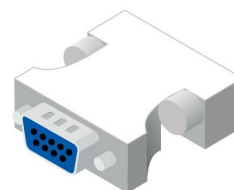
▌ INFO: MX2-HDMI20 series matrix switchers are DCE units according to their pin-out. For more information, see the Serial Management section.

Factory default settings of the serial port: RS-232 enabled; 57600 Baud, Protocol: LW3.

4.2.5. Ethernet (LAN) Port

The matrix can be controlled by Ethernet/LAN connection. The Ethernet port can be connected to a LAN hub, switch or router by a CATx cable. While both cable types (straight or cross) are supported and handled by the device, the pin assingment below is recommended.
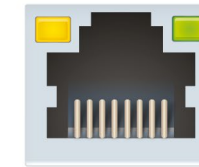
Pin	TIA/EIA T568A	TIA/EIA T568B
1	white/green	white/orange
2	green	orange
3	white/orange	white/green
4	blue	blue
5	white/blue	white/blue
6	orange	green
7	white/brown	white/brown
8	brown	brown
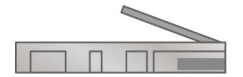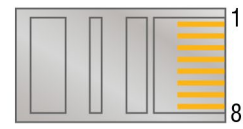
RJ-45 Connector

▌ **DIFFERENCE:** Certain models are supplied with RJ45 connector for Ethernet communication. See the details in the Model Comparison table.

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

Neutrik EtherCON Connector

▌ **DIFFERENCE:** The **-R** suffixed models have EtherCON connector for Ethernet communication.
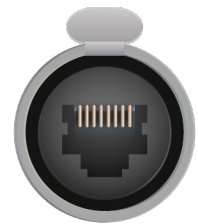
4.2.6. USB Connector

MX2-HDMI20 series matrix switchers have standard USB mini-B receptacle.

4.3. Connecting Steps

4K PC

Media player

Power outlet

HDMI   HDMI   Power

Audio   HDMI   LAN

Audio amplifier   4K projector   Ethernet   Touch control
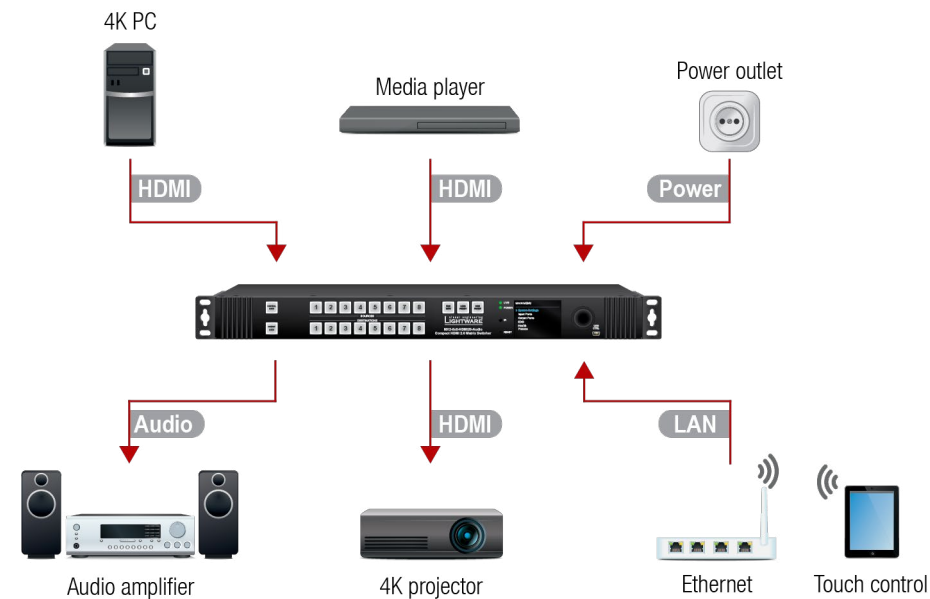
HDMI   Connect the desired sources to the **HDMI input ports**.
Always use high-quality HDMI cables. Maximum cable lengths for inputs: 1920x1080@60Hz 4:4:4 - 40m; 3840x2160@30Hz 4:4:4 - 15m; 3840x2160@60Hz 4:4:4 - 5m

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.

4.3.1. Powering On

Connect the power cords to the AC input of the Power Supply Units (PSU).

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 a power failure or an accidental power down.

1 RU-high models

The 1 RU-high models are immediately powered on. After the self-test (about 20 seconds), the router reloads its last configuration and it is ready to use.

0.4-0.2 A   FUSE: F 3.15 A L

~ 50/60 Hz

100-240 VAC

Made in EU, Hungary

Other models

Certain models are assembled with a power button (see the details in the Model Comparison table).

After switching the power switch to the **ON** position, the router starts up. If the mains' switch is in the **ON** position, then the matrix starts up immediately when the power cord is connected to the AC source. During the initial self-test and loading of the latest settings, **The matrix is about to start** appears on the LCD screen and the router reloads its last configuration.

100-240 VAC ~
2.3-1.1 A   50/60 Hz

INFO: After switching ON, the router reloads the latest settings that were used before it was switched off. The router has an internal emergency memory that stores all current settings and tie configurations.

Redundant Power Supplies

The **-R** suffix in the model name shows that the model has redundant PSUs, which can be switched on and off without interrupting the video transmission. Using only one or both the PSUs at the same time is also possible.

Double PSU allows connection to two different AC power lines to ensure the continuous power for the matrix.

100-240 VAC ~
2.3-1.1 A   50/60 Hz

5

Device Concept

The following chapter describes the features of the device with a few real-life examples.

▸ Port Diagram
▸ HDMI Video Options
▸ DisplayPort Video Options
▸ Analog Audio Options

5.1. Port Diagram
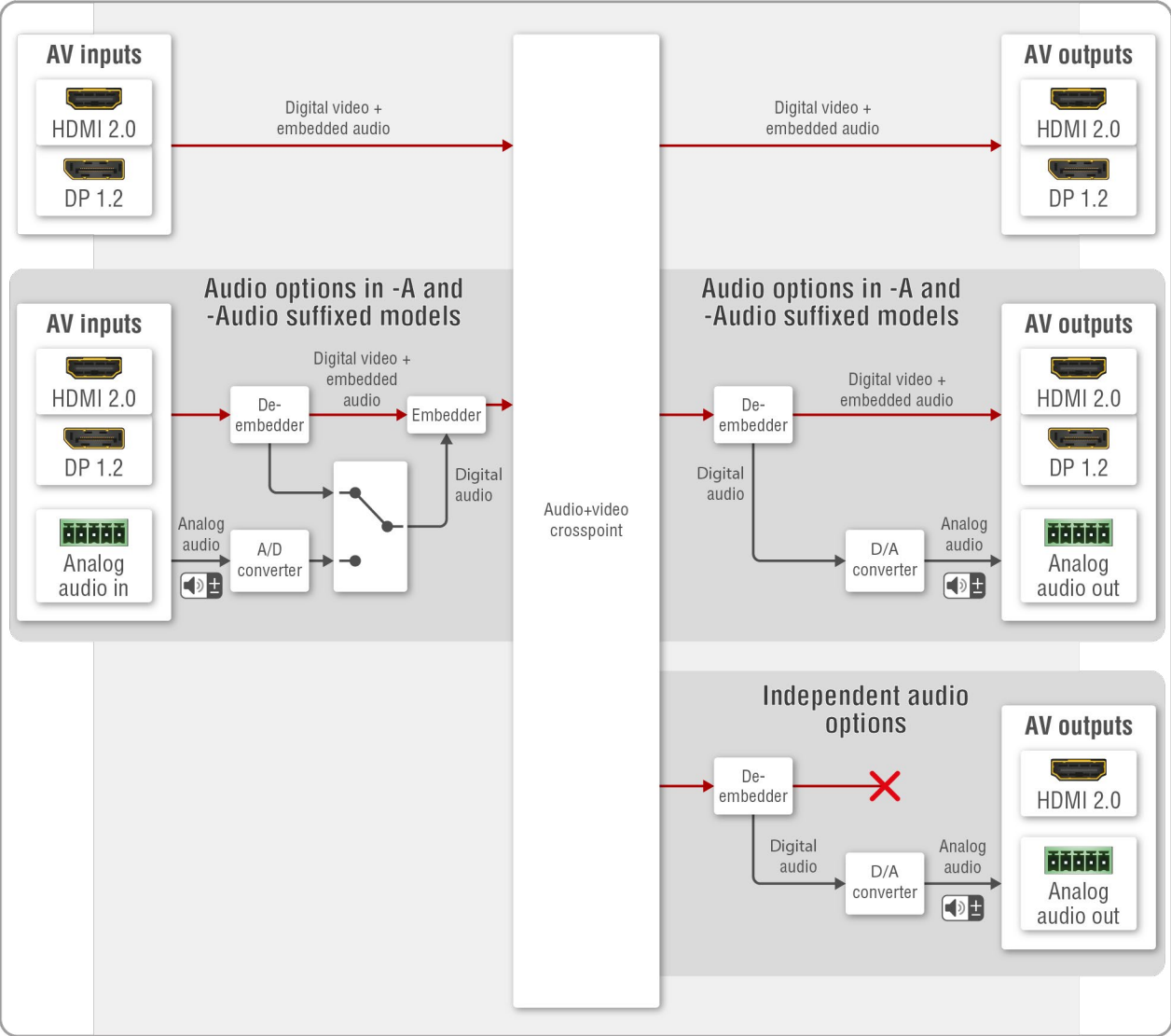
AV port diagram for the MX2 standalone matrix switcher series

ATTENTION! Please note there is no independent audio layer in the matrix. It means the same embedded audio can be switched to a HDMI/DP video port and an Analog audio output port when switching an AV stream in the crosspoint.

ATTENTION! If you select an **Independent audio output** as an audio destination, the embedded audio and the video signal is switched together to the related HDMI and Independent audio output port and in this case the HDMI output port **does not transmit AV signal**.

5.2. HDMI Video Options

ATTENTION! The matrix switcher accepts video signals in 8, 10 and 12 bit color depth, but the sampling pattern conversion is always made in 8 bit with the result of 12 bit.

Color Space	HDMI Input		Output color conversion	Color Space	HDMI OUT	
	Sampling method	Color depth			Sampling method	Color depth
YCbCr	4:4:4	8		YCbCr		12
		10				12
		12				12
		16	4:4:4 to 4:2:2		4:2:2	12
RGB	4:4:4	8		RGB		12
		10				12
		12				12
		16				12

DIFFERENCE: Only the MX2-8X8-HDMI20-AUDIO-L model is capable of the **4:4:4 to 4:2:0 conversion** and the split function. The availability of this setting depends on the hardware version of the output board (V1x_), only in the MX2-8x8-HDMI20 model. **4:4:4 to 4:2:2 conversion is** available from V2x_ hardware version of the output board. The hardware version can be checked in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

5.3. DisplayPort Video Options

> **DIFFERENCE:** DisplayPort inputs are available in certain models, **-D** letter in the model name refers to that (see the Model Comparison table).
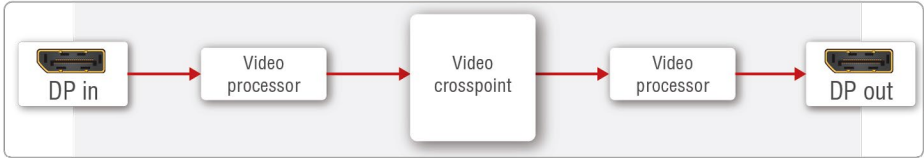
Port Diagram of the Displayport input and Displayport output matrix

▪ If the emulated EDID does not support the deep color signal (10, 12-bit), and the incoming video is deep colored, then the video processor converts the signal to 8-bit automatically. The compatible color depths can be checked in the EDID Menu in Software Control – Lightware Device Controller software.

▪ The factory default EDID (F49 - 1920x1080p60.00Hz) has deep color support up to the full HD resolution. When the resolution of the incoming video signal is more than the full HD with deep color (e.g. 4K@30Hz with 10-bit or 12-bit), the color depth is reduced to 8-bit.

▪ If the signal is 4K@30Hz with 10-bit or 12-bit, using F146 EDID (3840x2160@60Hz with deep color support) is highly recommended.

▪ DisplayPort signals over 18Gbps will be converted down by either truncating bit depth or by converting RGB signal to YCbCr 4:2:2 12-bit signal based on user selection. The second option will not reduce the color depth, instead it results in loss of chroma information.

▪ The video processor converts the DisplayPort video signal to HDMI in all models.

5.3.1. Color Conversion

The table below gives an overview about the automatic color conversion of the video signal. This conversion happens without any user intervention, in color conversion setting (4:4:4 to 4:2:2); in the DP output port this is not available.

Color Space	HDMI Input		Color conversion	DP Output	
	Sampling method	Color depth		Sampling method	Color depth
YCbCr	4:4:4	8	➜	4:4:4	8
		10	➜		10
		12	♺		10
		16	♺		10
	4:2:2	8	➜	4:2:2	8
		10	♺		8
		12	♺		8
		16	♺		8
	4:2:0	8	➜	4:4:4	8
		10	➜		10
		12	♺		10
		16	♺		10
RGB		8	➜		8
		10	➜		10
		12	♺		10
		16	♺		10

➜ No color conversion

♺ Color conversion

5.3.2. Limitations of the DisplayPort Video Options

- DP Multi-Stream (MST) is not supported.
- The matrix is recognized as a DP-to-HDMI converter by the connected DisplayPort source.
- The video input signal of 3840x2160 4:4:4 RGB 10 bit is converted to 3840x2160 4:2:2 YCbCr 10 bit or 3840x2160 4:4:4 RGB 8 bit on the DisplayPort input.
- Dual-mode DisplayPort (DP++) is not supported.
- Adaptive-Sync and FreeSync™ are not supported.
- HDR is not supported on the DisplayPort outputs.

5.4. Analog Audio Options

DIFFERENCE: The **-A** suffix in the model name refers to the analog audio option (for more information about the models, see the Model Comparison table).

- An external audio signal can be embedded in the HDMI stream by the Analog Audio input port. In this case the audio from the analog input port is converted and embedded in the HDMI stream. Furthermore, the Analog audio output ports allow to de-embed the audio of the HDMI output stream. Please note that only stereo LPCM can be de-embedded from the HDMI signal.

The test pattern generator feature makes it possible to transmit the analog audio without any video signal.

6

Software Control - Using the Built-in Web

The built-in website of the matrix allows connection and control of the matrix via a web browser. Built-in web and Lightware Device Controller Software has the same look and functionality.

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

System Requirements   *#web #builtinweb*

Operating System: Microsoft Windows XP, Windows Vista, Windows 7, Windows 10, macOS, Linux.

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

> **ATTENTION!** The EDID export function works only in Windows and macOS operating systems, under Mozilla Firefox or Google Chrome web browsers.

6.1. Establishing the Connection

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

Step 1. Connect the matrix and the computer either via

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

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

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

6.2. The Layout of the Built-in Web

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

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

Tile View of the Crosspoint Menu of the Built-in Webpage
(Displayed in a mobile device)

7

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 macOS. The application can be downloaded from www.lightware.com. The Windows and the Mac versions have the same look and functionality.

▶ Install and Update
▶ Running the LDC
▶ Device Discovery Window
▶ Crosspoint Menu
▶ Input Port Properties
▶ Output Port Properties
▶ Presets
▶ EDID Menu
▶ Settings Menu
▶ Advanced View

7.1. Install and Update

Minimum System Requirement

RAM: 1 GB

Minimum display resolution: 1280x720

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 macOS	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 macOS

▌ 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 by 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.

▌ **ATTENTION!** Please check the **firewall settings** on the macOS device. LDC needs to be added to the exeptions of the blocked software for the proper operation.

The Updating 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 LDC updates are found.

The current and the update version numbers 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 on 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 from the **drop down list**.
- If necessary, the proxy settings are available by clicking on the **Setup** button.

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

Step 4. When the download process finished, the **Download Update** button changes to **Launch update.** Click on it to install the new version.

7.2. Running the LDC

The common way to start the software is to double-click on the LDC icon. But the LDC can be run by command line parameters as follows:
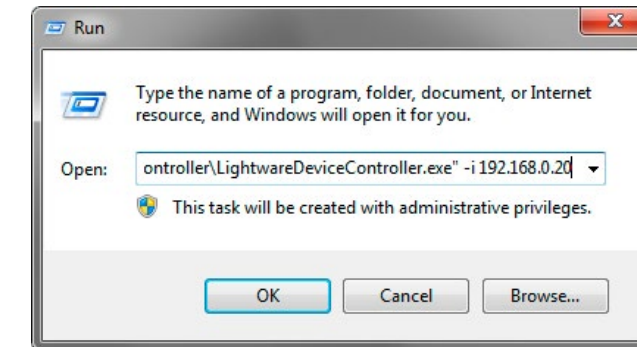
Launching of LDC in a Run window in Windows operating system

Connecting to a Device with Static IP Address

Format: `LightwareDeviceController -i <IP_address>:<port>`

Example: `LightwareDeviceController -i 192.168.0.20:6107`

The LDC is connected to a device with the indicated static IP address directly; the Device Discovery window is not displayed. When the port number is not set, the default port is used: 10001 (LW2 protocol). For LW3 devices, use the **6107** port number.

Adjusting the Zoom

The window can be zoomed to a specific value to fit to the resolution of the desktop (higher/lower). '1' is the default value (100%).

Format: `LightwareDeviceController -z <magnifying_value>`

Example: `LightwareDeviceController -z 1.2`

▌ **ATTENTION!** The last set value is stored and applied when LDC is started without a parameter.

7.3. Device Discovery Window

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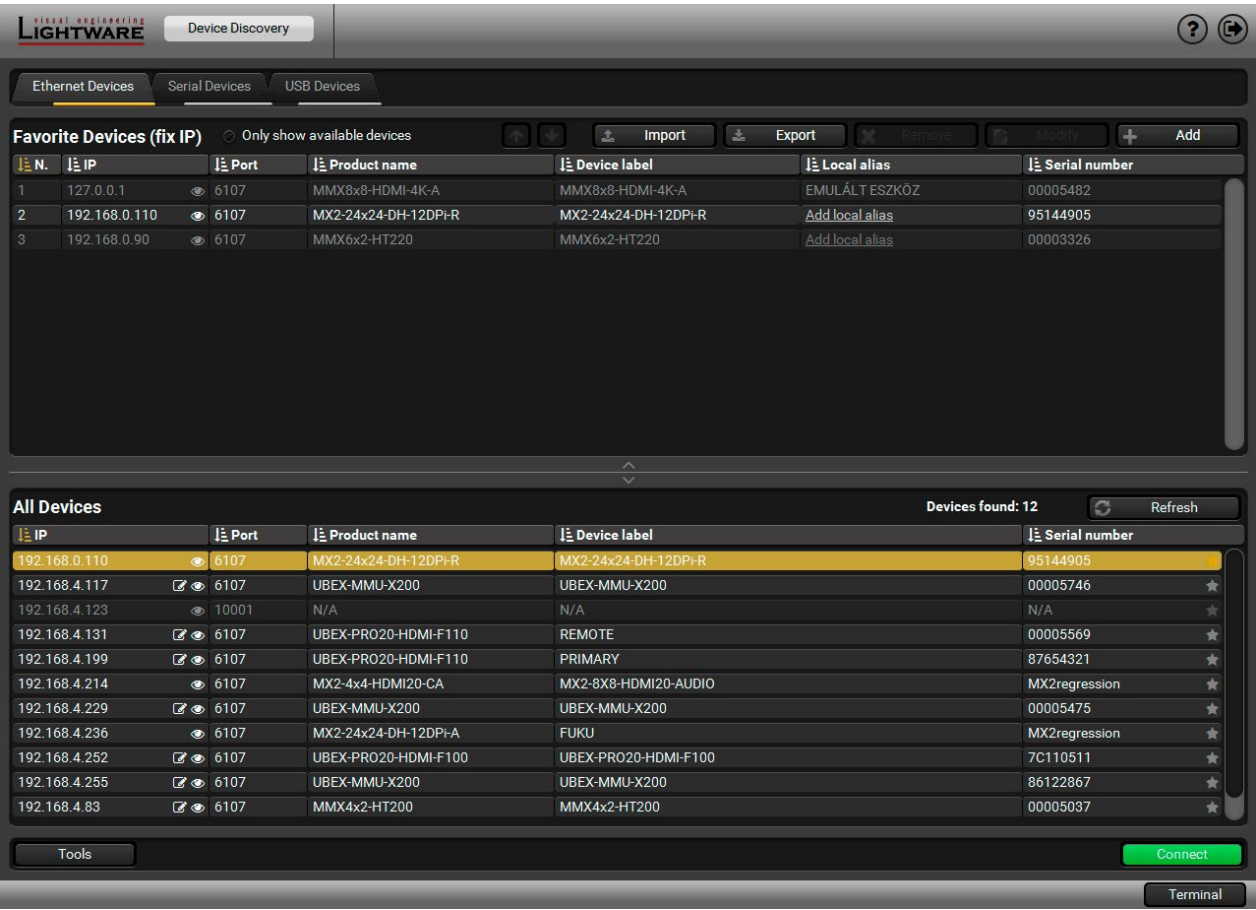
Device Discovery Window

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

▪ **Favorite Devices:** You can add any Lightware device that is connected via Ethernet, and there is 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 that 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.

Changing the IP Address 🖉

To modify IP address settings quickly, it is not necessary to enter the device's settings/network menu, you can set them by clicking the pencil icon next to the IP address.

You can see the new settings only in this window.

#network #ipaddress #dhcp #mac

Identifying the Device   👁

Clicking on the icon makes the four front panel LEDs blink in green for 10 seconds. The feature helps to identify the device itself in the rack shelf. *#identifyme*

Import/Export the List of Favorite Devices

▌ **DIFFERENCE:** This feature is available only from LDC version v2.5.5.

The list of favorite devices can be exported/imported with the dedicated buttons (saved as *.JSON file). The list can be imported later (in another computer, too), but please note that the current list will be overwritten by the imported list.

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 the 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.

7.4. Crosspoint Menu

7.4.1. 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.   *#crosspoint #switch #gridview*
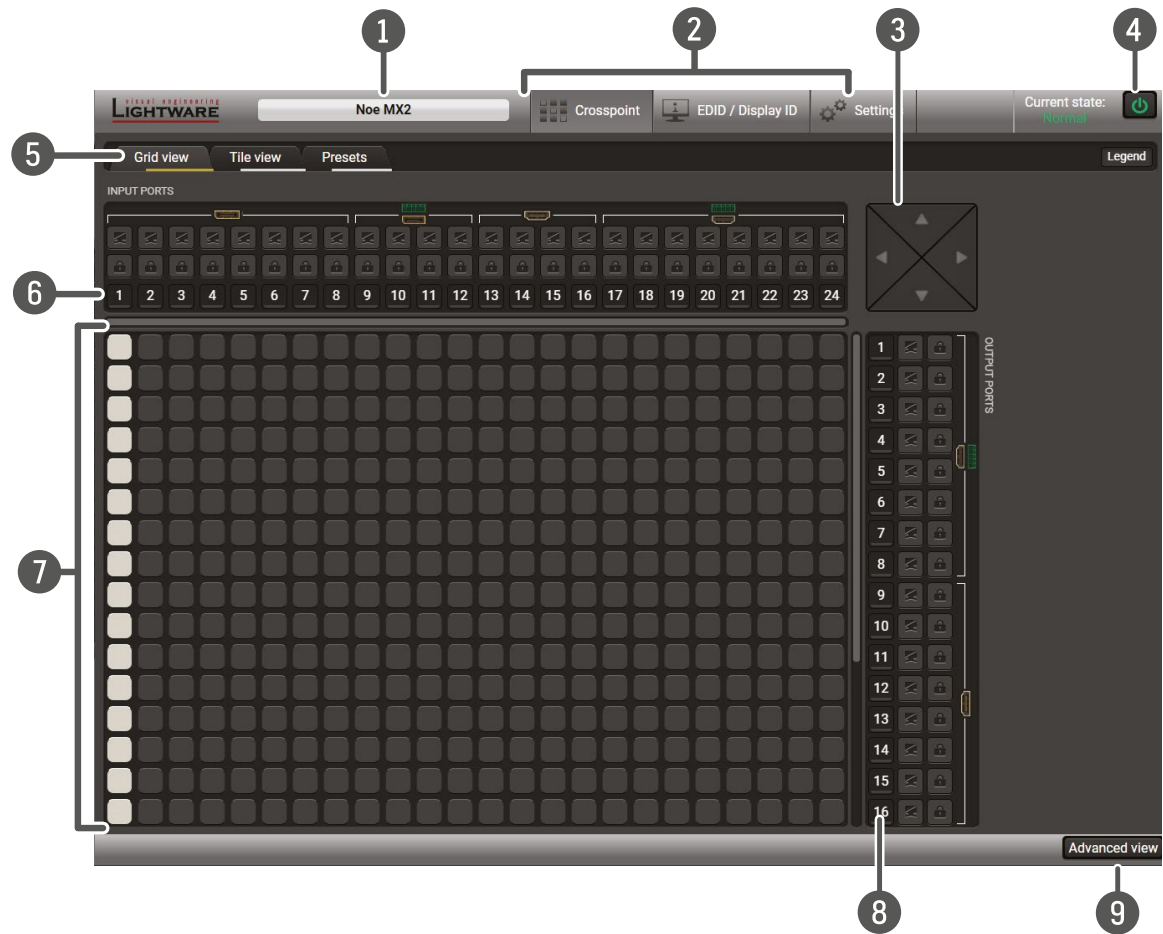
Crosspoint menu of the MX2-24x24-DH-12DPi-R model

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 the Status Tab section, and the 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	**Navigation Panel**	When the matrix size is too big to display all inputs and outputs, click on the navigation bars that can be moved up and down or left and right to reach the other ports.
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   *#mute #unmute*

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   *#lock #unlock*

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

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

7.4.2. 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. *#crosspoint #switch #tileview*

Control Buttons

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
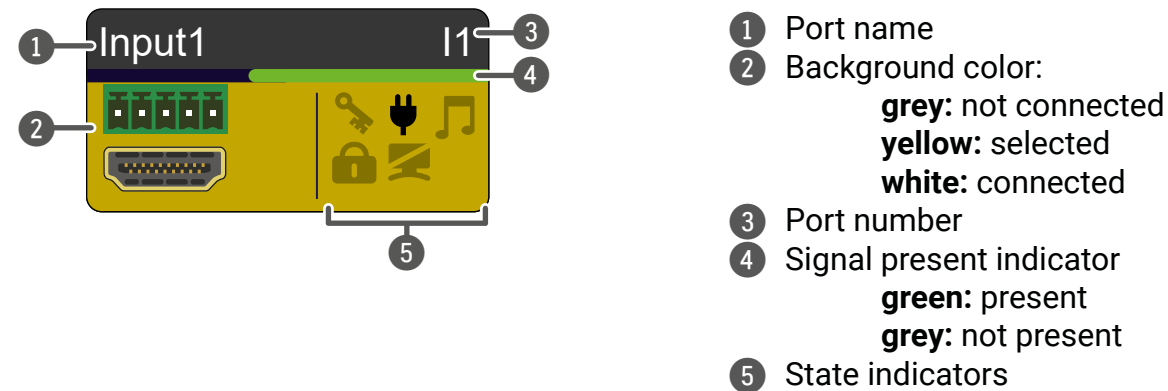
State Indicators

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 port 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. The 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. The 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.   *#take #autotake*

7.5. Input Port Properties

7.5.1. HDMI Inputs

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

General Tab - General

General tab in the input port properties window

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 *#mute #unmute*

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 *#lock #unlock*

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 and the crosspoint 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 (displays the **Monitor Name** in the EDID menu).

General Tab - Video Settings

HDCP Enable *#hdcp*

▪ **Disable HDCP on input:** 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.

*The availability of this setting depends on the hardware version of the input board (V1x_) and the port type (HDMI), only in MX2-8x8-HDMI20 model. The hardware version can be found in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

Resetting the default values: **HDCP = HDCP 2.2 and HDCP 1.4**.

General Tab - Audio Settings
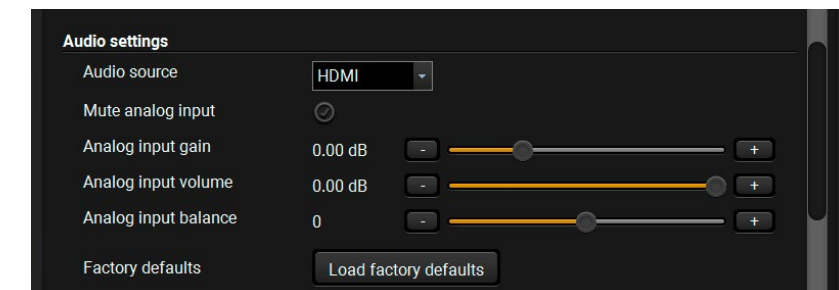
Analog audio settings in the output port properties window

Audio source *#audio #analogaudio*

▪ **Off:** audio is not embedded in the video stream.

▪ **HDMI:** the audio of the incoming video stream is embedded in the video.

▪ **Analog input :** the analog audio input signal is embedded in the video.

DIFFERENCE: Analog audio properties appear only in **-Audio or -A** suffixed models, where there is an analog audio port beside the video port.

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).

Video status

The signal format and the detected parameters are described in these sections.
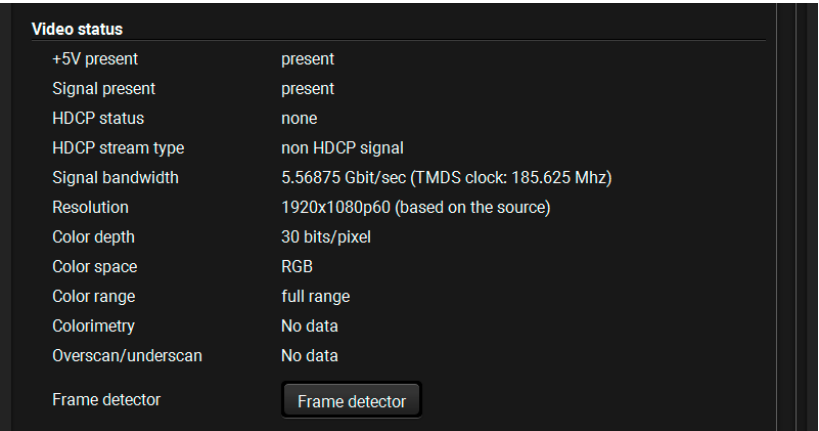
Video status information in the input port properties window

The following signal status information is displayed in this section:

+ 5V present, Signal present, HDCP status, HDCP stream type, Signal bandwidth, Resolution, Color depth, Color space, Color range, Colorimetry, Overscan/underscan, Frame Detector.

HDCP status

The currently applied HDCP encryption level on the input (e.g. HDCP 1.4).

- **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 the HDCP v2.2 section (the first figure).
- **HDCP 2.2 stream (non HDCP 1.4 convertable):** the signal is encrypted with HDCP 2.2, and is not allowed to be converted and encrypted with HDCP v1.4. In this case the signal can be displayed only on a HDCP v2.2-compliant sink device.

General Tab - Embedded audio

Presence of the embedded audio and the sampling frequency are displayed in Embedded audio section.

CEC Tab

The MX2-HDMI20 series 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 or DP cable, in this case between the source and the input port of the matrix switcher.   *#cec*

▌ **ATTENTION!** Make sure that the controlled unit is CEC-capable and that this function is enabled.
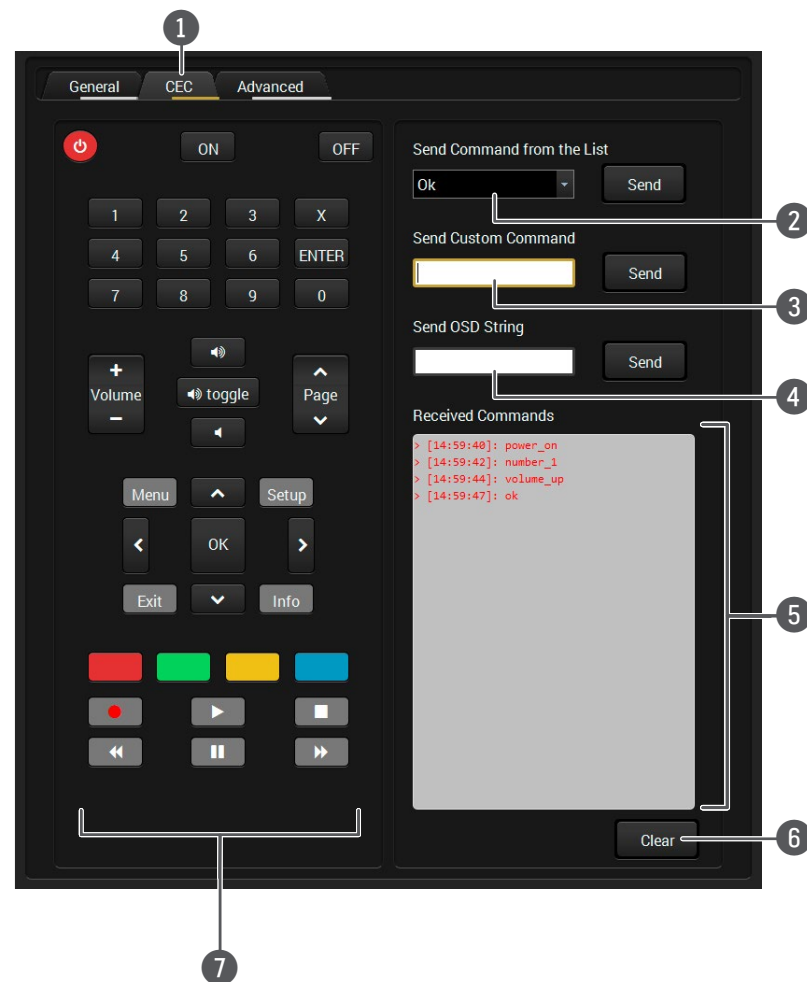
Layout of CEC panel in Lightware Device Contoller

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 characters long (15 bytes). Click on the **Send** button to confirm.

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 commands towards the source. The communication is displayed in the Received Command box. For the list of commands, see the Sending CEC Commands Towards the Source section. Both the layout and functionality are similar to the design of a remote control.

▌ INFO: The first 2x2 bit are the source and destination address. In this case that is always 04.

▌ INFO: According to the standard, the CEC feature works only at HDMI ports.

Advanced Tab

AVI Infoframe, Audio InfoFrame, Vendor Specific Infoframe

Advanced signal information can be displayed on this tab if the video signal contains them. It could be used for cable diagnostic purpose.
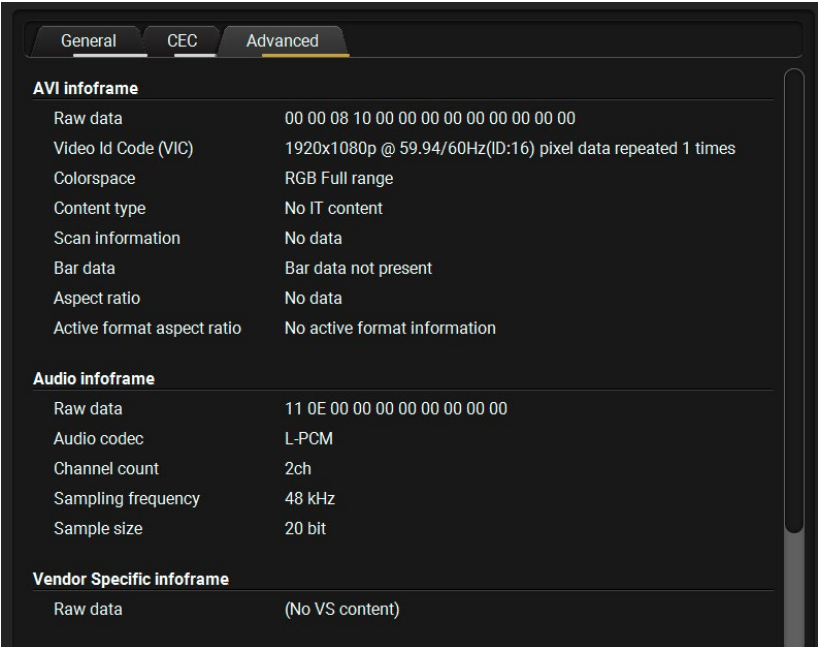
Advanced tab in the input port properties window

High Dynamic Range (HDR) Infoframe

This layout supports the HDR signal analysis by converting the raw infoframe data to a human-readable format. When the video signal is HDR and its infoframe contains metadata, then it will be displayed in this tab. *#hdr*
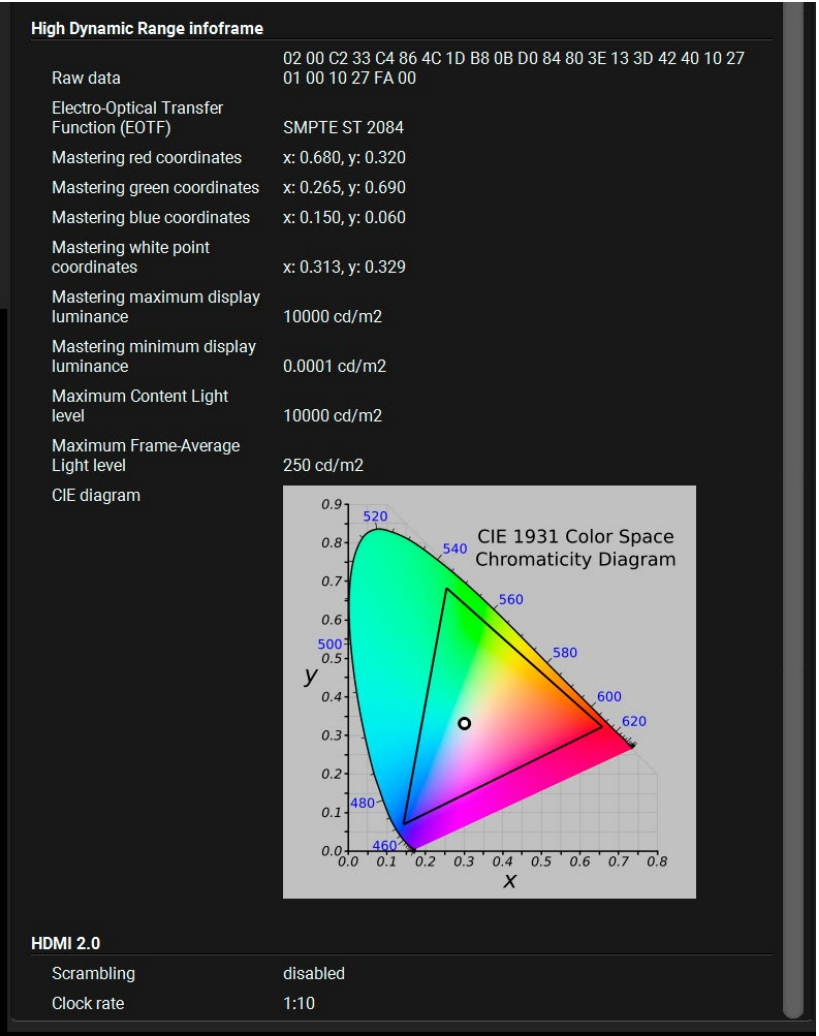
Advanced tab in the input port properties window

HDMI 2.0

▪ HDMI 2.0 related information: Scrambling / Clock rate

7.5.2. DisplayPort Inputs

> INFO: This window appears only when the selected port is DisplayPort. See the Model Comparison table on which model has DP input.

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

General Tab- General

General tab in the input port properties window

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   *#mute #unmute*

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   *#lock #unlock*

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 and the crosspoint state of this port 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 (displays the **Monitor Name** in the EDID menu).

General Tab - Displayport Link

This section has a built-in help in the LDC. Click on the ℹ icon to open the related info textbox in a pop-up window.
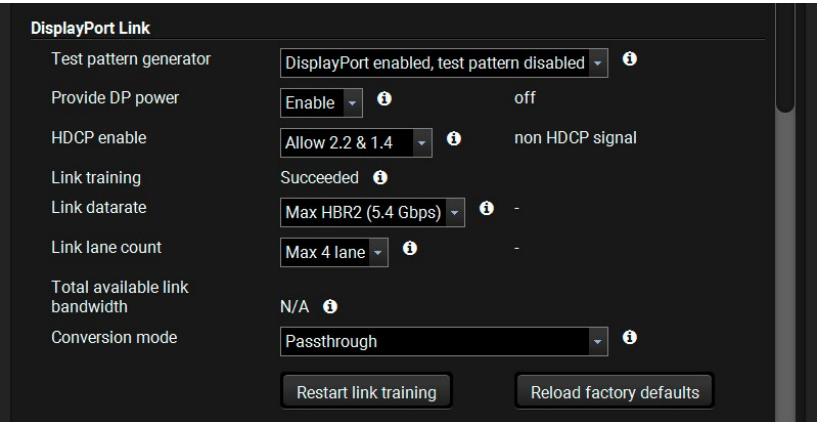
DisplayPort settings in the input port properties window

Test pattern generator *   *#testpattern #nosyncscreen*

- **DisplayPort enabled, test pattern disabled:** default value for DP video transmission.
- **DisplayPort disabled, test pattern enabled:** This function makes it possible to route the analog audio towards the output without any video transmission. Enabling testpattern will disable the DisplayPort connector.

* Test pattern generator option appears only in **-A or -Audio** suffixed models, where there is an analog audio port beside the DP port.

Provide DP Power   *#testpattern #nosyncscreen*

- **Enable /Disable**: DisplayPort input ports are capable of providing about 1.5 W (500 mA @ 3.3V) power on the DP_PWR pin. As in DisplayPort copper cables this pin is not connected, the setting has no effect when a PC or a media player is attached to the respective port. Typically, this feature can be used for powering DisplayPort dongles, adapters and active optical cables that do not have external power supplies. The matrix is also capable of detecting and displaying short circuit conditions where the current exceeds the 500 mA limit. Adjusting these settings may help restarting or powering down the connected device.

HDCP enable   *#hdcp*

- ▪ **Disable HDCP on input:** 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.

*The availability of this setting depends on the hardware version of the input board (V1x_) and the port type (HDMI), only in MX2-8x8-HDMI20 model. The hardware version can be found in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

Link training   *#linktraining*

This is a status information about the success of the link training. The result of the connection can be succeeded or not ready.

Link training is a process where the source (PC, laptop, media server) and the sink (matrix) agree on a data rate, lane count and electrical parameters. The successful link training is a pre-requisite of the video transmission. If the quality of the DisplayPort cable is insufficient to reliably handle higher data rates, link training will result in a lower data rate where stable connection between the source and the matrix can be maintained.

Clicking on the **Restart Link Training** button starts to build up the connection again between the matrix switcher and the source (it happens automatically when the source is connected). It is equal to unplugging the DP connector and reconnecting it.

Link datarate

The DisplayPort 1.2 standard uses fix data rates on the high-speed lanes. With this setting, it is possible to limit the maximum data rate. Please note that the source can use lower data rate if the quality of the cable is low.

- ▪ **Max RBR:** Reduced Bit Rate uses 1.62 Gbps bandwidth per lane
- ▪ **Max. HBR:** High Bit Rate (HBR) uses 2.70 Gbps
- ▪ **Max. HBR2:** HBR2 is the fastest mode with a data rate of 5.40 Gbps per lane

INFO: RBR and HBR are defined in the DisplayPort 1.0-1.1a standards, while HBR2 was introduced in DisplayPort 1.2.

Link lane count

DisplayPort cables have four high-speed lanes, each of them are capable of transmitting data at a rate of 5.40 Gbps.

The following parameters can be set:

- ▪ **Max. 1 lane:** Transmits data at a rate of 5.40 Gbps.
- ▪ **Max. 2 lane:** Transmits data at a rate of 10.80 Gbps.
- ▪ **Max. 4 lane:** Transmits data at a rate of 21.60 Gbps.

The source and the sink agree on the link lane count during the link training process. Fewer link lanes result in lower power consumption at the transmitter side. With this setting, it is possible to limit the number of link lanes used.

INFO: Please note that the source can still use fewer lanes if there is no need for high data rates.

Total available link bandwidth

Displays the maximum available bandwidth.

The total available link bandwidth is the actual Link datarate multiplied by the Link lane count. If the bandwidth of the video stream is higher than the total available link bandwidth, then it is not possible to transmit the video stream over the link.

Conversion mode   *#colorspace*

The following settings are available:

- ▪ **Passthrough:** the video signal is transmitted to the output without any changing.
- ▪ **RGB 4:4:4 to YCbCr 4:2:2 12 bit:** the video converter subsamples the 4:4:4 signal to 4:2:2.
- ▪ **RGB 4:4:4 to YCbCr 4:2:0 8 bit:** the video converter subsamples the 4:4:4 signal to 4:2:0.

INFO: When the DisplayPort source sends RGB 4:4:4 10-bit HDR signal, then it will be converted to 8-bit HDMI signal, because of the HDMI 2.0 bandwidth limit. Enabling YCbCr 4:2:2 conversion will save bandwidth by chroma subsampling and preserve the color depth.

Below the Displayport Link section, the summary of the DP-related settings and status information of the selected port can be seen.

Status information of the active signal

Status information of the disconnected port

The audio setting possibilities are the same with the HDMI port's. For more details see the General Tab - Audio Settings section.   *#status*

Video status

The signal format and the detected parameters are described in these sections.
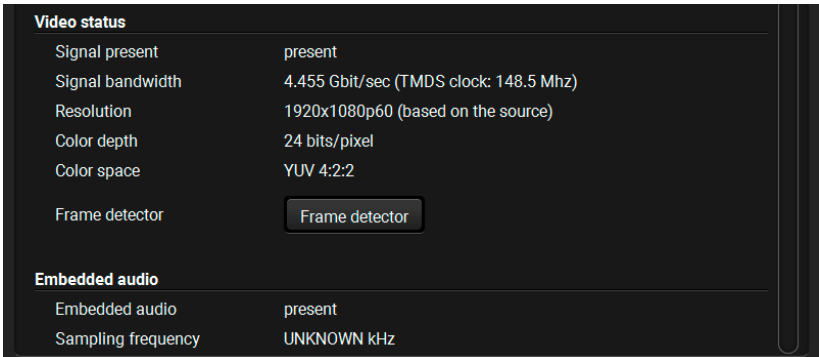
Video status information in the input port properties window

The following signal status information is displayed in this section:

- **Signal present**
- **Signal bandwidth**
- **Resolution**
- **Color depth**

  INFO: Make sure the emulated EDID supports deep color in case of 10-bit or 12-bit color depth video signal. For more information about it, see DisplayPort Video Options.

- **Color space**
- Frame Detector

Embedded audio

The embedded audio's presence and the sampling frequency are displayed in the Embedded audio section.

CEC Tab   *#cec*

The DisplayPort CEC-capability is similar to the HDMI, for more details about the CEC command sending, see the CEC Tab section.

Advanced Tab

See more details about the advanced signal information in the Advanced Tab section.

7.6. Output Port Properties

7.6.1. HDMI Outputs

Click on a port to display its properties.
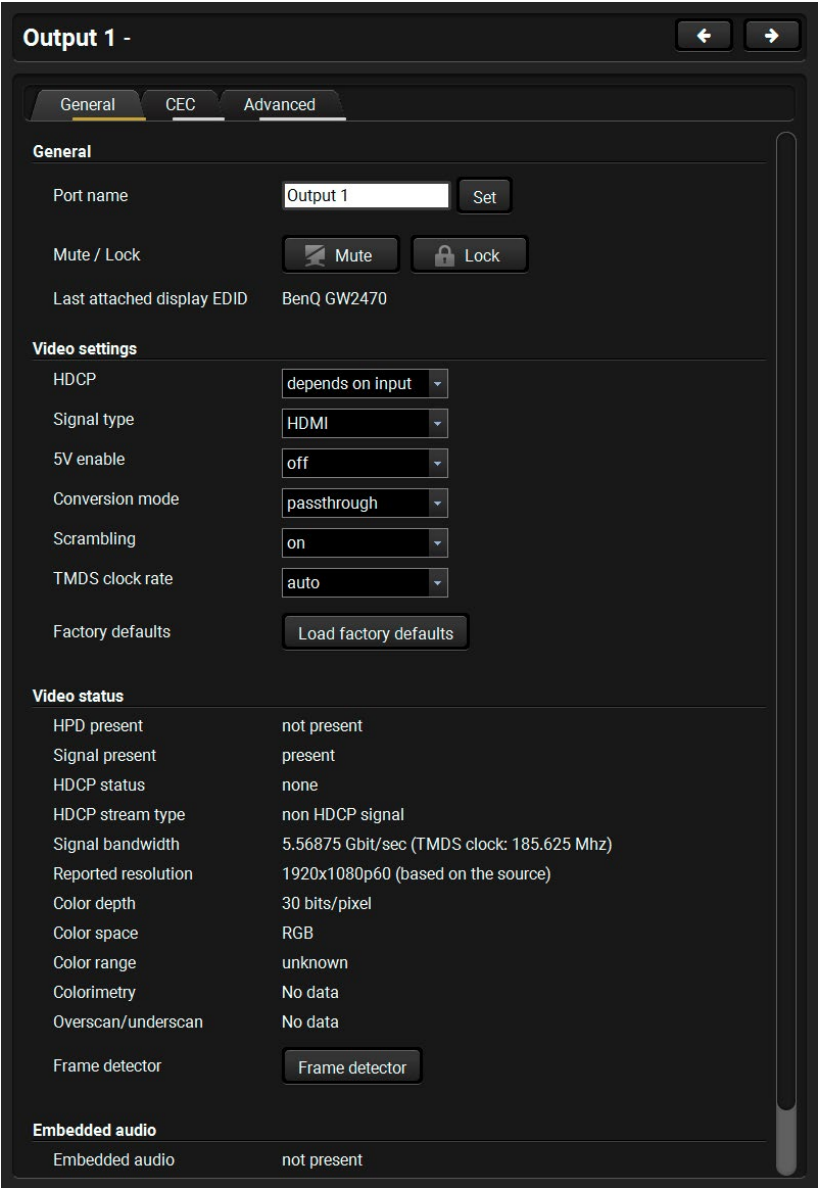
Output port properties window

General Tab - General

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   *#mute #unmute*

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   *#lock #unlock*

The output port can be locked to the currently connected input port via the button. If the port is locked, button text is **Unlock**. In this case the mute state and the crosspoint state of the port 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).

General Tab - Video settings

HDCP   *#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 from a drop-down list:
Auto, HDMI, DVI.

5V enable   *#power5v*

- **On:** +5V power is always sent, thus the sink and the port are always connected.
- **Off:** +5V power is not sent towards the sink, thus the sink does not sense the connection.

Conversion mode   *#colorspace*

DIFFERENCE: Only the MX2-8X8-HDMI20-AUDIO-L model is capable of 4:4:4 to 4:2:0 conversion and the split function. The availability of this setting depends on the hardware version of the output board (V1x_), only in MX2-8x8-HDMI20 model. The hardware version can be found in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

- **Passthrough:** no signal conversion.
- **4:4:4 to 4:2:0 :** the signal is converted to the indicated color depth.
- **4:4:4 to 4:2:2:** the signal is converted to the indicated color depth.

ATTENTION! 10 bit 4:4:4- video signal is converted to **12 bit** 4:2:2.

- **LEFT part/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 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. See the application diagram in the Typical Application chapter.

Scrambling   *#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 **On / 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** = depends on input; **Signal type** = auto; **Conversion mode** = passthrough; **Scrambling** = auto; **TMDS clock rate** = auto.

General Tab - Audio settings *#audio #analogaudio #mute #unmute*

INFO: Analog audio properties appear only in **-A or -Audio** suffixed models, where there is an analog audio port beside the HDMI port.

Mute analog output

The analog audio output signal can be muted by this option.
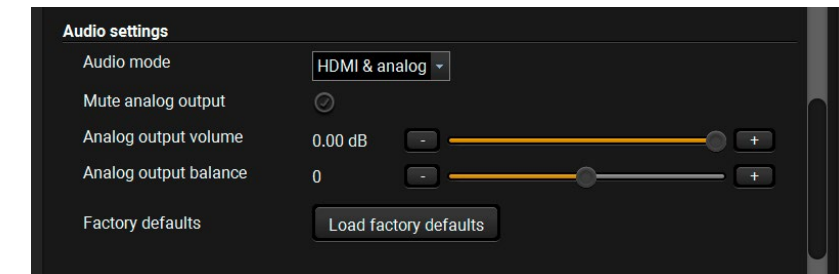
Analog audio settings in the output port properties window

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).

General Tab - Video status

The signal format and the detected parameters are described in these sections.
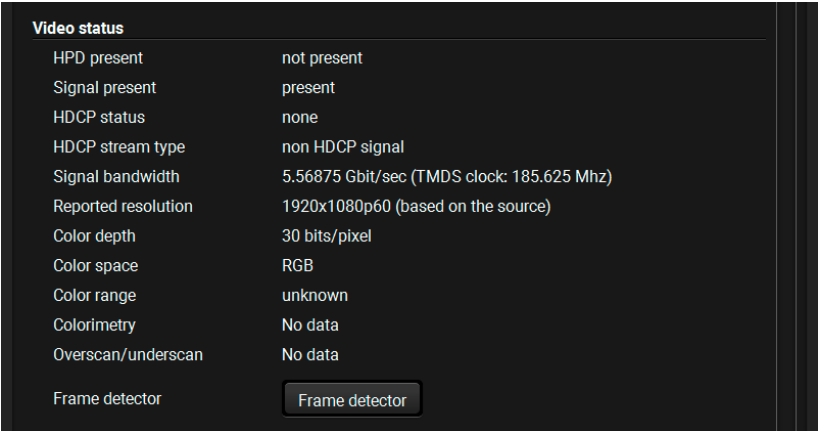
Video status information in the output port properties window

The following signal status information is displayed in this section:

HPD present, Signal present, HDCP status, HDCP stream type, Signal bandwidth, Reported resolution, Color depth, Color space, Color range, Colorimetry, Overscan/underscan, Frame Detector.

HDCP status   *#hdcp*

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 is not allowed to be converted and encrypted with HDCP v1.4. In this case the signal can be displayed only on a HDCP v2.2 compliant sink device.

Advanced tab
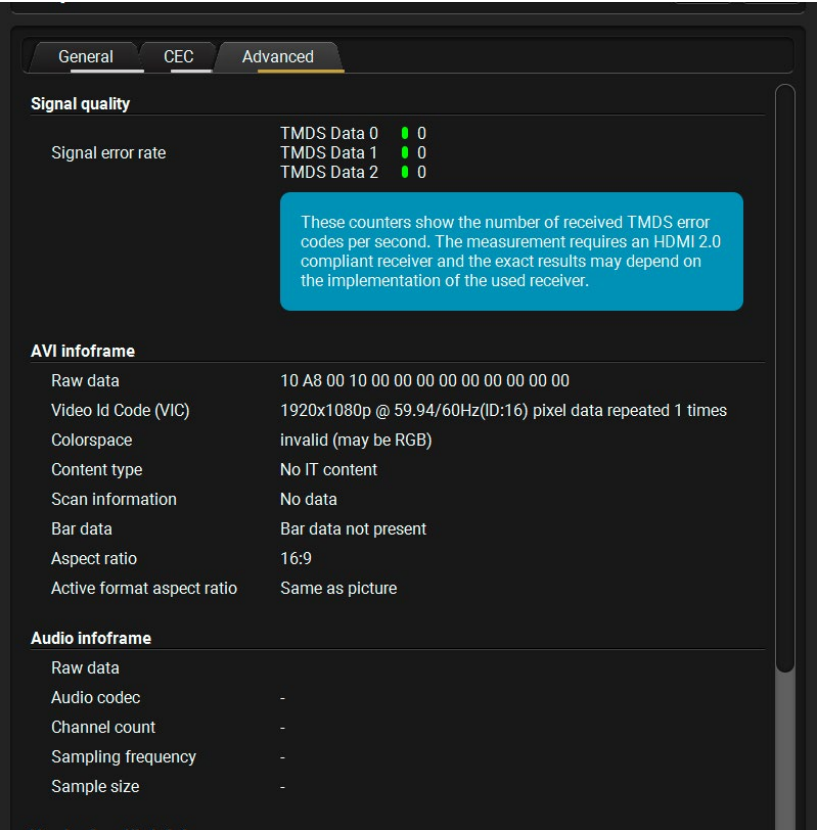
Advanced tab in the output port properties window

Signal quality

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

- Signal error rate: number of the faulty characters 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 mean the error rate of the data packages.

See more details about the advanced signal information in section.

7.6.2. Frame Detector

The ports can show detailed information about the signal like full size and active video resolution. This feature is a good troubleshooter if compatibility problems occur during system installation. To access this function, open the port properties window and click on the **Frame detector** button. *#framedetector*
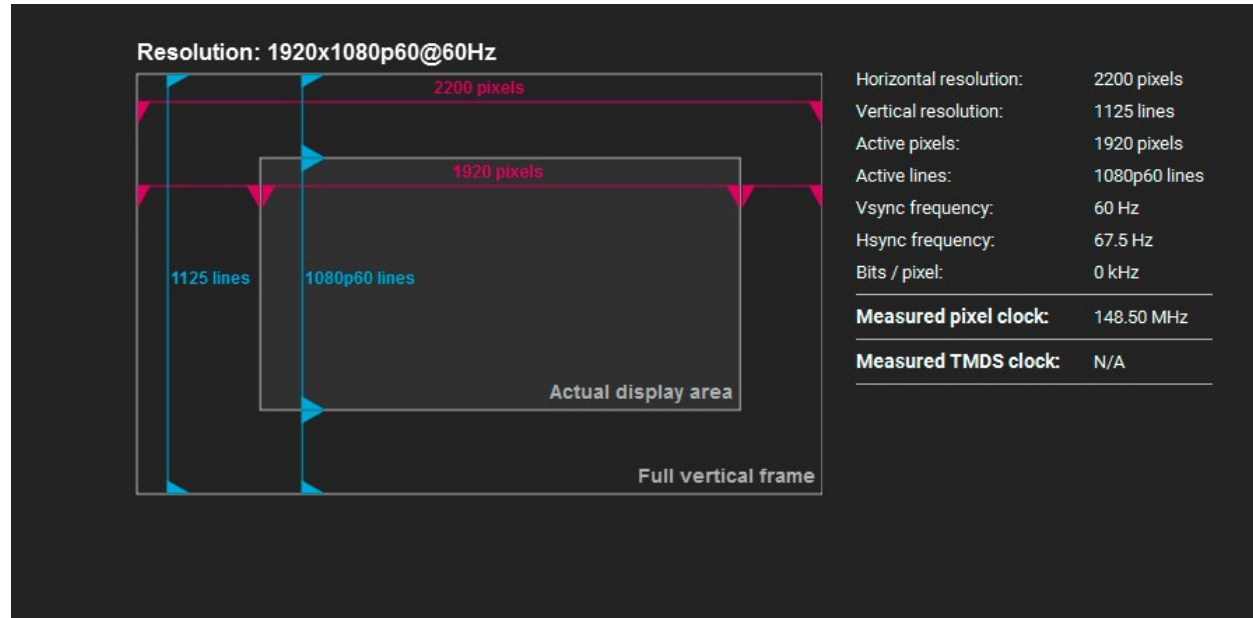
Frame Detector Window

Lightware's Frame Detector function works like a signal analyzer and makes it possible to determine the exact video format that is present on the port, thus helps to identify many problems. E.g. actual timing parameters may differ from the expected, and this may cause some displays to drop the picture.

Frame Detector measures detailed timings on the video signals just like a built-in oscilloscope, but it is much more easy to use. Actual display area shows the active video size (light grey). Dark grey area of the full frame is the blanking interval, which can contain the info frames and embedded audio data for HDMI signals. Shown values are measured directly on the signal and not retrieved only from the HDMI info frames.

7.6.3. DisplayPort Outputs

Click on a port to display its properties.
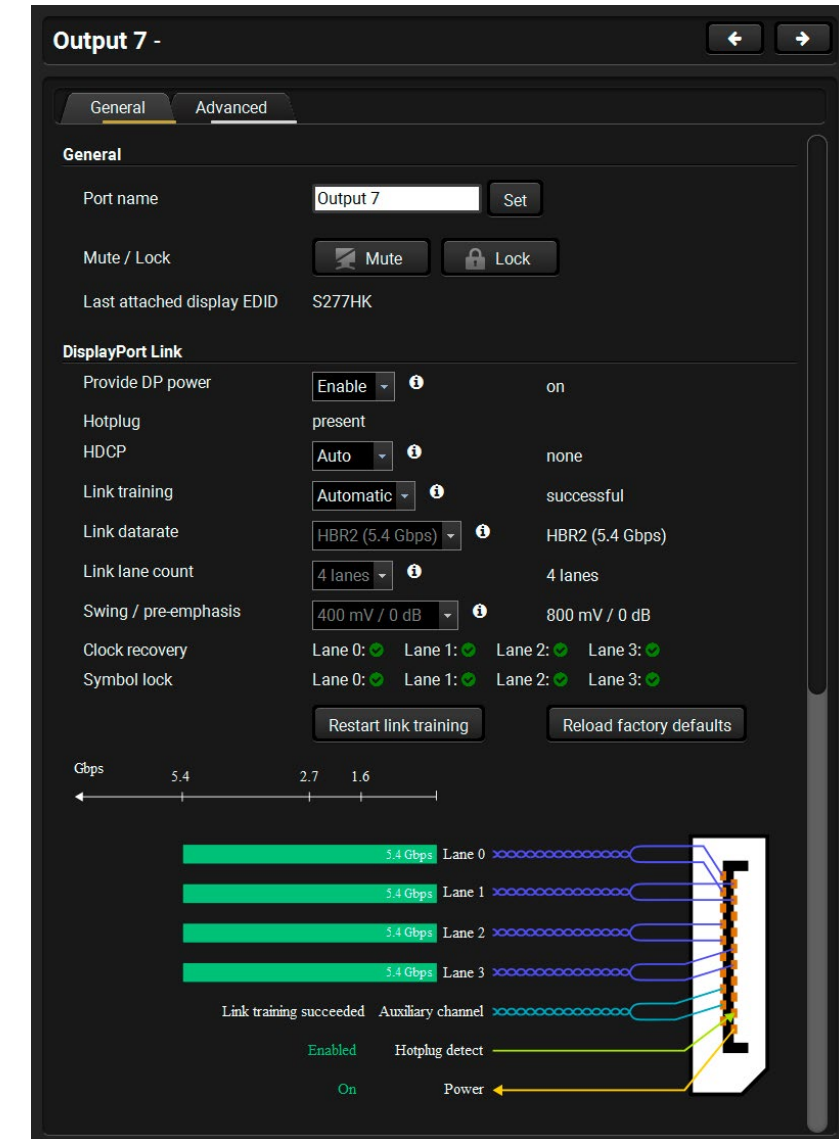
Output port properties window

General Tab - General

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   *#mute #unmute*

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   *#lock #unlock*

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 and the crosspoint state of the port 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).

General Tab - Displayport Link

This section has a built-in help in the LDC. Click on the ❶ icon to open the related info textbox in a pop-up window.

DisplayPort settings in the input port properties window

Provide DP Power   *#dppower*

- **Enable /Disable**: DisplayPort output ports are capable of providing about 1.5 W (500 mA @ 3.3V) power on the DP_PWR pin. As in DisplayPort copper cables this pin is not connected, the setting has no effect when a PC or a media player is attached to the respective port. Typically, this feature can be used for powering DisplayPort dongles, adapters and active optical cables that do not have external power supplies. The matrix is also capable of detecting and displaying short circuit conditions where the current exceeds the 500 mA limit. Adjusting these settings may help restarting or powering down the connected device.

HDCP enable   *#hdcp*

- **Auto:** The matrix forces the source to send the signal without encryption if the content allows.
- **Always:** The matrix forces the source to send the signal with encryption.

Link training   *#linktraining*

- **Automatic:** The link training process starts without any user interruption, parameters are set automatically. Using this setting is highly recommended!
- **Forced:** This mode means that the link training process is skipped, the signal sending is based on the configured values of Link datarate, Link lane count, . Only for advanced users for special troubleshooting cases!

▌ INFO: Certain displays require the standard link training process and will not display the video without it.

Link datarate

▌ INFO: This drop-down menu becomes active when the **Link training** is set to **Forced**.

The DisplayPort 1.2 standard uses fix data rates on the high-speed lanes. This setting defines the fix datarate. If the quality of the cable is low, lower data rate setting is recommended.

- **RBR:** Reduced Bit Rate uses 1.62 Gbps bandwidth per lane.
- **HBR:** High Bit Rate (HBR) uses 2.70 Gbps.
- **HBR2:** HBR2 is the fastest mode with a data rate of 5.40 Gbps per lane.

▌ INFO: RBR and HBR are defined in the DisplayPort 1.0-1.1a standards, while HBR2 was introduced in DisplayPort 1.2.

Link lane count

▌ INFO: This drop-down menu becomes active when the **Link training** is set to **Forced**.

DisplayPort cables have four high-speed lanes, each of them are capable of transmitting data at a rate of 5.40 Gbps.

The following parameters can be set:

- **1 lane:** Transmits data at a rate of 5.40 Gbps.
- **2 lane:** Transmits data at a rate of 10.80 Gbps.
- **4 lane:** Transmits data at a rate of 21.60 Gbps.

Fewer link lanes result in lower power consumption at the transmitter side. With this setting, it is possible to declare the used number of link lanes.

Swing / pre-emphasis

▌ INFO: The drop-down menu becomes active when the **Link training** is set to **Forced**.

In case of low cable quality or unstable signal transmission, the forced voltage level and pre-emphasis level can be changed on main link lanes. This setting is valid for all lanes.

The following values can be chosen from the drop-down menu:

- 400mV / 0 dB
- 400mV / 3.5 dB
- 400mV / 6 dB
- 600mV / 0 dB
- 600mV / 3.5 dB
- 600mV / 6 dB
- 600mV / 9.5 dB
- 800mV / 0 dB
- 800mV / 3.5 dB

Clock recovery and symbol lock

The clock recovery and symbol lock status information appear on each lines. It gives a feedback about the successful link training.

Successful clock recovery and symbol lock on every lane

The clock recovery and symbol lock were not successful

▌ INFO: This status information comes from self-test of the link training process. When the link training is set to forced, the matrix does not performe the link training, so the clock recovery and symbol lock is always unsuccessful.

Restart link training

Clicking on the **Restart Link Training** button starts to build up the connection again between the matrix switcher and the sink (it happens automatically when the sink is connected). It is equal to unplugging the DP connector and reconnecting it.

Reload factory defaults

Resetting the default values for Displayport Link section.

General tab- Audio settings

See more details about this tab in the General Tab - Audio Settings section.

General tab - Video status

See more details about this tab in the Video status section.

General tab - Embedded audio

The embedded audio's presence and the sampling frequency are displayed in the General Tab - Embedded audio section.

Advanced Tab

See more details about the advanced signal information in the Advanced Tab section.

7.7. Presets

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

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

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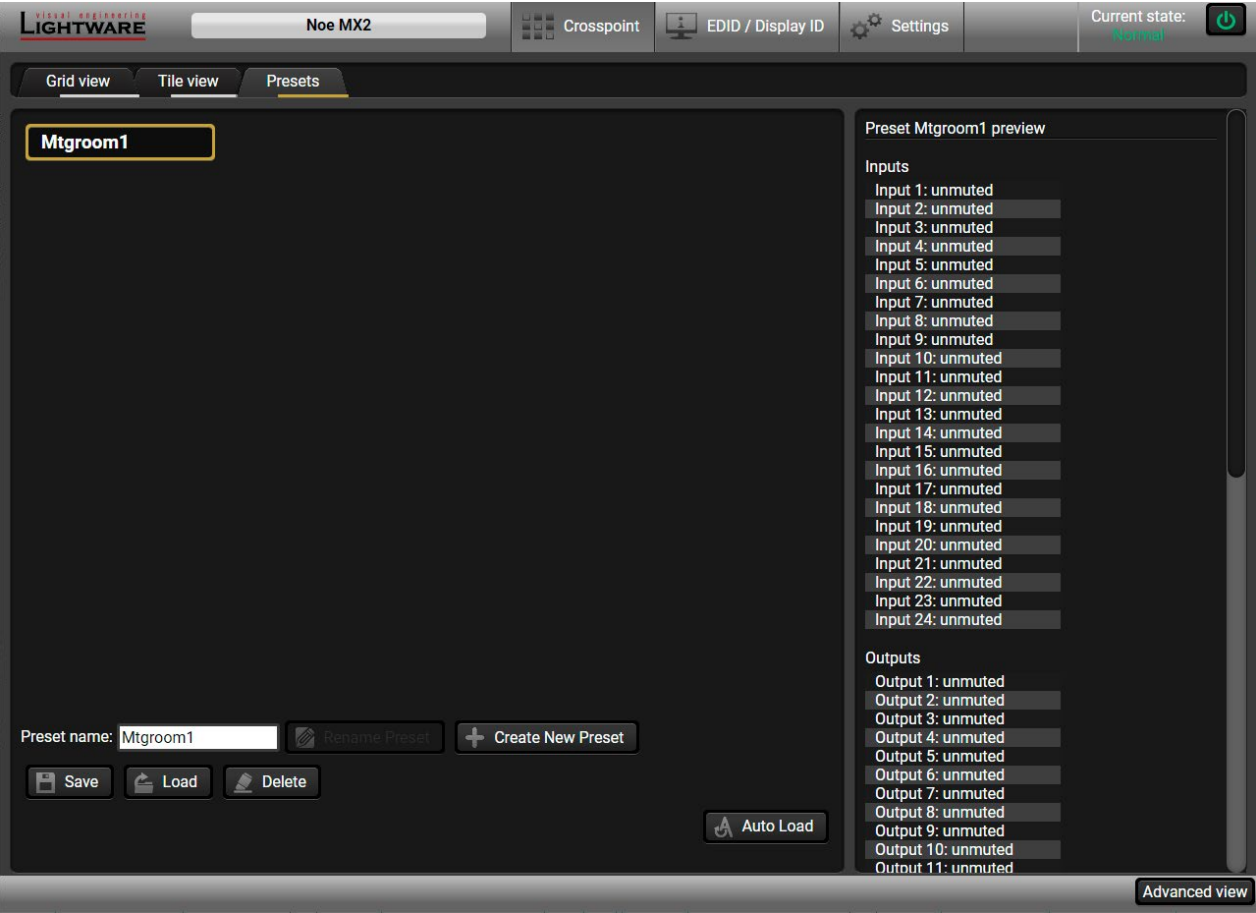
Presets Tab

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 that 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, its length can up to 16 characters. The following are allowed when naming: letters (A-Z and a-z), hyphen (-), underscore (_), and numbers (0-9).

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

Overwriting an Existing Preset

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

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

Renaming a Preset

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

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

Deleting a Preset

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

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

7.8. EDID Menu

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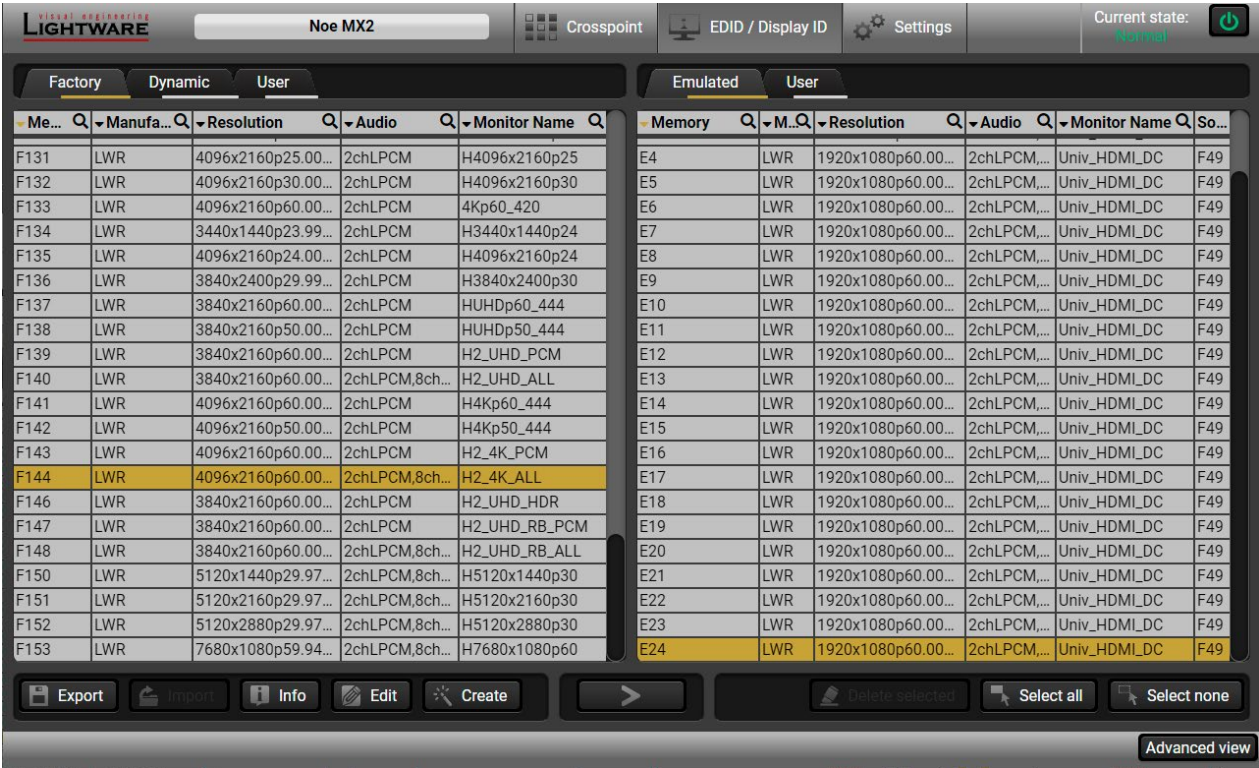
#edid

Control buttons

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

7.8.1. 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.

7.8.2. 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).

7.8.3. EDID Summary Window

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

> ▌ INFO: Make sure the emulated EDID supports deep color in case of 10-bit or 12-bit color depth video signal. For more information about it, see more information in the DisplayPort Video Options section. The compatible color depths can be checked in CEA HDMI VSDB tab.

7.8.4. 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 that 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 (https://lightware.com/pub/media/lightware/filedownloader/file/Application-Note/EDID_Editor_Application_Notes.pdf) and download the EDID Editor user's manual.

EDID Editor Window

7.8.5. Creating an EDID

Since the Advanced EDID Editor mentioned above needs more complex knowledge about EDID, Lightware introduced a wizard-like interface for fast and easy EDID creation. With Easy EDID Creator, it is possible to create custom EDIDs in four simple steps. By clicking on the **Create** button below the left panel, Easy EDID Creator is opened in a new window.

Easy EDID Creator Wizard

7.8.6. Display ID Extension

The Display ID is defined by a VESA standard as part of the EDID structure. The Advanced EDID editor gets a Display ID section where additional metadata is stored for the video sources about the display capabilities.

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

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

EDID Editor Window

7.9. Settings Menu

7.9.1. Status Tab

General information about the product is displayed in this tab: *#status #firmwareversion #label #devicelabel*

- ▪ **Device name** (read-only), **Device label** (editable), **Part number** and **Serial number**,
- ▪ **Firmware versions**;
- ▪ **Hardware versions**,
- ▪ **Temperature** values, **Voltages**, **Operation** time.
- ▪ In **-R** suffixed models: PSU status can be seen in this tab (PSU1/PSU2: running / failed)
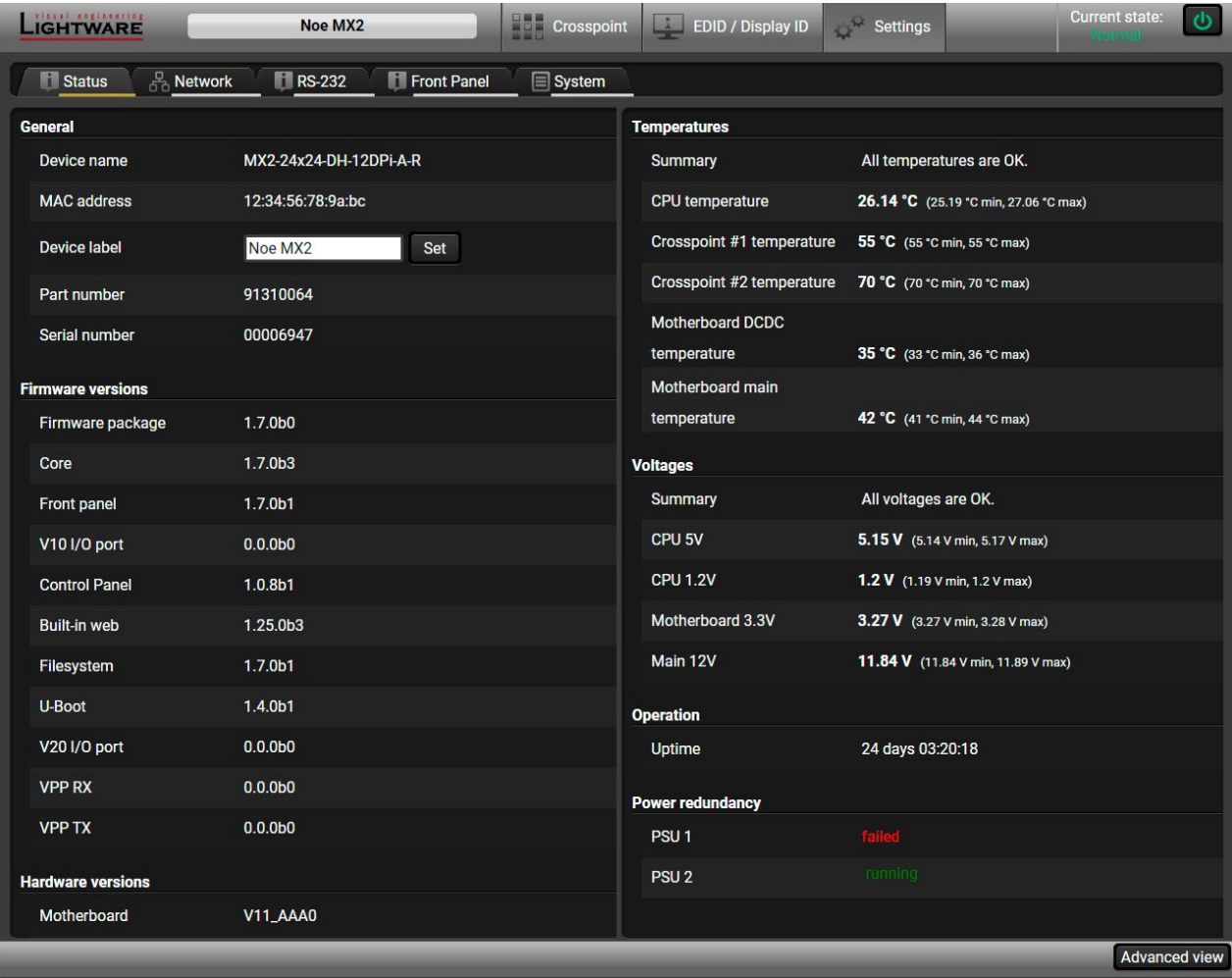
Status Tab in the Settings Menu

7.9.2. Network Tab

Network-related settings are available on the tab.   *#network #ipaddress #dhcp*
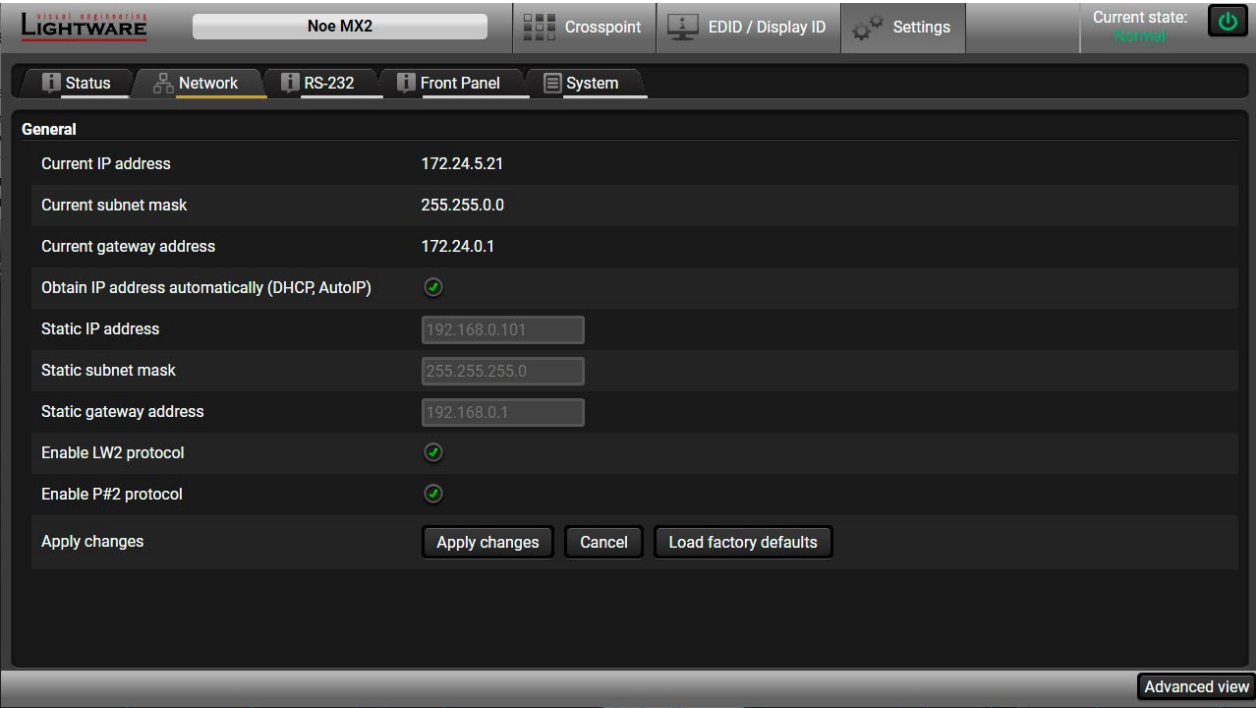
Network Tab in the Settings Menu

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 the next three lines can be used to define the IP settings. The device can be controlled by LW3, LW2 protocols, or P#2 protocol.

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

7.9.3. RS-232 Tab

The local RS-232 port settings are available on this tab. *#serial #rs-232 #rs232*
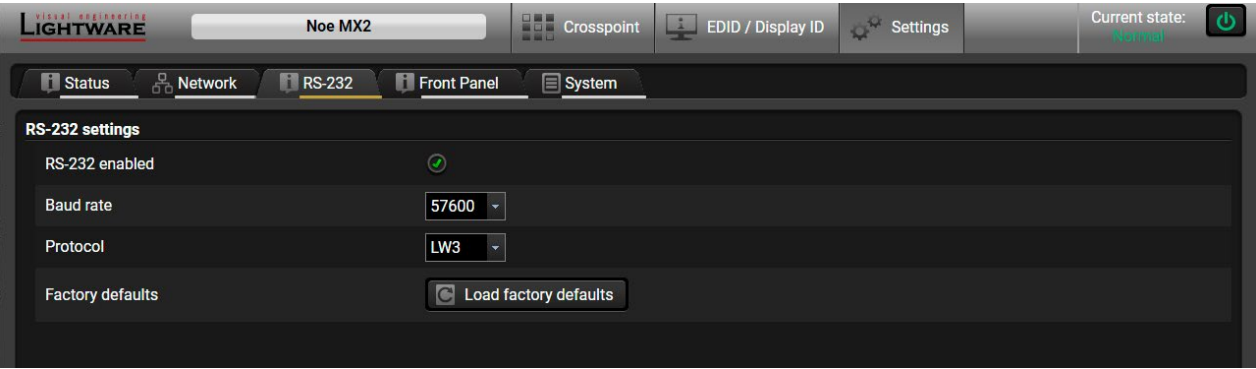
RS-232 Tab in the Settings Menu

7.9.4. Front Panel Tab

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

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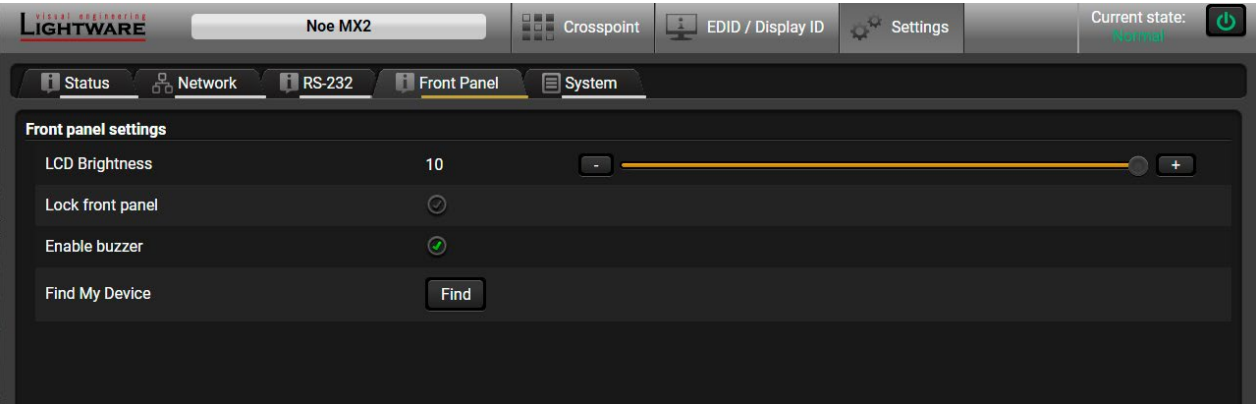
Front Panel Tab in the Settings Menu

7.9.5. System Tab

The following settings are available on this tab: *#factory #reset #reboot #restart #date #time*

- ▪ **Load factory default settings**,
- ▪ **Reboot the device**,
- ▪ **Sett 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.
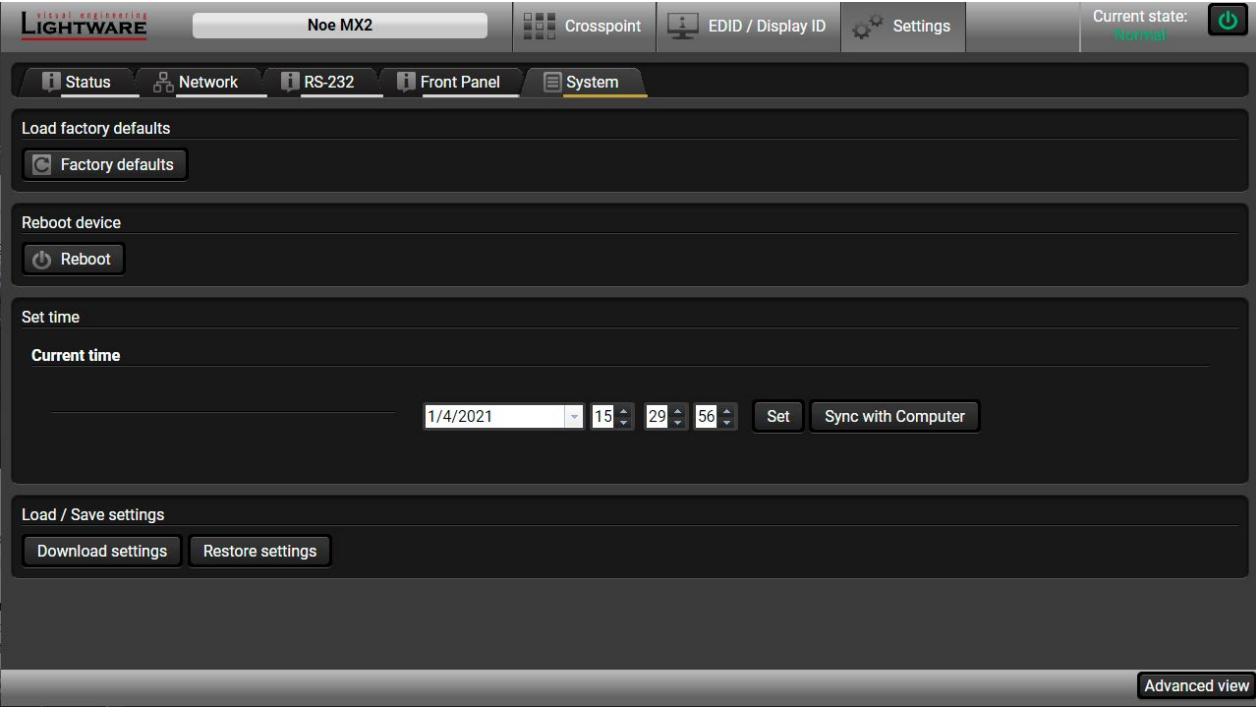
System Tab in the Settings Menu

7.10. 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. *#advancedview #terminal*
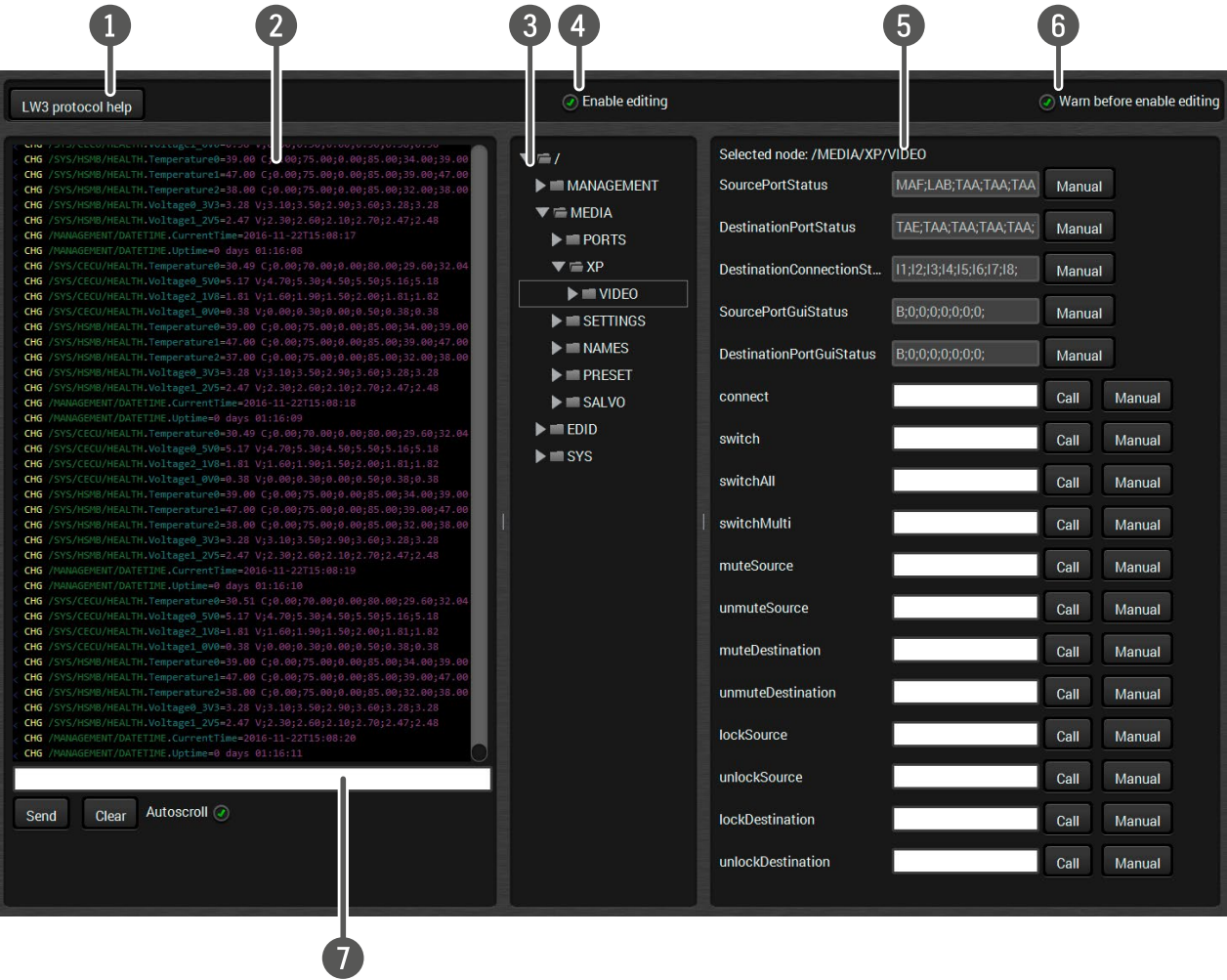
1 LW3 protocol help   Pushing the button results in a help window opening, which describes the most important information about LW3 protocol commands in HTML format.

2 Terminal window   Commands and responses with time and date are listed in this window. A sent command starts with a '>' character, while a received response starts with a '<' character. The color of each item depends on the type of the command and the response. The content of the window can be emptied with the **Clear** button. If the **Autoscroll** option is ticked, the list is scrolled automatically when a new line is added.

3 Protocol tree   LW3 protocol tree; select an item to see its content.

4 Edit mode   The default appearance is the read-only mode. If you want to modify the values or parameters, tick the option. You will be prompted to confirm your selection.

5 Node list   Correspondent parameters and nodes are shown that are connected to the selected item in the protocol tree.

     Manual button: Manual (short description) of the node can be called and displayed in the terminal window.

     Set button: Saves the value/parameter typed in the textbox.

     Call button: Calls the method, e.g. reloads factory default settings.

6 Warning mode   If this is checked, a warning window pops up when you enable Edit mode.

7 Command line   Type the desired command and execute it by the **Send** button. Clear all current commands and responses in the Terminal window with the **Clear** button.

8

LW2 Programmers' Reference

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

▶ Protocol Description
▶ Instructions for the Terminal Application Usage
▶ Router Status Commands
▶ Crosspoint Operations
▶ Preset Handling
▶ LW2 Commands - Quick Summary

8.1. Protocol Description

The protocol description hereinafter stands for Lightware protocol. The commands can be sent to the device in RAW format via the TCP/IP port no. 10001.

The receiver accepts commands surrounded by curly brackets - { } - and responds data surrounded by round brackets - ( ) - only if a command was successfully executed. All input commands are converted to uppercase, but respond commands can contain upper and lower case letters as well.

Legend for Control Commands

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
<in/out>	Input or output port 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.)
<in2/out2>	Input or output number in 2 digit ASCII format*
<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

* The command has the same arguments on the input ports and the output port, as well.

8.2. Instructions for the Terminal Application Usage

Terminal Application

The LW2 protocol commands can be applied to the receiver using a terminal application. You need to install one of them on your control device, for example **Putty** or **CLI**. *#terminal*

Establishing Connection

Follow the steps for establishing connection to the receiver:

Step 1. Connect the receiver to a LAN over Ethernet.

Step 2. Open the terminal application (e.g. Putty).

Step 3. Add the **IP address** of the device (default: 192.168.0.100) and the **port number (10001)**.

Step 4. Select the **Raw** connection type, and open the connection.

Once the terminal window is opened, you can enter the LW2 protocol commands, which are listed in the following sections.
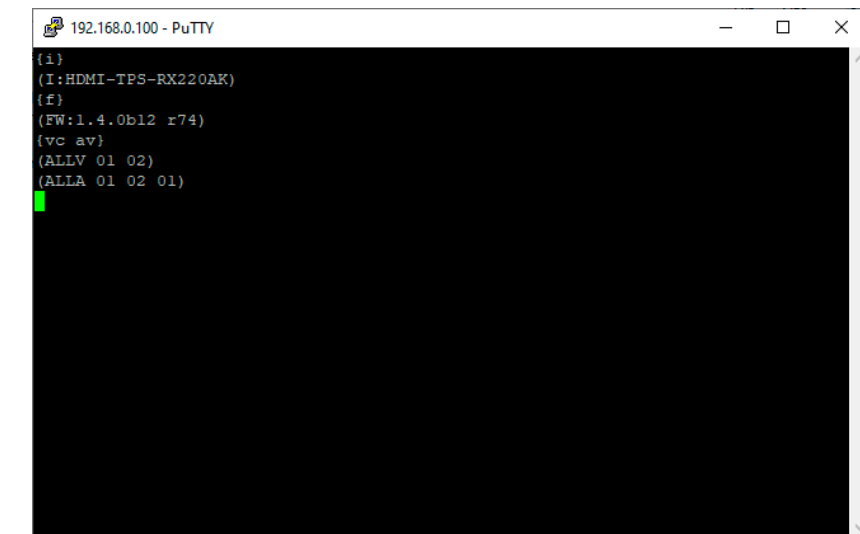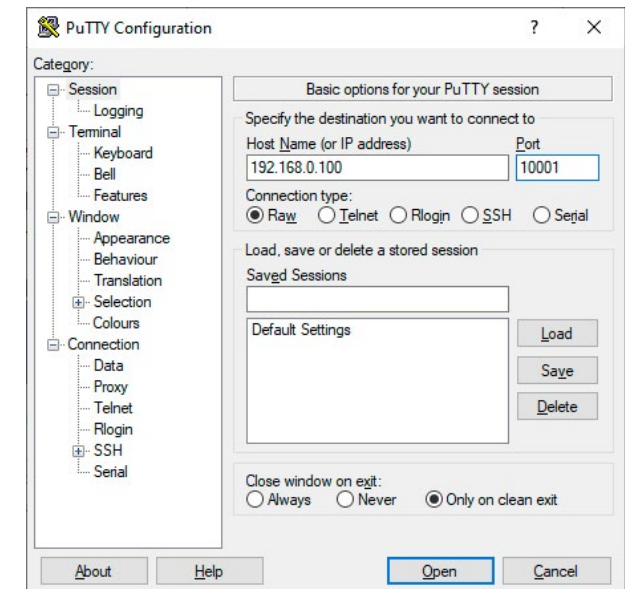
LW2 protocol command communication in a terminal window

8.3. Router Status Commands

8.3.1. List of All Available LW2 Commands

Command and Response

→ {lcmd}

← (LCMD# LCMD: List all commands)CrLf

← <LW2_commands>CrLf

← (LCMD END)CrLf

Example

→ {lcmd}

← (LCMD# LCMD: List all commands)

← (LCMD# PING: Always response PONG)

← (LCMD# CT: Compile time)

← ...

← (LCMD END)

8.3.2. Viewing Product Type

The device responds its name.

Command and Response

→ {i}

← (I:<PRODUCT_TYPE>)CrLf

Example

→ {i}

← (I:MX2-24x24-DH-12DPi-A-R)

8.3.3. Viewing Serial Number

The device responds its 8-digit serial number.   *#serialnumber*

Command and Response

→ {S}

← (SN:<SERIAL_N>)CrLf

Example

→ {s}

← (SN:00006947)

8.3.4. Viewing the Installed Firmware

View the installed firmware package version. To view the firmware version of the controller, see the {FC} command.   *#firmwareversion*

Command and Response

→ {f}

← (FW:<FW_VER>•<s>)CrLf

Parameters

<FW_VER> is the firmware package version. It is followed by <s> string, which may indicate special versions.

Example

→ {f}

← (FW:1.7.0b3)

8.3.5. Viewing CPU Firmware Compile Time

Returns the date when the microcontroller firmware was compiled.

Command and Response

→ {CT}

← (Complied: <DATE&TIME>)CrLf

Example

→ {ct}

← (Compiled: May 11 2016 11:01:27)

8.3.6. Viewing Firmware of the Controller

Shows the firmware package versions of all installed controllers.

Command and Response

→ {FC}

← (CF•<DESC>)CrLf

← (CF•<DESC>)CrLf

← …

← (CF•END)CrLf

Parameters

<FW_VER> is the firmware version. It is followed by <s> string, which may indicate special versions.

Example

→ {fc}

← (MX-CPU2 FW:1.4.1b1 r80)

← (SL END)

8.3.7. Viewing Installed Motherboard

Shows the hardware name and revision of the installed card.

Command and Response

→ {IS}
← (SL#•0•<MB_DESC>)CrLf
← (SL•END)CrLf

Example

→ {is}
← (SL# 0 MX2-8X8-HDMI20-AUDIO V11_AAA0)
← (SL END)

8.3.8. Viewing Crosspoint Size

Shows the physical crosspoint size.

Command and Response

→ {getsize•<layer>}
← (SIZE=<size>•<layer>)CrLf

Parameters

Identifier	Parameter description	Parameter values
<size>	Crosspoint size	<number_of_inputs>**x**<number_of _outputs>
<layer>	Signal type of the layer	See the previous section

Example

→ {GETSIZE}
← (SIZE=24x24)

The matrix reports that it has an 24x24 crosspoint.

8.3.9. Viewing Router's Health

Internal voltages and measured temperature values are shown.

Command and Response

→ {ST}
← (ST•<DESC>)CrLf

Example

→ {st}
← (ST CPU 3.3V 5.00V 3.00V 5.00V)

8.3.10. Querying Control Protocol (RS-232)

The device can be controlled with different control protocols. This command queries the active protocol of the currently used control interface.

Command and Response

→ {P_?}
← (CURRENT•PROTOCOL•=•#<protocol>)CrLf

Parameters

Identifier	Parameter description	Parameter values
<protocol>	Control protocol	**1:** LW2 protocol **2:** P#2 protocol

Example

→ {P_?}
← (CURRENT PROTOCOL = #1)

The device communicates with LW2 protocol. *#controlprotocol*

▌ **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.

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

8.4. Crosspoint Operations

8.4.1. Switching an Input to an Output

Switching an input <in> to output <out>. Following commands with A, V, AV parameter value can take effect in multiple layers, according to their parameters. Depending on 'A' or 'V' it can change only the Audio or only the Video layer; or 'AV' changes both.   *#crosspoint*   *#switch*

Command and Response

→ {<in>@<out>•<layer>}
← (O<out2>•I<in2>•<layer>)CrLf

Parameters

Identifier	Parameter description	Parameter values
<layer>	Signal type of the layer	**A:** audio layer **V:** video layer **AV:** audio & video layer
<out>	Output port	**O1-O4 (or O8)**
<in>	Input port	**I1-I8** **0:** Using the '0' (zero) value, the input will be disconnected and no signal will appear on the output

INFO: The <layer> parameter usually can be skipped for legacy purposes. In this case, the devices change all (Video & Audio) layers, but using status commands, it displays information about only the Video layer. Please use the AV option when available.

Example 1

→ {2@1 AV}
← (O01 I02)

I2 audio and I2 video input ports are switched to O1 output port.

Example 2

→ {0@1}
← (O01 I00)

ATTENTION! The response of 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 the Viewing the Connection of an Output Port section. To achieve multiple switches executed together, see the Batch Switching Outputs section.

8.4.2. Switching an Input to All Outputs

Switch input <in> to all outputs.

Command and Response

→ {<in>@O}
← (I<in2>•ALL)CrLf

Example

→ {2@O}
← (I02 ALL)

8.4.3. Batch Switching Outputs

The device is capable of switching 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 device with less than 10 milliseconds delay, the commands are collected 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 one 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 in batch switching failing to occur. The example below shows a command that resulted in batch switching:

One by one commands

→ {02@01 V}
← (O01 I02)CrLf
→ {05@04 V}
← (O04 I05)CrLf

Batch commands

→ {02@01}{05@04}
← (O01 I02)CrLf
← (O04 I05)CrLf

8.4.4. Viewing the Connection of an Output Port

See the connected input port number of an output port.

Command and Response

→ {?<out>}

← (O<out>• I<input>)CrLf

Example

→ {?1}

← (O01 I03)

Input 3 is switched to output 1.

8.4.5. Viewing Connections of all Outputs

Viewing the output's connection results in different response length, because it depends on the device.

Command and Response   *#crosspoint   #switch*

→ {VC•<layer>}

← (ALL<layer>•<O01>•<O02>)CrLf

Parameters

O01 shows the corresponding output's connection state.

Identifier	Parameter description	Parameter values
<layer>	Signal type of the layer	**A:** audio layer **V:** video layer **AV:** audio & video layer

State letters

Letter	State	Example
L	Output is locked	L01
M	Output is muted	M01
U	Output is locked and muted	U01

Example

→ {VC AV}

← (ALLA)

← (ALLV M01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01)

8.4.6. Viewing Mutes on all Outputs

Displays the mute states on all outputs.

Command and Response

→ {VM}

← (MUT<out>)CrLf

Parameters

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

Example

→ {VM}

← (MUT 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0)

Output 1 and 7 is muted, the other outputs are not muted.

8.4.7. Muting Specified Output

Mute the <out> output. The output signal is turned off.

Command and Response   *#mute #lock #unmute   #unlock*

→ {#<out>}

← (1MT<out>)CrLf

Example

→ {#01}

← (1MT01)

> **ATTENTION!** Muting does not change the state of the crosspoint, but disables the output itself. This way the last connection can be easily restored with an unmute command. Switching a muted output does not unmute the output.

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

> INFO: Switching a muted output does not unmute the output.

8.4.8. Unmuting Specified Output

Unmute the <out> output.   *#unmute*

Command and Response

→ {+<out>}
← (0MT<out>)CrLf

Example

→ {+01}
← (0MT01)

> INFO: Unmuting an output makes the previous connection active, as the crosspoint state has not been changed by the muting command, only the output was disabled.

8.4.9. Locking Specified Output

Locking an output port. Output's state cannot be changed until unlocking. *#lock*

Command and Response

→ {#><out>}
← (1LO<out²>)CrLf

Example

→ {#>01 A}
← (1LO01 A)

8.4.10. Unlocking a Specified Output

Unlocking an output port. The connection on output can be changed.

Command and Response

→ {+<<out>}
← (0LO<out>)CrLf

Example

→ {+<01}
← (0LO01)

O1 video output port is unlocked.

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

8.5. Preset Handling

8.5.1. Loading a Preset

Recall a saved preset. *#preset*

Command and Response

→ {%<preset>}
← (LPR<out>)CrLf

Example

→ {%Mtgroom1}
← (LPRMtgroom1)

Preset called "Mtgroom1" has been loaded and applied.

8.6. LW2 Commands - Quick Summary

Router Status Commands

List of All Available LW2 Commands
> → {lcmd}

Viewing Product Type
> → {i}

Viewing Serial Number
> → {S}

Viewing the Installed Firmware
> → {f}

Viewing CPU Firmware Compile Time
> → {CT}

Viewing Firmware of the Controller
> → {FC}

Viewing Installed Motherboard
> → {IS}

Viewing Crosspoint Size
> → {getsize•<layer>}

Viewing Router's Health
> → {ST}

Querying Control Protocol (RS-232)
> → {P_?}

Crosspoint Operations

Switching an Input to an Output
> → {<in>@<out>•<layer>}

Switching an Input to All Outputs
> → {<in>@O}

Viewing the Connection of an Output Port
> → {?<out>}

Viewing Connections of all Outputs
> → {VC•<layer>}

Viewing Mutes on all Outputs
> → {VM}

Muting Specified Output
> → {#<out>}

Unmuting Specified Output
> → {+<out>}

Locking Specified Output
> → {#><out>}

Unlocking a Specified Output
> → {+<<out>}

Preset Handling

Loading a Preset
> → {%<preset>}

9

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.

9.1. 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.

9.2. Instructions for the Terminal Application Usage

Terminal Application

The LW3 protocol commands can be applied to the switcher using a terminal application. You need to install one of them to your control device, for example **Putty** or **CLI**. *#terminal*

Establishing Connection

Follow the steps for establishing connection to the receiver:

Step 1. Connect the receiver to a LAN over Ethernet.

Step 2. Open the terminal application (e.g. Putty).

Step 3. Add the **IP address** of the device (default: DHCP) and the **port number (6107)**.

Step 4. Select the **Raw** connection type, and open the connection.

Once the terminal window is opened, you can enter the LW3 protocol commands, which are listed in the following sections.
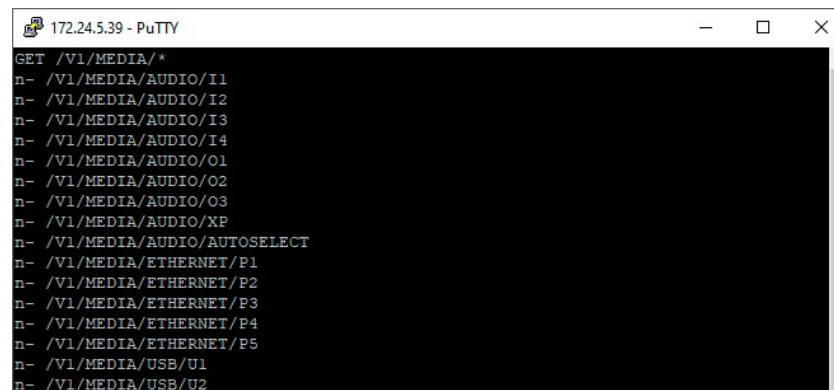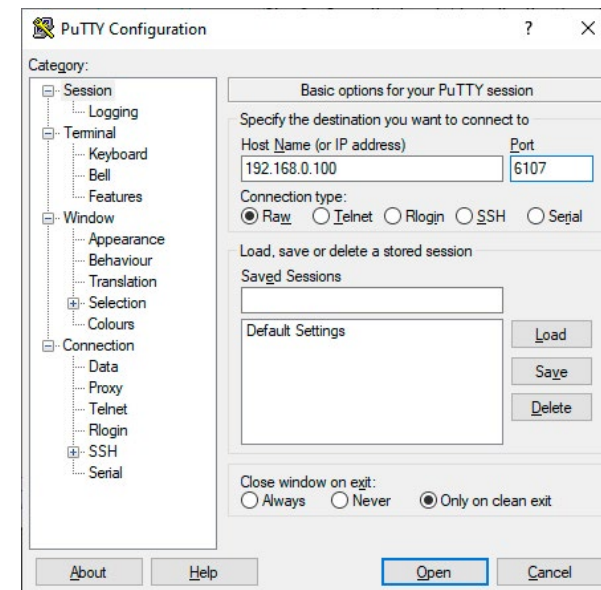
LW3 protocol command communication in a terminal window

9.3. Protocol Rules

9.3.1. LW3 Tree Structure and Command Structure (examples)

9.3.2. General Rules
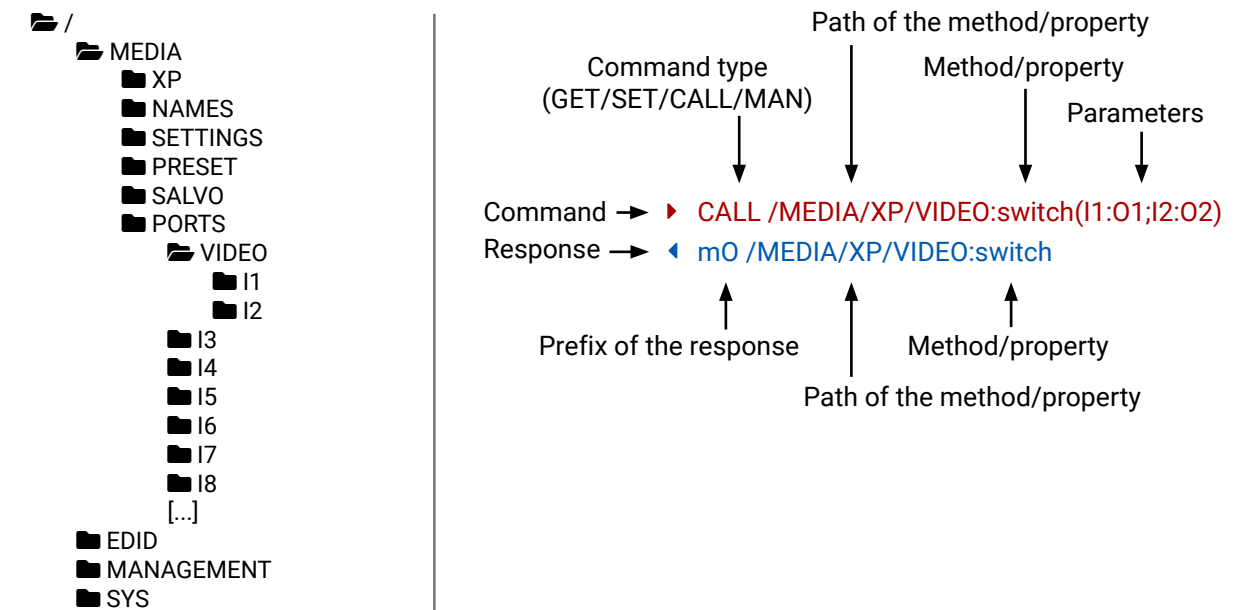
- All names and parameters are case-sensitive.
- The nodes are separated by a slash ('/') character.
- The node name can contain the elements of the English alphabet and numbers.
- Use the TCP port no. 6107 when using LW3 protocol over Ethernet.
- When a command is issued by the device, the received response cannot be processed by the CPU.
- The node paths describe the exact location of the node, listing each parent node up to the root.
- The length of a line (command/response, command type / prefix, path, method/property and
- parameters together) can be max. 800 bytes.
- The command lines have to be closed by Carriage return and Line Feed (CrLf)

9.3.3. Legend for the Control Commands

Command and Response – Example

▶ GET·/V1/MEDIA/VIDEO/I2.SignalPresent

◀ pr·/V1/MEDIA/VIDEO/I2.SignalPresent=<signal_present>

Format	Description
<in>	Input port number
<out>	Output port number
<port>	Input or output port number
<loc>	Location number
<parameter>	Specific property 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

Further, not listed <parameters> are defined at each command.

9.3.4. 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/PORTS/VIDEO/I1/CEC

◀ pr /MEDIA/PORTS/VIDEO/I1/CEC.LastReceivedMessage=

◀ pr /MEDIA/PORTS/VIDEO/I1/CEC.LastSentCommandResult=ACK

◀ pw /MEDIA/PORTS/VIDEO/I1/CEC.OsdString=

◀ pw /MEDIA/PORTS/VIDEO/I1/CEC.Broadcast=false

◀ m- /MEDIA/PORTS/VIDEO/I1/CEC:factoryDefaults

◀ m- /MEDIA/PORTS/VIDEO/I1/CEC:send

◀ m- /MEDIA/PORTS/VIDEO/I1/CEC:sendHex

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/PORTS/VIDEO/I1/SETTINGS.Conversion=OFF

◀ pw /MEDIA/PORTS/VIDEO/I1/SETTINGS.Conversion=OFF

CALL command

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

▶ CALL /MEDIA/XP/VIDEO:switch(I1:O1)

◀ mO /MEDIA/XP/VIDEO:switch

MAN command

The manual is a human readable text that describes the syntax and provides a hint on 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/PORTS/VIDEO/I1/SETTINGS.EnablePower

◀ pm /MEDIA/PORTS/VIDEO/I1/SETTINGS.EnablePower [true|false] Enables or disables 3v3 powering on DP_PWR pin

9.3.5. 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
n-	a node
nE	an error for a node
nm	a manual for a node
ns	a child node of a node
pr	a read-only property
pw	read-write property
pE	an error for the property
pm	a manual for the property
m-	a method
mO	a response after a successful method execution
mF	a response after a failed method execution
mE	an error for a method
mm	a manual for a method

9.3.6. Error Messages

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

▶ CALL /MEDIA/XP/VIDEO:switch(IA:O1)

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

9.3.7. 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 that are used as control characters in the protocol. They must be escaped. The escape character is the backslash ('\'), and escaping means injecting a backslash before the character that should be escaped (like in C language).

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

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

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

9.3.8. 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 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 intends to wait for the whole response, and also wants to be sure that the received lines belong together and to the same command. For this purpose 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

◀ pr /EDID.Features=DisplayID;

◀ 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.

9.3.9. Subscription

DEFINITION: Subscribing 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, they 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 about the changes on that connection.

Subscribe to a Node

▶ OPEN /MEDIA/VIDEO

◀ o- /MEDIA/VIDEO

Unsubscribe from a Node

▶ CLOSE /MEDIA/VIDEO

◀ c- /MEDIA/VIDEO

Subscribe to Multiple Nodes

▶ OPEN /MEDIA/VIDEO/*

◀ o- /MEDIA/VIDEO/*

Unsubscribe from Multiple Nodes

▶ CLOSE /MEDIA/VIDEO/*

◀ c- /MEDIA/VIDEO/*

Get the Active Subscriptions

▶ OPEN

◀ o- /MEDIA/VIDEO

◀ o- /EDID

◀ o- /DISCOVERY

9.3.10. Notifications about the Changes of the Properties

When the value of a property is changed and the user is subscribed to the node that the property belongs to, an asynchronous notification is generated. This notification is called 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/AUDIO/O3 ◄ o- /MEDIA/AUDIO/O3 ▶ GET /MEDIA/AUDIO/O3.VolumePercent ◄ pm /MEDIA/AUDIO/O3.VolumePercent=100.00	connection #1
▶ GET /MEDIA/AUDIO/O3.VolumePercent ◄ pw /MEDIA/AUDIO/O3.VolumePercent=100.00 ◄ SET /MEDIA/AUDIO/O3.VolumePercent=50.00 ◄ pw /MEDIA/AUDIO/O3.VolumePercent=50.00	connection #2
◄ CHG /MEDIA/AUDIO/O3.VolumePercent=50.00	connection #1

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

9.3.11. 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
<u><expression></u>	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

9.4. System Commands

9.4.1. 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=MX2-24x24-DH-12DPi-R

9.4.2. Setting the Device Label

This property can be changed to a custom text. The default format of the device label is the following: LW_<product_name>_<serial_no>

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

Command and Response *#label #devicelabel*

▶ 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 long. Longer names are truncated.

Example

▶ SET /MANAGEMENT/UID.DeviceLabel=MX2_Control_room

◄ pw /MANAGEMENT/UID.DeviceLabel=MX2_Control_room

9.4.3. Querying the Serial Number

Command and Response

▶ GET·/.SerialNumber

◄ pr·/.SerialNumber=<serial_nr>

Example

▶ GET /.SerialNumber

◄ pr /.SerialNumber=87654321

9.4.4. Resetting the Matrix

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

Command and Response *#reset #reboot #restart*

▸ CALL·/SYS:softReset()
◂ mO·/SYS:softReset=

Example

▸ CALL /SYS:softReset()
◂ mO /SYS:softReset=

9.4.5. Restoring the Factory Default Settings

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

Command and Response *#factory*

▸ CALL·/SYS:factoryDefaults()
◂ mO·/SYS:factoryDefaults=

Example

▸ CALL /SYS:factoryDefaults()
◂ mO /SYS:factoryDefaults=

9.4.6. Querying the Operation Mode (Standby Mode) of the Matrix

In standby mode the video transmission is disabled, the LCD is switched off, but remote connections (LAN, RS-232) remain available.

Command and Response *#standby*

▸ GET·/MANAGEMENT/POWER.Operation
◂ pr·/MANAGEMENT/POWER.Operation=<op_mode>

Parameters

Identifier	Parameter description	Parameter values
<op_mode>	Operation mode of the matrix	**NORMAL:** The matrix operates in normal mode, the video transmission and the other functions are enabled. **STANDBY:** The video transmission is disabled, but the device is available remotely.

Example

▸ GET /MANAGEMENT/POWER.Operation
◂ pr /MANAGEMENT/POWER.Operation=NORMAL

9.4.7. Switching to Standby Mode

In standby mode the video transmission is disabled, the LCD is switched off, but remote connections (LAN, RS-232) remain available.

Command and Response *#standby*

▸ CALL·/MANAGEMENT/POWER:standby()
◂ mO·/MANAGEMENT/POWER:standby=

Example

▸ CALL /MANAGEMENT/POWER:standby()
◂ mO /MANAGEMENT/POWER:standby=

9.4.8. Switching to Normal Mode

When 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=

9.5. Switching and Crosspoint Settings

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

9.5.1. Querying the Video Crosspoint State

Command and Response *#switch #crosspoint*

▸ GET·/MEDIA/XP/VIDEO.DestinationConnectionStatus
◂ pr·/MEDIA/XP/VIDEO.DestinationConnectionStatus=<out1_state>;<out2_state>;...;<out8_state>

Parameters

The <out#_state> parameters mean the output ports (O1, O2 etc.) 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;I1;I1;I1;I1;I1;I1;I1;I1;I1;I1;I1;I1;I1;I1;I1;I1;

I1 input port is connected to all output ports.

9.5.2. 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

9.5.3. Disconnecting the Output from any Input

Command and Response

▸ CALL·/MEDIA/XP/VIDEO:switch(0:<out>)
◂ mO·/MEDIA/XP/VIDEO:switch=OK

Example

▸ CALL /MEDIA/XP/VIDEO:switch(0:O1)
◂ mO /MEDIA/XP/VIDEO:switch=OK

9.5.4. 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:switchAll(I1)
◂ mO /MEDIA/XP/VIDEO:switchAll=OK

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

9.5.5. 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 be set on all output ports (see the **Example2**).

Parameters

The <out#_source> parameters mean the 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

9.5.6. Video Input Port Settings (HDMI and DisplayPort)

9.5.7. 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   *#hdcp*

▸ 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 always internally converted up to HDCP 2.2, thus the signal cannot be switched to HDCP 1.4 sinks.

*The availability of this setting depends on the hardware version of the input board (V1x_) of the selected HDMI port, only in MX2-8x8-HDMI20 model. The hardware version can be found in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

Example

▸ SET /MEDIA/PORTS/VIDEO/I1/SETTINGS.HdcpVersion=3

◂ pw /MEDIA/PORTS/VIDEO/I1/SETTINGS.HdcpVersion=3

9.5.8. Muting an Input Port

Command and Response *#mute*

▸ CALL·/MEDIA/XPVIDEO:muteSource(<in>)

◂ mO·/MEDIA/XP/VIDEO:muteSource=OK

Example

▸ CALL /MEDIA/XP/VIDEO:muteSource(I1)

◂ mO /MEDIA/XP/VIDEO:muteSource=OK

9.5.9. Unmuting an Input Port

Command and Response *#unmute*

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

◂ mO·/MEDIA/XP/VIDEO:unmuteSource=OK

Example

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

◂ mO /MEDIA/XP/VIDEO:unmuteSource=OK

9.5.10. Locking an Input Port

Command and Response *#lock*

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

◂ mO·/MEDIA/XP/VIDEO:lockSource=OK

Example

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

◂ mO /MEDIA/XP/VIDEO:lockSource=OK

9.5.11. Unlocking an Input Port

Command and Response *#unlock*

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

◂ mO·/MEDIA/XP/VIDEO:unlockSource=OK

Example

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

◂ mO /MEDIA/XP/VIDEO:unlockSource=OK

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

9.5.12. Querying the Status of the Source Ports

Command and Response *#status*

▶ GET·/MEDIA/XP/VIDEO.SourcePortStatus

◀ pr·/MEDIA/XP/VIDEO.SourcePortStatus=<in1_state>;<in2_state>;...;<in_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
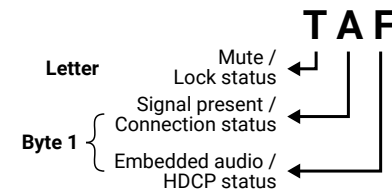
	Byte 1			
	Character 2		Character 3	
	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0
	Embedded audio status	**HDCP status**	**Signal present status**	**Connection status**
0 0	Unknown			
0 1	Reserved			
1 0	No embedded audio	Not encrypted	No signal	Not connected
1 1	Embedded audio presents	Encrypted	Signal presents	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

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

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

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

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

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

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

9.5.13. Setting the Audio Mode

Command and Response *#audio #analogaudio*

▶ SET·/MEDIA/PORTS/VIDEO/<in>/EMBEDDEDAUDIO.AudioMode=<audio_mode>
◀ pw·/MEDIA/PORTS/VIDEO/<in>/EMBEDDEDAUDIO.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 *Analog audio properties appear only in **-Audio** suffixed models, where there is an analog audio port beside the HDMI port.

Example

▶ SET /MEDIA/PORTS/VIDEO/I1/EMBEDDEDAUDIO.AudioMode=OFF
◀ pw /MEDIA/PORTS/VIDEO/I1/EMBEDDEDAUDIO.AudioMode=OFF

> INFO: In case of **-A** or **-Audio** suffixed models, modifying the /MEDIA/PORTS/VIDEO/<in>/EMBEDDEDAUDIO. AudioMode=<audio_mode> property will change the /MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO. AudioMode=<audio_mode> property.

9.5.14. Sending CEC Commands Towards the Source

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

9.5.14.1. 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. *#cec*

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 – Calling 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

9.5.14.2. 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 following 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_1	number_2	number_3	number_4	number_5
number_6	number_7	number_8	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_2	select_media_3	select_media_4	select_media_5
power_toggle	power_on	power_off	stop_function	f1
f2	f3	f4		

9.5.14.3. 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> can be max. 30 characters (15 bytes) long in hexadecimal format.

Example

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

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

9.6. DisplayPort Input Settings

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

▌ **DIFFERENCE:** DisplayPort settings are available in certain models, **-D** letter in the model name refers to that (see the Model Comparison table).

9.6.1. Setting the Maximum Lane Number

Command and Response

▶ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.DpMaxLaneCount=<lane>

◀ pw·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.DpMaxLaneCount=<lane>

Parameters

Identifier	Parameter description	Parameter values
<lane>	DisplayPort data transmission proceeds through the lanes. This defines the maximum number of lanes used.	**1:** One lane is able to transmit 5.4 Gbps of data. **2:** Two lanes are able to transmit 10.8 Gbps of data. **4:** Four lanes are able to transmit 21.6 Gbps of data.

Example

▶ SET /MEDIA/PORTS/VIDEO/I2/SETTINGS.DpMaxLaneCount=4

◀ pw /MEDIA/PORTS/VIDEO/I2/SETTINGS.DpMaxLaneCount=4

9.6.2. Enabling DP Power

This property allows to provide 1.5W (500mA @ 3.3W) power on DP_PWR pin. The default value is true.

Command and Response   *#dppower*

▶ SET /MEDIA/PORTS/VIDEO/<out>/SETTINGS.EnablePower=<enable_power>

◀ pw /MEDIA/PORTS/VIDEO/<out>/SETTINGS.EnablePower=<enable_power>

Parameters

<enable_power>	**true**: The matrix sends 1.5W power on the chosen port. **false**: The matrix does not provide any power on the chosen port.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.EnablePower=true

◀ pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.EnablePower=true

9.6.3. Setting the Maximum Link Data Rate

Command and Response

▶ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.DpMaxLinkRate=<data_rate>

◀ pw·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.DpMaxLinkRate=<data_rate>

Parameters

Identifier	Parameter description	Parameter values
<data_rate>	The maximum data rate per lane.	**RBR:** Reduced Bit Rate uses 1.62 Gbps bandwidth. **HBR:** High Bit Rate uses 2.70 Gbps bandwidth. **HBR2:** High Bit Rate2 uses 5.40 Gbps bandwidth.

Example

▶ SET /MEDIA/PORTS/VIDEO/I1/SETTINGS.DpMaxLinkRate=HBR2

◀ pw /MEDIA/PORTS/VIDEO/I1/SETTINGS.DpMaxLinkRate=HBR2

9.6.4. Enabling the Test Pattern

Command and Response *#testpattern #nosyncscreen*

▶ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.TpgMode=<tpg_status>

◀ pw·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.TpgMode=<tpg_status>

Parameters

Identifier	Parameter description	Parameter values
<tpg_status>	The testpattern is enabled or disabled.	**0:** The testpattern is disabled. **1:** The testpattern is enabled.

Example

▶ SET /MEDIA/PORTS/VIDEO/I2/SETTINGS.TpgMode=1

◀ pw /MEDIA/PORTS/VIDEO/I2/SETTINGS.TpgMode=1

9.6.5. Setting the Conversion Mode

> INFO: DisplayPort signals over 18Gbps will be converted down by either truncating bit depth or by converting RGB signal to YCbCr 4:2:2 12-bit signal based on user selection. The second option will not reduce the color depth, instead it results in loss of chroma information.

Command and Response   *#colorspace*

▸ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.Conversion=<conversion_mode>

◂ pw·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.Conversion=<conversion_mode>

Parameters

Identifier	Parameter description	Parameter values
<conv_mode>	Conversion mode	**OFF:** The video signal is transmitted without any changing. **422:** The video converter subsamples the 4:4:4 signal to 4:2:2. **420:** The video converter subsamples the 4:4:4 signal to 4:2:0.

Example

▸ SET /MEDIA/PORTS/VIDEO/I1/SETTINGS.Conversion=OFF

◂ pw /MEDIA/PORTS/VIDEO/I1/SETTINGS.Conversion=OFF

9.6.6. Restarting Link Training

This method is equal with pulling the DP connector out and plugging it in again.

Command and Response   *#linktraining*

▸ CALL·/MEDIA/PORTS/VIDEO/<in>/SETTINGS:dpLinkTrain()

◂ mO·/MEDIA/PORTS/VIDEO/<in>/SETTINGS:dpLinkTrain=

Example

▸ CALL /MEDIA/PORTS/VIDEO/I1/SETTINGS:dpLinkTrain()

◂ mO /MEDIA/PORTS/VIDEO/I1/SETTINGS:dpLinkTrain=

9.7. Audio Input Port Settings

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

> DIFFERENCE: Audio settings are available when there is an analog audio port beside the chosen video port. **-A** or **-Audio** suffix in the model name refers to the analog audio feature (see the Model Comparison table about the analog audio availability).

9.7.1. Audio Mode Setting

Command and Response #audio *#analogaudio #volume #balance #gain #mute #unmute*

▸ 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

> INFO: In case of **-Audio** suffixed models, modifying the /MEDIA/PORTS/VIDEO/<in>/ANALOGAUDIO. AudioMode=<audio_mode> property will change the /MEDIA·/PORTS/VIDEO/<in>/EMBEDDEDAUDIO. AudioMode=<audio_mode> property.

9.7.2. Analog Audio Input Level Settings

9.7.2.1. 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

9.7.2.2. Setting the Balance (by a Step Value)

Command and Response *#audio #analogaudio #volume #balance #gain #mute #unmute*

▸ 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.

9.7.2.3. 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

9.7.2.4. 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

9.8. Video Output Port Settings (HDMI and Displayport)

9.8.1. 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 <out#_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 (HDMI and DisplayPort) 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.

9.8.2. Muting an Output

Command and Response *#mute*

▸ 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

9.8.3. Unmuting an Output

Command and Response *#unmute*

▸ 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

9.8.4. Locking an Output

Command and Response   *#lock*

▶ CALL·/MEDIA/XP/VIDEO:lockDestination(<u><out></u>)

◀ mO·/MEDIA/XP/VIDEO:lockDestination=OK

Example

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

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

9.8.5. Unlocking an Output

Command and Response   *#unlock*

▶ CALL·/MEDIA/XP/VIDEO:unlockDestination(<u><out></u>)

◀ mO·/MEDIA/XP/VIDEO:unlockDestination=OK

Example

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

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

9.8.6. Setting the HDCP Mode (Output Port)

Command and Response   *#hdcp*

▶ SET·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.HdcpMode=<HDCP_mode>

◀ pw·/MEDIA/PORTS/VIDEO/<out>/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

9.8.7. Setting the Audio Mode

Command and Response   *#audio #analogaudio*

▶ SET·/MEDIA/PORTS/VIDEO/<out>/EMBEDDEDAUDIO.AudioMode=<audio_mode>

◀ pw·/MEDIA/PORTS/VIDEO/<out>/EMBEDDEDAUDIO.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 *Analog audio properties appear only in **-Audio** suffixed models, where there is an analog audio port beside the HDMI port.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/EMBEDDEDAUDIO.AudioMode=OFF

◀ pw /MEDIA/PORTS/VIDEO/O1/EMBEDDEDAUDIO.AudioMode=OFF

INFO: In case of **-Audio** suffixed models, modifying the /MEDIA/PORTS/VIDEO/<out>/EMBEDDEDAUDIO. AudioMode=<audio_mode> property will change the /MEDIA/PORTS/VIDEO/<out>/ANALOGAUDIO. AudioMode=<audio_mode> property.

9.9. HDMI Output Settings

DIFFERENCE: HDMI settings are available in certain models, **-H** letter in the model name refers to that (see the Model Comparison table).

9.9.1. 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

9.9.2. 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   *#scrambling*

▶ 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** / **ON** / **OFF**.

Example

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

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

9.9.3. 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.

Conversion   *#colorspace*

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

Command and Response   *#colorspace*

▶ SET·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.Conversion=<conv_mode>

◀ pw·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.Conversion=<conv_mode>

Parameters

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. **422**:** The signal is converted to the indicated color depth. The matrix switcher accepts video signals in 8, 10 and 12 bit color depth, but the sampling pattern conversion is always made in 8 bit. **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 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.

*The availability of this property depends on the hardware version of the output board (V1x_) of the HDMI port. The hardware version can be found in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

** The availability of **4:4:4 to 4:2:2 conversion** depends on the hardware version of the output board (V2x_). The hardware version can be checked in the Status Tab in the LDC or in the System Settings Menu, Device Info submenu in the LCD.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.Conversion=OFF

◀ pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.Conversion=OFF

9.9.4. Sending CEC Commands Towards the Sink

▌ INFO: The hidden first 2x2 bits of the CEC command are static (always 40), they refer to the logical address of the sender and the addressee. **4:** sender is a **Playback Device 1**. ; **4:** the addressee is the **TV**.   *#cec*

▌ INFO: According to the standard, the CEC feature works only at HDMI ports.

9.9.4.1. 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

9.9.4.2. Sending a CEC Command in Text Format

▌ INFO: According to the standard, the CEC feature works only at HDMI ports.

Command and Response   *#cec*

▶ 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 following are accepted as a <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_1	number_2	number_3	number_4	number_5
number_6	number_7	number_8	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_2	select_media_3	select_media_4	select_media_5
power_toggle	power_on	power_off	stop_function	f1
f2	f3	f4		

9.9.4.3. Sending a CEC Command in Hexadecimal Format

▌ INFO: According to the standard, the CEC feature works only at HDMI ports.

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 can be max. 30 characters long (15 bytes) 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

9.10.　DisplayPort Output Settings

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

▌ **DIFFERENCE:** DisplayPort settings are available in certain models, **-D** letter in the model name refers to that (see the Model Comparison table).

9.10.1.　Enabling DP Power

This property allows providing 1.5W (500mA @ 3.3W) power on DP_PWR pin. The default value is true.

Command and Response　　　　　*#dppower*

▶ SET·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.EnablePower=<enable_power>

◀ pw·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.EnablePower=<enable_power>

Parameters

Identifier	Parameter description	Parameter values
<enable_power>	The matrix can provide 1.5W power on each Displayport connector.	**true**: The matrix sends 1.5W power on the chosen port. **false**: The matrix does not provide any power on the chosen port.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.EnablePower=true

◀ pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.EnablePower=true

9.10.2.　Enabling Forced Link Training

Command and Response　　　　　*#linktraining*

▶ SET·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedMode=<forced_mode>

◀ pw·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedMode=<forced_mode>

Parameters

Identifier	Parameter description	Parameter values
<forced_mode>	It allows the configuration of the output link training parameters (Link datarate, Link lane, Swing / pre-emphasis) manually, the link training process is skipped.	**true**: The link training mode is **Forced**. Link datarate, Link lane count and Swing / pre-emphasis parameters can be modified. **false**: The link training mode is **Automatic**. The matrix and the agree on the link training parameters automatically without any user interruption.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.DpForcedMode=true

◀ pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.DpForcedMode=true

9.10.3.　Setting the Forced Lane Number

Command and Response

▶ SET·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedLaneCount=<lane>

◀ pw·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedLaneCount=<lane>

Parameters

Identifier	Parameter description	Parameter values
<lane>	DisplayPort data transmission proceeds through the lanes. This defines the number of lanes used.	**1:** One lane is able to transmit 5.4 Gbps of data. **2:** Two lanes are able to transmit 10.8 Gbps of data. **4:** Four lanes are able to transmit 21.6 Gbps of data.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.DpForcedLaneCount=2

◀ pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.DpForcedLaneCount=2

For more details about the Forced link training, see the General Tab - Displayport Link section.

9.10.4.　Setting the Forced Link Data Rate

Command and Response

▶ SET·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedLinkRate=<data_rate>

◀ pw·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedLinkRate=<data_rate>

Parameters

Identifier	Parameter description	Parameter values
<data_rate>	The data rate per lane.	**RBR:** Reduced Bit Rate uses 1.62 Gbps bandwidth. **HBR:** High Bit Rate uses 2.70 Gbps bandwidth. **HBR2:** High Bit Rate2 uses 5.40 Gbps bandwidth.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/SETTINGS.DpForcedLinkRate=HBR2

◀ pw /MEDIA/PORTS/VIDEO/O1/SETTINGS.DpMaxLinkRate=HBR2

For more details about the Forced link training, see the General Tab - Displayport Link section.

9.10.5. Setting the Swing / pre-emphasis

Command and Response

▶ SET·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedLaneLevel=<voltage_level>;<preemph_level>;

◀ pw·/MEDIA/PORTS/VIDEO/<out>/SETTINGS.DpForcedLaneLevel=<voltage_level>;<preemph_level>;

Parameters

Identifier	Parameter description	Parameter values
<voltage_level>	Forced voltage level on main link lanes. Valid for all lanes.	**0:** 400mV **1:** 600mV **2:** 800mV
<preemph_level>	Forced preemphasis level on main link lanes. Valid for all lanes.	**0:** 0 dB **1:** 3.5 dB **2:** 6 dB

Example

▶ SET /MEDIA/PORTS/VIDEO/O8/SETTINGS.DpForcedLaneLevel=0;2;

◀ pw /MEDIA/PORTS/VIDEO/O8/SETTINGS.DpForcedLaneLevel=0;2;

For more details about the Forced link training see General Tab - Displayport Link section.

9.10.6. Restarting Link Training

This method is equal to pulling the DP connector out and plugging it in again.

Command and Response

▶ CALL·/MEDIA/PORTS/VIDEO/<out>/SETTINGS:dpLinkTrain()

◀ mO·/MEDIA/PORTS/VIDEO/<out>/SETTINGS:dpLinkTrain=

Example

▶ CALL /MEDIA/PORTS/VIDEO/O1/SETTINGS:dpLinkTrain()

◀ mO /MEDIA/PORTS/VIDEO/O1/SETTINGS:dpLinkTrain=

9.11. Audio Output Port Settings

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

9.11.1. Audio Mode Setting

█ **DIFFERENCE:** Analog audio properties appear only in **-A or -Audio** suffixed models, where there is an analog audio port beside the HDMI port.   *#audio #analogaudio #volume #balance #mute #unmute*

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 not present in the HDMI stream nor on the Analog Audio output port. **HDMI:** Audio is present only in the HDMI stream. **ANALOG:** Audio is present only on the Analog Audio output port. **HDMI+ANALOG:** Audio is present in the HDMI stream and on the Analog Audio output port.

Example

▶ SET /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.AudioMode=HDMI

◀ pw /MEDIA/PORTS/VIDEO/O1/ANALOGAUDIO.AudioMode=HDMI

9.11.2. Analog Audio Output Level Settings

> **DIFFERENCE:** Analog audio properties appear only in **-A or -Audio** suffixed models, where there is an analog audio port beside the HDMI port.

9.11.2.1. 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

9.11.2.2. 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

The volume of the audio signal is 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.**

9.11.2.3. 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

9.11.2.4. 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

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

9.11.2.5. 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

9.12. Preset Handling

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

9.12.1. Creating a New Preset

Command and Response   *#preset*

▶ 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.

9.12.2. 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(My_pres)

◀ mO /MEDIA/PRESET/My_pres:save=Ok

The existing '**My_pres**' has been overwritten with the current settings.

9.12.3. Loading a Preset

Command and Response

▶ CALL·/MEDIA/PRESET/<preset_name>:load()

◀ mO·/MEDIA/PRESET/<preset_name>:load=Ok

Example

▶ CALL /MEDIA/PRESET/My_pres:load()

◀ mO /MEDIA/PRESET/My_pres:load=Ok

Explanation

'**My_pres**' preset has been loaded and applied.

9.12.4. 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**'.

9.13. 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()**   *#network #ipaddress #dhcp*

9.13.1. 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

▸ CALL /MANAGEMENT/NETWORK:applySettings()

◂ m0 /MANAGEMENT/NETWORK:applySettings=

9.13.2. 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

▸ CALL /MANAGEMENT/NETWORK:applySettings()

◂ m0 /MANAGEMENT/NETWORK:applySettings=

9.13.3. Static IP Address Settings

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

9.13.3.1. 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

▸ CALL /MANAGEMENT/NETWORK:applySettings()

◂ m0 /MANAGEMENT/NETWORK:applySettings=

9.13.3.2. 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

▸ CALL /MANAGEMENT/NETWORK:applySettings()

◂ m0 /MANAGEMENT/NETWORK:applySettings=

9.13.3.3. 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

▸ CALL /MANAGEMENT/NETWORK:applySettings()

◂ m0 /MANAGEMENT/NETWORK:applySettings=

9.14. EDID Management

9.14.1. Querying the Emulated EDIDs

Command and Response *#edid*

▶ 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.

9.14.2. 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=

9.14.3. 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=

9.15. RS-232 Port Settings

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

9.15.1. Setting the Current Command Protocol

Command and Response *#serial #rs232 #rs-232*

- ▸ 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

9.15.2. 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: 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200.

Example

- ▸ SET /MANAGEMENT/SERIAL.Baudrate=57600
- ◂ pw /MANAGEMENT/SERIAL.Baudrate=57600

9.16. LW3 Commands – Quick Summary

System Commands

Querying the Product Name

▸ GET·/.ProductName

Setting the Device Label

▸ SET·/MANAGEMENT/UID/DeviceLabel=<Custom_name>

Querying the Serial Number

▸ GET·/.SerialNumber

Resetting the Matrix

▸ CALL·/SYS:softReset()

Restoring the Factory Default Settings

▸ CALL·/SYS:factoryDefaults()

Querying the Operation Mode (Standby Mode) of the Matrix

▸ GET·/MANAGEMENT/POWER.Operation

Switching to Standby Mode

▸ CALL·/MANAGEMENT/POWER:standby()

Switching to Normal Mode

▸ CALL·/MANAGEMENT/POWER:wakeUp()

Switching and Crosspoint Settings

Querying the Video Crosspoint State

▸ GET·/MEDIA/XP/VIDEO.DestinationConnectionStatus

Switching an Input to an Output

▸ CALL·/MEDIA/XP/VIDEO:switch(<in>:<out>)

Disconnecting the Output from any Input

▸ CALL·/MEDIA/XP/VIDEO:switch(0:<out>)

Switching an Input to All Outputs

▸ CALL·/MEDIA/XP/VIDEO:switchAll(<in>)

Multiple Switching

▸ CALL·/MEDIA/XP/VIDEO:switchMulti(<out1_source>;<out2_source>;...;<out8_source>)

Setting the HDCP State

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

Muting an Input Port

▸ CALL·/MEDIA/XPVIDEO:muteSource(<in>)

Unmuting an Input Port

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

Locking an Input Port

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

Unlocking an Input Port

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

Querying the Status of the Source Ports

▸ GET·/MEDIA/XP/VIDEO.SourcePortStatus

Setting the Audio Mode

▸ SET·/MEDIA/PORTS/VIDEO/<in>/EMBEDDEDAUDIO.AudioMode=<audio_mode>

Sending CEC Commands Towards the Source

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

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

Sending a CEC Command in Text Format

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

Sending a CEC Command in Hexadecimal Format

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

DisplayPort Input Settings

Setting the Maximum Lane Number

▸ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.DpMaxLaneCount=<lane>

Enabling DP Power

▸ SET /MEDIA/PORTS/VIDEO/<out>/SETTINGS.EnablePower=<enable_power>

Setting the Maximum Link Data Rate

▸ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.DpMaxLinkRate=<data_rate>

Enabling the Test Pattern

▸ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.TpgMode=<tpg_status>

Setting the Conversion Mode

▸ SET·/MEDIA/PORTS/VIDEO/<in>/SETTINGS.Conversion=<conversion_mode>

Restarting Link Training

▸ CALL·/MEDIA/PORTS/VIDEO/<in>/SETTINGS:dpLinkTrain()

Audio Input Port Settings

Audio Mode Setting

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

Setting the Balance (the Exact Value)

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

Setting the Balance (by a Step Value)

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

Setting the Mute State

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

Setting the Gain

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

Video Output Port Settings (HDMI and Displayport)

Querying the Status of the Output Ports

▸ GET·/MEDIA/XP/VIDEO.DestinationPortStatus

Muting an Output

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

Unmuting an Output

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

Locking an Output

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

Unlocking an Output

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

Setting the HDCP Mode (Output Port)

▸ SET·/MEDIA/PORTS/VIDEO/\<out\>/SETTINGS.HdcpMode=\<HDCP_mode\>

Setting the Audio Mode

▸ SET·/MEDIA/PORTS/VIDEO/\<out\>/EMBEDDEDAUDIO.AudioMode=\<audio_mode\>

HDMI Output Settings

Setting the Signal Type (HDMI mode)

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

Scrambling

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

Setting the Signal Conversion Mode

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

Sending CEC Commands Towards the Sink

▸ SET·/MEDIA/PORTS/\<out\>/CEC.OsdString=\<text\>

▸ CALL·/MEDIA/PORTS/VIDEO/\<out\>/CEC:send(set_osd)

Sending a CEC Command in Text Format

▸ CALL·/MEDIA/PORTS/VIDEO/\<out\>/CEC:send(\<command\>)

Sending a CEC Command in Hexadecimal Format

▸ CALL·/MEDIA/PORTS/VIDEO/\<out\>/CEC:sendHex(\<hex_command\>)

DisplayPort Output Settings

Enabling DP Power

▸ SET·/MEDIA/PORTS/VIDEO/\<out\>/SETTINGS.EnablePower=\<enable_power\>

Enabling Forced Link Training

▸ SET·/MEDIA/PORTS/VIDEO/\<out\>/SETTINGS.DpForcedMode=\<forced_mode\>

Setting the Forced Lane Number

▸ SET·/MEDIA/PORTS/VIDEO/\<out\>/SETTINGS.DpForcedLaneCount=\<lane\>

Setting the Forced Link Data Rate

▸ SET·/MEDIA/PORTS/VIDEO/\<out\>/SETTINGS.DpForcedLinkRate=\<data_rate\>

Setting the Swing / pre-emphasis

▸ SET·/MEDIA/PORTS/VIDEO/\<out\>/SETTINGS.DpForcedLaneLevel=\<voltage_level\>;\<preemph_level\>;

Restarting Link Training

▸ CALL·/MEDIA/PORTS/VIDEO/\<out\>/SETTINGS:dpLinkTrain()

Audio Output Port Settings

Audio Mode Setting

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

Setting the Volume (Exact Value)

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

Setting the Volume (by Step Value)

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

Setting the Balance (Exact Value)

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

10

Firmware Update

This chapter is meant to help customers perform firmware updates on our products by giving a few tips on how to start and by explaining the features of the Lightware Device Updater v2 (LDU2) software. The latest software and firmware pack can be downloaded from **www.lightware.com**.

10.1. Backward Compatibility

Up to 1.2.0 firmware version, the firmware packages are in **.lfp** format (LFP1 file), the update can be done with Lightware Device Updater v1 (LDU1) software.

Above 1.2.0 firmware version, the firmware package format is **.lfp2** (LFP2 file) the update can be done with Lightware Device Updater v2 (LDU2) software.

ATTENTION! While the firmware is being updated, the normal operation mode is suspended, as the device is switched to bootload mode. The firmware update process has an effect on the configuration and the settings of the device.

10.2. Introduction

Lightware Device Updater v2 (LDU2) software is the second generation of the LFP-based (Lightware Firmware Package) firmware update process.

DIFFERENCE: This software can be used for uploading the packages with LFP2 extension only. LDU2 is not suitable for using LFP files, please use the LDU software for that firmware update.

LDU   LDU2

10.3. Preparation

Most Lightware devices can be controlled over several interfaces (e.g. Ethernet, USB, RS-232). But the firmware can be updated usually over one dedicated interface, which is the Ethernet in most cases.

If you want to update the firmware of one or more devices you need the following:

- **LFP2 file**,
- **LDU2 software** installed on your PC or Mac.

Both can be downloaded from www.lightware.com/downloads.

Optionally, you can download the **release notes** file in HTML format.

10.3.1. About the Firmware Package (LFP2 File)

All necessary tools and binary files are packed into the LFP2 package file. You need only this file to do the update on your device.

- This allows the use of the same LFP2 package for different devices.
- The package contains all the necessary components, binary, and other files.
- The release notes is included in the LFP2 file, which is displayed in the window where you select the firmware package file in LDU2.

10.3.2. LDU2 Installation

ATTENTION! Minimum system requirement: 2 GB RAM. The minimum screen resolution is 1600x900.

ATTENTION! Certain ports are used for the communication in the background; please check the list in the Applied Ports (Network Settings) section.

INFO: The Windows, Mac and Linux applications have the same look and functionality.

Download the software from www.lightware.com/downloads.

Installation in case of Windows OS

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

Installation Modes

Normal install	Snapshot install
Available for Windows, macOS and Linux	Available for Windows only
The installer can update only this instance	Cannot be updated
One updateable instance may exist for all users	Many different versions can be installed for all users

ATTENTION! Using the default Normal install is highly recommended.

INFO: If you have a previously installed version, you will be prompted to remove the old version before installing the new one.

Installation in case of macOS

Mount the DMG file by double clicking on it, and drag the LDU2 icon over the Applications icon to copy the program into the Applications folder. If you want to copy LDU2 into another location, just drag the icon over the desired folder.

ATTENTION! Please check the firewall settings on the macOS device. LDC needs to be added to the exceptions of the blocked software for the proper operation.

INFO: This type of installer is equal to the **Normal install** of Windows.

Installation in case of Linux

Step 1. Download the **archive file** (tar.gz) from www.lightware.com and unpack it to a temp folder.

Step 2. Run the **install_ldu2.sh** file in the temp folder. The script will install LDU2 into the following folder: HOME/.local/share/lightware/ldu2.

Step 3. The folder above will contain this file: **LightwareDeviceUpdaterV2.sh** that can be used to start LDU2.

10.4. Running the Software

> **ATTENTION!** The computer that runs LDU2 and the target device (that will be updated) must be in the same subnet. The update cannot be performed behind a firewall or gateway.

You have two options:

- **Starting the LDU2** by double-clicking on the shortcut/program file, or
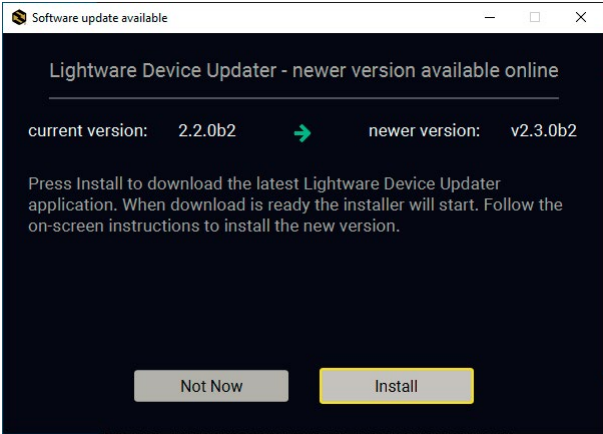- Double-clicking on an **LFP2 file**.

10.4.1. LDU2 Interfaces

The software can be used over:

- The Graphical User Interface (GUI), or by
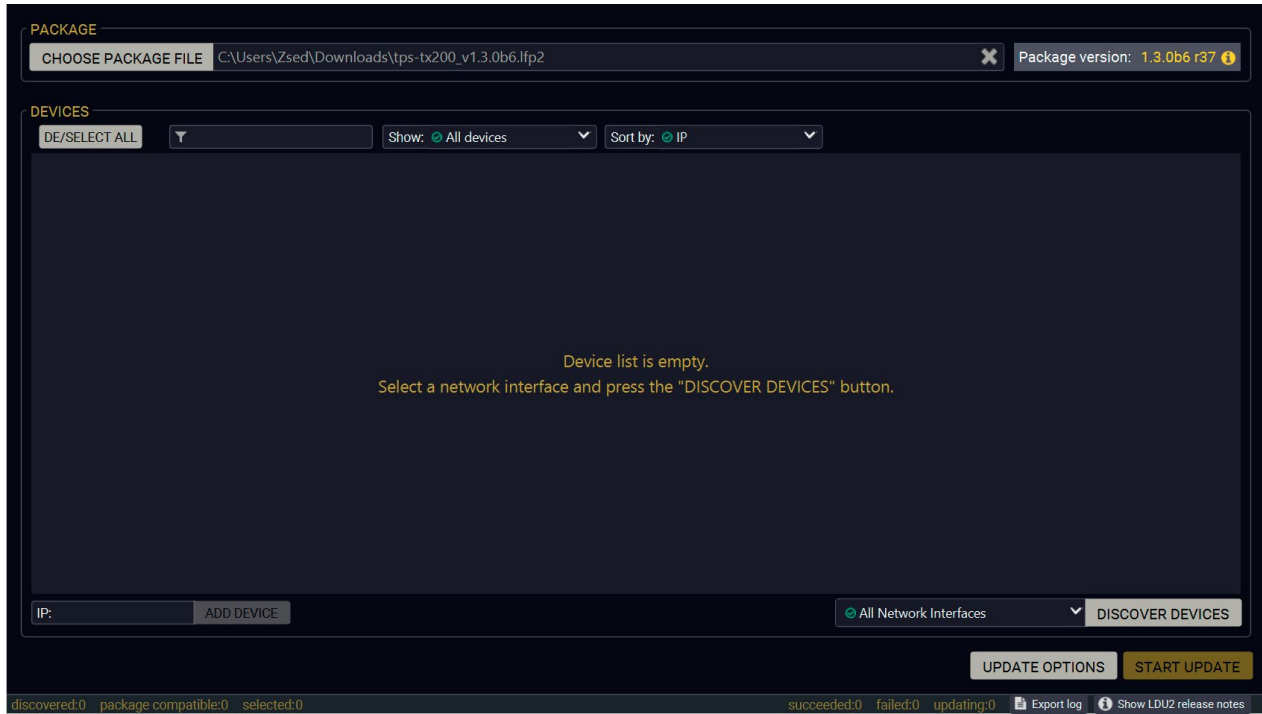- The Command Line Interface (CLI).

LDU2 Auto-Update

At startup, the software checks if a newer version is available on the web.

Main Screen

When the software is started via the shortcut, the device discovery screen appears. Press the **Search for devices** button to start finding the Lightware devices:

If you start the software by double-clicking on the LFP2 file, the firmware will be loaded. Press the **Discover devices** button; all the devices will be listed that are compatible with the selected firmware pack.

> INFO: If you press the **Choose package file** button, the release notes of the LFP2 file will be displayed in the right panel; see the Step 1. Select the Firmware Package section.

Device List

When the discovery has completed, the devices available on the network are listed in the application.
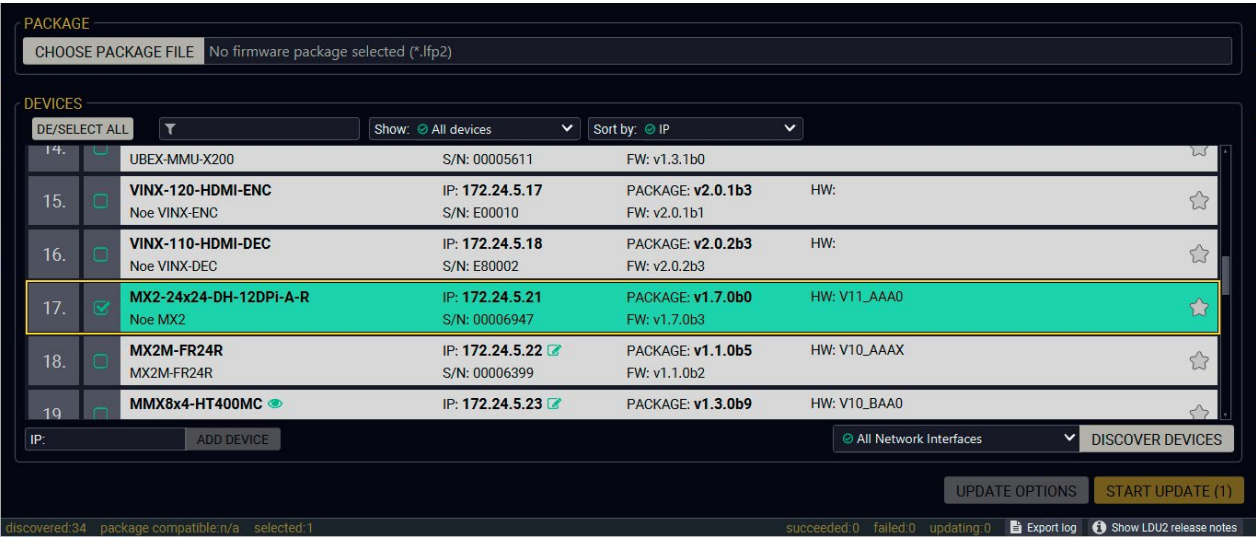
If the desired device is not discovered, you can add it by typing the IP address in the dedicated field and pressing the **Add device** button.

Legend of the Icons

✏	**IP address editor**	The IP address of the device can be changed in the pop-up window.
👁	**Identify me**	Clicking on the icon results in the front panel LEDs blinking for 10 seconds, which helps to identify the device phisically.
⭐	**Favorite device**	The device has been marked, thus the IP address is stored. When a device is connected with that IP address, the star will be highlighted in that line.
ⓘ	**Further information available**	Device is unreachable. Change the IP address by pressing the **IP address editor** icon or use the front panel buttons (if available).
🔑	**Cleartext login enabled**	The password-protection is enabled. You have to enter the password to perform the firmware update in the **Parameters** window or in the appearing window in the beginning of the update.
🔧	**Service mode**	The device is in bootload mode. Backup and restore cannot be performed in this case.

10.5. The Updating Steps

> **ATTENTION!** While the firmware is being updated, the normal operation mode is suspended, as the device is switched to bootload mode. Signal processing is not performed. Do not interrupt the firmware update. If any problem occurs, reboot the unit and restart the process.

Keeping the Configuration Settings

By default, device configuration settings are restored when firmware update is finished. If factory reset has been chosen in the parameters window, all device settings will be erased. In the case of factory reset, you can save the settings of the device in the Lightware Device Controller software and restore it later.

The following flow chart demonstrates how this function works in the background.

Step 1. Create a backup

The current configuration of the device is being saved into a configuration backup file on your computer.

Step 2. Start the Update

The device reboots and starts in bootload mode (firmware update mode).

Step 3. Upgrade

The CPU firmware is changed to the new one.

Step 4. Factory reset

All configuration settings are restored to the factory default values.

Step 5. Conversion / Restore

The firmware package checks the backup data before the restoration procedure, and if it is necessary, a conversion is applied to avoid incompatibility problems between the firmware versions. All configuration settings are restored to the device after the conversion.

If the factory default option is selected in the Parameters window, the conversion / restore procedure will not be performed!

Step 6. Finish

Once the firmware update procedure is finished, the device reboots and is ready to use.
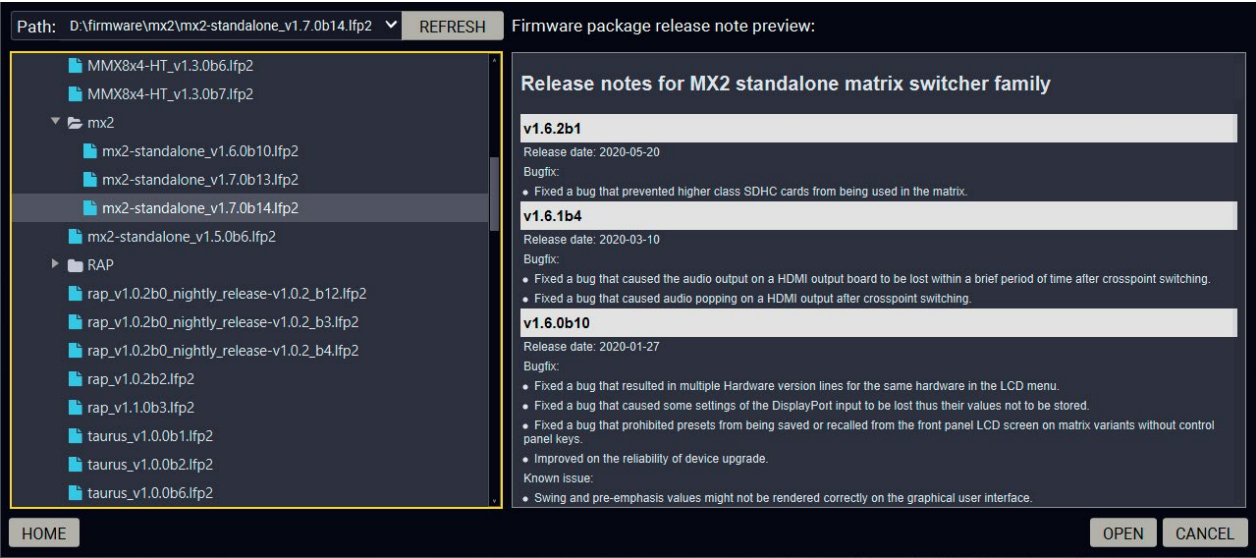
10.6. Updating Via GUI

To update the desired device(s) via the Graphical User Interface follow, these steps.

Step 1. Select the Firmware Package

Click on the **Choose Package File** button and navigate to the location where the LFP2 file was saved. When you click on the name of package, the preview of the release notes are displayed in the right panel.

CHOOSE PACKAGE FILE

After the package file is loaded, the list is filtered to show the compatible devices only. The current firmware version of the device is highlighted in orange if it is different from the version of the package loaded.
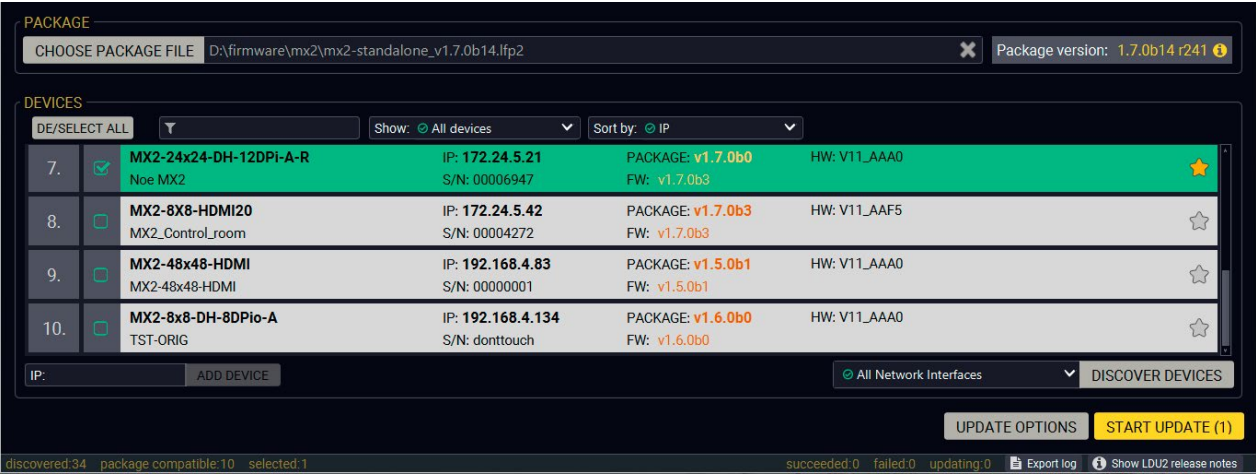
INFO: If you start the update by double-clicking on the LFP file, the screen above will be loaded right away.

The Meaning of the Symbols

	Show details	The log about the updating process of the device can be displayed in a new window.
	Service mode	The device is in bootload mode. Backup and restore cannot be performed in this case.

Step 2. Select the desired devices for updating.

Select the devices for updating; the selected line will be highlighted in green.

If you are not sure which device to select, press the **Identify me** 👁 button. It makes the front panel LEDs blink for 10 seconds. The feature helps to find the device physically.

Step 3. Check the update parameters

DIFFERENCE: The appearing settings are device-dependent, and can be different device by device.

Clicking on the **Update Options** button, special settings will be available, such as:

UPDATE OPTIONS

▪ Creating a backup about the configuration,
▪ Restore the configuration or reloading the factory default settings after the firmware update,
▪ Uploading the default Miniweb (if available)   *#builtinweb*   *#miniweb*   *#web*

Please arrange the settings carefully.

Step 4. Start the update and wait until it is finished

Click on the **Start Update** button to start the procedure. The status is shown in percent in the right side of the device line, and the overall process in the bottom progress bar. The update takes about 10-12 minutes to finish, which is independent of the number of the updated devices, since the updates are processed simultaneously.

START UPDATE

INFO: The device might reboot during the firmware update procedure.

The log about the updating process can be displayed in a new window by pressing the 📄 button. When the progress bar reaches 100% (**Done** is displayed at all devices), the update of all devices are finished successfully and a message appears; you can close the software.
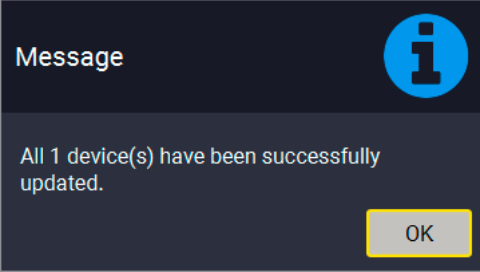
Step 5. Wait until the unit reboots with the new firmware

Once the firmware update procedure is completed, the device is rebooted with the new firmware. Shutting down and restarting the device is recommended.

10.7. Command Line Interface (CLI)

█ **DIFFERENCE:** The Command Line Interface is available from **LDU2 v2.9.0b9**.

The CLI of the LDU2 software is a simple tool for creating scriptable device updates without the need of human interactions. It allows batch updating with the same features that are available in case of GUI usage.

10.7.1. How to Run

Running under Windows® OS

The installer of LDU2 puts the following file into the installation folder:
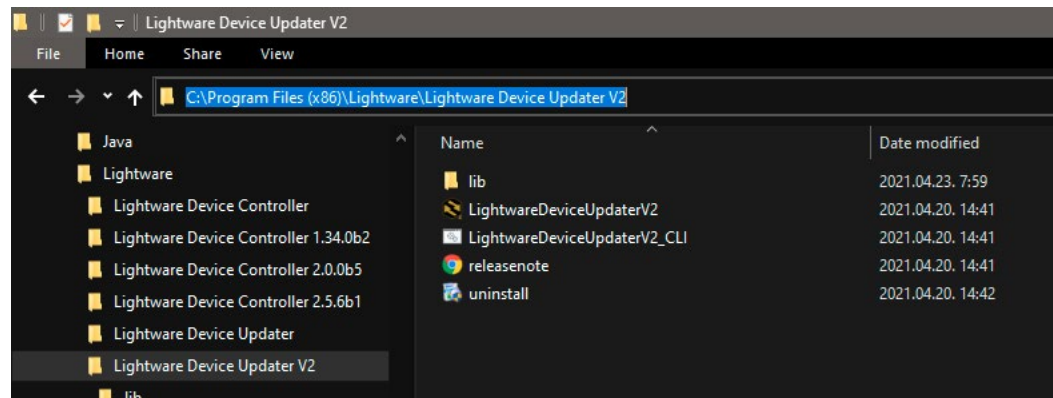
`LightwareDeviceUpdaterV2_CLI.cmd`

CLI is available via this file, the exe is not suitable for that purpose. Open a command line window to execute or test the features directly.

Step 1. Open an Explorer window where the cmd file is located, the default is:
`c:\Program Files (x86)\Lightware\Lightware Device Updater V2\LightwareDeviceUpdaterV2_CLI.cmd.`

Step 2. Click on the address line (highlighed with blue in the picture), type `cmd.exe` and press enter. The command interpreter window of Windows is opened at the path of the LDU2 install folder.

Step 3. Now you can use the `LightwareDeviceUpdaterV2_CLI.cmd` file with the commands and options, which are described in the coming sections:

Running under Linux

The Command Line Interface under Linux Operating Systems can be run by the following:

`LightwareDeviceUpdaterV2.sh.`

Running an update:

```
bash LightwareDeviceUpdaterV2.sh update --ip 172.24.5.27 --package ~/Downloads/mx2-standalone_
v1.7.0b17.lfp2
```

The commands and options are the same under Windows® and Linux, too. Following sections contain examples with **LightwareDeviceUpdaterV2_CLI.cmd**.

10.7.2. How to Use

Command Structure

The commands can be run over CLI in the following way:

`LightwareDeviceUpdaterV2_CLI.cmd [command] [options]`

`[Command]`: a certain command described in the coming sections; only one command can be run at a time

`[Options]:` mandatory and/or optional parameters of the command, if any. Optional parameters have a default value, which can be found at each affected command. You only have to define the parameter if you want to apply a different value. The **order of the options** is arbitrary.

Important Notes

▪ CLI is **case-sensitive** (including commands, options and other parameters).
▪ There is **no limit** regarding the number of the devices to update. At most. 20 devices are updated simoultaneously, when one of them is finished, the next (21st) will be started automatically.
▪ If an update is failed, the IP address of the affected device(s) are listed at the end.

10.8. CLI Commands

█ INFO: The commands and options described in the following sections are the same under Windows® and Linux, too. The examples contain **LightwareDeviceUpdaterV2_CLI.cmd**.

About the Examples

▪ Sent command is in **blue,** response is in **grey**.
▪ If the response in practice is **longer than listed** in the example, this symbol can be seen: [...].

10.8.1. Help

The defined commands and options can be listed by the **help** command.

Command

`LightwareDeviceUpdaterV2_CLI.cmd help`

Example

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd help

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar help
Command line usage:
    Win: LightwareDeviceUpdaterV2_CLI.cmd [command] [options]
    Linux: LightwareDeviceUpdaterV2.sh [command] [options]

    Commands:
        * help
        * version
        * update
        * deviceInfo
        * restore
        * packageOptions
[...]
```

10.8.2. LDU2 Version

The response shows the version of the LDU2 and the version of the Script API (the Application Programming Interface that is used by the LDU2 and the script).

Command

```
LightwareDeviceUpdaterV2_CLI.cmd version
```

Example

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd version

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar version
LDU2 version: 2.9.0b9
Script API version: 1.3.9
```

10.8.3. Checking For New LDU2 Version

The following command can be used to check if an update of LDU2 is available. This is just a request, since the CLI is not suitable for handling the complete installer of the software.

Command

```
LightwareDeviceUpdaterV2_CLI.cmd checkForUpdates
```

Example 1

```
c:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd checkForUpdates

c:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar checkForUpdates
Current LDU2 version: 2.9.1b1
LDU2 is up-to-date
```

Example 2

```
c:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd checkForUpdates

c:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar checkForUpdates
Current LDU2 version: 2.9.1b1
New version is available online: v2.9.2b2
Download URL: http://update.lightware.hu/ldu2/lwr/v2.9.2b2/install_LDU2_v2.9.2b2.exe
```

10.8.4. Device Info

The most important information about the selected device is displayed; see the example for more details.

Command

```
LightwareDeviceUpdaterV2_CLI.cmd deviceInfo [options]
```

Options

Option	Description	Required?
-i or --ip	List of IP addresses of devices to be updated	one of them is mandatory
-n or --hostName	List of host names of devices to be updated	
-v or --packageVersion	Shows installed package version only	optional

Example 1

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd deviceInfo --ip
192.168.1.12

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar deviceInfo --ip
192.168.1.12
Product name:    MX2-8x8-HDMI20-Audio
IP address:      192.168.1.12
Serial number:   00002263
MAC address:     a8:d2:36:ff:22:63
Part number:     91540065
Device label:    123
Package version: v1.3.0b6
CPU FW version:  v1.3.0b3
HW version:      V12_KAA0
Operation mode:  Application mode
```

Example 2

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd deviceInfo --ip
192.168.1.12 --packageVersion

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar deviceInfo --ip
192.168.1.12 --packageVersion
v1.3.0b6
```

10.8.5. Update

This command can be used to update the firmware of the devices.

Command

```
LightwareDeviceUpdaterV2_CLI.cmd update [options]
```

Options

Option	Description	Required?
-p or --package	The path of the firmware package file	yes
-i or --ip	List of IP addresses of devices to be updated	one of them is mandatory
-n or --hostName	List of host names of devices to be updated	
-b or --backupFolder	Folder to create device configuration backup at. Default: USER_HOME/.ldu2/backup	optional
-f or --factoryDefault	Apply factory reset during device update. Default: false	optional
-r or --reportProgress	Report update progress in percent. Default: false	optional
Package-specific options	Certain LFP2 packages have features that can be applied at this command; see the Package Options section.	optional

ATTENTION! The configuration is restored automatically if the factory default option is not applied in the **update** command. In that case, there is no need to run the **restore** command after the update.

Example

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd update --ip
192.168.1.12 --package C:\Firmwares\mx2-standalone_v1.7.0b17.lfp2 --reportProgress

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar update --ip
192.168.1.12 --package C:\Firmwares\mx2-standalone_v1.7.0b17.lfp2 --reportProgress
[2021-05-12 08:59:36.336] [ INFO] [         main] - Device IPs: [192.168.1.12]
[2021-05-12 08:59:39.409] [ INFO] [         main] - All the selected devices are accessible over the network.
[2021-05-12 08:59:39.628] [ INFO] [         main] - All the selected devices are compatible with the specified
package.
[2021-05-12 08:59:40.025] [ INFO] [    192.168.1.12] - Package version: 1.3.2b3
[2021-05-12 08:59:40.092] [ INFO] [    192.168.1.12] - Login functionality is currently not enabled.
[2021-05-12 08:59:40.129] [ INFO] [    192.168.1.12] - Creating backup of device settings...
[2021-05-12 08:59:43.582] [ INFO] [    192.168.1.12] - Backup HTTP enable properties
[2021-05-12 08:59:44.638] [ INFO] [ProgressReporter] - Progress: 2%
[2021-05-12 08:59:46.111] [ INFO] [    192.168.1.12] - HTTP and HTTP post have got enabled on port 80
[2021-05-12 08:59:46.319] [ INFO] [    192.168.1.12] - No miniweb file is found on the device.
[2021-05-12 08:59:48.890] [ INFO] [    192.168.1.12] - HTTP and HTTP post properties have got restored on port 80
[2021-05-12 08:59:48.897] [ INFO] [    192.168.1.12] - Switching device into bootload mode...
[2021-05-12 08:59:49.640] [ INFO] [ProgressReporter] - Progress: 5%
[...]
```

The lines containing "ProgressReporter" can be enabled optionally. If it is enabled, the current state is displayed in every 5 seconds.

10.8.6. Restore

Restores device configuration from a backup file.

TIPS AND TRICKS: This command can be used for uploading a configuration to numerous devices (aka Configuration cloning by CLI).

Command

```
LightwareDeviceUpdaterV2_CLI.cmd restore [options]
```

Options

Option	Description	Required?
-i or --ip	List of IP addresses of devices to be updated	one of them is mandatory
-n or --hostName	List of host names of devices to be updated	
-b or --backupFile	The path of the configuration backup file	yes
-k or --keepOriginalIp	Do not override the network settings of the device with the ones in the backup file. It comes in handy when multiple devices' configuration is being restored from a single backup file. Default: false	optional

ATTENTION! The configuration is restored automatically if the factory default option is not applied in the **update** command. In that case, there is no need to run the **restore** command after the update.

Example

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd restore --ip
192.168.1.12 --backupFile C:\mybackup.lw3 --keepOriginalIp

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar restore --ip
192.168.1.12 --backupFile C:\mybackup.lw3 --keepOriginalIp
[2021-05-12 10:49:36.412] [ INFO] [         main] - Executing configuration restore...
[2021-05-12 10:49:36.425] [ INFO] [         main] - Device IPs: [192.168.1.12]
```

INFO: The firmware package checks the backup data before the restoration procedure, and if it is necessary, a conversion is applied to avoid incompatibility problems between the firmware versions. In that case, two backup files are created: the original, and a new one with "_converted" suffix. Using the last one for restoring is recommended.

10.8.7. Package Options

Shows package-specific update options.

Command

```
LightwareDeviceUpdaterV2_CLI.cmd packageOptions [options]
```

Options

Option	Description	Required?
-p or --package	The path of the firmware package file	yes

Example

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd packageOptions
--package c:\Firmwares\mx2-standalone_v1.7.0b17.lfp2

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar packageOptions
--package c:\Firmwares\tps-tx200_v1.3.2b3.lfp2

Backup and restore options:
        --skipPresetsAtRestore : if true, device presets will not be restored. (Default: false)
        --uploadDefaultMiniWeb : if true and no custom miniweb is present on the device, the default built-in
miniweb will be uploaded to the device. (Default: false)

Test options:
        --test : if true, no update will be performed, communication with the device will be tested. (Default:
false)
```

Package option example can be seen in the following section.

10.8.8. Complex Examples

The following options are applied:

- Firmware is updated
- Factory default settings are restored

```
C:\Program Files (x86)\Lightware\Lightware Device Updater V2>LightwareDeviceUpdaterV2_CLI.cmd update --ip
192.168.1.12 --factoryDefault --package c:\Firmwares\mx2-standalone_v1.7.0b17.lfp2

C:\Program Files (x86)\Lightware\Lightware Device Updater V2>lib\jre\bin\java.exe -jar lib\ldu2.jar update --ip
192.168.1.12 --factoryDefault --package c:\Firmwares\mx2-standalone_v1.7.0b17.lfp2
[2021-05-12 11:22:09.089] [ INFO] [          main] - Device IPs: [192.168.1.12]
[2021-05-12 11:22:12.947] [ INFO] [          main] - All the selected devices are accessible over the network.
[2021-05-12 11:22:13.225] [ INFO] [          main] - All the selected devices are compatible with the specified
package.
[2021-05-12 11:22:13.777] [ INFO] [    192.168.1.12] - Package version: 1.3.2b3
[2021-05-12 11:22:13.878] [ INFO] [    192.168.1.12] - Login functionality is currently not enabled.
[2021-05-12 11:22:13.896] [ INFO] [    192.168.1.12] - Switching device into bootload mode...
[2021-05-12 11:22:34.519] [ INFO] [    192.168.1.12] - Gathering UID information from device...
[2021-05-12 11:22:35.097] [ INFO] [    192.168.1.12] - UID info - Device IP: 192.168.1.12 Product name: MX2-
16x16-DH-8DPi-A-R Product part number: 91310068 Serial number: 00002263 Hardware version: V12_KAA0 MAC address:
A8:D2:36:FF:22:63
[2021-05-12 11:22:35.589] [ INFO] [    192.168.1.12] - Package version on device: 1.3.2b3 r44
[2021-05-12 11:22:35.626] [ INFO] [    192.168.1.12] - Updating MX2 Standalone series application fw part 1...
[2021-05-12 11:22:36.123] [ INFO] [    192.168.1.12] -  [mx2.bin.ER_IROM1]'s current version on device: 1.3.1b1 r35
[2021-05-12 11:22:36.124] [ INFO] [    192.168.1.12] -  [mx2.bin.ER_IROM1]'s version in the package: 1.3.1b1 r35
[2021-05-12 11:22:52.439] [ INFO] [    192.168.1.12] -  [tps_tx200.bin.ER_IROM1]'s firmware version updated in FVS
EEPROM.
[2021-05-12 11:22:52.442] [ INFO] [    192.168.1.12] - Updating VS100TX fw...
[2021-05-12 11:22:52.920] [ INFO] [    192.168.1.12] -  [vs100_tx.bin]'s current version on device: 1.1.0b0 r0
[2021-05-12 11:22:52.921] [ INFO] [    192.168.1.12] -  [vs100_tx.bin]'s version in the package: 1.1.0b0 r63
[2021-05-12 11:23:06.423] [ INFO] [    192.168.1.12] -  [vs100_tx.bin]'s firmware version updated in FVS EEPROM.
[2021-05-12 11:23:06.425] [ INFO] [    192.168.1.12] - Updating MX2 Standalone series application fw part 2...
[2021-05-12 11:23:06.903] [ INFO] [    192.168.1.12] -  [mx2.bin.ER_IROM2]'s current version on device: 1.3.1b1 r35
[2021-05-12 11:23:06.904] [ INFO] [    192.168.1.12] -  [mx2.bin.ER_IROM2]'s version in the package: 1.7.0b17 r35
[2021-05-12 11:23:27.858] [ INFO] [    192.168.1.12] -  [mx2.bin.ER_IROM2]'s firmware version updated in FVS
EEPROM.
[2021-05-12 11:23:27.860] [ INFO] [    192.168.1.12] - Updating PS171 FW...
[2021-05-12 11:23:28.338] [ INFO] [    192.168.1.12] -  [mx2_family_ps171.bin]'s current version on device: 1.0.6b0
r0
[2021-05-12 11:23:28.340] [ INFO] [    192.168.1.12] -  [mx2_family_ps171.bin]'s version in the package: 1.7.0b17
r522
[2021-05-12 11:23:44.810] [ INFO] [    192.168.1.12] -  [mx2_family_ps171.bin]'s firmware version updated in FVS
EEPROM.
[2021-05-12 11:23:51.412] [ INFO] [    192.168.1.12] - Setting system information...
[2021-05-12 11:23:57.994] [ INFO] [    192.168.1.12] - Starting application...
[2021-05-12 11:25:44.239] [ INFO] [    192.168.1.12] - Done

All 1 update(s) finished successfully.
```

10.8.9. Exit Codes

There is a return value in all cases, when a command run is finished. Currently, three codes are defined:

Code	Displayed text	Description
0	N/A	The update performed successfully
1	Update error (ErrorCode:1)	The error happened during the update
2	CLI error (ErrorCode:2	The error happened before starting the update

The error line contains further information about the error.

Querying the Exit Code under Windows®

```
c:\Program Files (x86)\Lightware\Lightware Device Updater V2\echo %errorlevel%
0
```

Querying the Exit Code under Linux

```
echo $?
0
```

If this value is queried after the update and it is 0, the update performed successfully.

10.9. If the Update is not successful

- Restart the process and try the update again.
- If the device cannot be switched to bootload (firmware update) mode, you can do that manually as written in the User's manual of the device. Please note that backup and restore cannot be performed in this case.
- If the backup cannot be created for some reason, you will get a message whether to continue the process without backup or stop the update. A root cause can be that the desired device is already in bootload (firmware update) mode, thus the normal operation mode is suspended and backup cannot be made.
- If an update is not successful, the **Export log** button becomes red. If you press the button, you can download the log file as a ZIP package, which can be sent to Lightware Support if needed. The log files contain useful information about the circumstances to find the root cause.   *#bootload*

11

Troubleshooting

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

At first, check front panel LEDs and take the necessary steps according to their states. For more information about front panel LEDs of the matrix, see the Product Overview 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.

The following sections are available in the chapter:

▸ USE CASES
▸ HOW TO SPEED UP THE TROUBLESHOOTING PROCESS

11.1. Use Cases

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.	4.3
	Cable connection problem	Cables must fit very well, check all the connectors.	4.3
	No incoming signal	No video signal is present on the HDMI input ports. Check the source device and the HDMI cables.	4.3
	Not the proper video port is the active one	Check the video crosspoint settings.	3.1.1 7.4 LW2 8.4 LW3 9.5.1
	Not the proper interface is the active one	If the source/display has more connectors, check if the proper interface is selected.	
	Output port is muted	Check the mute state of output ports.	7.6 LW2 8.4.6 LW3 9.8.1
	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).	3.2.4 7.8 LW3 9.14
	HDCP is disabled	Enable HDCP on input port(s) of the matrix.	6.4.1 LW3 9.5.6
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 does not support this resolution.	Check the emulated EDID and select another (e.g. F139 EDID on the input port).	3.2.4 7.8 LW3 9.14

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.	3.1 7.4.1 LW2 8.4.5 LW3 9.7.1
	Output port is muted	Check the output port properties.	3.2.3 7.6 LW2 8.4.6 LW3 9.8.1
	Analog audio input: volume is set very low	Check the Analog audio input port settings (Volume).	3.2.2 7.5.1 LW3 9.7.2
	Analog audio output: volume is set very low	Check the Analog audio output port settings (Volume).	3.2.3 7.6 LW3 9.11.2
HDMI output signal contains no audio	HDMI mode was set to DVI	Check the properties of the output port and set to HDMI or Auto.	3.2.3 7.6 LW3 9.9.1
	DVI EDID is emulated	Check the EDID and select an HDMI EDID to emulate.	3.2.4 6.6 LW3 9.14

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.	4.2
	Serial settings are different	Check the port settings of the matrix and the connected serial device(s). Pay attention to link and/or local ports.	7.9.3 LW3 9.15

Ethernet				
No LAN connection can be established	Incorrect IP address is set (direct connect)	Disable DHCP server and set the IP addresses to be in the same subnet.	🔳	7.9.2
			LW3	9.13
		Restore the factory default settings (with fix IP).	🔳	7.9.5
			LW3	9.4.5
	IP address conflict	Change the IP address to a not reserved one or enable DHCP if DHCP server exists in the network.	🖥	3.2.1
			🔳	7.9.2
			LW3	9.13

11.2. 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.
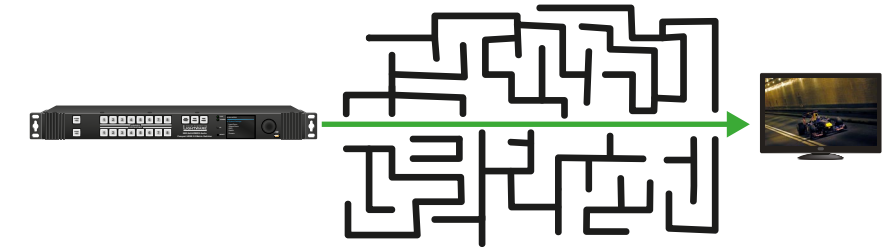
However, the troubleshooting process can be even faster... with your help.

There are certain pieces of information that push us in the right direction to find 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 a file and send it 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 information above you can give us, the better. Please send this information to the Lightware Support Team (support@lightware.com) to speed up the troubleshooting process.

12

Technologies

The following sections contain descriptions and useful technical information on 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 following:

▸ EDID Management
▸ HDCP Management
▸ Pixel Accurate Reclocking
▸ Serial Management

12.1. EDID Management

12.1.1. 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.
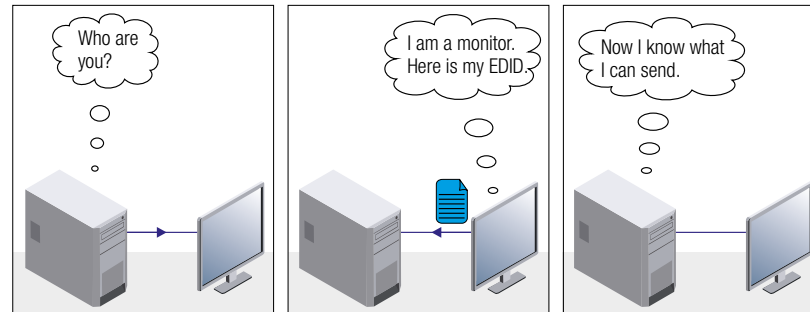
EDID Communication

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 is 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.

12.1.2. 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.

12.2. HDCP Management

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

12.2.1. 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. Even though 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.

12.2.2. 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.

Non-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.

12.2.3. 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 AV system: HDCP v2.2 allows 32 devices (HDCP v1.4 allows 128 devices). A 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 the application of 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 settings are:

HDCP 2.2   HDCP 1.4

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

	INPUT	OUTPUT
HDMI port	Allow HDCP 2.2 and HDCP 1.4	Depends on input or Maximum possible
DP port	Allow HDCP 2.2 and HDCP 1.4	Auto or Always

HDCP v1.4 Source and HDCP v2.2 Sink

The example below 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 (convertible) *	HDCP v1.4	HDCP v2.2
HDCP v2.2 (not convertible) *	Blank (or red) screen	HDCP v2.2

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

** Stream type 1: the video stream does not allow the conversion of the signal.

12.3. Pixel Accurate Reclocking

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

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

Intra-pair skew

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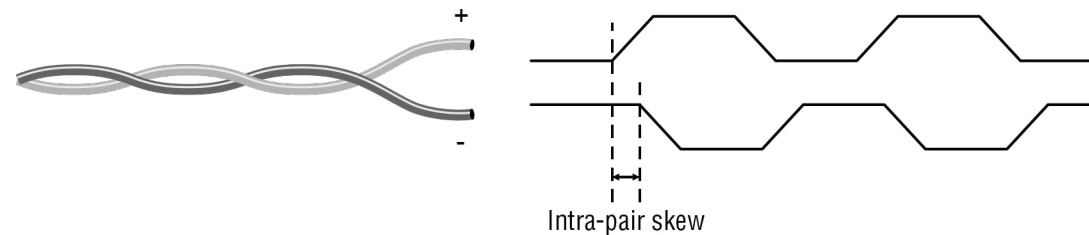
Inter-pair skew

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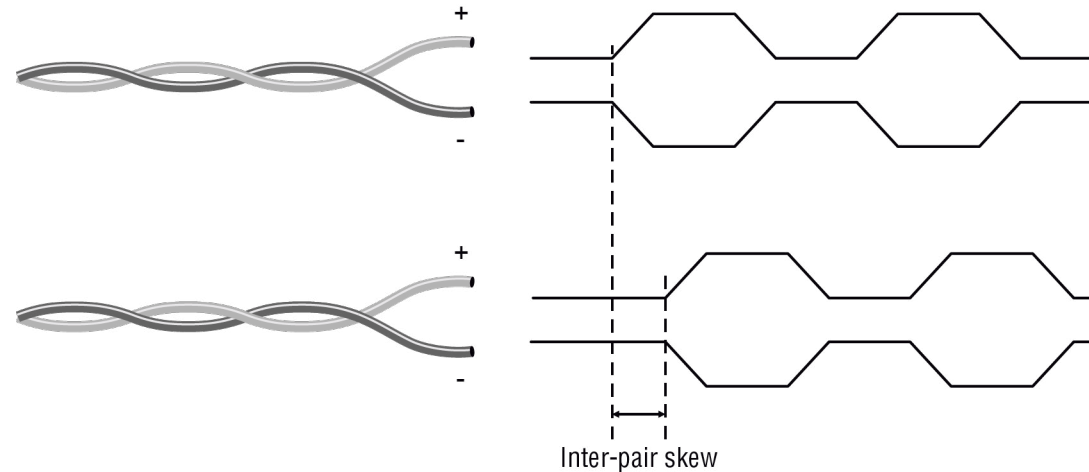
Jitter

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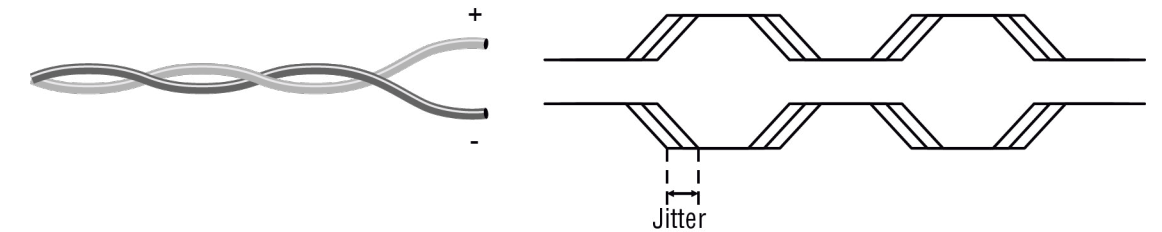
Noise

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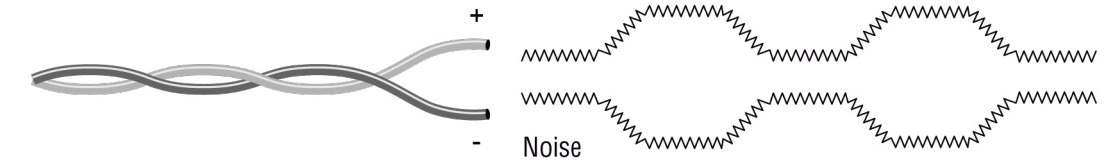
12.4. Serial Management

12.4.1. General Information

There are two types of devices in general serial communication:

- **Data Terminal Equipment:** Data Terminal Equipment (DTE) is an end instrument that converts user information into signals or reconverts received signals. Typical DTE devices: computers, LCD touch panels and control systems.
- **Data Circuit-terminating Equipment:** Data Circuit-terminating Equipment (DCE) is a device that sits between the DTE and a data transmission circuit. It is also called data communication equipment and data carrier equipment. Typical DCE devices: projectors, industrial monitors and amplifiers.

Among others, the pin assignment is different between DTE and DCE.

	DTE	DCE
Pin 2:	RD	TD
Pin 3:	TD	RD

RD: Received Data (digital input)
TD: Transmitted Data (digital output)

Different type of serial cables must be used between different serial devices.

	DTE	DCE
DTE	Null-modem	Straight
DCE	Straight	Null-modem *

* In general, contact DCE with DCE by tail-circuit serial cable.

12.4.2. Types of Serial Cables

Straight Serial Cable	Null-modem Serial Cable
Straight pin-outs both ends.	Straight pin-out at the one end and cross pin-out at the other end (interchange lines of TX and RX).

Serial cables between devices may have male or female plugs and their type may be straight or null-modem in usual.

ATTENTION! The cable type does not depend on the plug type.

12.4.3. RS-232 Signal Transmission over MX2 Matrix switchers

The following examples describe the detailed integration of Lightware devices between different RS-232 pin assignment units.

INFO: **-R** suffixed models in MX2-HDMI20 series are supplied with D-SUB serial connector. These models are DCE units (according to their pinouts) with female plugs.

Extending RS-232 between DTE and DCE Third-party Devices

Connect straight serial cable between controller system (DTE) and the matrix (DCE).
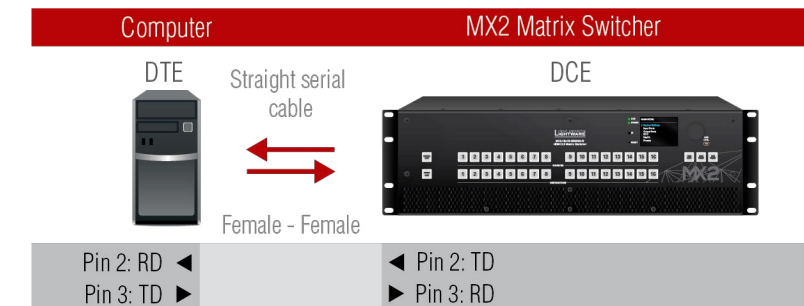
RS-232 Connection Example between a Controller System and a Matrix Switcher

Extending RS-232 between DTE and DTE Third-party Devices

Connect a null-modem serial cable between a projector (DCE) an a matrix (DCE).
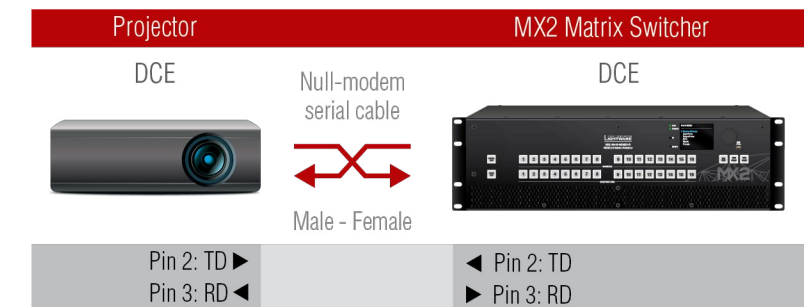
RS-232 Connection Example between a Projector and a Matrix Switcher

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Appendix

Tables, drawings, guides, technical details and the hashtag keyword list as follows:

▸ Specifications
▸ Applied Ports (Network Settings)
▸ Factory Default Settings
▸ Mechanical Drawings
▸ Cable Wiring Guide
▸ Factory EDID List
▸ Front and Rear Views with Port Numbering
▸ Direction of the Airflow
▸ Firmware Release Notes
▸ Hashtag Keyword List
▸ Further Information

13.1. Specifications

General

Compliance	UL, CE
Electrical safety	IEC/EN 62368-1:2014
EMC (emission)	IEC/EN 55032:2015
EMC (immunity)	IEC/EN 55035:2017
RoHS	EN 63000:2018
Warranty	3 years
Operating temperature	0° to +50°C (+32° to +122°F)
Storage temperature	-20 to +70 °C (-4 to +158°F)
Storage humidity	0% to 95%, non-condensing
Operating humidity	10% to 90%, non-condensing
Cooling	by cooling fans, air flows from front to rear

Power

Power supply option	Built-in PSU
Supported power source	100-240V AC, 50~60Hz
Power consumption 1 - MX2-8x8-HDMI20-Audio, -L (no signal / max signal)	10 W / 75 W
Power consumption 1 - MX2-16x16-HDMI20 (no signal / max. signal)	47 W / 83 W
Power consumption 1 - MX2-24x24-HDMI20 (no signal / max. signal)	53 W / 108 W
Power consumption 1 - MX2-32x32-HDMI20-A-R (no signal / max. signal)	98 W / 167 W
Power consumption 1 - MX2-48x48-HDMI20-A-R (no signal / max. signal)	108 W / 203 W
Heat dissipation - MX2-8x8-HDMI20-Audio, -L (no signal / max signal)	34,1 BTU/h / 255,9 BTU/h
Heat dissipation - MX2-16x16-HDMI20 (no signal / max. signal)	160,3 BTU/h / 283,1 BTU/h
Heat dissipation - MX2-24x24-HDMI20 (no signal / max. signal)	180,8 BTU/h / 368,5 BTU/h
Heat dissipation - MX2-32x32-HDMI20-A-R (no signal / max. signal)	334,3 BTU/h / 569,8 BTU/h
Heat dissipation - MX2-48x48-HDMI20-A-R (no signal / max. signal)	368,5 BTU/h / 692,6 BTU/h

AC power connector	IEC C14 receptacle / Neutrik powerCON
AC fuse	F 3.15A

[1] without 500 mA current, +5V on the HDMI output

Enclosure

Rack mountable	Yes, (rack ears supplied)
Material	1 mm steel
Dimensions in mm - MX2-8x8-HDMI20-Audio	442 (482 2) W x 43.7 H x 177.5 D
Dimensions in mm - MX2-8x8-HDMI20-Audio-L	442 (482 2) W x 43.7 H x 277.4 D
Dimensions in mm - MX2-8x8-HDMI20-CA	442 (482 2) W x 43.7 H x 277.4 D
Dimensions in mm - MX2-16x16-HDMI20-Audio, -Audio-R, -R	441 (483 2) W x 132.6 H x 280.2 D
Dimensions in mm - MX2-24x24-HDMI20-Audio, -Audio-R, -R	440.5 (483 2) W x 177 H x 280.2 D
Dimensions in mm - MX2-32x32-HDMI20-A-R	440.5 (483 2) W x 355 H x 280.2 D
Dimensions in mm - MX2-48x48-HDMI20-A-R	440.5 (483 2) W x 355 H x 280.2 D
Dimensions in inch - MX2-8x8-HDMI20-Audio	17.4 (18.9 2) W x 1.7 H x 6.9 D
Dimensions in inch - MX2-8x8-HDMI20-Audio-L	17.4 (18.9 2) W x 1.7 H x 10.9 D
Dimensions in inch - MX2-8x8-HDMI20-CA	17.4 (18.9 2) W x 1.7 H x 10.9 D
Dimensions in inch - MX2-16x16-HDMI20-Audio, -Audio-R, -R	17.3 (19 2) W x 5.2 H x 11 D
Dimensions in inch - MX2-24x24-HDMI20-Audio, -Audio-R, -R	17.3 (19 2) W x 6.9 H x 11 D
Dimensions in inch - MX2-32x32-HDMI20-A-R	17.3 (19 2) W x 13.9 H x 11 D
Dimensions in inch - MX2-48x48-HDMI20-A-R	17.3 (19 2) W x 13.9 H x 11 D
Weight - MX2-8x8-HDMI20-Audio	3210 g (7 lb)
Weight - MX2-8x8-HDMI20-Audio-L	3250 g (7.1 lb)
Weight - MX2-8x8-HDMI20-CA	3210 g (7 lb)
Weight - MX2-16x16-HDMI20-R	8540 g (18.8 lb)
Weight - MX2-24x24-HDMI20	9250 g (20.4 lb)
Weight - MX2-24x24-HDMI20-Audio-R	10090 g (22.2 lb)
Weight - MX2-48x48-HDMI20-A-R	23400 g (51.6 lb)
2 with rack-mounting ears	

Video Inputs

HDMI Input ³

Connector type	19-pole HDMI type A receptacle
AV standard	DVI 1.0, HDMI 2.0
HDCP compliance	HDCP 2.2
Color space	RGB, YCbCr
Video delay	0 frame

³ Only MX2-HDMI20 series models are built with HDMI input ports.

Supported resolutions at 8 bits/color 4	up to 4096x2048@30Hz (4:4:4) or 4096x2048@60Hz (4:2:0); up to 3840x2160@30Hz (4:4:4) or 3840x2160@60Hz (4:2:0); 1920x1080@60Hz (4:4:4) up to 12 bits/color
Max. input HDMI cable length (with premium cerified cable) at 1920x1080@60Hz 4:4:4.	40m
Max. input HDMI cable length (with premium cerified cable) at 3840x2160@30Hz 4:4:4	15m
Max. input HDMI cable length (with premium cerified cable) at 3840x2160@60Hz 4:4:4	5m
Reclocking	Pixel Accurate Reclocking
3D support	Yes
Audio formats	all formats in line with HDMI 2.0 standard
Input cable equalization	Yes, +12dB fixed

⁴ All standard VESA, CEA and other custom resolutions up to 600MHz (HDMI 2.0) are supported.

DP Input ⁵

Connector type	20-pole DisplayPort receptacle
AV standard	DVI 1.0, HDMI 2.0, DP 1.2 (with 18 Gbps bandwidth limitation)
HDCP compliance	HDCP 2.2
Color space	RGB, YCbCr
Video delay	0 frame
Supported resolutions at 8 bits/color 6	up to 4096x2048@30Hz (4:4:4) or 4096x2048@60Hz (4:2:0); up to 3840x2160@30Hz (4:4:4) or 3840x2160@60Hz (4:2:0); 1920x1080@60Hz (4:4:4) up to 12 bits/color

Audio formats	all formats in line with HDMI 2.0 standard
3D support	Yes

⁵ Only MX2-DH series models are built with HDMI input ports.

⁶ All standard VESA, CEA and other custom resolutions up to 600MHz (DP 1.2) are supported.

Audio Ports

Analog Audio Input ⁷

Connector type	5-pole Phoenix connector
Audio formats	2-channel PCM
Sampling frequency	48 kHz
Maximum input level	+0 dBu, 0.77 Vrms, 2.19 Vpp
Signal transmission	Balanced / unbalanced audio
Balance	-100 (-95 dB) - +100 (0 dB) (0 = center)
Gain	-12 dB - +35 dB

Analog Audio Output ⁸

Connector type	5-pole Phoenix connector
Audio formats	2-channel PCM
Sampling frequency	48 kHz
Signal transmission	Balanced / unbalanced audio
Volume	-78 dB - 0 dB
Balance	-100 (-95 dB) - +100 (0 dB) (0 = center)
Nominal Differential Output Level @ 0 dB Gain	+4 dBu
Nominal Differential Output Level @ 3 dB Gain	+7 dBu

⁷ Only -*Audio* and -*A* suffixed models are built with analog audio input ports. See more details in the Model Comparison section.

⁸ Only -*Audio* and -*A* suffixed models are built with analog audio input ports. See more details in the Model Comparison section.

Control Ports

RS-232 serial port

Connector type (-R suffixed models)	9-pole D-SUB
Connector type (in other models)	3-pole Phoenix connector
Baud rates	Between 200 and 115200 Baud
Data bits	8 or 9

Parity	None / Odd / Even
Stop bits	1 / 1.5 / 2

Ethernet port

Connector type (-R suffixed models)	RJ45 female
Connector type (in other models)	Neutrik etherCON
Ethernet data rate	10/100Base-T, full duplex with autodetect
Power over Ethernet (PoE)	Not supported

USB port

Connector type	USB mini-B type
USB compliance	USB 2.0
Device class	HID

EDID Management

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

13.2. Applied Ports (Network Settings)

The following ports are necessary to pass via a network switch/firewall for a proper working between the device and the softwares:

Purpose/function	Affected software	Protocol	Port nr.
Firmware update SCP	LDU2	TCP	22
Device Discovery	LDC	UDP	224.0.0.251:5353
Remote IP	LDC	UDP	230.76.87.82:37421
LW2 protocol	-	TCP	10001
LW3 protocol	-	TCP	6107
Secondary protocol	-	TCP	23
HTTP port	-	TCP	80

13.3. 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
General Video Settings	
Crosspoint setting	Input 1 on all outputs
Emulated EDID	F49 - (Universal HDMI, all audio formats with deep color support) on all inputs
HDMI port	
HDCP enable (input)	Allow HDCP 2.2 and HDCP 1.4
Audio source (input)	HDMI
HDCP (output)	Depends on input
Signal type (output)	Auto
Conversion mode (output)	Passthrough
Audio mode: HDMI port (output)	HDMI
Audio mode: HDMI with analog audio (output)	HDMI+ANALOG
Scrambling	Auto
TMDS clock rate	Auto
Signal type	Auto
DisplayPort	
HDCP enable (input)	Allow HDCP 2.2 and HDCP 1.4
Link data rate (input)	Max. HBR2 (5.4 Gbps)
Link lane count (input)	Max. 4 lane
Audio source (input)	DisplayPort
Audio Input/Output Ports	
Audio source	HDMI
Audio mode (HDMI out)	HDMI
Audio mode (Analog audio out)	HDMI+ANALOG
Analog audio output	Enabled (de-embedding from HDMI signal)
Analog Audio Input Levels	Balance: 0 (center) Gain: 0 dB
Analog Audio Output Levels	Balance: 0 (center) Volume: 0 dB

13.4. Mechanical Drawings

MX2-8x8-HDMI20-Audio
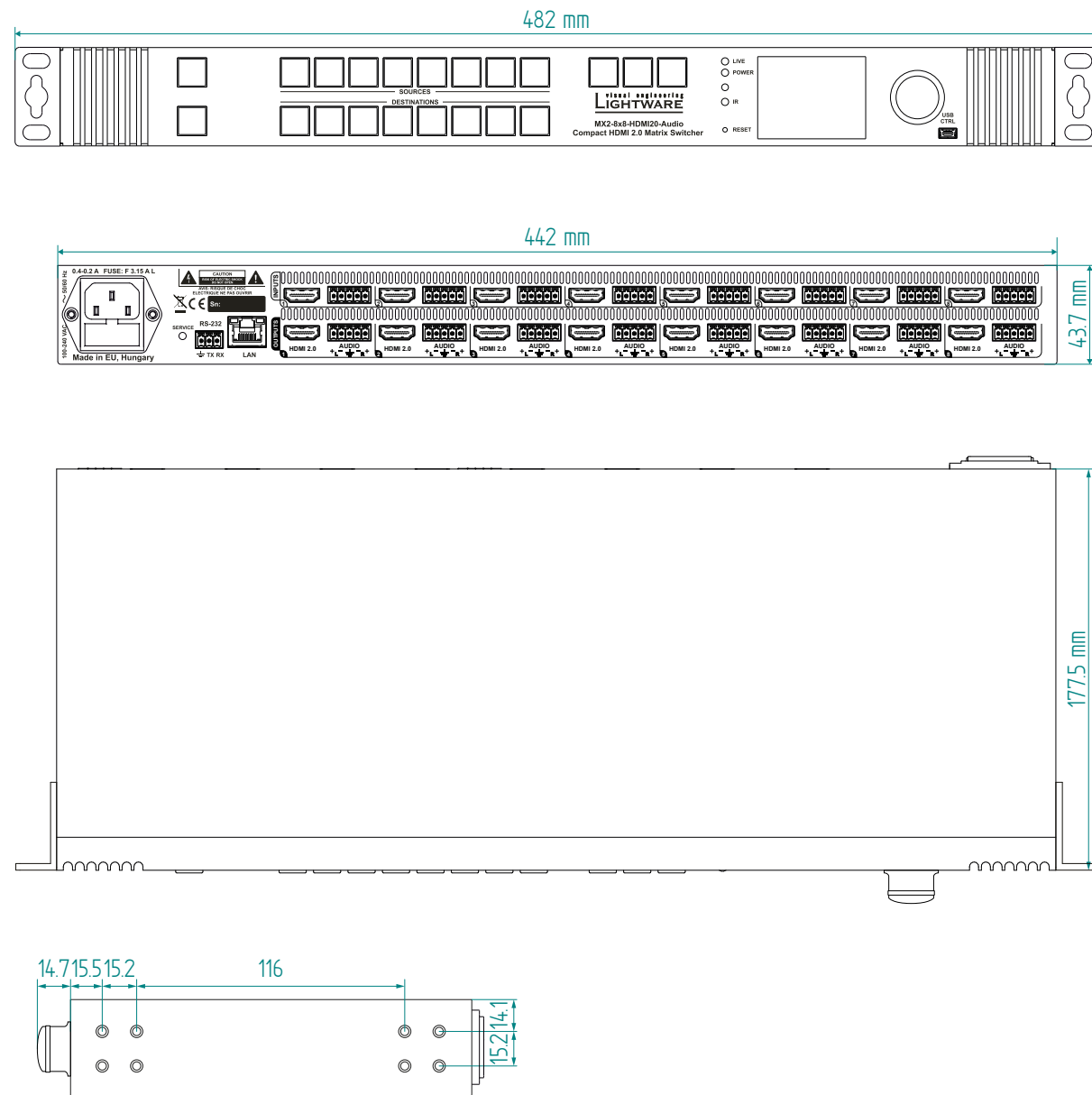
MX2-8x8-HDMI20-Audio-L

INFO: MX2-4x4-HDMI20-CA, MX2-8x4-HDMI20-CA, MX2-8x8-HDMI20-L, -CA, MX2-8x8-DH-4DPi-A; MX2-8x8-DH-8DPi-A models have the same size.
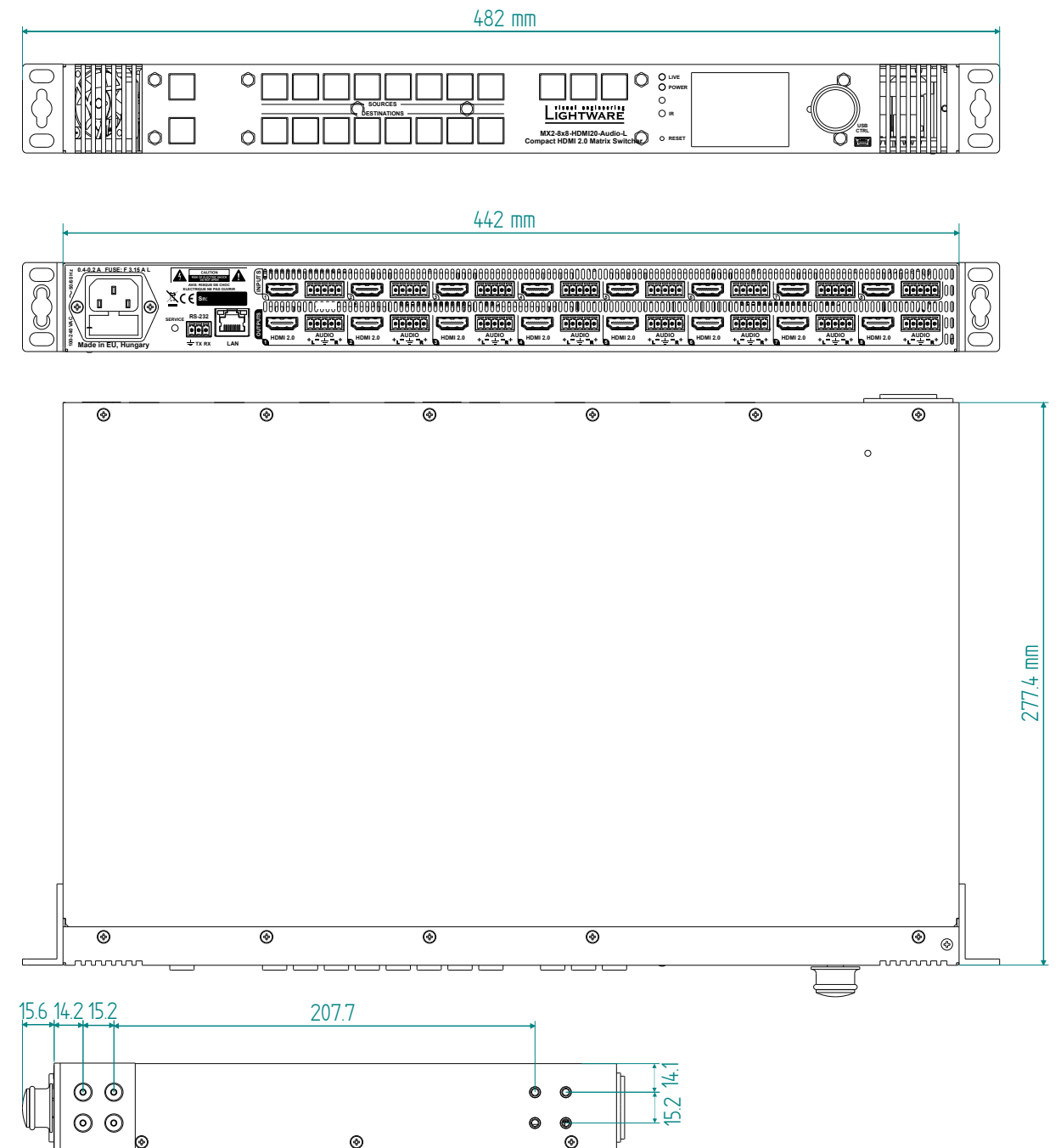
MX2-16x16-HDMI20-Audio-R

INFO: The 2 RU-high models have the same size: MX2-16x8-HDMI20-Audio-R, MX2-16x16-HDMI20, -R, -Audio, -Audio-R; MX2-16x16-DH-8DPi-A-R
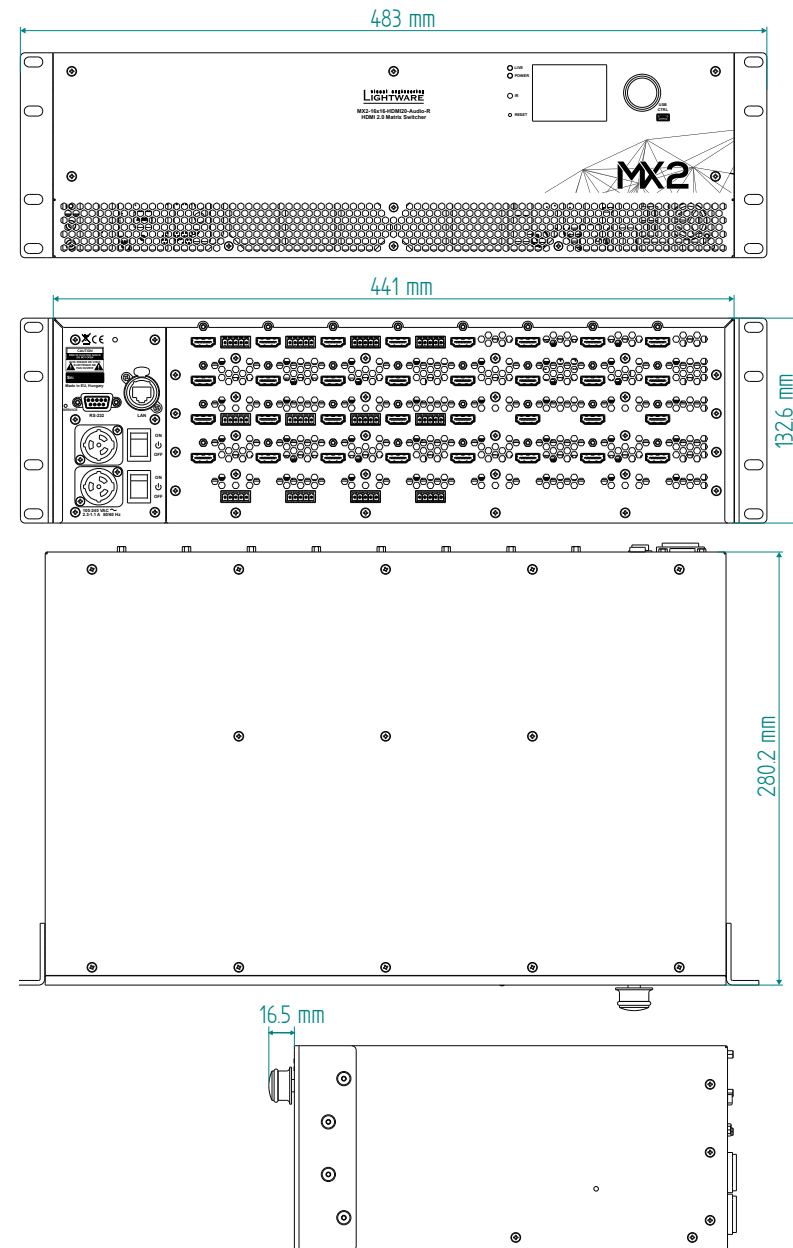
MX2-24x24-HDMI20-Audio-R

INFO: The 4 RU-high models have the same size: MX2-24x24-HDMI20, -R, -Audio, -Audio-R; MX2-24x24-DH-12DPi-R; -A-R
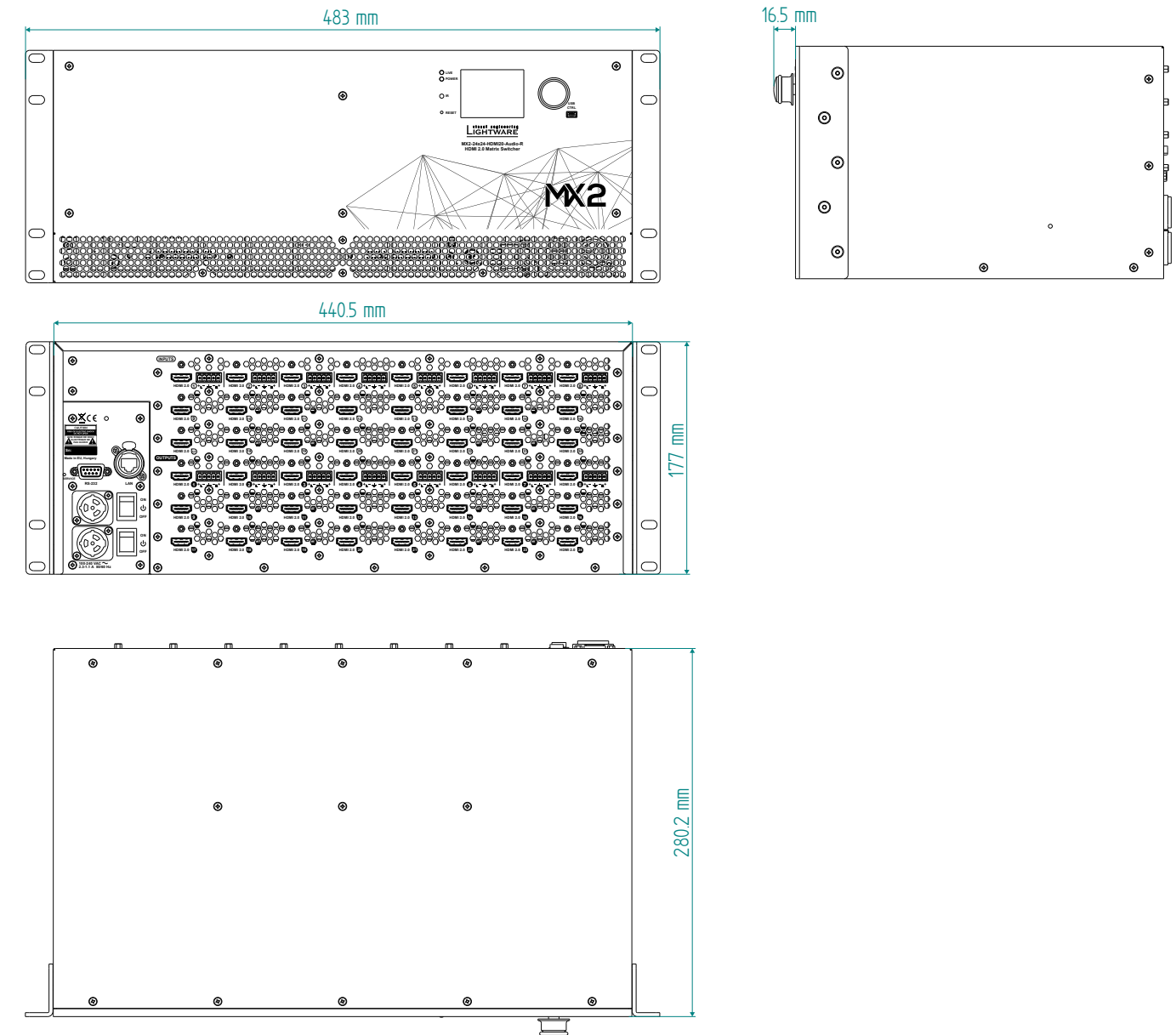
MX2-48x48-HDMI20-A-R

INFO: The 8 RU-high models have the same size:
MX2-32x32-HDMI20-A-R, MX2-32x32-DH-16DPi-A-R, MX2-48x48-HDMI20-A-R.
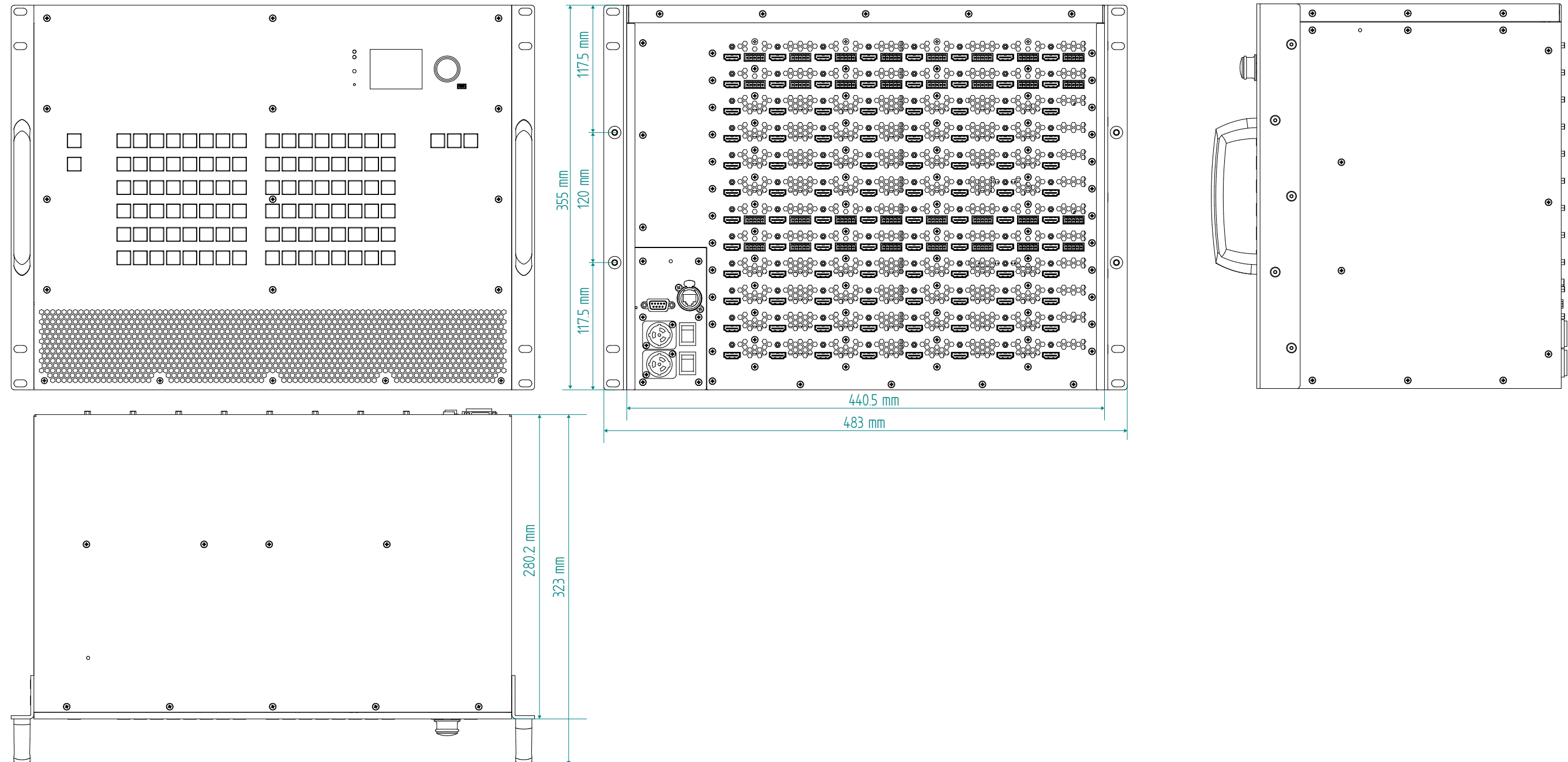
13.5. Cable Wiring Guide

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. Ligthware products are usually built with 5-pole Phoenix connectors so we would like to help users assembling their own audio cables. See the most common cases below.

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.

13.5.1. Serial Ports

The device is built with 3-pole Phoenix connector. See the examples below of connecting to a DCE (Data Circuit-terminating Equipment) or a DTE (Data Terminal Equipment) type device:

Lightware device and a DCE D-SUB 9 and Phoenix	Lightware device and a DTE D-SUB 9 and Phoenix
TX RX 5 1 9 6 2: TX data 3: RX data 5: Ground	TX RX 1 5 6 9 2: RX data 3: TX data 5: Ground
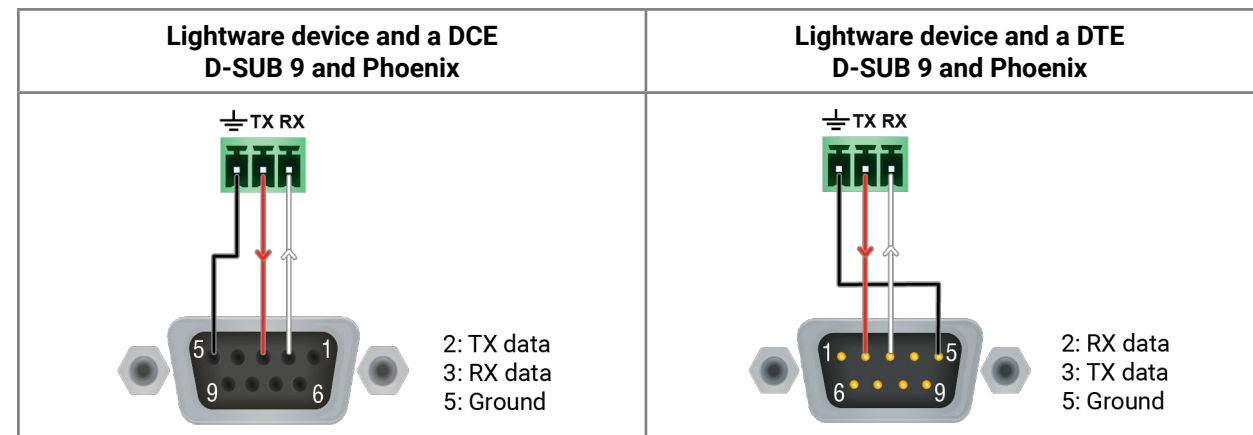
13.5.2. Audio Ports

The Pinout of the 5-pole Phoenix Connector

Pin nr.	Signal
1	Left+
2	Left-
3	Ground
4	Right-
5	Right+
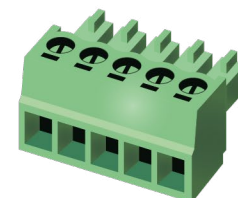
**From Unbalanced Output to Balanced Input**

2 x 6.3 (1/4") TS - Phoenix	2 x RCA - Phoenix	3.5 (1/8") TRS - Phoenix
AUDIO Input	AUDIO Input	AUDIO Input
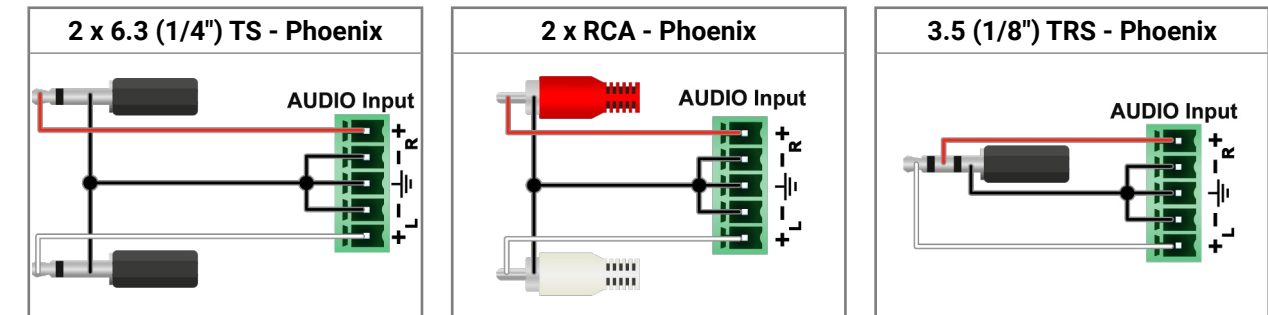
From Balanced Output to Unbalanced Input

Phoenix - 2 x 6.3 (1/4") TS	Phoenix - 2 x RCA	Phoenix - 3.5 (1/8") TRS
AUDIO Output	AUDIO Output	AUDIO Output

From Balanced Output to Balanced Input

Phoenix - 2 x 6.3 (1/4") TRS	Phoenix - 2 x XLR	2 x 6.3 TRS (1/4") - Phoenix
AUDIO Output	AUDIO Output	AUDIO Input
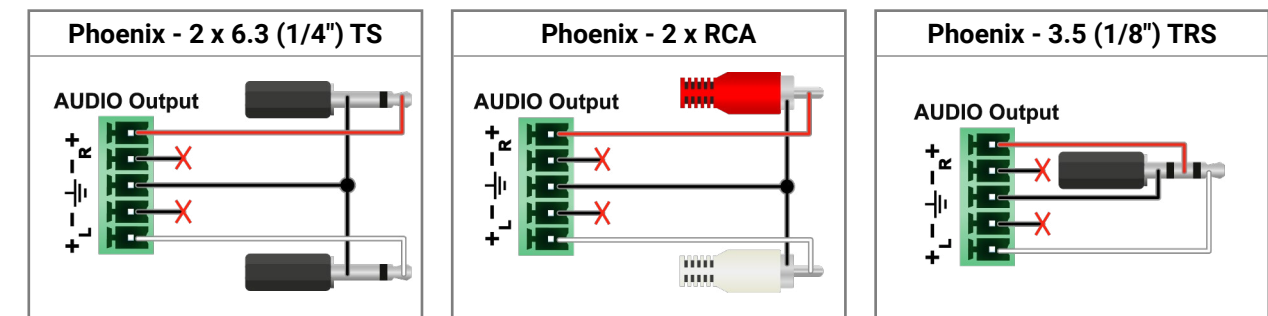
2 x XLR - Phoenix	Phoenix - Phoenix
AUDIO Input	AUDIO Output AUDIO Input
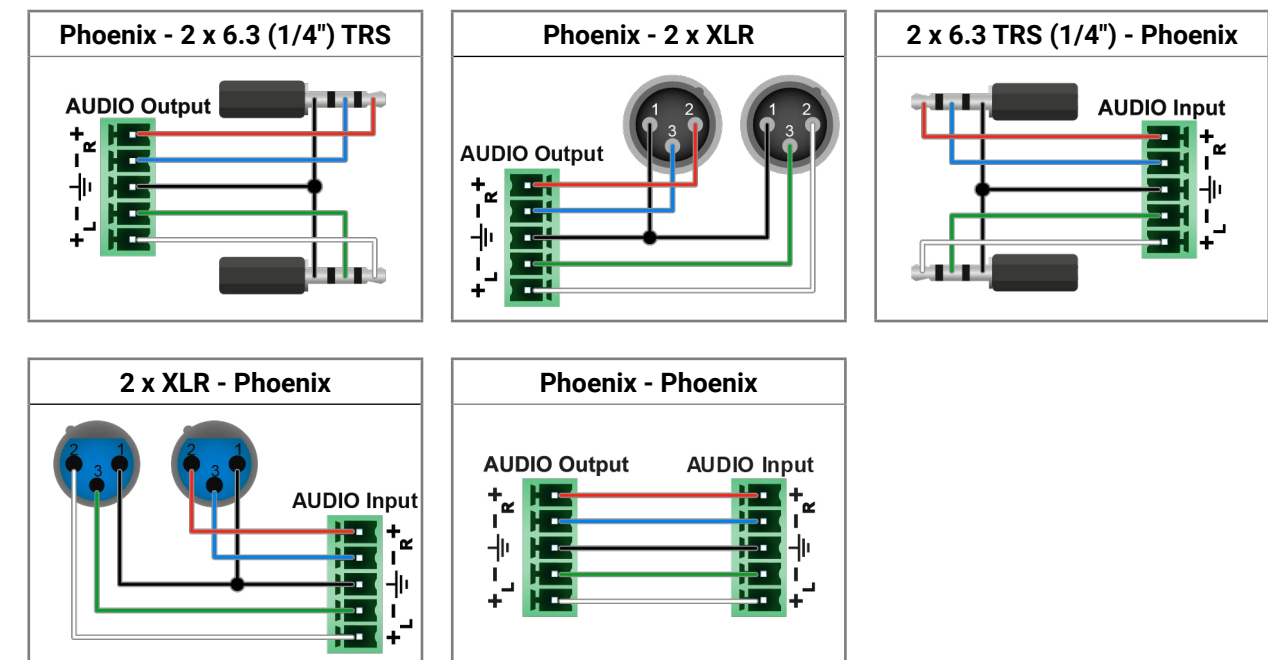
13.6. Factory EDID List

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

Mem.	Resolution	Type
F34	720 x 576 @ 50.00 Hz	H
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

Mem.	Resolution	Type
F110	3840 x 2160 @ 24.00 Hz	H
F111	3840 x 2160 @ 25.00 Hz	H
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	

Mem.	Resolution	Type
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
F148	3840 x 2160 @ 60.00 Hz	RB, ALL
F150	5120 x 1440p @ 29.97 Hz	H
F151	5120 x 2160p @ 29.97 Hz	H
F152	5120 x 2880p @ 29.97 Hz	H
F153	7680 x 1080p @ 59.94 Hz	H

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)

DI

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

13.7. Front and Rear Views with Port Numbering

13.7.1. MX2-4x4-HDMI20-CA

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-4	1-4	-	-	-	1-2

13.7.2. MX2-8x4-HDMI20-CA

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-8	1-4	-	-	1-2	1-2
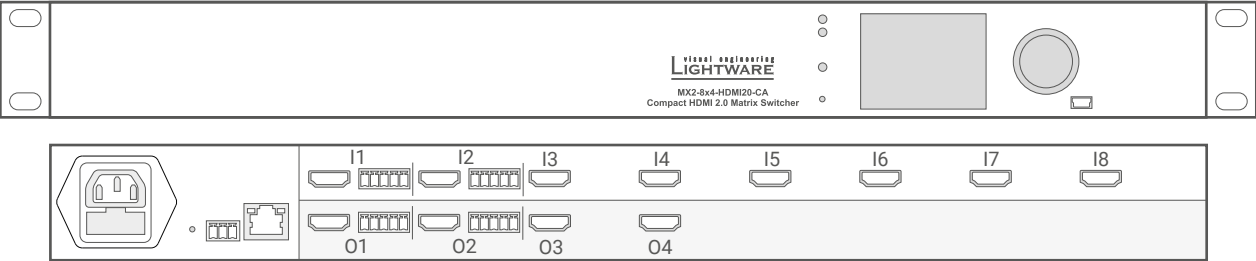
13.7.3. MX2-8x8-HDMI20-L

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-8	1-8	-	-	-	-

13.7.4. MX2-8x8-HDMI20-CA

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-8	1-8	-	-	1-2	1-2

13.7.5. MX2-8X8-HDMI20-Audio

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-8	1-8	-	-	1-8	1-8

13.7.6. MX2-8X8-HDMI20-Audio-L

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-8	1-8	-	-	1-8	1-8

13.7.7. MX2-8x8-DH-4DPi-A

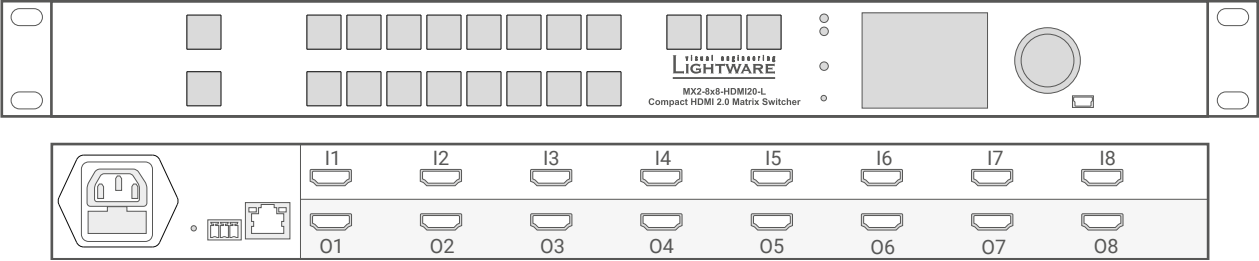| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
5-8	1-8	1-4	-	-	1-2

13.7.8. MX2-8x8-DH-4DPio-A

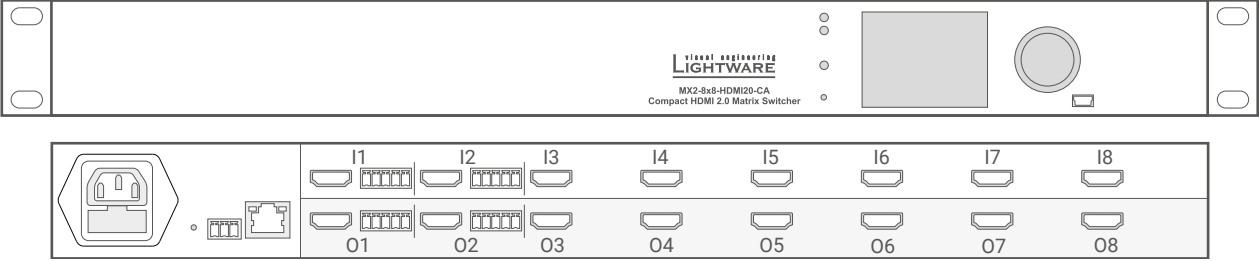| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-4	1-4	5-8	5-8	1-8	1-8

13.7.9. MX2-8x8-DH-8DPi-A

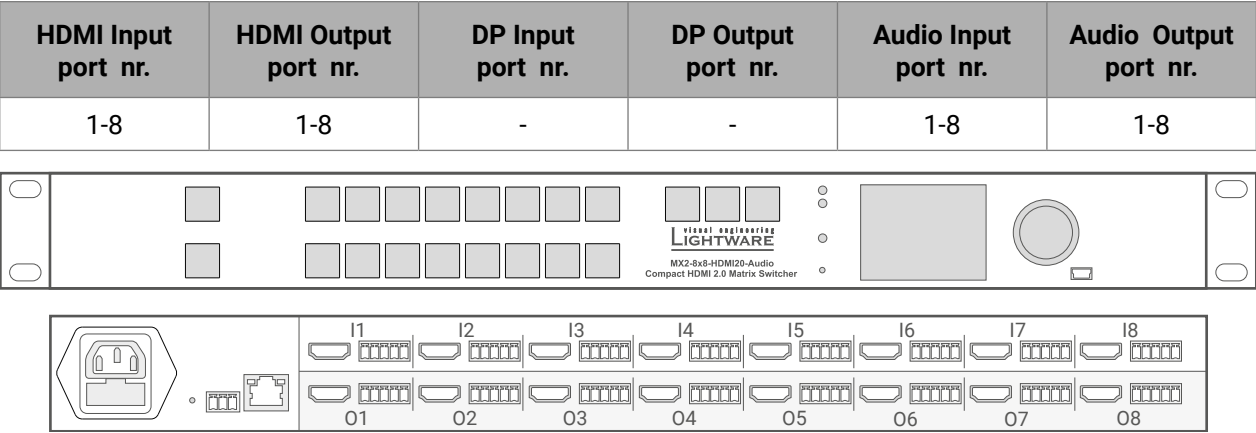| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
-	1-8	1-8	-	1-4	1-4

13.7.10. MX2-8x8-DH-8DPio-A

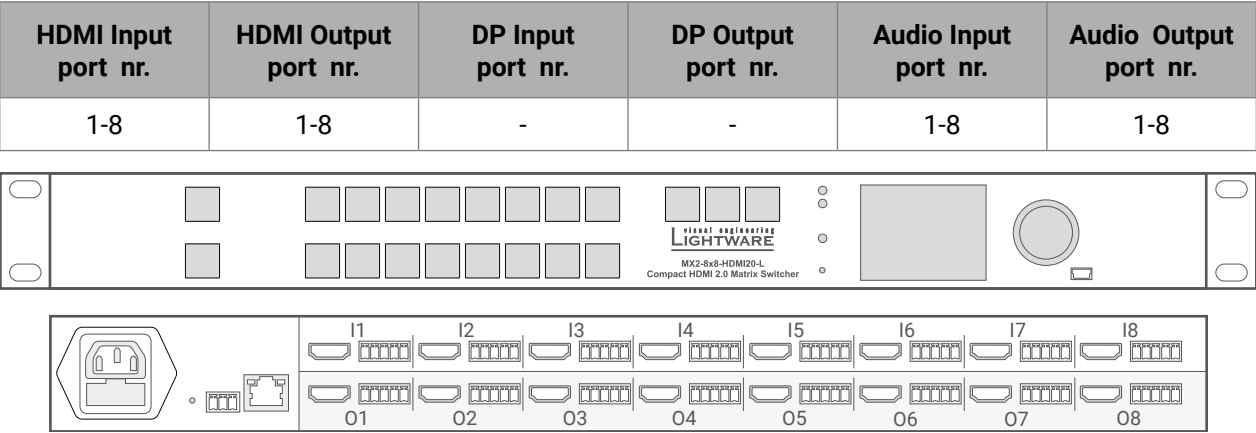| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
-	-	1-8	1-8	1-4	1-8

13.7.11. MX2-16x8-HDMI20-Audio-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-16	1-8	-	-	1-4	1-4, 9-12

13.7.12. MX2-16x16-HDMI20

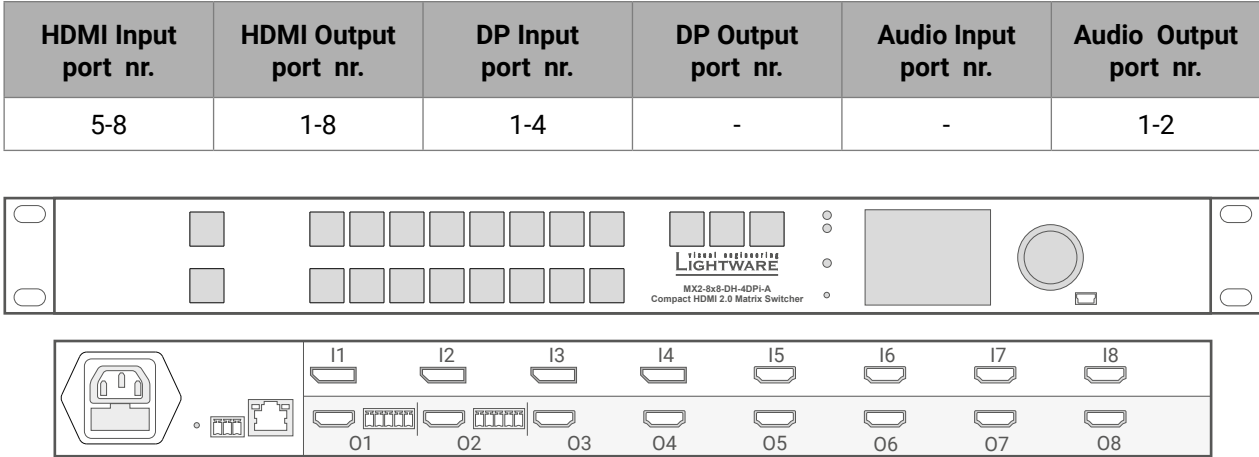| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-16	1-6	-	-	-	-

13.7.13. MX2-16x16-HDMI20-Audio

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-16	1-6	-	-	1-4	1-4; 17-20

13.7.14. MX2-16x16-HDMI20-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-16	1-16	-	-	-	-

13.7.15. MX2-16x16-HDMI20-Audio-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-16	1-16	-	-	1-4	1-4; 17-20

13.7.16. MX2-16x16-DH-8DPi-A-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
9-16	1-16	1-8	-	9-16	1-4; 17-20

13.7.17. MX2-24x24-HDMI20

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-24	1-24	-	-	-	-

13.7.18. MX2-24x24-HDMI20-Audio

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-24	1-24	-	-	1-8	1-8
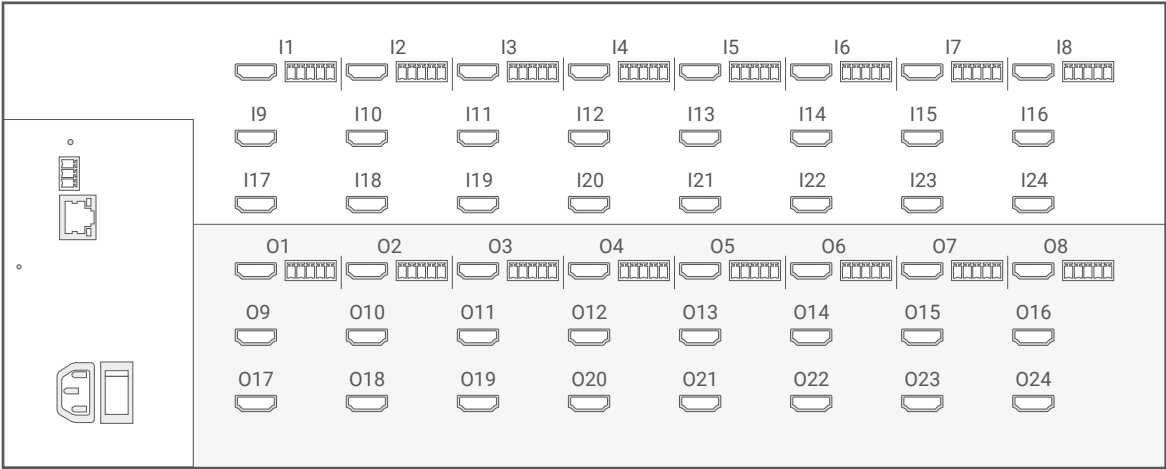
13.7.19. MX2-24x24-HDMI20-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-24	1-24	-	-	-	-

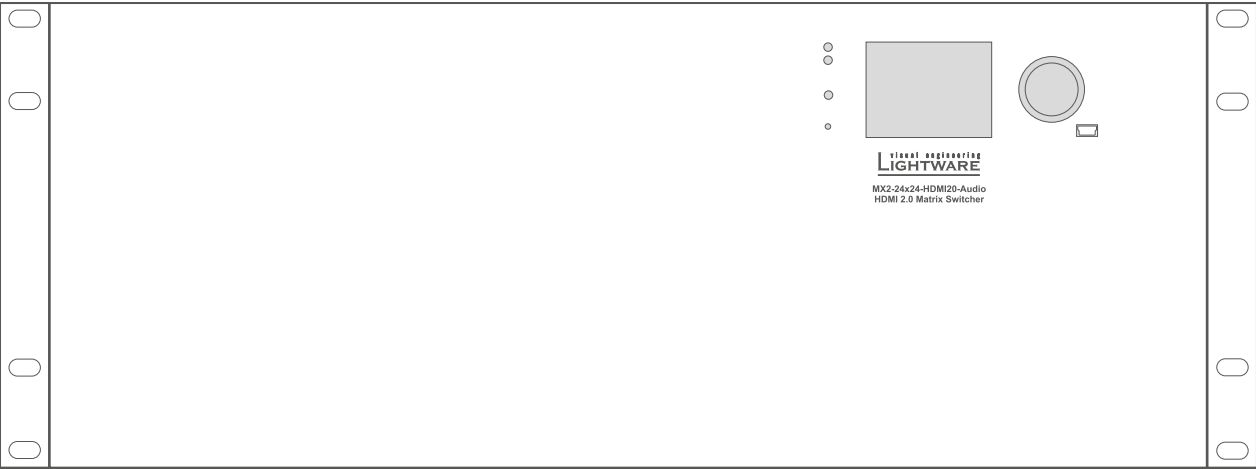### 13.7.20. MX2-24x24-HDMI20-Audio-R

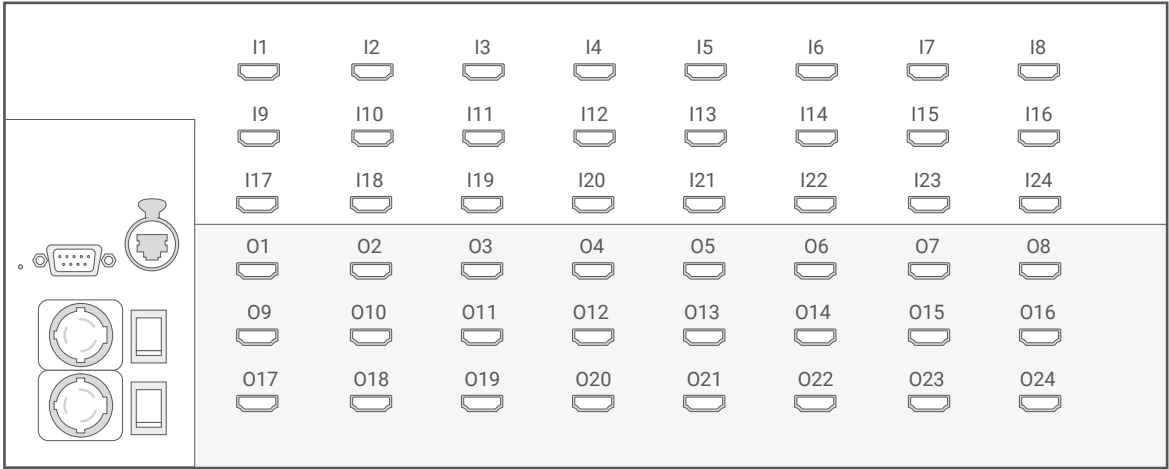| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-24	1-24	-	-	1-8	1-8

13.7.21. MX2-24x24-DH-12DPi-R

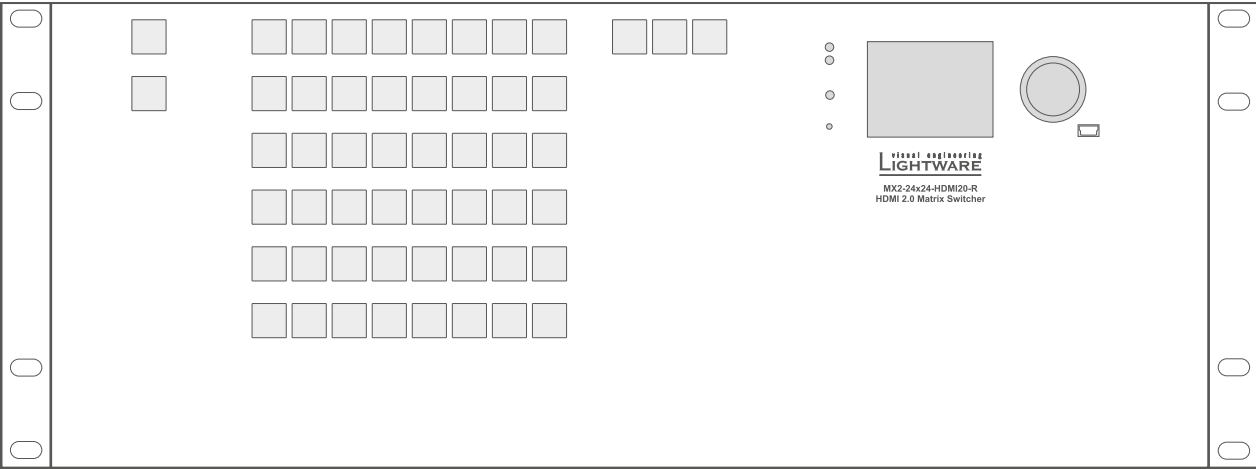| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
13-24	1-24	1-12	-	-	-

13.7.22. MX2-24x24-DH-12DPi-A-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
13-24	1-24	1-12	-	9-12; 17-24	1-8

13.7.23. MX2-24x24-DH-24DPio-A-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
-	-	1-24	1.24	1-8	1-24

13.7.24. MX2-32x32-HDMI20-A-R

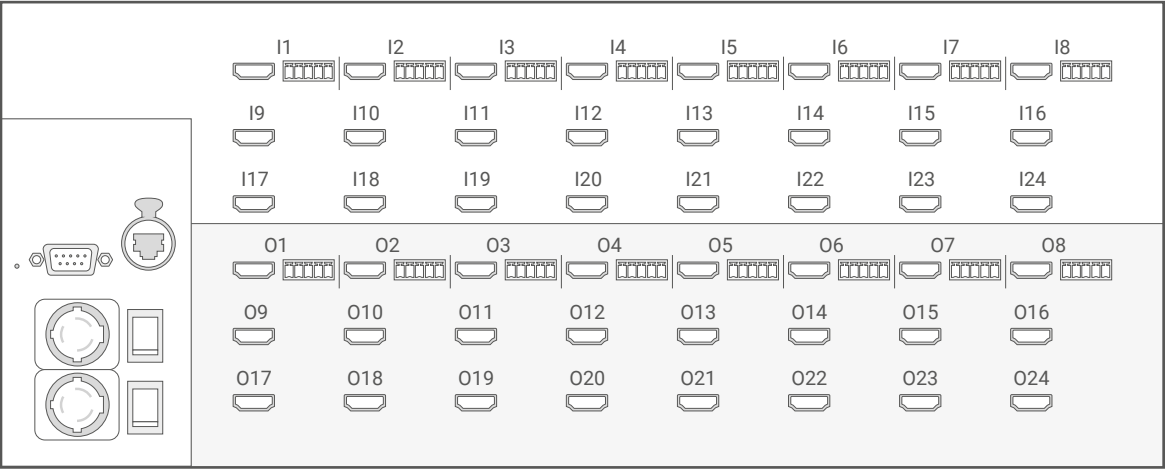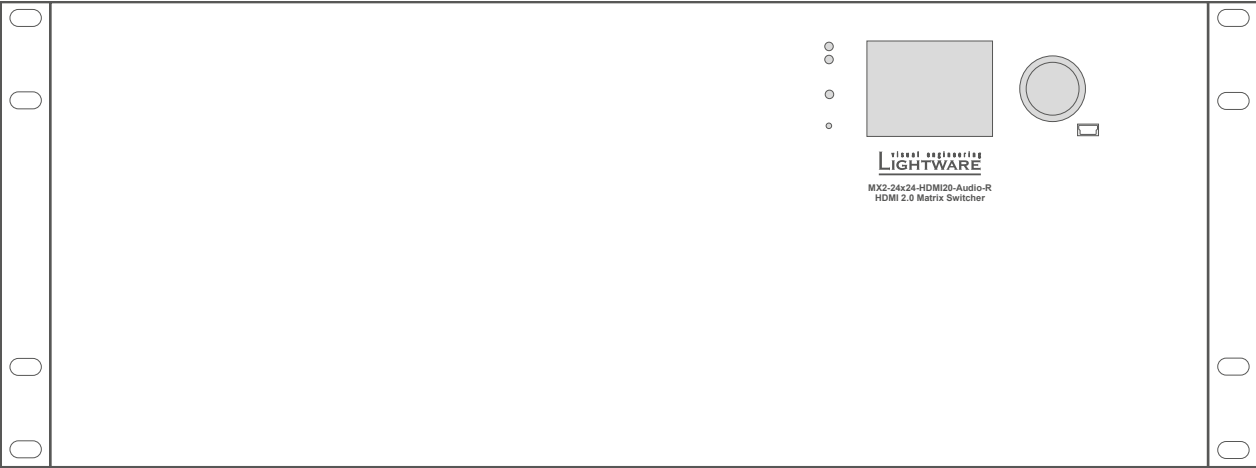| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-32	1-32	-	-	1-16	1-16; 33-40

13.7.25. MX2-32x32-DH-16DPi-A-R

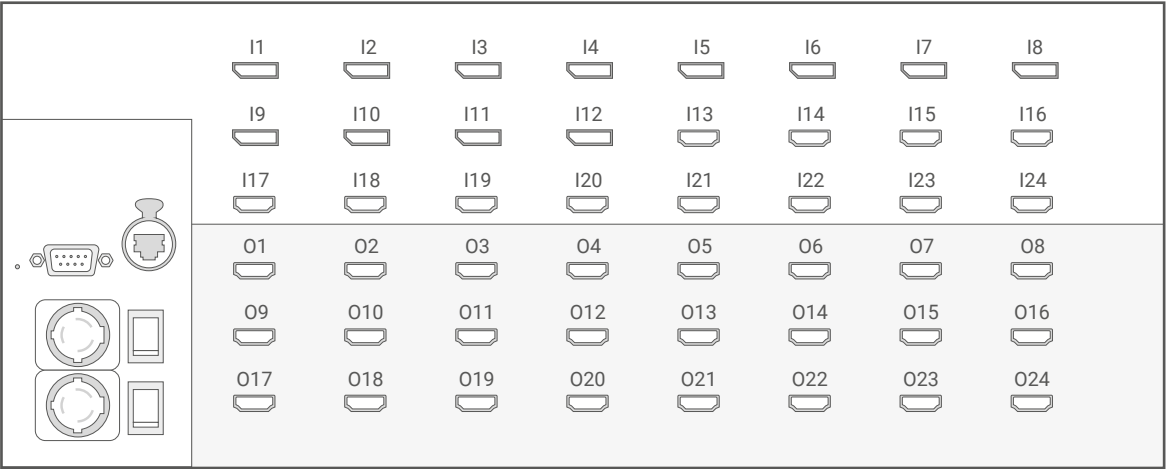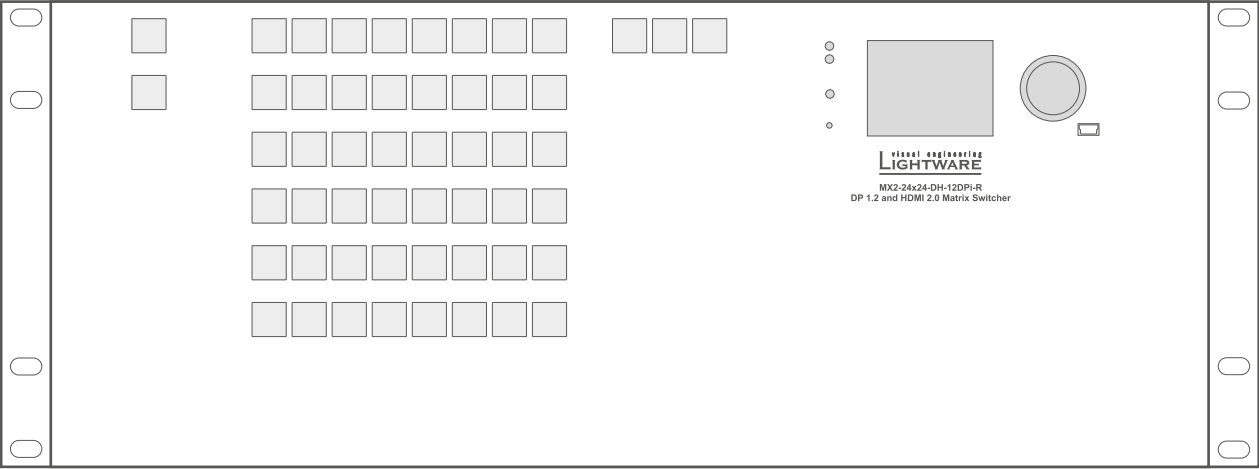| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
17-32	1-32	1-16	-	9-12; 17-24	1-16; 33-40

13.7.26. MX2-48x48-HDMI20-A-R

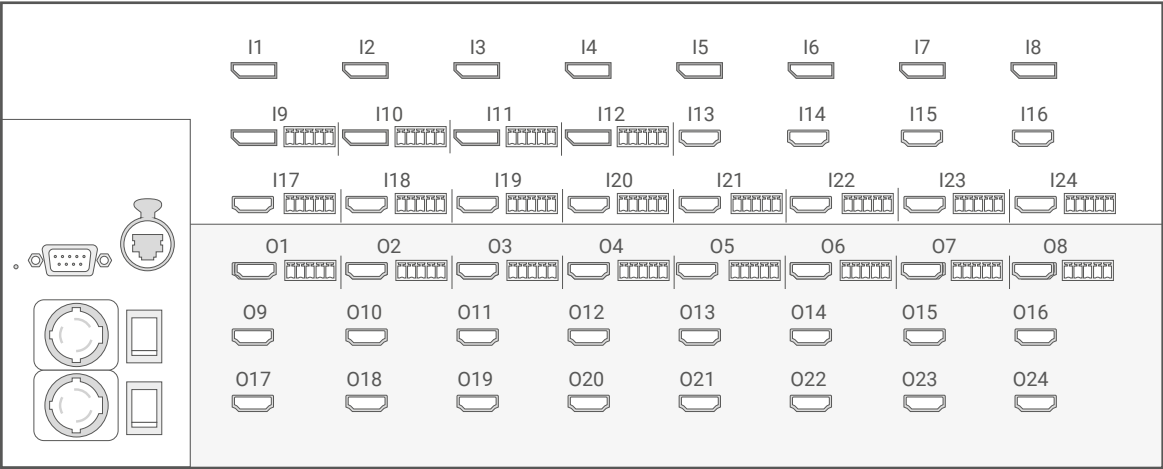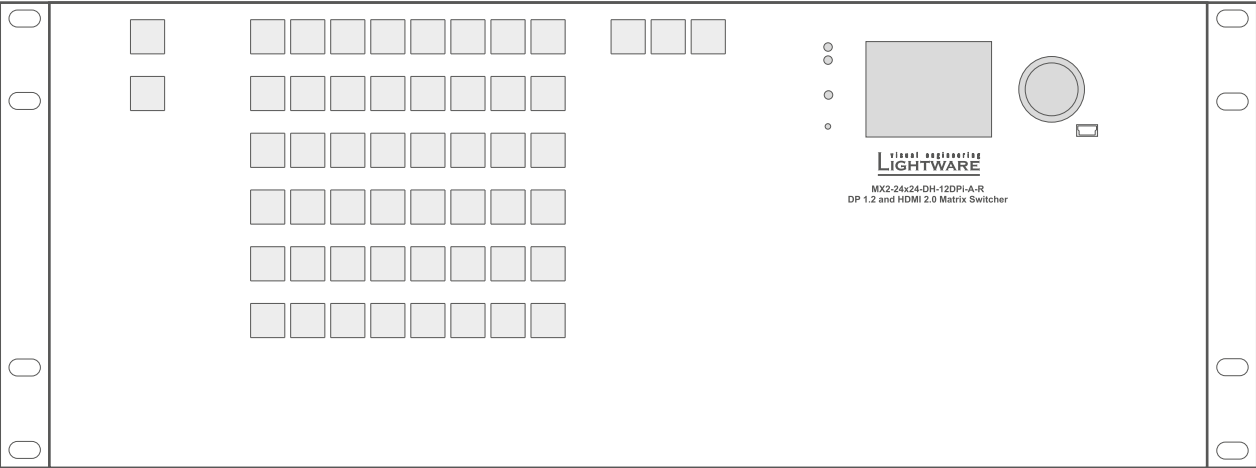| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
1-48	1-48	-	-	1-16	1-16

13.7.27. MX2-48x48-DH-24DPio-A-R

HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
25-48	25-48	1-24	1-24	1-8; 25-32	1-32

13.7.28. MX2-48x48-DH-48DPi-A-R

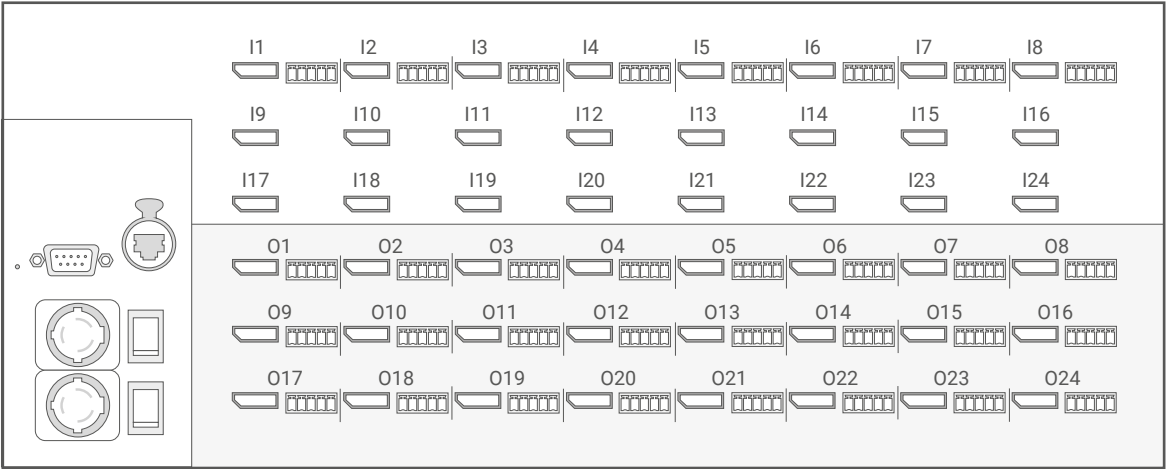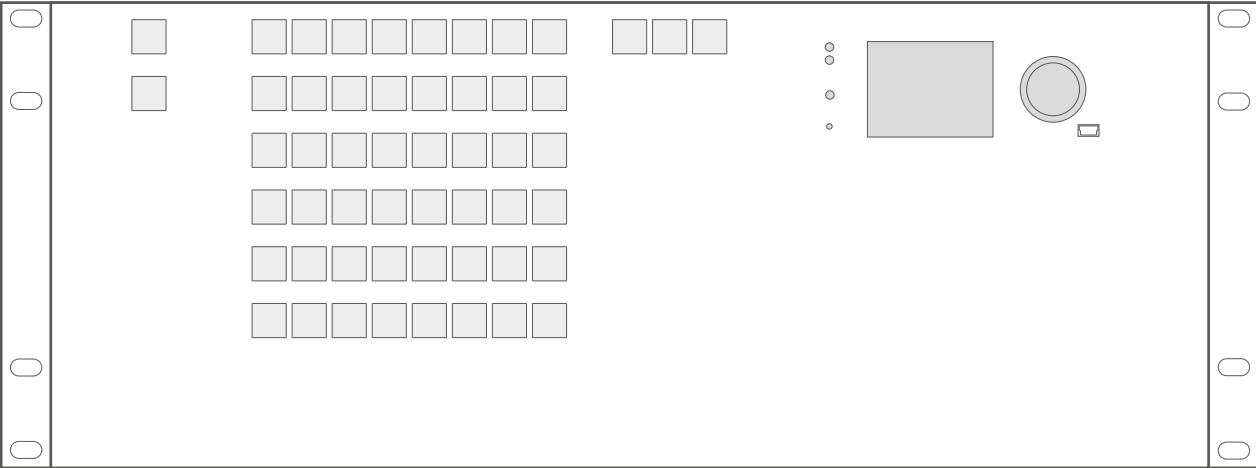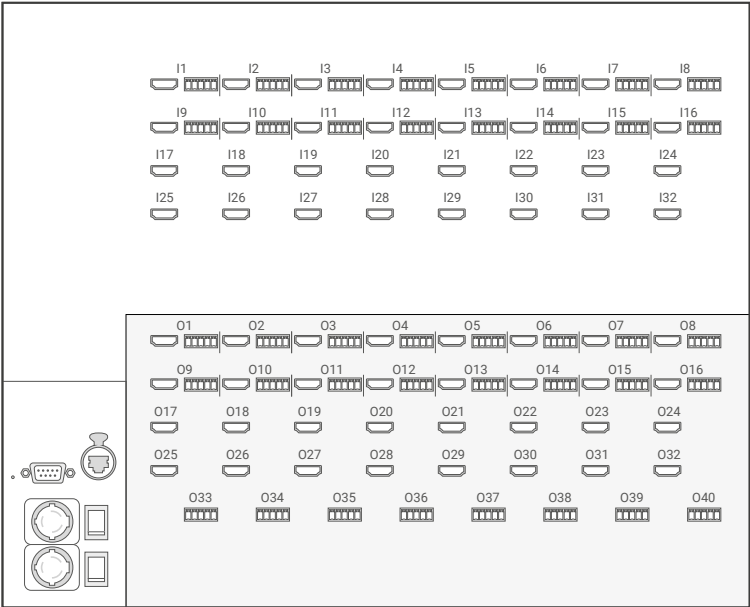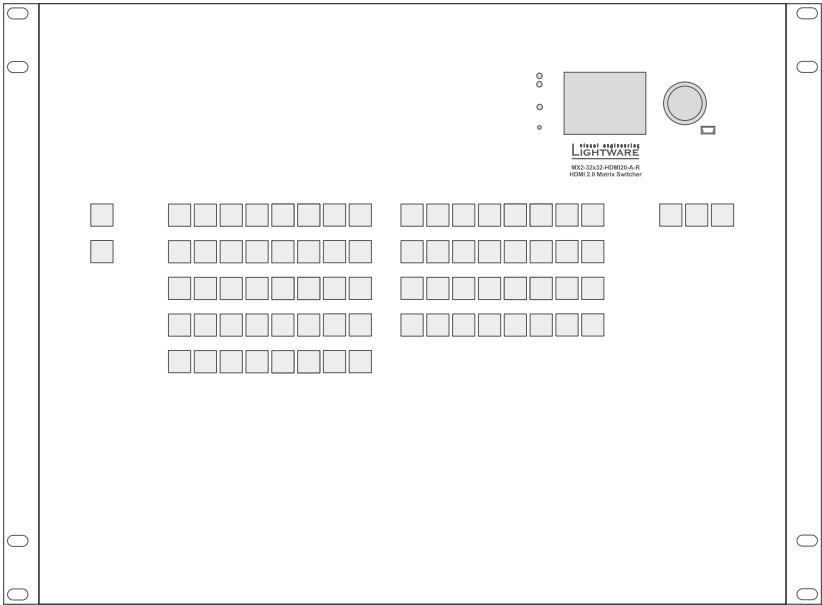| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
-	1-48	1-48	-	1-16	1-16

13.7.29. MX2-48x48-DH-48DPio-A-R

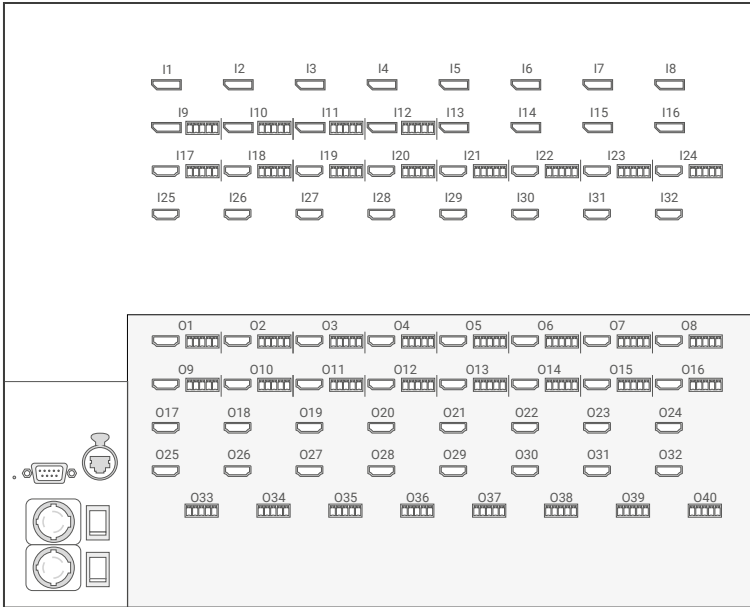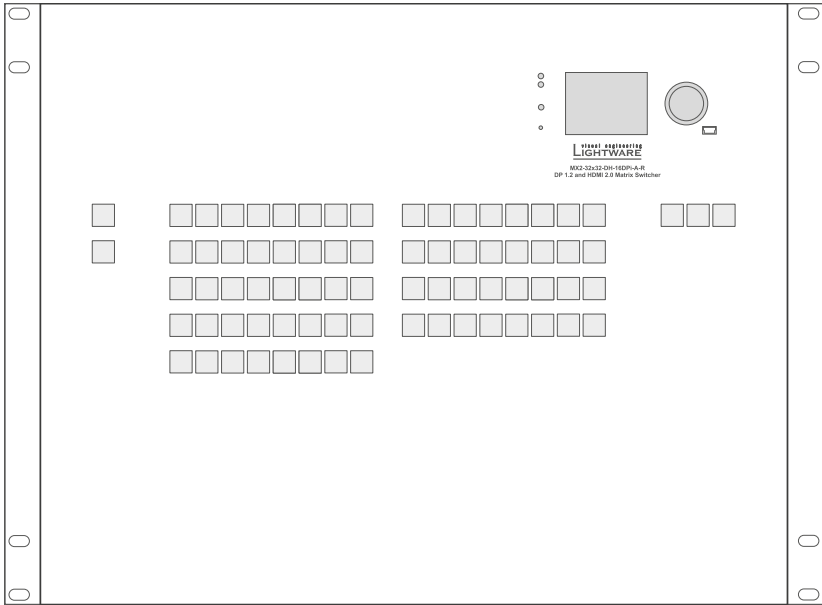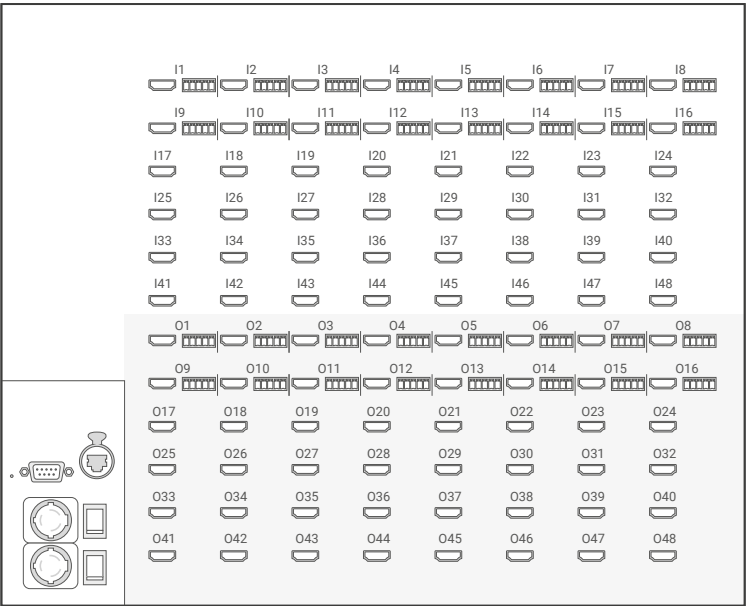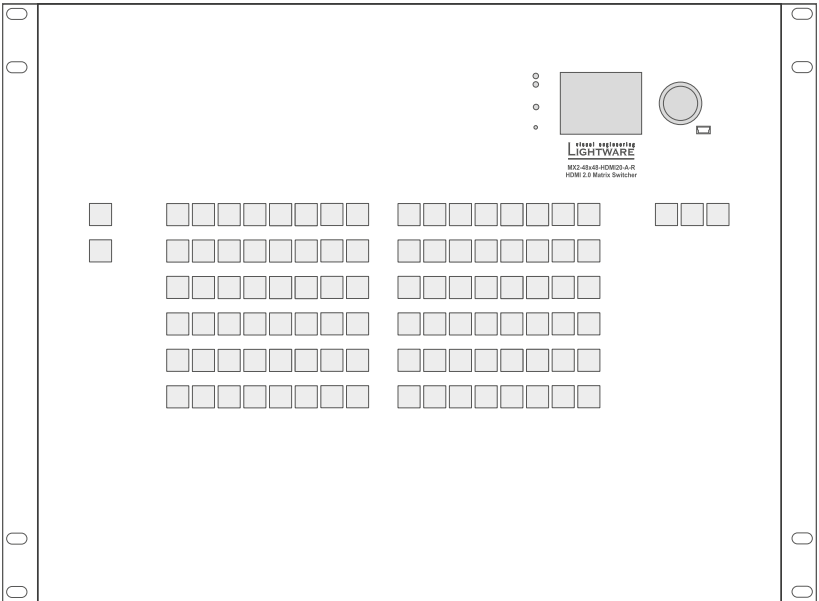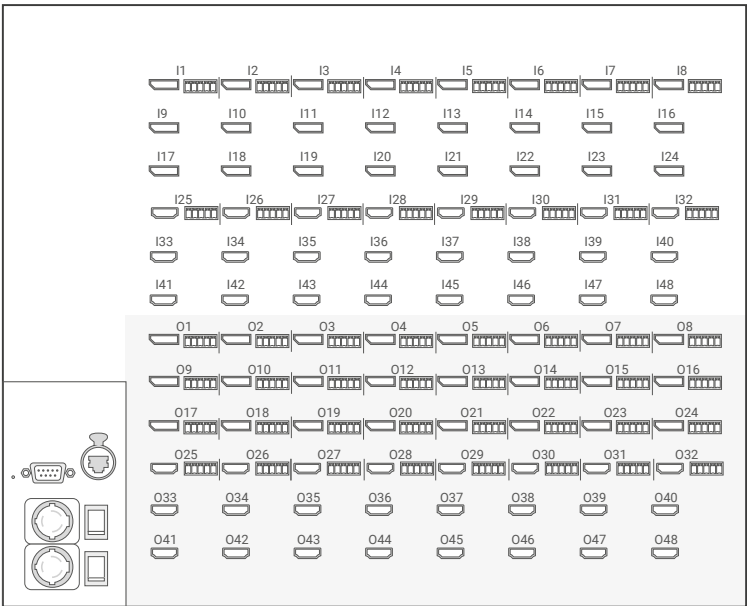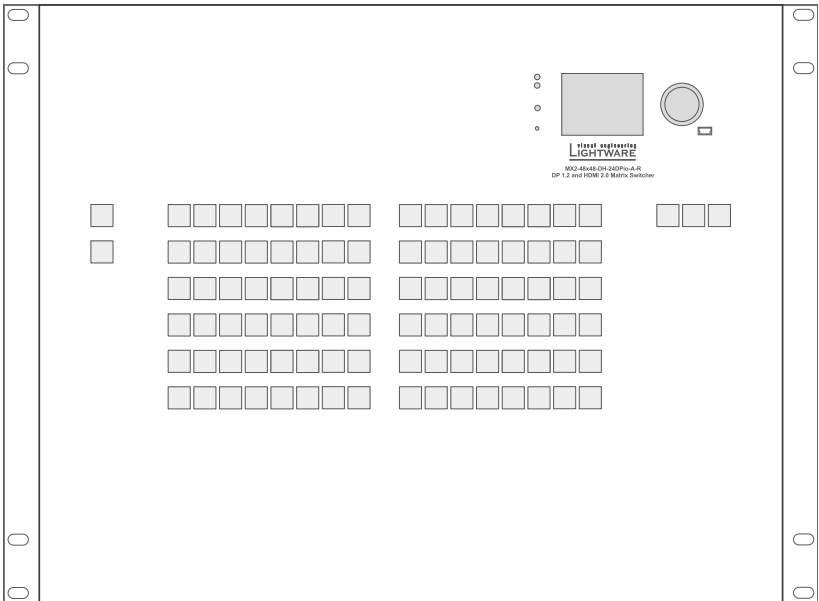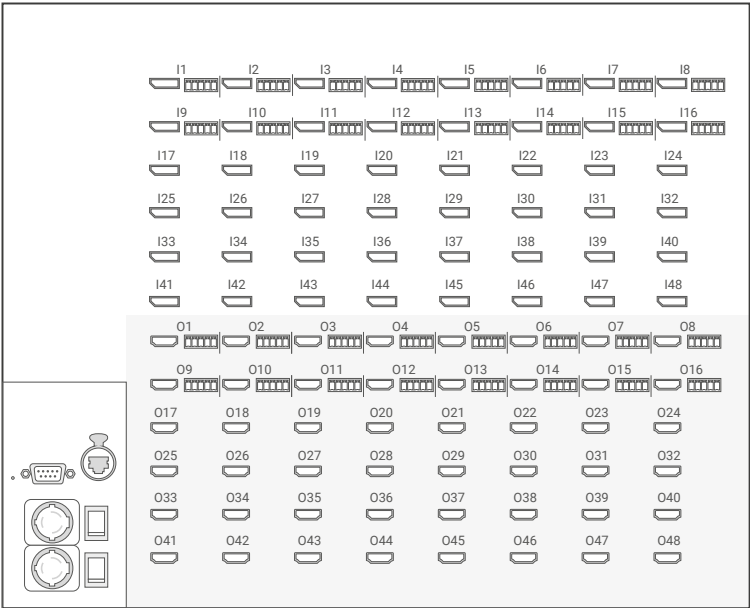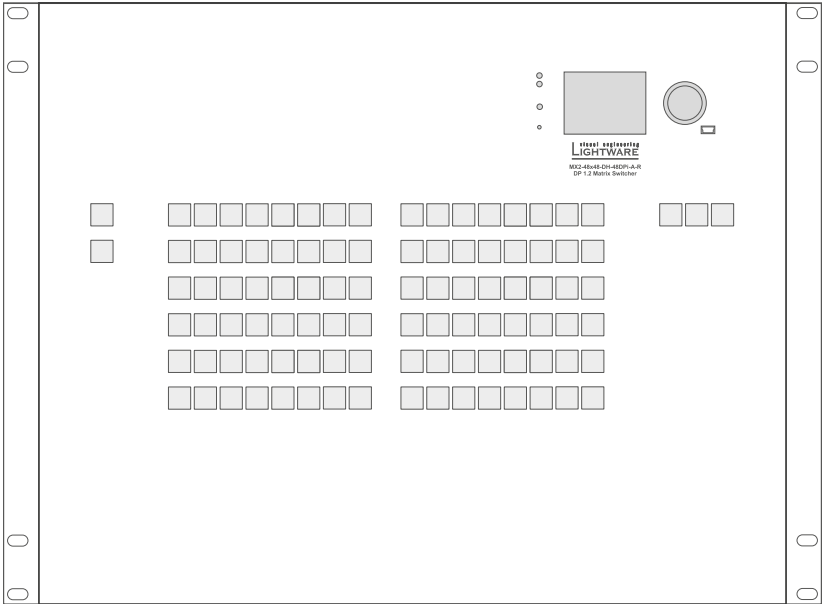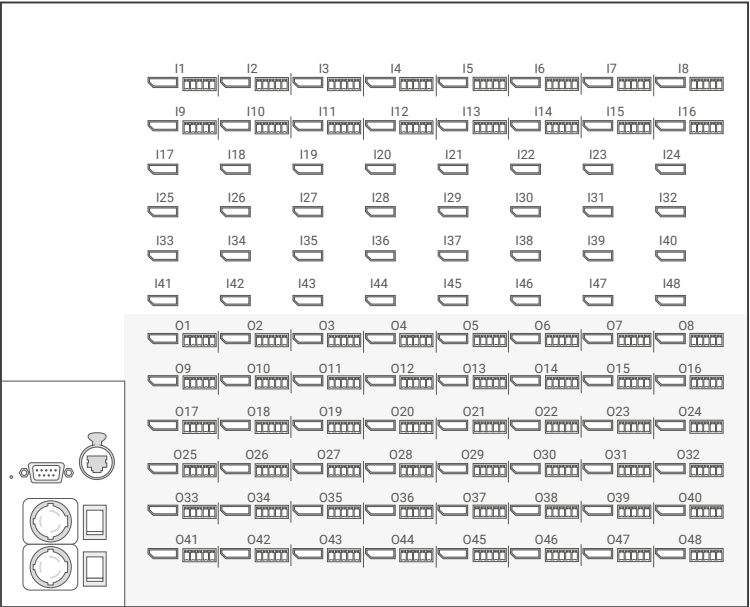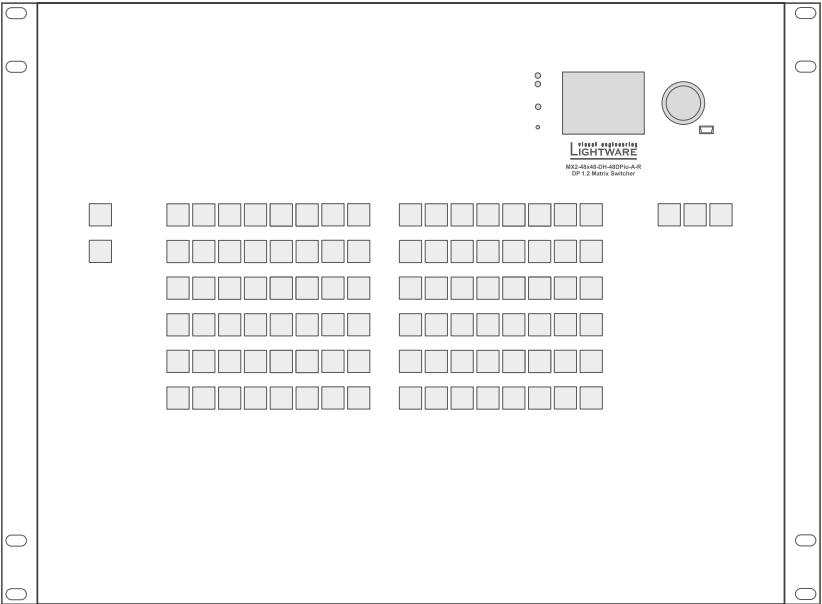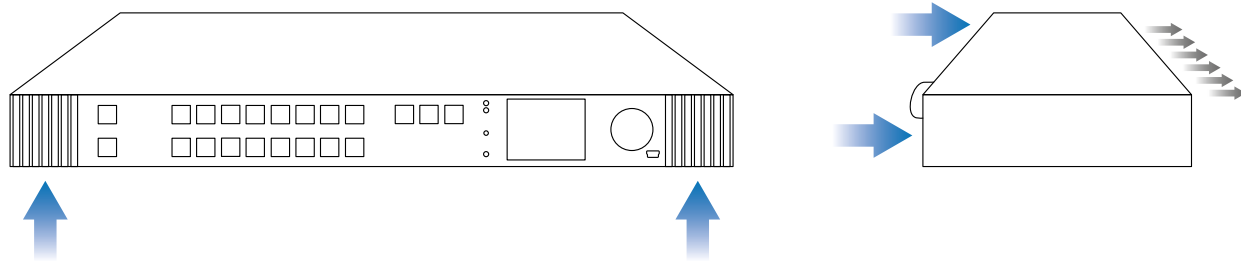| HDMI Input port nr.	HDMI Output port nr.	DP Input port nr.	DP Output port nr.	Audio Input port nr.	Audio Output port nr.
-	-	1-48	1-48	1-16	1-48

13.8. Direction of the Airflow

13.9. Firmware Release Notes

The list below shows the released firmware packages with important notes.

Legend

D: DVI EDID

H: HDMI EDID

U: Universal EDID, supporting many standard resolutions:

- **F29:** Universal EDID for DVI signals (no audio support).
- **F47:** HDMI EDID supporting PCM audio.
- **F48:** HDMI EDID supporting all type of audio.
- **F49:** HDMI EDID supporting all type of audio and deep color.
- **F89:** Universal EDID for analog signals (no audio support).
- **F118:** HDMI EDID supporting PCM audio and 4K@30 Hz signals.
- **F119:** HDMI EDID supporting all type of audio and 4K@30 Hz signals.

DiD (in column EDID features): with Display ID support

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

Mem	Resolution	Type	EDID features
F1	640 x 480p @ 60.00 Hz	D	DVI
F2	848 x 480p @ 60.00 Hz	D	DVI
F3	800 x 600p @ 60.32 Hz	D	DVI
F4	1024 x 768p @ 60.00 Hz	D	DVI
F5	1280 x 768p @ 50.00 Hz	D	DVI
F6	1280 x 768p @ 59.94 Hz	D	DVI
F7	1280 x 768p @ 75.00 Hz	D	DVI

Mem	Resolution	Type	EDID features
F8	1360 x 768p @ 60.02 Hz	D	DVI
F9	1280 x 1024p @ 50.00 Hz	D	DVI
F10	1280 x 1024p @ 60.02 Hz	D	DVI
F11	1280 x 1024p @ 75.02 Hz	D	DVI
F12	1400 x 1050p @ 50.00 Hz	D	DVI
F13	1400 x 1050p @ 60.00 Hz	D	DVI
F14	1400 x 1050p @ 75.00 Hz	D	DVI
F15	1680 x 1050p @ 60.00 Hz	D	DVI
F16	1920 x 1080p @ 50.00 Hz	D	DVI
F17	1920 x 1080p @ 60.00 Hz	D	DVI
F18	2048 x 1080p @ 50.00 Hz	D	DVI
F19	2048 x 1080p @ 60.00 Hz	D	DVI
F20	1600 x 1200p @ 50.00 Hz	D	DVI
F21	1600 x 1200p @ 60.00 Hz	D	DVI
F22	1920 x 1200p @ 50.00 Hz	D	DVI
F23	1920 x 1200p @ 59.56 Hz	D	DVI
F24	2048 x 1200p @ 59.96 Hz	D	DVI
F29	1920 x 1080p @ 60.00 Hz	U	DVI
F30	1440 x 480i @ 60.05 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F31	1440 x 576i @ 50.08 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F32	640 x 480p @ 59.95 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F33	720 x 480p @ 59.94 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F34	720 x 576p @ 50.00 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F35	1280 x 720p @ 50.00 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F36	1280 x 720p @ 60.00 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F37	1920 x 1080i @ 50.04 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F38	1920 x 1080i @ 50.00 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F39	1920 x 1080i @ 60.05 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F40	1920 x 1080i @ 60.05 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F41	1920 x 1080p @ 24.00 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F42	1920 x 1080p @ 25.00 Hz	H	HDMI; YUV444; YUV422; 2CH_AUD

Mem	Resolution		Type	EDID features
F43	1920 x 1080p @ 30.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F44	1920 x 1080p @ 50.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F45	1920 x 1080p @ 59.94	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F46	1920 x 1080p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F47	1920 x 1080p @ 60.00	Hz	U	HDMI; YUV444; YUV422; 2CH_AUD
F48	1920 x 1080p @ 60.00	Hz	U	HDMI; YUV444; YUV422; 8CH_AUD
F49	1920 x 1080p @ 60.00	Hz	U	HDMI; YUV444; YUV422; DC30; DC36; YUVDC; 8CH_AUD
F98	1280 x 720p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD; 3D
F99	1920 x 1080p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD; 3D
F100	1024 x 768p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F101	1280 x 1024p @ 50.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F102	1280 x 1024p @ 60.02	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F103	1280 x 1024p @ 75.02	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F104	1600 x 1200p @ 50.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F105	1600 x 1200p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F106	1920 x 1200p @ 59.56	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F107	2560 x 1440p @ 59.95	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F108	2560 x 1600p @ 59.86	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F109	3840 x 2400p @ 24.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F110	3840 x 2160p @ 24.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F111	3840 x 2160p @ 25.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F112	3840 x 2160p @ 30.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F118	3840 x 2160p @ 30.00	Hz	U	HDMI; YUV444; YUV422; 2CH_AUD
F119	3840 x 2160p @ 30.00	Hz	U	HDMI; YUV444; YUV422; 8CH_AUD
F120	3840 x 2160p @ 60.00	Hz	H	HDMI; YUV444; YUV422; YUV420; 2CH_AUD
F121	1440 x 1080p @ 59.91	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F122	2560 x 2048p @ 59.98	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F123	1280 x 800p @ 59.91	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F124	1440 x 900p @ 59.90	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F125	1366 x 768p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD

Mem	Resolution		Type	EDID features
F126	1600 x 900p @ 59.98	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F127	2048 x 1080p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F128	2560 x 1080p @ 60.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F129	3440 x 1440p @ 24.99	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F130	3440 x 1440p @ 29.99	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F131	4096 x 2160p @ 25.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F132	4096 x 2160p @ 30.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F133	4096 x 2160p @ 60.00	Hz	4	HDMI; YUV444; YUV422; YUV420; 2CH_AUD
F134	3440 x 1440p @ 23.99	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F135	4096 x 2160p @ 24.00	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F136	3840 x 2400p @ 29.99	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F137	3840 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; 2CH_AUD
F138	3840 x 2160p @ 50.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; 2CH_AUD
F139	3840 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; YUV420; 2CH_AUD
F140	3840 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; YUV420; 8CH_AUD
F141	4096 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; 2CH_AUD
F142	4096 x 2160p @ 50.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; 2CH_AUD
F143	4096 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; YUV420; 2CH_AUD
F144	4096 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; YUV420; 8CH_AUD
F145	2560 x 2048p @ 49.97	Hz	H	HDMI; YUV444; YUV422; 2CH_AUD
F146	3840 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV420; DC30; DC36; YUVDC; YUV420_DC30; YUV420_DC36; 2CH_AUD; HDR
F147	3840 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; 2CH_AUD
F148	3840 x 2160p @ 60.00	Hz	H	HDMI; HDMI2; YUV444; YUV422; 8CH_AUD
F150	5120 x 1440p @ 29.97	Hz	H	HDMI; HDMI2; 8CH_AUD; HDR; DiD
F151	5120 x 2160p @ 29.97	Hz	H	HDMI; HDMI2; 8CH_AUD; HDR; DiD
F152	5120 x 2880p @ 29.97	Hz	H	HDMI; HDMI2; 8CH_AUD; HDR; DiD
F153	7680 x 1080p @ 59.94	Hz	H	HDMI; HDMI2; 8CH_AUD; HDR; DiD

13.10. Hashtag Keyword List

This user's manual contains keywords with hashtag (#) to help you to find the relevant information as quick as possible.

The format of the keywords is the following:

#<keyword>

The usage of the keywords: use the **Search** function (Ctrl+F / Cmd+F) of your PDF reader application, type the # (hashtag) character and the wished keyword.

The **#new** special keyword indicates a new feature/function or model that has just appeared in the latest firmware or software version.

Example

#dhcp

This keyword is placed at the DHCP (dynamic IP address) setting in the front panel operation, the Lightware Device Controller (LDC) and the LW3 programmer's reference section.

The following list contains all hashtag keywords placed in the document with a short description belonging to them. The list is in **alphabetical order** by the hashtag keywords.

Hashtag Keyword ↓ᵃ	Description
Tag	Description
#advancedview	Advanced view window
#analogaudio	Analog audio related settings
#audio	Audio related settings
#autotakemode	Autotake mode
#balance	Balance (for analog audio) setting
#builtinweb	Built-in web
#button	Front panel button operations
#cec	CEC related settings
#colorspace	Color space converter related settings
#controllock	Front panel control lock
#controlprotocol	Control protocol (LW2 / LW3) query
#crosspoint	Crosspoint switch setting
#date	Date setting
#devicelabel	Device label
#dhcp	Dynamic IP address (DHCP) setting
#dppower	DisplayPort power setting
#edid	EDID related settings

Hashtag Keyword ↓ᵃ	Description
#firmwareversion	Firmware version query
#framedetector	Frame detector in LDC/built-in web
#gain	Gain (for analog audio) setting
#gridview	Grid view in LDC
#hdcp	HDCP-encryption related setting
#hdr	High Dynamic Range (HDR) related information
#ipaddress	IP address related settings
#label	Device label
#linktraining	DP link training setting
#lock	Port lock settings
#mute	Port mute setting
#network	Network (IP address) related settings
#new	New feature/function of the product
#nosyncscreen	Test pattern (no sync screen) settings
#outputlock	Front panel output lock
#power	Power supply and redundancy related information
#power5v	HDMI 5V power mode setting
#preset	Preset related settings
#reboot	Restarting the device
#redundancy	Power supply and redundancy related information
#reset	Restarting the device
#restart	Restarting the device
#rs232	RS-232 related settings
#rs-232	RS-232 related settings
#scrambling	Scrambling setting
#serial	RS-232 related settings
#standby	Standby power mode setting
#status	Status query
#switch	Crosspoint switch setting
#takemode	Take mode
#terminal	Advanced view window
#testpattern	Test pattern (no sync screen) settings
#tileview	Tile view in LDC
#time	Time setting

Hashtag Keyword ↓ᵃᵤ	Description
#unlock	Port unlock settings
#unmute	Port unmute setting
#volume	Volume (for analog audio) setting
#web	Built-in web

13.11. Further Information

Limited Warranty Statement

1. Lightware Visual Engineering PLC (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 product's warranty period.

Document Revision History

Rev.	Release date	Changes	Editor
1.0	20-12-2016	Initial Version	Laszlo Zsedenyi
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2.17	08-07-2022	Changes in the Box contents section	Tamas Forgacs
2.18	06-10-2022	Minor corrections for HTML export	Laszlo Zsedenyi
2.19	04-11-2022	Fixed AV port diagram, minor corrections	Tamas Forgacs

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