

MX8x4DVI-Pro
MX8x8DVI-Pro



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 apparatus shall not be exposed to dripping or splashing and that no objects filled with liquids, such as vases, shall be placed on the apparatus. No naked flame sources, such as lighted candles, should be placed on the apparatus.

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

Ventilation

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

WARNING

To prevent injury, the apparatus is recommended to securely attach to the floor/wall or mount in accordance with the installation instructions.

WEEE (Waste Electrical & Electronic Equipment)

Correct Disposal of This Product



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.

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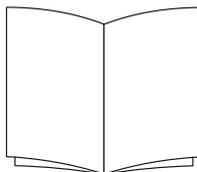
1. Introduction

Thank You for choosing Lightware MX8x8 matrix switcher. The product has 8 DVI inputs which can be routed to the 8 DVI outputs in any combination. The router conforms to DVI 1.0 specification, and switches signals between 25 - 165 MHz pixel clock frequency: from 640x480@60Hz to 1920x1200@60Hz or 2048x1080@60Hz PC resolutions, including HDTV resolutions as well. Each input signal is equalized for distances of 50 meter high quality 24AWG cable and each output is reclocked for jitter free signal transmission.

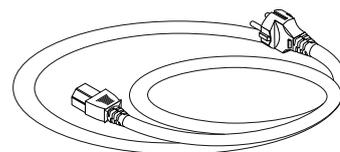
1.1. Box contents



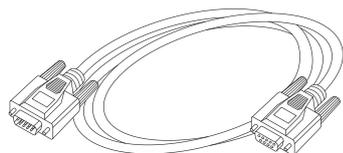
Matrix switcher



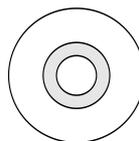
User's manual



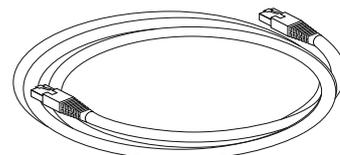
IEC power cable



RS-232 9-pole D-sub male
to female serial cable



CD-ROM with Control
Software



Cross-Link UTP Patch
cable

1.2. Description

MX8x8DVI-PRO is an 8 input and 8 output DVI matrix router, switching all DVI-D resolutions from 640x480 @ 60Hz to 1920 x 1200 including all HDTV resolutions: 720p, 1080i, 1080p, 2048 x1080. All inputs have a unique cable equalization circuit which allows using up to 50 meter cable. All outputs drive 500 mA power on DVI +5V pin to power fiber optical DVI cables.

MX8x8DVI-Pro contains the Advanced EDID Management feature. The user can emulate any EDID on the switcher's inputs independently, read out and store any attached monitor's EDID in the internal memory locations, upload and download EDID files using Lightware Device Controller software or the built-in webpage. The DVI crosspoint switcher can be controlled through 9 pole D-sub connector via RS-232 or RS-422 protocol, and IP based Ethernet connection including web access.

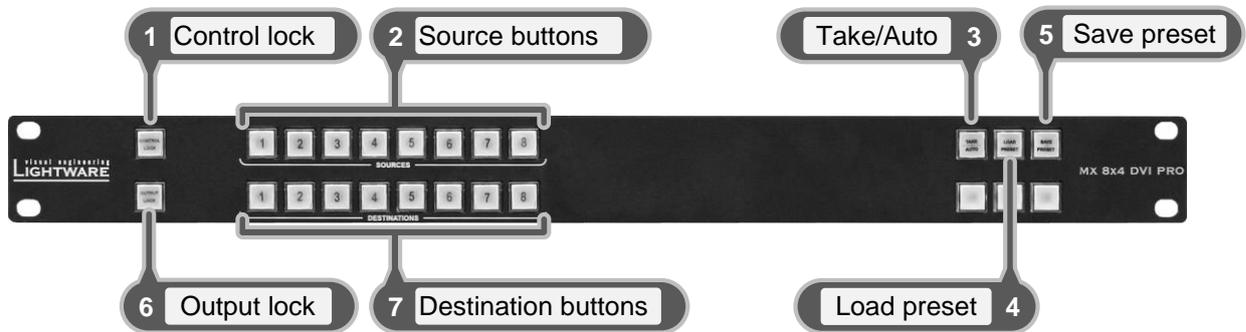
Front panel buttons are illuminated and easy field relegendable with text for informative system integration.

1.3. Features

- **50 meter input cable compensation** – Using 24AWG high quality DVI cable, the MX8x8DVI-Pro automatically compensates up to 50 meter cable length, which extends installation possibilities even on highest HDTV or computer resolutions. In case of lower pixel resolutions, this length can be even higher.
- **EDID routing** – Advanced EDID management with EDID emulation. The user can emulate any EDID on the switcher's inputs independently, read out and store any attached monitor's EDID in 100 internal memory locations, upload and download EDID files using Lightware Device Control software.
- **8 Inputs, 8 Outputs non-blocking cross point matrix architecture** – The router allows any input to be switched to any output or more outputs simultaneously.
- **Single link, max 1.65 Gbps DVI-D transmission (1920x1200 or 2048x1080)** – The MX8x8DVI-Pro routes any DVI single link signal between 25 and 165 MHz pixel clock frequency conforming to DVI 1.0 standard.
- **Supports all HDTV resolutions** – 720p, 1080i and 1080p etc. without HDCP encoding - Unencrypted HDTV signals up to 165 MHz pixel clock frequency regardless of resolution are passed through MX8x8DVI-Pro.
- **Signal Detect LED-s at each input connector** – Active DVI signals are detected: clock channel activity is green indicated, when signal is applied to the input.
- **Output PLL reclocking** – (removes jitter caused by long cables) each output has a clean, jitter free signal, eliminating signal instability and distortion caused by long cables or connector reflections.
- **Front panel button control** – 8 source select, 8 destination select, Take, Load preset, Save preset, Panel Lock, Output Lock.
- **Relegendable buttons** – Each button has an easy removable flat cap and a translucent label to identify sources and destinations.
- **RS-232 or RS-422 control** – Simple ASCII-based RS-232 protocol is used for switching, preset calling, status request, etc.
- **Ethernet control** – TCP/IP Ethernet 10Base-T or 100Base TX (Auto-Sensing).
- **Fiber cable support** – Self powered DVI fiber cables using +5V from DVI sources (VGA cards, etc.) usually are consuming more than 50 mA, which load is maximum allowed by DVI 1.0 standard. MX8x8DVI-Pro supports +5V 500 mA constant current output on each DVI output to power long distance fiber optical cables.
- **Universal power supply** – MX8x8DVI-Pro accepts AC voltages from 100 to 240 Volts with 50 or 60 Hz line frequency on standard IEC connector.
- **Power failure memory** – In case of power failure the unit stores its latest configuration, and after next power up it loads automatically.

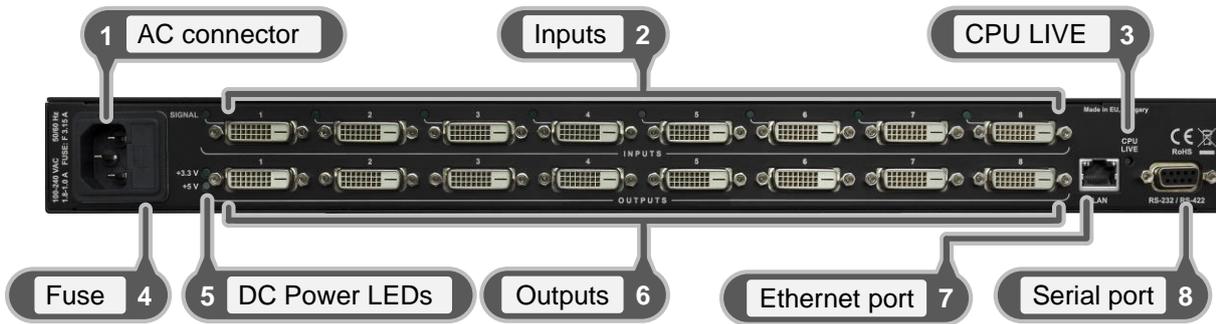
2. Controls and connections

2.1. Front view



- | | |
|-------------------------------------|---|
| <p>1 Control lock</p> | Disables or enables front panel operation. When red illuminated, operations on front panel are prohibited. |
| <p>2 Source buttons</p> | Source buttons have three functions: to select an input, to select a preset and to view the selected input's state (take mode). |
| <p>3 Take/Auto</p> | This button has two functions: displays the actual switching mode of the router or executes switching on TAKE mode. |
| <p>4 Load preset</p> | Loads and executes a previously saved preset from one of the preset memories. |
| <p>5 Save preset</p> | Stores actual matrix state, in one of preset memories. |
| <p>6 Output lock</p> | Locks and protects one (or more) outputs. Inhibits accidental input changing on protected output. |
| <p>7 Destination buttons</p> | Destination buttons have two functions: to select an output, or to view the selected output's state. |

2.2. Rear view



- | | |
|-------------------------------|---|
| <p>1 AC connector</p> | Standard IEC power connector. The router works with 100 to 240 Volts, 50 or 60 Hz power sources. |
| <p>2 Inputs</p> | 24 pole DVI-D digital-only female receptacle connectors. Connect DVI source devices to these connectors. |
| <p>3 CPU LIVE</p> | The LED is continuously blinking if the CPU works properly. |
| <p>4 Fuse</p> | Replace with F 3.15 A type only. |
| <p>5 DC power LEDs</p> | Indicators for presence of internal DC power voltages: +3.3 Volts and +5 Volts. Green lighting when power voltages are present. |
| <p>6 Outputs</p> | 24 pole DVI-D digital-only female receptacle connectors. Connect DVI monitors or other displays to these connectors. |
| <p>7 Ethernet port</p> | RJ 45 connector. Remote control port for connecting the unit to Local Area Network. |
| <p>8 Serial port</p> | 9-pole D-sub female connector for remote control applications. Can be ordered with RS-232 or RS-422 control. |

2.3. Electrical connections

2.3.1. DVI input

MX8x8DVI-Pro provides 24 pole „digital only” DVI-D connectors for input connections. Always use high quality DVI cable for connecting sources and displays.

Each input has a built in signal detection circuit with an LED located next to the input connector. The LED lights green, if the associated connector has an active DVI clock signal applied.

Pin	Signal	Pin	Signal	Pin	Signal
1	TMDS Data2-	9	TMDS Data1-	17	TMDS Data0-
2	TMDS Data2+	10	TMDS Data1+	18	TMDS Data0+
3	TMDS Data2 Shield	11	TMDS Data1 Shield	19	TMDS Data0 Shield
4	<i>n.c.</i>	12	<i>n.c.</i>	20	<i>n.c.</i>
5	<i>n.c.</i>	13	<i>n.c.</i>	21	<i>n.c.</i>
6	DDC Clock	14	+5V Power	22	TMDS Clock Shield
7	DDC Data	15	GND (for +5V)	23	TMDS Clock+
8	<i>n.c.</i>	16	Hot Plug Detect	24	TMDS Clock-

Table 2-1. DVI-I connector pin assignments

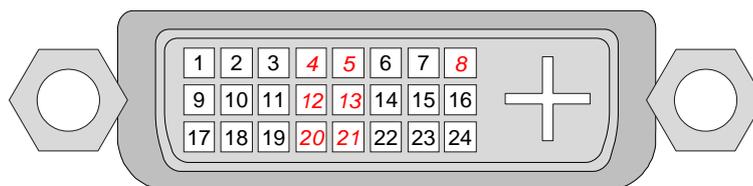


Figure 2-1. DVI-D “digital only” connector Single link pin assignments

Cable lengths at inputs

MX8x8DVI-Pro has an advanced built-in cable compensation circuit, which automatically provides cable length compensation. This circuit extends the maximum usable cable length to even 60 meter using high quality 22AWG copper cable on WUXGA 1920x1200 graphics resolution.

Signal	Cable type	22 AWG Reference type DVI GEAR: SHR DVI	24 AWG Reference type TASKER: TSK 1060
	Resolution	Max length (meter)	Max length (meter)
	1920x1200; 1600x1200; 2048x1080p; 1080p	60 m	50 m
	1680x1050; 1400x1050; 1280x1024	75 m	62 m
	1024x768; 1365x768; 720p; 1080i;	92 m	77 m
	800x600	100 m	84 m
	640x480; 480p; 576p	120 m	100 m

Table 2-2. Maximum DVI cable lengths at inputs

DVI outputs

MX8x8DVI-Pro provides 24 pole "digital only" DVI-D connectors for output connections. As standard DVI outputs, there can be used limited length cables, since there is no output amplification applied. For using longer cable runs at outputs, use fiber optical DVI cables or active DVI repeaters/extenders.

Fiber Cable powering

As a special feature MX8x8DVI-Pro on DDC +5V output (pin 14 on output connectors) is able to supply 500 mA current to power fiber optical DVI cables. Standard DVI outputs or VGA cards supply only 55 mA current on +5V output, thus unable to power directly a fiber optical cable.

Info: MX8x8DVI-Pro does not check if the connected sink (monitor, projector or other equipment) supports Hotplug or EDID signals but outputs the selected signal immediately after switch command.

2.3.2. RS-232/RS-422 control port

Devices can be remote controlled through industry standard 9 pin D-SUB female connector located on the rear panel of the unit. Please use a standard RS-232 Male to Female cable (straight through).

Info: M8x8DVI-Pro can be ordered with either RS-232 or RS-422 communication port. The port settings are done in the factory.

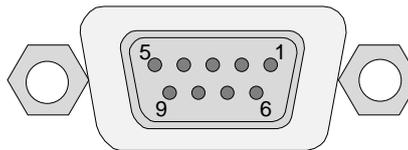


Figure 2-2. D-SUB 9 pin female (DE9F) connector

Pin nr.	RS-232	RS-422
1	NC, not connected	TX- data transmit complement
2	TX data transmit (output)	TX+ data transmit true
3	RX data receive (input)	RX+ data receive true
4	DTR (internally connected to Pin 6)	RX- data receive complement
5	GND signal ground (shield)	GND signal ground (shield)
6	DSR (internally connected to Pin 4)	NC non connected
7	RTS (internally connected to Pin 8)	NC non connected
8	CTS (internally connected to Pin 7)	NC non connected
9	NC, not connected	NC non connected

Table 2-3. D-sub connector pin assignment

RS-232 port settings:

9600 Baud, 8 data bit, 1 stop bit, no parity

3. Technologies

3.1. Basics

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

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

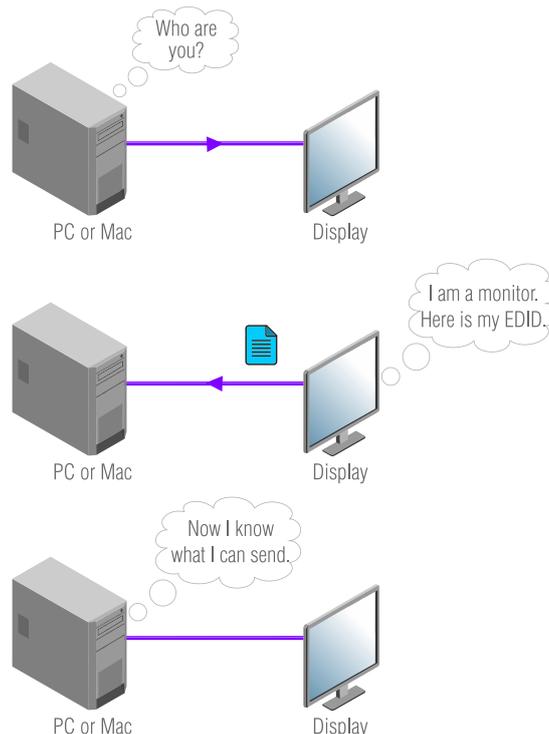


Figure 3-1. EDID communication

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 the most common extension 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 are HDMI capable which have the extension.

3.1.1. Common problems related to EDID

Problem: „I have changed to a different EDID on MX8x8DVI-Pro 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 don't sense that EDID has been changed. You need to restart your source to make it read out the EDID again.

Problem: „I have an MX8x8DVI-Pro and I'm using a Lightware factory preset EDID. I would like to be able to choose from different resolutions, but my source allows only one resolution.”

Solution: Most Lightware factory preset EDIDs allow only one resolution, forcing the sources to output only that particular signal. You need to select the Universal EDID that supports all common VESA resolutions, see the factory EDID list.

3.2. Advanced EDID management

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

MX8x8DVI-Pro provides Lightware's Advanced EDID Management function that helps system integration. The transmitter's built-in memory stores and emulates pre-programmed factory EDIDs, user's EDID and the monitor's EDID that is connected to the receiver. The transmitter stores the EDID of the attached monitor or projector in a non-volatile memory. This way the EDID from a monitor is available when the monitor is unplugged, or switched off.

The EDID emulated on the DVI input can be copied from the transmitter's memory (static EDID emulation), or from the last attached monitor's memory (dynamic EDID emulation). For example, the transmitter can be set up to emulate a device, which is connected to the receiver's DVI output. In this case, the EDID is automatically changed, if the monitor is replaced with another display device (as long as it has a valid EDID).

Advanced EDID management can be controlled via Lightware Device Controller.

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

Info: When EDID has been changed, the transmitter toggles the HOTPLUG signal for 2 seconds. Some sources do not observe this signal, so in this case the change is not recognized by the source. In such cases, the source device must be restarted or powered OFF and ON again.

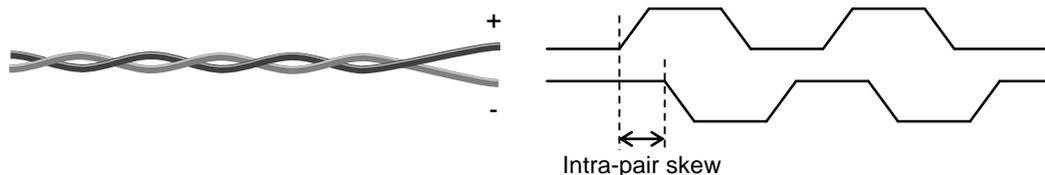
3.3. Pixel Accurate Reclocking

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

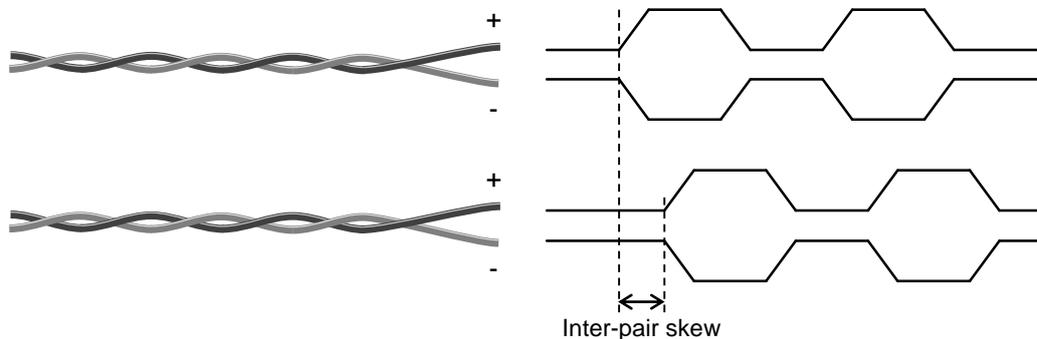
Lightware's sophisticated Pixel Accurate Reclocking technology fixes more problems than general TMDS reclocking. It removes not only intra-pair skew but inter-pair skew as well.

The Pixel Accurate Reclocking circuit eliminates the following errors:

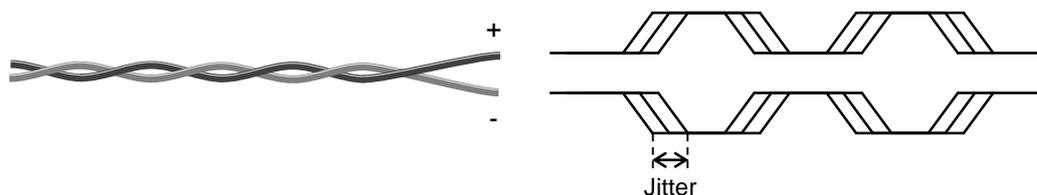
Intra-pair skew: skew between the + and - wires within a differential wire pair (e.g. Data2- and Data2+). It's caused by different wire lengths or slightly different wire construction (impedance mismatch) in DVI cable. It results in jitter.



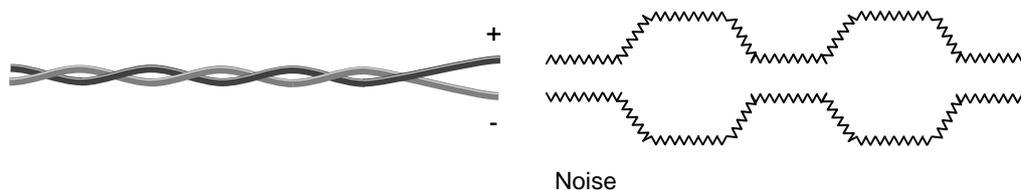
Inter-pair skew: skew between two differential wire pairs in a cable. It's caused by different wire pair lengths or different number of twists in the DVI cable. Too much inter-pair skew results in color shift in the picture or sync loss.



Jitter: signal instability in the time domain. The time difference between two signal transitions should be a fix 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.



The Pixel Accurate Reclocking circuit completely regenerates the original video signal and outputs a strong, high-quality digital signal that conforms to the DVI specification.

4. Operation

4.1. Power on

Connect the power cord to the router's IEC standard power input connector. MX8x8DVI-Pro is immediately powered on when the power cord is connected to the AC source. The router does not have a power switch, it remains powered on, until AC line voltage is present.

After powered on, the unit performs a self-test, all front panel buttons light up for one second. After the self-test the router reloads its last configuration and it is ready for use.

Info: After switching on, the router reloads the latest settings which were used before turning off. MX8x8DVI-Pro has an internal emergency memory which stores all current settings and tie configurations. This memory is independent from presets and invisible for the user. This built-in feature helps the system to be ready immediately in case of power failure or accidentally powering down.

4.2. Front panel operations

4.2.1. TAKE / AUTOTAKE modes

The router has two different switching modes: TAKE and AUTOTAKE. If the TAKE button is unlit, TAKE mode is active. When the TAKE button is continuously lighting green, AUTOTAKE mode is selected.

Press and hold the TAKE button for two seconds to change between TAKE and AUTOTAKE modes.

TAKE mode allows the user to make multiple connections and deselections at once. This mode is useful when time delay is not allowed between multiple switching.

AUTOTAKE mode is useful when immediate actions must be done or fast switching is needed between sources on a destination.

4.2.2. Control lock

Front panel button operations can be enabled or disabled using CONTROL LOCK button, while RS-232/422 control is still enabled. If CONTROL LOCK button is dark, front panel button operations are enabled. If there is a continuous red lighting, front panel buttons are disabled. Press and release CONTROL LOCK button to toggle the control lock state.

4.2.3. Switching

Creating a connection or multiple connections in TAKE mode

Step 1. Press and release the selected source button.

The pressed source button and all destination buttons which are currently connected to this source will light up. The dark remaining destination buttons are not connected to this source. This is an informative display about current status of the selected input (view only).

Step 2. Press and release the selected destination button or buttons.

The preselected destination button(s) start blinking.

Step 3. Press and release TAKE button.

The tie or ties will be executed, thus the selected input is switched to the selected output(s).

Deselecting or muting in TAKE mode

Step 1. Press and release the selected source button.

The pressed source button and all destination buttons which are currently connected to this source will light up. The dark remaining destination buttons are not connected to this source. This is an informative display about current status of the selected input (view only).

Step 2. Press and release the selected, green lighting destination button.

The pressed destination or multiple destinations will turn dark.

Step 3. Press and release TAKE button to execute disconnection.

Info: Deselected destinations are disconnected from any source, thus output devices will display black image or "no signal" message, or automatically will turn off.

Info: Multiple switching and deselecting actions can be done simultaneously, during only one TAKE action.

Creating a connection in AUTOTAKE mode

Step 1. Press and release the selected destination button. The pressed destination button, and the actually connected source button are lighting green. If no source is connected (the output is muted) no source button will light.

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

Deselecting or muting in AUTOTAKE mode

Step 1. Press and release the selected destination button.

The pressed destination button, and the actually connected source button are lighting green. If no source is connected (the output is muted) no source button will light.

Step 2. Press and release the active green lighting source button. The output is muted.

Info: Deselected destinations are disconnected from any source, thus output devices will display black image or "no signal" message or automatically will turn off.

4.2.4. Presets operations

MX8x8DVI-Pro has 8 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 presets even in case of power down. Memory numbers are assigned to source buttons 1 to 8.

Saving a Preset in TAKE mode

Step 1. Press and release SAVE PRESET button.

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

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

Info: Preset save action always stores the current configuration for all outputs.

Loading a Preset in TAKE mode

Step 1. Press and release LOAD PRESET button.

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

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

Info: Loading a preset always modifies all output states.

Saving a Preset in AUTOTAKE mode

Step 1. Press and release 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.

Info: 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.

Info: Loading a preset always modifies all output states.

4.2.5. VIEW current state

User can check the current switching status on the front panel using front panel buttons. View mode is slightly different in TAKE or AUTOTAKE modes because of different switching philosophy of the two modes.

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

View current state in TAKE mode

If the router is in TAKE mode, 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 will light up which are currently connected to the selected source. This informative display will remain for 5 seconds, then turns all buttons unlit.

If all source and destination and TAKE buttons are unlit (the unit is in TAKE mode, and no input was selected in last 5 seconds), press and release a destination button to see its current state. Now the source button which is connected to the selected destination will light up. If no source button is lighting, the selected destination is in muted state. Pressing another destination button, there can be seen the last pressed state of destination.

View current state in AUTOTAKE mode

Info: In AUTOTAKE mode only the destinations' states are shown.

Press and release the required destination button. Now the source button which is connected to the selected destination will light up. If no source button is lighting, the selected destination is in muted state. Pressing another destination button, there can be seen the last pressed current state of destination.

4.2.6. Output lock

Using MX8x8DVI-Pro there is a possibility to lock a destination. This feature prevents an accidental switching to the locked destination in case of important signal. Locking a destination means, that no input configuration can be changed or deselected on that particular destination.

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

Lock an output in TAKE mode

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

Step 2. Press and release the Output Lock button. Now the Output Lock button will light up in red color.

Step 3. Press and release TAKE button. The desired destination now is locked.

Unlock an output in TAKE mode

- Step 1.** Press and release the required destination button which was previously locked. Now the selected destination button and the currently configured source button and the Output Lock button will light up.
- Step 2.** Press and release the Output Lock button (deselect). Now the Output Lock button will turn off, however the locking function has not been unlocked yet.
- Step 3.** Press and release TAKE button. The desired destination now is unlocked.

Lock an output in AUTOTAKE mode

- Step 1.** Press and release the required destination button. Now the selected destination button and the currently configured source button will light up (view mode).
- Step 2.** Press and release the Output Lock button. Now the Output Lock button will light up in red color, and lock function is activated. No source can be changed at the locked destination.

Unlock an output in AUTOTAKE mode

- Step 1.** Press and release the required destination button which was previously locked. Now the selected destination button and the currently configured source button and the Output Lock button will light up
- Step 2.** Press and release the Output Lock button (deselect). Now the Output Lock button will turn off, and the locking function has been unlocked.

4.2.7. Changing and viewing current protocol

M8x8DVI-Pro is equipped with multiple router protocols.

- Step 1.** Switch the router in TAKE mode if used previously in AUTOTAKE mode by pressing TAKE button for 2 seconds (TAKE will not light continuously).
- Step 2.** Press and release CONTROL LOCK button (it will light in red).
- Step 3.** Press and keep pressed Output Lock button; one of the source buttons will light up:

Source#1 button lights:	Lightware protocol is active
Source#2 button lights:	Protocol#2 is active
- Step 4.** When Output Lock is pressed, press the desired Source button, accordingly to the new protocol. The desired Source button starts blinking, the router performs a reset and all buttons light up for 4 seconds. Now the new protocol is active.

4.2.8. Reset factory default DVI signal settings

The factory default DVI signal setup can be loaded by the front panel buttons as follows:

- Step 1.** Press and release the CONTROL LOCK button (it will light in red).
- Step 2.** Press and keep pressed the OUTPUT LOCK button (Source 1 or 2 will light).
- Step 3.** Press and release the TAKE button. TAKE, LOAD PRESET and SAVE PRESET buttons will light up for a moment sequentially and the default DVI signal settings are loaded.

4.2.9. Reset factory default (static) IP address

The factory default fix IP address can be loaded by the front panel buttons as follows:

- Step 1.** Press and release the CONTROL LOCK button (it will light in red).
- Step 2.** Press and keep pressed the OUTPUT LOCK button (Source 1 or 2 will light).
- Step 3.** Press and release the LOAD PRESET button. TAKE, LOAD PRESET and SAVE PRESET buttons will light up for a moment sequentially and the default fix IP address is reloaded: 192.168.254.254, subnet mask: 255.255.0.0.

5. Software control – using Lightware Device Controller (LDC)

The device can be controlled by a computer through the Ethernet port using Lightware Device Controller. The software can be installed to a Windows PC or MAC OS X. The application and the User's manual can be downloaded from www.lightware.eu. The Windows and the Mac versions have the same look and functionality.

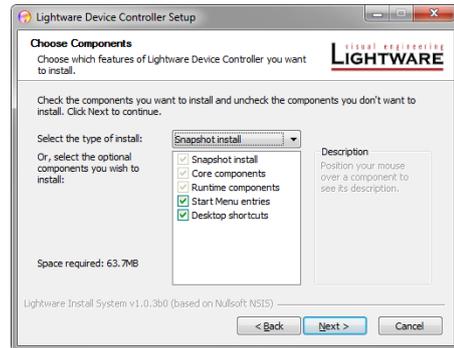
5.1. Steps of the installation in case of Windows OS

Step 1. Run *Install_LDC_v1.1.0b3.exe*. If User Account Control appears click Yes.

Step 2. A welcome window opens. Click Next.

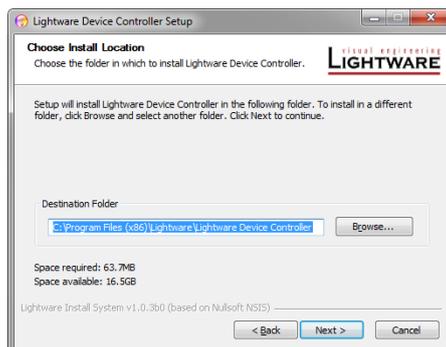


Step 3. Select the type of the installation: normal or snapshot install. Select the optional components then click Next. (Normal install is recommended.)



Normal install	Snapshot install
Available for Windows and MAC OS X	Available for Windows
The installer can update only this instance	Cannot be updated
Only one updateable instance can exist for all users	More than one different versions can be installed for all users
Does not contain the version in its name	Version number is displayed in the name

Step 4. Select the destination folder and click Next. (Default path is highly recommended.)



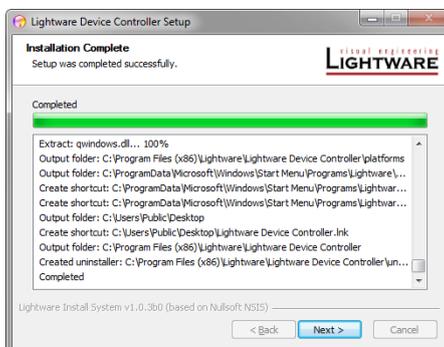
- Step 5.** Select the Start Menu Folder and click Next. (Using the default folder is highly recommended. If the Start menu entries was not checked in Step 3 this window will be skipped.)



- Step 6.** Verify the settings and if they are correct click Install. (If not, click Back and change the setting.)



- Step 7.** After the installation of the last component the Next button is activated. Click on it.



- Step 8.** If the installation is complete, click Finish. (Uncheck the box if you do not want to run the software immediately.)



5.2. Steps of the installation in case of Mac OS X

Info: After the installation the Windows and the Mac application has the same looks and functionality.

Step 1. Mount the DMG file with double clicking on it.



LightwareDeviceContro
llerinstaller.dmg

Step 2. 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.

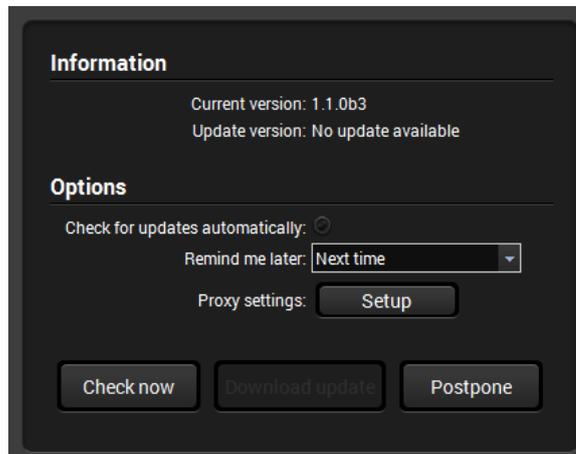


Info: This type of the installer is equal with the Normal install in case of Windows. This is an updateable version with the same attributes.

5.3. LDC Upgrade

Step 1. Run the application.

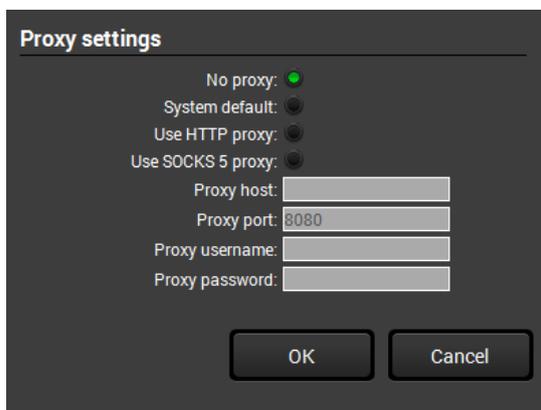
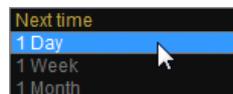
The Device Discovery window appears automatically and the program checks the available updates on Lightware's website and opens the update window if the LDC found updates.



The current and the update version number can be seen in the top of the window and they are shown in this window even with the snapshot install.

Step 2. Set the desired update setting in the option section.

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



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

User can check updates manually by clicking the Check now button.

5.4. Establishing the connection

Step 1. Connect to the device by a computer directly or via Ethernet. Cable type does not matter, both patch and cross cable can be used.

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

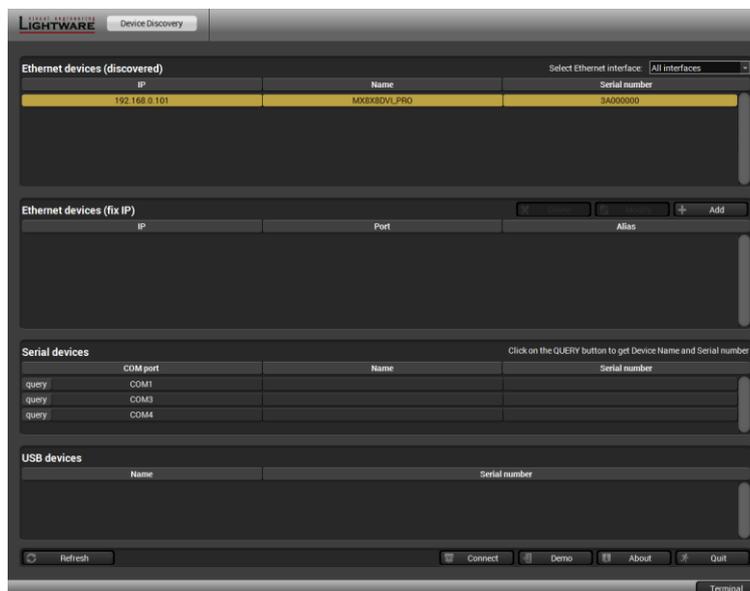


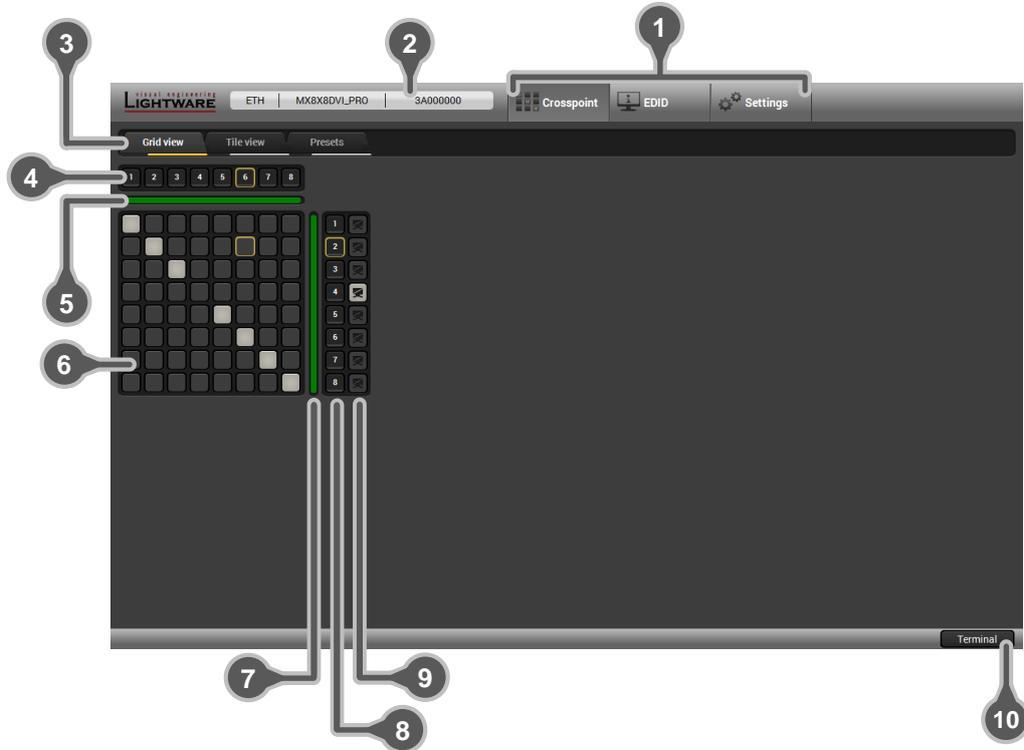
Figure 5-1. Ethernet connection in Device discovery window

Step 3. Select the desired device from the discovered devices click on the Connect button. If you do not see your device in the list, you can add it by clicking on the Add button and typing its IP address.

5.5. Crosspoint menu

When the LDC finds the hardware, it determines the product type, and the LDC starts with the default page.

5.5.1. Grid view



- 1 Main menu** The available menu is displayed: Crosspoint, EDID and Settings.
- 2 Information ribbon** The label shows the interface type, the name and the serial number of the connected device. The device discovery window can be started by clicking on this ribbon.
- 3 Tab selector ribbon** The Crosspoint and the Settings menu contains more tabs which are displayed in this line. The yellow line shows the active one.
- 4 Input ports** Each number represents an input port.
- 5 Type of input board** The color of the line shows the installed input board type; green color means DVI board.
- 6 Connections** Dark grey square means the port is not available. Light grey square means the port is available but no connection between the input and the output. White square means there is a connection between the input and the output port.
- 7 Type of output board** The color of the line shows the installed output board type; green color means DVI board.
- 8 Output ports** Each number represents an output port.
- 9 Mute buttons** Outputs can be easily muted by clicking on the mute button.
- 10 Terminal** This general-purpose terminal is created mainly for testing and debugging purposes. (For more information, see section [5.8](#) on page [36](#).)

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, then the connection is made, the square becomes white and the cursor is changed back to a pointer.



E.g. input 6 is not connected to output 2 according to the first picture above. After the connection the square becomes light grey.

Muting outputs

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



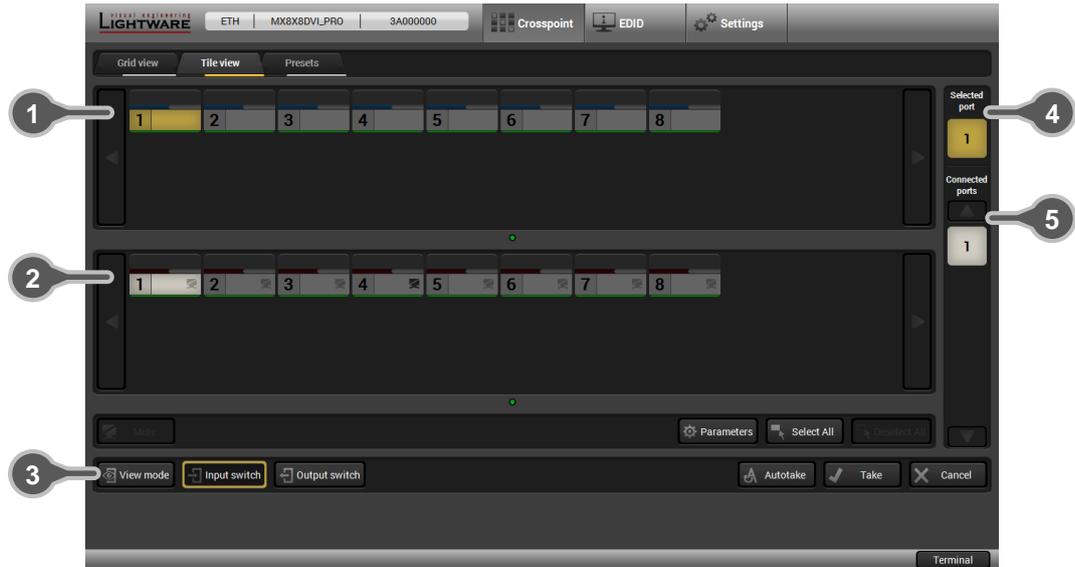
Info: Switching muted outputs does not unmute them, muting remains active until mute button is clicked again.

Info: Outputs can be disconnected from any inputs (by protocol command). In this case the crosspoint view will not show any white square for the disconnected output and the output will have no signal just like when muted. Click on a crosspoint square to connect the output again to an input.

5.5.2. Tile view

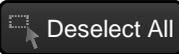
Tile view is a new feature of Lightware Device Controller. The new approach is to display the input and output ports by tiles. Each tile means an input or output port and additionally shows the most important port and signal information. Thus, user can check the status of many ports at the same time without clicking on a port or opening port settings window. Three display modes are defined in Tile view for MX matrices:

- View mode,
- Input switch mode and
- Output switch mode.

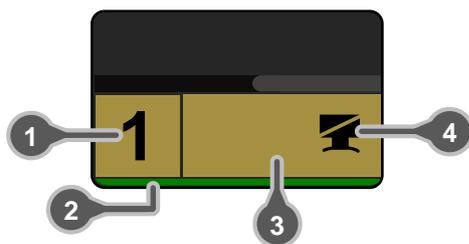


- 1 Input ports** Each tile represents an input port.
- 2 Output ports** Each tile represents an output port.
- 3 Display mode** The three available display modes can be selected by the buttons.
- 4 Selected port** Last selected port is displayed with yellow background on the port bar. Press the button to open port settings window.
- 5 Connected port(s)** Those ports are listed (with white background) on the port bar, which are connected to the Selected port.

Control buttons

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

Port tiles



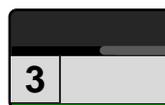
- ① Port number
- ② Board type
- ③ Background color
- ④ Port is muted (black), port is not muted (grey)

Background colors (port state)

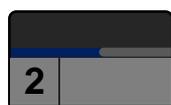
The colors of the port tiles represent different states of the port as follows:



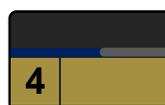
Dark grey
Port is not available
(no board is installed)



White
Connected port



Light grey
Port is available



Yellow
Selected port

Display modes

Three display modes are defined in Tile view for MX matrices:

- View mode,
- Input switch mode and
- Output switch mode.

Crosspoint changes can be made in Input switch mode and Output switch mode. The working method is the same in both cases but the priority is different.

View mode

This mode was designed to display crosspoint state of a selected- and its connected port(s).

Info: Crosspoint settings cannot be changed in View mode but port settings are available.

Input switch mode

The mode can be also named as 'Input priority-mode'. In the mode an input port has to be selected at first then connected output port(s) is/are shown. Thus, the output port(s) connected to the input port can be changed.

Output switch mode

The mode can be also named as 'Output priority-mode'. In the 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.

Info: Output ports can be (un)muted only in Output switch mode.

Switching operations

Take mode

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



- Step 1.** Press the desired Input switch or Output switch button to select switching mode.
- Step 2.** Select the desired port; it will be highlighted with yellow color and also displayed on the port bar on the right.
- Step 3.** Connected port(s) is/are highlighted with white color and also displayed 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 Take button to execute changes or Cancel to ignore the operations.

Info: Take mode remains active until it is switched off. Selecting another view mode or menu 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)connect ports to/from the previously selected port – is executed immediately after pressing the port button. Following steps describe the process of the switching:



- Step 1.** Press the desired Input switch or Output switch button to select switching mode.
- Step 2.** Select the desired port; it will be highlighted with yellow color and also displayed on the port bar on the right.
- Step 3.** Connected ports are highlighted with white color and also displayed 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 does not change the Take/Autotake mode state.

Port parameters (only on output ports)



Select an output port and press the Parameters button, or Press the output port button on the port bar on the right, and the available settings are displayed in a new window:

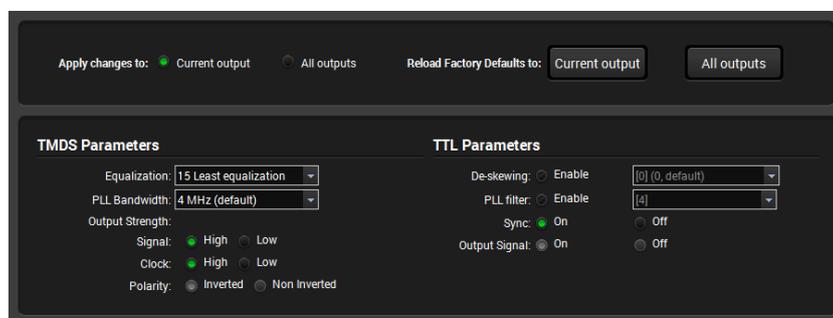


Figure 5-2. Output port properties

5.5.3. Preset operations

Preset operations can be done in Crosspoint submenu on the Preset tab at the devices, which support Preset operations, e.g. matrices. Each Lightware matrix switcher has 32 preset memories that can be loaded and saved at any time.

Info: A preset setting stores a full configuration of all outputs, so preset loading have an effect on every output, except the locked ones.

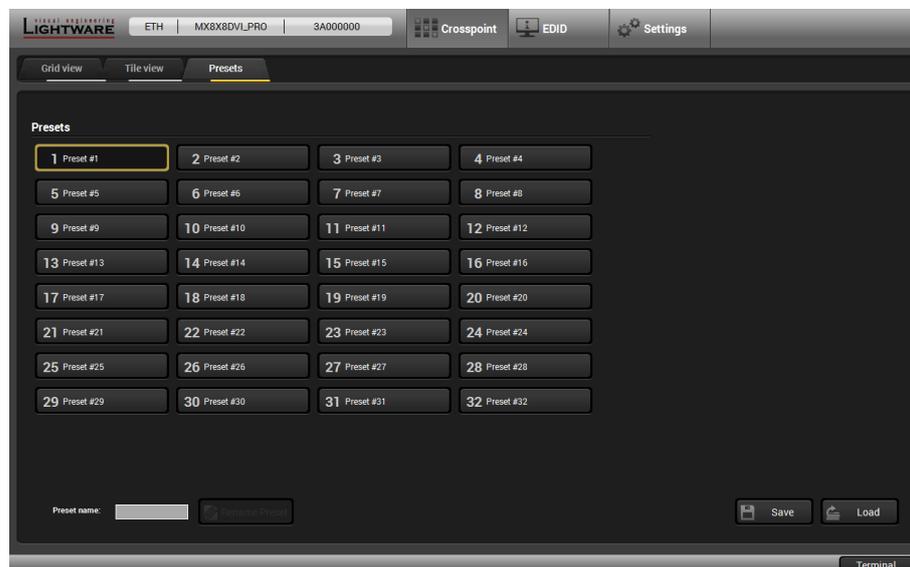


Figure 5-3. Presets tab

Loading a preset

- Step 1.** Select the Presets tab from the Crosspoint menu.
- Step 2.** Select the preset memory (Preset1...Preset32) you want to load as the next crosspoint configuration.
- Step 3.** Press Load button; now the preset is loaded.
- Step 4.** The new I/O configuration is displayed in the Grid view.

Saving a preset

- Step 1.** Make the desired crosspoint connections in Tile view or Grid view.
- Step 2.** Select the preset memory (Preset1...Preset32) where you want to save your current crosspoint connections.
- Step 3.** Press Save button; a confirmation message is displayed when the preset is stored.

5.6. EDID menu

Advanced EDID Management can be accessed by selecting EDID menu.



Figure 5-4. EDID management

There are two panels: left one contains Source EDIDs, right one contains Destination places where the EDIDs can be emulated. The list can be scrolled by mouse wheel or by grabbing and moving up and down.

Control buttons



Exporting an EDID (save to a file)



Executing EDID emulation (Transfer button)



Importing an EDID (load from a file)



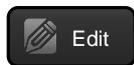
Deleting EDID (from user memory)



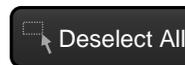
Opening selected EDID with Summary window



Selecting all memory places in the right panel



Opening Advanced EDID Editor with selected EDID



Selecting none of the memory places in the right panel



Opening Easy EDID Creator

5.6.1. About EDID memory

EDID memory is non-volatile and consists of four blocks, each for different purpose. These blocks are:

- 1..50 Factory Preset EDIDs
- 51..100 User saved EDIDs
- 101..108 Dynamic (Last attached monitor's EDIDs – Outputs)
- 109..116 Emulated EDIDs (emulated on a specific input)

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

Factory preset EDIDs

The factory EDIDs (F1-F50) are factory preprogrammed and cannot be modified. These are the most common resolutions. They are specially provided to force graphic cards to output only the exact pixel resolution and refresh rate.

MEMORY	Resolution	MEMORY	Resolution
F01	640 x 480 @ 60.0 Hz	F26	1600 x 1200 @ 60.0 Hz
F02	640 x 480 @ 75.0 Hz	F27	1920 x 1200 @ 60.0 Hz
F03	848 x 480 @ 60.0 Hz	F28	1440 x 480i @ 59.0 Hz
F04	800 x 600 @ 50.0 Hz	F29	640 x 480 @ 59.94 Hz
F05	800 x 600 @ 60.30 Hz	F30	720 x 480 @ 59.92 Hz
F06	800 x 600 @ 74.99 Hz	F31	1440 x 480i @ 59.0 Hz
F07	1024 x 768 @ 49.98 Hz	F32	720 x 576 @ 50.0 Hz
F08	1024 x 768 @ 60.0 Hz	F33	1280 x 720 @ 50.0 Hz
F09	1024 x 768 @ 75.2 Hz	F34	1280 x 720 @ 60.0 Hz
F10	1152 x 864 @ 75.0 Hz	F35	1920 x1080i @ 50.0 Hz
F11	1280 x 768 @ 50.0 Hz	F36	1920 x1080i @ 50.0 Hz
F12	1280 x 768 @ 59.92 Hz	F37	1920 x1080i @ 60.0 Hz
F13	1280 x 768 @ 75.0 Hz	F38	1920 x 1080 @ 24.0 Hz
F14	1360 x 768 @ 60.1 Hz	F39	1920 x 1080 @ 24.99 Hz
F15	1364 x 768 @ 50.0 Hz	F40	1920 x 1080 @ 30.0 Hz
F16	1364 x 768 @ 59.93 Hz	F41	1920 x 1080 @ 50.0 Hz
F17	1364 x 768 @ 74.98 Hz	F42	1920 x 1080 @ 49.99 Hz
F18	1280 x 1024 @ 50.0 Hz	F43	1920 x 1080 @ 60.0 Hz
F19	1280 x 1024 @ 60.1 Hz	F44	2048 x 1080 @ 49.99 Hz
F20	1280 x 1024 @ 75.1 Hz	F45	2048 x 1080 @ 50.0 Hz
F21	1366 x 1024 @ 59.99 Hz	F46	2048 x 1080 @ 59.99 Hz
F22	1400 x 1050 @ 49.99 Hz	F47	Reserved
F23	1400 x 1050 @ 59.99 Hz	F48	Reserved
F24	1400 x 1050 @ 75.0 Hz	F49	Reserved
F25	1600 x 1200 @ 50.0 Hz	F50	Reserved

Table 5-1. Factory Preset EDID list

5.6.2. Changing emulated EDID

- Step 1.** Select the desired EDID list from one of the three sources by pressing its button.
- Step 2.** Select an EDID from the Source panel that has to be emulated.
- Step 3.** Press the Emulated button above the Destination panel.
- Step 4.** Select the desired port where the EDID has to be emulated (more ports can also be selected); the EDID(s) will be highlighted with yellow cursor.
- Step 5.** Press the Transfer button to change the emulated EDID.

5.6.3. 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 Source panel (highlight with yellow cursor).
- Step 2.** Press the Save button to open the Save as dialog and download the file to the computer.

5.6.4. Importing an EDID

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

- Step 1.** Press the User button above the Source panel.
- Step 2.** Select a memory slot from the Source panel.
- Step 3.** Press the Upload button below the Source panel.
- Step 4.** Browse the file in the opening window then press Open button. The browsed EDID is imported into the selected User memory.

Info: The imported EDID overwrites the selected memory place even if it is not empty.

5.6.5. EDID Summary window

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

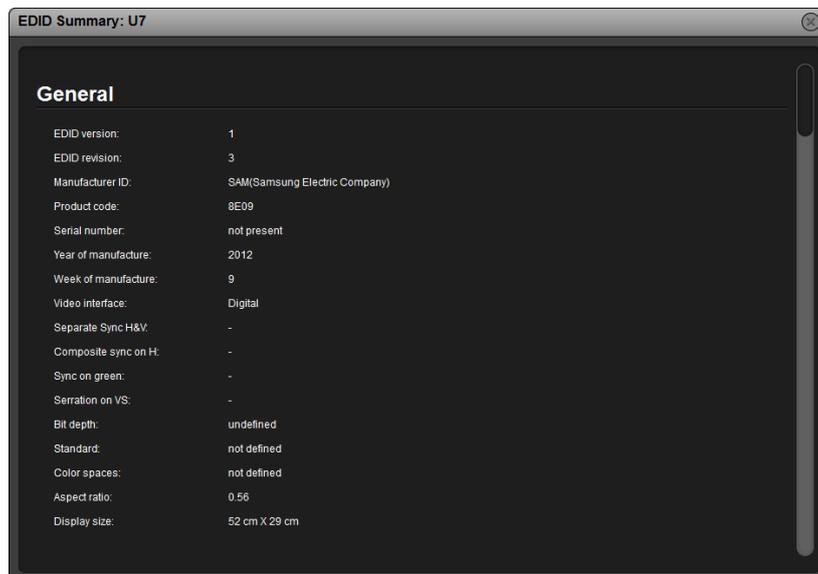


Figure 5-5. EDID Summary

5.6.6. Editing an EDID

Select an EDID from the Source panel and press the Edit button to display the Advanced EDID Editor window. The editor can read and write all descriptors, which are defined in the standards, including the additional CEA extensions. Any EDID from the device's memory or a saved EDID file can be loaded in 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.

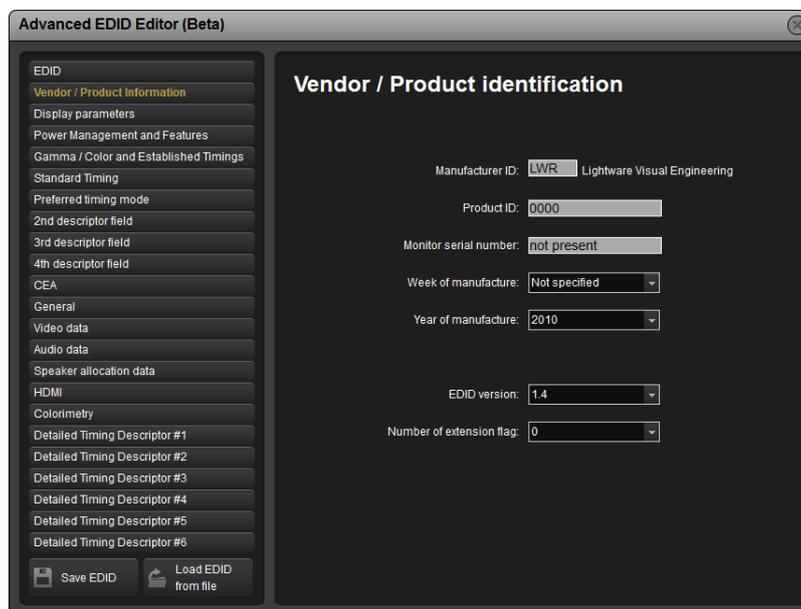


Figure 5-6. Advanced EDID Editor

5.6.7. Creating an EDID (Easy EDID Creator)

Since above mentioned Advanced EDID Editor needs more complex knowledge about EDID, Lightware introduced a wizard-like interface for fast and easy EDID creation. With Easy EDID Creator it is possible to create custom EDIDs in four simple steps.

By clicking on the EEC button below Source panel, Easy EDID Creator is opened in a new window.

5.6.8. Deleting EDID(s)

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

- Step 1.** Press the User button above the Destination panel.
- Step 2.** Select the desired memory slot(s); more ports can be selected. Use the Select All and Deselect All buttons according to the needs. The EDID(s) will be highlighted with yellow cursor.
- Step 3.** Press the Delete selected button to delete the EDID(s).

5.7. Settings menu

The menu contains Hardware- and Software-related settings and information about connected device. The content of the tabs is also device-dependent.

5.7.1. Configuration

Settings about establishing the connection to the desired device are available on this tab.

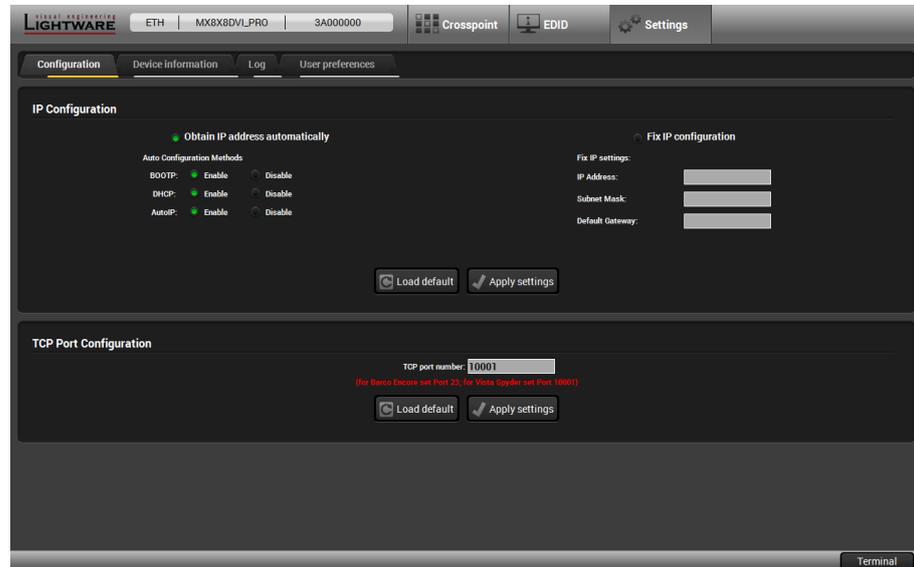


Figure 5-7. Configuration tab in the Settings menu

IP Configuration

The IP address and TCP/IP port can be set up here.

Obtain IP address automatically

By selecting the Obtain IP address automatically option, the device gets the IP address from the DHCP server on the LAN, or if DHCP server is not present, it gets an AutoIP address from 169.254.xxx.xxx domain. Set BOOTP, DHCP and AutoIP settings according to your network requirements. Always press the Apply settings button to save changes.

Info: Load default button restores the default network settings (fix IP) to the device: IP Address: 192.168.254.254, Subnet Mask: 255.255.0.0, Default Gateway: 0.0.0.0.

Info: When serial port is used for connection, these settings cannot be changed.

5.7.2. Device information

Basic information about connected device and installed cards are listed on this tab.

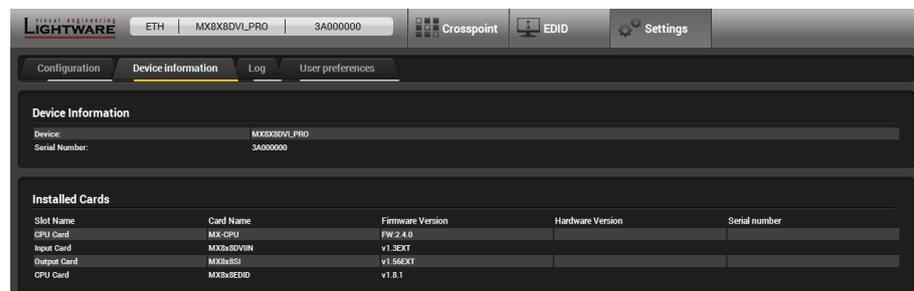
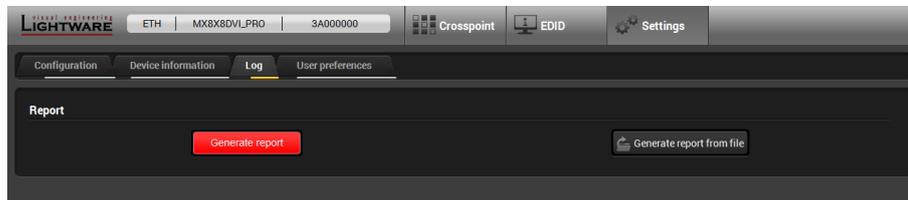


Figure 5-8. Device information tab

5.7.3. Log

Generate report

LDC is able to collect information from the device and save it to a report file. This information package can be sent to Lightware support team when a problem may arise with the device.



Step 1. Press the red button: Generate report file.

Step 2. LDC collects the needed information; this may take up to 5 minutes.

Step 3. After generating the report the 'Save as' dialog box appears. Select the folder where you want to save the report file. The default file name can be changed.

The report contains the following information:

- Current command protocol
- Device type and serial number
- Current crosspoint state
- Firmware version of the internal controller
- Installed I/O board types and versions
- Hardware health status

Generate report from file

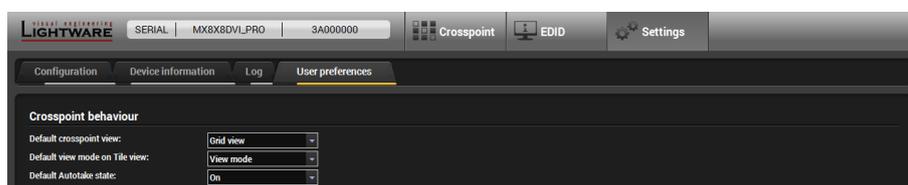
LDC is able to send a custom command file to the matrix. The command file can be generated by Lightware support. This is needed when some special commands has to be used for configuring the device or troubleshooting.

Info: This function is only for special troubleshooting cases.

5.7.4. User preferences

The last tab contains three basic settings about the outlook of Lightware Device Controller:

- Default crosspoint view (Grid view / Tile view),
- Default view mode in Tile view (View mode / Input switch / Output switch),
- Default Autotake state (On / Off).



5.8. Terminal window

This general purpose terminal is created mainly for testing and debugging purposes. After a successful connection is established with a device this terminal can be used either via serial RS-232 or TCP/IP LAN connection. The command text can be typed directly. Press the Terminal button in the right bottom corner to open the window.

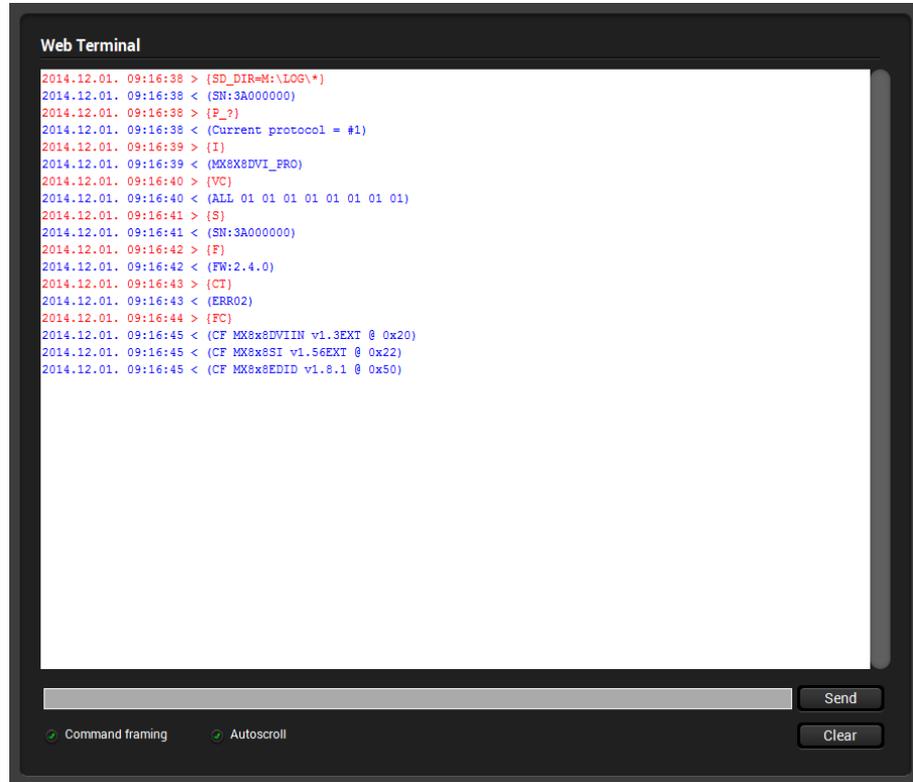


Figure 5-9. Terminal window

By default commands are automatically surrounded by framing brackets. Every sent command is red-colored and gets a '>' prefix. Received responses are blue-colored and starts with '<'.

The timecode in every row shows the exact time when the command was sent or the response received.

If the Command framing checkbox is unchecked, you can send multiple commands together, however in this case you have to type in the framing brackets manually.

If the Autoscroll checkbox is checked, the window is scrolled down automatically when a new row is added.

The window can be emptied by pressing the Clear button.

6. Software control – Using the built-in webpage

MX8x8DVI-Pro has a built-in web page, which can be accessed over TCP/IP protocol and offers you full control over almost all settings even if you do not have the opportunity to install new programs. The router's built-in website is compatible with most common browsers and requires no additional software components.

Info: The only way to find out the router's IP address (if it is not known) is to search for devices with Lightware Device Controller software. If this is not possible for some reason, the IP address can be reset to factory default (192.168.254.254) with the front panel buttons. See section 4.2.9 on page 19 for details.

Info: Only one opened web page is allowed simultaneously. Other TCP/IP connections are prohibited while the web page is opened. Using more instances of the web page simultaneously will result in inadequate operations.

6.1. Establishing the connection

Info: If the connection is made through the router's Ethernet port, be sure that the computer is in the same network as the router.

Info: 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 switcher 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 192.168.254.254).

6.2. The layout of the built-in web

The built-in web page allows almost the same controlling functions which are available via the Lightware Device Controller. Select a menu item on the left side; the default screen is the Control menu.

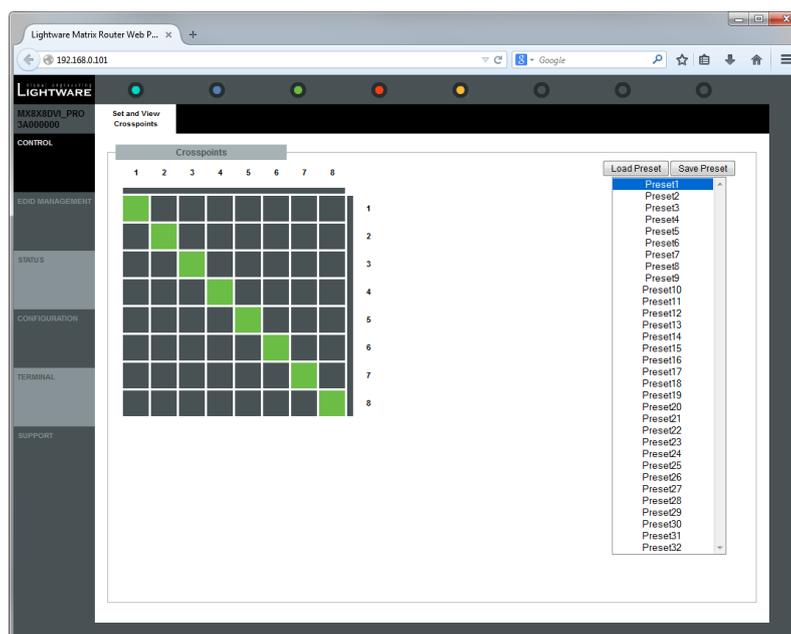


Figure 6-1. Built-in webpage displaying the Control menu

7. Programmers' reference

Users can connect to the matrix through Ethernet or serial port. After establishing connection, there is no difference between connection types (except some rare cases, which are uniquely noted).

Lightware matrix routers can be controlled with external devices which can communicate according to the router protocol. Lightware routers have a special protocol, but to interoperate with third party devices, a secondary protocol is also provided.

7.1. Protocol description

The protocol description hereinafter stands for **Lightware protocol**.

The matrices accept 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:

<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 ² >	=	input number in 2 digit ASCII format (01, 02, 10, 12 etc.)
<out ² >	=	output number in 2 digit ASCII format (01, 02, 10, 12 etc.)
<id>	=	id number in 1 or 2 digit ASCII format
<id ² >	=	id number in 2 digit ASCII format
CrLf	=	Carriage return, Line feed (0x0D, 0x0A)
•	=	space character (0x20)
→	=	each command issued by the controller
←	=	each response received from the router

ASCII table

The most frequently used characters are highlighted.

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	[NUL]	32	20	[Space]	64	40	@	96	60	`
1	01	[SOH]	33	21	!	65	41	A	97	61	a
2	02	[STX]	34	22	'	66	42	B	98	62	b
3	03	[ETX]	35	23	#	67	43	C	99	63	c
4	04	[EOT]	36	24	\$	68	44	D	100	64	d
5	05	[ENQ]	37	25	%	69	45	E	101	65	e
6	06	[ACK]	38	26	&	70	46	F	102	66	f
7	07	[BEL]	39	27	'	71	47	G	103	67	g
8	08	[BS]	40	28	(	72	48	H	104	68	h
9	09	[TAB]	41	29	)	73	49	I	105	69	i
10	0A	[LF]	42	2A	*	74	4A	J	106	6A	j
11	0B	[VT]	43	2B	+	75	4B	K	107	6B	k
12	0C	[FF]	44	2C	,	76	4C	L	108	6C	l
13	0D	[CR]	45	2D	-	77	4D	M	109	6D	m
14	0E	[SOH]	46	2E	.	78	4E	N	110	6E	n
15	0F	[SI]	47	2F	/	79	4F	O	111	6F	o
16	10	[DLE]	48	30	0	80	50	P	112	70	p
17	11	[DC1]	49	31	1	81	51	Q	113	71	q
18	12	[DC2]	50	32	2	82	52	R	114	72	r
19	13	[DC3]	51	33	3	83	53	S	115	73	s
20	14	[DC4]	52	34	4	84	54	T	116	74	t
21	15	[NAK]	53	35	5	85	55	U	117	75	u
22	16	[SYN]	54	36	6	86	56	V	118	76	v
23	17	[ETB]	55	37	7	87	57	W	119	77	w
24	18	[CAN]	56	38	8	88	58	X	120	78	x
25	19	[EM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUB]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESC]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FS]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GS]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RS]	62	3E	>	94	5E	^	126	7E	~
31	1F	[US]	63	3F	?	95	5F	_	127	7F	[DEL]

7.2. Switching and control commands

7.2.1. View connection on a specified output

Description: Shows the input that is connected to the queried output.

Format	Example
Command {?<out>}	→ {?01}
Response (O<out²>●|<in²>)CrLf	← (O01 I02)CrLf

Explanation: Input 2 is switched to output 1.

7.2.2. Switch one input to one output

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

Format	Example
Command {<in>@<out>}	→ {1@5}
Response (O<out²>●|<in²>)CrLf	← (O05 I01)CrLf

Explanation: Input 1 is switched to output 5.

Info: The response for this command does not show if the output is muted. To check the mute status a separate query has to be used like {VC}, see section [7.2.4](#) on page [40](#).

7.2.3. Switch one input to all outputs

Description: Switch input <in> to all outputs.

Format	Example
Command {<in>@O}	→ {02@O}
Response (I<in ² >●ALL)CrLf	← (I02 ALL)CrLf

Explanation: Input 2 is switched to all outputs.

Info: The response for this command does not show if any of the outputs are muted. To check the mute status, a separate query has to be used.

7.2.4. View connection on all outputs

Description: Viewing all outputs' connection showing the input number that is connected to them.

Format	Example
Command {VC}	→ {VC}
Response (ALL●<O1>●<O2>●<O3> ●<O4>●<O5>●<O6>●<O7> ●<O8>)CrLf	← (ALL 01 00 01 01 01 01 01 01)CrLf

Legend: <Ox> indexes are two digit numbers showing the corresponding output.

Explanation: Viewing connection for all outputs. Input 1 is connected to all the outputs, except O2: the second output is muted, that is why its number is 00.

7.2.5. View mutes on all outputs

Description: Viewing all outputs' mute state results in different response length.

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

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

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

7.2.6. Mute specified output

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

Format	Example
Command {#<out>}	→ {#2}
Response (MUT●<out ² >)CrLf	← (MUT 02)CrLf

Explanation: Output 2 is muted. No signal is present on output 2 now.

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

Info: Switching a muted output does not unmute the output.

7.2.7. Unmute specified output

Description: Unmute output <out>.

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

Explanation: Output 3 is unmuted. Now output 3 is switched to the last connected input.

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

7.3. Preset operations

7.3.1. Save preset to the specified memory location

Description: Save current crosspoint configuration (output states) to preset <id>.

Format	Example
Command {\$<id>}	→ {\$4}
Response (SPR<id?>)CrLf	← (SPR04)CrLf

Explanation: Current crosspoint state is saved to preset 4, including the mute state of the outputs.

Info: The matrix has 32 preset memories, the first 8 are available via front panel buttons.

7.3.2. Load preset from the specified location

Description: Load crosspoint configuration from preset <id>.

Format	Example
Command {%<id>}	→ {%4}
Response (LPR<id?>)CrLf	← (LPR04)CrLf

Explanation: Current crosspoint state is changed according to preset 4, including the mute state of the outputs.

7.4. System status commands

7.4.1. View product type

Description: The router responds its name.

Format	Example
Command {i}	→ {i}
Response (<PRODUCT_TYPE>)CrLf	← (I: MX8x8DVI_Pro)CrLf

Explanation: The connected device is an MX8x8DVI_Pro.

7.4.2. View serial number

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

Format	Example
Command {s}	→ {s}
Response (SN:<SERIAL_N>)CrLf	← (SN:11270142)CrLf

Info: Old devices may have only the last 4 numbers written onto the back of the router.

7.4.3. View firmware version of the CPU

Description: View the CPU firmware revision.

Format	Example
Command {f}	→ {f}
Response (FW:<FW_VER><s>)CrLf	← (FW:2.4.0)CrLf

Legend: <FW_VER> is the firmware version.

7.4.4. View firmware for all controllers'

Description: Shows the firmware versions of all installed controllers.

Format	Example
Command {FC}	→ {fc}
Response (CF●<DESC>)CrLf	← (CF MX8x8DVIIN v1.3EXT @ 0x20)
(CF●<DESC>)CrLf	CrLf
...	← (CF MX8x8SI v1.56EXT @ 0x22)CrLf
	← (CF MX8x8EDID v1.8.1 @ 0x50)CrLf

Explanation: The matrix has a DVI input-, a DVI output-, and an EDID router board.

7.4.5. Error responses

Invalid input number

Description: Given input number exceeds the maximum number of inputs or equals zero.

Response (ERR01)CrLf

Invalid output number

Description: Given output number exceeds the installed number of outputs or equals zero.

Response (ERR02)CrLf

Invalid preset number

Description: Given preset number exceeds the maximum allowed preset number.

Response (ERR04)CrLf

7.5. LW2 commands – Quick summary

Operation	See in chapter	Command
View connection on a specified output	7.2.1	{<in>@<out>}
Switch one input to all outputs	7.2.3	{<in>@O}
View connection on a specified output	7.2.1	{?<out>}
View connection on all outputs	7.2.4	{VC}
View mutes on all outputs	7.2.5	{VM}
Mute specified output	7.2.6	{#<out>}
Unmute specified output	7.2.7	{+<out>}
Save preset to the specified memory location	7.3.1	{\${id}}
Load preset from the specified location	7.3.2	{%<id>}
View product type	7.4.1	{i}
View serial number	7.4.2	{S}
View firmware version of the CPU	7.4.3	{F}
View firmware for all controllers'	7.4.4	{FC}

8. Firmware upgrade – by Lightware matrix firmware updater

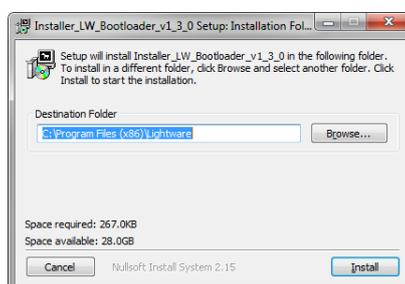
MX8x8DVI-Pro can be upgraded with new firmware versions via RS-232 port using a computer. In order to get the latest firmware (*.HEX file) for your product, please contact support@lightware.eu. The firmware upgrade can be performed in two ways:

- Front Panel Enabled Upgrade, or
- Jumper Enabled Upgrade.

Front Panel Enabled Upgrade is the simplest mode for firmware upgrade. Jumper Enabled Upgrade is only needed, when the unit does not have a software installed or the Front Panel Enabled Upgrade failed from any reason.

8.1. Install Lightware matrix firmware updater software

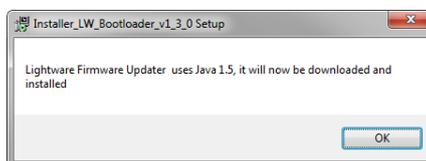
Step 1. Run Installer_SW_BOOTLOADER_V1_LWR_v1.3.0.exe.



Select the destination folder (using the default path is highly recommended).

Step 2. Install Java Runtime Environment.

The program will download and install Java 1.5 if necessary. In the end of the process you will get a confirmation and the Bootloader setup continues.



Step 3. In the end of the setup process you can create a shortcut to the Bootloader on the desktop, then the install is finished.

8.2. Front panel enabled upgrade

Front Panel Enabled Upgrade is the simplest mode for software upgrade. To prevent unwanted software modifications via RS-232 commands, the user has to set the matrix to bootloader mode by using front panel buttons. Follow the steps described below.

Step 1. Connect to the matrix via RS-232 port.

Use a straight through serial cable between the computer and the matrix.

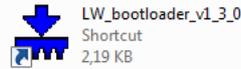
Step 2. Switch on the matrix by connecting the AC power cable.

Step 3. Check the current protocol setting:

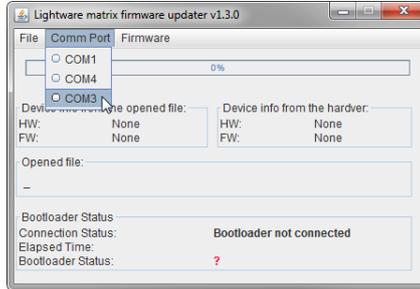
1. Switch the matrix to TAKE mode,
2. Press the CONTROL LOCK button,
3. Press and keep pressed the OUTPUT LOCK button:
 - If SOURCE 1 lights up: LW protocol is active,
 - If SOURCE 2 lights up: Protocol #2 is active.

If necessary set the protocol by pressing SOURCE 1.

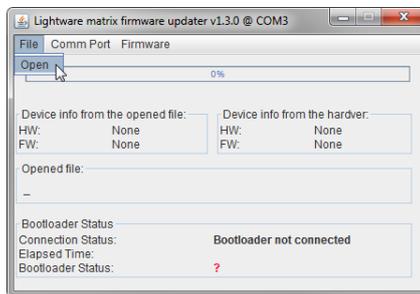
Step 4. Launch LW_bootloader_v1_3_0.



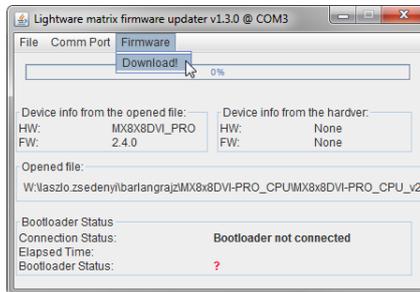
Step 5. Select the desired COM port from the Comm Port menu.



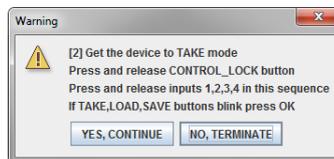
Step 6. Load the new firmware file by selecting the File / Open menu and browsing the file.



Step 7. Select Firmware / Download! from the menu.



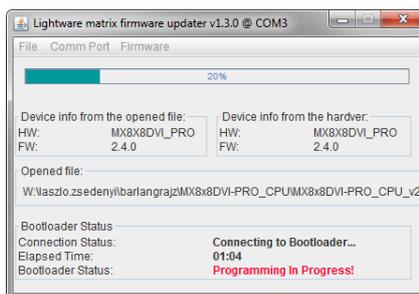
Step 8. Enable bootload mode.



Now the computer requests to switch the matrix to bootload mode (in order to perform the upgrade process) that can be allowed by the front panel buttons as follows:

1. Switch the unit to TAKE mode
2. Press and release the CONTROL LOCK button
3. Press and release Source 1, Source 2, Source 3 and Source 4 buttons sequentially.
4. TAKE, LOAD PRESET and SAVE PRESET buttons start blinking; now the matrix is in bootload mode and out of normal operation.

Step 9. Press YES, CONTINUE button to start the erasing and programming process.



When the process is finished, Bootloader status is changed to Ready; the window can be closed.

Step 10. Switch off the matrix and on again.

Info: Once the firmware upgrade failed, the router will NOT indicate its bootloader enabled state with TAKE LOAD SAVE buttons blinking, because previous software has been deleted, but steps 1 to 10 can still be repeated.

8.3. Jumper enabled upgrade

Warning! To prevent shock, never operate the unit with open cabinet. There are high voltage components inside. Never plug the power cord when the cabinet is open. Always unplug the power cord before opening the cabinet.

If the firmware upgrade process is failed, the process can be performed by settings working mode of the matrix manually as described in the following steps.

Step 1. Disconnect the unit from the AC power.

Step 2. Loosen the 12 screws and remove the top cover.

Step 3. Insert a Jumper on BOOTL – JP6 position as shown on the picture below:



Step 4. Reassemble the top cover with 2 screws – temporary for safety.

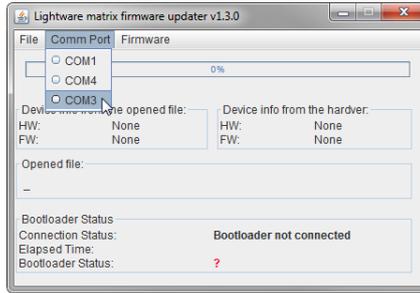
Step 5. Connect the RS-232 cable between the router and the computer.

Step 6. Power ON the router connecting to the AC power. Now the router starts up in bootload mode, no normal operation is possible.

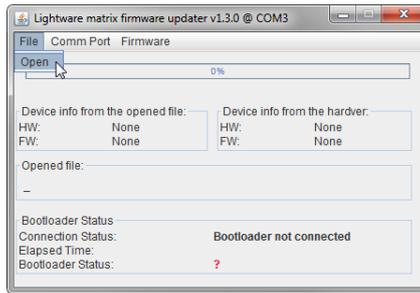
Step 7. Launch LW_bootloader_v1_3_0.



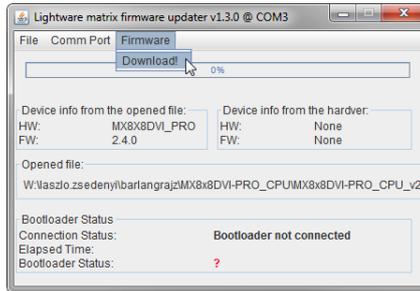
Step 8. Select the desired COM port from the Comm Port menu.



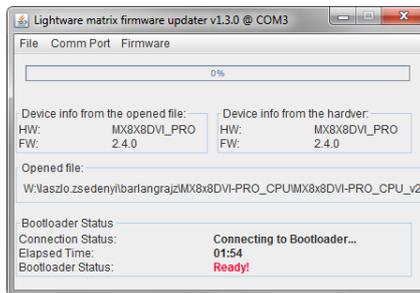
Step 9. Load the new firmware file by selecting the File / Open menu and browsing the file.



Step 10. Select Firmware / Download! from the menu, and the upgrade process is started: erasing and programming. Never disconnect the RS-232 cable during firmware upgrade!



Step 11. When the process is finished, Bootloader status is changed to Ready; the window can be closed.



Step 12. Disconnect the router from AC power and remove the jumper.

Step 13. Assemble the top cover, than power the unit up again. After powering the unit up, all buttons will light up for 4 seconds, indicating, that the unit is ready for operation. In case of failure repeat the process.

Info: With J1 inserted, the router will always start up in bootload mode. The unit will not work properly while J1 is inserted.

9. Appendix

9.1. Specifications

Inputs

DVI input signals	8 x DVI single link
Connectors.....	24-pole DVI-D digital only
Auto equalization	Yes, max 40 dB at 825 MHz
Input cable equalization	max. 50 m with 24AWG cable at 1.65 Gbps
EDID.....	Yes, for each input

Signal

Data rate	all between 25 Mbps and 1.65 GBPS / color
Channels.....	1x TMDS Clock + 3x TMDS Colors
Resolutions	all between 640x480 and 1920x1200@60Hz
Color depth	24 bits, 8 bit/color
HDTV resolutions.....	720p, 1080i, 1080p
HDCP compliant	No

Outputs

DVI output signals.....	8x DVI single link
Connectors.....	24 pole DVI-D digital only
Output pre-emphasis	No
+5V output current	500mA continuous each

Control

Front Panel buttons.....	YES, 21 buttons
Serial Port	9-pole D-sub Female RS-232 or RS-422
Baud rate	9600 Baud, 8 bit, 1stop bit, no parity
Ethernet port	RJ 45 female connector
Ethernet protocol.....	TCP/IP, UDP/IP, ARP
.....	ICMP, SNMP, TFTP, Telnet, DHCP,
.....	BOOTP, HTTP, and AutoIP

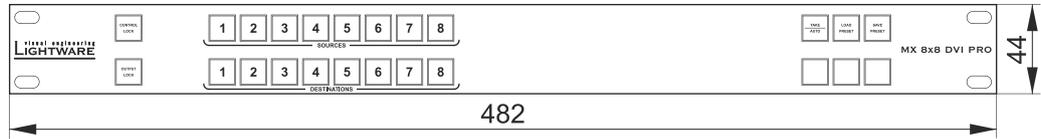
General

Power	100-240 V AC 50/60 Hz 1.8..1.0 A
Compliance	CE
EMI/EMC.....	EN 55103-1, EN 55103-2
Safety.....	EN 60065 Class I
Rack mount.....	Yes, 1U high
Enclosure	Metal
Enclosure dimensions.....	44 mm H x 446 (482) mm W x 303 mm D
Weight.....	3kg
Warranty	3 years

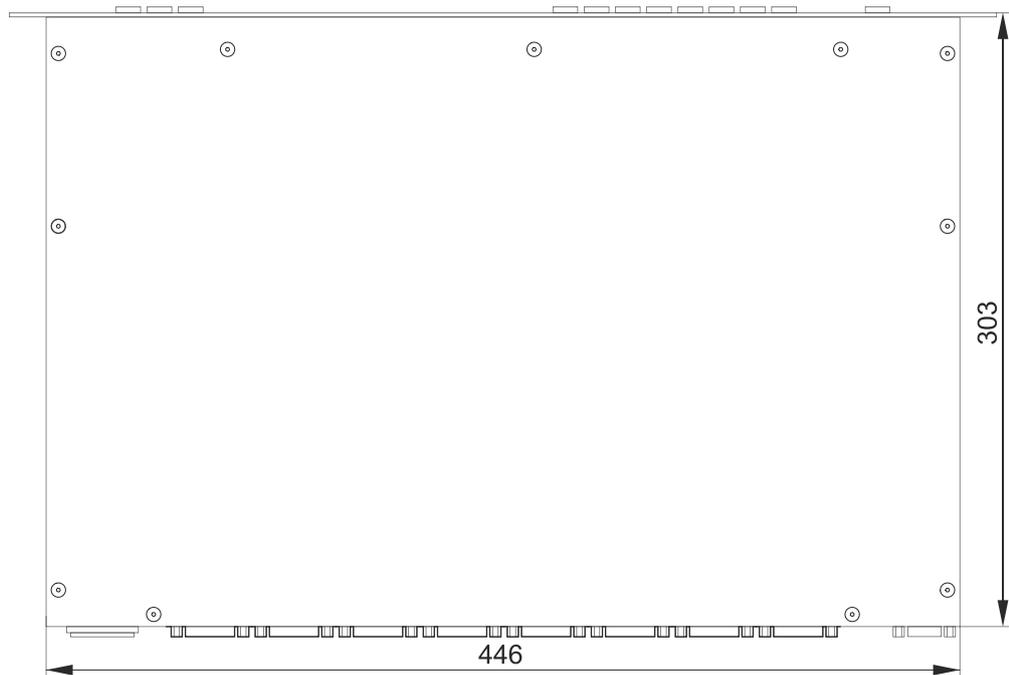
9.2. Mechanical drawings

Info: Dimensions are in mm.

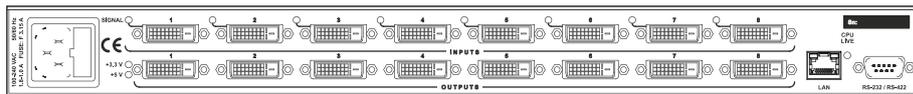
Front view



Top view



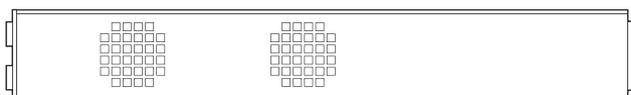
Rear view



Left view



Right view



10. Version applicability

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

Item	Version
MX8x8DVI-Pro firmware	2.4.0
Lightware Device Controller software	1.2.0
Lightware matrix firmware updater software	1.3.0
MX CPU card	1.1
DVI input card	1.21
DVI output card	1.1
EDID router card	1.0

11. Warranty

Lightware Visual Engineering warrants this product against defects in materials and workmanship for a period of three years from the date of purchase.

The customer shall pay shipping charges when unit is returned for repair. Lightware will cover shipping charges for return shipments to customers.

In case of defect please call your local representative, or Lightware at

Lightware Visual Engineering
H-1071 Budapest, Peterdy Street 15, HUNGARY

E-mail: support@lightware.eu

12. Document revision history

Document	Release Date	Changes	Editor
Rev. 1.0	09-01-2009	Initial version	Gergely Vida
Rev. 1.1	20-12-2012	Serial cable type correction	Gergely Zuban
Rev. 1.2	03-12-2014	General document update; Lightware Device Controller, built-in webpage added	Laszlo Zsedenyi
Rev. 1.3	16-12-2015	Safety instructions updated	Laszlo Zsedenyi