visual engineering
LIGHTWARE

User's Manual

HDMI-TPS-RX110AY

HDBaseT™ Multimedia Extender

Important Safety Instructions

Class II apparatus construction.

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

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

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

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

Ventilation

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

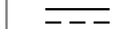
WARNING

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

Waste Electrical & Electronic Equipment WEEE

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

Common Safety Symbols

Symbol	Description
	Direct current
	Alternating current
	Double insulation
	Caution, possibility of eletric shock
	Caution

Symbol Legend

The following symbols and markings are used in the document:

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

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

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

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

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

Navigation Buttons

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

Navigate to the Table of Contents.

Step back one page.

Step forward to the next page.

Document Information

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

Item	Version
Lightware Device Controller (LDC) software	1.20.0b5
Lightware Device Updater (LDU) Software	1.5.2b3
Controller firmware	1.2.0
Hardware	1.2

Document revision: **2.2**

Release date: 31-10-2018

Editor: Judit Barsony

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1

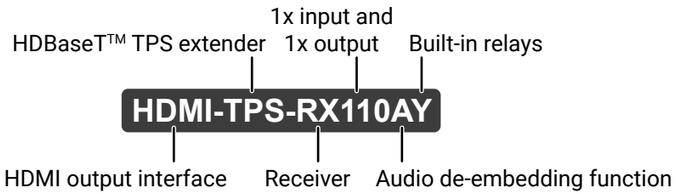
Introduction

Thank you for choosing Lightware's HDMI-TPS-RX110AY receiver. In the first chapter we would like to introduce the device highlighting the most important features in the below listed sections:

1.1. Description

A small size HDBaseT™ TPS receiver unit is being developed in the Lightware works with one PoE capable TPS input and a single HDMI output. The unit is full 4K/UHD and 3D capable and HDCP compliant. The HDMI audio is de-embedded to the balanced audio output via a Phoenix (Euroblock) connector, the audio port has volume and balance control. The built-in Event Manager feature and the dual Relay module of the device are both configurable via the Lightware Device Controller software. Further control options are served by the USB, RS-232, IR (in and out) and Ethernet ports.

Model Denomination



1.2. Compatible Devices

The receiver is compatible with other Lightware TPS transmitters, matrix TPS and TPS2 boards, 25G TPS2 boards, as well as third-party HDBaseT-extenders, displays, but not compatible with the phased out TPS-90 extenders.

> **ATTENTION!** The receiver is PoE-compatible (Power over Ethernet, can be powered remotely via using CATx cable) but the device can only receive power and cannot send power other PoE-compatible devices. Only the TPS connector is PoE-compatible, Ethernet port cannot receive power.

The receiver is compatible with any third-party HDBaseT™ device.

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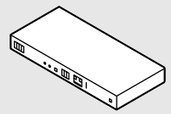
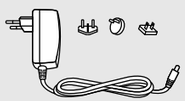
The List of Compatible Lightware Devices

- MX Modular matrix frames - MX-TPS/TPS2-OB
- 25G Modular matrix frames - 25G-TPS2-OB
- Standalone TPS matrix frames – MMX6x2-HT series
- TPS Transmitters:
  - HDMI-TPS-TX95/97
  - DVI-HDCP-TPS-TX95/97
  - UMX-TPS-TX100 series
  - WP-UMX-TPS-TX100 series
  - SW4-TPS-TX240
  - HDMI-TPS-TX200 series
  - DVI-HDCP-TPS-TX200 series
  - DP-TPS-TX200 series
- Single port standalone TPS power injector – TPS-PI-1P1

1.3. Box Contents



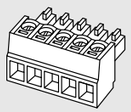
HDMI-TPS-RX110AY receiver



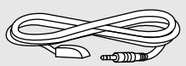
12V DC adaptor with interchangeable plugs

Phoenix® Combicon 3-pole connector

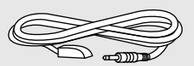
Phoenix® Combicon 4-pole connector



Phoenix® Combicon 5-pole connector



Infrared detector unit



Infrared emitter unit

Safety & warranty info, Quick Start Guide

1.4. Features

3D and 4K Support

High bandwidth allows extension of resolutions up to 4K and even 3D sources and displays are supported.

Signal Transmission up to 170 m

Video and audio signal transmission (HDMI, Ethernet, RS-232, and Infra-Red over a single CAT5e…CAT7e cable.

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.

HDCP-compliant

The receiver fulfills the HDCP standard. HDCP capability on the digital video inputs can be disabled when non-protected content is extended.

Built-in Event Manager

The Event Manager tool takes care of all the necessary control in a smaller configuration by performing predefined actions in response to device status changes. Hence, in a less complex environment, there is no need to invest in additional control solutions, which makes the receiver the best choice for numerous applications.

Remote Power

The receiver is PoE-compatible and can be powered locally by the supplied power adaptor, or remotely via the TPS connection (through the CATx cable) with a compatible power source equipment, e.g. MMX6x2-HT series matrix switchers and TPS2 matrix boards.

Bi-directional RS-232 Pass-through

AV systems can also contain serial port controllers and controlled devices. Serial port pass-through supports any unit that works with standard RS-232.

Relay

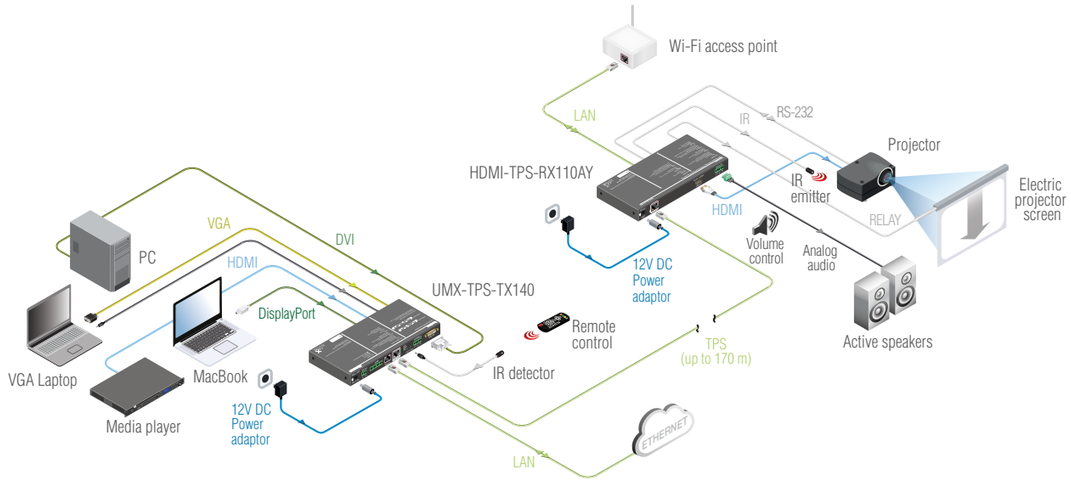
2x controllable relay modules up to 30V, 1A support.

Ethernet Control

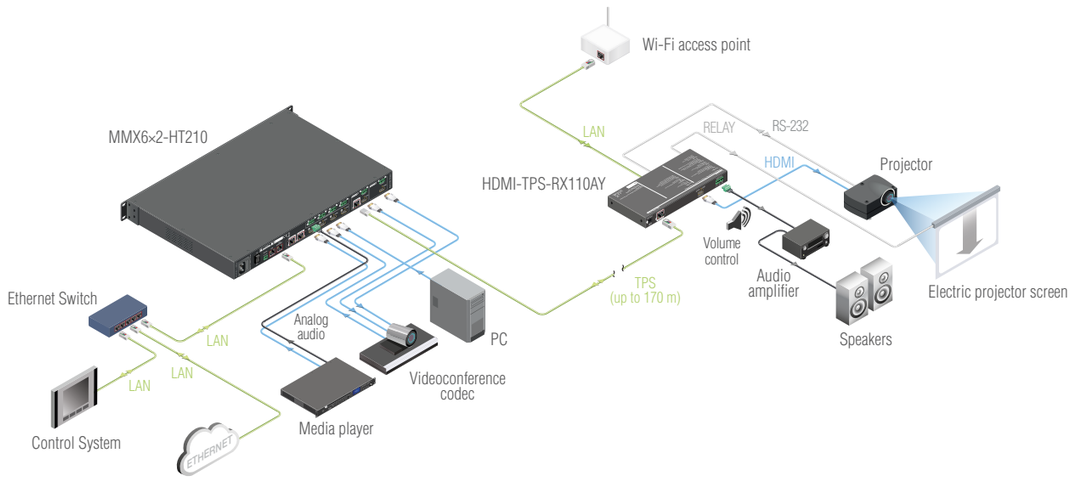
Multiple simultaneous TCP/IP connections are available with a simple ASCII-based protocol for controlling, configuring the receiver or perform a firmware upgrade.

1.5. Typical Application

Standalone Application Diagram



Integrated System Diagram



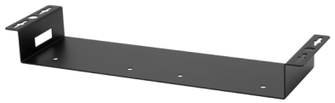
2

Installation

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

2.1. Mounting Options

To mount the receiver Lightware supplies optional accessories for different usage. There are two kinds of mounting kits with similar fixing method. The receiver has two mounting holes with inner thread on the bottom side; see the bottom view in the Mechanical Drawings section. Fasten the device by the screws enclosed to the accessory:



Under-desk double mounting kit

1U high rack shelf

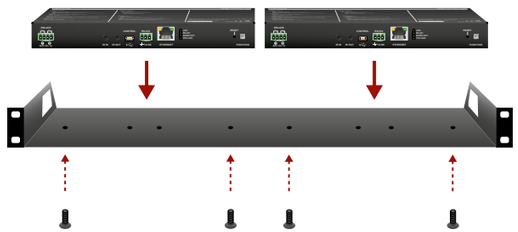
The Under-desk double mounting kit makes easy to mount a single device on any flat surface, e.g. furniture. 1U high rack shelf provides mounting holes for fastening two half-rack or four quarter-rack sized units. Pocket-sized devices can also be fastened on the shelf. To order mounting accessories please contact sales@lightware.com.

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

INFO: The receiver is half-rack sized.

2.1.1. 1U High Rack Shelf

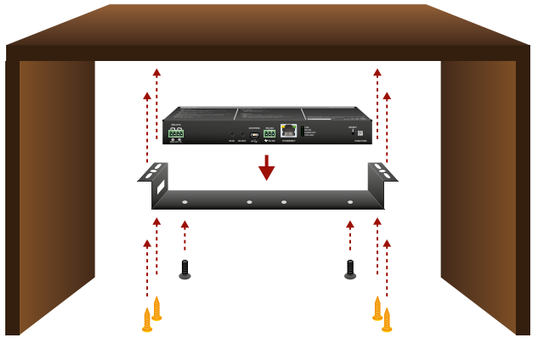
Allows rack mounting for half-rack, quarter-rack and pocket sized units.



1U high rack shelf provides mounting holes for fastening two half-rack or four quarter-rack sized units. Pocket sized devices can also be fastened on the self.

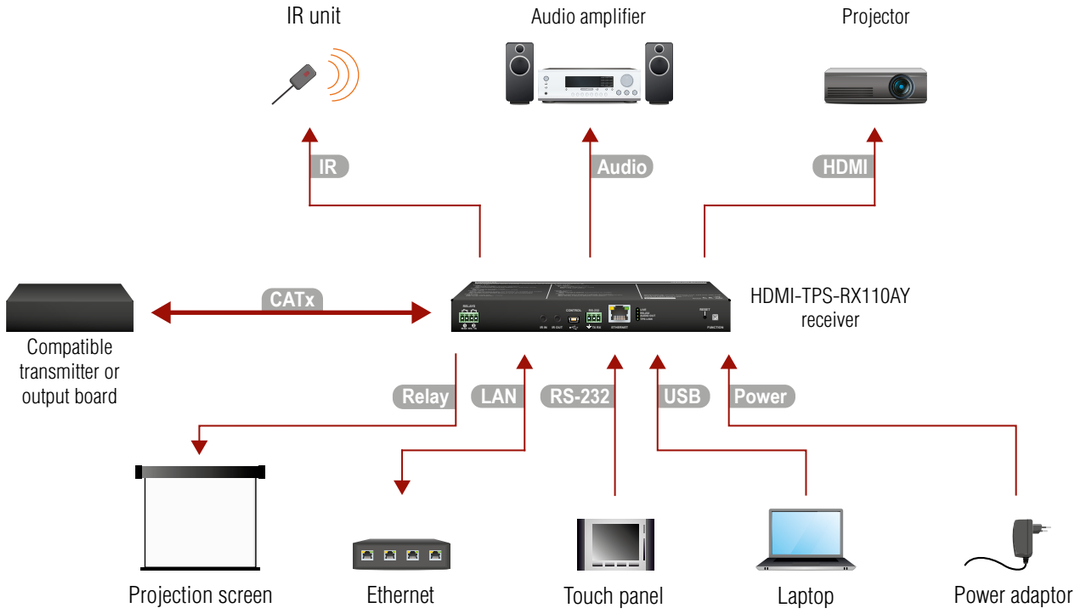
2.1.2. Under-desk Double Mounting Kit

The UD-kit double makes it easy to mount a single receiver on any flat surface (e.g. furniture).



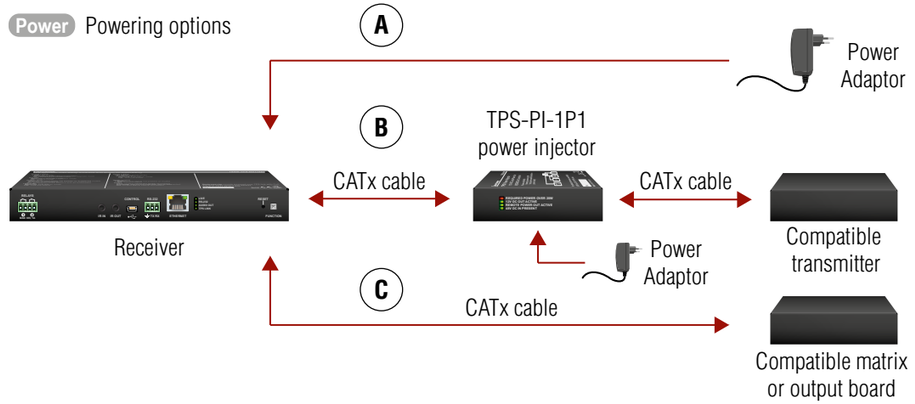
INFO: The chipboard screws are not supplied with the mounting kit.

2.2. Connecting Steps



CATx	Connect the compatible transmitter or the matrix output board and the receiver unit by a CATx cable via the TPS connectors.
HDMI	Connect the sink device to the HDMI output port.
Audio	Optionally connect an audio device (e.g. an audio amplifier) to the audio output port. See the wiring guide for the Phoenix 5-pole connector in the Audio Cable Wiring Guide section.
IR	Optionally for Infrared extension: - Connect the IR emitter to the IR OUT port of the receiver. - Connect the IR detector to the IR IN port of the receiver.
USB	Optionally connect the receiver to a control device (e.g. laptop) with an USB mini cable.
RS-232	Optionally for RS-232 extension: connect a controller/controlled device (e.g. touch panel) to the RS-232 port.
LAN	Optionally connect the receiver to a LAN network in order to control the device.
Relay	Optionally for relays: connect a controlled device(s) (e.g. a projection screen) to the relay port.
Power	See powering options on the next section.

Powering Options



A **Using local PSU** - connect the power adaptor to the DC input on the receiver first, then to the AC power socket.

B **Using PoE with connecting a transmitter**: connect the TPS IN (PoE) port of the receiver to the TPS+PoE output port of the TPS-PI-1P1 power injector by a CATx cable as well as connect the TPS output port of the transmitter to the TPS port of the TPS-PI-1P1 by a CATx cable.

C **Using PoE with connecting a matrix or an output board**: connect the TPS IN (PoE) port of the receiver to the PoE-compatible TPS output port of the matrix or output board by a CATx cable.

ATTENTION! In case of connecting the receiver to an output board of the matrix always connect an external PSU to the board. For the detailed information please read the user's manual of the matrix.

ATTENTION! The Ethernet port does not support PoE. Only the TPS port support PoE function.

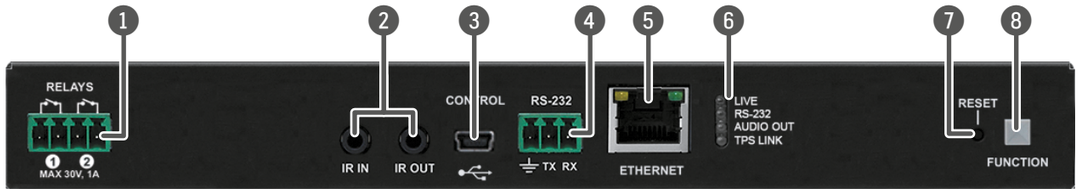
INFO: If both remote and local power sources are connected, the remote power will be used.

3

Product Overview

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

3.1. Front View



1	**Relay**	4-pole Phoenix connector for relay ports. Pin assignment can be found in the Relay Connector section.
2	**IR IN and OUT**	3-pole TRS connector, also known as 3.5 mm (1/8”) jack plug for optional IR receiver (IR IN) and transmitter (IR OUT). Pin assignments can be found in the IR Connector section.
3	**USB**	USB interface for LDC connection to control the receiver.
4	**RS-232**	3-pole Phoenix connector for controlling the device with LDC or third-party control systems. Pin assignment can be found in the RS-232 Connector section.
5	**Ethernet**	Locking RJ45 connector for controlling the device with LDC or third-party control systems and LDU for firmware upgrade.
6	**Status LEDs**	The LEDs give immediate feedback about current state of the device. See below the details.
7	**Reset button**	Pressing reset button reboots the extender.
8	**Function button**	Special functions are available with this button (switch to bootload mode, enable DHCP, restore factory default settings). For the details about special functions see the Front Panel - Special Functions section.

Status LEDs

LIVE

OFF:	The device is not powered.
BLINKING:	(slow; 1 sec): Device is powered and operational. (fast; 0,5 sec): Device is in bootload mode.
ON:	The device is powered but not operational.

RS-232

OFF:	RS-232 ports (local and link) in Pass-through mode.
BLINKING:	Command Injection mode is active.
ON:	RS-232 ports (local and link) are in Control mode.

AUDIO OUT

OFF:	Embedded audio is not present or analog output is muted.
BLINKING:	Embedded audio format is not supported for audio de-embedding.
ON:	Embedded audio is present and de-embedded.

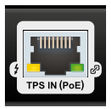
TPS LINK

OFF:	No TPS link between transmitter and receiver.
BLINKING:	Device is in low power mode or in Ethernet fallback mode.
ON:	TPS link is established, HDBaseT or Long Reach mode is active.

3.2. Rear View

1	**DC 12V IN**	Local power in; connect the output of the supplied 12V DC power adaptor. For more details see next section.
2	**TPS IN (PoE)**	Locking RJ45 connector. Connect a twisted pair cable between the transmitter and the receiver. Remote powering is also available through this connector. Maximum CATx cable distances can be found in the Maximum Extension Distances section.
3	**SIGNAL status LED**	The LED gives immediate feedback about current state of the HDMI output signal. See the legend below.
4	**HDMI OUT**	Connect an HDMI cable between the receiver and the local sink device. Applied cable shall not be more, than 30 m (when the signal is 1080p) and 20 m (when the signal is 4K).
5	**HDCP status LED**	The LED gives immediate feedback about current state of HDCP. See the legend next to the table.
6	**AUDIO OUT**	5-pole Phoenix connector for asymmetric analog audio output. Pin assignment can be found in the next section.

TPS Input LEDs



OFF:	Remote power (PoE) is inactive, device is powered locally.
ON:	Remote power is active.
OFF:	No TPS link between the transmitter and receiver.
BLINKING:	Device is in low power mode or Ethernet fallback mode.
ON:	TPS signal is present.

SIGNAL LED for HDMI Output

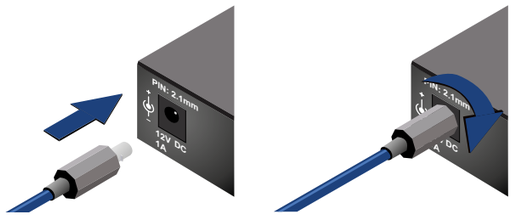
OFF:	Output signal is not present or muted.
ON:	Signal is present.

HDCP LED for HDMI Output

OFF:	Output signal is not HDCP-encrypted.
BLINKING:	Non-HDCP capable device is connected, encrypted signal is replaced with red screen.
ON:	Output signal is HDCP-encrypted.

3.3. Electrical Connections

3.3.1. DC 12V Connection



Locking DC connector

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

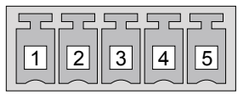
WARNING! Always use the supplied 12V power adaptor. Warranty void if damage occurs due to use of a different power source.

3.3.2. HDMI Connector

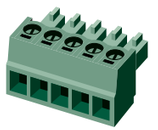
The extender provides standard 19 pole HDMI connector for output. Always use high quality HDMI cable for connecting sources and displays.

3.3.3. Analog Audio Output

5-pole Phoenix connector is used for balanced analog audio output. Unbalanced audio signals can be connected as well. For unbalanced output connect + and ground to the source and connect – to the ground.



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



Analog audio connector and plug pin assignments

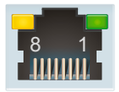
Compatible Plug Type

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

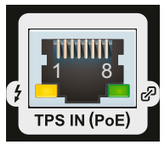
You can find more information about analog audio function in the Audio Interface section. Audio cable wiring guide is in the Audio Cable Wiring Guide section.

3.3.4. Ethernet Connector (TPS and LAN Ports)

The extender provides standard RJ45 connectors for TPS IN and LAN ports. Always use high quality Ethernet cable for connecting transmitters and receivers. Maximum CATx cable distances can be found in the Maximum Extension Distances section.



RJ45 connector for LAN port



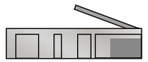
RJ45 connector for TPS input port

Wiring of TPS and LAN Cables

Lightware recommends the termination of LAN cables on the basis of TIA/EIA T 568 A or TIA/EIA T 568 B standards.

Top

Bottom



Side

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

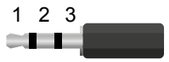
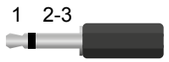
You can find more information about TPS interface in the TPS Interface section.

3.3.5. USB Connector

The extender provides standard USB 2.0 mini B-type connector for software control purpose.

3.3.6. IR Connector

IR detector and IR emitter can be connected to the receiver with TRS (Tip, Ring, and Sleeve) connectors. They are also known as (3,5 mm or approx. 1/8") audio jack, phone jack, phone plug, and mini-jack plug. The pin assignments are the following for the detector and the emitter:

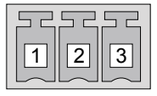
 Detector – 3-pole TRS		 Emitter – 2-pole TS	
1 Tip	Signal (active low)	1 Tip	+5V
2 Ring	GND	2 Ring	Signal (active low)
3 Sleeve	+5V	3 Sleeve	

INFO: Ring pole of the emitter is optional. If your IR emitter has three-pole TRS plug, then the Ring and the Sleeve are the same signal (Output -).

You can find more information about Infrared interface in the IR Interface section.

3.3.7. RS-232 Connector

The receiver contains a 3-pole Phoenix connector which is used for RS-232 serial connection.



Pin nr.	Signal
1	Ground
2	TX data
3	RX data

RS-232 connector pin assignments

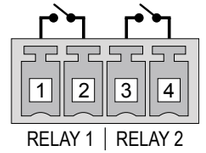
Compatible Plug Type

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

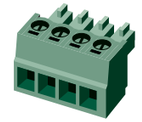
You can find more information about RS-232 interface in the Serial Interface section.

3.3.8. Relay Connector

The receiver contains a 4-pole Phoenix connector which is used for relay connection.



Pin nr.	Signal
1	Pin 1 for Relay 1
2	Pin 2 for Relay 1
3	Pin 1 for Relay 2
4	Pin 2 for Relay 2



Relay connector pin assignment

INFO: The maximum ratings for each relay are 30V and 1A, AC/DC.

Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch, 4-pole), type: MC 1.5/4-ST-3.5.

You can find more information about relay interface in the Relay Interface section.

3.4. TPS Receiver Concept

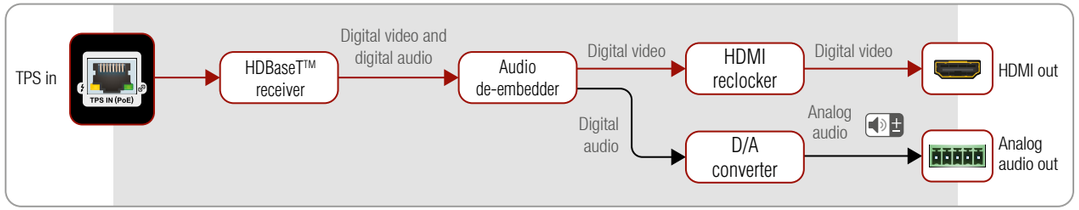
HDMI-TPS-RX110AY is a multifunctional receiver with HDBaseT™ (TPS) technology. The device can be controlled via many kind of interfaces, e.g. Ethernet, USB, RS-232, and Infrared. The receiver is built with audio de-embedder and relay function.

+ Ethernet
+ RS-232
+ Infrared
+ Local USB
+ Relay

Summary of the interfaces

3.5. Port Diagram

The following figure describes the port diagram of the device:



Port diagram of HDMI-TPS-RX110AY receiver

The device receives HDMI/DVI, Ethernet, RS-232, Infrared signals on the TPS input line. A/V signals are processed in the HDBaseT™ receiver unit. The audio de-embedder separates the digital audio and video signals. The digital video signal through the HDMI reclocker can be forwarded to the local sink device by the HDMI output port while digital audio signal is converted to analog by the digital-analog (D/A) converter and forwarded to the local audio sink device by the analog audio output port.

3.6. TPS Interface

The device is built with TPS (Twisted Pair Single) interface which are using HDBaseT™ technology. It means the unit receives video, audio, Ethernet, RS-232, and Infrared signals via a single CATx cable.

TPS Interface Working Modes

The TPS working mode between the transmitter and the receiver is determined by the mode set in them. Both devices TPS mode settings together determine the finally established TPS transmission mode.

The following TPS modes are defined in the receiver:

- **Auto**: The TPS mode is determined automatically.
- **HDBaseT**: Ideal for high resolution signals up to 4K.
- **Long reach**: Ideal for big distances up to 1080p@60Hz with extended cable lengths.
- **LPPF1***: Only RS-232 communication is transmitted (@ 9600 baud).
- **LPPF2***: Only RS-232 (@ 9600 baud) and Ethernet communication are transmitted.

* LPPF: Low Power Partial Functionality.

		Selected mode on RX side				
		LPPF1	**LPPF2**	**HDBaseT**	**Long reach**	**Auto**
Selected mode on TX side	**LPPF1**	LPPF1	LPPF1	LPPF1	LPPF1	LPPF1
	LPPF2	LPPF1	LPPF2	LPPF2	LPPF2	LPPF2
	HDBaseT	LPPF1	LPPF2	HDBaseT	Long reach	HDBaseT
	Long reach	LPPF1	LPPF2	Long reach	Long reach	Long reach
	Auto	LPPF1	LPPF2	HDBaseT	Long reach	HDBaseT **

** If there is valid HDMI/DVI signal is on the TX side, the TPS mode will be HDBaseT on both side. If the transmitter does not transmits HDMI/DVI signal, the TPS mode will be changed to LPPF2 or LPPF1 automatically. Long reach mode is not available when both sides are set to Auto mode.

When using automatic operation mode selection, the device determines the mode of operation. If both halfs are set to Auto mode, the source side is the initiator. It will negotiate each state transition with its sink side partner.

When one of the devices is configured to manual operation mode selection, the other device may be placed in automatic mode. In this case, the mode transition negotiation is initiated by the host-managed device and the auto-mode device follows through. The allowed cable lengths and resolutions are listed in the Maximum Extension Distances section.

3.7. Audio Interface

3.7.1. Audio Input

The device can receive embedded audio signal on the TPS input line.

3.7.2. Audio Output Modes

The device can transmit two types of audio:

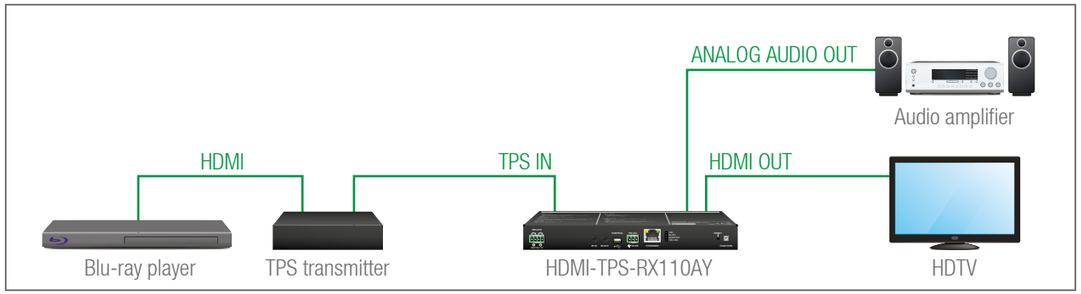
- Embedded (HDMI) and
- Analog balanced stereo audio.

Audio de-embedding

The receiver has built-in audio de-embedder what means the device is able to receive HDMI signal with embedded audio via TPS line and can separate to video and audio signals on the output side.

> **ATTENTION!** De-embedding function supports 2 channel PCM audio signals only. Other audio formats are not supported and de-embedding will not be successful.

3.7.3. Audio Options - Example



The Concept

The source is a Blu-ray player which sends audio and video signals on HDMI to the transmitter. The receiver accepts the signal on the TPS line, the audio signal is still embedded. HDMI-TPS-RX110AY makes de-embedding the AV signal to separated digital audio and analog audio signals and transmit them to the HD TV and the audio amplifier.

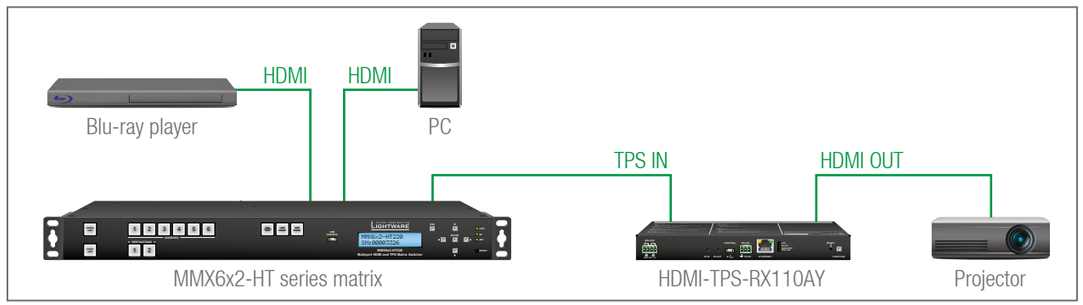
The following ways are available for the audio devices:

- The **Receiver** transmits the digital audio signal together with the video signal to the **HDTV**.
- The **Receiver** de-embeds the digital audio signal and converts it to analog one. It is transmitted to the **Audio amplifier**. So the **HDTV** provides the picture and **Audio amplifier** provides the sound. In this case digital audio on HDMI line needs to be muted.

3.8. Video Interface

The device can receive digital video signal via TPS line from any HDBaseT™ compliant transmitter, matrix or matrix board. On the output side the receiver transmits HDMI signal toward the sink.

Video Interface - Example



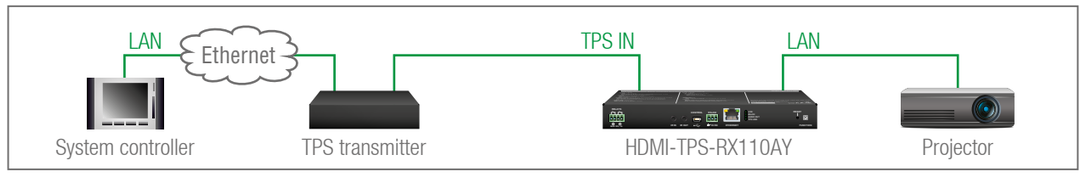
The Concept

The Receiver is connected to the Matrix which has two sources: a Blu-ray player and a PC. The input source can be selected in the matrix which transmits the video signal toward the receiver via the TPS interface.

3.9. Control Features

HDMI-TPS-RX110AY has several control functions. This chapter is about to present the possibilities through two simple layout examples.

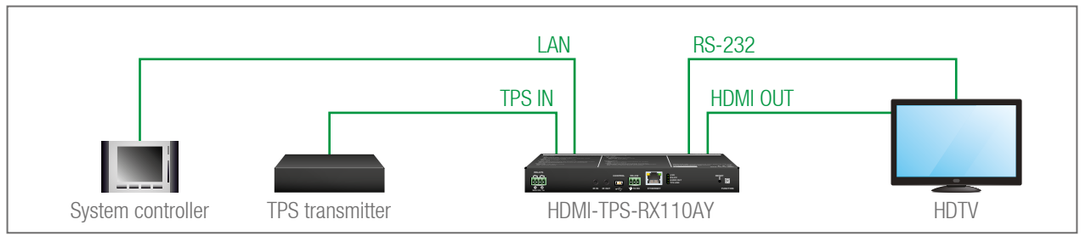
System Control via Local Ethernet (Example)



The following ways are available for device control:

- The **System controller** can communicate with the **Receiver** via the TPS line of the **Transmitter** with using LW2/LW3 protocol commands.
- The **System controller** can communicate directly with the **Projector** via their IP:port address.
- The **Receiver** can send a commands (e.g. as an action by the Event Manager) to the IP:port address of the **Projector** by using LW3 protocol methods.

System Control via Local RS-232 (Example)



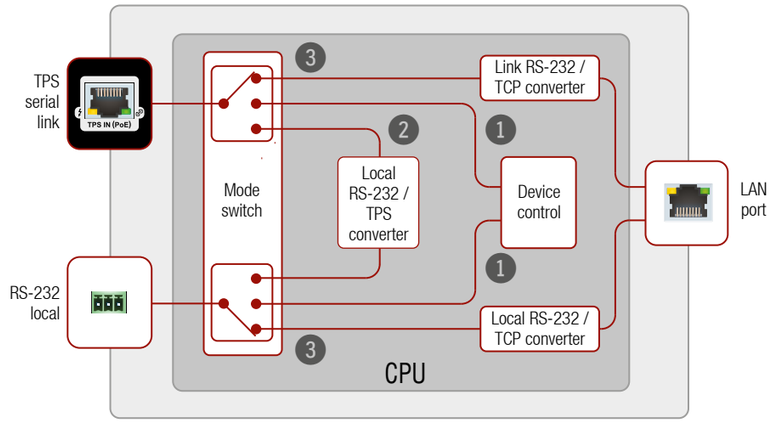
The following ways are available for controlling the devices:

- The **System controller** can communicate with LW2/LW3 protocol commands via the local RS-232 port of the **Receiver**.
- The **System controller** can send TCP or UDP messages to the IP:port address of the **Receiver** by using LW3 protocol methods.
- The **Receiver** can send LW3 protocol commands to the **HDTV** via the local RS-232 port.

3.9.1. Serial Interface

Technical Background

Serial data communication can be established via the local RS-232 port (Phoenix connector) or via the TPS lines. The RS-232 ports – which are connected to the CPU – can be configured separately (e.g. if the Baud rates are different, the CPU does the conversion automatically between the ports). The RS-232 port can be switched to Pass-through mode, Control mode, or Command Injection mode; see the figure below.



Block diagram of the serial interface

The following settings are defined:

1. The Local and the TPS serial port is in **Control mode**.
2. The Local and the TPS serial port is in **Pass-through mode**.
3. The Local and the TPS serial port is in **Command Injection mode**.

INFO: All settings are available in the LDC software, see settings in the RS-232 section.

Only one mode can be used at the same time: Control mode, or Pass-through mode, or Command Injection mode. If you choose one of them, TPS serial link and local RS-232 port will operate in the same mode.

Pass-through Mode

In pass-through mode, the given device forwards the data that is coming from one of its ports to another same type of port. The command is not processed by the CPU. Incoming serial data is forwarded from TPS input port to local RS-232 port and vica versa inside the receiver.

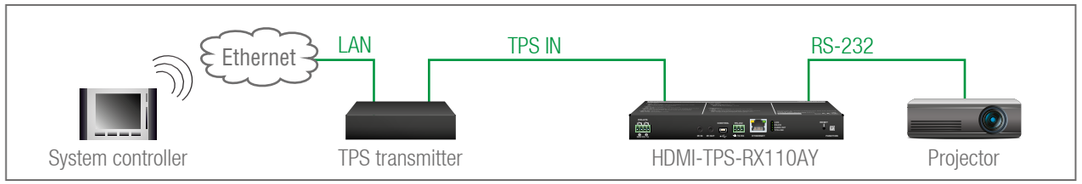
Control Mode

The incoming data from the given port is processed and interpreted by the CPU. The mode allows to control the receiver directly. LW2 or LW3 protocol commands are accepted – depending on the current port setting.

Command Injection Mode

In this mode, the receiver works as an RS-232 bidirectional converter. The TPS signal is converted to RS-232 data and vice versa. TCP/IP port numbers are defined for the serial ports (TPS and local) for this purpose. E.g. the default Command Injection port number of the local RS-232 port is 8001. If a command is coming from the TPS interface which addresses to the port no. 8001, it will be transmitted to the Tx pin of the local RS-232 port. That works in the opposite direction of course and the method is the same on the serial interface of the TPS port as well.

RS-232 Signal Transmission – Example



The Concept

The System controller can send commands to the receiver through the TPS transmitter and is able to remote control the projector via RS-232.

Settings

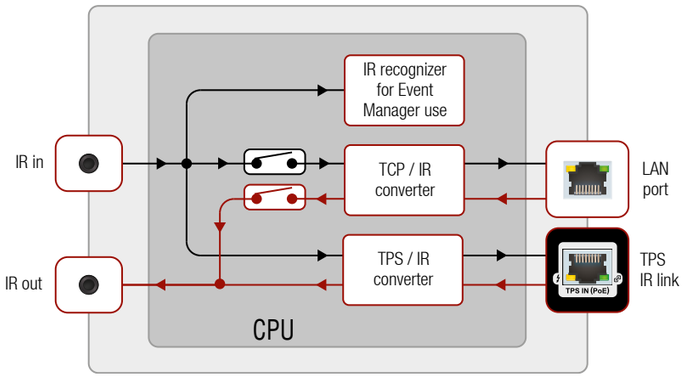
- **System controller**: wireless IP connection to the same Ethernet as the transmitter is connected to. Use a dedicated software tool (e.g. a terminal) which is suitable for sending commands via TCP/IP to a certain IP:port address.
- **Transmitter**: set the RS-232 mode to Command Injection on TPS output port. Set the further parameters (Baud rate, Data bits, etc.) in accordance with the specifications of the projector. The transmitter will transmit the RS-232 data toward the receiver.
- **Receiver**: set the RS-232 mode to Pass-through on RS-232 port.
- **Projector**: note the RS-232 port setting that is specified by the Manufacturer. Connect a suitable serial cable with the proper wiring.

3.9.2. IR Interface

ATTENTION! For the complete usage attach the supplied IR emitter unit to the IR OUT and the IR detector unit to the IR IN connectors.

Technical Background

The Infrared signal transmission is similar to the serial data communication. The receiver contains dedicated IR I/O connection and also can transmit/receive IR signal via the TPS interface. The signal is in pronto HEX format in both cases.



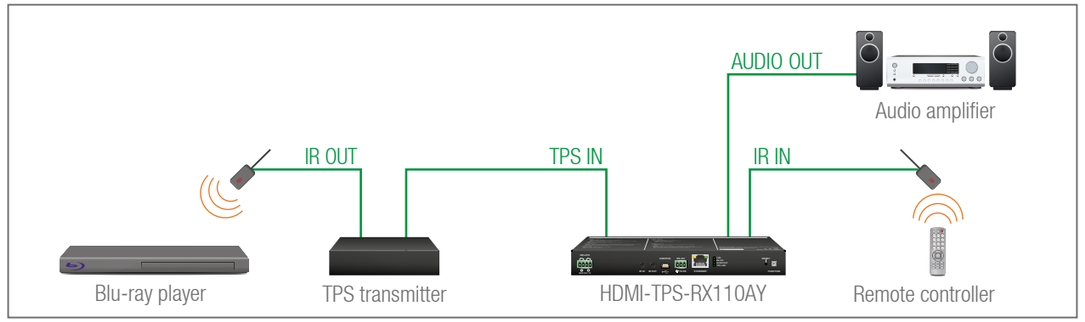
Block diagram of the IR interface

The most trivial usage of the IR interface is the transparent mode: signal received or sent on local IR ports are transmitted directly on the TPS IR link port and vica versa. Beside of this there is an IR recognizer in the device where you can assign actions in Event Manager for. The third option is the command injection mode (like at serial interface in the previous section) where you can send IR commands over LAN. Command injection mode can be turned on and off by input/output ports.

INFO: All settings are available in the LDC software, see settings in the Infra section.

INFO: The modulation of output IR signal can be turned off or on by LW3 command, see the Enable/Disable Output Signal Modulation section.

IR Signal Transmission - Example



The Concept

An IR detector is attached to the Infrared input port of the Receiver and IR signals are sent by the Remote controller. The Receiver is connected to a compatible Transmitter built with IR output port via TPS line. An audio device is also connected to the audio output port of the receiver.

The following ways are available for controlling the devices:

- **Transparent mode**: IR signals are received over the local IR input port of the **Receiver** by the Remote controller. The signals transmitted further over the TPS line to the **Transmitter** which can control the **Blu-ray player** via an IR emitter.
- **Event Manager usage**: set an action in Event Manager that if the volume control buttons are pressed on the **Remote controller**, increase or decrease the volume of the analog audio port of the **Receiver**. In this case you can control the audio device via the Receiver remotely. See the details about the Event Manager settings in the Event Manager section.

3.9.3. USB Control Interface

The device can be controlled over front panel USB mini B-type connector. This interface only supports LW3 protocol. The interface can be used to establish a connection to Lightware Device Controller software.

3.9.4. Ethernet Control Interface

The device can be controlled over front panel Ethernet standard RJ45 connector which connected to LAN. This interface supports both LW2 and LW3 protocols.

The interface can be used to remote control the device with Lightware Device Controller and establish the connection to Lightware Device Updater software and perform firmware upgrade.

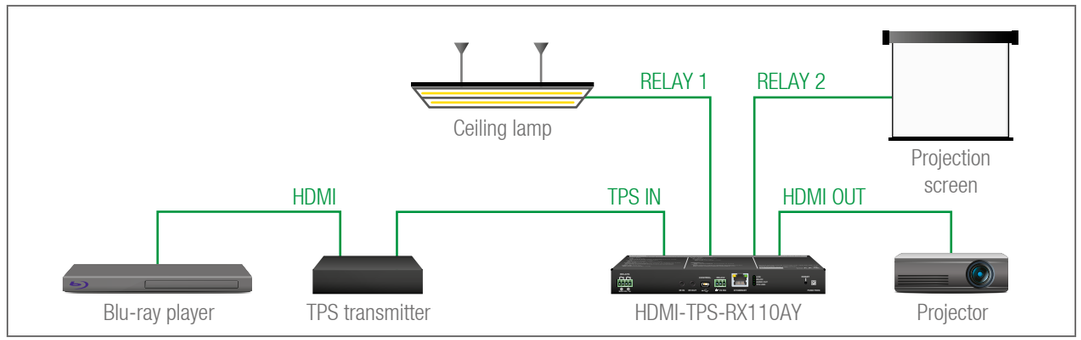
3.9.5. Relay Interface

HDMI-TPS-RX110AY receiver contains two relay modules which can be accessed by a 4-pole Phoenix connector. The relays can be controlled by Lightware protocol commands (LW3) and Event manager actions can be assigned to the port.

ATTENTION! The device built with normally open (N.O.) contact relays which means when the unit is not powered (DC plug is disconnected), the relays will open.

INFO: The default state of each relay ports is open.

Application of Relays - Example



The Concept

Ceiling lamp is turned off by Relay 1 and projection screen is rolled down by Relay 2 when signal received from the transmitter over TPS input line.

Settings of the Receiver

- **Relay 1**: create an event in Event manager: when signal is present on Input 1 (I1) then set Relay 1 to be open. Also create another event when signal is not present on Input 1 (I1) then set Relay 1 to be closed.
- **Relay 2**: create an event in Event manager when signal is present on Input 1 (I1) then set Relay 2 to be closed. Also create another event when signal is not present on Input 1 (I1) then set Relay 2 to be open.

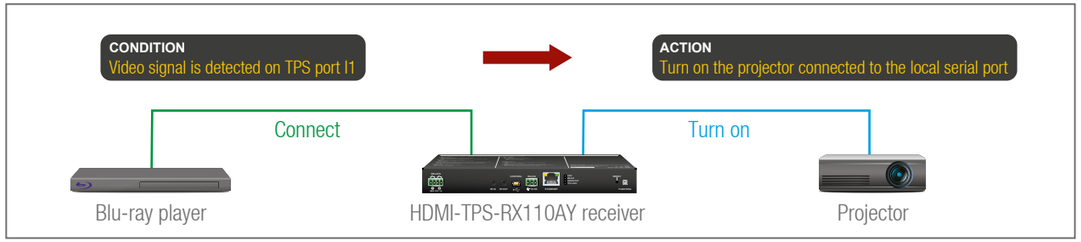
When Blu-ray player starts to play the presentation video, signal is received over TPS input line so Relay 1 opens which results turning off the lights, furthermore Relay 2 closes and the projection screen is rolled down. When the presentation is ended, signal ceases on the TPS input line, so Relay 1 closes which results turning on the lights, furthermore Relay 2 opens and projection screen returns to its enclosure.

See the details about the Event Manager settings in the Event Manager section.

3.10. Further Built-in Features

3.10.1. Automatically Launched Actions – The Event Manager

The Event Manager feature means that the device can sense changes on its ports and is able to react according to the pre-defined settings. Lightware Device Controller contains a user-friendly software tool and allows to create Events by defining a Condition and an Action.



Event Manager example

See more information about the settings in the Event Manager section.

3.10.2. Receiver Cloning – Configuration Backup and Restore

The receiver (configuration) cloning of HDMI-TPS-RX110AY is a simple method that eliminates the need to repeatedly configure certain devices to have identical (non-factory) settings. If the devices are installed in the same type of system multiple times then it is enough to set up only one device to fit the user's needs and then copy those settings to the others, thus saving time and resources.

See more information about the settings in the Configuration Cloning (Backup Tab) section.

3.10.3. Remote Firmware Upgrade of Connected Lightware Devices

The firmware of the Lightware TPS devices can be upgraded individually by Lightware Device Updater (LDU) software. HDMI-TPS-RX110AY contains a feature which allows having a faster and more comfortable firmware upgrade process. When the firmware of the connected extenders has to be upgraded the TPS connection is necessary towards the extenders – nothing else. The LDU will find the connected devices and can upgrade them.

The upgrade process is almost the same as in the case of the usual upgrade process. See the details of the process in the Remote Firmware Upgrade of Connected Lightware Devices section.

4

Operation

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

4.1. Front Panel - Special Functions

4.1.1. Programmable Function Button

Action or an operation can be assigned to the **Function** button. "Function button pressed" is a condition that can be selected in the Event Manager. See more details in the Event Manager section.

4.1.2. Enable Dynamic (DHCP) IP Address

The device gets a static IP address as a factory default setting. If this setting does not fit to the circumstances during install or usage, DHCP can be enabled from the front panel:

Step 1. Make sure the device is powered on and operational.

Step 2. Press and keep pressed the **Function** button for 5 seconds.

Step 3. After 5 seconds front panel LEDs start blinking; release the button and press it 3 times again quickly (within 3 seconds).

Step 4. The LEDs get dark, DHCP gets enabled.

4.1.3. Reset to Factory Default Settings

To restore factory default values, do the following steps:

Step 1. Make sure the device is powered on and operational.

Step 2. Press and keep pressed the **Function** button for 10 seconds. After 5 seconds front panel LEDs start blinking but keep on pressing the button.

Step 3. After 10 seconds the blinking gets faster; release the button and press it 3 times again quickly (within 3 seconds).

Step 4. The LEDs get dark, the device restores the factory default settings and reboots.

Factory default settings are listed in the Factory Default Settings section.

4.1.4. Reseting the Device

In few cases (after firmware upgrade, etc) you may need to reset the device. Pushing the reset button results the same as you disconnect and reconnect the power adaptor to the receiver. To reseting the device follow the steps:

Step 1. Push the button with a thin object for a second.

Step 2. Wait until the device reboots. You can use the receiver when the LIVE LED is blinking slowly again.

ATTENTION! Reseting the device does not reset the settings to factory defaults. To reset factory default settings see previous section.

4.1.5. Entering Bootload Mode

It may happen that the firmware upgrade process is not successful as the device cannot be switched to bootload mode automatically. In this case, receiver device can be forced to switch to bootload mode as follows:

Step 1. Make sure the transmitter is powered off.

Step 2. Press and keep pressed the **Function** button.

Step 3. Power on the receiver. If the device is switched to bootload mode the LIVE LED is blinking quickly (less than 500 ms duty cycle). The other LEDs are off.

4.2. Software Control Modes

User has more possibilities to control the device besides the front panel buttons. The following list contains the software control modes:

- **Lightware Device Controller (LDC)**: you can connect to the device via our control software with using USB, RS-232 or Ethernet interfaces and control or configure the device as you wish. For the details see the Software Control - Lightware Device Controller chapter.
- **LW2 protocol commands**: you can configure the device by using the reduced command set of LW2 protocol. For more details see the LW2 Programmers' Reference chapter.
- **LW3 protocol commands**: you can configure the device by using the full-range command set of LW3 protocol. For more details see the LW3 Programmers' Reference chapter.

5

Software Control - Lightware Device Controller

The device can be controlled by a computer through RS-232, Ethernet, and USB interfaces by the Lightware Device Controller (LDC). The software can be installed on a Windows PC or Mac OS X. The application and the User's Manual can be downloaded from www.lightware.com.

5.1. Install and Upgrade

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

Installation for Windows OS

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

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

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

Comparison of installation types

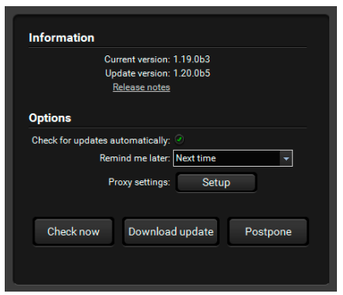
ATTENTION! Using the Normal install as the default choice is highly recommended.

Installation for Mac OS X

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

Upgrading of LDC

Step 1. Run the application.

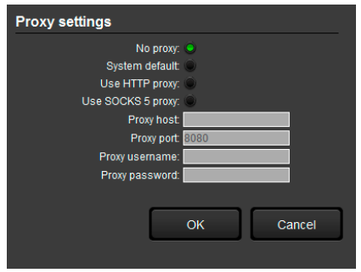


The **Device Discovery** window appears automatically and the program checks the available updates on Lightware's website and opens the update window if the LDC found updates.

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

The **Update** window can also be opened by clicking the **About icon** and the **Update** button.

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



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

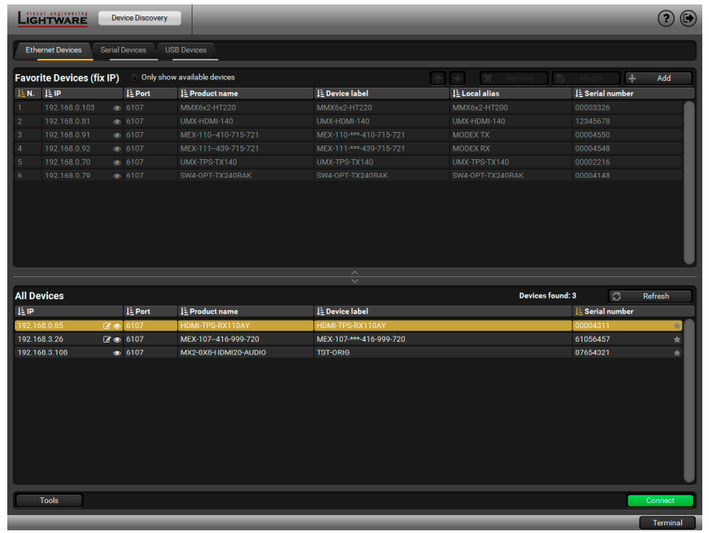
Step 3. Click the **Download update** button to start the upgrading.

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

5.2. Establishing the Connection

Step 1. Connect the device to a computer via USB, RS-232 or Ethernet.

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

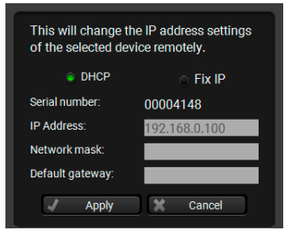


Device discovery window in LDC

Change 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 beside the IP address.

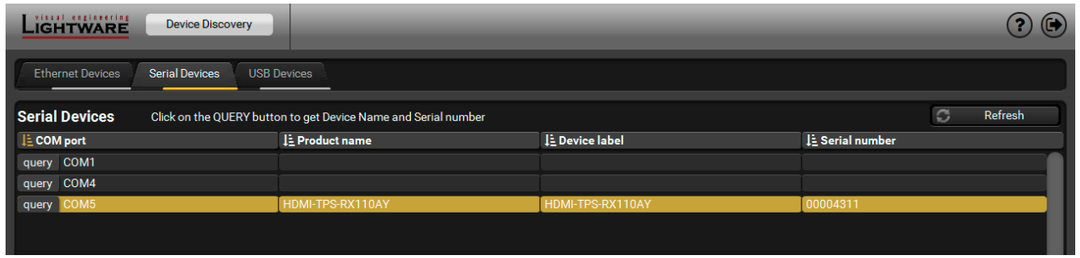
You can see the new settings only in this window.



Identifying the Device

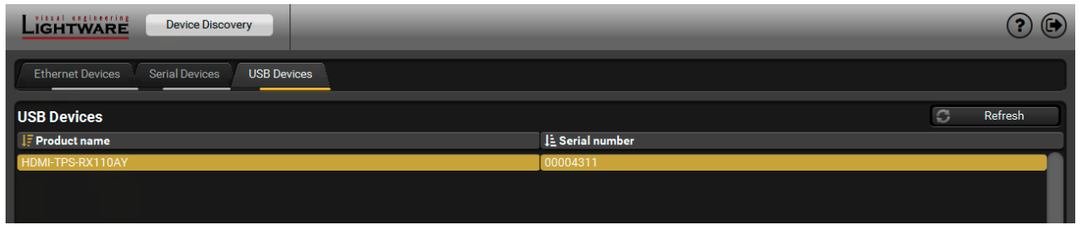
Clicking on the icon results the blinking of the status LEDs for 10 seconds. The feature helps to identify the device itself in the rack shelf.

Step 3. Select the unit from the discovered Ethernet devices or under Serial devices; when the device is connected through RS-232 click on the **Query** button next to the desired serial port to display the device's name and serial number. Double click on the transmitter or select the device and click on the **Connect** button.



Serial devices tab in LDC

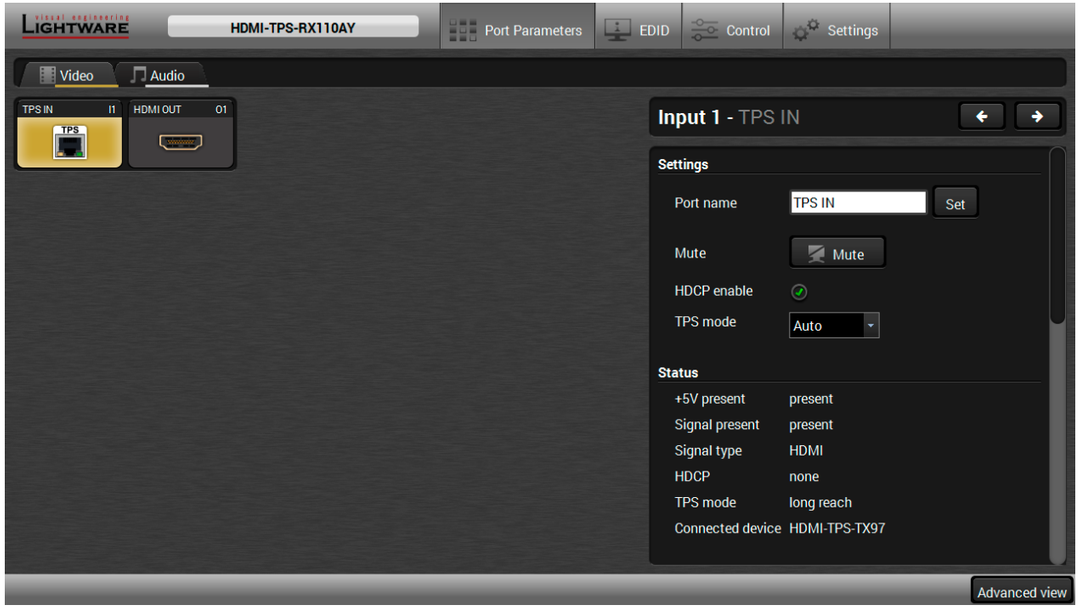
ATTENTION! Before the device is connected via the local RS-232 port, make sure that **Control mode** and **LW3 protocol** are set on the serial port.



USB tab in LDC

5.3. Port Parameters Menu

5.3.1. Video Tab



Video tab in Port parameters menu

The most important video related information and settings are available on this tab.

Link Video (I1)

This is the TPS (HDBaseT) input line of the receiver. Clicking on the TPS icon results the settings panel appearing on the right side. You can check the status of the line, signal info and current emulated EDID.

Available Settings:

- HDCP setting (enable / disable);
- TPS mode (see details in the TPS Interface section);
- Cable Diagnostics and Frame Detector tools;
- Reloading Factory Default Settings.

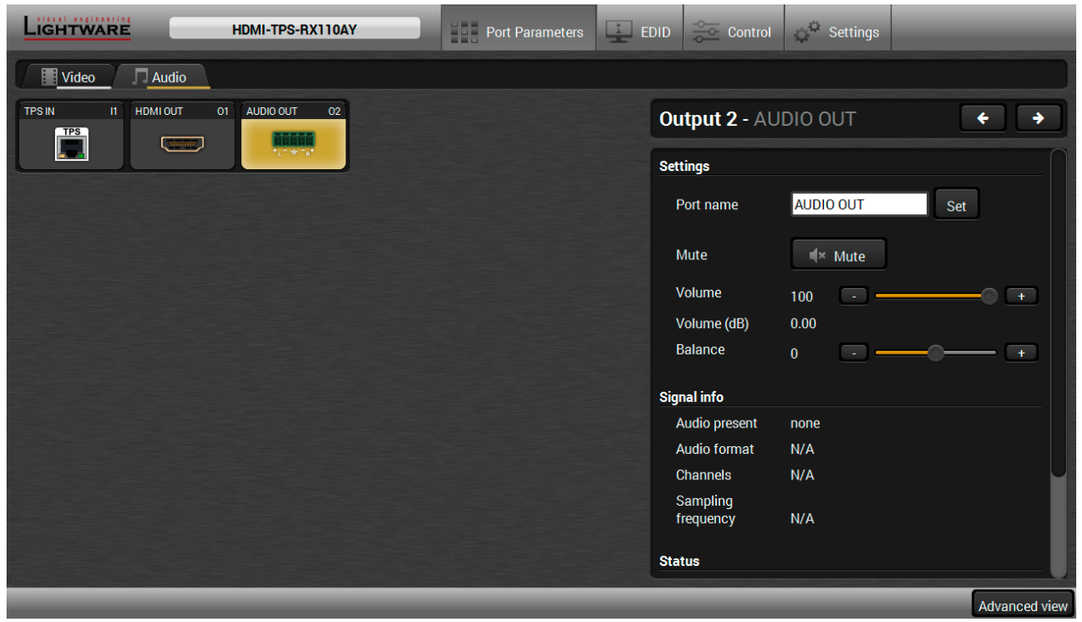
HDMI OUT Video (O1)

This is the HDMI output line of the receiver. Clicking on the HDMI icon results the settings panel appearing on the right side. You can check the status of the line, and signal and display info.

Available Settings:

- Mute/Unmute port;
- Signal type: Auto, DVI, or HDMI;
- HDCP mode: Auto or Always;
- Power 5V mode: Auto, Always on, or Always off;
- Test pattern mode: Off, On, No signal;
- Test pattern clock source: 480p, 576p, or Original video signal;
- Test pattern: Red, Green, Blue, Black, White, Ramp, Chess, Bar, Cycle;
- Frame Detector;
- Reloading Factory Default Settings.

5.3.2. Audio Tab



Audio tab in Port parameters menu

The most important audio related information and settings are available on this tab.

Link Audio (I1)

This is the embedded TPS audio input line of the receiver. Clicking on the TPS icon results the settings panel appearing on the right side. You can check the signal info of the port.

Available Settings:

- Mute/Unmute port;
- Lock/Unlock port;
- Reloading factory defaults (see factory default settings in the Factory Default Settings section).

HDMI OUT Audio (O1)

This is the embedded HDMI audio output line of the receiver. Clicking on the HDMI icon results the settings panel appearing on the right side. You can check the signal info of the port.

Available Settings:

- Mute/Unmute port;
- Lock/Unlock port;
- Reloading factory defaults (see factory default settings in the Factory Default Settings section).

Audio Out (O2)

This is the de-embedded analog audio output line of the receiver. Clicking on the HDMI icon results the settings panel appearing on the right side. You can check the signal info and the de-embeding status of the signal.

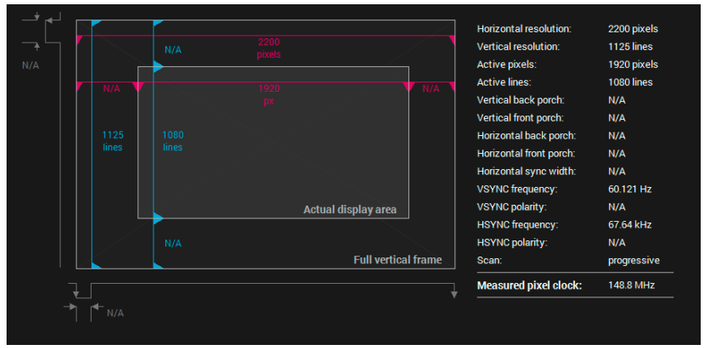
Available Settings:

- Mute/Unmute port;
- Volume (in percent);
- Balance;
- Reloading factory defaults (see factory default settings in the Factory Default Settings section).

5.4. Diagnostic Tools

5.4.1. Frame Detector

The ports can show detailed information about the signal like blanking intervals 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 **Frame detector** button.



Frame detector window

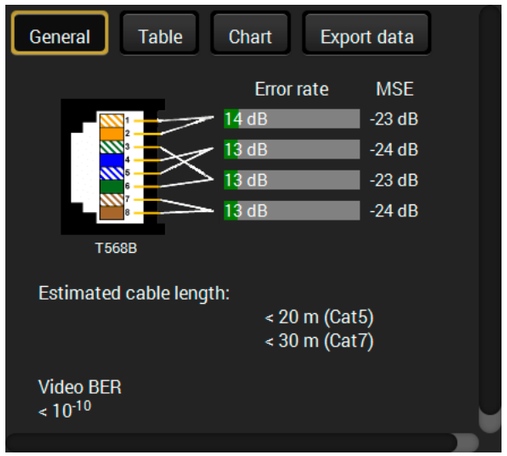
Lightware's Frame Detector function works like a signal analyzer and makes possible to determine the exact video format that is present on the port, thus helps to identify many problems. E.g. actual timing parameters may differ from the expected and this may cause some displays to drop the picture.

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 gray). Dark gray 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 actually on the signal and not retrieved only from the HDMI info frames.

5.4.2. Cable Diagnostics

The cable diagnostics is a useful tool to determine any cable related issues in case of TPS connection. The estimated cable length and the quality of the link are measured periodically and the diagnostic window shows the values in real-time. If the green bars hit the first line in the middle they turn into red. It means the number of the errors – during the extension – is higher than recommended. The link might be alive but recovering of the received data is not guaranteed.

INFO: Each bar represents a differential line in the CATx cable. The inappropriate termination of the cable usually causes high error rates. Check the cable terminations or change the cable.



Reference Values

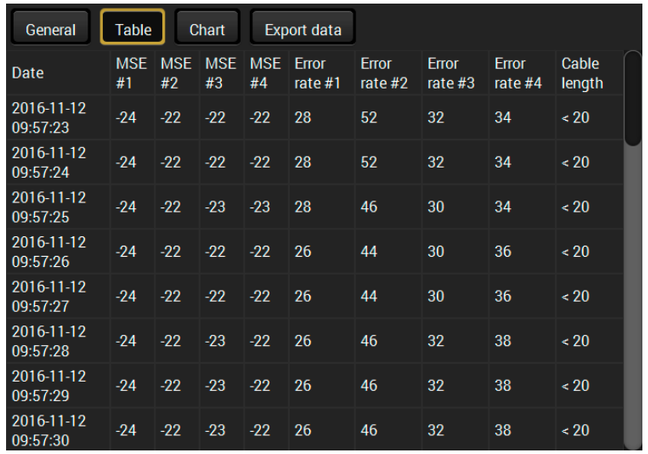
Value	Explanation
10^{-10}-10^{-9}	Excellent image quality
10^{-8}	Minor error, not recognizable by eyes
10^{-7}	Sometimes recognizable flash on a special test pattern
10^{-6}	Small noise can be seen
10^{-5}	Easy to recognize image error
10^{-4}	Bad image quality

Above displayed "Video BER < 10^{-10}" value means that on average there is 1 bad pixel after 10^{10} pixels, which means the number of the bit errors is about 1 pixel in every 15 minutes.

INFO: You can find more details about maximum twisted pair cable distances in the Maximum Extension Distances section.

Table and Chart Views

Cable diagnostics can be displayed in advanced modes as well. Two ways are available: **table view** and **chart view**. Data can be exported to a file on clicking on the **Export data** button.



Date	MSE #1	MSE #2	MSE #3	MSE #4	Error rate #1	Error rate #2	Error rate #3	Error rate #4	Cable length
2016-11-12 09:57:23	-24	-22	-22	-22	28	52	32	34	< 20
2016-11-12 09:57:24	-24	-22	-22	-22	28	52	32	34	< 20
2016-11-12 09:57:25	-24	-22	-23	-23	28	46	30	34	< 20
2016-11-12 09:57:26	-24	-22	-22	-22	26	44	30	36	< 20
2016-11-12 09:57:27	-24	-22	-22	-22	26	44	30	36	< 20
2016-11-12 09:57:28	-24	-22	-23	-22	26	46	32	38	< 20
2016-11-12 09:57:29	-24	-22	-23	-22	26	46	32	38	< 20
2016-11-12 09:57:30	-24	-22	-23	-22	26	46	32	38	< 20

Table view of cable diagnostics

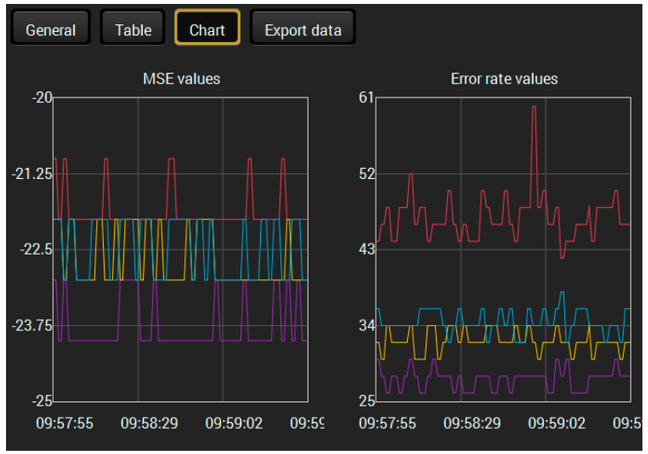
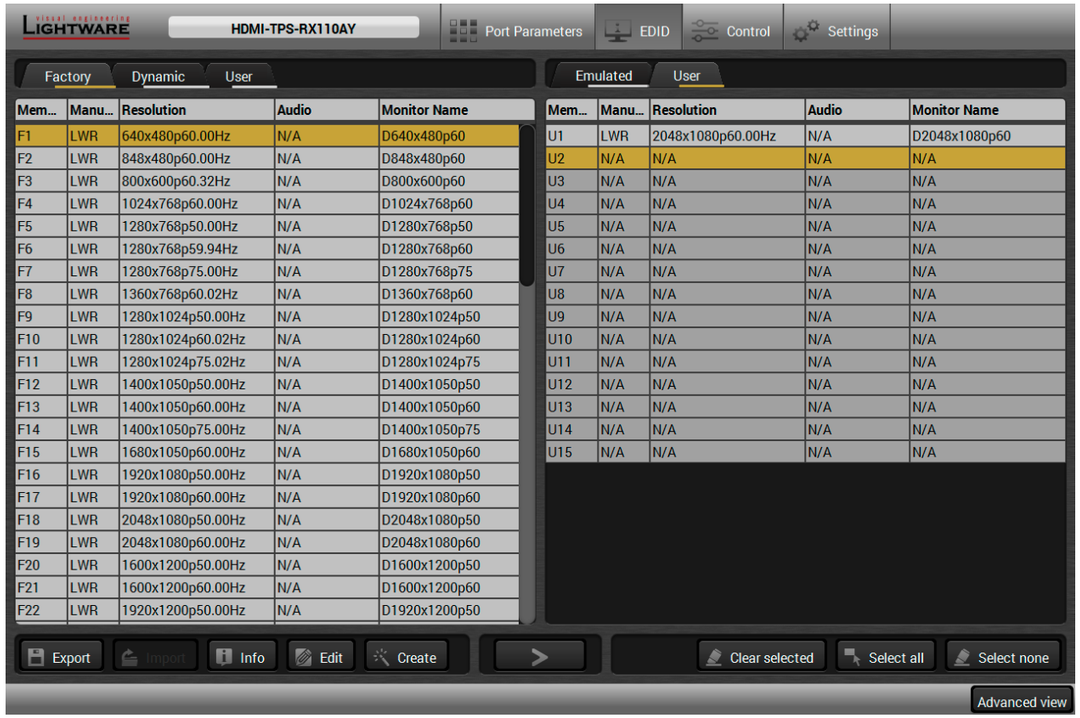


Chart view of cable diagnostics

5.5. EDID Menu

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



Mem...	Manu...	Resolution	Audio	Monitor Name
F1	LWR	640x480p60.00Hz	N/A	D640x480p60
F2	LWR	848x480p60.00Hz	N/A	D848x480p60
F3	LWR	800x600p60.32Hz	N/A	D800x600p60
F4	LWR	1024x768p60.00Hz	N/A	D1024x768p60
F5	LWR	1280x768p50.00Hz	N/A	D1280x768p50
F6	LWR	1280x768p59.94Hz	N/A	D1280x768p60
F7	LWR	1280x768p75.00Hz	N/A	D1280x768p75
F8	LWR	1360x768p60.02Hz	N/A	D1360x768p60
F9	LWR	1280x1024p50.00Hz	N/A	D1280x1024p50
F10	LWR	1280x1024p60.02Hz	N/A	D1280x1024p60
F11	LWR	1280x1024p75.02Hz	N/A	D1280x1024p75
F12	LWR	1400x1050p50.00Hz	N/A	D1400x1050p50
F13	LWR	1400x1050p60.00Hz	N/A	D1400x1050p60
F14	LWR	1400x1050p75.00Hz	N/A	D1400x1050p75
F15	LWR	1680x1050p60.00Hz	N/A	D1680x1050p60
F16	LWR	1920x1080p50.00Hz	N/A	D1920x1080p50
F17	LWR	1920x1080p60.00Hz	N/A	D1920x1080p60
F18	LWR	2048x1080p50.00Hz	N/A	D2048x1080p50
F19	LWR	2048x1080p60.00Hz	N/A	D2048x1080p60
F20	LWR	1600x1200p50.00Hz	N/A	D1600x1200p50
F21	LWR	1600x1200p60.00Hz	N/A	D1600x1200p60
F22	LWR	1920x1200p50.00Hz	N/A	D1920x1200p50

Mem...	Manu...	Resolution	Audio	Monitor Name
U1	LWR	2048x1080p60.00Hz	N/A	D2048x1080p60
U2	N/A	N/A	N/A	N/A
U3	N/A	N/A	N/A	N/A
U4	N/A	N/A	N/A	N/A
U5	N/A	N/A	N/A	N/A
U6	N/A	N/A	N/A	N/A
U7	N/A	N/A	N/A	N/A
U8	N/A	N/A	N/A	N/A
U9	N/A	N/A	N/A	N/A
U10	N/A	N/A	N/A	N/A
U11	N/A	N/A	N/A	N/A
U12	N/A	N/A	N/A	N/A
U13	N/A	N/A	N/A	N/A
U14	N/A	N/A	N/A	N/A
U15	N/A	N/A	N/A	N/A

EDID menu

Control Buttons

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

5.5.1. EDID Operations

Changing Emulated EDID

Step 1. Choose the desired **EDID list** on the source panel and select an **EDID**.

Step 2. Press the **Emulated** button on the top of the Destination panel.

Step 3. Select the desired **port** on the right panel (one or more ports can be selected); the EDID(s) will be highlighted with a yellow cursor.

Step 4. Press the **Transfer** button to change the emulated EDID.

Learning an EDID

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

Exporting an EDID

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

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

Step 1. Select the desired **EDID** from the Source panel (line will be highlighted with yellow).

Step 2. Press the **Export** button to open the dialog box and save the file to the computer.

Importing an EDID

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

Step 1. Press the **User** button on the top of the Source panel and select a **memory** slot.

Step 2. Press the **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:

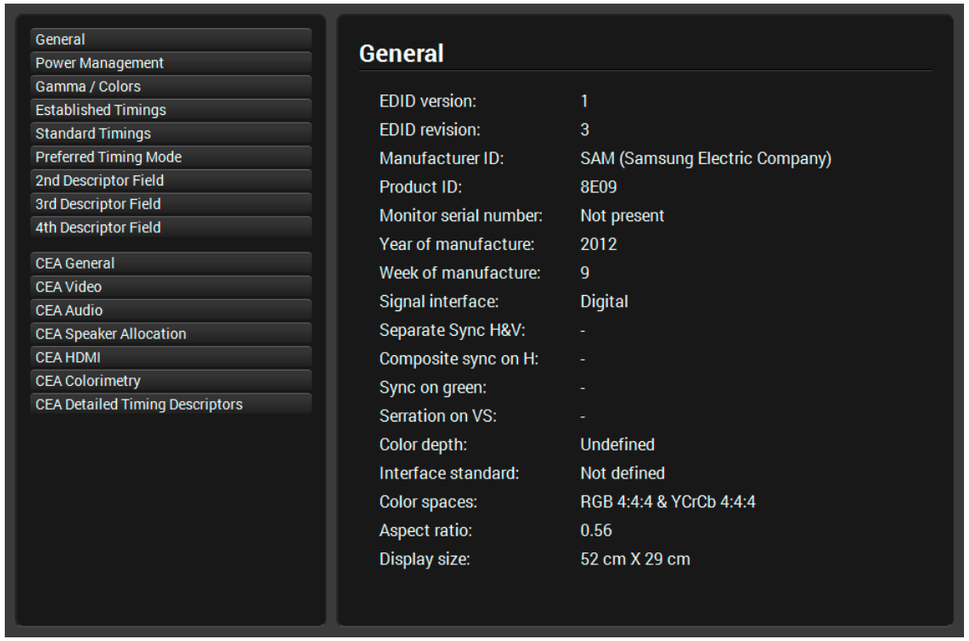
Step 1. Press **User** button on the top of the Destination panel.

Step 2. Select the desired **memory** slot(s); one or more can be selected (“Select All” and “Select None” buttons can be used). The EDID(s) will be highlighted with yellow.

Step 3. Press the **Delete selected** button to delete the EDID(s).

5.5.2. EDID Summary Window

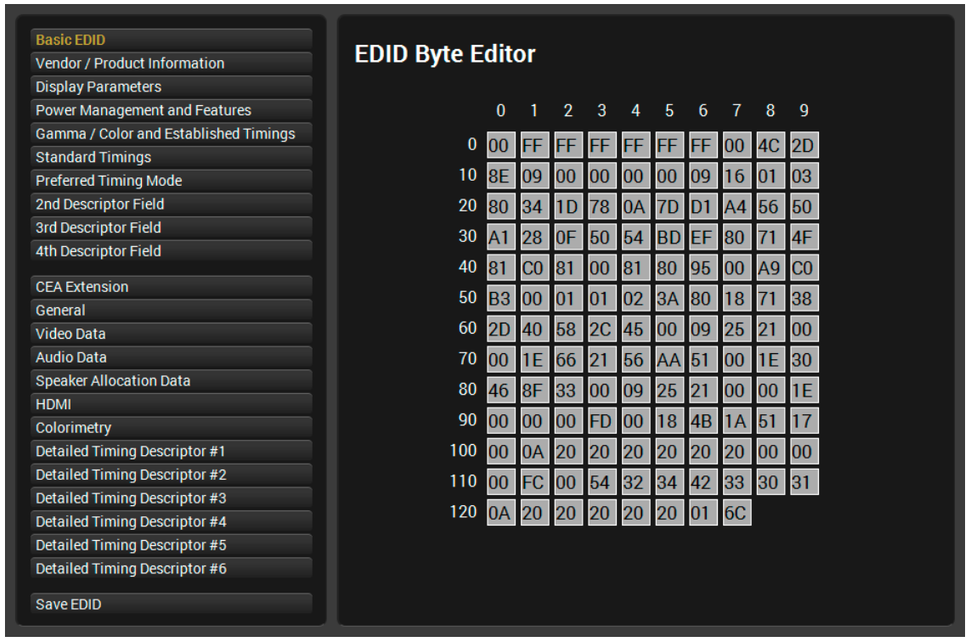
Select an EDID from Source panel and press **Info** button to display EDID summary.



EDID summary window

5.5.3. Editing an EDID

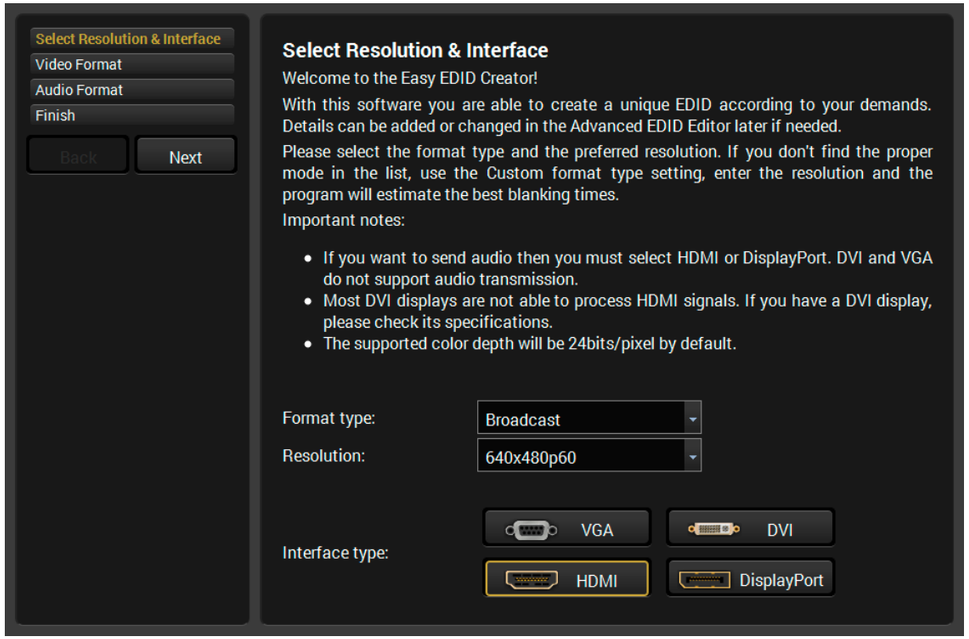
Select an EDID from Source panel and press Edit button to display Advanced EDID Editor window. The editor can read and write all descriptors, which are defined in the standards, including the additional CEA extensions. Any EDID from the device's memory or a saved EDID file can be loaded into the editor.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



EDID Editor window

5.5.4. Creating an EDID - Easy EDID Creator

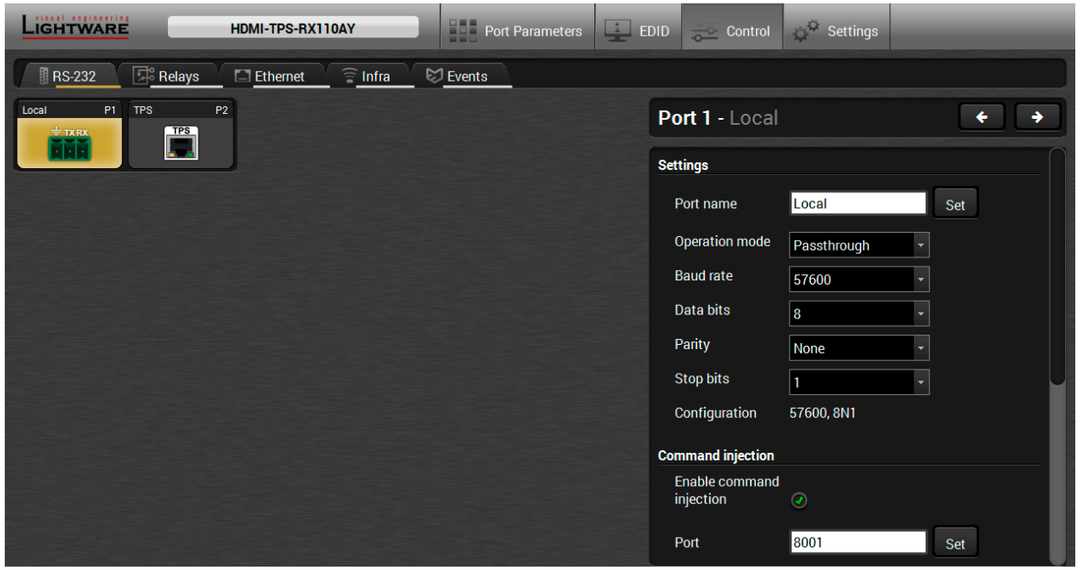
Since above mentioned Advanced EDID Editor needs more complex knowledge about EDID, Lightware introduced a wizard-like interface for fast and easy EDID creation. With Easy EDID Creator it is possible to create custom EDIDs in four simple steps. By clicking on the **Create** button below Source panel,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



EDID Creator window

5.6. Control Menu

5.6.1. RS-232



RS-232 tab in Control menu

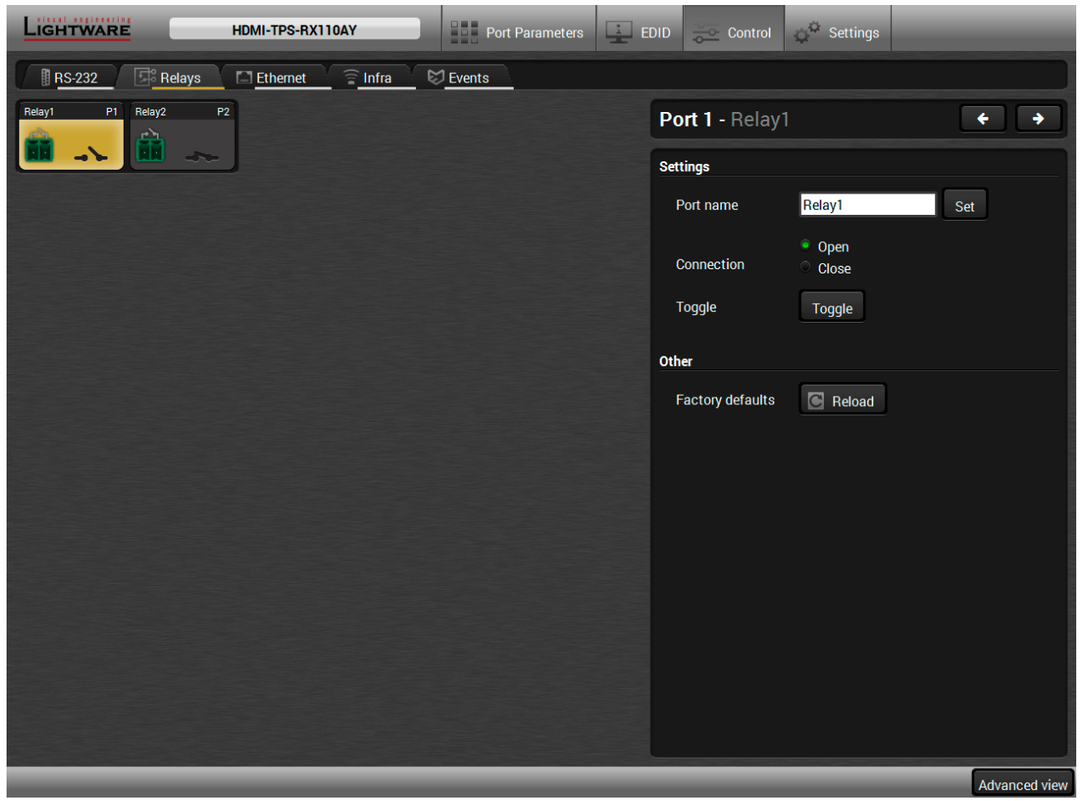
The following settings and functions are available (both on local and TPS serial ports):

- Operation mode: Pass-through, Control, or Command Injection (for more details about serial interface modes see the Serial Interface section);
- Baud rate: 4800, 7200, 9600, 14400, 19200, 38400, 57600, 115200;
- Data bits: 8 or 9;
- Parity: None, Odd, or Even;
- Stop bits: 1, 1.5, or 2;
- Command injection: enable or disable;
- Command injection port number;
- Control protocol: LW2 or LW3;
- Message sending via serial port;
- Reloading factory defaults (see factory default settings in the Factory Default Settings section).

ATTENTION! Operation mode of the local and TPS serial ports can be set together only. It means if you set the local RS-232 port to Control mode, the TPS serial link will be changed to Control mode either automatically.

ATTENTION! If the receiver is connected to a TPS2 output board of a matrix frame, the RS-232 configuration settings (baud rate, data bits, e.t.c.) will not be changeable on the receiver side.

5.6.2. Relays

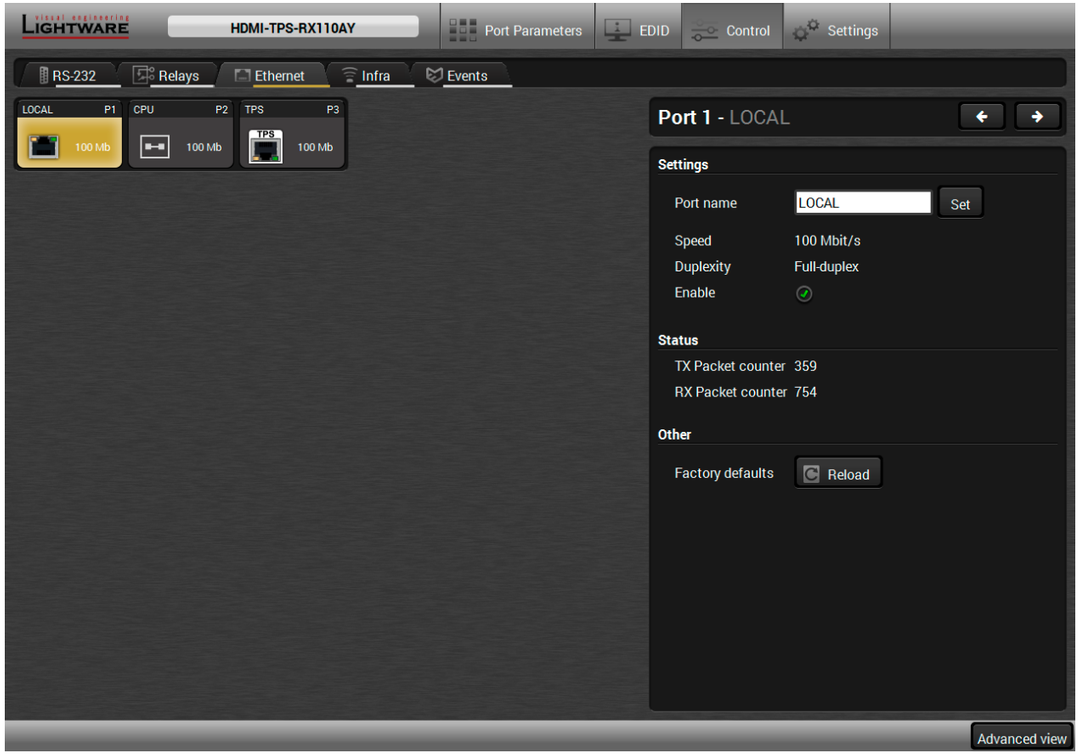


Relays tab in Control menu

Two relays are built into the HDMI-TPS-RX110AY receiver. The following settings are available for both relay ports:

- Connection state: Open or Close;
- Toggle;
- Reloading factory defaults (see factory default settings in the Factory Default Settings section).

5.6.3. Ethernet



Ethernet tab in Control menu

Three ports are displayed in the Ethernet settings: Local, CPU, and TPS. You can check the status of the Ethernet line by each ports: the speed and the duplexity of the connection.

The following settings are available for each ports:

- Enable / disable the port; *
- Reloading factory defaults (see factory default settings in the Factory Default Settings section).

* CPU Ethernet port cannot be disabled.

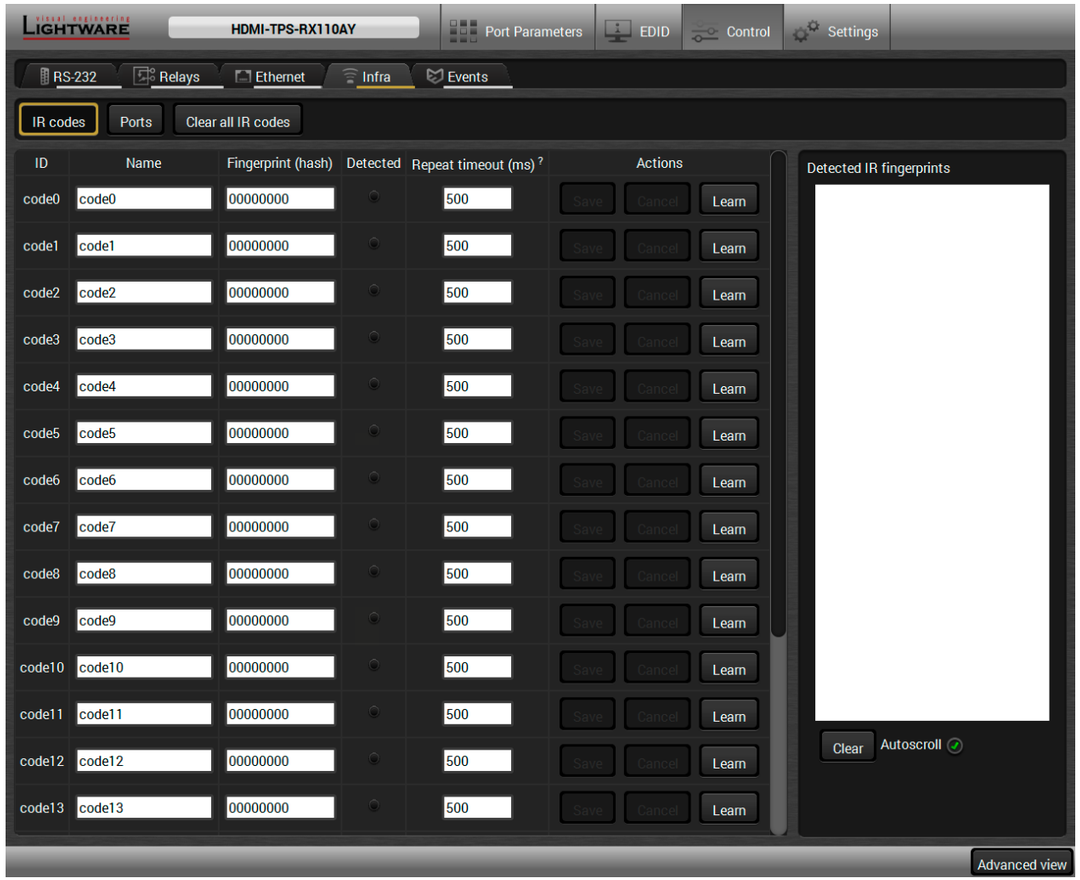
5.6.4. Infra

> **ATTENTION!** The device has no built-in Infrared receiver and transmitter. For the complete usage attach an IR emitter unit to the IR OUT and an IR detector unit to the IR IN connectors.

Infrared (IR) receiver and transmitter options can be found on this tab. There are three submenus are available under it: **IR codes**, **Ports**, and **Clear all IR codes**.

IR Codes

User can set the name of the IR code, the fingerprint (hash), and the repeat timeout in ms, as well as actions can be ordered to each IR codes.



IR codes window in Control menu

Description	Function
ID	Code number.
Name	You can give an unique name for the desired code.
Fingerprint (hash)	Fingerprint code in pronto hexa format.
Detected	Indicator gives feedback about the given IR code is detected currently.
Repeat timeout (ms)	You can set a timeout to avoid the involuntary code recurrence.
Actions	Action buttons for the desired IR code: **Save**: saving the fingerprint. **Cancel**: canceling the fingerprint. **Learn**: learning the detected IR code.
Detected IR fingerprints	You can check the detected IR codes in this panel. Pushing **Clear** button deleting all current fingerprints and switch on or off the automatic scrolling with the **Autoscroll** pipe.

20 fingerprints can be stored in the device at the same time. Each of them can be ordered to an action in Event Manager. For more details about events see Event Manager section.

Learning IR Codes

Step 1. Connect the IR detector unit to the IR IN port of the receiver.

Step 2. Click on the **Learn** button.

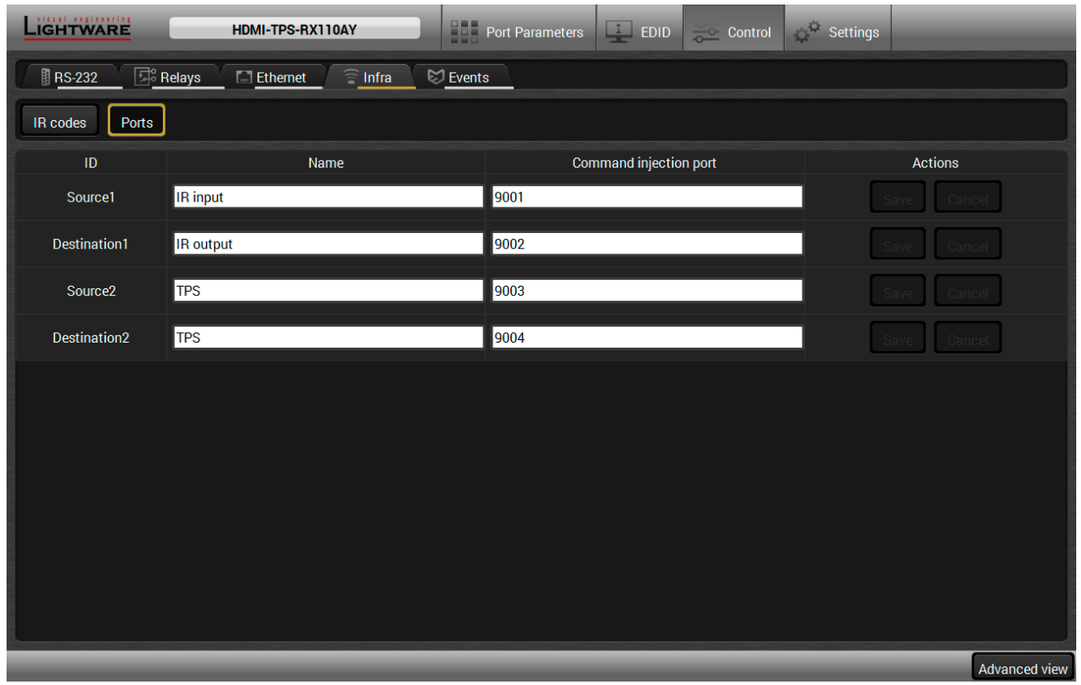
Step 3. Turn the remote controller to the IR detector. A pop-up window appears in LDC - press your remote button to learn.

Step 4. Once the code is received, a new window pops up in LDC - learning completed. Click **OK** to continue.

Step 5. Optionally type a unique name for the code in the **Name** text box. The default name is code#, e.g. code0.

Ports

User can set the name and command injection port to each sources and destinations. For more details about IR interface see the IR Interface section.



Infra tab - Ports window

Clear all IR codes

Clicking on the button results deleting all stored IR fingerprints.

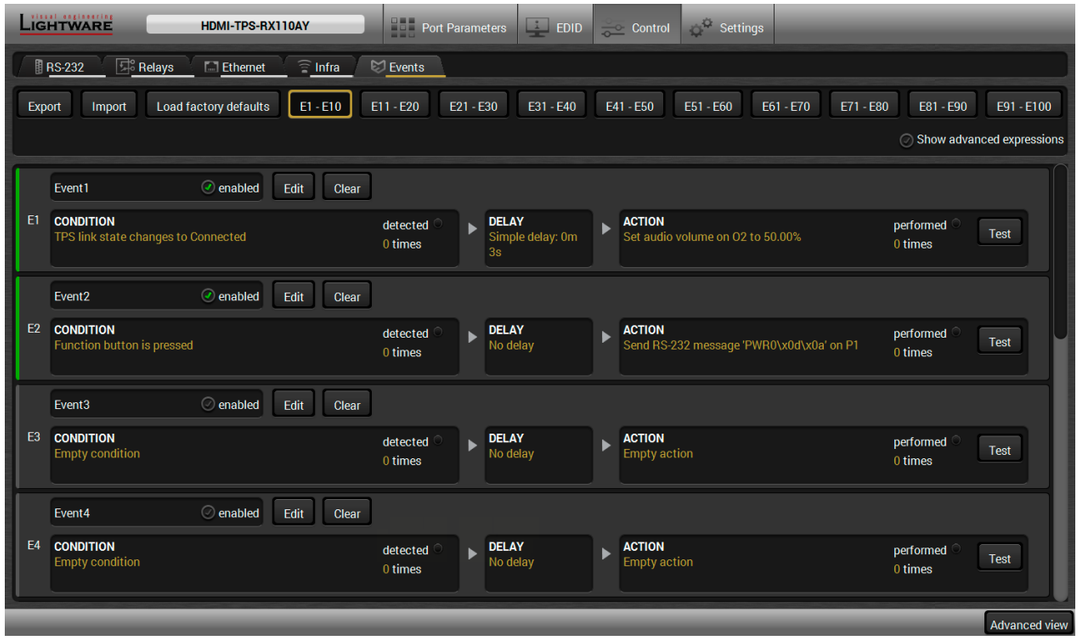
5.7. Event Manager

The feature means that the device can sense changes on its ports and able to react according to the pre-defined settings. The development idea of the Event manager is based on users' feedbacks. In many cases internal events (such as signal present or HDCP active) are necessary to display but it is not easy when the device is hard to access (e.g. built under the desk). For more details and examples about Event Manager please visit our website (www.lightware.com) and download **Event Manager user's guide** in the Downloads section.

The Event manager can be configured to perform an action if a condition has been detected. E.g. the desired setup is that after a certain type of signal has been detected on I1 port, the port has to be switched to O1. The settings can be done via the LDC in the Control/Events tab, or by LW3 protocol commands. Configurable events number depends on the device what you are using actually.

Numerous new ideas and requests have been received in connection with the features and settings of the Event manager since the first release. Therefore, the user interface has been re-designed and many new functions implemented. The Event editor can be opened by pressing the Edit button at each Event.

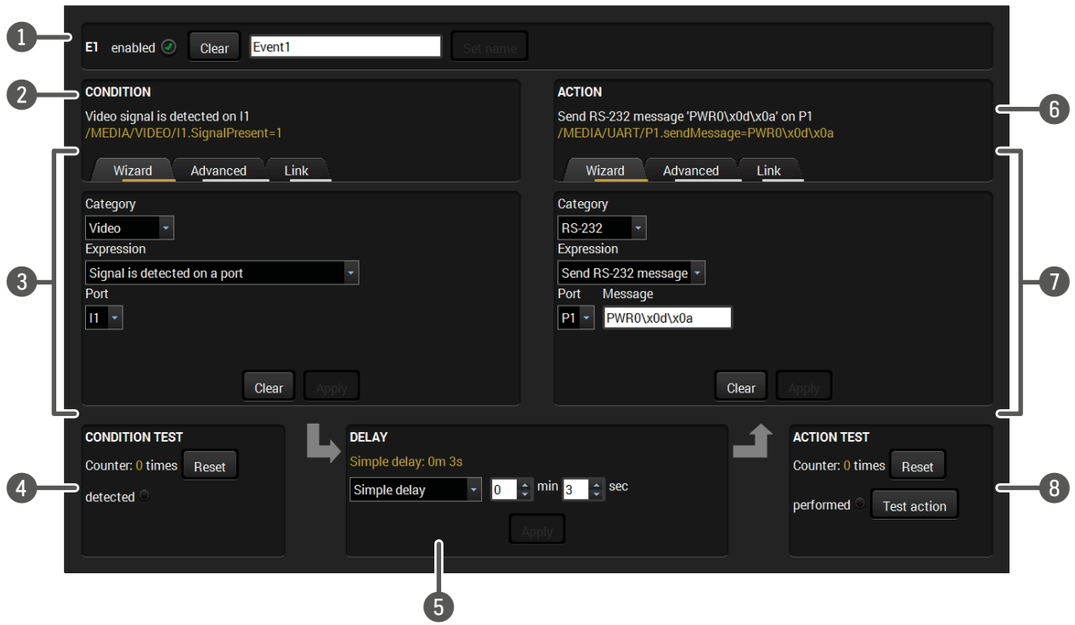
There is a **gray bar** on the left of the Event panel in each line. If a condition and an action are set and the Event is enabled, the bar is displayed **in green**.



Control menu, Event Manager tab

5.7.1. The Event Editor

Press the **Edit** button in the desired Event line to open the Event editor window.

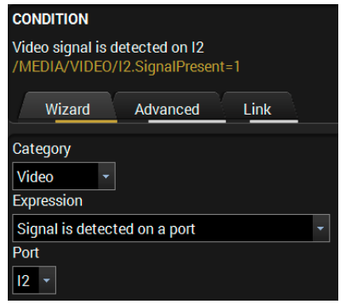


1	**Event header**	The name of the Event is displayed. Type the desired name and press the Set name button. The Event can be cleared by the Clear button. Use the tick mark to enable/disable the Event.
2	**Condition header**	If the condition is set, the description (white colored text) and the exact LW3 protocol expression (yellow colored text) can be seen. If the advanced mode was used the description is “Custom condition”.
3	**Condition panel**	The Wizard, the Advanced or the Link tool is available to set the condition. The parameters and settings are displayed below the buttons.
4	**Condition test**	The set condition can be tested to see the working method in the practice.
5	**Delay settings**	The action can be scheduled to follow the condition after the set time value.
6	**Action header**	If the action is set, the description (white colored text) and the exact LW3 protocol expression (yellow colored text) can be seen. If the advanced mode was used the description is “Custom action”.
7	**Action panel**	The Wizard, the Advanced or the Link tool is available to set the action. The parameters and settings are displayed below the buttons.
8	**Action test**	The set action can be tested to see the working method in the practice.

5.7.2. Create or Modify an Event

Wizard Mode

The wizard mode lists the most common conditions and actions, so the user does not have to look for LW3 nodes and properties.



Step 1. Click on the **Edit** button of the desired Event; the **Event editor** is displayed.

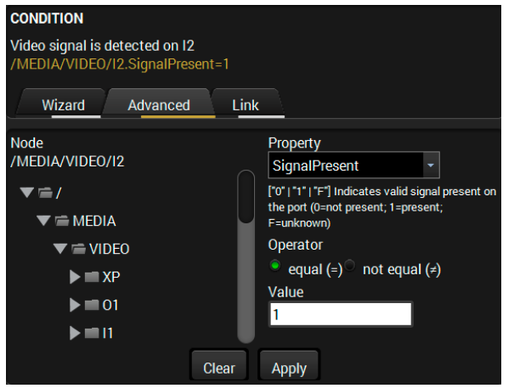
Step 2. The wizard mode is displayed as default. Select the desired **Category** first (e.g. Audio or Video).

Step 3. Select the desired **Expression** from the drop-down menu. If any other parameter is necessary to set, it is going to be displayed.

Step 4. Press the **Apply** button to store the settings of the Condition.

Advanced Mode

The goal of this mode is the same as of the wizard: set the properties and methods for conditions and actions. The difference is the number of the available and usable properties and methods of the LW3 protocol. Advanced mode allows almost all of it.



Step 1. Click on the **Edit** button of the desired Event; the **Event editor** is displayed.

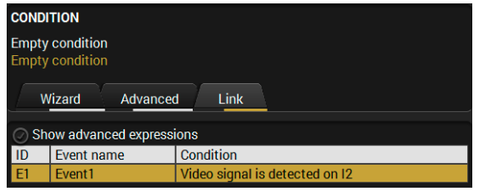
Step 2. The wizard mode is the default, press the **Advanced** button. The LW3 protocol tree is displayed showing the list of the properties in the drop-down menu. Navigate to the desired node.

Step 3. Select the desired **Property** from the menu. The **manual** of the property is displayed below to help to select the necessary property and to set the value.

Step 4. Set the desired **value** and **operator**, then press the **Apply** button to store settings.

The Link Tool

The new interface allows creating more actions to the same condition. In that case, a condition can trigger more actions. To set such an Event, the Link tool has been introduced.



Step 1. Click on the **Edit** button of the desired Event; the **Event editor** is displayed.

Step 2. The wizard mode is displayed as default, press the **Link** button.

Step 3. All the saved Events are analyzed and the **conditions** are listed (it takes some seconds to finish). The **Show advanced expressions** option allows showing the exact path and set the value of the given property.

Step 4. Select the desired **Condition** and press the **Apply** button to store the settings.

5.7.3. Special Tools and Accessories

The Name of the Event

The name of a port can be changed by typing the new name and clicking the **Set** button. The following characters are allowed when naming:

Letters (A-Z) and (a-z), numbers (0-9), special characters: hyphen (-), underscore (_), and space ( ).

Enable or Disable an Event

The set Event can be enabled or disabled in the Event list, or directly in the Event editor window by setting the **tick mark** beside the name.

Testing the Condition

When the desired Condition is arranged, the setting can be tested. The Event list and the Event editor contains a small panel that shows if the set condition is detected and how many times. The **Counter** can be reset by the button in Event editor. If the Condition is true, the **detected** mark turns green for two seconds and the **Counter** is increased.

Testing the Action

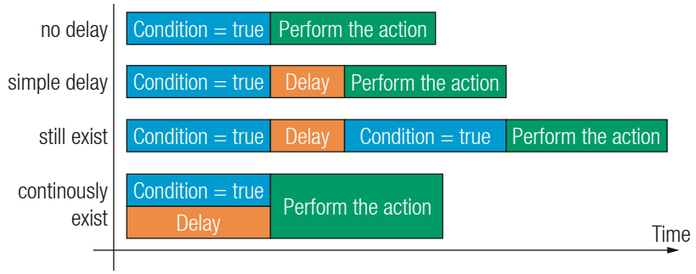
The method is the same as testing the Condition, but in this case, the Action can be triggered manually by pressing the **Test** button.

TIPS AND TRICKS: The Test button is also placed on the Action panel in the Event list. Thus, you can check the Actions without opening the Event editor.

Delay the Action

In most cases the Action is performed immediately after the Condition is detected. But sometimes a delay is necessary between the Condition and the Action. Therefore, the new Event manager contains the Delay panel which allows that feature with below settings:

- **No delay**: when the Condition is detected, the Action is launched.
- **Simple delay**: when the Condition is detected, the Action is launched after the set time interval.
- **Still exists**: when the Condition is detected, the Action is launched after the set time interval only if the Condition still exists.
- **Continuously exists**: when the Condition is detected, the Action is launched after the set time interval only if the Condition has been existing continuously.



The available delay settings of an Event

TIPS AND TRICKS: **Show advanced expressions** option is a useful tool when you look for the path or value of a property but just the expression is displayed. The option is available in the Event list window or when Link tool is used.

5.7.4. Clear One or More Event(s)

Clear an Event

Press the **Clear** button in the Event list or in the header section in the Event editor.

Clear all Events

When all the Events must be cleared press the **Load factory defaults** button above the Event list. You will be prompted to confirm the process.

5.7.5. Export and Import Events

The feature allows saving all the Events. The backup file can be uploaded to another HDMI-TPS-RX110AY receiver.

Export all the Events

Step 1. Press the **Export** button above the Event list.

Step 2. The Save as dialog box will appear. Set the desired folder and file name, then press the **Save** button.

The generated file is a simple text file which contains LW3 protocol commands. The file can be viewed by a simple text editor, e.g. Notepad.

ATTENTION! Editing the file is recommended only for expert users.

Import all the Events

Step 1. Press the **Import** button above the Event list.

Step 2. The Open dialog box will appear. Select the desired folder and file, then press the **Open** button.

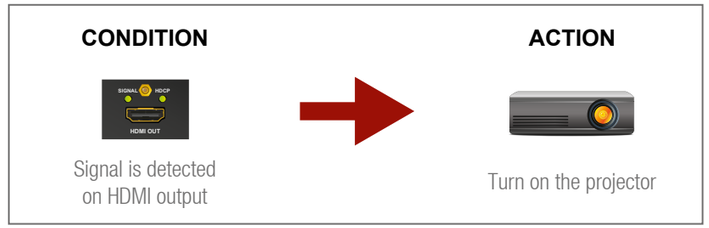
5.7.6. Event Creating - Example

The following example shows you on a real-life situation how to set up an Event.

The Concept

The HDMI-TPS-RX110AY receiver is connected to a projector by the HDMI output port. The receiver is also connected to the projector by the RS-232 port and can send commands via the serial line.

The task is to turn on the projector when signal is detected on the HDMI output port.



RS-232 Settings

Make sure that the serial line is established between the receiver and the projector. Check that the RS-232 settings of the receiver is set exactly the same which required for the projector: baud rate, data bits, parity, stop bits. The receiver needs to be set to: Control protocol: LW3; and RS-232 mode: Pass-through. See the relevant LDC settings in the RS-232 section.

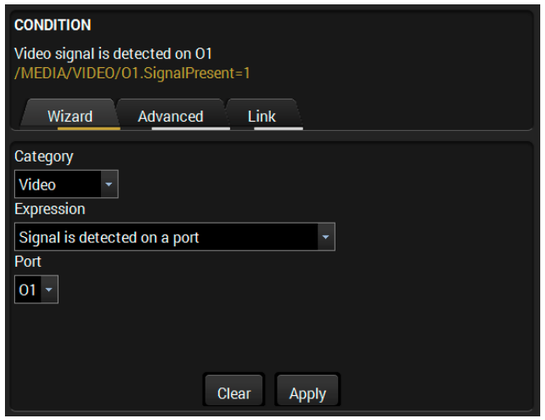
Setting the Event

You can create the Event in the Wizard in few simple steps:

Step 1. Set the condition.

Select the required parameters to set the condition:

- **Category**: Video;
- **Expression**: Signal is detected on a port;
- **Port**: O1.



Click on the **Apply** button to complete the procedure. When it is done, the condition appears on the upper side in textual and LW3 command format as well.

Step 2. Set the action.

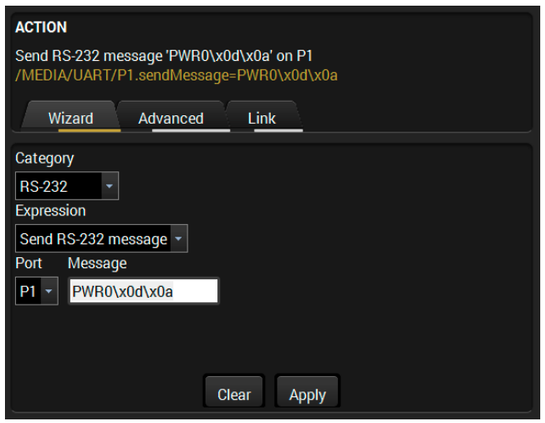
If the condition is fulfilled, the following action needs to be launched: the receiver sends a command to the projector over the serial line:

- **Power on** - the required command which is accepted by the projector: PWR0<CR><LF>

For this instance the command has to be closed with the <CR><LF> characters so they need to be escaped. You can use the following format for escaping:

<command$_1$><\x0d\x0a><command$_2$><\x0d\x0a>...
...<command$_n$><\x0d\x0a>

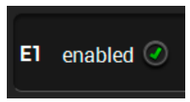
In the current case the command is: PWR0\x0d\x0a



Select the required parameters to set the action:

- **Category**: RS-232;
- **Expression**: Send RS-232 message;
- **Port**: P1;
- **Message**: PWR0\x0d\x0a

Step 3. Enable the Event.

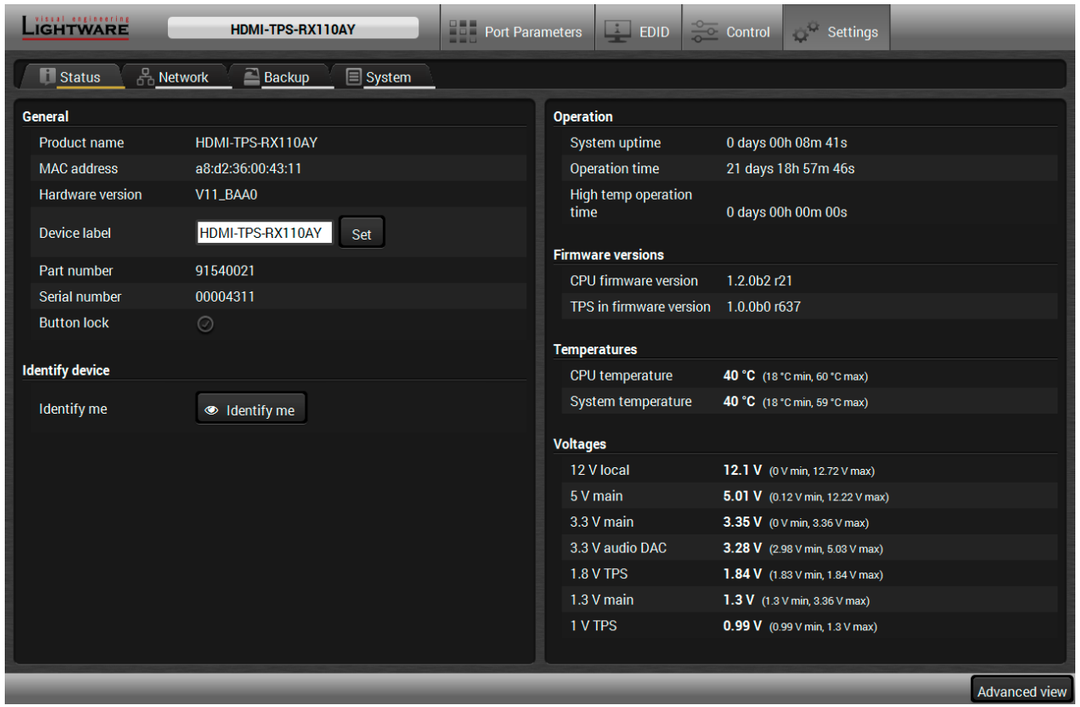


Select the **E1 enabled** pipe in upper left corner to set the Event as launched.

> INFO: If you do not find the required category/expression/etc what you need, choose the Advanced mode in the Wizard where the entire LW3 structure tree is available. For example instead of signal detection you can set a specified resolution or color range either as a condition.

5.8. Settings Menu

5.8.1. Status



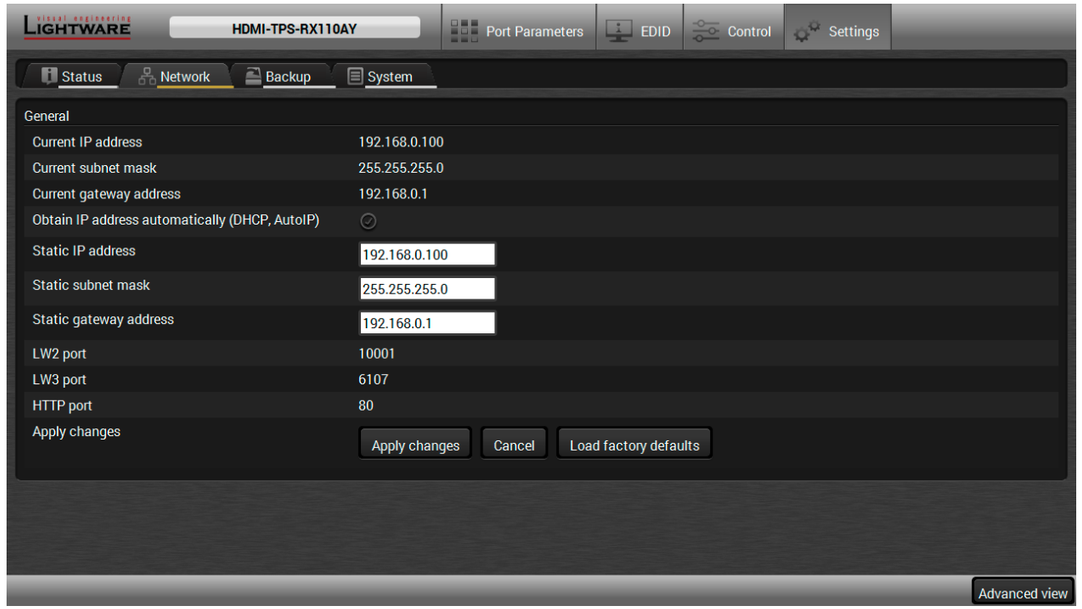
Status tab in Settings menu

The most important hardware and software related information can be found on this tab: hardware and firmware version, serial numbers, temperatures, operation time, and voltage information. Device label can be changed to unique description by the **Set** button.

You can disable the Function button functionally with marking the **Button lock** option.

Clicking on the **Identify me** button results the blinking of the status (in green) and crosspoint LEDs (in orange) for 10 seconds. The feature helps to identify the device itself in the rack shelf.

5.8.2. Network



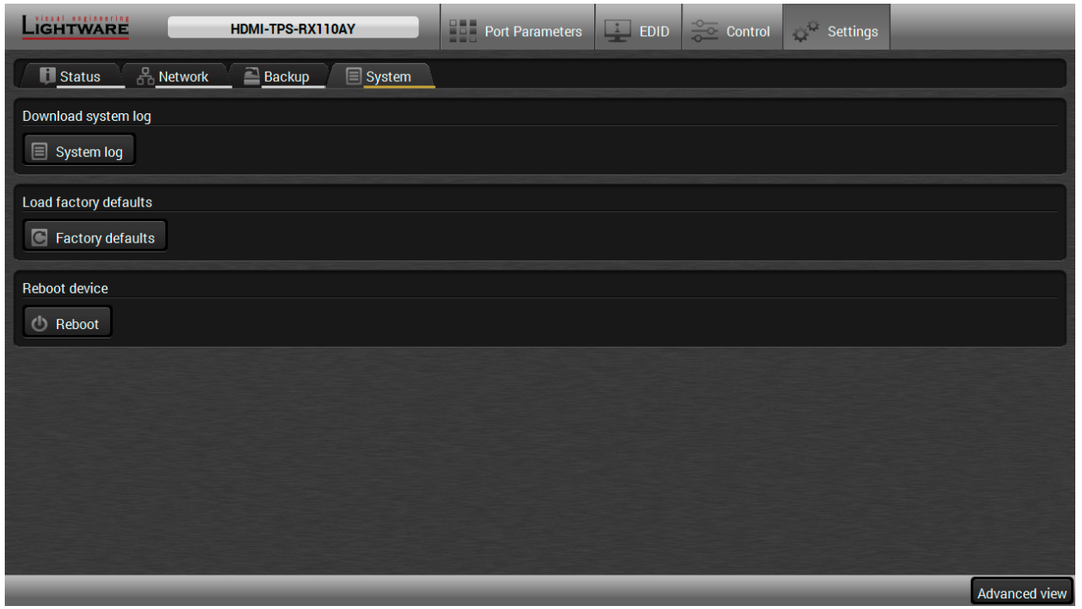
Network tab in Settings menu

IP address and DHCP settings can be set on this tab. Always press the **Apply settings** button to save changes. Factory defaults settings can be recalled with a dedicated button.

5.8.3. Backup

Details about this function can be found in the Configuration Cloning (Backup Tab) section.

5.8.4. System

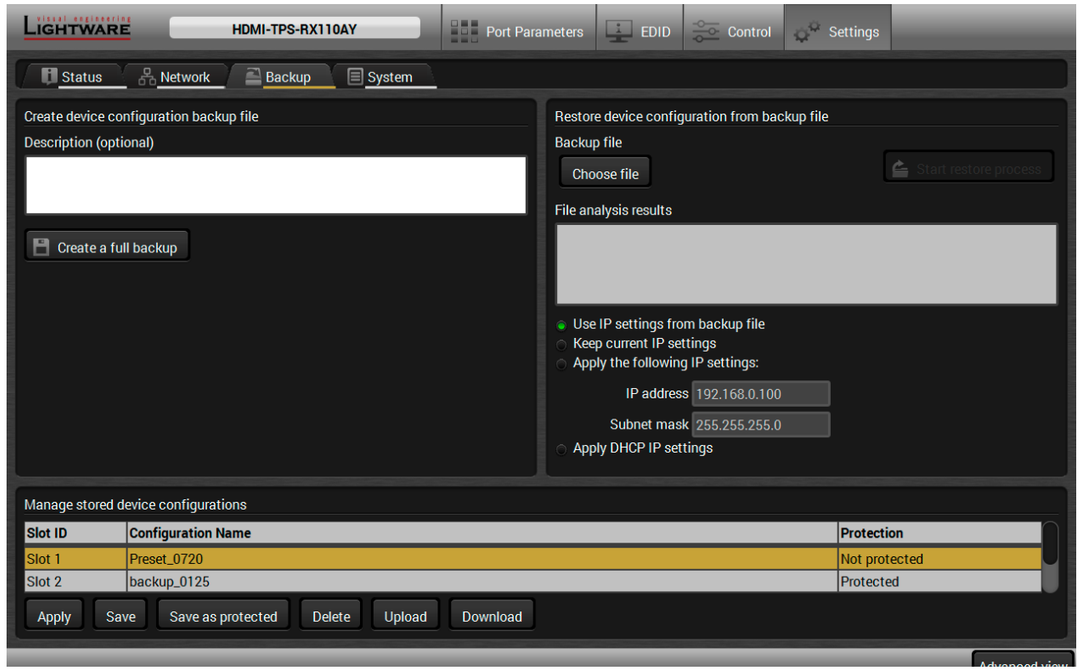


System tab in Settings menu

Three functions are available under System tab:

- **Download system log** - saving the file of the device.
- **Load factory defaults** - recalling factory defaults settings and values. All factory default settings are listed in the Factory Default Settings section.
- **Reboot** - rebooting the system.

5.9. Configuration Cloning (Backup Tab)



Backup tab

The configuration cloning of Lightware LW3 devices is a simple method that eliminates the need to repeatedly configure certain devices to have identical (non-factory) settings. If the devices are installed in the same type of system multiple times then it is enough to set up only one device to fit the user's needs and then copy those settings to the others, thus saving time and resources.

5.9.1. Cloning Steps in a Nutshell

Installing multiple devices with the same customized configuration settings can be done in a few easy steps:

Step 1. Configure one device with all your desired settings with the LDC software.

Step 2. Backup the full configuration file to your computer.

Step 3. If needed, make some modifications to the configuration file using a text editor (e.g. Notepad). E.g. modifying the static IP address is needed when DHCP is not used.

Step 4. Connect to the other device which has to be configured and upload (restore) your configuration file.

Step 5. Done! You can have as many totally identical, customized devices as you like.

5.9.2. Save the Settings of the Device (Backup)

Step 1. Apply the desired settings in the transmitter (port parameters, crosspoint, etc.)

Step 2. Select the **Settings** / **Backup** tab from the menu.

Step 3. Write a short **description** in the text box on the left (optional).

Step 4. Press the **Create a full backup** button. You will be prompted to save the file to the computer. The default file name is the following:

```
BACKUP_<DEVICE TYPE>_SN<SERIAL NUMBER>.LW3
```

Step 5. Set the desired **file name**, select the folder and **save** the file.

> TIPS AND TRICKS: Using the exact product type in the filename is recommended since it makes the file usage more comfortable.

About the Backup File

The backup file is a simple text file which contains LW3 protocol commands. The first line is the description, and the further lines are the commands which will be executed during the restore process. The file can be viewed (and/or edited) by a simple text editor, e.g. Notepad.

> **ATTENTION!** Editing the command lines is only recommended for expert users.

See the entire list of saved data in the section.

5.9.3. Upload the Settings to a Device (Restore)

> **WARNING!: Please note that the settings will be permanently overwritten with the restored parameters in the device. Withdrawal is not possible.**

> **ATTENTION!**: The cloning is successful when the backup file is downloaded from the same type of source device as the destination device.

The Restoring Process

Step 1. Select the **Settings** / **Backup** tab from the menu.

Step 2. Click on the **Choose file** button on the right panel and **browse** the desired file.

Step 3. The file is checked and the result will be displayed in the textbox below. If the file is correct, the settings can be restored.

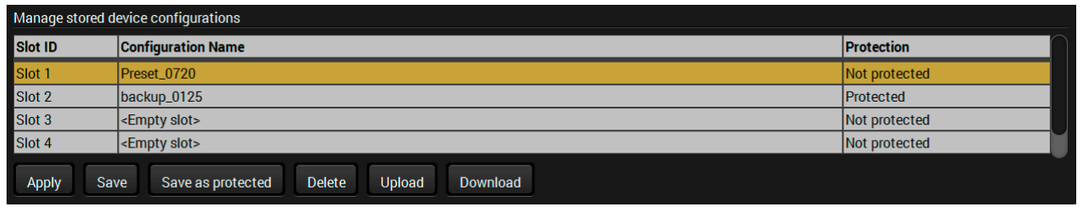
Step 4. Choose **IP settings** what you want to use after backup. You can apply settings from the backup file, keep actual settings, set it manually in a dialog box or apply DHCP.

Step 5. Press the **Start restore process** button and click on the **Yes** button when asked.

Step 6. Reboot the device to apply the network settings after finishing.

5.9.4. Create and Restore Backups from the Device Memory

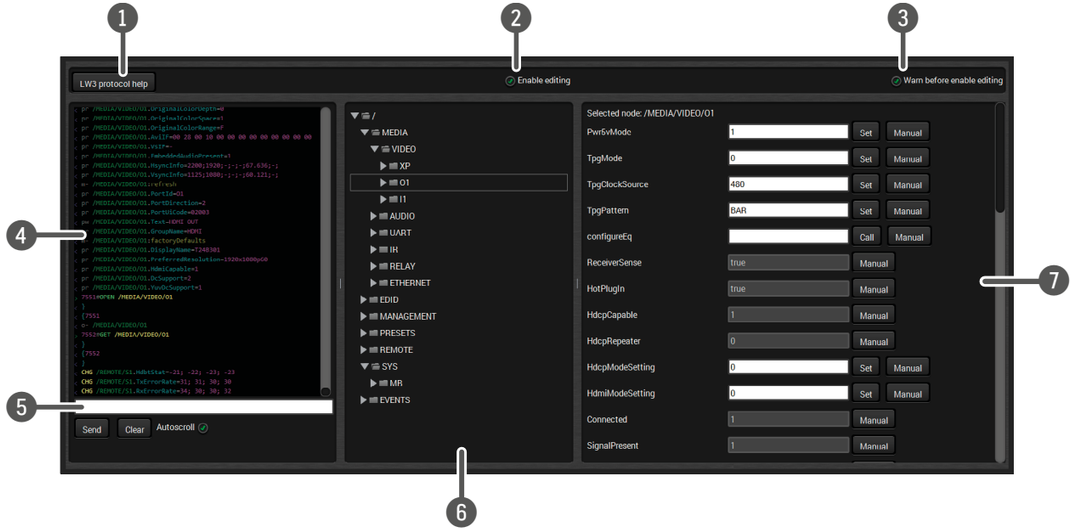
HDMI-TPS-RX110AY receiver is able to store backups in its own memory and can be recalled from there so user does not need to save backup files to the local computer. Four slots are available for this purpose.



You can save presets as not protected with using **Save** button and as protected with using the **Save as protected** button. Restoring a preset select on the slot of the desired backup and click on the **Apply** button. You can save presets from a file from your local computer clicking on the **Upload** button and you can also save a preset from the device's memory to a backup file with using the **Download** button. If you do not need a saved preset any more, select it and click on the **Delete** button.

> **WARNING! Loading factory default settings will erase all presets which has been saved in the device memory!**

5.10. Advanced View Window



1	**LW3 protocol help**	Pushing the button results a help window opening which describes the most important information about LW3 protocol commands in HTML format.
2	**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.
3	**Warning mode**	If this pipe checked in, a warning window pops up when you enable Edit mode.
4	**Terminal window**	Commands and responses with time and date are listed in this window. Sent command starts with '>' character, received response starts with '<' character. The color of each item depends on the type of the command and response. The content of the window can be emptied by the **Clear** button. If the **Autoscroll** option is ticked, the list is scrolled automatically when a new line is added.
5	**Command line**	Type the desired command and execute it by the **Send** button. Clear all current commands and responses in the Terminal window by the **Clear** button.
6	**Protocol tree**	LW3 protocol tree; select an item to see its content.
7	**Node list**	Correspondent parameters and nodes are shown which 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

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.

6.1. LW2 Protocol Description

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

Format	Explanation
<in>	Input number in 1 or 2 digit ASCII format (01, 5, 07, 16, etc.)
<out>	Output number in 1 or 2 digit ASCII format
<in²>	Input number in 2 digit ASCII format (01, 02, 10, 12 etc.)
<out²>	Output number in 2 digit ASCII format (01, 02, 10, 12 etc.)
<loc>	Location number in 1, 2 or 3 digit ASCII format
<id>	id number in 1 or 2 digit ASCII format
<id²>	id number in 2 digit ASCII format
CrLf	Carriage return, Line feed (0x0D, 0x0A)
●	Space character (0x20)
→	Each command issued by the controller
←	Each response received from the router

6.2. General LW2 Commands

6.2.1. View Product Type

Description: The device responds its name.

Format	Example
Command {I} Response (I:<PRODUCT_TYPE>)CrLf	→ {i} ← (I:HDMI-TPS-RX110AY)

Explanation: The connected device is a HDMI-TPS-RX110AY.

Legend: <PRODUCT_TYPE> shows type.

6.2.2. Query Control Protocol

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

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

Explanation: The device communicates with LW2 protocol.

6.2.3. View Firmware Version of the CPU

Description: View the CPU firmware revision.

Format	Example
Command {F} Response (FW:<FW_VER><s>)CrLf	→ {f} ← (FW:1.2.0b6)

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

6.2.4. Connection Test

Description: Simple test to see if the connection is established successfully.

Format	Example
Command {PING} Response (PONG!)CrLf	→ {ping} ← (PONG!)

6.2.5. View Serial Number

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

Format	Example
Command {S} Response (SN:<SERIAL_N>)CrLf	→ {s} ← (SN:5A004254)

6.2.6. Compile Time

Description: Returns the date, when the CPU firmware was compiled.

Format	Example
Command {CT} Response (Complied: <DATE&TIME>)CrLf	→ {ct} ← (Compiled: Sep 30 2016 14:07:56)

6.2.7. View Installed Board

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

Format	Example
Command {IS} Response (SL#●0●<MB_DESC>)CrLf (SL●END)CrLf	→ {is} ← (SL# 0 HDMI-TPS-RX110AY V12) ← (SL END)

Explanation: The device reports its motherboard (slot 0).

6.2.8. View Firmware for All Controllers

Description: Shows the firmware versions of all installed controllers.

Format	Example
Command {FC} Response (CF●<DESC>)CrLf (CF●<DESC>)CrLf … (CF END)CrLf	→ {fc} ← (CF HDMI-TPS-RX110AY 1.2.0b6) ← (SL END)

Explanation: The device has one control panel.

6.2.9. Restart the Device

Description: The device can be restarted without unplugging power.

Format	Example
Command {RST} Response	→ {RST}

Explanation: The device reboots; no response is sent in this case.

6.2.10. Query Health Status

Description: Internal voltages and measured temperature values are shown.

Format	Example
Command {ST} Response (ST●<DESC>)CrLf	→ {ST} ← (ST CPU 0.09V 12.13V 5.03V 3.31V 3.32V 3.39V 1.85V 1.31V 1.00V 42.46C 42.55C)

6.2.11. Restore Factory Default Settings

Description: Settings can be reset to factory default values as follows:

Format	Example
Command {FACTORY=ALL} Response (FACTORY ALL…)CrLf	→ {factory=all} ← (FACTORY ALL…)

Explanation: All settings and parameters are reset to factory default, see the table in the Factory Default Settings section.

6.3. Port Settings

6.3.1. Mute Specified Output

> INFO: <A/V/AV> option 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 AV option, when available.

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

Format	Example
Command {#<out>●<layer>} Response (1MT<out²>●<layer>)CrLf	⟶ {#1 AV} ⟵ (1MT01 AV)

Explanation: O1 audio and O1 video output ports are muted.

Legend:

<layer>	Layer
A	Audio layer
V	Video layer
AV (or nothing)	Audio & Video layer

> **ATTENTION!** 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. Switching a muted output does not unmute the output.

6.3.2. Unmute Specified Output

Description: Unmute output <out>.

Format	Example
Command {+<out>●<layer>} Response (0MT<out²>●<layer>)CrLf	⟶ {+2 A} ⟵ (0MT02 A)

Explanation: O2 audio port is unmuted.

Legend: See in the previous section.

> 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.

6.3.3. Lock the Output

Description: Lock an output port. Output's state cannot be changed until unlocking.

Format	Example
Command {#><out>●<layer>} Response (1LO<out²>●<layer>)CrLf	⟶ {#>1 AV} ⟵ (1LO01 AV)

Explanation: O1 audio port and O1 video output ports are locked.

Legend: See in the Mute Specified Output section.

6.3.4. Unlock the Output

Description: Unlock an output port. The connection on output can be changed.

Format	Example
Command {+<<out>●<layer>} Response (0LO<out²>●<layer>)CrLf	⟶ {+<1 A} ⟵ (0LO01 A)

Explanation: O1 audio output port is unlocked.

Legend: See in the Mute Specified Output section.

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

6.3.5. View Connection State on The Output

Description: Viewing the crosspoint state of the device; showing the input port numbers connected to the outputs.

Format	Example
Command {VC●<layer>} Response (ALL<layer>●<O01>●<O02>)CrLf	⟶ {vc av} ⟵ (ALLV 01 01) ⟵ (ALLA 01 01)

Legend: All <Ox> indexes show the corresponding output's connection state. If value <O2> equals 01 it means that output 2 is connected to input 1. All <Ox> indexes are two digit ASCII characters (01 or 02).

State Letters:

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

Explanation: O1 audio and O1 video output ports are connected to I1 audio and I1 video input ports.

6.3.6. View Crosspoint Size

Description: Shows the physical crosspoint size.

Format	Example
Command {GETSIZE●<layer>} Response (SIZE=<size>●<layer>)CrLf	⟶ {getsize av} ⟵ (SIZE=1x1 V) ⟵ (SIZE=1x2 A)

Legend:
<size>: <number of inputs>x<number of outputs>
<layer>: See the details in the Mute Specified Output section.

Explanation: The device reports that it has a video crosspoint with 1 input and 1 output, and an audio crosspoint with 1 input and 2 outputs.

6.4. Network Configuration

6.4.1. Query the Current IP Status

Description: IP address settings can be queried as follows.

Format	Example
Command {IP_STAT=?} Response (IP_STAT=<type>; <ip_address>;<subnet_mask>; <gateway_addr>)CrLf	➞ {ip_stat=?} ← (IP_STAT=0;192.168.0.100; 255.255.255.0;192.168.0.1)

Legend:

<type>:	0 = static IP; 1 = DHCP.
<ip_addr>:	IP address (four decimal octets separated by dots).
<subnet_mask>:	Subnet mask (four decimal octets separated by dots).
<gateway_addr>:	Gateway address (four decimal octets separated by dots).

Explanation: The device has a static (fix) IP address: 192.168.0.95; the subnet mask is 255.255.255.0, the gateway address is 192.168.0.1.

6.4.2. Set the IP Address

Description: IP address can be set as follows.

Format	Example
Command {IP_ADDRESS=<type>;<ip_address>} Response (IP_ADDRESS=<type>;<ip_address>)CrLf	➞ {ip_address=0;192.168.0.110} ← (IP_ADDRESS=0;192.168.0.110;)

Legend: <type>: 0 = static IP; 1 = DHCP

> INFO: The IP address can be queried by typing the “ip_address=?” command. The response contains the fix IP address that is stored in the device even if DHCP is enabled; in this case, this IP address is not valid.

6.4.3. Set the Subnet Mask

Description: Subnet mask can be set as follows.

Format	Example
Command {IP_NETMASK=<subnet_mask>} Response (IP_NETMASK=<subnet_mask>)CrLf	➞ {ip_netmask=255.255.255.0} ← (IP_NETMASK=255.255.255.0)

Legend: <subnet_mask>: Four decimal octets separated by dots.

> INFO: The subnet mask can be queried by typing the “ip_address=?” command. The response contains the fix IP subnet mask that is stored in the device even if DHCP is enabled; in this case, this IP subnet mask is not valid.

6.4.4. Set the Gateway Address

Description: Gateway address can be set as follows.

Format	Example
Command {IP_GATEWAY=<gateway_addr>} Response (IP_GATEWAY=<gateway_addr>)CrLf	➞ {ip_gateway=192.168.0.50} ← (IP_GATEWAY=192.168.0.50)

Legend: <gateway_addr>: Four decimal octets separated by dots.

> INFO: The gateway address can be queried by typing the “ip_gateway=?” command. The response contains the static IP gateway address that is stored in the device even if DHCP is enabled. In that case, the latest valid gateway address (for static IP) is stored.

6.4.5. Apply Network Settings

Description: Apply the network settings and restart the network interface.

Format	Example
Command {ip_apply} Response (IP_APPLY)CrLf	➞ {ip_apply} ← (IP_APPLY)

6.5. RS-232 settings

6.5.1. Set RS-232 Mode

Description: RS-232 mode can be set as follows. See more details about RS-232 modes in the Serial Interface section.

Format	Example
Command {RS232=<mode>} Response (RS232=<mode>)CrLf	→ {RS232=CONTROL} ← (RS232=CONTROL)

Legend: <mode>: CONTROL = Control mode;
CI = Command Injection mode;
PASS = Pass-through.

6.5.2. Set Local RS-232 Parameters

Description: The parameters of local RS-232 port can be set as follows.

Format	Example
Command {RS232_LOCAL_FORMAT= <BaudRate>;<DataBit>; <Parity>;<StopBit>} Response (RS232_LOCAL_FORMAT= <BaudRate>;<DataBit>; <Parity>;<StopBit>)CrLf	→ {RS232_LOCAL_FORMAT=9600;9;O;X} ← (RS232_LOCAL_FORMAT=9600;9;O;1)

Legend:

<Parameter>	Parameter	Values
<BaudRate>	Baud rate	X (no change); 4800; 7200, 9600; 14400; 19200; 38400; 57600; 115200
<DataBit>	Data bit	X (no change); 8; 9
<Parity>	Parity	X (no change); N (None); E (Even); O (Odd)
<StopBit>	Stop bit	X (no change); 1; 1,5; 2

Explanation: Local RS-232 port is set the baud rate to 9600, data bit to 9, parity to odd, and stop bit is not changed, remained 1.

INFO: The current settings can be queried by the “RS232_LOCAL_FORMAT=?” command.

6.5.3. Set Link RS-232 Parameters

Description: The parameters of RS-232 TPS link port can be set as follows.

Format	Example
Command {RS232_LINK_FORMAT=<BaudRate>; <DataBit>;<Parity>;<StopBit>} Response (RS232_LINK_FORMAT=<BaudRate>; <DataBit>;<Parity>;<StopBit>)CrLf	→ {RS232_LINK_FORMAT=9600;9;O;X} ← (RS232_LINK_FORMAT=9600;9;O;1)

Legend: see previous section.

Explanation: RS-232 TPS link port is set the baud rate to 9600, data bit to 9, parity to odd, and stop bit is not changed, remained 1.

INFO: The current settings can be queried by the “RS232_LINK_FORMAT=?” command.

6.5.4. Set Local RS-232 Control Protocol Port

Description: The control protocol of local RS-232 port can be set as follows.

Format	Example
Command {RS232_LOCAL_PROT=<protocol>} Response (RS232_LOCAL_PROT=<protocol>)CrLf	→ {RS232_LOCAL_PROT=LW2} ← (RS232_LOCAL_PROT=LW2)

Legend: LW2 = LW2 command protocol LW3 = LW3 command protocol

INFO: The current setting can be queried by the “RS232_LOCAL_PROT=?” command.

6.5.5. Set Link RS-232 Control Protocol Port

Description: The port number of RS-232 TPS link port can be set as follows.

Format	Example
Command {RS232_LINK_PROT=<protocol>} Response (RS232_LINK_PROT=<protocol>)CrLf	→ {RS232_LINK_PROT=LW2} ← (RS232_LINK_PROT=LW2)

Legend: LW2 = LW2 command protocol LW3 = LW3 command protocol

INFO: The current setting can be queried by the “RS232_LINK_PROT=?” command.

6.6. Relay Settings

6.6.1. Query Relay Connection State

Description: Current relay connection state can be queried.

Format	Example
Command {RELAY<port_nr>=?} Response (RELAY<port_nr>=<dir>;<state>)CrLf	→ {RELAY1=?} ← (RELAY1=O;O)

Legend: <dir>: it is always O.

<state>:

Parameter	Description
C	Closed
O	Opened

Explanation: Relay1 is opened now.

6.6.2. Set Relay Connection State

Description: Relay connection state can be changed to be opened or closed.

Format	Example
Command {RELAY<port_nr>=<dir>;<state>} Response (RELAY<port_nr>=<dir>;<state>)CrLf	→ {RELAY1=O;C} ← (RELAY1=O;C)

Legend: <dir>: it is always O.

<state>:

Parameter	Description
C	Closed
O	Opened

Explanation: Relay1 is closed now.

6.7. LW2 Commands – Quick Summary

General LW2 Commands

Operation	See in chapter	Command
View Product Type	6.2.1	{I}
Query Control Protocol	6.2.2	{P_?}
View Firmware Version of the CPU	6.2.3	{F}
Connection Test	6.2.4	{PING}
View Serial Number	6.2.5	{S}
Compile Time	6.2.6	{CT}
View Installed Board	6.2.7	{IS}
View Firmware for All Controllers	6.2.8	{FC}
Restart the Device	6.2.9	{RST}
Query Health Status	6.2.10	{ST}
Restore Factory Default Settings	6.2.11	{FACTORY=ALL}

Port and Crosspoint Settings

Operation	See in chapter	Command
Mute Specified Output	6.3.1	{#<out>●<layer>}
Unmute Specified Output	6.3.2	{+<out>●<layer>}
Lock the Output	6.3.3	{#><out>●<layer>}
Unlock the Output	6.3.4	{+<out>●<layer>}
View Connection State on The Output	6.3.5	{VC●<layer>}
View Crosspoint Size	6.3.6	{GETSIZE●<layer>}

Network Configuration

Operation	See in chapter	Command
Query the Current IP Status	6.4.1	{IP_STAT=?}
Set the IP Address	6.4.2	{IP_ADDRESS=<type>;IP_ADDRESS}
Set the Subnet Mask	6.4.3	{IP_NETMASK=<subnet_mask>}
Set the Gateway Address	6.4.4	{IP_GATEWAY=<gateway_address>}
Apply Network Settings	6.4.5	{IP_APPLY}

RS-232 Settings

Operation	See in chapter	Command
Set RS-232 Mode	6.5.1	{RS232=<mode>}
Set Local RS-232 Parameters	6.5.2	{RS232_LOCAL_FORMAT=<BaudRate>;<DataBit>;<Parity>;<StopBit>}
Set Link RS-232 Parameters	6.5.3	{RS232_LINK_FORMAT=<BaudRate>;<DataBit>;<Parity>;<StopBit>}
Set Local RS-232 Control Protocol Port	6.5.4	RS232_LOCAL_PROT=<protocol>
Set Link RS-232 Control Protocol Port	6.5.5	RS232_LINK_PROT=<protocol>

Relay Settings

Operation	See in chapter	Command
Query Relay Connection State	6.6.1	{RELAY<port_nr>=?}
Set Relay Connection State	6.6.2	{RELAY<port_nr>=O;O|C}

7

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

7.1. Overview

Lightware 3 (LW3) protocol is used by the 25G hybrid matrix, the MODEX family and the new series of Lightware TPS and OPT products, including the HDMI-TPS-RX110AY receiver. The protocol (LW3) 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 for implementing a human readable, but programmatically still ease to parse, which is suitable for different products with a different feature list.

In order to implement a flexible, easy-to-use protocol that is straightforward to adapt to new devices and provides outstanding scalability and sustainability, we decided to organize all settings, parameters and properties of the device to a tree structure with 'nodes', 'properties' and 'methods'.

7.1.1. Elements of the Tree Structure

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

7.1.1.1. Node

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

Format: (the root node): nX●/

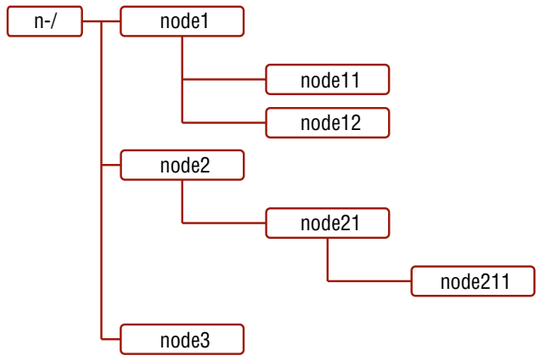
Path: nX●/[nodeName]/[nodeName]/[nodeName]

Legend:

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

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

Following example presents the structure of the tree traversal:



Path of the nodes:

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

Tree structure of the nodes

7.1.1.2. Property

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

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

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

Legend:

p: property

'X' can be:

'r': if the property is read-only.

'w': if the property is readable, writable.

'm': the manual of the property.

'E': error message for the property.

'v': virtual node property: contains a node path to a node which will be linked to the property's parent node.

Example:

The following two ones are read-only properties:

pr●/node1/node12.ReadOnlyProperty=value1

pr●/.DeviceName=25G Hybrid Device

The following two ones are read-write properties:

pw●/node1/node12.ReadWriteProperty=value2

pw●/.DeviceNickName=John

7.1.1.3. Method

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

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

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

Legend:

m: method

'X' can be:

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

'F': when the execution of the method failed.

'm': the manual of the method.

'E': error message for the method.

Example:

mO●/node1/node12:method1

mO●/MEDIA/VIDEO/XP:switch

mE●%E001:Syntax error

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

7.1.2. Escaping

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

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

Example:

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

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

7.1.3. Error Messages

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

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

Legend:

'X' can be:

'-': syntax error. Cannot parse the command at all.

'n': node error.

'p': property error.

'm': method error.

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

YYY: error code	Name	Default text
000	Lw3ErrorCodes_None	
001	Lw3ErrorCodes_Syntax	Syntax error
002	Lw3ErrorCodes_NotFound	Not found
003	Lw3ErrorCodes_AlreadyExists	Already exists
004	Lw3ErrorCodes_InvalidValue	Invalid value
005	Lw3ErrorCodes_IllegalParamCount	Illegal parameter count
006	Lw3ErrorCodes_IllegalOperation	Illegal operation
007	Lw3ErrorCodes_AccessDenied	Access denied
008	Lw3ErrorCodes_Timeout	Timeout
009	Lw3ErrorCodes_CommandTooLong	Command too long
010	Lw3ErrorCodes_InternalError	Internal error
011	Lw3ErrorCodes NotImplemented	Not implemented

7.1.4. Prefix Summary

The following prefixes are defined in the LW3 protocol:

'n-': a node,

'nE': an error for a node,

'nm': a manual for a node,

'pr': a read-only property,

'pw': read-write property,

'pE': an error for the property,

'pm': a manual for the property,

'm-': a method,

'mO': a response after a success method execution,

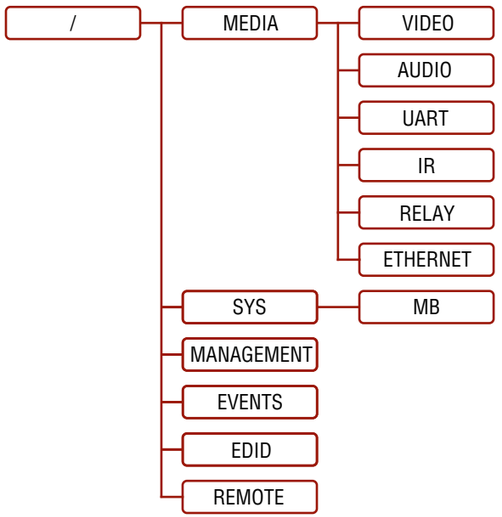
'mF': a response after a failed method execution,

'mE': an error for a method,

'mm': a manual for a method.

7.2. The Tree Structure of the Receiver

The /MEDIA node is used by the LDC to connect input ports to output ports on different layers. Each subnode of /MEDIA is representing a layer, e.g. video (/MEDIA/VIDEO), audio (/MEDIA/AUDIO) or RS-232 (/MEDIA/UART). Each layer has a crosspoint to define connections between the ports associated with the layer, all of them are represented by a specific node. E.g. the video layer node is /MEDIA/VIDEO: under the video layer node, the video crosspoint node (XP) and the video ports (I1, O1, ...) are located.



INFO: The tree structure is available in the Advanced view of LDC, see the Advanced View Window section.

7.3. LW3 Commands

7.3.1. Get Command

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

The Response Format

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

The defined prefixes are:

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

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

Get All Children of a Node

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

Command format: GET●[nodePath]

Response format: n-●[nodePath]

Example:

```
> GET /MEDIA
< n- /MEDIA/VIDEO
< n- /MEDIA/AUDIO
< n- /MEDIA/UART
< n- /MEDIA/IR
< n- /MEDIA/RELAY
< n- /MEDIA/ETHERNET
```

Get All Properties and Methods of a Node

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

Command format: GET●[nodePath].*

Response format: (for properties)

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

Legend:

X can be:

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

Response format: (for methods)

m-●[nodePath]:[methodName]

Example:

```
> GET /EDID.*
< pr /EDID.EdidStatus=D1:E1
< m- /EDID:switch
< m- /EDID:switchAll
< m- /EDID:copy
< m- /EDID:delete
< m- /EDID:reset
```

Get All Child Nodes, Properties and Methods of a Node

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

Command format: GETALL●[nodePath]

Response format: (for nodes)

n-●[nodePath]

Response format: (for properties)

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

Legend:

X can be:

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

Response format: (for methods)

m-●[nodePath]:[methodName]

Example:

```
> GETALL /EDID
< n- /EDID/F
< n- /EDID/D
< n- /EDID/U
< n- /EDID/E
< pr /EDID.EdidStatus=D1:E1
< m- /EDID:switch
< m- /EDID:switchAll
< m- /EDID:copy
< m- /EDID:delete
< m- /EDID:reset
```

7.3.2. Set Command

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

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

Response format:

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

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

Example:

```
> SET /SYS/MB/RS232.Rs232Mode=1
< pw /SYS/MB/RS232.Rs232Mode=1
```

Error response format:

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

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

Legend: XXX: error number.

Examples:

```
> SET /SYS/MB/RS232.Rs232Mode=11
< pE /SYS/MB/RS232.Rs232Mode %E004:Invalid value
```

```
> SET /SYS/MB/RS232/Local.ActiveProtocol=LW3
< pE %E004:Writing read-only property
```

7.3.3. Invocation

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

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

Response format:

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

mX●[nodePath]:[methodName]=Y

Legend:

X can be:

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

Y can be:

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

Example:

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

Error response format:

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

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

Example:

```
> CALL /EDID:switch(D1:R1)
< mE %E001:Syntax error
```

7.3.4. Manual

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

Command format:

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

Response format:

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

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

Example: (for a property)

```
> MAN /SYS/MB/RS232/Local.ActiveProtocol
< pm /SYS/MB/RS232/Local.ActiveProtocol ["LW2" | "LW3"] Active Protocol
```

Example: (for a method)

```
> MAN /SYS/MB/RS232/Local:factoryDefaults
< mm /SYS/MB/RS232/Local:factoryDefaults [] Restore factory default settings
```

7.3.5. Signature

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

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

Command format: XXXX#[command]

Legend: xxxx: 4-digit long hexadecimal value.

Response format:

{XXXX

[command lines]

}

Example:

```
> 1103#GET /MEDIA/UART.*
< {1103
< pr /MEDIA/UART.PortCount=2
< pr /MEDIA/UART.PortUI=P1:01209;P2:12224
< pr /MEDIA/UART.P1=LOCAL
< pr /MEDIA/UART.P2=TPS
< }
```

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

7.3.6. Subscription

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

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

Subscribe to a Node

Command format: OPEN●[nodePath]

Response format: o-●[nodePath]

Example:

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

Subscribe to Multiple Nodes

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

Command format: OPEN●[nodePath]/*

Response format: o-●[nodePath]/*

Example:

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

Get the Active Subscriptions for the Current Connection

Command format: OPEN

Response format: o-●[nodePath]

Example:

```
> OPEN
< o- /MEDIA/VIDEO
< o- /EDID
< o- /LOG
```

Unsubscribe from a Node

Command format: CLOSE●[nodePath]

Response format: c-●[nodePath]

Example:

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

Unsubscribe from Multiple Nodes

Command format: CLOSE●[nodePath]/*

Response format: c-●[nodePath]/*

Example:

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

7.3.7. Notifications about the Changes of the Properties

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

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

Example:

```
< CHG /EDID.EdidStatus=F48:E1;F49:E2;F48:E3;F48:E4;F48:E5
```

A Short Example of How to Use the Subscription

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

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

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

7.4. Formal Definitions

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

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

7.5. System Commands

7.5.1. Query the Product Name

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

Command format: GET●/.ProductName

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

Example:

```
> GET /.ProductName
< pr /.ProductName=HDMI-TPS-RX110AY
```

7.5.2. Set the Device Label

> **ATTENTION!** The device label can be changed to a custom text in the Status tab of the LDC software. This writable parameter is not the same as the ProductName parameter.

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

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

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

Example:

```
> SET /MANAGEMENT/UID.DeviceLabel=RX110_Conference1
< pw /MANAGEMENT/UID.DeviceLabel=RX110_Conference1
```

7.5.3. Query the Serial Number

Command format: GET●/.SerialNumber

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

Example:

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

7.5.4. Query the Firmware Version

Command format: GET●/SYS/MB.FirmwareVersion

Response format: pr●/SYS/MB.FirmwareVersion=<firmware_version>

```
> GET /SYS/MB.FirmwareVersion
< pr /SYS/MB.FirmwareVersion=1.2.0b6
```

7.5.5. Identify the Device

Calling the method results the blinking of the status LEDs for 10 seconds. The feature helps to identify the device itself in the rack shelf.

Command format: CALL●/MANAGEMENT/UI:identifyMe()

Response format: mO●/MANAGEMENT/UI:identifyMe=

Example:

```
> CALL /MANAGEMENT/UI:identifyMe()
< mO /MANAGEMENT/UI:identifyMe
```

7.5.6. Resetting the Device

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

Command format: CALL●/SYS:reset()

Response format: mO●/SYS:reset=

Example:

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

7.5.7. Restore the Factory Default Settings

Command format: CALL●/SYS:factoryDefaults()

Response format: mO●/SYS:factoryDefaults=

Example:

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

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

7.6. Video Port Settings

INFO: Video port numbering can be found in the Input/Output Port Numbering section.

7.6.1. Query the Status of Source Port

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

Response format: pr●/MEDIA/VIDEO/XP.SourcePortStatus=[<I_1>]

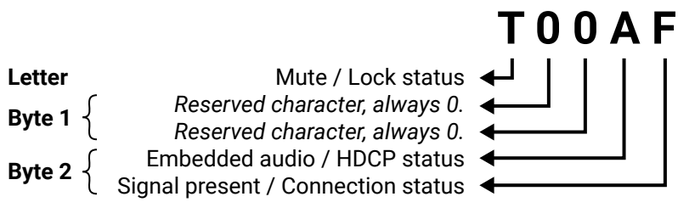
The response contains 5 ASCII characters for each port. The first character indicates the mute/lock state, the next four characters represent a 2-byte HEX code showing the current state of the input ports.

Example:

```
> GET /MEDIA/VIDEO/XP.SourcePortStatus
< pr /MEDIA/VIDEO/XP.SourcePortStatus=T00EF
```

Legend:

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



	Byte 1				Byte 2			
	Character 2		Character 3		Character 4		Character 5	
	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0
	Reserved	**Reserved**	**Reserved**	**Reserved**	**Embedded audio status**	**HDCP status**	**Signal present status**	**Connection status**
0 0	Reserved	Reserved	Reserved	Reserved	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 (T00EF):

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

The Most Common Received Port Status Responses

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

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

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

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

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

T00FF	T	0		0		F		F	
	Unlocked, Unmuted	0 0	0 0	0 0	0 0	1 1	1 1	1 1	1 1
		Reserved	Reserved	Reserved	Reserved	Embedded audio presents	Encrypted	Signal presents	Connected

7.6.2. Query the Status of Destination Port

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

Response format: pr●/MEDIA/VIDEO/XP.DestinationPortStatus=[<O_1>]

The response contains 5 ASCII characters for each port. The first character indicates the mute/lock state, the next 2-byte long HEX code showing the current state of the output port.

Example:

```
> GET /MEDIA/VIDEO/XP.DestinationPortStatus
< pr /MEDIA/VIDEO/XP.DestinationPortStatus=M00BF
```

Legend: See at previous section.

Example:

M	0		0		B		F	
Unlocked, Muted	0 0	0 0	0 0	0 0	1 0	1 1	1 1	1 1
	Reserved	Reserved	Reserved	Reserved	No embedded audio	Encrypted	Signal presents	Connected

7.6.3. Mute Input Port

Command format: CALL●/MEDIA/VIDEO/XP:muteSource(<I_n>)

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

Example:

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

7.6.4. Unmute Input Port

Command format: CALL●/MEDIA/VIDEO/XP:unmuteSource(<I_n>)

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

Example:

```
> CALL /MEDIA/VIDEO/XP:unmuteSource(I1)
< mO /MEDIA/VIDEO/XP:unmuteSource
```

7.6.5. Lock Input Port

Command format: CALL●/MEDIA/VIDEO/XP:lockSource(<I_n>)

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

Example:

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

7.6.6. Unlock Input Port

Command format: CALL●/MEDIA/VIDEO/XP:unlockSource(<I_n>)

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

Example:

```
> CALL /MEDIA/VIDEO/XP:unlockSource(I1)
< mO /MEDIA/VIDEO/XP:unlockSource
```

7.6.7. Mute Output

Command format: CALL●/MEDIA/VIDEO/XP:muteDestination(<O_n>)

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

Example:

```
> CALL /MEDIA/VIDEO/XP:muteDestination(O1)
< mO /MEDIA/VIDEO/XP:muteDestination
```

7.6.8. Unmute Output

Command format: CALL●/MEDIA/VIDEO/XP:unmuteDestination(<O_n>)

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

Example:

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

7.6.9. Lock Output

Command format: CALL●/MEDIA/VIDEO/XP:lockDestination(<O_n>)

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

Example:

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

7.6.10. Unlock Output

Command format: CALL●/MEDIA/VIDEO/XP:unlockDestination(<O_n>)

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

Example:

```
> CALL /MEDIA/VIDEO/XP:unlockDestination(O1)
< mO /MEDIA/VIDEO/XP:unlockDestination
```

7.6.11. HDCP Setting (Input Port)

HDCP capability can be enabled/disabled on the input ports, thus, non-encrypted content can be seen on a non-HDCP compliant display. See more information in the HDCP Management section.

Command format: SET●/MEDIA/VIDEO/<I_n>.HdcpEnable=true|false

Response format: pw●/MEDIA/VIDEO/<I_n>.HdcpEnable=true|false

Example:

```
> SET /MEDIA/VIDEO/I1.HdcpEnable=false
< pw /MEDIA/VIDEO/I1.HdcpEnable=false
```

7.6.12. HDCP Setting (Output Port)

HDCP capability can be set to Auto/Always on the output ports, thus, non-encrypted content can be transmitted to a non-HDCP compliant display. See more information in the HDCP Management section.

Command format: SET●/MEDIA/VIDEO/<O_n>.HdcpModeSetting=0|1

Response format: pw●/MEDIA/VIDEO/<O_n>.HdcpModeSetting=0|1

Parameters:

.HdcpModeSetting	0	1
HDCP mode	Auto	Always

Example:

```
> SET /MEDIA/VIDEO/O1.HdcpModeSetting=0
< pw /MEDIA/VIDEO/O1.HdcpModeSetting=0
```

7.6.13. Test Pattern Generator

The output ports can send a special image towards the sink devices for testing purposes. The setting is available on output ports with the below-listed parameters.

Test Pattern Generator Mode Setting:

Command format: SET●/MEDIA/VIDEO/<O_n>.TpgMode=0|1|2

Response format: pw●/MEDIA/VIDEO/<O_n>.TpgMode=0|1|2

Parameters:

.TpgMode	0	1	2
Test pattern generator mode	**Disabled** The test pattern is not displayed on the output	**Enabled** The test pattern is displayed on the output	**No signal mode** The test pattern is displayed if there is no signal on the output port

Example:

```
> SET /MEDIA/VIDEO/O1.TpgMode=2
< pw /MEDIA/VIDEO/O1.TpgMode=2
```

Clock Source – The Clock Frequency of the Test Pattern

Command format: SET●/MEDIA/VIDEO/<O_n>.TpgClockSource=480|576|EXT

Response format: pw●/MEDIA/VIDEO/<O_n>.TpgClockSource=480|576|EXT

Parameters:

.TpgClockSource	480	576	EXT
Clock frequency	480p	576p	External clock (from actual TMDS source)

Example:

```
> SET /MEDIA/VIDEO/O1.TpgClockSource=576
< pw /MEDIA/VIDEO/O1.TpgClockSource=576
```

Test Pattern

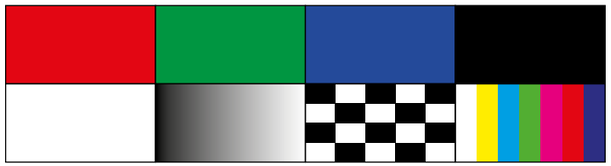
Command format: SET●/MEDIA/VIDEO/<O_n>.TpgPattern=<pattern>

Response format: pw●/MEDIA/VIDEO/<O_n>.TpgPattern=<pattern>

Parameters:

<pattern>	RED	GREEN	BLUE	BLACK	WHITE	RAMP	CHESS	BAR	CYCLE

Cycle setting means all the patterns are changed sequentially approx. in every 2 seconds.



Example:

```
> SET /MEDIA/VIDEO/O1.TpgPattern=GREEN
< pw /MEDIA/VIDEO/O1.TpgPattern=GREEN
```

7.6.14. HDMI Mode Settings (Output Port)

Command format: SET●/MEDIA/VIDEO/<O_n>.HdmiModeSetting=0|1|2

Response format: pw●/MEDIA/VIDEO/<O_n>.HdmiModeSetting=0|1|2

Parameters:

.HdmiModeSetting	0	1	2
HDMI mode	Auto	DVI	HDMI

Example:

```
> SET /MEDIA/VIDEO/O1.HdmiModeSetting=2
< pw / MEDIA/VIDEO/O1.HdmiModeSetting=2
```

7.6.15. Query the Recent TPS Mode

Command format: GET●/REMOTE/S_n.tpsMode

Response format: pr●/REMOTE/S_n.tpsMode=A|H|L|1|2

Parameters:

.tpsMode	A	H	L	1	2
TPS mode	Auto	HDBaseT	Long reach	LPPF1	LPPF2

Example:

```
> GET /REMOTE/S1.tpsMode
< pr /REMOTE/S1.tpsMode=H
```

See more information about TPS modes in the TPS Interface section.

7.6.16. TPS Mode Settings

Command format: SET●/REMOTE/S_n.tpsModeSetting=A|H|L|1|2

Response format: pw●/REMOTE/S_n.tpsModeSetting=A|H|L|1|2

Parameters: See at previous section.

Example:

```
> SET /REMOTE/S1.tpsModeSetting=A
< pw /REMOTE/S1.tpsModeSetting=A
```

See more information about TPS modes in the TPS Interface section.

7.7. Audio Port Settings

INFO: Audio port numbering can be found in the Input/Output Port Numbering section.

7.7.1. Query the Status of Source Port

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

Response format: pr●/MEDIA/AUDIO/XP.SourcePortStatus=[<I_1>]

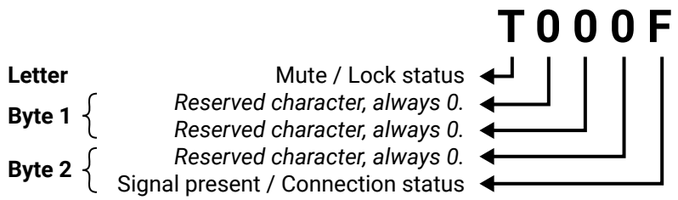
The response contains 5 ASCII characters for each port. The first character indicates the mute/lock state, the next four characters represent a 2-byte HEX code showing the current state of the input ports.

Example:

```
> GET /MEDIA/AUDIO/XP.SourcePortStatus
< pr /MEDIA/AUDIO/XP.SourcePortStatus=T000F
```

Legend:

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



	Byte 1				**Byte 2**			
	Character 2		Character 3		Character 4		Character 5	
	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0	BIT 7-6	BIT 5-4	BIT 3-2	BIT 1-0
	Reserved	**Reserved**	**Reserved**	**Reserved**	**Reserved**	**Reserved**	**Signal present status**	**Connection status**
0 0	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Unknown	
0 1							Reserved	
1 0							No signal	Not connected
1 1							Signal presents	Connected

Example and Explanation (for input 2, M000B):

M	**0**		**0**		**0**		**B**	
Unlocked, Muted	0 0	0 0	0 0	0 0	0 0	0 0	1 0	1 1
	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	No signal	Connected

The Most Common Received Port Status Responses

T000A	**T**	**0**		**0**		**0**		**A**	
	Unlocked, Unmuted	0 0	0 0	0 0	0 0	0 0	0 0	1 0	1 0
		Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	No signal	Not connected

T000B	**T**	**0**		**0**		**0**		**B**	
	Unlocked, Unmuted	0 0	0 0	0 0	0 0	0 0	0 0	1 0	1 1
		Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	No signal	Connected

T000F	**T**	**0**		**0**		**0**		**F**	
	Unlocked, Unmuted	0 0	0 0	0 0	0 0	0 0	0 0	1 1	1 1
		Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Signal presents	Connected

Only for Phoenix audio port: Character 5 is C (11 00) which means signal is present but the cable connection status is unknown. The explanation is Phoenix connector has no pin which can indicate the connection status so this is always unknown.

T000C	**T**	**0**		**0**		**0**		**C**	
	Unlocked, Unmuted	0 0	0 0	0 0	0 0	0 0	0 0	1 1	0 0
		Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Signal presents	Unknown

7.7.2. Query the Status of Destination Port

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

Response format: pr●/MEDIA/AUDIO/XP.DestinationPortStatus=[<O_1>;<O_2>]

The response contains 5 ASCII characters for each port. The first character indicates the mute/lock state, the next 2-byte long HEX code showing the current state of the output port.

Example:

```
> GET /MEDIA/AUDIO/XP.DestinationPortStatus
< pr /MEDIA/AUDIO/XP.DestinationPortStatus=T000F;M000F
```

Legend: See at previous section.

Example and Explanation (for output 2, M000F):

M	**0**		**0**		**0**		**F**	
Unlocked, Muted	0 0	0 0	0 0	0 0	0 0	0 0	1 1	1 1
	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Signal presents	Connected

7.7.3. Mute Input Port

Command format: CALL●/MEDIA/AUDIO/XP:muteSource(<I_n>)

Response format: mO●/MEDIA/AUDIO/XP:muteSource

Example:

```
> CALL /MEDIA/AUDIO/XP:muteSource(I1)
< mO /MEDIA/AUDIO/XP:muteSource
```

7.7.4. Unmute Input Port

Command format: CALL●/MEDIA/AUDIO/XP:unmuteSource(<I_n>)

Response format: mO●/MEDIA/AUDIO/XP:unmuteSource

Example:

```
> CALL /MEDIA/AUDIO/XP:unmuteSource(I1)
< mO /MEDIA/AUDIO/XP:unmuteSource
```

7.7.5. Mute Output

Command format: CALL●/MEDIA/AUDIO/XP:muteDestination(<O_n>)

Response format: mO●/MEDIA/AUDIO/XP:muteDestination

Example:

```
> CALL /MEDIA/AUDIO/XP:muteDestination(O1)
< mO /MEDIA/AUDIO/XP:muteDestination
```

7.7.6. Unmute Output

Command format: CALL●/MEDIA/AUDIO/XP:unmuteDestination(<O_n>)

Response format: mO●/MEDIA/AUDIO/XP:unmuteDestination

Example:

```
> CALL /MEDIA/AUDIO/XP:unmuteDestination(O1)
< mO /MEDIA/AUDIO/XP:unmuteDestination
```

7.7.7. Analog Audio Output Level Settings

Volume (dB)

Command format: SET●/MEDIA/AUDIO/<O_n>.VolumedB=<level>

Response format: pw●/MEDIA/AUDIO/<O_n>.VolumedB=<level>

Parameters: <level> Sets the output volume (attenuation) between -95.625 dB and 0 dB in step of -0.375 dB. The value is rounded up if necessary to match with the step value.

Example:

```
> SET /MEDIA/AUDIO/O2.VolumedB=-15
< pw /MEDIA/AUDIO/O2.VolumedB=-15.00
```

Volume (Percent)

ommand format: SET●/MEDIA/AUDIO/<O_n>.VolumePercent=<percent>

Response format: pw●/MEDIA/AUDIO/<O_n>.VolumePercent=<percent>

Parameters: <level> Sets the output volume (attenuation) between 100% and 0%, in step of 1%. The value is rounded up if necessary to match with the step value.

Example:

```
> SET /MEDIA/AUDIO/O2.VolumePercent=50
< pw /MEDIA/AUDIO/O2.VolumePercent=50
```

Balance

Command format: SET●/MEDIA/AUDIO/<O_n>.Balance=<level>

Response format: pw●/MEDIA/AUDIO/<O_n>.Balance=<level>

Parameters: <level> Sets the balance; -100 means left balance, 100 means right balance, step is 1. Center is 0 (default).

Example:

```
> SET /MEDIA/AUDIO/O2.Balance=0
< pw /MEDIA/AUDIO/O2.Balance=0
```

7.7.8. Analog Audio Output Level Settings by Steps

Volume in dB

Command format: SET●/MEDIA/AUDIO/<O$_n$>.stepVolumedB=<step>

Response format: pw●/MEDIA/AUDIO/<O$_n$>.VolumedB=<step>

Parameters: <level> Sets the output volume (attenuation) between -95.625 dB and 0 dB in step of -0.375 dB. The value is rounded up if necessary to match with the step value.

Example:

```
> SET /MEDIA/AUDIO/O2.stepVolumedB=5
< pw /MEDIA/AUDIO/O2.stepVolumedB
```

Volume in Percent

ommand format: SET●/MEDIA/AUDIO/<O$_n$>.stepVolumePercent=<percent>

Response format: pw●/MEDIA/AUDIO/<O$_n$>.stepVolumePercent=<percent>

Parameters: <level> Sets the output volume (attenuation) between 100% and 0%, in step of 1%. The value is rounded up if necessary to match with the step value.

Example:

```
> SET /MEDIA/AUDIO/O2.stepVolumePercent=15
< pw /MEDIA/AUDIO/O2.stepVolumePercent
```

Balance

Command format: SET●/MEDIA/AUDIO/<O$_n$>.stepBalance=<level>

Response format: pw●/MEDIA/AUDIO/<O$_n$>.stepBalance=<level>

Parameters: <level> Sets the balance; -100 means left balance, 100 means right balance, step is 1. Center is 0 (default).

Example:

```
> SET /MEDIA/AUDIO/O2.stepBalance=1
< pw /MEDIA/AUDIO/O2.stepBalance
```

7.8. Network Configuration

7.8.1. Query the DHCP State

Command format: GET●/MANAGEMENT/NETWORK.DhcpEnabled

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

Example:

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

7.8.2. Change the DHCP State

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

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

Example:

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

7.8.3. Query the IP Address

Command format: GET●/MANAGEMENT/NETWORK.IpAddress

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

Example:

```
> GET /MANAGEMENT/NETWORK.IpAddress
< pr /MANAGEMENT/NETWORK.IpAddress=192.168.0.100
```

7.8.4. Change the IP Address (Static)

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

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

Example:

```
> SET /MANAGEMENT/NETWORK.StaticIpAddress=192.168.0.85
< pw /MANAGEMENT/NETWORK.StaticIpAddress=192.168.0.85
```

7.8.5. Query the Subnet Mask

Command format: GET●/MANAGEMENT/NETWORK.NetworkMask

Response format: pr●/MANAGEMENT/NETWORK.NetworkMask=<netmask>

Example:

```
> GET /MANAGEMENT/NETWORK.NetworkMask
< pr /MANAGEMENT/NETWORK.NetworkMask=255.255.255.0
```

7.8.6. Change the Subnet Mask (Static)

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

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

Example:

```
> SET /MANAGEMENT/NETWORK.StaticNetworkMask=255.255.255.0
< pw /MANAGEMENT/NETWORK.StaticNetworkMask=255.255.255.0
```

7.8.7. Query the Gateway Address

Command format: GET●/MANAGEMENT/NETWORK.GatewayAddress

Response format: pr●/MANAGEMENT/NETWORK.GatewayAddress=<gw_address>

Example:

```
> GET /MANAGEMENT/NETWORK.GatewayAddress
< pr /MANAGEMENT/NETWORK.GatewayAddress=192.168.0.1
```

7.8.8. Change the Gateway Address (Static)

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

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

Example:

```
> SET /MANAGEMENT/NETWORK.StaticGatewayAddress=192.168.0.5
< pw /MANAGEMENT/NETWORK.StaticGatewayAddress=192.168.0.5
```

7.9. RS-232 Port Configuration

> INFO: Serial (local and link) port numbering can be found in the Input/Output Port Numbering section.

7.9.1. Protocol Setting

Command format: SET●/MEDIA/UART/<P_n>.ControlProtocol=0|1

Response format: pw●/MEDIA/UART/<P_n>.ControlProtocol=0|1

Parameters:

.ControlProtocol	0	1
RS-232 protocol mode	LW2	LW3

Example:

```
> SET /MEDIA/UART/P1.ControlProtocol=1
< pw /MEDIA/UART/P1.ControlProtocol=1
```

7.9.2. BAUD Rate Setting

Command format: SET●/MEDIA/UART/<P_n>.Baudrate=0|1|2|3|4|5|6|7

Response format: pw●/MEDIA/UART/<P_n>.Baudrate=0|1|2|3|4|5|6|7

Parameters:

.Baudrate	0	1	2	3	4	5	6	7
BAUD rate value	4800	7200	9600	14400	19200	38400	57600	115200

Example:

```
> SET /MEDIA/UART/P1.Baudrate=2
< pw /MEDIA/UART/P1.Baudrate=2
```

7.9.3. Databit Setting

Command format: SET●/MEDIA/UART/<P_n>.DataBits=8|9

Response format: pw●/MEDIA/UART/<P_n>.DataBits=8|9

Example:

```
> SET /MEDIA/UART/P1.DataBits=8
< pw /MEDIA/UART/P1.DataBits=8
```

7.9.4. Stopbits Setting

Command format: SET●/MEDIA/UART/<P$_n$>.StopBits=0|1|2

Response format: pw●/MEDIA/UART/<P$_n$>.StopBits=0|1|2

Parameters:

.StopBits	0	1	2
Stopbit value	1	1,5	2

Example:

```
> SET /MEDIA/UART/P1.StopBits=0
< pw /MEDIA/UART/P1.StopBits=0
```

7.9.5. Parity Setting

Command format: SET●/MEDIA/UART/<P$_n$>.Parity=0|1|2

Response format: pw●/MEDIA/UART/<P$_n$>.Parity=0|1|2

Parameters:

.Parity	0	1	2
Parity setting	no parity	odd	even

Example:

```
> SET /MEDIA/UART/P1.Parity=0
< pw /MEDIA/UART/P1.Parity=0
```

7.9.6. RS-232 Operation Mode

Command format: SET●/MEDIA/UART/<P$_n$>.Rs232Mode=0|1|2

Response format: pw●/MEDIA/UART/<P$_n$>.Rs232Mode=0|1|2

Parameters:

.Rs232Mode	0	1	2
RS-232 operation mode	Pass-through	Control	Command injection

Example:

```
> SET /MEDIA/UART/P1.Rs232Mode=1
< pw /MEDIA/UART/P1.Rs232Mode=1
```

Command Injection Mode

Command format: SET●/MEDIA/UART/<P$_n$>.CommandInjectionEnable=true|false

Response format: pw●/MEDIA/UART/<P$_n$>.CommandInjectionEnable=true|false

Example:

```
> SET /MEDIA/UART/P1.CommandInjectionEnable=true
< pw /MEDIA/UART/P1.CommandInjectionEnable=true
```

ATTENTION! The local RS-232 and TPS serial link are mirrored. If you change the RS-232 mode on P1 (local) port, the P2 (TPS serial link) will also be changed.

ATTENTION! The Command injection status is stored in another read-only property: /MEDIA/UART/<P$_n$>.CommandInjectionStatus.

7.10. Sending Message via the Communication Ports

7.10.1. Sending Message via TCP Port

The device can be used for sending a message to a certain IP:port address. The three different commands allow controlling the connected (third-party) devices.

Sending TCP Message

The command is for sending a command messages in ASCII-format with an option for escaping special charaters.

Command format: CALL●/MEDIA/ETHERNET.tcpMessage(<IP_address>:<port_no>=<message>)

Response format: mO●/MEDIA/ETHERNET:tcpMessage

Example:

```
> CALL /MEDIA/ETHERNET.tcpMessage(192.168.0.20:5555=PWR0\x0d\x0a)
< mO /MEDIA/ETHERNET:tcpMessage
```

Escaping in the Message

When commands need to be separated by <CR><LF> charaters to be recognized by the controlled device, then they need to be escaped. You can use the following format for escaping:

<command$_1$><\x0d\x0a><command$_2$><\x0d\x0a>...<command$_n$><\x0d\x0a>

Sending Text Message

The command is for sending a text message in ASCII-format.

INFO: Escaping will not be processed using the **tcpText** command.

Command format: CALL●/MEDIA/ETHERNET.tcpText(<IP_address>:<port_no>=<message>)

Response format: mO●/MEDIA/ETHERNET:tcpText

Example:

```
> CALL /MEDIA/ETHERNET.tcpText(192.168.0.20:5555=pwr_on)
< mO /MEDIA/ETHERNET:tcpText
```

Sending Binary Message

The command is for sending a binary message in HEX format.

INFO: Escaping will not be processed using the **tcpBinary** command.

Command format: CALL●/MEDIA/ETHERNET.tcpBinary(<IP_address>:<port_no>=<message>)

Response format: mO●/MEDIA/ETHERNET:tcpBinary

Example:

```
> CALL /MEDIA/ETHERNET.tcpBinary(192.168.0.20:5555=0100000061620000cdcc2c40)
< mO /MEDIA/ETHERNET:tcpBinary
```

7.10.2. Sending Message via UDP Port

The device can be used for sending a message to a certain IP:port address. The three different commands allow controlling the connected (third-party) devices.

Sending UDP Message

The command is for sending a command messages in ASCII-format with an option for escaping special charaters.

Command format: CALL●/MEDIA/ETHERNET.udpMessage(<IP_address>:<port_no>=<message>)

Response format: mO●/MEDIA/ETHERNET:udpMessage

Example:

```
> CALL /MEDIA/ETHERNET.udpMessage(192.168.0.20:5555=PWR0\x0d\x0a)
< mO /MEDIA/ETHERNET:udpMessage
```

Escaping in the Message

When commands need to be separated by <CR><LF> charaters to be recognized by the controlled device, then they need to be escaped. You can use the following format for escaping:

<command$_1$><\x0d\x0a><command$_2$><\x0d\x0a>...<command$_n$><\x0d\x0a>

Sending Text Message

The command is for sending a text message in ASCII-format.

INFO: Escaping will not be processed using the **udpText** command.

Command format: CALL●/MEDIA/ETHERNET.udpText(<IP_address>:<port_no>=<message>)

Response format: mO●/MEDIA/ETHERNET:udpText

Example:

```
> CALL /MEDIA/ETHERNET.udpText(192.168.0.20:5555=pwr_on)
< mO /MEDIA/ETHERNET:udpText
```

Sending Binary Message

The command is for sending a binary message in HEX format.

INFO: Escaping will not be processed using the **udpBinary** command.

Command format: CALL●/MEDIA/ETHERNET.udpBinary(<IP_address>:<port_no>=<message>)

Response format: mO●/MEDIA/ETHERNET:udpBinary

Example:

```
> CALL /MEDIA/ETHERNET.udpBinary(192.168.0.20:5555=0100000061620000cdcc2c40)
< mO /MEDIA/ETHERNET:udpBinary
```

7.10.3. Sending Message via an RS-232 Port

The RS-232 ports can be used for sending a command message to a device which can be controlled over serial port. Both local RS-232 and extended link RS-232 ports can be used. The three different commands allow to use different message formats.

Sending Message

The command is for sending a command messages in ASCII-format with an option for escaping special charaters.

Command format: CALL●/MEDIA/UART/<P$_n$>.sendMessage(<message>)

Response format: mO●/MEDIA/UART/<P$_n$>:sendMessage

Example:

```
> CALL /MEDIA/UART/P1.sendMessage(PWR0\x0d\x0a)
< mO /MEDIA/UART/P1:sendMessage
```

Escaping in the Message

When commands need to be separated by <CR><LF> charaters to be recognized by the controlled device, then they need to be escaped. You can use the following format for escaping:

<command$_1$><\x0d\x0a><command$_2$><\x0d\x0a>...<command$_n$><\x0d\x0a>

Sending Text Message

The command is for sending a text message in ASCII-format.

INFO: Escaping will not be processed using the **sendText** command.

Command format: CALL●/MEDIA/UART/<P_n>.sendText(<message>)

Response format: mO●/MEDIA/UART/<P_n>:sendText

Example:

```
> CALL /MEDIA/UART/P2.sendText(pwr_on)
< mO /MEDIA/UART/P2:sendText
```

Sending Binary Message

The command is for sending a binary message in HEX format.

INFO: Escaping will not be processed using the **sendBinaryMessage** command.

Command format: CALL●/MEDIA/UART/<P_n>.sendBinaryMessage(<message>)

Response format: mO●/MEDIA/UART/<P_n>:sendBinaryMessage

Example:

```
> CALL /MEDIA/UART/P1.sendBinaryMessage(0100000061620000cdcc2c40)
< mO /MEDIA/UART/P1:sendBinaryMessage
```

7.11. Infrared Port Configuration

INFO: Infrared (local and link) port numbering can be found in the Input/Output Port Numbering section.

7.11.1. Enable Command Injection Mode

Command format: SET●/MEDIA/IR/<S|D_n>.CommandInjectionEnable=true|false

Response format: pw●/MEDIA/IR/<S|D_n>.CommandInjectionEnable=true|false

Example:

```
> SET /MEDIA/IR/S1.CommandInjectionEnable=true
< pw /MEDIA/IR/S1.CommandInjectionEnable=true
```

7.11.2. Change Command Injection Port Number

Command format: SET●/MEDIA/IR/<S|D_n>.CommandInjectionPort=<port_no>

Response format: pw●/MEDIA/IR/<S|D_n>.CommandInjectionPort=<port_no>

Example:

```
> SET /MEDIA/IR/S1.CommandInjectionPort=9001
< pw /MEDIA/IR/S1.CommandInjectionPort=9001
```

7.11.3. Enable/Disable Output Signal Modulation

Command format: SET●/MEDIA/IR/<D_n>.EnableModulation=true|false

Response format: pw●/MEDIA/IR/<D_n>.EnableModulation=true|false

Example:

```
> SET /MEDIA/IR/D2.EnableModulation=false
< pw /MEDIA/IR/D2.EnableModulation=false
```

Explanation:

Signal modulation is turned off on TPS IR output line (D2).

INFO: The default setting value is "true" (enabled).

7.12. Relay Port Settings

7.12.1. Set Relay Connection State

Command format: SET●/MEDIA/RELAY/<P_n>.Output=O|C

Response format: pw●/MEDIA/RELAY/<P_n>.Output=O|C

Parameters:

.Output	O	C
Relay connection state	Open	Closed

Example:

```
> SET /MEDIA/RELAY/P1.Output=C
< pw /MEDIA/RELAY/P1.Output=C
```

Explanation: P1 relay port is set to be closed.

7.13. EDID Management

7.13.1. Query the Emulated EDIDs

Command format: GET●/EDID.EdidStatus

Response format: pr●/EDID.EdidStatus=<E_loc>:<E_1>;<E_loc>:<E_2>;...;<E_loc>:<E_n>

Example:

```
> GET /EDID.EdidStatus
< pr /EDID.EdidStatus=D1:E1
```

Explanation:

Emulated EDID memory for input port is listed with the EDID number that is currently emulated on the input.

7.13.2. Query the Validity of a Dynamic EDID

Command format: GET●/EDID/D/D_n.Validity

Response format: pr●/EDID/D/D_n.Validity=true|false

Example:

```
> GET /EDID/D/D1.Validity
< pr /EDID/D/D1.Validity=true
```

Explanation:

The 'Validity' property is true, valid EDID is stored in D1 memory place.

7.13.3. Query the Preferred Resolution of an User EDID

Command format: GET●/EDID/U/U_n.PreferredResolution

Response format: pr●/EDID/U/U_n.PreferredResolution=<preferred_resolution>

Example:

```
> GET /EDID/U/U2.PreferredResolution
< pr /EDID/U/U2.PreferredResolution=1920x1080p60.00Hz
```

> INFO: Use the "Manufacturer" property to query the manufacturer and the "MonitorName" property to query the name of the monitor.

7.13.4. Emulating an EDID to an Input Port

Command format: CALL●/EDID:switch(<source>:<destination>)

Response format: mO●/EDID:switch

Example:

```
> CALL /EDID:switch(F49:E2)
< mO /EDID:switch
```

Legend:

<source>: Source EDID memory place: Factory / User / Dynamic.

<destination>: The emulated EDID memory of the desired input port.

7.13.5. Copy an EDID to User Memory

Command format: CALL●/EDID:copy(<D_n>|<E_n>|<F_n>|<U_n>:<U_m>)

Response format: mO●/EDID:copy

Example:

```
> CALL /EDID:copy(D1:U1)
< mO /EDID:copy
```

Explanation:

The EDID of the last connected sink of D1 (Output 1) has been copied to U1.

7.13.6. Deleting an EDID from User Memory

Command format: CALL●/EDID:delete(<U_n>)

Response format: mO●/EDID:delete

Example:

```
> CALL /EDID:delete(U1)
< mO /EDID:delete
```

7.13.7. Resetting the Emulated EDIDs

Command format: CALL●/EDID:reset()

Response format: mO●/EDID:reset

Example:

```
> CALL /EDID:reset()
< mO /EDID:reset
```

Explanation: Calling this method switches all emulated EDIDs to factory default one. See the table in the Factory EDID List section.

7.14. LW3 Commands - Quick Summary

System Commands

	Operation / Path
7.5.1	Query the Product Name
	/.ProductName
7.5.2	Set the Device Label
	/MANAGEMENT/UID.DeviceLabel
7.5.3	Query the Serial Number
	/.SerialNumber
7.5.4	Query the Firmware Version
	/SYS/MB.FirmwareVersion
7.5.5	Identify the Device
	/MANAGEMENT/UI:identifyMe
7.5.6	Resetting the Device
	/SYS:reset()
7.5.7	Restore the Factory Default Settings
	/SYS:factoryDefaults()

Video Port Settings

	Operation / Path
7.6.1	Query the Status of Source Port
	/MEDIA/VIDEO/XP.SourcePortStatus
7.6.2	Query the Status of Destination Port
	/MEDIA/VIDEO/XP.DestinationPortStatus
7.6.3	Mute Input Port
	/MEDIA/VIDEO/XP:muteSource(<input>)
7.6.4	Unmute Input Port
	/MEDIA/VIDEO/XP:unmuteSource(<input>)
7.6.5	Lock Input Port
	/MEDIA/VIDEO/XP:lockSource(<input>)
7.6.6	Unlock Input Port
	/MEDIA/VIDEO/XP:unlockSource(<input>)
7.6.7	Mute Output
	/MEDIA/VIDEO/XP:muteDestination(<output>)
7.6.8	Unmute Output
	/MEDIA/VIDEO/XP:unmuteDestination(<output>)
7.6.9	Lock Output
	/MEDIA/VIDEO/XP:lockDestination(<output>)
7.6.10	Unlock Output
	/MEDIA/VIDEO/XP:unlockDestination(<output>)
7.6.11	HDCP Setting (Input Port)
	/MEDIA/VIDEO/<input>.HdcpEnable
7.6.12	HDCP Setting (Output Port)
	/MEDIA/VIDEO/<output>.HdcpModeSetting
7.6.13	Test Pattern Generator
	/MEDIA/VIDEO/<output>.TpgMode|TpgClockSource|TpgPattern
7.6.14	HDMI Mode Settings (Output Port)
	/MEDIA/VIDEO/<output>.HdmiModeSetting
7.6.15	Query the Recent TPS Mode
	/REMOTE/S1.tpsMode
7.6.16	TPS Mode Settings
	/REMOTE/S1.tpsModeSetting

Audio Port Settings

	Operation / Path
7.7.1	Query the Status of Source Port
	/MEDIA/AUDIO/XP.SourcePortStatus
7.7.2	Query the Status of Destination Port
	/MEDIA/AUDIO/XP.DestinationPortStatus
7.7.3	Mute Input Port
	/MEDIA/AUDIO/XP:muteSource(<input>)
7.7.4	Unmute Input Port
	/MEDIA/AUDIO/XP:unmuteSource(<input>)

Operation / Path	
7.7.5	Mute Output
	/MEDIA/AUDIO/XP:muteDestination(<output>)
7.7.6	Unmute Output
	/MEDIA/AUDIO/XP:unmuteDestination(<output>)
7.7.7	Analog Audio Output Level Settings
	/MEDIA/AUDIO/<output>.VolumedB|VolumePercent|Balance
7.7.8	Analog Audio Output Level Settings by Steps
	/MEDIA/AUDIO/<output>.stepVolumedB|stepVolumePercent|stepBalance

Network Configuration

Operation / Path	
7.8.1	Query the DHCP State
	/MANAGEMENT/NETWORK.DhcpEnabled
7.8.2	Change the DHCP State
	/MANAGEMENT/NETWORK.DhcpEnabled
7.8.3	Query the IP Address
	/MANAGEMENT/NETWORK.IpAddress
7.8.4	Change the IP Address (Static)
	/MANAGEMENT/NETWORK.StaticIpAddress
7.8.5	Query the Subnet Mask
	MANAGEMENT/NETWORK.NetworkMask
7.8.6	Change the Subnet Mask (Static)
	/MANAGEMENT/NETWORK.StaticNetworkMask
7.8.7	Query the Gateway Address
	/MANAGEMENT/NETWORK.GatewayAddress
7.8.8	Change the Gateway Address (Static)
	/MANAGEMENT/NETWORK.StaticGatewayAddress

RS-232 Port Configuration

Operation / Path	
7.8.1	Query the DHCP State
	/MEDIA/UART/<port_no>.ControlProtocol
7.9.2	BAUD Rate Setting
	/MEDIA/UART/<port_no>.Baudrate
7.9.3	Databit Setting
	/MEDIA/UART/<port_no>.DataBits
7.9.4	Stopbits Setting
	/MEDIA/UART/<port_no>.StopBits
7.9.5	Parity Setting
	/MEDIA/UART/<port_no>.Parity
7.9.6	RS-232 Operation Mode
	/MEDIA/UART/<port_no>.Rs232Mode

Sending Message via the Communication Ports

Operation / Path	
7.10.1	Sending Message via TCP Port
	/MEDIA/ETHERNET.tcpText|tcpMessage|tcpBinary
7.10.2	Sending Message via UDP Port
	/MEDIA/ETHERNET.udpText|udpMessage|udpBinary
7.10.3	Sending Message via an RS-232 Port
	/MEDIA/UART/<port_no>.sendText|sendMessage|sendBinaryMessage

Infrared Port Configuration

Operation / Path	
7.11.1	Enable Command Injection Mode
	/MEDIA/IR/<port_no>.CommandInjectionEnable
7.11.2	Change Command Injection Port Number
	/MEDIA/IR/<port_no>.CommandInjectionPort
7.11.3	Enable/Disable Output Signal Modulation
	/MEDIA/IR/<port_no>.EnableModulation

Relay Port Settings

	Operation / Path
7.12.1	Set Relay Connection State
	/MEDIA/RELAY/<port_no>.Output

EDID Management

	Operation / Path
7.13.1	Query the Emulated EDIDs
	/EDID.EdidStatus
7.13.2	Query the Validity of a Dynamic EDID
	/EDID/D/<dynamic_edid_memory>.Validity
7.13.3	Query the Preferred Resolution of an User EDID
	/EDID/U/<user_edid_memory>.PreferredResolution
7.13.4	Emulating an EDID to an Input Port
	/EDID:switch(<source>:<destination>)
7.13.5	Copy an EDID to User Memory
	/EDID:copy(<source>:<destination>)
7.13.6	Deleting an EDID from User Memory
	/EDID:delete(<user_edid_memory>)
7.13.7	Resetting the Emulated EDIDs
	/EDID:reset()

8

Firmware Upgrade

The receiver can be upgraded by using Lightware Device Updater (LDU) software via Ethernet. The firmware pack with the necessary components (*.lfp file) for your specific product, the LDU application, and the User's manual can be downloaded from the Support page of our website www.lightware.com.

ATTENTION! While the firmware is being upgraded, the normal operation mode is suspended as the receiver is switched to bootload mode. Signal processing is not performed. Do not interrupt the firmware upgrade. If any problem occurs, reboot the receiver and restart the process.

ATTENTION! The firmware upgrade process has an effect on the configuration and the settings of the device. For more details, please see the Keeping the Configuration Settings section before the upgrade.

8.1. About the Firmware Package (LFP File)

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

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

8.2. Short Instructions

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

Step 2. Install the LDU application.

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

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

8.3. Install and Upgrade

Installation for Windows OS

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

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

Normal 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 version can be installed for all users

Comparison of install types

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

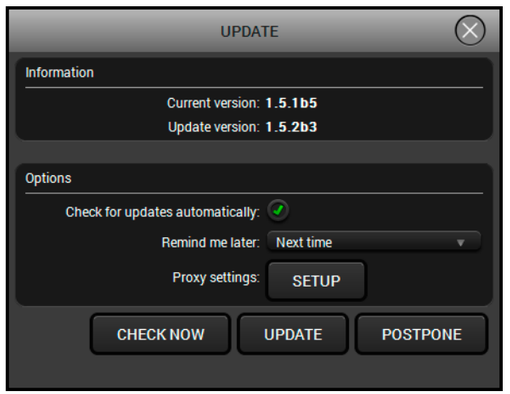
Installation for Mac OS X

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

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

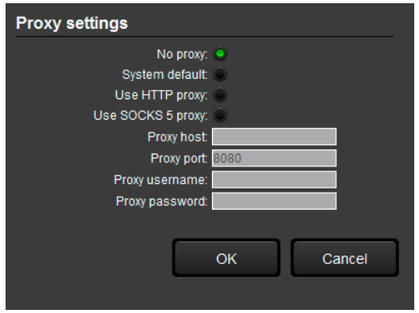
LDU Upgrade

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



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

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



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

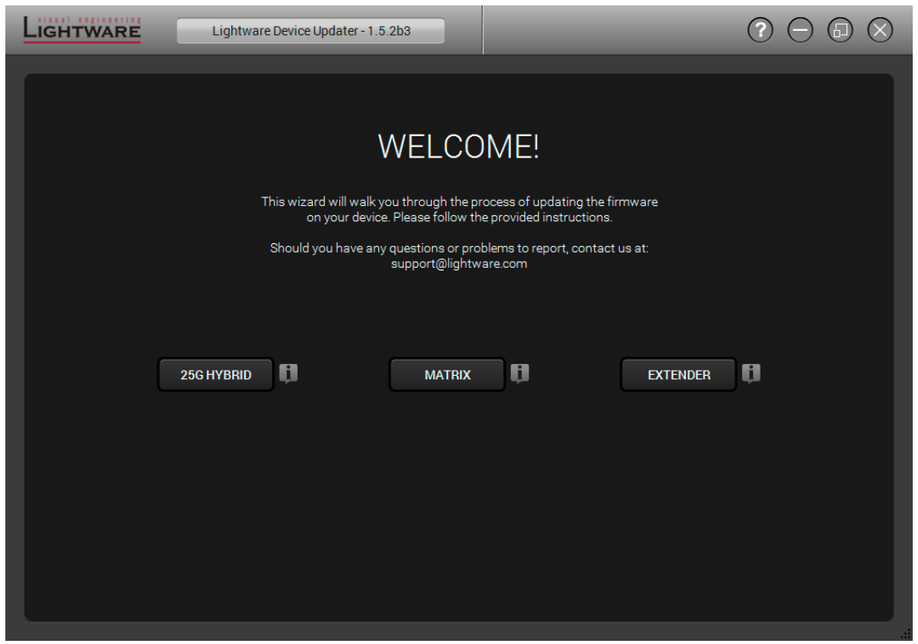
8.4. Detailed Instructions

8.4.1. Establish the Connection

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

8.4.2. Start the LDU and Follow the Instructions

After launching LDU the welcome screen will appear:

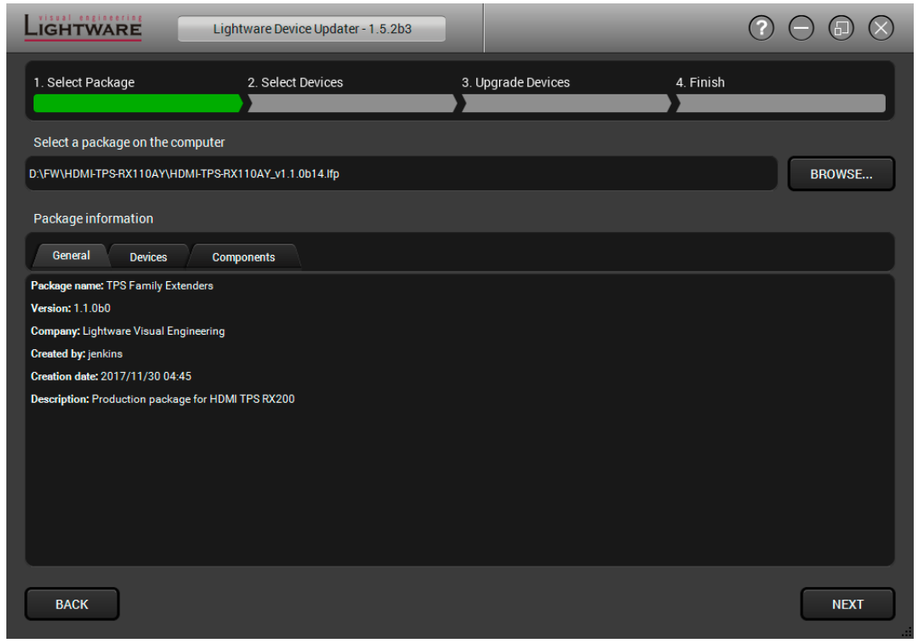


Pressing the button a list will appear showing the supported devices:

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

Step 1. Select the package.

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



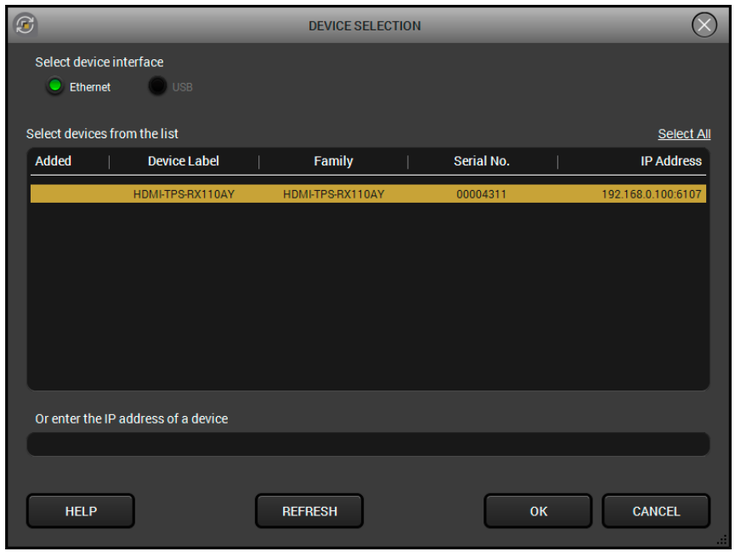
Package information is displayed:

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

Click on the **Next** button and follow the instructions.

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

Step 2. Select device.

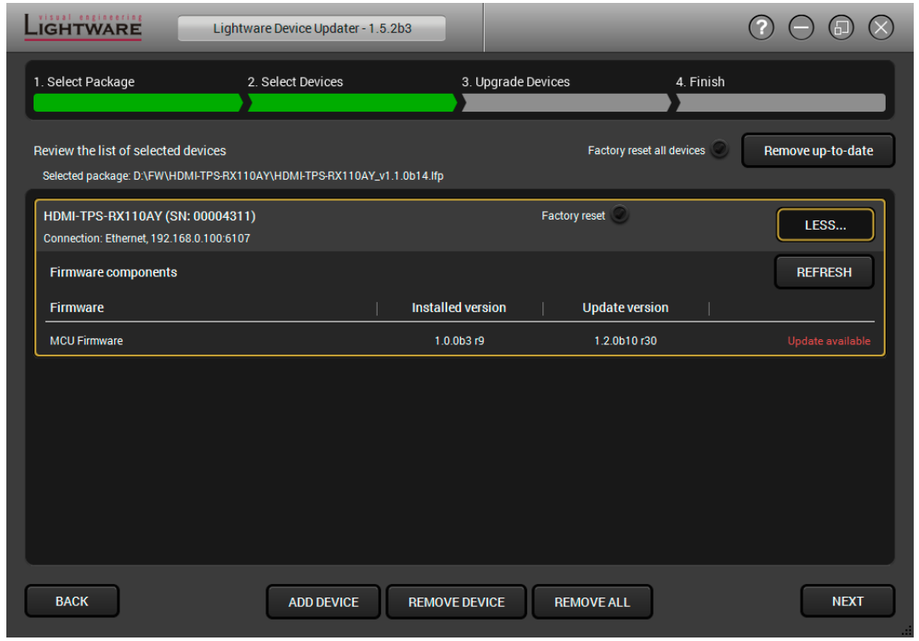


The following step is to select the desired device(s). The available and supported devices are searched and listed automatically. If the desired device is not listed, update the list by clicking the **Refresh** button. Select the desired devices: highlight them with a **yellow cursor,** then click **OK**.

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

Firmware Components

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



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

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

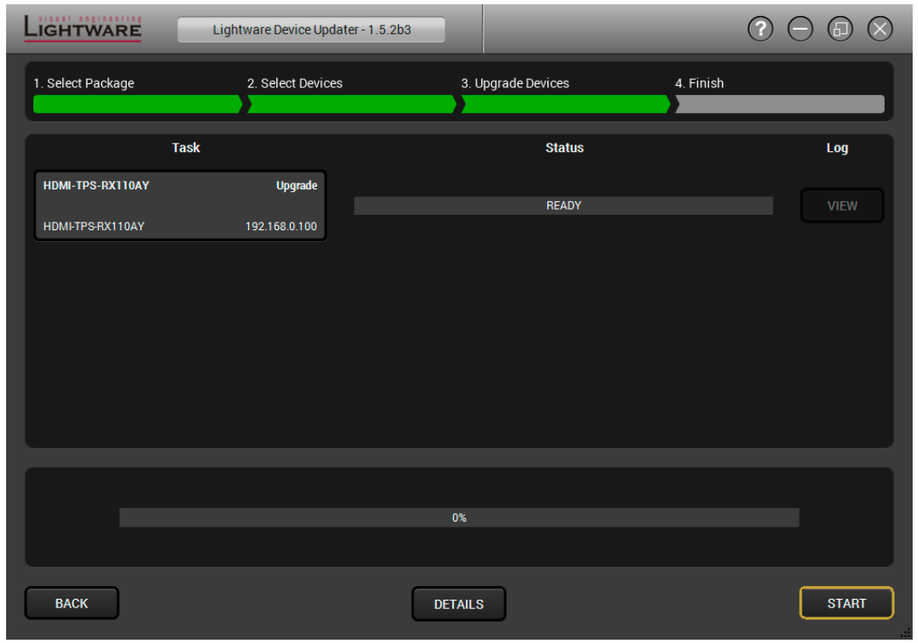
Enabling **Factory reset** will perform factory default values for all settings in the device. Three different status can exist:

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

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

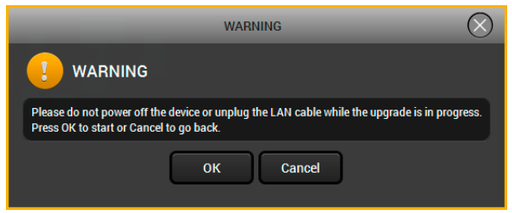
Step 3. Upgrade the device.

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

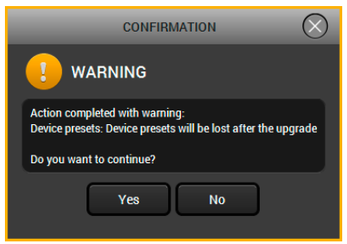


Two warning windows will pop up before starting upgrading the device:

- Do not unplug the power cable (or CATx cable from the TPS input port in case of PoE) and the LAN cable while the upgrade is in progress. Click **OK** to continue.

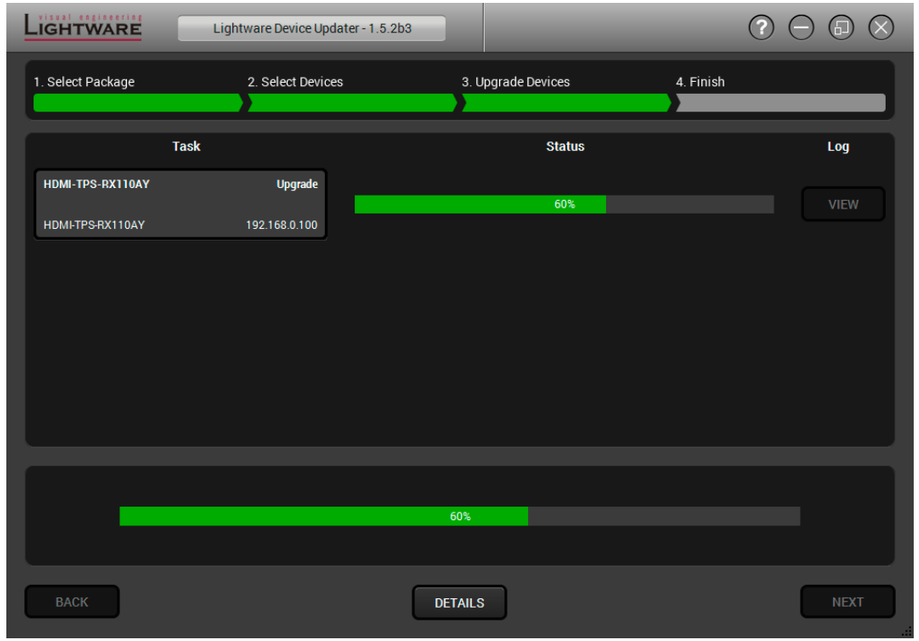


- Please note the device presets will lost after the firmware upgrade. If you want to continue the procedure, click **Yes**.

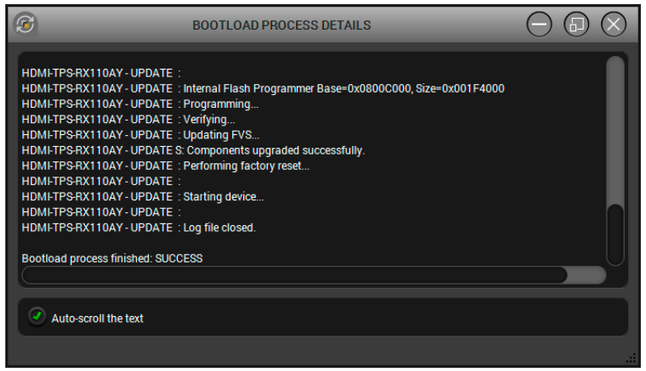


You can save the device presets to offline file as well. See more details about the presets in the Configuration Cloning (Backup Tab) section.

When you confirmed the warnings, the upgrade process starts automatically.

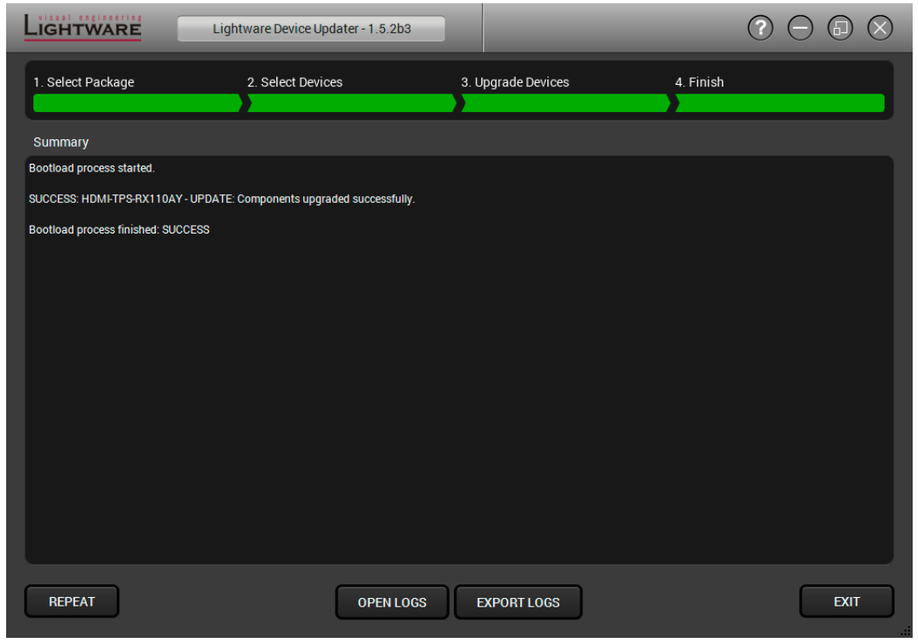


Details button opens a new window where the process is logged – see below.



Step 4. Finish.

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



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

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

Export logs by saving the files as a zipped file.

Press **Exit** to close the program.

If the upgrade failed, the progress bar of the device is changed to red; restart the device(s) and repeat the process.

8.5. Keeping the Configuration Settings

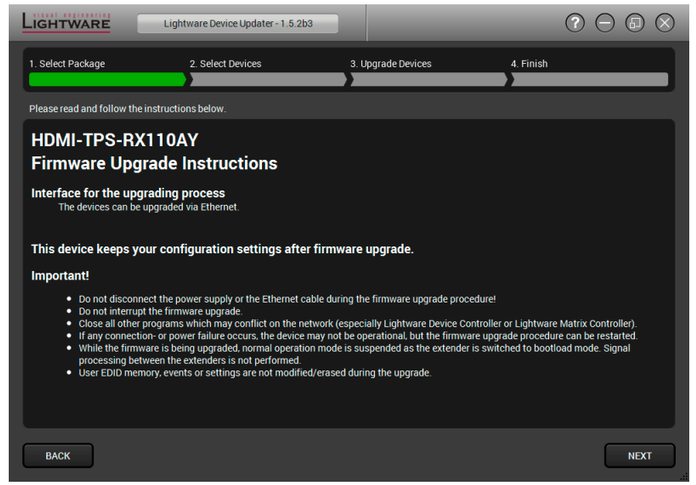
User can keep all configuration settings and restore to the device after firmware upgrading or can choose to perform a factory reset – it means all settings will be erased in the device. In case of factory reset you can save the settings of the device and restore it later. For the detailed information about saved data refer to the Content of Backup File section.

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

Flow chart of firmware upgrade

The details about the procedure: when firmware upgrade starts, the first step is making a backup of the settings of the device. The firmware package checks the backup data and if it is needed, a conversion is applied to avoid incompatibility problems between the firmware versions. If you do not want to keep configuration settings, you can set the **Factory reset** option enabled.

The instruction in the firmware package of the device will inform you about this function availability, reading it is highly recommended in every case.



Instructions page in the firmware package

ATTENTION! In specific cases restoring cannot be applied fully and certain settings are not copied back to the device. If a warning message appears, user can get back the original data from the backup. Logs of the upgrade procedure contain all backup data, it can be exported at the end of the upgrade procedure. Details about the procedure of log exporting can be found in the Detailed Instructions section. In case of any question, please contact support@lightware.com.

ATTENTION! In certain cases, the new firmware version requires setting all parameters to set factory defaults. In this case, the “Factory reset” option is enabled by default and not changeable by the user, see details in the Detailed Instructions section.

ATTENTION! The feature is only supported by LDU version 1.3.0 and above.

8.6. Remote Firmware Upgrade of Connected Lightware Devices

Firmware of Lightware devices can be upgraded via another connected Lightware device without removing the device from the system. It means user does not have to connect directly to the upgradable device, it can be reached and flashed through other devices. It's a more comfortable way to keep up-to-date your Lightware devices.

There are two types of remote upgrading:

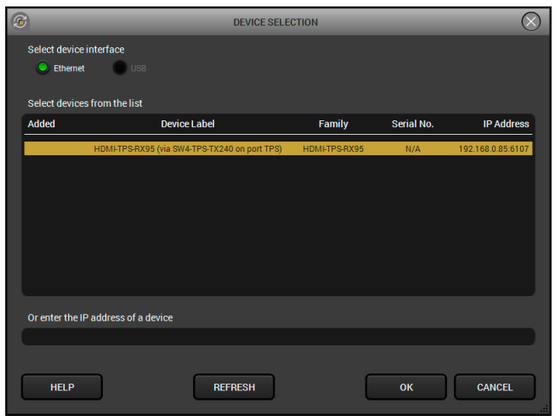
Extended Upgrade

- Intelligent devices can be upgraded via another intelligent or basic device via TPS or OPTS/OPTM link.
- For example, HDMI-TPS-RX110AY extenders can be upgraded via MMX6x2-HT series matrix or a HDMI-TPS-TX95 extender.

Hosted Upgrade

- Basic devices can be upgraded only via an intelligent device via TPS link.
- For example, TPS 95 series extenders can be upgraded via MMX6x2-HT series matrix or HDMI-TPS-RX110AY extenders.
- In case of hosted upgrade, the procedure is almost the same as described in Firmware upgrade – Detailed Instructions. The only difference is that the host device's name, and IP address appears beside the name of the device to be upgraded.

ATTENTION! During hosted upgrade the host device turned to bootload mode when the extender is upgraded. During the upgrade normal operation mode is suspended. When the upgrade is successfully finished, the normal operation mode is restored.



Remote device in device selection window

9

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.

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

9.1. Use Case Studies

At first, check front panel LEDs and take the necessary steps according to their states. For more information about status, LEDs refer to the Front View and Rear View sections.

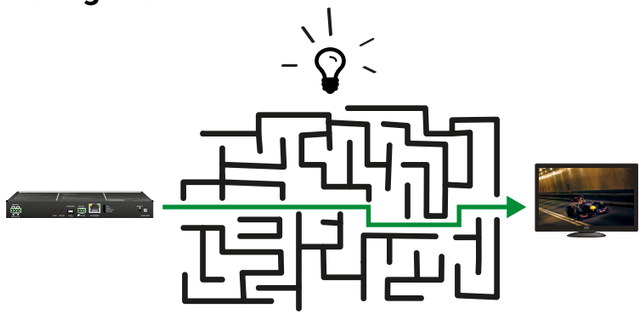
Symptom	Root cause	Action	Refer to
Video signal			
No picture on the video output	Device or devices are not powered properly	Check the receiver and the other devices if they are properly powered; try to unplug and reconnect them.	3.3.1
	Cable connection problem	Cables must fit very well, check all the connectors (video and TPS cables).	3.3
	No incoming signal	If the TPS LINK LED does not light, no signal is present on the TPS input port. Check the source device and the CATx cable.	3.3
	TPS mode problem	Check the actual TPS mode and the selected modes of the extenders.	5.3.1
	The output is muted	Check the mute state of output port.	5.3.1 6.3.5 7.6.2
	Display is not able to receive the video format	Check the emulated EDID; select another (e.g. emulate the EDID of the display on the input port).	5.5 7.13
	HDCP is disabled	Enable HDCP on the input and output port.	5.3.1 7.6.11 7.6.12
Not the desired picture displayed on the video output	Video output is set to test pattern (no sync screen) statically	Check Test Pattern settings in the HDMI output properties.	5.3.1 7.6.13
	Video output is set to test pattern (no sync screen) as there is no picture on video source	Check video settings of the source.	

Symptom	Root cause	Action	Refer to
Audio signal			
No audio is present on output	Source audio volume is low or muted	Check the audio settings of the source.	
	Output port is muted	Check the output port properties.	5.3.2 LW2 6.3.5 LW3 7.7.2
	Analog audio volume is set low	Check the Analog audio output port settings (volume).	5.3.2 LW3 7.7.7
HDMI output signal contains no audio	HDMI mode was set to DVI	Check the properties of the output port and set to HDMI or Auto.	5.3.1 LW3 7.6.14
	DVI EDID is emulated	Check the EDID and select and HDMI EDID to emulate.	5.5 LW3 7.13
RS-232 signal			
Connected serial device does not respond	Cable connection problem	Check the connectors to fit well; check the wiring of the plugs.	3.3.7
	RS-232 settings are different	Check the port settings of the transmitter and/or the receiver and the connected serial device(s). Pay attention to Link and/or Local ports.	5.6.1 LW2 6.5 LW3 7.9
	RS-232 mode is not right	Check the RS-232 mode settings (pass-through, control or command injection)	5.6.1 LW2 6.5.1 LW3 7.9.6
Network			
No LAN connection can be established	Incorrect IP address is set (fix IP)	Use dynamic IP address by enabling DHCP option.	4.1.2 5.8.2 LW2 6.4.2 LW3 7.8.2
		Restore the factory default settings (with fix IP).	4.1.3 5.8.4 LW2 6.2.11 LW3 7.5.7
	IP address conflict	Check the IP address of the other devices, too.	

Symptom	Root cause	Action	Refer to
Miscellaneous			
Function button is out of operation	Function button is locked	Unlock the button	5.8.1
Error messages received always	Different protocol is set	Check the port protocol settings (LW2 / LW3) and use the proper protocol commands.	5.6.1 LW2 6.5.4 LW2 6.5.5 LW3 7.9.1

9.2. How to Speed Up the Troubleshooting Process

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



However, the troubleshooting process can be even faster... with your help.

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

This information is the following:

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

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

10

Technologies

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

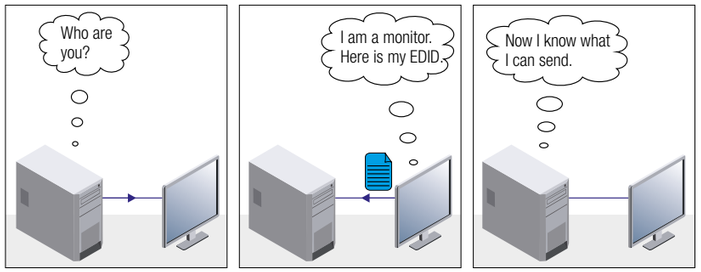
- EDID Management
- HDCP Management
- Pixel Accurate Reclocking

10.1. EDID Management

10.1.1. Understanding the EDID

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

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



EDID Communication

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

Common Problems Related to EDID

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

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

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

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

10.1.2. 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.

10.2. HDCP Management

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

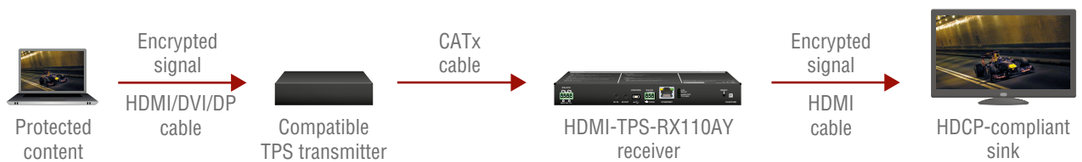
10.2.1. Protected and Unprotected Content

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

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

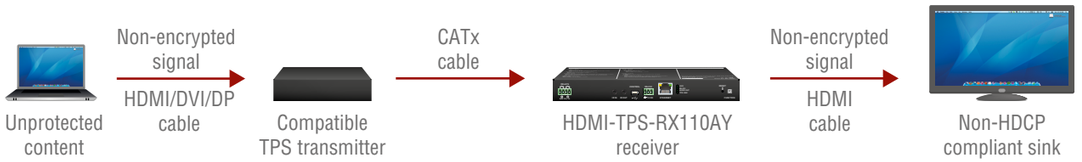
10.2.2. Disable Unnecessary Encryption

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.

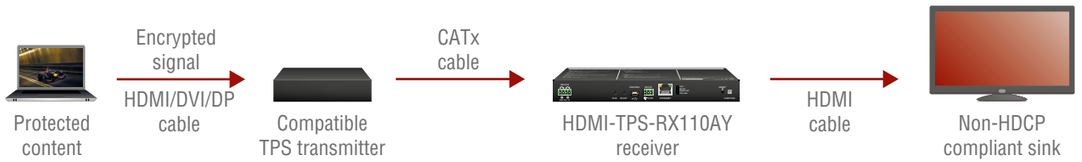
Not HDCP-compliant Sink 1.



Non-HDCP compliant sink is connected to the receiver. 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 receiver, 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 receiver but the source would send protected content with encryption. If HDCP is enabled on the input port of the receiver, 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 receiver, the source will not send the signal. The solution is to replace the display device to an HDCP-capable one.

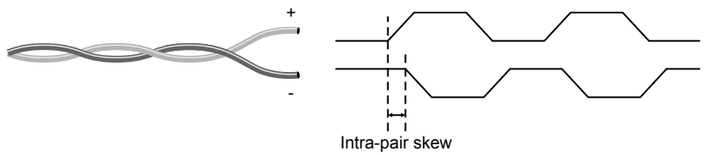
10.3. Pixel Accurate Reclocking

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

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

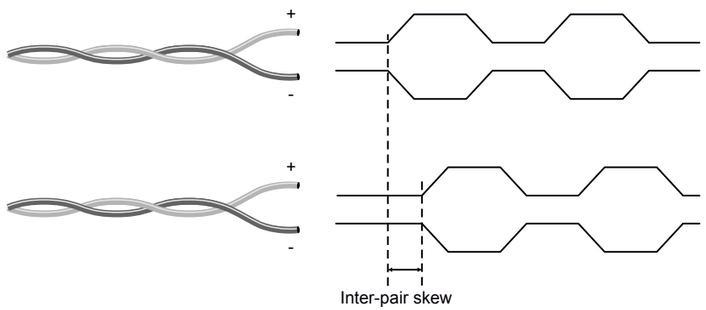
Intra-pair skew

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



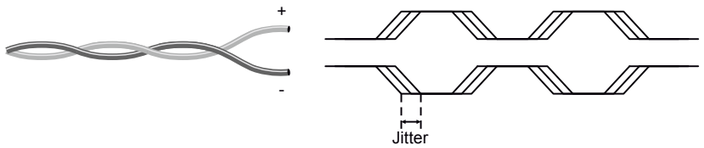
Inter-pair skew

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



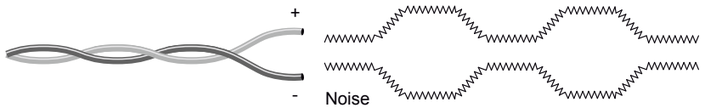
Jitter

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



Noise

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



11

Appendix

Tables, drawings, guides, and technical details as follows:

11.1. Specification

General

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

Power

Power supply ..... External power adaptor or PoE remote powering
Power adaptor ..... In 100-240 V AC 50/60 Hz, Out 12V DC, 2 A
Power connector ..... Locking DC connector (2.1 mm pin)
Power over TPS ..... DC 48V, 1A (IEEE 802.3af)
Power consumption ..... 10 W (typ)

Enclosure

Rack mountable ..... Yes
Material ..... 1 mm steel
Dimensions in mm ..... 221W x 100.4D x 26H
Dimensions in inch ..... 8.7 W x 3.95 D x 1.02 H
Weight ..... 607 g

Audio/Video Ports

HDCP compliant ..... Yes, HDCP 1.4

TPS Input Port

TPS port connector type ..... RJ45 connector
Power over Ethernet (PoE) ..... Yes (IEEE 802.3af)
Compliance ..... HDBaseT™
Transferred signals (TPS) ..... Video, Audio, RS-232, Infrared, Ethernet
Max. video resolutions ..... 1920x1080@120 Hz, 24 bit
..... 1600x1200@60 Hz, 36 bit
..... 3840x2160@30 Hz, 24 bit
Audio formats ..... 8 channel PCM
..... Dolby TrueHD
..... DTS-HD Master Audio 7.1
Reclocking ..... Pixel Accurate Reclocking
HDCP compliant ..... Yes

HDMI Output Port

HDMI port connector type ..... 19-pole HDMI Type A receptacle
Standard ..... DVI 1.0, HDMI 1.4
Max. video resolutions ..... 1920x1080@120 Hz, 24 bit
..... 1600x1200@60 Hz, 36 bit
..... 3840x2160@30 Hz, 24 bit
Audio formats ..... 8 channel PCM
..... Dolby TrueHD
..... DTS-HD Master Audio 7.1
Reclocking ..... Pixel Accurate Reclocking
HDCP compliant ..... Yes

Analog Audio Output Port

Audio port connector ..... 5-pole Phoenix connector
Signal transmission ..... Balanced and unbalanced audio
Volume ..... -95.62 – 0 dB

Control Ports

RS-232 Control

Serial port connector ..... 3-pole Phoenix connector
Available Baud rates ..... between 4800 and 115200
Available Data bits ..... 8 or 9
Available Parity ..... None / Odd / Even
Available Stop bits ..... 1 / 1.5 / 2

USB Control

USB connector ..... USB mini B type
USB 2.0 compliance ..... Yes

Infrared Control

Number of IR ports ..... 2 (1x RX, 1x TX)

Connector type..... 3.5mm TRS (approx. 1/8" jack) **Ethernet Control**

Connector type..... Locking RJ45

Ethernet data rate ..... 10/100Base-T, full duplex with autodetect

Power over Ethernet (PoE) .....Not supported

Relay Port

Port connector ..... 4-pole Phoenix connector

Number of relays 2

Type .....Normally open contacts

Maximum ratings..... 30 V, 1 A, AC/DC

Default connection state ..... Open

11.2. Input/Output Port Numbering

The following table contains the input and output ports with their ID numbers which shall be used when protocol command sending or in Lightware Device Controller.

Audio/Video Ports

Port name	Video port nr.		Emulated EDID memory	Audio port nr.	
	LW2	LW3		LW2	LW3
TPS Link in	1	I1	E1	1	I1
HDMI out	1	O1	-	1	O1
Audio out	-	-	-	2	O2

RS-232 Ports

Port name	Port nr. (LW2 / LW3)
Local	P1
TPS link	P2

Infrared Ports

Port name	Port nr. (LW3)
Local IR input	S1
Local IR output	D1
TPS link input	S2
TPS link output	D2

11.3. Content of Backup File

The backup file contains numerous settings and parameters saved from the device. When the file is uploaded to a device, the followings will be overwritten:

TPS input port
Video port name, Audio port name, HDCP setting
Ethernet port name, Ethernet port status (enable / disable)
Remote port name, Remote port status (enable / disable)
Analog audio output port
Port name, Volume, Balance
HDMI output port
Port name, HDCP mode, HDMI mode, Power +5V mode
Test pattern mode, clock source, and type
Audio port name, Audio output enabled, S/PDIF mode
Port parameters
Mute video ports
Mute audio ports, Lock audio ports
Local and TPS serial port
RS-232 mode, Control protocol, Baud rate, Data bits, Stop bits, Parity
Port name and CI (Command Injection) port number
Local and TPS IR port
Port status (enable / disable), Code length, Repetition code, Enable modulation
Input port name, Output port name
CI status (enable / disable), CI port number
USB port
Port name, Port status (enable / disable)
Relay ports
Port name, Connection state
Network settings
DHCP status (enable / disable)
Static IP address, Network mask, Gateway address
Further settings
User EDID data (U1-U15)
Event manager: settings of all Events (E1-E100)

11.4. Factory Default Settings

Parameter	Setting/Value
Video port settings	
TPS mode	Auto
HDCP	Enabled
Test pattern mode	Disabled
Test pattern clock source	480p
Test pattern	Bar
Output HDMI mode	Auto
Output HDCP mode	Auto
Power 5V mode	Always on
Analog audio port settings	
Volume	0.00 dB (100%)
Balance	0 (center)
Network settings	
IP address	192.168.0.100
Subnet mask	255.255.255.0
Static gateway	192.168.0.1
DHCP	Disabled
Port numbers (LW2 / LW3 / HTTP)	10001 / 6107 / 80
TPS Ethernet status	Enabled
Relay port settings	
Connection state	Open
RS-232 settings	
Control protocol	LW2
Baud rate	57600
Databits	8
Parity	No
Stopbits	1
Operation mode (Link and Local)	Pass-through
Command injection port nr. (Local / TPS)	8001 / 8002
IR port settings	
Command injection status	Enabled
Comm. inj. input port nr. (Local / TPS)	9001 / 9002
Comm. inj. output port nr. (Local / TPS)	9003 / 9004

11.5. Maximum Extension Distances

Resolution	Pixel clock rate	Cable lengths (Auto / Longreach TPS mode)		
		CAT5e AWG24	CAT7 AWG26**	CAT7 AWG23
1024x768@60Hz	65 MHz	100 m / 130 m*	90 m / 120 m*	120 m / 170 m*
1280x720p@60Hz	73.8 MHz	100 m / 130 m*	90 m / 120 m*	120 m / 170 m*
1920x1080p@60Hz / 24bpp	148.5 MHz	100 m / 130 m*	90 m / 120 m*	120 m / 170 m*
1920x1200@60Hz	152.9 MHz	100 m / NA	90 m / NA	120 m / NA
1600x1200@60Hz	162 MHz	100 m / NA	90 m / NA	120 m / NA
1920x1080@60Hz / 36bpp	223.6 MHz	70 m / NA	70 m / NA	100 m / NA
3840x2160@30Hz UHD	297 MHz	70 m / NA	70 m / NA	100 m / NA
4096x2160@30Hz 4K	297 MHz	70 m / NA	70 m / NA	100 m / NA

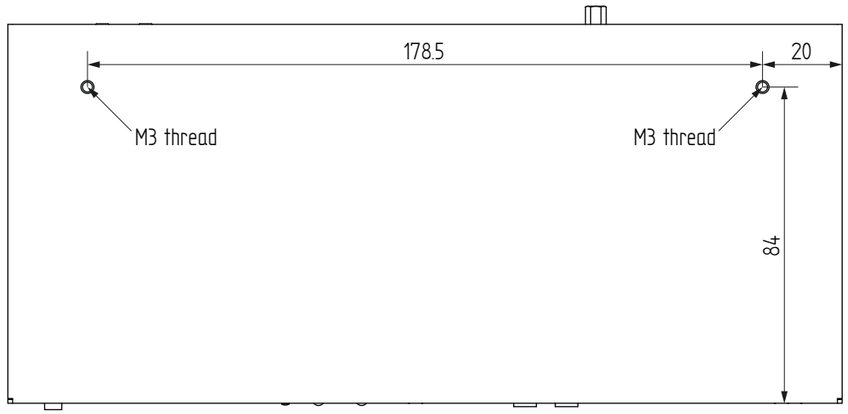
* With Long reach operation mode which supports pixel clock frequencies up to 148.5 MHz.

** When remote powering is used with AWG26 cables, distances are 20% shorter.

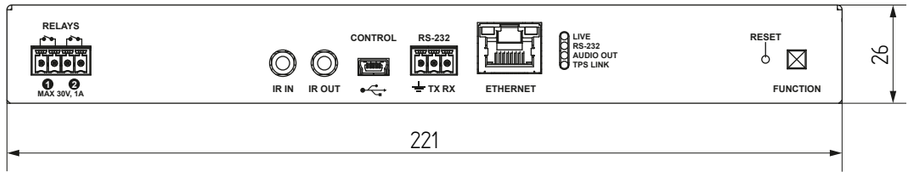
11.6. Mechanical Drawings

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

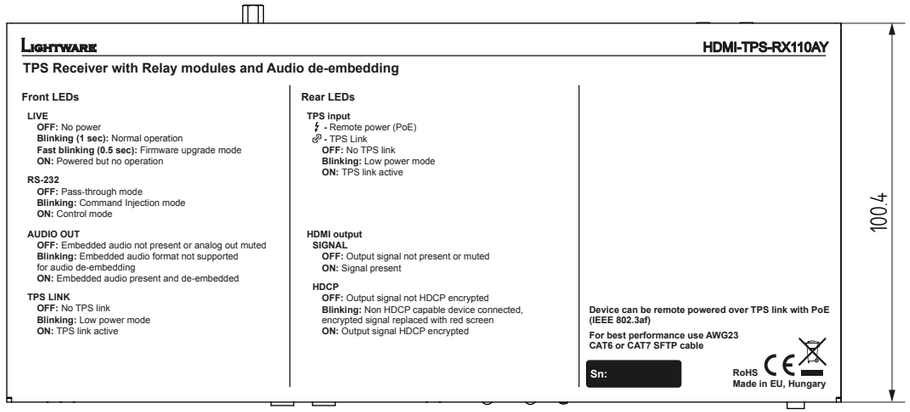
Bottom View



Front View

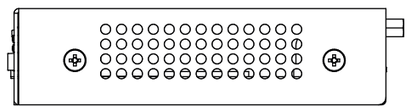


Top View



Rear View

Side View



11.7. Audio Cable Wiring Guide

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

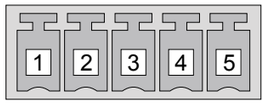
ATTENTION! Symmetric and asymmetric lines can be linked with passive accessories (e.g. special cables), but in this case half of the line level is lost.

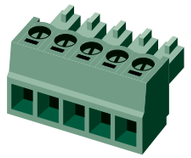
ATTENTION! There are numerous types of regularly used connector and cable types to connect audio devices. Please always make sure that a connector or cable fits your system before use.

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

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

The Pinout of the 5-pole Phoenix Connector





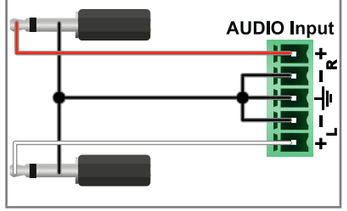
Pin nr.	Signal
1	Left+
2	Left-
3	Ground
4	Right-
5	Right+

Compatible Plug Type

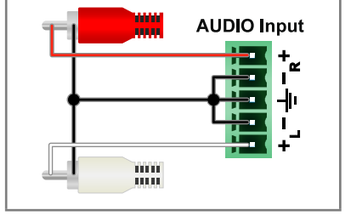
Phoenix® Combicon series (3.5mm pitch, 5-pole), type: MC 1.5/5-ST-3.5.

From Unbalanced Output to Balanced Input

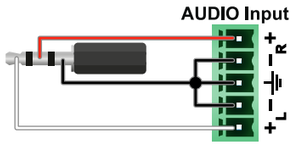
2 x 6.3 (1/4") TS - Phoenix



2 x RCA - Phoenix

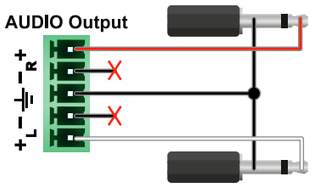


3.5 (1/8") TRS - Phoenix

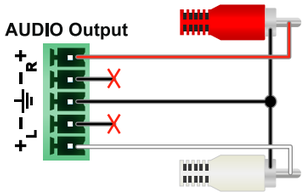


From Balanced Output to Unbalanced Input

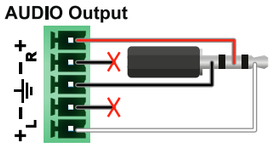
Phoenix - 2 x 6.3 (1/4") TS



Phoenix - 2 x RCA

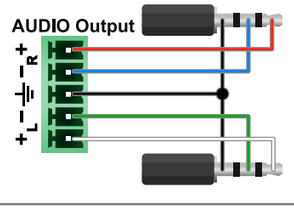


Phoenix - 3.5 (1/8") TRS

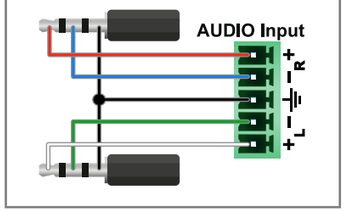


From Balanced Output to Balanced Input

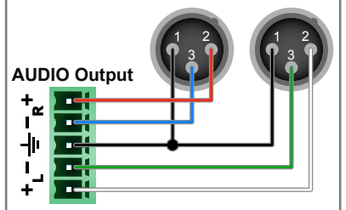
Phoenix - 2 x 6.3 (1/4") TRS



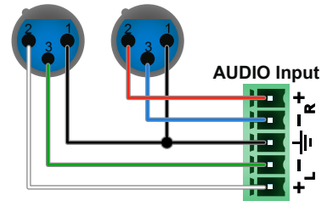
2 x 6.3 TRS (1/4") - Phoenix



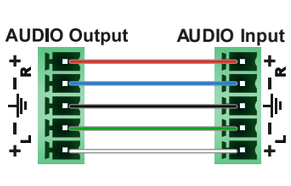
Phoenix - 2 x XLR



2 x XLR - Phoenix



Phoenix - Phoenix



11.8. 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
F25-F28	Reserved	
F29	**Universal_DVI**	D
F30	1440 x 480i @ 60.05 Hz	H
F31	1440 x 576i @ 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 1080i @ 50.04 Hz	H
F38	1920 x 1080i @ 50.00 Hz	H
F39	1920 x 1080i @ 60.05 Hz	H
F40	1920 x 1080i @ 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_PCM**	H
F48	**Universal_HDMI_ALL**	H
F49	**Universal_HDMI_DC**	H
F50-F89	Reserved	
F90	1920 x 2160 @ 59.99 Hz	D
F91	1024 x 2400 @ 60.01 Hz	D
F92-F93	Reserved	
F94	2048 x 1536 @ 60.00 Hz	D
F95	Reserved	
F96	2560 x 1600 @ 59.86 Hz	D
F97	3840 x 2400 @ 24.00 Hz	D
F98	1280 x 720 @ 60.00 Hz	H3D
F99	1920 x 1080 @ 60.00 Hz	H3D
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

Mem.	Resolution	Type	Mem.	Resolution	Type
F104	1600 x 1200 @ 50.00 Hz	H			
F105	1600 x 1200 @ 60.00 Hz	H			
F106	1920 x 1200 @ 59.56 Hz	H			
F107	2560 x 1440 @ 59.95 Hz	H			
F108	2560 x 1600 @ 59.86 Hz	H			
F109	3840 x 2400 @ 24.00 Hz	H			
F110	3840 x 2160 @ 24.00 Hz	H			
F111	3840 x 2160 @ 25.00 Hz	H			
F112	3840 x 2160 @ 30.00 Hz	H			
F113-F117	Reserved				
F118	**Universal_4K_PCM**	H4K			
F119	**Universal_4K_ALL**	H4K			
F120	3840 x 2160 @ 60.00 Hz	H4K			

Legend

Type	Description
D	DVI EDID
H	HDMI EDID
A	Analog EDID
DL	Dual-Link DVI EDID
H3D	HDMI EDID with 3D support
H4K	HDMI EDID with 4K resolution support

11.9. Further Information

Limited Warranty Statement

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

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

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

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

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

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

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

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

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

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

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

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

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

Document Revision History

Rev.	Release date	Changes	Editor
1.0	22-12-2016	Initial version	Tamas Forgacs
1.1	06-02-2017	Added detailed audio function description in LW3 programmer's reference, added RS-232 commands in LW2 programmer's reference	Tamas Forgacs
2.0	19-09-2017	New document format, updated LW3 prog. ref. chapter	Tamas Forgacs
2.1	04-12-2017	Major updates for firmware v1.2.0, updated Troubleshooting chapter	Tamas Forgacs
2.2	31-10-2018	1080p120Hz signal support info added	Judit Barsony

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