visual engineering

LIGHTWARE

User's Manual

HDMI-OPT-TX100, HDMI-OPT-RX100
HDMI-OPT-TX100R, HDMI-OPT-RX100R
HDMI-OPT-TX200R, HDMI-OPT-RX200R

Fiber Optical 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.
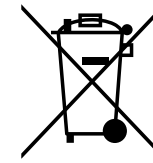
Ventilation

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.

Caution: Laser product

INVISIBLE LASER RADIATION
AVOID DIRECT EYE EXPOSURE
CLASS 3R LASER PRODUCT
Radiated wavelenght:
778 nm, 800 nm, 825 nm, 850 nm, 911 nm, 980 nm
Output power <= 1 mW
Classified by EN 60825-1:2007

Common Safety Symbols

Symbol	Description
‒ ‒ ‒	Direct current
∿	Alternating current
▣	Double insulation
⚡	Caution, possibility of eletric shock
⚠	Caution
☢	Laser radiation

Symbol Legend

The following symbols and markings are used in the document:

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

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

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

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

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

Navigation Buttons

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

Navigate to the Table of Contents.

Step back one page.

Step forward to the next page.

Document Information

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

Item	Version
Lightware Device Controller (LDC) software	1.23.2b1
Lightware Bootloader Software	3.3.3
Controller firmware - HDMI-OPT-TX series	1.9.7.b1
Controller firmware - HDMI-OPT-RX series	1.9.7.b1
Hardware	2.0

Document revision: **3.0**

Release date: 13-08-2018

Editor: Judit Barsony

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

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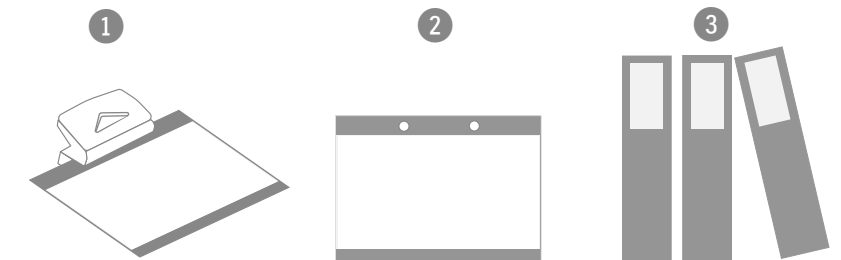
❶ ❷ ❸

Table of Contents

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Introduction

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

- ▶ DESCRIPTION
- ▶ BOX CONTENTS
- ▶ MODEL COMPARISON
- ▶ FEATURES OF THE DEVICE
- ▶ COMPATIBLE DEVICES
- ▶ TYPICAL APPLICATION

1.1. Description

Lightware HDMI-OPT series devices extend HDMI 1.3, DVI 1.0 with HDCP and bi-directional RS-232 signals* over one multimode fiber, and transmit the video signal with embedded audio up to 2500 meters distance.

All transmitters feature Lightware's well-known Advanced EDID Management with a memory of 100 EDIDs, 50 of which are user programmable. Using the Factory, Custom or Transparent EDID emulation the user can fix and lock EDID data on the transmitter's input connector.

Dual output is available on 200 series units through a built-in distribution amplifier. HDMI-OPT-TX200R has a local monitor HDMI output to enable easy monitoring of the outgoing signal and HDMI-OPT-RX200R has two identical HDMI outputs.* Pixel Accurate Reclocking feature is included in all transmitters and receivers - a Lightware technology to eliminate jitter and skew generated by low quality sources and multiple daisy-chained devices.

Single Fiber Technology makes these units fully HDMI 1.3 and HDCP 1.1 compliant without need of a second fiber cable or copper connection. To simplify cabling, the bi-directional communication – which is necessary for HDCP handshaking – is performed on the same fiber core that transmits the video signal.

Bidirectional RS-232 extension* is available on **R** versions for remote device control over the same fiber core.

* This feature is available in specific product types. For more details, see Model Comparison table.

Model Denomination

HDMI Input   Transmitter RS-232 control

HDMI-OPT-TX200R

AV extension over fiber   Number of the input ports

HDMI Input   Receiver   RS-232 control

HDMI-OPT-RX200R

AV extension over fiber   Number of the output ports

1.2. Box Contents
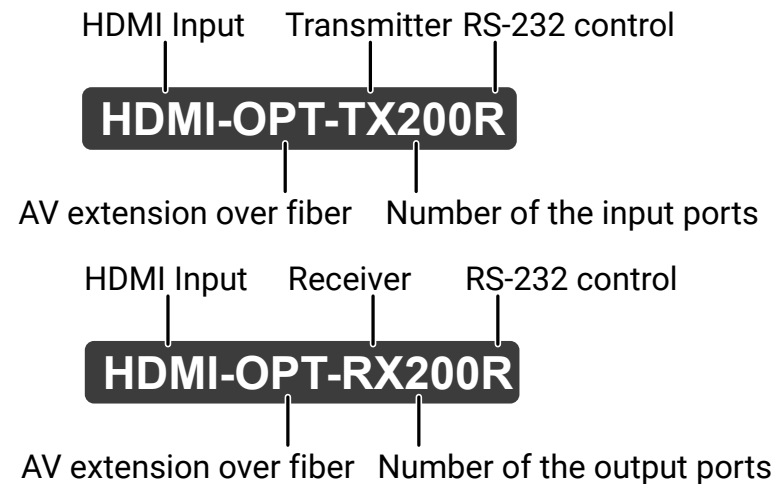
HDMI-OPT series transmitter or receiver	Safety & warranty info, Quick Start Guide	5V DC adaptor with interchangeable plugs

1.3. Model Comparison

The available models have different features depending on the design. The following table contains the most important differences of the models.

Transmitters

	Video ports		Interface port	Optical output port
	HDMI input	Monitor output (HDMI)	RS-232	SC multimode output
HDMI-OPT-TX100	✔	-	-	✔
HDMI-OPT-TX100R	✔	-	✔	✔
HDMI-OPT-TX200R	✔	✔	✔	✔

Receivers

	Video ports		Interface port	Optical output port
	HDMI output 1	HDMI output 2	RS-232	SC multimode input
HDMI-OPT-RX100	✔	-	-	✔
HDMI-OPT-RX100R	✔	-	✔	✔
HDMI-OPT-RX200R	✔	✔	✔	✔

1.4. Features of the Device

> INFO: Certain features depend on the configuration of the model. For more information about the models see Model Comparison section.

Advanced EDID Management

The user can emulate any EDID on the inputs independently, read out and store any attached monitor's EDID in 100 internal memory locations, upload and download EDID files using Lightware Device Controller software.

Pixel Accurate Reclocking

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

Supports All HDTV Resolutions

720p, 1080i and 1080p etc. with or without HDCP encoding. Signals with up to 225 MHz pixel clock frequency - regardless of the resolution - are passed through.

HDCP Compliant

The HDMI-OPT extenders support HDCP encrypted HDMI signal transmission.

Cross Compatibility

Cross compatibility between all the devices in the product series is ensured thanks to Lightware's attentive design. Any transmitter can be paired with any receiver without restriction. With Lightware's hybrid modular matrix concept, it is even possible to connect an extender box directly to the matrix router using an MX-HDMI-OPT series input or output board (MX-HDMI-OPT-IB or MX-HDMI-OPT-OB).

Front Panel Control on the Transmitter

EDID address selection with two decimal rotary switches and LEARN button are available for Advanced EDID Management. On the HDMI-OPT-TX200R and TX100R the BAUD RATE rotary switch allows selecting the appropriate speed of serial communication.

1.5. Compatible Devices

The HDMI-OPT series devices are compatible with the following:

Transmitters

- HDMI-OPT-RX100, HDMI-OPT-RX100R, HDMI-OPT-RX200R receivers;
- MX-FR modular frames with MX-HDMI-OPT-IB-SC card.

Receivers

- HDMI-OPT-TX100, HDMI-OPT-TX100R, HDMI-OPT-TX200R transmitters;
- MX-FR modular frames with MX-HDMI-OPT-OB-SC card.
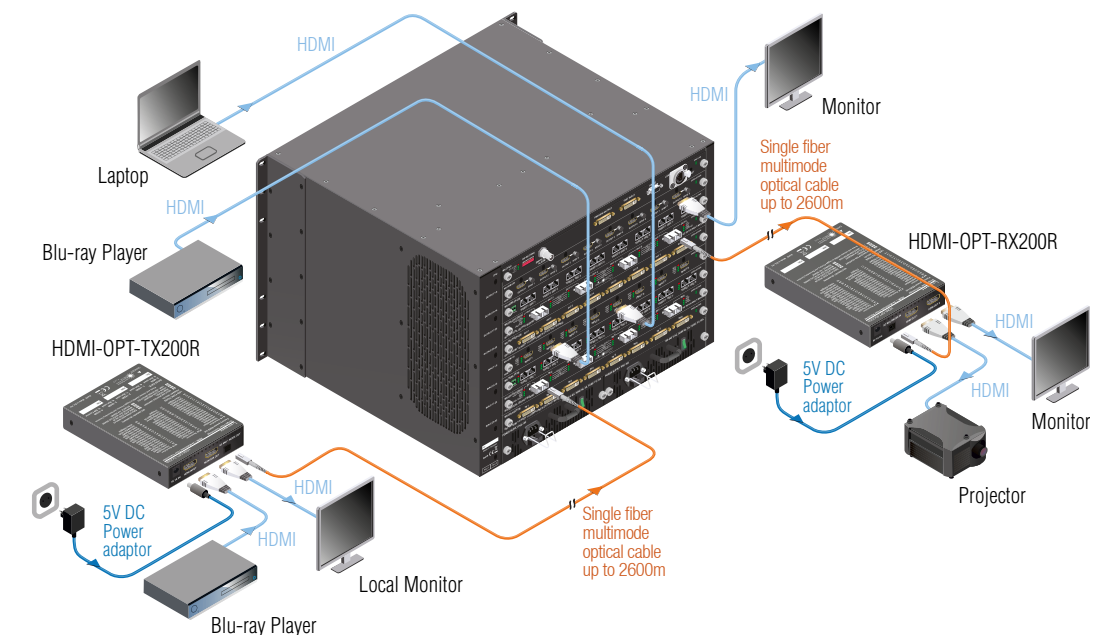
1.6. Typical Application

Application examples

- Long distance lossless HDMI or DVI signal transmission
- Ground loop isolation
- Multiroom video and audio control
- Professional AV systems, conference rooms
- High End home cinema
- Yacht installations

Standalone Application Diagram
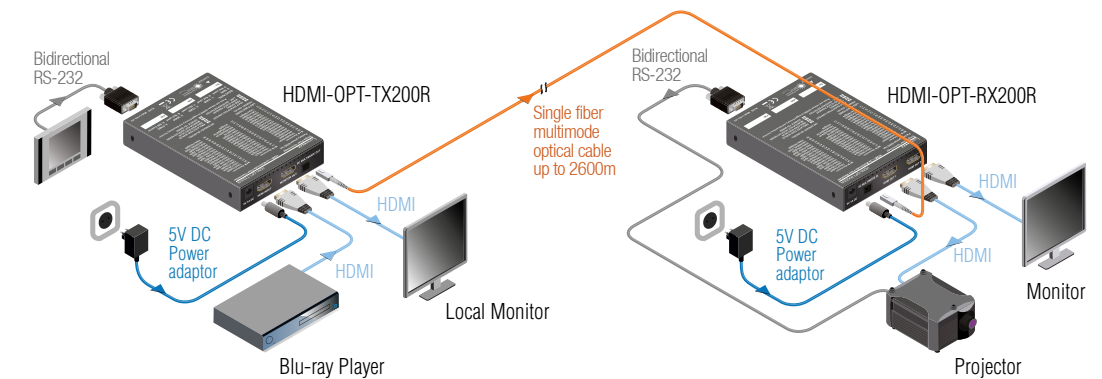
Integrated System Diagram

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:

▸ MOUNTING OPTIONS
▸ CONNECTING STEPS

2.1. Mounting Options

To mount the extenders Lightware supplies optional accessories for different usage. There are three kinds of mounting kits with similar fixing method:

Under-desk mounting kit   ***Under-desk double mounting kit***

1U high rack shelf
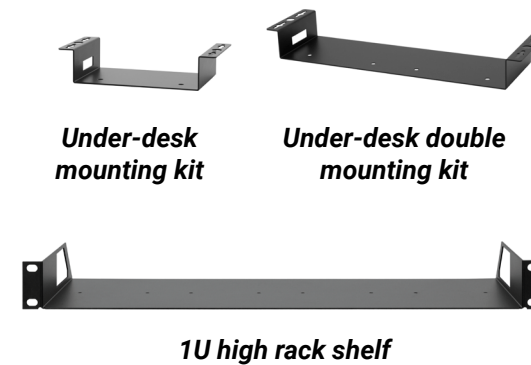
The device has two mounting holes with inner thread on the bottom side; see the bottom view in Mechanical Drawings section. Fasten the device by the screws enclosed to the accessory.

To order mounting accessory kits 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 extenders are quarter-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.
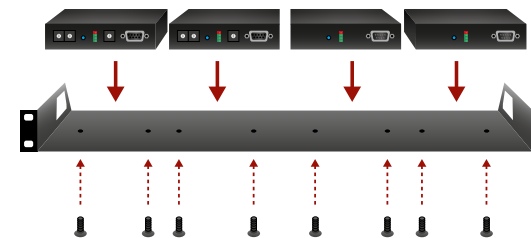
2.1.2. Under-desk Mounting Kit

The UD kit allows pocket sized units to be easily mounted on any flat surface (e.g. furniture).
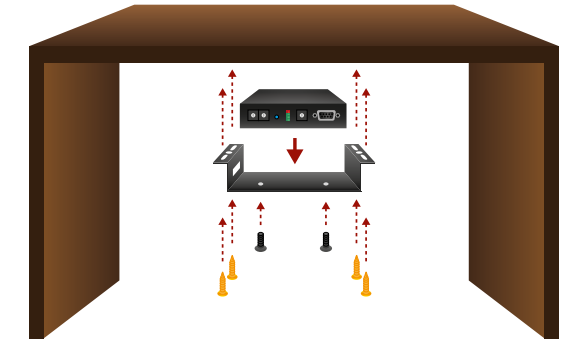
> INFO: The chipboard screws are not supplied with the mounting kit.

2.1.3. Under-desk Double Mounting Kit

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

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

2.2. Connecting Steps

Transmitter side

PC   Monitor

HDMI   HDMI

HDMI-OPT series transmitter   OPTM

Power   RS-232

Power adaptor   Touch panel

Receiver side

Projector   HDTV

HDMI   RS-232   HDMI

HDMI-OPT series receiver

Power

Power adaptor
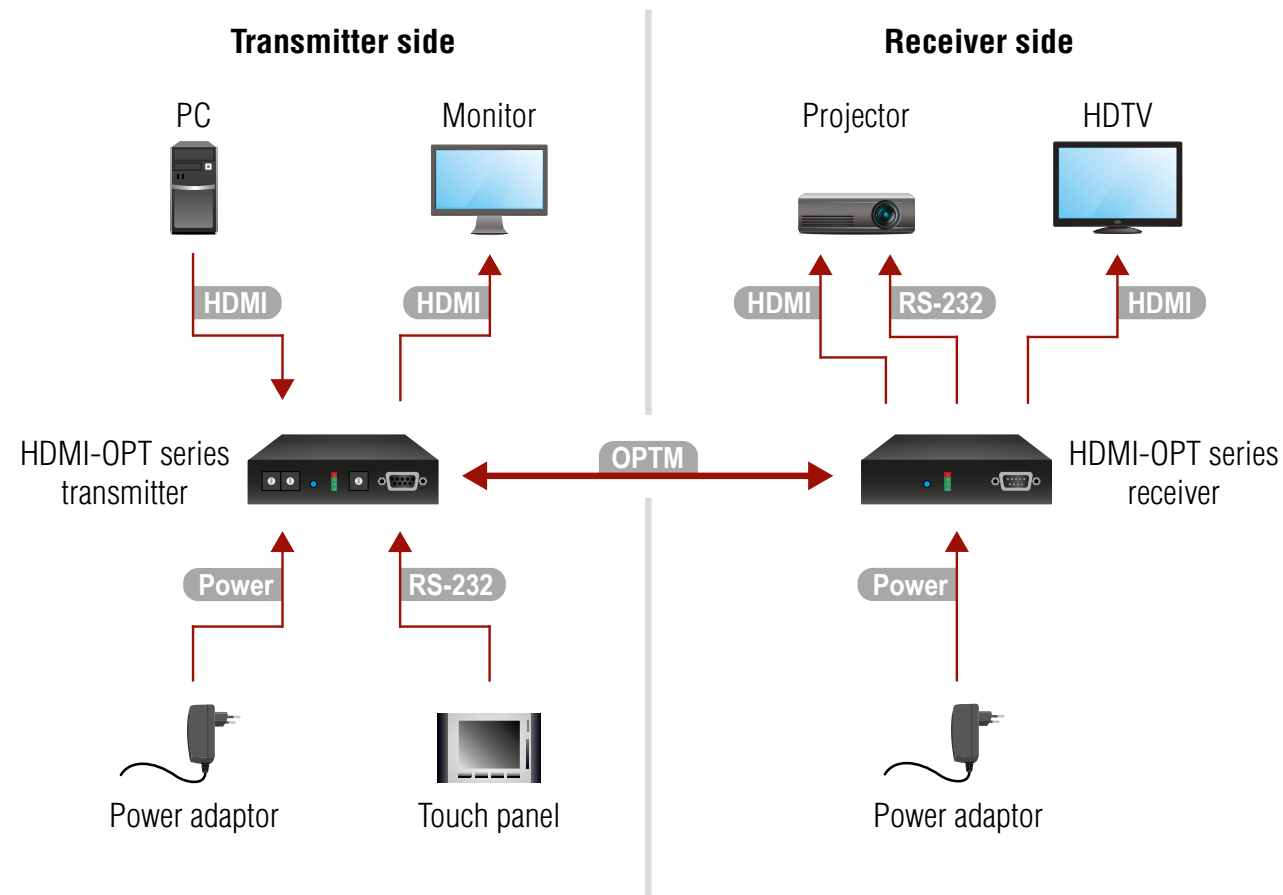
Transmitter side

OPTM	Connect a multimode (OPTM) fiber cable to the SC fiber output port of the transmitter.
HDMI	Connect the source (e.g. a PC) to the HDMI input port of the transmitter by a HDMI cable.
HDMI	Optionally connect a local display (e.g. monitor) to the output port. [1]
RS-232	Optionally connect a controller device (e.g. touch panel) to the RS-232 port of the transmitter. [2]
Power	Firstly connect the power adaptor to the DC input of the transmitter, then to the AC power socket.

Receiver side

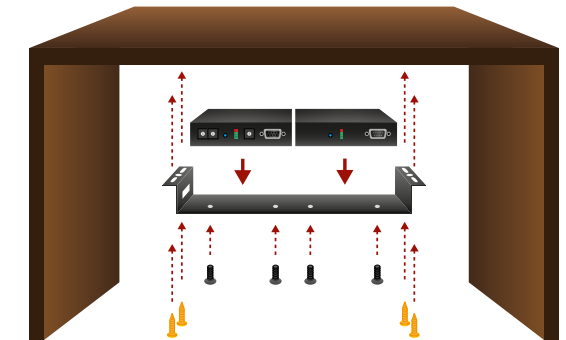|	
OPTM	Connect a multimode (OPTM) fiber cable to the SC fiber input port of the receiver.
HDMI	Connect the sink (e.g. a projector) to the HDMI output port of the receiver by a HDMI cable.
HDMI	Optionally connect a controlled device (e.g. projector) to the RS-232 port of the receiver. [3]
RS-232	Optionally connect a secondary display (e.g. HDTV) to the HDMI OUT 2 port. [4]
Power	Firstly connect the power adaptor to the DC input of the receiver, then to the AC power socket.

[1] Only in the case of HDMI-OPT-TX200R model.

[2] Only in the case of HDMI-OPT-TX100R/TX200R models.

[3] Only in the case of HDMI-OPT-RX100R/RX200R models.

[4] Only in the case of HDMI-OPT-RX200R model.

WARNING! Please do not look directly into the SC fiber optical connector if the cable is connected to the transmitter only and the laser is active.

INFO: Powering the devices on is recommended to do as the final step during the installation.

2.2.1. Baud Rate Settings

HDMI-OPT units use some of the standard timings for the RS-232 pass-through. To work the bidirectional serial communication well between serial ending devices users must choose the proper baud rate on the transmitter units. Please read the serial devices' user's manual to find the appropriate baud rates. The best one is both devices' most common value.

If the communication speed ability of a serial device is unknown use the lowest (#0: 9600) value.

To use Lightware Device Controller or Lightware Bootloader software select the #9 position (SW control).
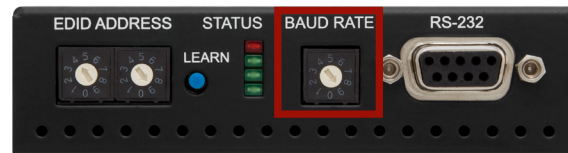
Baud Rate Rotary on the HDMI-OPT-TX200R model

Rotary switch position	BAUD rate
0	9600
1	14400
2	19200
3	38400
4	57600
5	Not used
6	Not used
7	Not used
8	Not used
9	SW control

Baud Rate Rotary Switch Values

3

Product Overview

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

- ▸ HDMI-OPT Series Receivers
- ▸ HDMI-OPT Series Transmitters
- ▸ Electrical Connections
- ▸ Optical Extender Concept
- ▸ HDMI Output Settings
- ▸ RS-232 Signal Transmission

3.1. HDMI-OPT Series Receivers

HDMI-OPT-RX100 - Front and Rear View
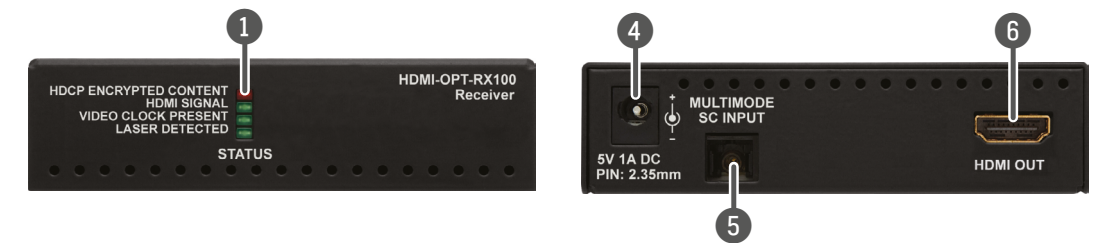
HDMI-OPT-RX100R - Front and Rear View
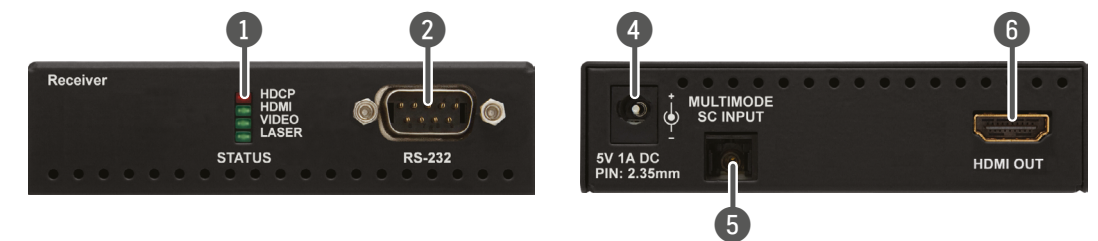
HDMI-OPT-RX200R - Front and Rear View
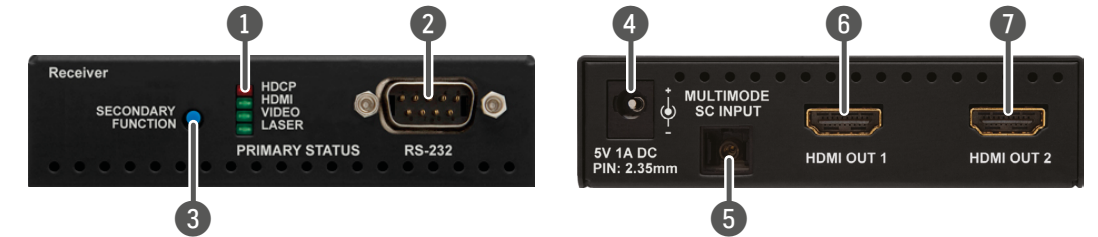
①	**Status LEDs**	The LEDs give feedback about the state of units and video signal. For more information see The Legend of Status LEDs section.
②	**RS-232 port**	9-pole D-sub male connector. Connect a serial cable between the receiver and the serial device. For more details see Serial Management section.
③	**Function button**	Toggles the LED functions between **PRIMARY (SOLID)** and **SECONDARY (BLINKING)**. For more information see Primary and Secondary Modes section.
④	**5V DC input**	Connect the output of the supplied 5V DC power adaptor.
⑤	**SC Fiber Input**	Connect a multimode single fiber optical cable between the extenders.
⑥	**HDMI output**	Connect one HDMI cable between the receiver and the sink device.
⑦	**HDMI output 2**	Connect one HDMI cable between the receiver and the secondary sink device.

3.2. HDMI-OPT Series Transmitters

HDMI-OPT-TX100 - Front and Rear View
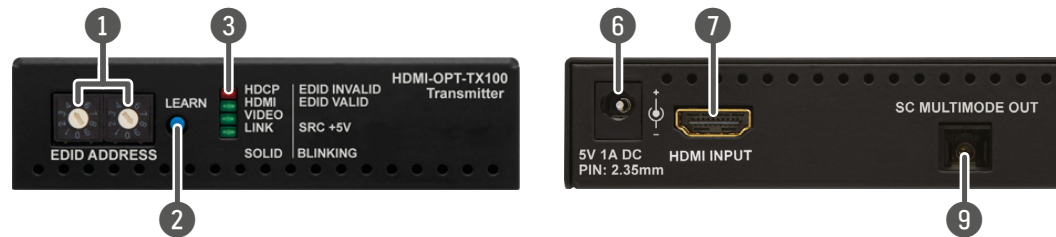
HDMI-OPT-TX100R - Front and Rear View

HDMI-OPT-TX200R - Front and Rear View

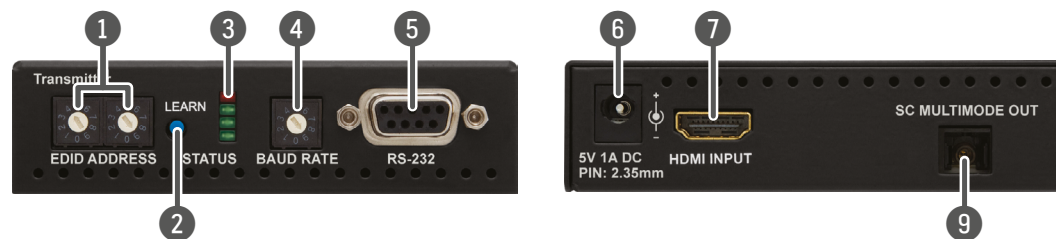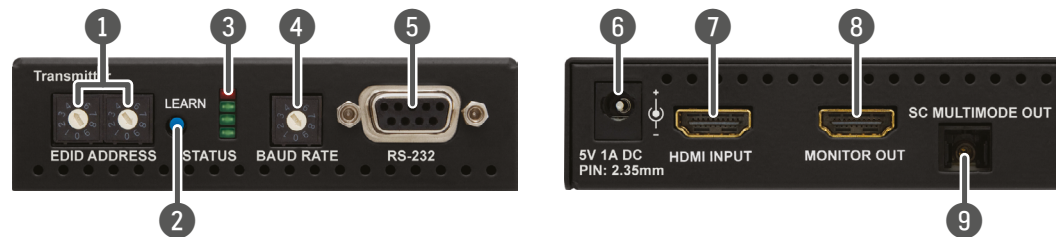|		
1	**EDID rotary switches**	The rotary switches select one of 99 addresses. EDID memories #1..#50 contain factory presets and #51..#99 are user programmable. For more information see EDID Operations section.
2	**LEARN button**	Toggles the LED functions between **PRIMARY (SOLID)** and **SECONDARY (BLINKING)**. For more information see Primary and Secondary Modes section.
3	**Status LEDs**	The LEDs give feedback about the state of units and video signal. For more information about names and meanings of the Status LEDs see The Legend of Status LEDs section.
4	**Baud rate rotary**	The rotary switch selects one of 5 speeds of the serial communication (#0..#4) or the Software Control mode (#9).
5	**RS-232 port**	9-pole D-sub female connector. Connect a serial cable between the transmitter and the desired serial device. For more details see Serial Management section.
6	**5V DC input**	Connect the output of the supplied 5V DC power adaptor.
7	**HDMI input**	Connect one HDMI cable between the HDMI source and the transmitter.
8	**MONITOR output**	Connect one HDMI cable between the local display device and the transmitter.
9	**SC Fiber output**	Connect a multimode single fiber optical cable between the transmitter and the receiver.

3.3. Electrical Connections

3.3.1. DC 5V Connection

The device has locking DC connector to establish robust and safe power connection. After plugging it in, turn the plug clockwise as you can see in the picture below.
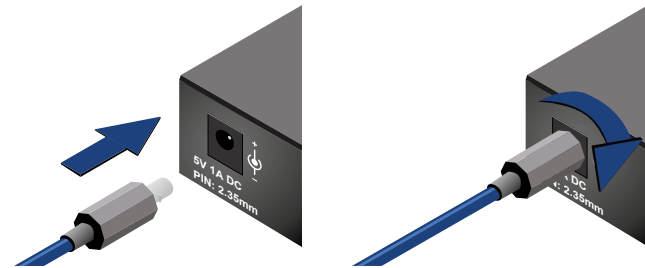
Locking DC connector

Do not forget to turn the connector counterclockwise before trying to disconnect the power adaptor.

> **WARNING!**
> **Always use the supplied 5V power adaptor. Warranty is void if damage occurs due to use of a different power source.**

3.3.2. HDMI Inputs and Outputs

HDMI-OPT units provide standard 19 pole HDMI connectors for inputs and outputs. Always use high quality HDMI cable for connecting sources and displays.

3.3.3. SC Fiber Input and Output

HDMI-OPT series transmitters and receivers provide multimode SC fiber optical input and output connectors.

Maximum fiber cable distances can be found in Maximum Extension Distances section.

3.3.4. RS-232 Connectors

HDMI-OPT-TX200R/TX100R and HDMI-TP-RX200R/RX100R have standard 9 pin female and male D-sub miniature receptacle.
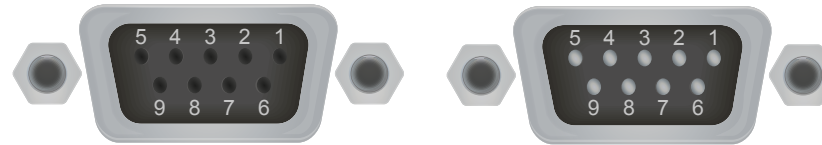
D-sub 9-pin female (DE9F)   *D-sub 9-pin male (DE9M)*

Pin nr.	RS-232 straight pin-out
1	Not connected
2	**TX data transmit (out)**
3	**RX data receive (in)**
4	DTR (Internally connected to Pin 6)
5	**GND signal ground (shield)**
6	DSR (Internally connected to Pin 4)
7	RTS (Internally connected to Pin 8)
8	CTS (Internally connected to Pin 7)
9	Not connected

Pin nr.	RS-232 cross pin-out
1	Not connected
2	**RX data receive (in)**
3	**TX data transmit (out)**
4	DTR (Internally connected to Pin 6)
5	**GND signal ground (shield)**
6	DSR (Internally connected to Pin 4)
7	RTS (Internally connected to Pin 8)
8	CTS (Internally connected to Pin 7)
9	Not connected

3.4. Optical Extender Concept

HDMI-OPT series transmitters and receivers are a digital audio/video signal extenders with RS-232 signal transmission. The transmitter receives HDMI video with embedded digital audio signal and transmits them over a single multimode fiber optical cable. Besides of the A/V signal the transmitter is able send RS-232 signal as well over the same optical line. The receiver accepts the optical signal and transmits to the sink device. In the case of RX200R model two display devices can be attached to the receiver. The receiver is also able to transmit the RS-232 commands to the controlled device.

Summary of Interfaces - Transmitters

INPUT **OUTPUT**

HDMI / DVI
RS-232 *

OPT { HDMI / DVI
RS-232 *

+ RS-232 *

* Only TX100R and TX200R models.

Summary of Interfaces - Receivers

INPUT **OUTPUT**

HDMI / DVI
RS-232 ** } OPT

HDMI / DVI
RS-232 **

+ RS-232 **

** Only RX100R and RX200R models.

3.5. HDMI Output Settings

HDMI-OPT unit is able to recognize the type of the incoming video signal and set automatically the proper one to the output.

Auto output mode function determines the output signal (DVI or HDMI) by the source, emulated EDID and the connected device's EDID on the local MONITOR OUT. Table below contains the possible cases of the signals' type.

Output signal

Monitor EDID

Local display

Output signal

Source   Emulated EDID   Transmitter   Receiver   Display
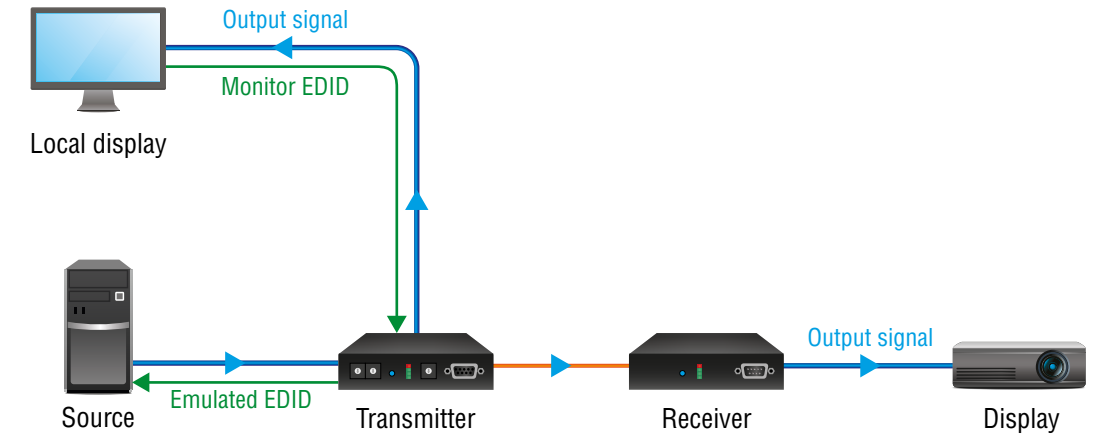
HDMI signal transmission example

Source	Emulated EDID	Local monitor EDID	Output signal type
DVI	DVI or HDMI	DVI or HDMI	DVI
HDMI	DVI	DVI or HDMI	DVI
HDMI	HDMI	DVI	DVI
HDMI	HDMI	HDMI	HDMI

In the highlighted row (HDMI source, HDMI emulated EDID but only DVI capable monitor) colorspace converting problems can appear. HDMI standard supports RGB and YUV (also known YCbCr) colorspaces but DVI supports only the RGB. HDMI-OPT units do not support colorspace conversion between HDMI YUV and RGB. If the source sends HDMI signal with YUV colorspace settings and the sink device can work only in RGB mode the color components can be mismatched during the process. Monitor recognize Y component as R, Cb as G and Cr as B. It causes wrong colors and the embedded audio frame of HDMI will be lost.

In most of the HDMI sources the colorspace can be set manually by the user. If not, an EDID must be used which does not support YUV colorspace. This kind of EDID can be made easily with Lightware Device Controller software. For the detailed instructions see Creating an EDID section.

INFO: EDIDs without CEA extension effect RGB colorspace but these EDIDs do not support HDMI embedded audio.

3.6. RS-232 Signal Transmission

ATTENTION! Only HDMI-OPT-TX100R and TX200R transmitters and HDMI-OPT-RX100R and RX200R receivers are built with RS-232 ports.

Technical Background

Serial data communication can be established via the local RS-232 port (D-SUB connector) and can be transmitted via the optical line up to 2600 meter far. The RS-232 commands are received by the receiver which can transmit them to the controllable device (e.g. a projector) via the local D-SUB port. This method makes the extenders suitable to control any third-party device with RS-232 commands.

RS-232 Signal Transmission - Example

| RS-232 | FIBER OPTICAL | RS-232 |

System controller   HDMI-OPT series transmitter   HDMI-OPT series receiver   Projector
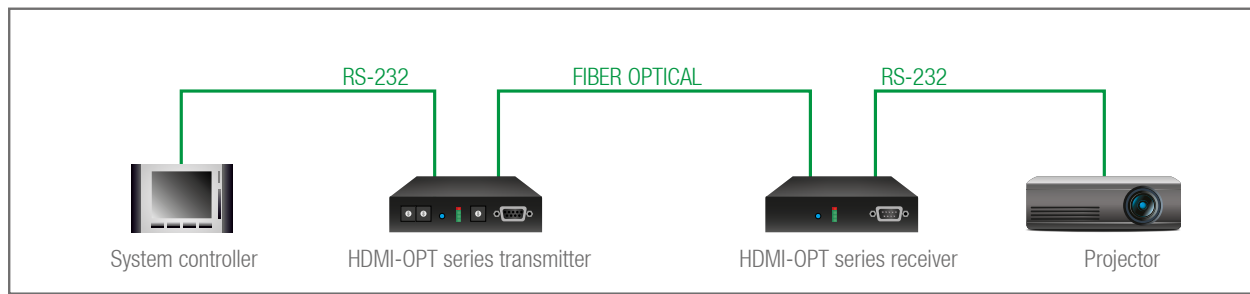
The Concept

The **System controller** sends messages over the RS-232 port of the Transmitter. The **Transmitter** sends the messages over the optical line without any modification toward the Receiver. The **Receiver** sends the messages to the **Projector** which is recognized and executed them.

INFO: Always check the baud rate of the sender and receiver devices. Do not forget to set up the correct baud rate value on the rotary switch located on the transmitter's front panel.

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 LEDs

To save space and simplify readability HDMI-OPT unit uses only four LEDs to inform users about the connections and the video signals. Because of the low numbers of LEDs two modes and several functions are used for display information.

4.1.1. Primary and Secondary Modes

Two modes are available. In **PRIMARY (SOLID)** mode LEDs light continuously and give information about the incoming connection and video signal. In **SECONDARY (BLINKING)** mode LEDs blink and give information about EDID management and outgoing connections. Push down and release the **LEARN** button to change between PRIMARY and SECONDARY mode.

> INFO: LED modes were made for only showing information and do not affect applying changes with front panel's controls. The user can choose or learn EDID in either LED modes, even though the actual state is not visible.

4.1.2. The Legend of Status LEDs

The legend shows the LEDs' color and short description about the meaning can also be found on the top of the devices.

HDMI-OPT-TX100 / HDMI-OPT-TX100R

PRIMARY (SOLID)	SECONDARY (BLINKING)
HDCP ENCRYPTED CONTENT HDMI SIGNAL VIDEO CLOCK PRESENT LINK - RECEIVER DETECTED	EMULATED EDID INVALID EMULATED EDID VALID SOURCE +5V SENSE
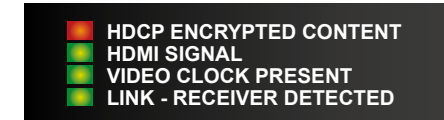
HDMI-OPT-TX200R

PRIMARY (SOLID)	SECONDARY (BLINKING)
HDCP ENCRYPTED CONTENT HDMI SIGNAL VIDEO CLOCK PRESENT LINK - RECEIVER DETECTED	EMULATED EDID INVALID EMULATED EDID VALID MONITOR OUT HOTPLUG SENSE SOURCE +5V SENSE

HDMI-OPT-RX100 / HDMI-OPT-RX100R

HDCP ENCRYPTED CONTENT
HDMI SIGNAL
VIDEO CLOCK PRESENT
LASER DETECTED
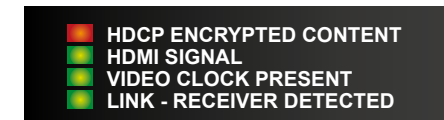
HDMI-OPT-RX200R

PRIMARY (SOLID)	SECONDARY (BLINKING)
HDCP ENCRYPTED CONTENT HDMI SIGNAL VIDEO CLOCK PRESENT LASER DETECTED	 OUT1 MONITOR HOTPLUG SENSE OUT2 MONITOR HOTPLUG SENSE

4.1.3. Transmitter LED Modes

Status LED	LED mode	Description	TX100	TX100R	TX200R
	PRIMARY (SOLID) MODE	**HDCP encrypted content**	Indicates if the source signal is HDCP encrypted.		
		HDMI signal	Indicates the type of the video signal. In case of existing HDMI signal the LED lights continuously. In case of existing DVI signal the LED is off and the Video Clock present LED is lights continuously.		
		Video clock present	Indicates if a valid HDMI clock signal is present on the transmitters' HDMI input or the receivers' SC multimode in connector.		
		Link - Receiver detected	Indicates if a powered receiver (e.g. RX200R) is connected to the transmitter and they can communicate over the fiber optical cable. When no receiver is connected, and the transmitter powered, the LED is blinking by 1Hz frequency.		
	SECONDARY (BLINKING) MODE	**Emulated EDID invalid**	The LED lights red if the selected EDID is invalid or empty memory selected.		
			After applying a Hot Plug signal(s) to the OUTPUT(s), this LED indicates that the unit is trying to read the EDID from the connected display device, but the EDID is invalid or missing.		
			After pressing the LEARN button, this LED's blinking indicates if the learn process was unsuccessful.		
		Emulated EDID valid	The LED lights green if the selected EDID is valid.		
			After applying a Hot Plug signal(s) to the OUTPUT(s), this LED indicates that the unit is reading the EDID from the connected display device and the EDID is valid.		
			After pressing the LEARN button, this LED's blinking indicates if the learn process was successful.		
		Monitor out hotplug sense	-	-	Indicates if a powered display device (or matrix switcher, repeater, etc.) is connected to the HDMI output connector and sends a valid hotplug signal on pin 19 through the HDMI cable.
		Source +5V sense	Indicates if a powered source unit (computer, DVD or Blu-Ray player, etc.) is connected to the HDMI INPUT connector and sends a valid +5V signal on pin 18 through the HDMI cable.		

4.1.4. Receiver LED Modes

Status LED	LED mode	Description	RX100	RX100R	RX200R
	PRIMARY (SOLID) MODE	**HDCP encrypted content**	Indicates if the source signal is HDCP encrypted.		
		HDMI signal	Indicates the type of the video signal. In case of existing HDMI signal the LED lights continuously. In case of existing DVI signal the LED is off and the Video Clock present LED is lights continuously.		
		Video clock present	Indicates if a valid HDMI clock signal is present on the transmitters' HDMI input or the receivers' SC multimode in connector.		
		Laser detected	Indicates if a powered transmitter (e.g. TX200R) is connected to the receiver and they can communicate over the fiber optical cable.		
	SECONDARY (BLINKING) MODE	**Monitor out hotplug sense OUT1 / OUT2**	-	-	Indicates if a powered display device (or matrix switcher, repeater, etc.) is connected to the HDMI output connector and sends a valid hotplug signal on pin 19 through the HDMI cable.

4.2. EDID Operations

ATTENTION! EDID settings are available in the HDMI-OPT series transmitters only, the receivers are transparent in the video signal point of view.

4.2.1. About EDID Memory

The EDID memory is non-volatile and can store 99 EDIDs. The memory structure is as follows:

Description	Rotary switch state	Memory bank number in LDC
Factory Preset EDID list	#01 - #50	F01 - F50
User programmable slots	#51 - #98	U1 - U48
Last attached monitor's EDID (local monitor)	#00	D01

INFO: HDMI-OPT series transmitters can handle both 128 Byte EDID and 256 Byte extended EDID structures.

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

INFO: The transmitters always learn the stored last attached monitor's EDID into the user programmable EDID memory.

Factory Preset EDIDs

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

Universal HDMI (F49) allows multiple resolutions including all common VESA defined resolutions. The use of universal EDID is recommended for fast and easy system setup.

You can find all the factory preset EDID in Factory EDID List section.

INFO: The factory EDIDs (#1..#50 inclusive) preprogrammed and cannot be modified. These are the most commonly used resolutions.

4.2.2. Switching EDID

The user can select an EDID to emulate on the input, this is called EDID routing. There are two types of the emulation: static and dynamic.

- **Static EDID emulation** happens, when an EDID from the Factory or User EDID list is routed to an input.
- **Dynamic EDID emulation** occurs, when an attached monitor's EDID is routed to an input. In this case the emulated EDID changes automatically, if a new monitor is attached to the output, by simply copying the data from the monitor.

Step 1. Use a screwdriver to change the memory address on the **rotary switches** on the front side of the transmitter. The left switch sets the tens value, the right switch gives the ones value of the EDID.

Location #17 is selected by the rotary switches

ATTENTION! Avoid the use of keys, coins, knives and other sharp objects switching the rotary switches.

Step 2. After either one of the rotary switches has been rotated the unit waits approximately two seconds before the selected EDID becomes active.

Step 3. Check the status of the device on the **Status LEDs**. See the The Legend of Status LEDs.

The address #00 has a special function in the case of HDMI-OPT-TX200R. If a monitor is connected to the **MONITOR OUT**, then its **EDID** is copied to the **HDMI INPUT** connector. If no monitor is connected to the MONITOR OUT then the EDID transmitted to the INPUT connector is the EDID of the last connected monitor.

4.2.3. Learning EDID

The factory preset EDIDs cannot be changed by the user. Only addresses from #51 to #98 are user programmable.

Step 1. After connecting the sink device to **HDMI OUTPUT**, use a screwdriver to select a user programmable memory address on the rotary switches. If the Status LED is illuminated red, then the memory slot is empty and ready to be programmed. If it is green, the memory was already used before, but still available for reprogramming.

ATTENTION! Avoid the use of keys, coins, knives and other sharp objects switching the rotary switches.

Step 2. Push the LEARN button on the front side of transmitter and hold it down for approximately three seconds. If the teaching is successful, the Status LED blinks four times green, if the teaching is unsuccessful, the Status LED blinks four times red.

Step 3. The normal function of the LED is in effect.

INFO: The last attached monitor's EDIDs are stored automatically, until a new monitor is attached to the MONITOR OUT. In the case of powering the unit off, the last attached monitor's EDID remains in non-volatile memory.

INFO: If the selected user memory is not empty, the new EDID will overwrite the previously stored EDID.

TIPS AND TRICKS: HDMI-OPT-TX200R can learn EDID with LEARN button from local HDMI output called MONITOR OUT.

4.2.4. Deleting EDID

EDID cannot be deleted by the controls on the front panel, only by Lightware Device Controller software. See more information in section EDID Menu.

5

Software Control - Using Lightware Device Controller

The device can be controlled by a computer through the RS-232 port using Lightware Device Controller (LDC). The software can be installed on a Windows PC or MacOS. The application and the User's manual can be downloaded from www.lightware.com. The Windows and the Mac versions have the same look and functionality.

▸ INSTALL AND UPGRADE
▸ ESTABLISHING THE CONNECTION
▸ I/O PARAMETERS MENU
▸ EDID MENU
▸ SETTINGS MENU
▸ TERMINAL WINDOW

5.1. Install and Upgrade

Installation for Windows OS

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

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

Normal install	Snapshot install
Available for Windows and MacOS	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 MacOS 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.
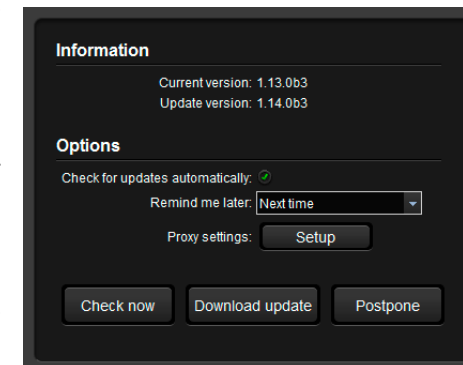
The **Update** window can also be opened by clicking the **About icon** and the **Update** button.

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 2. Click the **Download update** button to start the upgrading.

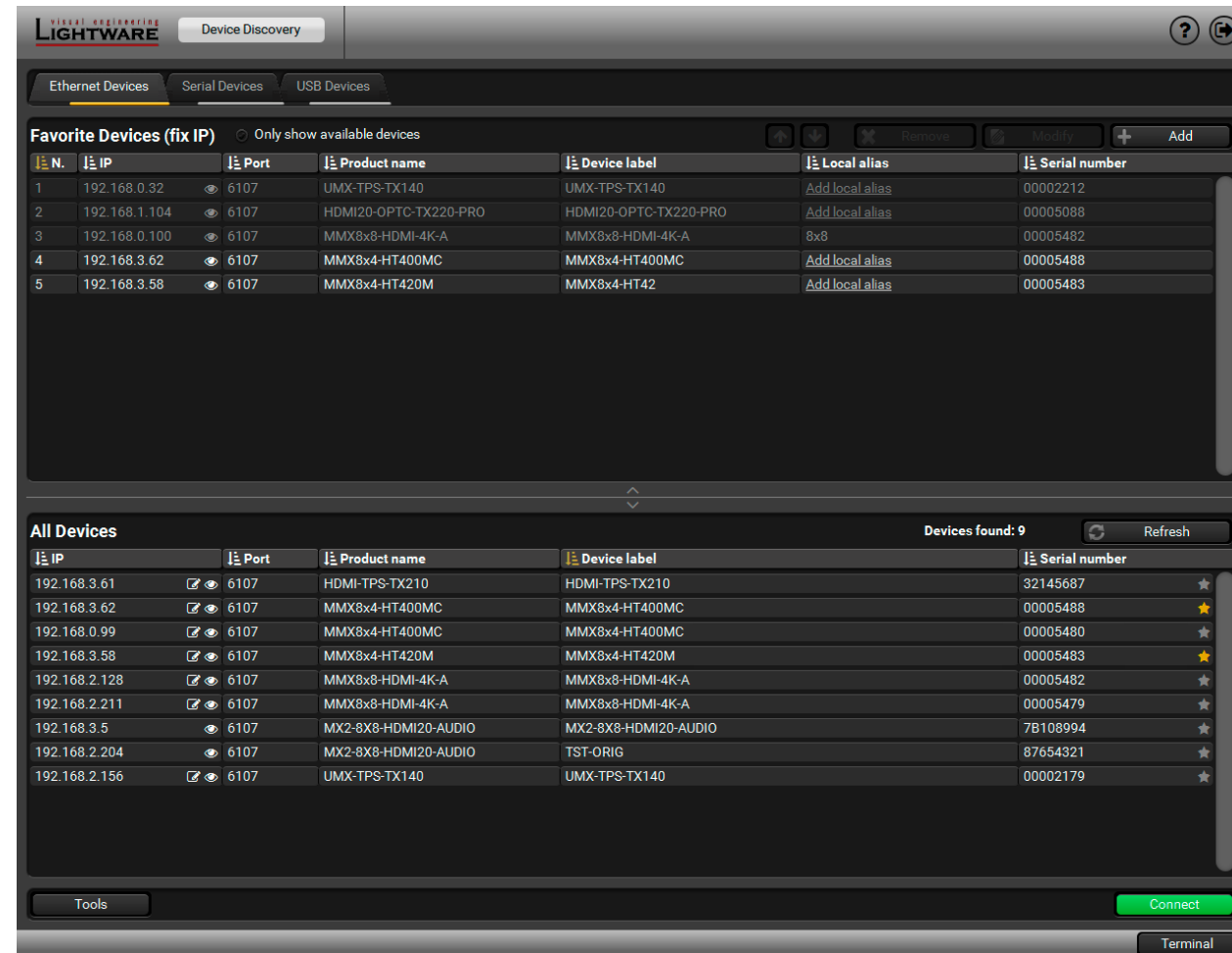The updates can be checked manually by clicking the **Check now** button.

INFO: After the installation, the Windows and the Mac application has the same look and functionality.
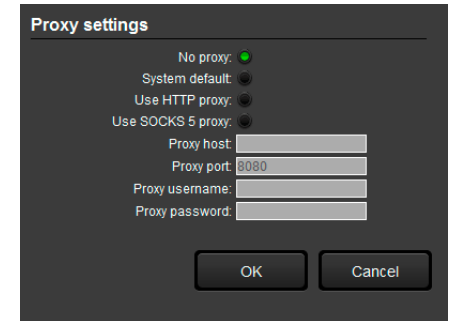
5.2. Establishing the Connection

Step 1. Connect the device to a computer via RS-232.

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

Device Discovery Window in LDC

Step 3. Select the **Serial Devices** tab. Click on the **Query** button to next to the desired serial port to display the device's name and serial number. Double click on the name of the device or select it and click on the **Connect** button.
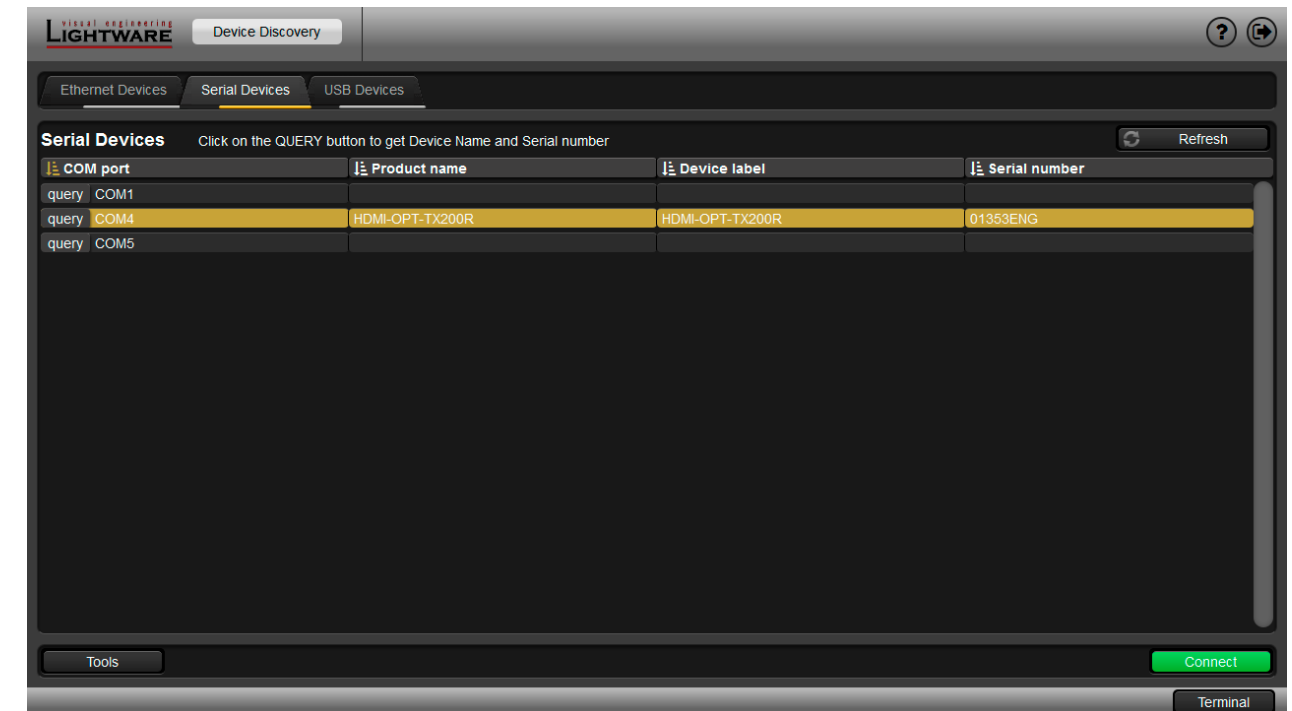
The Serial Devices Tab in Device Discovery Window

5.3. I/O Parameters Menu

The menu displays the current state of the device. The input port of the device is on the right top, the output ports are on the right bottom side. The properties of input port is displayed as default.

I/O Parameters menu
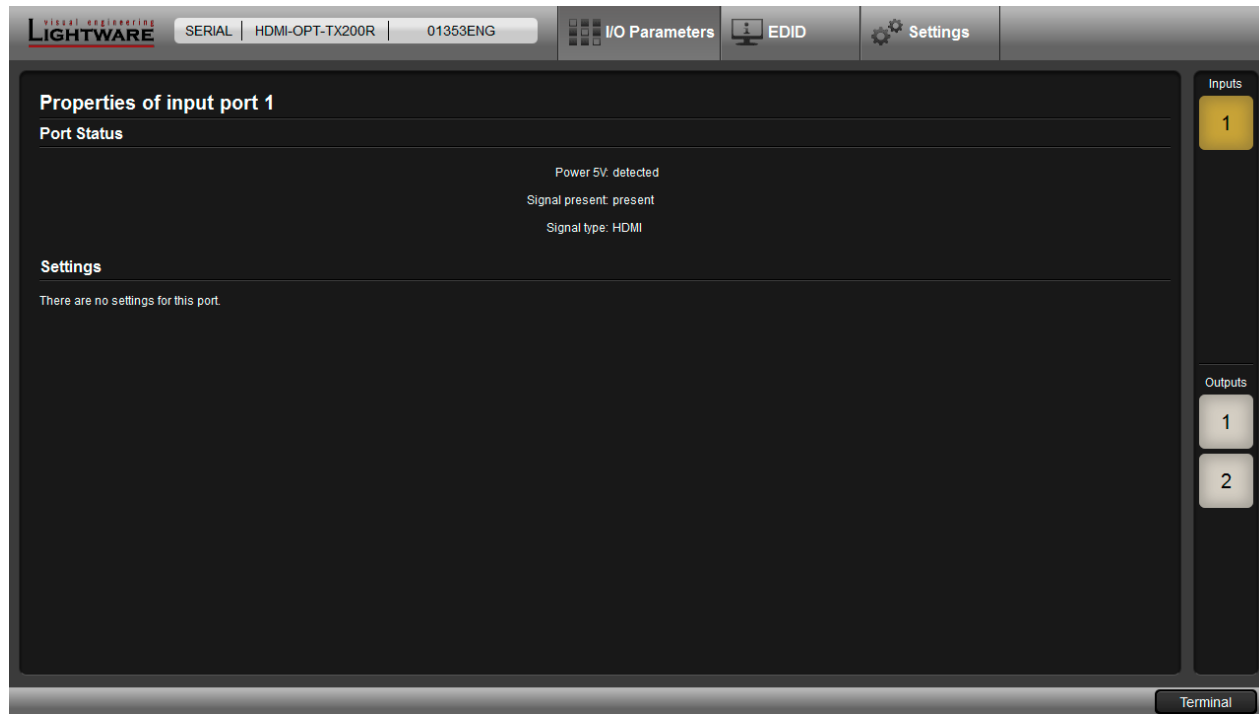
5.4. EDID Menu

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.
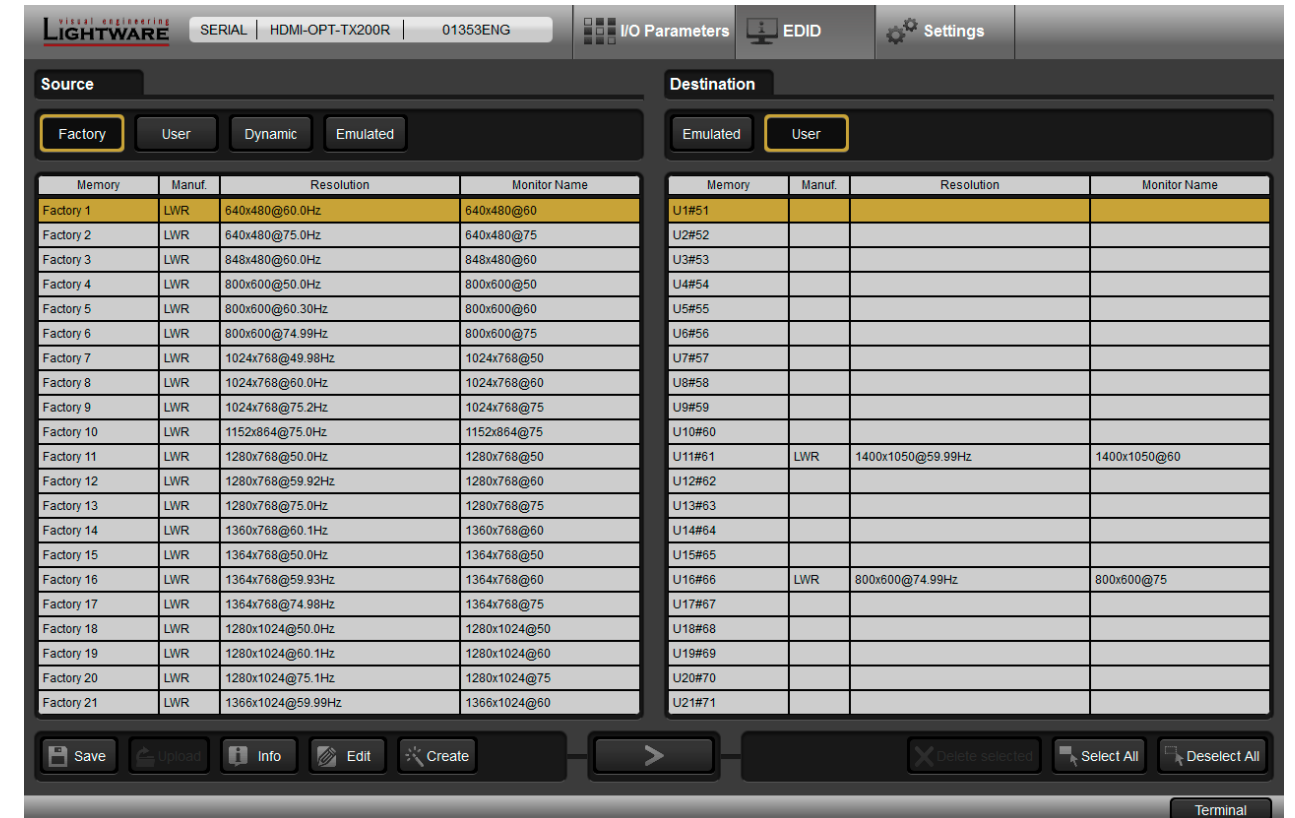
EDID Menu

Control Buttons

Save	Exporting an EDID (save to a file)	>	Executing EDID emulation or copying (Transfer button)
Upload	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	Deselect All	Selecting none of the memory places in the right panel
Create	Opening Easy EDID Creator		

5.4.1. Sources and Destinations

The EDID memory consists of four parts:

- **Factory** EDID list shows the pre-programmed EDIDs (F1-F50).
- **Dynamic** EDID list shows the display device connected to the device's outputs. The unit stores the last display devices' EDID on either output, so there is an EDID shown even if there is no display device attached to the output port at the moment.
- **User memory** locations can be used to save custom EDIDs. (U1 – U48)
- **Emulated** EDID list shows the currently emulated EDID for the inputs. The source column displays the memory location that the current EDID was routed from.

The source reads the EDID from the Emulated EDID memory on the INPUT port. Any EDID from any of the User/Factory/Dynamic EDID lists can be copied to the user memory.

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

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

5.4.2. EDID Operations

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 device (Dynamic).

Exporting an EDID

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

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

Step 2. Press the **Save** 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 **Upload** 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).

5.4.3. EDID Summary Window

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

EDID Summary Window

5.4.4. 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.

EDID Editor Window

5.4.5. Creating an EDID

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

Easy EDID Creator Window

5.5. Settings Menu

5.5.1. Device Information
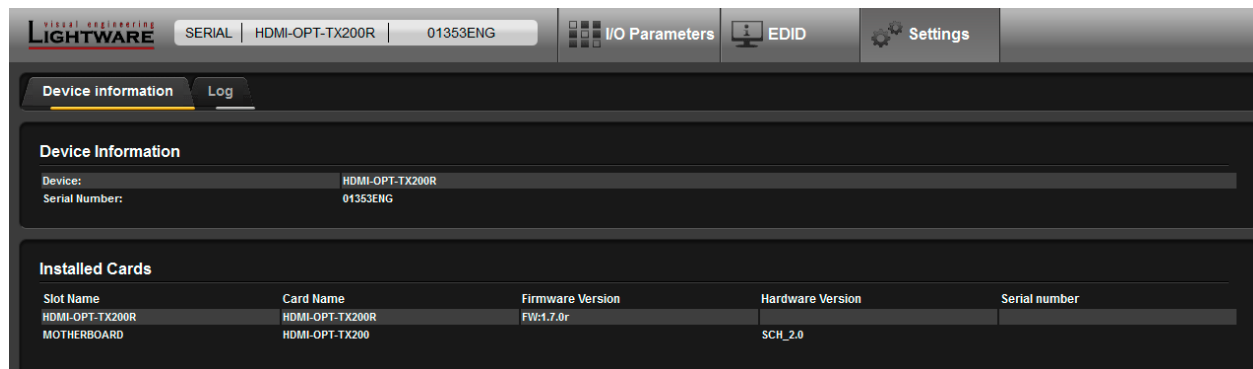
Device Information Tab in the Settings Menu

The serial number, installed firmware version and the hardware revision of the device is shown under the Device Information tab.

5.5.2. Log

Events logged by the device and report generators can be found on Log tab.
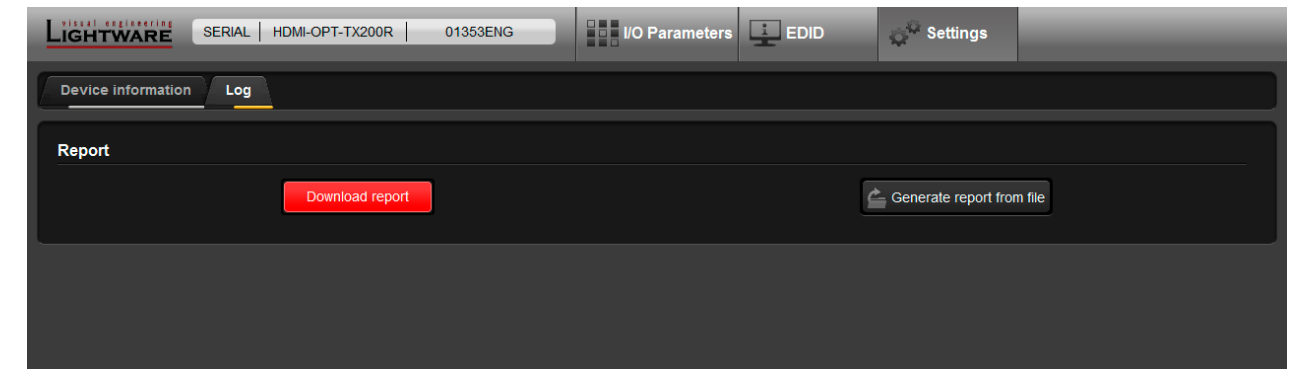
Log tab in the Settings Menu

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

Press the **red button**: Generate report file.

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

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

The report contains the following device-dependent information (if available):

- Device type and serial number,
- Firmware version,
- All EDID headers and status (emulated, dynamic, factory, user).

Open Custom Report from File

The Controller Software is able to send a custom command file to other Lightware devices (e.g. another HDMI-OPT series extender). The command file can be generated by Lightware support. This is needed when some special commands have to be used for configuring the device or troubleshooting.

INFO: This function is only for special troubleshooting cases.

5.6. Terminal Window

This general purpose terminal is intended mainly for testing and debugging purposes. The command text can be typed directly.

Terminal Window

By default commands are automatically surrounded by framing brackets. Every sent command and every received response gets an arrow (-> or <-) prefix, and has different font colors in order to help to distinguish.

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

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

The terminal can also be opened after starting the LDC - press the Terminal button on the Device discovery page on the bottom of the window.

TIPS AND TRICKS: The typed commands can be "browsed" when the cursor is in the command line and you press the *up* button on the keyboard. The commands are stored until the LDC is closed.

6

Firmware Upgrade

This chapter is meant to help customers perform firmware upgrades on our products by giving a few tips on how to start and by explaining the features of the Bootloader software. To get the latest software and firmware pack please contact support@lightware.com.

▸ UPGRADING STEPS IN A NUTSHELL

▸ DETAILED INSTRUCTIONS

WARNING! All EDIDs in the User Memory will be lost after the firmware upgrade. Save the user EDIDs before processing the upgrade.

6.1. Upgrading Steps in a Nutshell

Step 1. Installing the Lightware Bootloader Software.

Step 2. Downloading and saving all the firmware files that you want to upgrade.

Step 3. Connecting the Lightware device and the computer via RS-232 port.

Step 4. Starting the Lightware Bootloader application.

Step 5. Establishing the connection with the device.

Step 6. Selecting firmware to upgrade.

Step 7. Starting the upgrade process.

Step 8. Restarting the device.

6.2. Detailed Instructions

Use the Lightware Bootloader application to upgrade the device's firmware. The extender can only be upgraded via RS-232, so connect the device directly to the Windows based computer with an RS-232 cable.

Step 1. Installing the bootloader application with **Installer_LW_bootloader.exe.**

Step 2. Downloading and saving all the firmware files that you want to upgrade. If you have a zipped archive, extract it.

Step 3. Connecting the Lightware device and the computer via USB port.

Step 4. Starting the Lightware Bootloader application.

Step 5. Establishing the connection with the device.

During this mode all the status LEDs light continuously.

Click on the **Find** button. Check the **Available COM Ports** panel to find your device. Double click on the desired COM port, then click **YES** to establish connection with the extender. It will take few seconds to get all information from the device.

When the connection is established, the device is automatically switched to bootload mode.

▌ INFO: During bootload mode all the status LEDs light continuously.

Switching the Transmitter to Bootload Mode Manually

a) Turn the **EDID rotary switches** into #99 position.

b) Turn the **BAUD RATE rotary switch** into #9 position.

c) Connect the **5V DC** to the transmitter unit.

d) While pressing and holding the **LEARN** button plug the **5V DC** wall adaptor to the electric outlet.

Switching the HDMI-OPT-RX200R receiver to Bootload Mode Manually

a) Connect the **5V DC** to the receiver unit.

b) While pressing and holding the **SECONDARY FUNCTION** button plug the **5V DC** wall adaptor to the electric outlet.

Review the Firmware Versions

After the connection is made, the device properties, and the installed controller module is displayed.
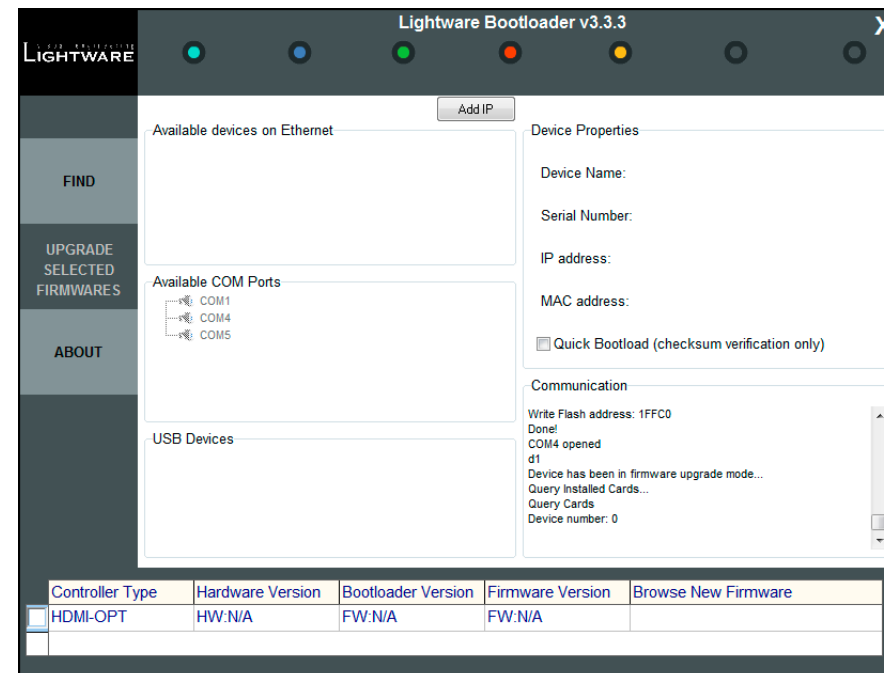
Step 6. Browse for the new firmware.

Click the corresponding cell in the **Browse New Firmware** column. A dialog pops up, to confirm if you really want to modify the path. Now you can browse for the new firmware file to upload. After opening the new file, the new firmware field will contain the name of the firmware file.
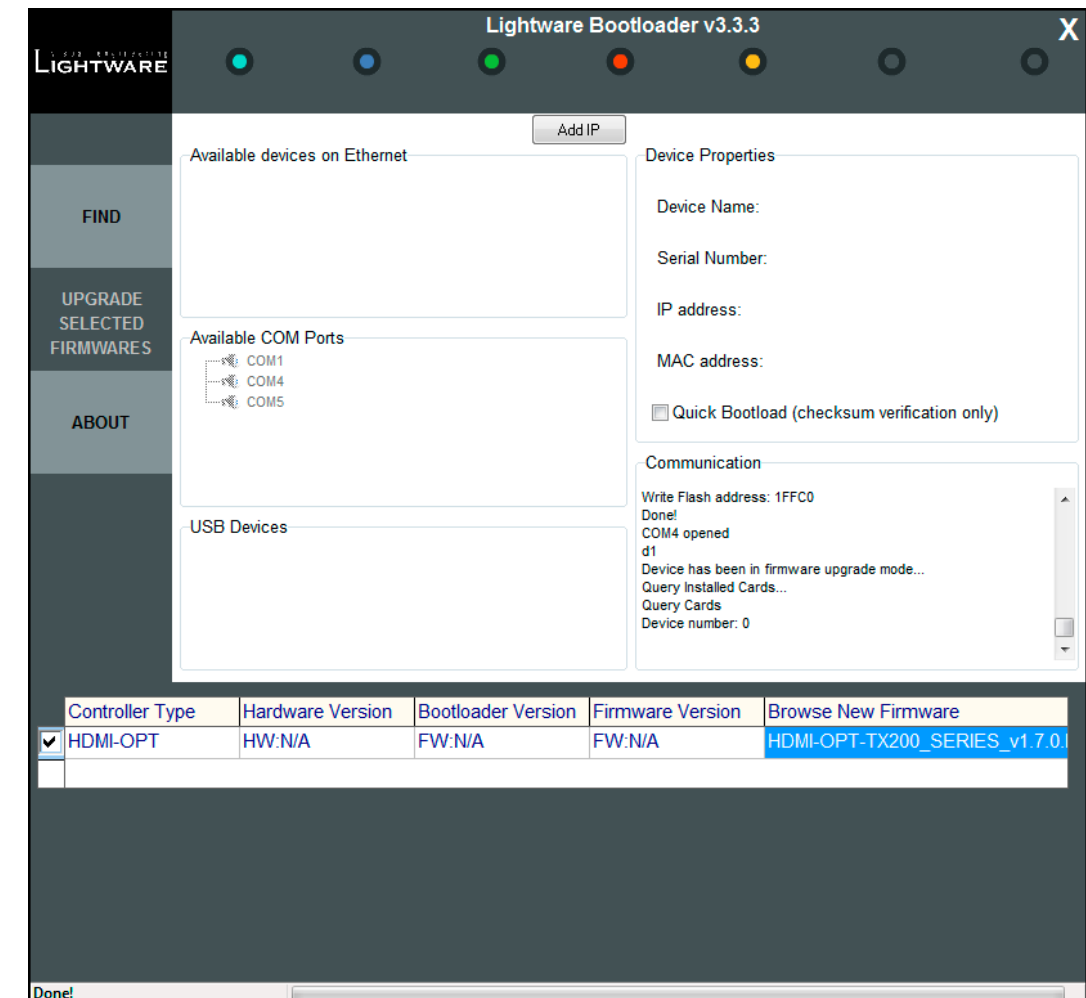
Step 7. Upgrade firmware.

Click **Upgrade selected firmwares** button. A confirmation message appears. After clicking the **Yes** button the selected controllers are being reprogrammed, with the firmware you selected. If you select a file that does not fit for the selected controller, you will get an information message about which file is wrong. If you selected a controller to upgrade, but you had not selected a file for it, then you will also get an information message about which file is missing.

Quick Bootload mode can be switched on or off any time. It makes the bootloader software faster by only checking the checksum of the controller. No data verification is done after writing if the checksum was correct.

A progress bar will show the current state of the reprogramming. With some controller type an erasing process will take place first, and then the programming is done, so the progress bar runs up twice.

When the reprogramming is finished, a **Done!** message will appear in the bottom left corner. The application closes the connection, and the device restarts.

Step 8. Done!

If the upgrade was successful, the following window pops up:
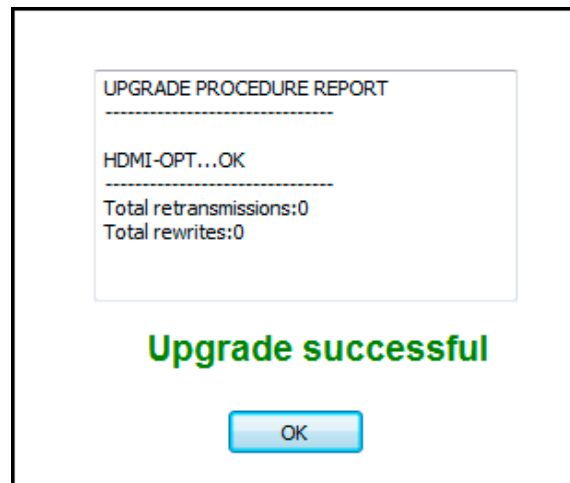
Now you can close the application, or you can select another device to upgrade. After closing the bootloader application, switch the upgraded devices off and then on. Now the extender is ready to be used with the new firmware!

7

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 sink device end.

At first, check front panel LEDs and take the necessary steps according to their states. For more information about status, LEDs refer to The Legend of Status LEDs section.

Pictogram Legend

Section to connections/cabling.

Section to front panel operation.

Section to LDC software.

Symptom	Root cause	Action	Refer to
		Video/audio signal	
No picture on the output	Device or devices are not powered properly	Check the extender 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.	3.3
	Endface surface of the fiber optical cable became contaminated	Use special fiber optical cable cleaning equipment to clean it carefully.	
	No incoming signal (transmitter)	If the Video Clock Present LED is not illuminated (in PRIMARY mode), no DVI signal is present on the DVI input port. Check the source device and the HDMI cable.	3.3
	No incoming signal (receiver)	If the Video Clock Present LED is not illuminated (in PRIMARY mode), no signal is present on the optical input port. Check the source device and the fiber cable.	3.3
	Invalid EDID is selected (transmitter)	Check the Emulated EDID Invalid LED (in SECONDARY mode). If it is illuminated red, then an invalid EDID or an empty memory address is selected. Select a valid EDID.	4.2.2
Strange colors are displayed	Incorrect colorspace has been applied	HDMI-OPT units do not support colorspace conversion between HDMI YUV and RGB. Change the colorspace on the HDMI source manually or modify an EDID with the Lightware Control Software to not support YUV colorspace.	5.4.4

8

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
▶ SERIAL MANAGEMENT

8.1. EDID Management

8.1.1. 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.
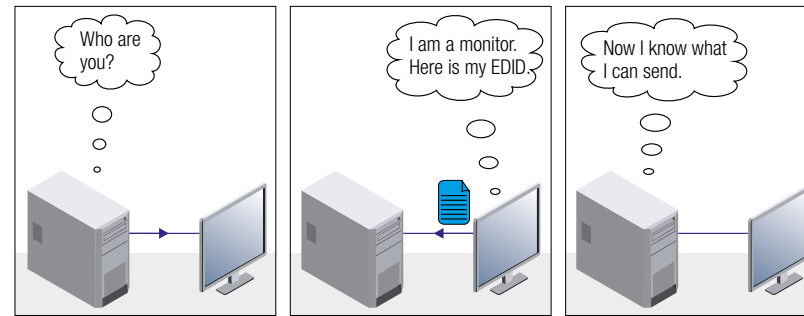
EDID Communication

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.

8.1.2. 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.

8.2. HDCP Management

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

8.2.1. 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 (e.g. an HDMI-OPT series extender) 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.

8.2.2. Real Life Examples

HDCP-Compliant Sink
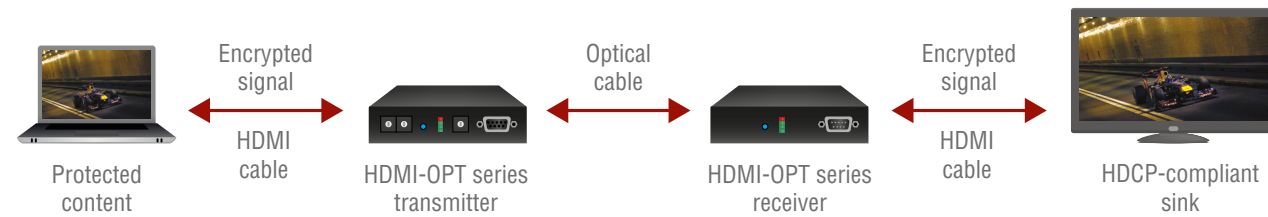
HDCP-compliant sink

All the devices are HDCP-compliant, both protected and unprotected content is transmitted and displayed on the sink device.

Non-HDCP Compliant Sink 1.
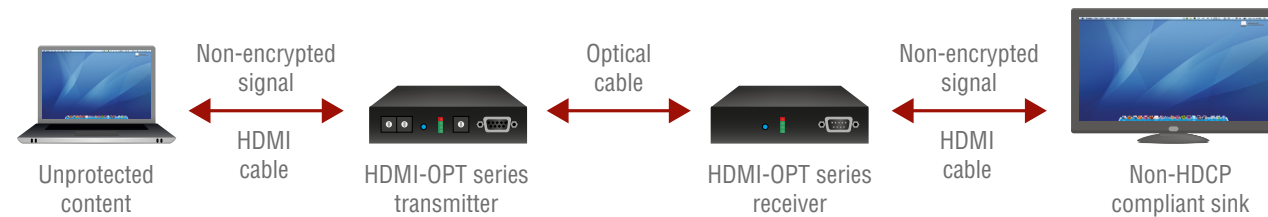
Non-HDCP compliant sink displaying unprotected content

Non-HDCP compliant sink is connected to the receiver. Since the content is unprotected the image will be visible on the sink.

Non-HDCP Compliant Sink 2.
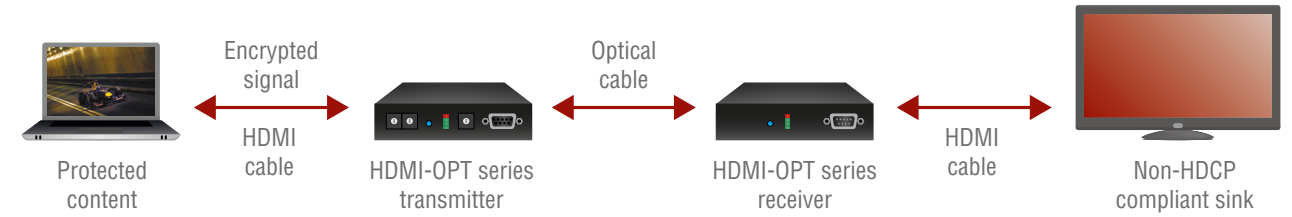
Non-HDCP compliant sink and protected content

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. The sink is not HDCP-compliant, thus, it will not display the video signal (but blank/red/ muted/etc. screen). The solution is to replace the display device to an HDCP-capable one.

8.3. Pixel Accurate Reclocking

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

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

Intra-pair skew

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

Intra-pair skew
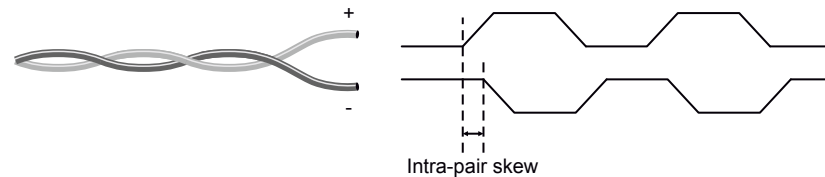
Inter-pair skew

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

Inter-pair skew
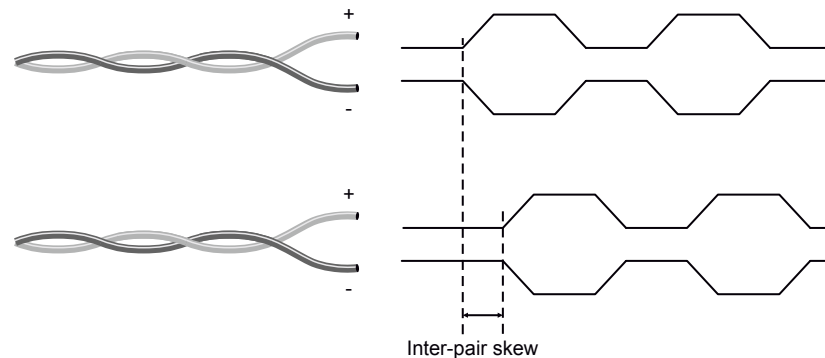
Jitter

Signal instability in the time domain. The time difference between two signal transitions should be a fixed value, but noise and other effects cause variations.
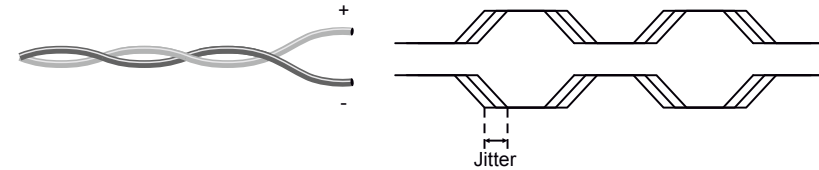
Jitter

Noise

Electromagnetic interference between other electronic devices such as mobile phones, motors, etc. and the DVI cable are coupled onto the signal. Too much noise results in increased jitter.

Noise
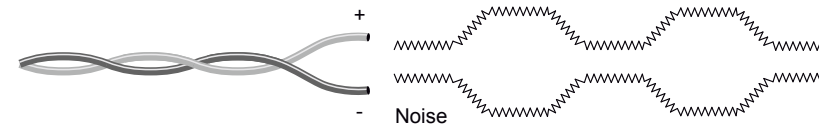
8.4. Serial Management

8.4.1. General Information

There are two types of devices in general serial communication:

- **Data Terminal Equipment:** Data Terminal Equipment (DTE) is an end instrument that converts user information into signals or reconverts received signals. Typical DTE devices: computers, LCD touch panels and control systems.
- **Data Circuit-terminating Equipment:** Data Circuit-terminating Equipment (DCE) is a device that sits between the DTE and a data transmission circuit. It is also called data communication equipment and data carrier equipment. Typical DCE devices: projectors, industrial monitors and amplifiers.

Among others the pin assignment is different between DTE and DCE.

	DTE	DCE
Pin 2:	RD	TD
Pin 3:	TD	RD

RD: Received Data (digital input)
TD: Transmitted Data (digital output)

INFO: HDMI-OPT transmitters (TX200R, TX100R) are DCE units and receivers (RX200R, RX100R) are DTE units according to their pin-outs.

Different type of serial cables must be used between different serial devices.

	DTE	DCE
DTE	Null-modem	TD
DCE	Straight	Null-modem*

* In general contact DCE with DCE by tail-circuit serial cable.

8.4.2. Types of Serial Cables

Straight Serial Cable	Null-modem Serial Cable
Straight pin-outs both ends.	Straight pin-out at the one end and cross pin-out at the other end (interchange lines of TX and RX).

Serial cables between devices may have male or female plugs and their type may be straight or null-modem in usual.

ATTENTION! The cable type does not depend on the plug type.

8.4.3. RS-232 Signal Transmission over Lightware Extender Devices

The following examples describe the detailed integration of Lightware devices between different RS-232 pin assignment units.

INFO: HDMI-OPT transmitters (TX200R, TX100R) are DCE units and receivers (RX200R, RX100R) are DTE units according to their pin-outs.

Extending RS-232 between DTE and DCE Third-party Devices

Connect null-modem serial cable between controller system (DTE) and the transmitter (DTE) and straight serial cable between receiver (DTE) and projector (DCE).

Controller system	Transmitter	Receiver	Projector
DTE	DCE	DTE	DCE
	Female – Male Straight serial cable	Transmission interface	Female – Male Straight serial cable
Pin 2: RD ◄	◄ Pin 2: TD	Pin 2: RD ◄	◄ Pin 2: TD
Pin 3: TD ►	► Pin 3: RD	Pin 3: TD ►	► Pin 3: RD
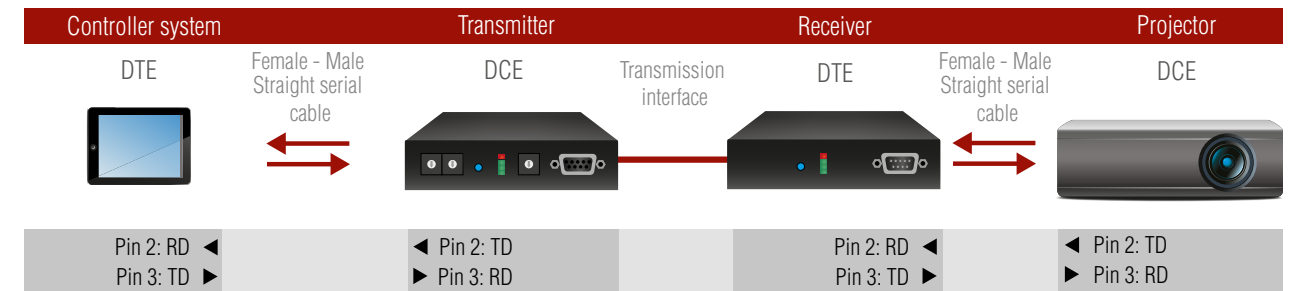
RS-232 Connection Example between a Controller System and a Projector

Extending RS-232 between DTE and DTE Third-party Devices

Connect straight serial cable between controller system (DTE) and the transmitter (DCE) and null-modem serial cable between receiver (DTE) and computer (DTE).

Computer	Transmitter	Receiver	Computer
DTE	DCE	DTE	DTE
	Female – Male Straight serial cable	Transmission interface	Female – Male Null-modem serial cable / Male – Female
Pin 2: RD ◄	◄ Pin 2: TD	Pin 2: RD ◄	► Pin 2: RD
Pin 3: TD ►	► Pin 3: RD	Pin 3: TD ►	◄ Pin 3: TD
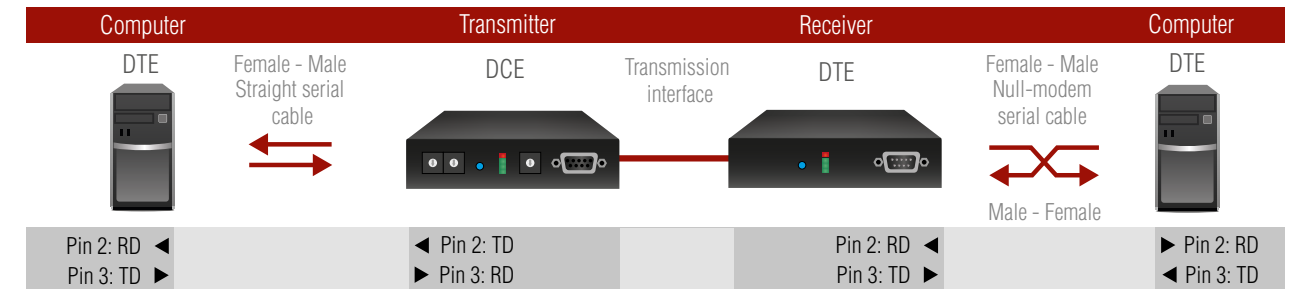
RS-232 Connection Example between Two Computers

9

Appendix

9.1. Specification

General

Compliance .... CE

EMC (Emission) .... EN 55032:2015

EMC (Immunity) .... EN 55035:2017

Safety.. EN 60065 Class II

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

Power adaptor.................In 100-240 V AC 50/60 Hz, Out 5V DC, 2.5 A

Power connector....................... Locking DC connector (2.35 mm pin)

Power input .... 5V DC 1 A

Power consumption (Transmitters).......................4 W (typ); 6W (max)

Power consumption (Receivers)...........................4 W (typ); 9W (max)

Enclosure

Material.. 1 mm steel

Dimensions in mm............ 100.4 x 131.9 x 26 (excluding connectors)

Dimensions in inch ...... 3.953 x 5.193 x 1.023 (excluding connectors)

Net Weight (TX200R/RX200R)... 410 g

Net Weight (TX100R/TX100/RX100R/RX100) .... 400 g

Optical Ports

Connector type..Standard simplex SC socket

Fiber .... 50/125 SC Multimode (preferred) 62.5/125 SC Multimode

Laser wavelengths - high speed4 channel CWDM: 778; 800; 825; 850 nm

Laser wavelengths - low speed........... 2 channel CWDM: 911; 980 nm

Laser class specification... Class 3R

Transmitter output OMA * ....-6.25 dBm (worst case)

Receiver OMA * sensitivity ....-14.25 dBm (worst case)

Optical loss budget.. 8 dBm (worst case)

Transmission distance .... 2600 meters (using OM4 type fiber)

* OMA: Optical Modulation Amplitude

Video Ports

Connector type................................. 19-pole HDMI Type A receptacle

Standard .... HDMI 1.3, DVI 1.0

Color depth.. maximum 36 bits, 12 bit/color

Format ....sRGB, YCbCr, xvYCC digital video

Maximum data rates............... 6.75 Gbps (2.25 Gbps /TMDS channel)

Maximum pixel clock..225 MHz

Video delay..0 frame

Resolutions.............. all between 640x480 and 2048x1080 deep color

HDTV resolutions..720p, 1080i, 1080p

HDCP compliant...Yes

EDID support ....Advanced EDID management

Reclocking.. Pixel Accurate Reclocking

EDID Emulation (Transmitters) .... Yes, 50 factory preset, 48 user programmable

Output mode .... Automatic (DVI or HDMI)

Colorspace conversion.. No

Serial Ports

Connector type (Transmitters)...DE-9F (9-pole D-sub Female)

Connector type (Receivers)...DE-9M (9-pole D-sub Male)

Direction ....Bidirectional

Baud rate .... 9600, 14400, 19200, 38400, 57600 Baud

Connectors / ESD protection (HBM EIA/JESD22-A114F)

HDMI input and output ....19-pole HDMI Type A socket / 8 kV

Serial port (TX100R/TX200R transmitters)............................. DE-9F (9-pole D-sub Female) / 15 kV

Serial port .... DE-9M (9-pole D-sub Male) / 15 kV

Optical fiber input and output ....Standard simplex SC socket / n.a.

Power connector... Locking DC connector (2.5/5.5 mm) / 2 kV

9.2. Maximum Extension Distances

	OM1	OM2	OM3	OM4
	(62.5/125)	(50/125)	(50/125)	(50/125)
1080p@60Hz 24 bpp	250 m	600 m	1200 m	2600 m
1080p@60Hz 36 bpp	150 m	400 m	800 m	1300 m
4096x2048@30Hz 24 bpp	Not supported	350 m	700 m	1100 m

9.3. Mechanical Drawings

The following drawings present the physical dimensions of the device. HDMI-OPT-TX200R can be seen in the pictures but the dimensions are valid for all the models. Dimensions are in mm.

Front View

Rear View

Bottom View

Top View
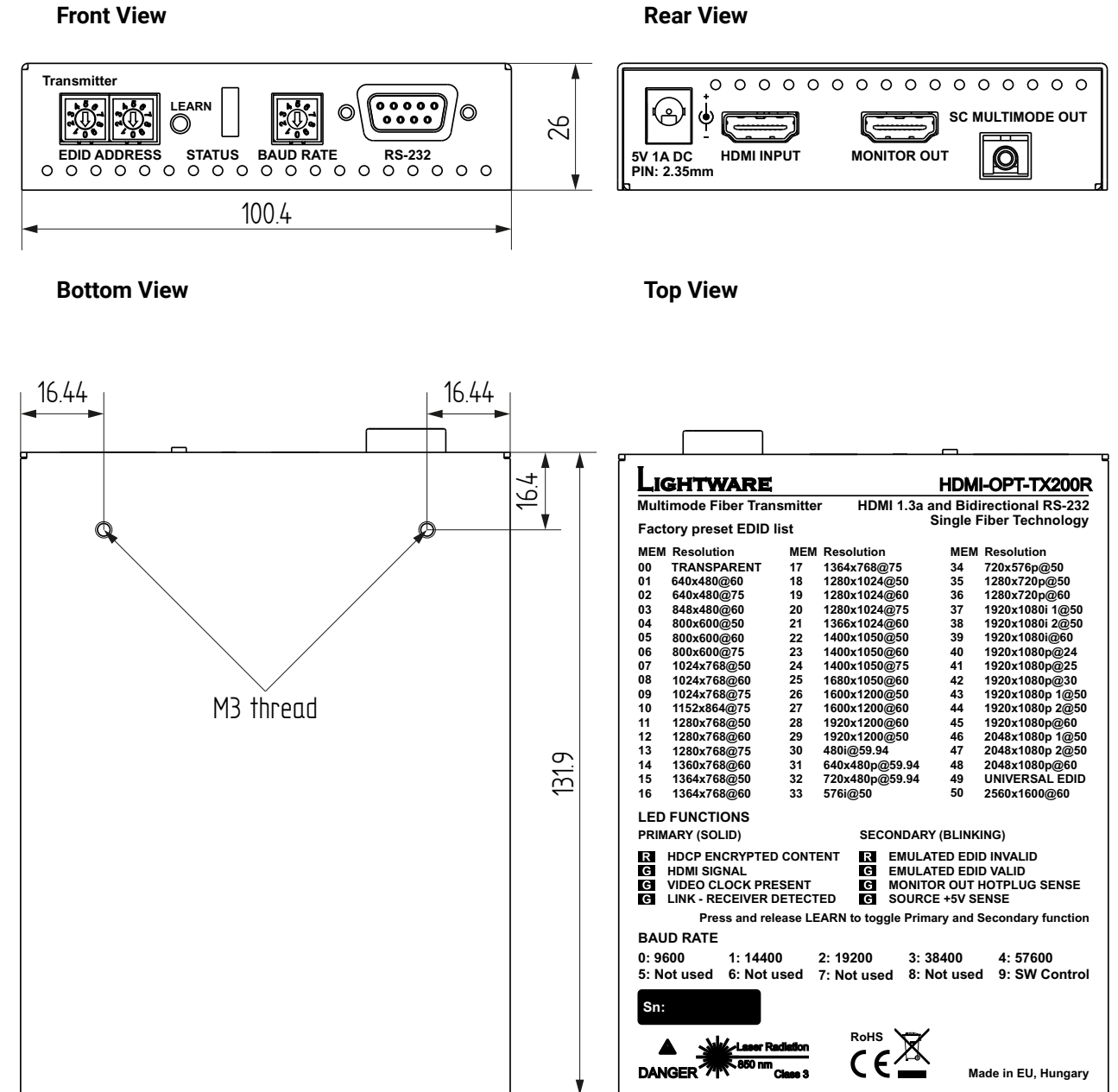
9.4. Factory EDID List

Mem.	Resolution				Type
F1	640 x	480	@ 60.00	Hz	DVI
F2	640 x	480	@ 75.00	Hz	DVI
F3	848 x	480	@ 60.00	Hz	DVI
F4	800 x	600	@ 50.00	Hz	DVI
F5	800 x	600	@ 60.30	Hz	DVI
F6	800 x	600	@ 74.99	Hz	DVI
F7	1024 x	768	@ 49.98	Hz	DVI
F8	1024 x	768	@ 60.00	Hz	DVI
F9	1024 x	768	@ 75.20	Hz	DVI
F10	1152 x	864	@ 75.00	Hz	DVI
F11	1280 x	768	@ 50.00	Hz	DVI
F12	1280 x	768	@ 59.92	Hz	DVI
F13	1280 x	768	@ 75.00	Hz	DVI
F14	1360 x	768	@ 60.10	Hz	DVI
F15	1364 x	768	@ 50.00	Hz	DVI
F16	1364 x	768	@ 59.93	Hz	DVI
F17	1364 x	768	@ 74.98	Hz	DVI
F18	1280 x	1024	@ 50.00	Hz	DVI
F19	1280 x	1024	@ 60.10	Hz	DVI
F20	1280 x	1024	@ 75.10	Hz	DVI
F21	1366 x	1024	@ 59.99	Hz	DVI
F22	1400 x	1050	@ 49.99	Hz	DVI
F23	1400 x	1050	@ 59.99	Hz	DVI
F24	1400 x	1050	@ 75.00	Hz	DVI
F25	1680 x	1050	@ 59.99	Hz	DVI
F26	1600 x	1200	@ 50.00	Hz	DVI
F27	1600 x	1200	@ 60.00	Hz	DVI
F28	1920 x	1200	@ 59.55	Hz	DVI
F29	1920 x	1200	@ 50.00	Hz	DVI
F30	1440 x	480i	@ 60.30	Hz	HDMI

Mem.	Resolution				Type
F31	640 x	480	@ 59.94	Hz	HDMI
F32	720 x	480	@ 59.92	Hz	HDMI
F33	1440 x	288	@ 50.60	Hz	HDMI
F34	720 x	576	@ 50.00	Hz	HDMI
F35	1280 x	720	@ 50.00	Hz	HDMI
F36	1280 x	720	@ 60.00	Hz	HDMI
F37	1920 x	1080i	@ 50.30	Hz	HDMI
F38	1920 x	1080i	@ 50.00	Hz	HDMI
F39	1920 x	1080i	@ 60.50	Hz	HDMI
F40	1920 x	1080	@ 24.00	Hz	HDMI
F41	1920 x	1080	@ 24.99	Hz	HDMI
F42	1920 x	1080	@ 30.00	Hz	HDMI
F43	1920 x	1080	@ 50.00	Hz	HDMI
F44	1920 x	1080	@ 49.99	Hz	HDMI
F45	1920 x	1080	@ 60.00	Hz	HDMI
F46	2048 x	1080	@ 49.99	Hz	HDMI
F47	2048 x	1080	@ 50.00	Hz	HDMI

Legend

D: DVI EDID

H: HDMI EDID

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

9.5. 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	13-08-2012	Initial version	Zsolt Marko
1.1	15-12-2015	Safety instructions updated, CE page pulled out	Laszlo Zsedenyi
2.0	10-04-2017	Minor updates to Software Control (LDC) chapter, updated Firmware Upgrade and Troubleshooting chapters	Tamas Forgacs
2.1	15-05-2018	HDCP description corrected	Laszlo Zsedenyi
3.0	13-08-2018	New format introduced	Judit Barsony

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