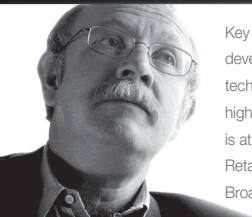


KD-X422POA

Power over HDBaseT/HDMI via CAT5e/6 Extenders,
Series XOA (Tx + Rx Set)

Operating Instructions



Key Digital®, led by digital video pioneer Mike Tsinberg, develops and manufactures high quality, cutting-edge technology solutions for virtually all applications where high-end video and control are important. Key Digital® is at the forefront of the video industry for Home Theater Retailers, Custom Installers, System Integrators, Broadcasters, Manufacturers, and Consumers.



Table of Contents

About KD-X422POA	1
Quick Setup Guide	3
Installation and Operation	3
Application Examples	4
Connections	6
Extending IR or RS-232 Control	8
Settings	12
LED Indicator Lights	15
RS-232 Commands	16
Specifications	19
Important Product Warnings:	20
Safety Instructions:	20
How to Contact Key Digital®	21
Warranty Information	21

Always follow the instructions provided in this Operating Manual.
Please check the Key Digital Website for the most up-to-date Manual.

About KD-X422POA

KD-X422POA HDBaseT/HDMI (Tx & Rx) Extenders with power over HDBaseT are an HDCP 2.2 compliant product that extend 4K/UHD 24/25/30 (4:4:4) and 4K/UHD 60 (4:2:0) signals up to 150 ft. using Key Digital® KD-CAT6STP1X Super CAT6A Shielded cable, or up to 125 ft. using a single third-party CAT5e/6 cable. 1080p/60, 1920x1200, 3D signals are extended up to 250 ft. via single Key Digital® KD-CAT6STP1X Super CAT6A shielded cable, or up to 230 ft. using a single third-party CAT5e/6 cable. In addition to HDMI video and audio signals, KD-X422POA carries IR and RS-232 signals for controlling remotely located equipment. Audio de-embed ports on the Tx unit enable external audio connectivity with audio distribution systems and amplifiers.

Key Features

- **HDBaseT via Single CAT5e/6 UTP/STP Extension:** With fully automatic adjustment of feedback, equalization, and amplification depending on cabling length
- **Power Over HDBaseT:** Features power extension from Tx to Rx with Power Over HDBaseT, Rx unit does not require power supply
- **Signal Extension:**
 - » Up to **150 ft. @ 4K** 24/25/30(4:4:4)/60(4:2:0) using KD-CAT6STP1X cabling
 - » Up to **125 ft. @ 4K** 24/25/30(4:4:4)/60(4:2:0) using third-party CAT5e/6 UTP/STP cabling
 - » Up to **250 ft. @ 1080p** / 1920x1200 using KD-CAT6STP1X cabling
 - » Up to **230 ft. @ 1080p** / 1920x1200 using third-party CAT5e/6 UTP/STP cabling
- **HDCP 2.2:** Compliancy up to HDCP 2.2 and backward compliant
- **HDR10 (High Dynamic Range):** More life-like images through a greater range of luminance levels
- **4K/Ultra HD Resolution:** Support for 4096x2160 or 3840x2160 24/25/30Hz at 4:4:4/8 Bit or 60Hz at 4:2:0/8 Bit
- **Deep Color Support:** Up to UHD/4K 30Hz 4:2:2/12 bits or 60Hz 4:2:0/8 bit

- **HDMI® and HDCP Licensing:** Fully licensed and compatible with HDCP 2.2 and HDMI latest technology such as 4K/UHD 4:2:0/8bit at 60f/s
- **EDID Control:** Internal library features 15 default EDID configurations and native EDID data from Output/Display devices connected via Rx
- **Hot Plug Detection Control:** Enables integrator to choose if active signal voltage is forced to connected input devices
- **Full Buffer System™:** Manages TMDS re-clocking / signal re-generation, HDCP authentication with source & display, EDID Control handshake, and Hot Plug control
- **Low Profile:** Super slim chassis design
- **IR Sensor:** Sensor powering via +5V on Rx unit's IR In port collects line-of-sight IR from remote(s) without external IR connecting block
- **Up/Down IR:** Two channels of IR enable control to/from devices connected to Tx and Rx units
- **RS-232:** Bi-Directional control to/from Tx and Rx unit on Phoenix connector
- **Rotary Switch RS-232 Control Mode:** Provides control of Tx unit as well as connectivity status
- **3D:** Support for standard 3D stereoscopic signal formats
- **Lossless compressed digital audio:** Support for Dolby® TrueHD, Dolby® Digital Plus, Dolby Atmos®, and DTS-HD Master Audio™
- **CEC Support:** For inter-device control between input and output HDMI channel
- **I2C Communication:** EDID and HDCP authentication to Display and Source
- **Control System Support:** Fully controllable by all RS-232 supported control systems via open API: Compass Control®, AMX®, Crestron®, KNX®, RTI®, Savant, URC®, Leviton® etc.

Accessories

- (1) 12V 2A DC Power Supply (Screw-In Type), (1) Mounting Bracket, (1) IR Emitter, (1) IR Sensor
- **Only requires power on the Tx unit, which extends power to the Rx unit**

Quick Setup Guide

- Step 1:** Find a safe and convenient location to mount or place units
- Step 2:** Begin with the Tx, Rx units and all input/output devices turned off with power cables removed
- Step 3:** Connect HDMI source to the input port of the Tx unit
- Step 4:** Connect HDMI display to the output port of Rx unit
- Step 5:** Connect CAT5e/6 cabling to Tx and Rx units. Use 568-B standard termination on both ends.
- Step 6:** If controlling external devices, connect IR emitter and sensor, and RS-232 cabling as needed
- Step 7:** **BEFORE** connecting power supply to power outlet, screw-in power supply on Tx unit.
- Step 8:** **AFTER** all connections are made, plug-in power supply to power outlet
- Step 9:** Power on input/output devices

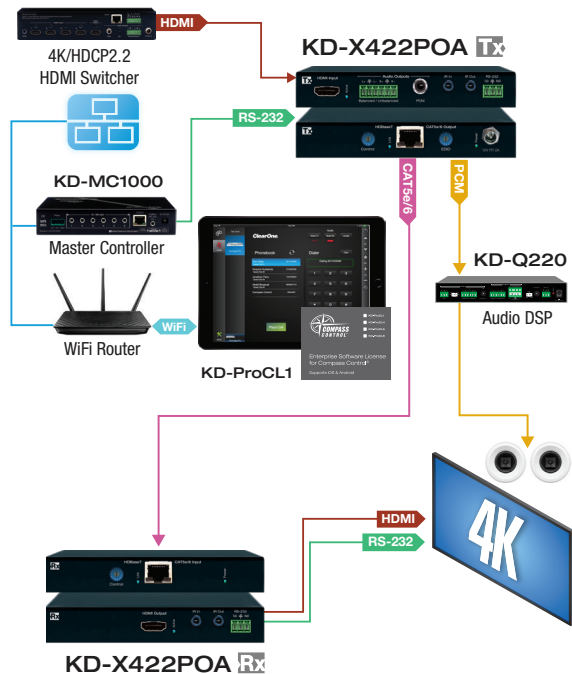
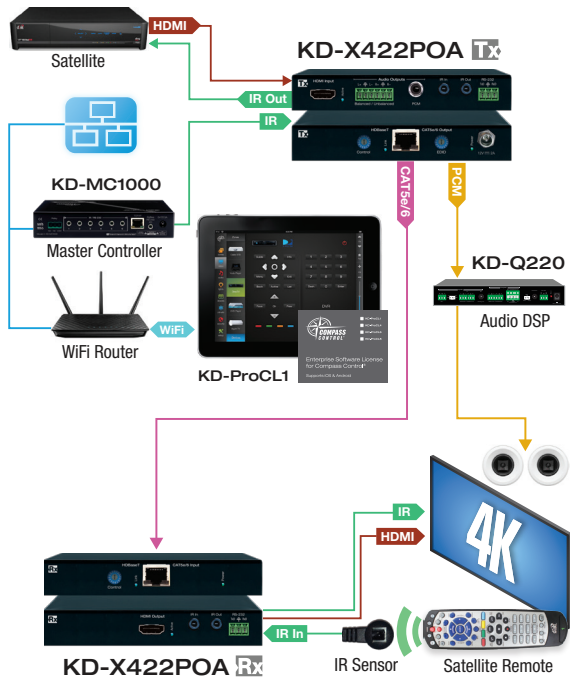
Installation and Operation

Before permanently securing the unit for final installation, test for proper operation of the unit and cables in your system. It is recommended that you leave enough ventilation space to provide sufficient airflow and cooling.



You MUST use the Power Supply provided with your unit or you VOID the Key Digital® Warranty and risk damage to your unit and associated equipment.

Application Example



Connections

Before making any connections, power off your source and display devices.

Tx Unit:

→ Using a HDMI cable, connect your source device to the HDMI port labeled "HDMI Input". For DVI-D/DVI-I sources, use appropriate adapters. For Display Port, use active converters.



→ Connect the CAT5e/6 or STP cable that connects to the Rx Unit at the port labeled "CAT5e/6 Output".



→ Make IR In and Out connections to receive (IR In port) or send (IR Out port) control signals. Refer to the "Extending IR & RS-232 Control" for more information.



→ Connect a stripped wire to DB9 adapter cable for bi-directional RS-232 control. Refer to the "Extending IR or RS-232 Control" and the "RS-232 Commands" section for more information.



→ De-embedded audio from the source is output in analog format on the L/R balanced/unbalanced phoenix connector. PCM coaxial digital audio is output on the RCA connector.

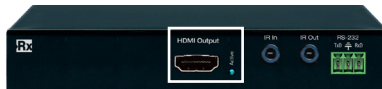


→ Connect 12V 2A DC Power Supply (Screw-In Type).



Rx Unit:

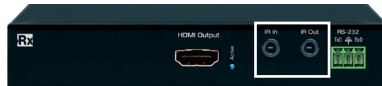
→ Using a short HDMI cable, connect your output / display device to the HDMI port labeled "HDMI Output".



→ Connect the CAT5e/6 cable at the port labeled "CAT5e/6 Input".



→ If you are sending or receiving IR, connect included IR Sensor and/or IR Emitter



- If you are transmitting or receiving RS-232, connect to the IR out (RS-232) port using a 3-wire pigtail to DB9 adapter



- After all the connections are made, FIRST connect power to the Tx unit using the included power supplies and then power up your source and display equipment.

Audio De-Embedding Outputs

Balanced/Unbalanced L/R Audio Output (Phoenix Connectors):

- Provides de-embedded 2ch analog audio output from HDMI input source

Digital Audio Output (Digital Coaxial RCA):

- Provides de-embedded Digital Audio Output from HDMI input



Notes:

- There are no volume or tone control features
- There are no DSP features. I.e., in order to achieve 2ch analog audio output, the HDMI input source audio format must be 2ch
- External audio connectors may be set off via RS-232. See the RS-232 Commands section for more information.

Audio Input Signal Format	Analog L/R Output	Digital Audio Output
2CH PCM	Pass-through	Pass-through
Multi-Channel PCM	MUTE	MUTE
DOLBY/DTS	MUTE	Pass-through
HD Audio	MUTE	MUTE

Extending IR or RS-232 Control

RS-232:

Bi-directional RS-232 is achieved utilizing the 3-pin phoenix RS-232 port. The pinout is the same on the Tx and Rx units. Three RS-232 functionality modes are selectable using the Control rotary.

→ RS-232 Pass-through Mode

- » Send and receive (bi-directional) RS-232 commands for controlling remote equipment. Supports baud rate up to 115,200bps.

→ Control Mode

- » Provides control of Tx units as well as connectivity status
- » See RS-232 Commands section for more information

→ Firmware Upgrade Mode


- » Two different types of firmware may be updated: MCU, and HDBaseT

RS-232 Cabling


RS-232 cables are available through Key Digital and other wire suppliers, and can also be fabricated by skilled technicians.

Key Digital RS-232 Cable Pinout Charts

Model	Wire	DB9 Pin	Signal
KD-3.5FDB96 3.5mm Stereo to Female DB9 (sold separately)	Red	2	TxD
	White	3	RxD
	Black	5	Ground
	Green	N/C	NA




KD-3.5FDB96 with 3.5mm TRS Connector




KD-3.5FDB96 after stripping wire

Model	Wire	DB9 Pin	Signal
KD-3.5MDB96 3.5mm Stereo to Male DB9 (sold separately)	Red	2	TxD
	Black	3	RxD
	Shield	5	Ground



KD-3.5MDB96 with 3.5mm TRS Connector



KD-3.5MDB96 after stripping wire

IR

Bi-directional IR control extension is supported.

- » "IR In" port on the Tx unit extends to the "IR Out" port of the Rx unit
- » "IR In" port on the Rx unit extends to the "IR Out" port of the Tx unit

→ **IR In:** The IR In port is different for the Tx and Rx units. The Tx unit's IR In port supports a Serial IR (hardwired) connection. The Rx unit's IR In port supports an IR Sensor.

» **Tx Unit / Serial IR:**

- » A fixed 5V input signal with a 3.5mm mini jack
- » IR signal on the tip. Mono or stereo 3.5mm mini jacks are supported, with the ring open / having no contact.
- » Typically fed from a dedicated control system or an IR distribution block

» **Rx Unit / IR Sensor:**

- » IR Sensors can be connected directly into the Rx unit's IR In port, without the need for an external IR distribution block
- » IR signal on the Tip, with 5V powering of the IR sensor on the Ring.

IR In	Tip	Ring	Sleeve	Typical 3.5mm Connector-type
Serial IR (Tx)	IR In	N/C	Ground	Mono
IR Sensor (Rx)	IR In	5V	Ground	Stereo

→ **IR Out:**

- » Pass-through from signal of corresponding IR In port, as determined by the position of the Control Rotary
- » Driving power: 5V with 32mA minimum current
- » Typically connected with an IR emitter

IR Out	Tip	Ring	Sleeve	Control Rotary Position
Serial IR	IR Out	N/C	Ground	Any

IR Cabling

Your KD-X422POA includes an IR Sensor and an IR Emitter.

Signal acceptance: The IR Sensor receives signals from a 90° angle at up to 30 ft. away. It accepts a maximum IR burst frequency of 55kHz.

Only the included IR sensors are compatible with the KD-X422POA. Third-party IR Sensors may not be compatible..



The included IR Sensor.

Connects to the IR In port on the Rx unit



The included blinking-type IR Emitter.

Connects to the IR Out port on either the Tx or Rx unit

Settings

EDID Control

EDID authentication is provided from the KD-X422POA Tx unit to the connected input / source device. The EDID file (AKA "handshake") is selected using the EDID Control rotary on the Tx unit (located on the face of the Tx unit, beneath the decora plate) and provides a list of compatible video and audio formats as well as digital data, informing the source device what it should output. Most sources will comply with a new EDID file without a power-cycle, but each source may behave differently.

Default EDID Control Table, selected via EDID Control rotary

Position	EDID Description	EDID Control Rotary
0	Copy EDID from CAT5e/6 Output	
1	1080i, 2CH AUDIO	
2	1080i, DOLBY/DTS 5.1	
3	1080i, HD AUDIO	
4	1080p, 2CH AUDIO	
5	1080p, DOLBY/DTS 5.1	
6	1080p, HD AUDIO	
7	4Kx2K@30, 2CH AUDIO	
8	4Kx2K@30, DOLBY/DTS 5.1	
9	4Kx2K@30, HD AUDIO	
A	4Kx2K@60, 2CH AUDIO	
B	4Kx2K@60, DOLBY/DTS 5.1	
C	4Kx2K@60, HD AUDIO	
D	1280x720p@60 DVI (no audio)	
E	1920x1080@30 DVI (no audio)	
F	3840x2160p@30 DVI (no audio)	

Control Rotary



The Control rotary enables the integrator to choose the desired setting for RS-232 and Hot Plug Detection control.

The Control Rotary is located on the Tx unit.

IMPORTANT! Please apply light pressure to the Control rotary when making your selection

Control Rotary Position Assignments:

Position	RS-232 Mode	Hot Plug Detection Control
0	RS-232 Pass-Through	Bypass
1	RS-232 Pass-Through	Bypass
2	RS-232 Pass-Through	Forced HPD On
3	RS-232 Pass-Through	Forced HPD On
4	RS-232 Pass-Through	Bypass
5	RS-232 Pass-Through	Bypass
6	RS-232 Pass-Through	Forced HPD On
7	RS-232 Pass-Through	Forced HPD On
8	RS-232 Control	Bypass
9	RS-232 Control	Bypass
A	Firmware Upgrade for MCU	Forced HPD On
B	Firmware Upgrade for MCU	Forced HPD On
C	Firmware Upgrade for HDBaseT	Bypass
D	Firmware Upgrade for HDBaseT	Bypass
E	Firmware Upgrade for HDBaseT	Forced HPD On
F	Firmware Upgrade for HDBaseT	Forced HPD On

Forced Hot Plug Detection (HPD)

Hot Plug Detection (HPD) may be forced on the Tx Rx unit in order to provide connected devices with necessary voltage to inform the device that a partner (display) is connected and active. If the Control rotary is set to any HPD Bypass setting, HPD signals from the output to the input device will pass as normal. In cases of many layers of connectivity, HPD may be lost leading to no signal at the display. In those cases, fix the Control rotary to any Forced HPD setting.

Range and Resolution:

Distance performance is significantly increased when using Key Digital KD-CAT6STP1X Super CAT6/STP Cabling.

- Up to 150 ft. @ 4K 24/25/30(4:4:4)/60(4:2:0) using KD-CAT6STP1X cabling
- Up to 125 ft. @ 4K 24/25/30(4:4:4)/60(4:2:0) using third-party CAT5e/6 UTP/STP cabling
- Up to 250 ft. @ 1080p / 1920x1200 using KD-CAT6STP1X cabling
- Up to 200 ft. @ 1080p / 1920x1200 using third-party CAT5e/6 UTP/STP cabling



NOTE: Use shielded metal RJ45 connectors with soldered ground wires when terminating shielded CAT5e/6. Key Digital part: KD-RJ45SC (compatible with KD-CAT6STP1X and other third-party CAT6/STP)

LED Indicator Lights

Power:

- » **Color:** Green
- » Solid illumination during power on state, as provided by healthy connection with power supply.
- » Steady blink if power is not adequate and/or if there is a connectivity problem with the KD-X222PO Rx unit

HDMI Active:

- » **Color:** Blue
- » Tx Unit: Solid illumination from active signal (TMDS + HPD) reception from connected source device
- » Rx Unit: Solid illumination from active Hot Plug Detection voltage with connected display/output device
- » If Hot Plug Detection is forced on Tx or Rx unit, the respective HDMI Active light will illuminate solid regardless of HDMI signal from/to connected source/display.

HDBaseT Link:

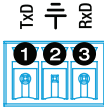
- » **Color:** Blue
- » Tx Unit: Solid illumination from active link with Rx unit
- » Rx Unit: Solid illumination from active link with Tx unit

RS-232 Commands

Connection protocol is as follows:

- Baud Rate = 57600 bits per second
- Data Bits = 8
- Stop Bits = 1
- Parity = None
- Flow Control = None
- Carriage Return: Required
- Line Feed: Required

Phoenix Terminal Connection Guide

Pin	Signal on Tx Unit	Corresponding Wire (Accessory)
	 <p>RS-232</p>	<p>Accessory not included. See Extending RS-232 and IR Control section for info on available Key Digital RS-232 cables.</p>
1	TxD	RxD / Pin 2 (Female DB9*) RxD / Pin 3 (Male DB9*)
2	Ground	Ground / Pin 5 (Female/Male DB9)
3	RxD	TxD / Pin 3 (Female DB9*) TxD / Pin 2 (Male DB9*)

Commands are not case-sensitive. Spaces shown below may be excluded.
Carriage return and line feed is required at the end of each string.

Status Command:

```
KD-X422POA > STA
```

```
-----
--                               Key Digital Systems  STATUS                               --
-----
--  KD-X422POA      System Address : 00          F/W Version : 1.00
--
--  RS232 : Baud Rate=57600bps, Data=8bit, Parity=None, Stop=1bit
--  Running Day : 000, Time : 00:03
--  HD-BaseT Mode : Normal      , Link = ON      , Auto Reset = ON
--
```

```
-- Video Input Status --
-- EDID = 00, PWR5V = ON , Link = ON , HDCP = 2.x, Video = HDMI --
--
-- CAT5e/6 Video Output Status --
-- DISP = SAM 2014, HPD = ON , HDCP = ON , DDC = GOOD, OUT = ON , HDMI--
```

Help Command:

```
KD-X422POA > H
```

```
-----
--                               Key Digital Systems  HELP                               --
-----
--  KD-X422POA      System Address : 00          F/W Version : 1.00
--
--  Azz             : All Commands may have Prefix System Address zz=[01-99] --
--  H               : Help --
--  STA            : Global Status --
--  SPCA xx        : Set System Address, xx = [00-99] (00=Single) --
--
-- Video I/O Setup Commands: --
-- SPO DBG ON/OFF : Set Output DGB ON/OFF --
-- SPO ON/OFF     : Set CAT5e/6 Output ON/OFF --
--
-- SPC ART ON/OFF : Set HD-BaseT Auto Reset ON/OFF --
-- SPC RSB z      : Set RS232 Baud Rate to z bps, z=[0-4] --
--                [0:57600, 1:38400, 2:19200, 3:9600, 4:4800] --
```

Specifications

Technical:

- Inputs Tx (Each): 1 HDMI, 1 IR In, 1 Bi-Directional RS-232
- Outputs Tx (Each): 1 CAT5e/6 UTP/STP, 1 IR Out, 1 Balanced/Unbalanced Audio, 1 PCM Audio
- Inputs Rx (Each): 1 CAT5e/6 UTP/STP, 1 IR In
- Outputs Rx (Each): 1 HDMI, 1 Bi-Directional RS-232
- DDC Signal (Data): Input DDC Signal: 5 Volts p-p (TTL)
- HDMI Video/Audio Signal: Input Video Signal: 1.2 Volts p-p
- HDMI Connector: Type A, 19 Pin Female
- RJ45 Connector: Shielded Link Connector, HDBaseT
- IR Connectors: 3.5 mm connectors
- RS-232 Connector: 3-pin phoenix terminal

General

- Regulation: CE, RoHS, WEEE
- Enclosure: Black Metal
- Product (Each): 5" x 4.06" x 1.06", Weight: 0.5 lbs
- Power (Tx Only): KD-PS12V2ASC, 12V/2A, 100-240VAC, 50-60Hz, Interchangeable head with screw-in connector
- Accessories: (2) Mounting brackets, (1) IR emitter, (1) IR sensor, (1) 6 pin terminal plug, (2) 3 pin terminal plug



Important Product Warnings:

1. Connect all cables before providing power to the unit.
2. Test for proper operation before securing unit behind walls or in hard to access spaces.
3. If installing the unit into wall or mounting bracket into sheet-rock, provide proper screw support with bolts or sheet-rock anchors.



Safety Instructions:

Please be sure to follow these instructions for safe operation of your unit.

1. Read and follow all instructions.
2. Heed all warnings.
3. Do not use this device near water.
4. Clean only with dry cloth.
5. Install in accordance with the manufacturer's instructions.
6. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
7. Only use attachments/accessories specified by the manufacturer.
8. Refer all servicing to qualified service personnel. Servicing is required when the device has been damaged in any way including:
 - » Damage to the power supply or power plug
 - » Exposure to rain or moisture



Power Supply Use:

You **MUST** use the Power Supply **provided** with your unit or you **VOID** the Key Digital® Warranty and risk damage to your unit and associated equipment.

How to Contact Key Digital®

Customer Support

For customer support questions please contact us at:

- Phone: 914-667-9700
- E-mail: customersupport@keydigital.com

Technical Support

For technical questions about using Key Digital® products, please contact us at:

- Phone: 914-667-9700
- E-mail: tech@keydigital.com

Repairs and Warranty Service

Should your product require warranty service or repair, please obtain a Key Digital® Return Material Authorization (RMA) number by contacting us at:

- Phone: 914-667-9700
- E-mail: rma@keydigital.com

Feedback

Please email any comments/questions about the manual to:

- E-mail: customersupport@keydigital.com

Warranty Information

All Key Digital® products are built to high manufacturing standards and should provide years of trouble-free operation. They are backed by a Key Digital Limited 3 Year Product Warranty Policy. <http://www.keydigital.com/warranty.htm>