

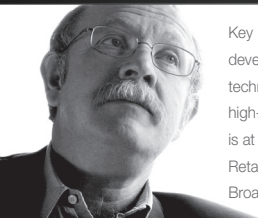
KD-X411ProK

HDBaseT/HDMI via Single CAT5e/6 (Tx+Rx Set) Extenders, with Audio De-embedding, EDID Control, Hot Plug Control, Full Buffer System, IR Sensor, Up/Down IR & RS-232, support Ultra HD/4K & HDCP2.2

KD-X411POHK

Power over HDBaseT/HDMI via Single CAT5e/6 (Tx+Rx Set) Extenders, with Audio De-embedding, EDID Control, Hot Plug Control, Full Buffer System, IR Sensor, Up/Down IR & RS-232, support Ultra HD/4K & HDCP2.2

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.



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Please read all instructions to insure safe operation of the product.

About KD-X411ProK/KD-X411POHK

KD-X411ProK/KD-X411POHK HDBaseT/HDMI (Tx & Rx) Extenders 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-X411ProK/POHK carries IR, RS-232 and TCP-IP 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
- **KD-X411POHK:** 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
- **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
- **Audio De-Embedding:** Audio from the HDMI input is de-embedded through the Coax digital (PCM) and/or Analog L/R audio output
- **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
- **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 3.5mm 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
- **Deep Color Support:** 12bit Deep Color video / 8bit color for 4K/UHD
- **Lossless compressed digital audio:** Support for Dolby® TrueHD, Dolby® Digital Plus and DTS-HD Master Audio™
- **CEC Support:** For inter-device control between main input and output HDMI channel
- **I2C Communication:** EDID and HDCP authentication to Display and Source
- **Control System Support:** Compatible with Compass Control®, AMX®, Control4®, Crestron®, RTI®, Savant, URC®, Leviton® etc.

KD-X411ProK Accessories

- (2) 5V 2A DC Power Supplies (Screw-In Type), (2) Mounting Brackets, (1) IR Emitter, (1) IR Sensor
- **KD-X411ProK requires power on both Tx and Rx units**

KD-X411POHK Accessories

- (1) 12V 2A DC Power Supply (Screw-In Type), (2) Mounting Brackets, (1) IR Emitter, (1) IR Sensor
- **KD-X411POHK 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 your KD-X411ProK/KD-X411POHK units
- Step 2:** Begin with the KD-X411ProK/KD-X411POHK Tx/Rx units and all input/output devices turned off with power cables removed
- Step 3:** Connect your HDMI source to the input port of your KD-X411ProK/KD-X411POHK Tx unit
- Step 4:** Connect your HDMI displays to the output port of your KD-X411ProK/KD-X411POHK Rx unit
- Step 5:** Connect KD-X411ProK/KD-X411POHK Tx unit to KD-X411ProK/KD-X411POHK Tx with CAT5e/6 cable
- Step 6:** Connect additional IR/RS-232 control connections and IR sensors
- Step 7: BEFORE connecting power supply to power outlet,** screw-in the power supply to the KD-X411ProK/KD-X411POHK Tx units and KD-X411ProK Rx unit
- Step 8: AFTER all connections are made, plug-in power supplies to power outlets**
- Step 9:** Power on input/output devices

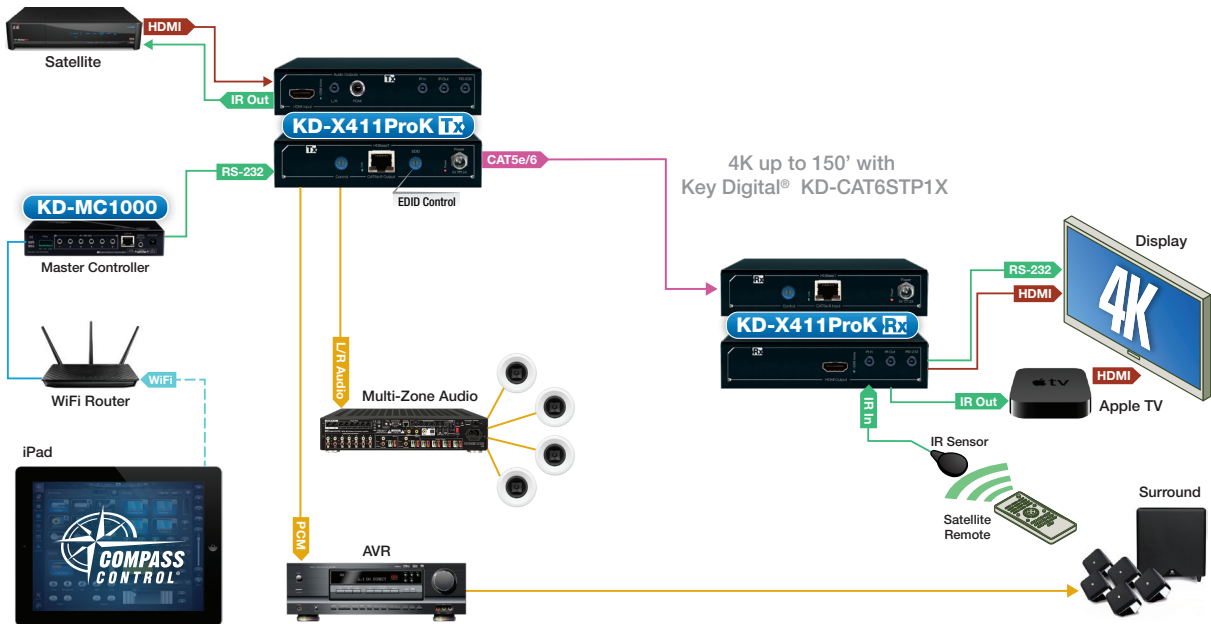
Installation and Operation

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

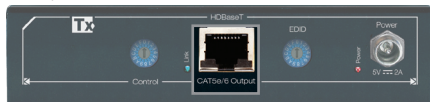
Before making any connections, power off your source and display devices.

Tx Unit:

- Using a short HDMI cable, connect your source device to the HDMI port labeled “HDMI Input”. To connect DVI or Display Port, use appropriate adapters.



- Connect the CAT5e/6 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 3.5mm Stereo 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.

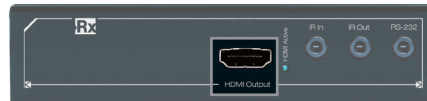


- Use the 3.5mm analog audio and/or PCM coaxial digital audio de-embd ports to integrate with audio distribution systems, amplifiers, or AV receivers.



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 RS-232 port



→ After all the connections are made, connect power to the Tx and Rx (KD-X411ProK only) using the included power supplies and then power up your source and display equipment.

Audio De-Embedding Outputs

Analog L/R Audio Output (3.5mm Stereo):

→ 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 RS-232 port on the Tx and Rx units. The connector is 3.5mm stereo and the pinout is the same on the Tx and Rx unit.

→ RS-232 Pass-through Mode

- » Send and receive (bi-directional) RS-232 commands for controlling remote equipment.

→ 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 (KD-X411ProK/KD-X411POHK units), and HDBaseT (extension over CAT5e/6)



RS-232 Cabling

3.5mm stereo to RS-232 adapter cables are available through Key Digital and other wire suppliers, and can also be fabricated by skilled technicians.



3.5mm stereo to Female DB9 connector (not included).

Key Digital part KD-3.5FDB96.

Typically used to connect to the COM port of the computer or master controller.



3.5mm stereo to Male DB9 connector
(not included).

Key Digital part KD-3.5MDB96.

Typically used to connect to the controlled device.

RS-232 Mode	Tip	Ring	Sleeve	Control Rotary
Pass-through	Tx	Rx	Ground	0-7
Control Mode	Tx	Rx	Ground	8, 9
F/W MCU	Tx	Rx	Ground	A, B
F/W HDBaseT	Tx	Rx	Ground	C, D, E, F

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-X400ProK/KD-X400POHK 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-X411ProK/KD-X411POHK. Third-party IR Sensors may not work with KD-X411ProK/KD-X411POHK



The included IR Sensor.

The 3.5mm connector is **stereo** and it connects to the **IR In** port of the Rx unit.



The included blinking-type IR Emitter.

The 3.5mm connector is **mono** and it connects to the **IR Out** port of the Tx or Rx unit.

The sleeve of the 3.5mm Male connector must have good physical contact with 3.5 mm Female input/output on the KD-X411ProK/POHK.



Some 3.5mm Male plugs feature a plastic sleeve that extends longer than an average sleeve. This may cause poor grounding contact. See the example on the left.

Settings

EDID Control

EDID authentication is provided from the KD-X411ProK/KD-X411POHK Tx unit to the connected input / source device. The EDID file (AKA "handshake") is selected using the EDID Control rotary on the Tx unit 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. Adjustments

Default EDID Control Table

0	Copy EDID from CAT5e/6 Output	A	4Kx2K@60, 2CH AUDIO
1	1080i, 2CH AUDIO	B	4Kx2K@60, DOLBY/DTS 5.1
2	1080i, DOLBY/DTS 5.1	C	4Kx2K@60, HD AUDIO
3	1080i, HD AUDIO	D	1280x720p@60 DVI (no audio)
4	1080p, 2CH AUDIO	E	1920x1080p@60 DVI (no audio)
5	1080p, DOLBY/DTS 5.1	F	1080p, 2CH AUDIO

6	1080p, HD AUDIO	 Rotary EDID Switch:
7	4Kx2K@30, 2CH AUDIO	
8	4Kx2K@30, DOLBY/DTS 5.1	
9	4Kx2K@30, HD AUDIO	

Control Rotary



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

In many settings, the Control rotary setting may not match on the Tx and Rx units.

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	Pass-Through	Bypass
1	Pass-Through	Bypass
2	Pass-Through	Forced HPD On
3	Pass-Through	Forced HPD On
4	Pass-Through	Bypass
5	Pass-Through	Bypass
6	Pass-Through	Forced HPD On
7	Pass-Through	Forced HPD On

8	Control Mode	Bypass
9	Control Mode	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-X411ProK/ KD-X411POH Rx unit

HDMI Active (HDMI Input/Output):

- » **Color:** Blue
- » Tx Unit: Solid illumination from active signal (HDMI TMDS) 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 to input device from Tx unit, the HDMI Active light will illuminate solid regardless of HDMI signal from connected device.

CAT5e/6 Input/Output:

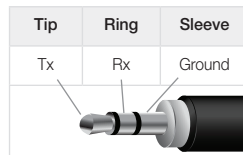
- » **Color:** Blue
- » Tx Unit: Solid illumination from active link and Hot Plug Detection voltage from Rx unit
- » Rx Unit: Solid illumination from active link with Tx unit

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

RS-232 Pinout:



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

Commands:

KD-X411ProK> H

```
-----
--                               Key Digital Systems  HELP                               --
-----
--  KD-X411ProK      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                                --
--                                                     --
--  Audio Output Setup Commands: [E=Enable, D=Disable]                       --
--  SPO AA E/D   : Enable/Disable External Analog Audio Output              --
--  SPO DA E/D   : Enable/Disable External Digital Audio Output             --
--                                                     --
--  SPC RSB z    : Set RS232 Baud Rate to z bps, z=[0-4]                    --
--                [0:57600, 1:38400, 2:19200, 3:9600, 4:4800]                --
-----
```

Status:

KD-X411ProK> STA

```

-----
--                               Key Digital Systems  STATUS                               --
-----
--  KD-X411ProK      System Address : 00          F/W Version : 1.00  --
--  RS232 : Baud Rate=57600bps, Data=8bit, Parity=None, Stop=1bit    --
--  Running Day : 000, Time : 00:01                                  --
--  HD-BaseT Mode : Normal, Link = ON                                --
--                                                           --
--  Video/Audio Input Status                                       --
--  EDID = 04, PWR5V = ON , Link = ON , HDCP = 1.x , Video = HDMI1.x --
--  AUDIO = PCM, 2.0CH, 48kHz, 24bit                               --
--                                                           --
--  HD-BaseT Video Output Status                                    --
--  DISP = SAM 2014, HPD = ON , HDCP = 1.x , DDC = GOOD, OUT = ON , HDMI--
-----

```

SpecificationsTechnical:

- 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 Analog Audio, 1 Digital 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 stereo mini jack
- RS-232 Connector: 3.5 mm stereo mini jack

General

- Regulation: CE, RoHS, WEEE
- Enclosure: Black Metal
- Product (Each): 5" x 4.06" x 1.06", Weight: 0.5 lbs
- KD-X411ProK Power: (2) KD-PS5V2ASC, 5V/2A, 100-240VAC, 50-60Hz, Interchangeable head with screw-in connector
- KD-X411POHK 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



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®

System Design Group (SDG)

For system design questions please contact us at:

→ Phone: 914-667-9700

→ E-mail: sdg@keydigital.com

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 10 Year Product Warranty Policy. <http://www.keydigital.com/warranty.htm>

