

User Manual

AC-EXO-444-KIT

Fiber Optic Extender with 4K60 4:4:4 support and 18Gbps HDR. ARC, IR, RS232, EDID Management and Test Patterns



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This is AVProEdge's flagship Fiber Optic Extender, allowing the user to extend an HDMI signal 2 kilometers via single-mode fiber, and up to 300 meters using multi-mode fiber. You can go even further by installing your own SFP port. It solves problems for both commercial and residential markets for distributing high value 4K 18Gbps content from rack to display. These extenders go the distance, no need to find power and cascade extenders for ultra long runs. Additionally AC-EXO-444 offers solutions for 18Gbps distribution in residential, digital entertainment centers, retail stores, AV events that require reliable and long distance distribution, suitable for Data Center, Control Rooms, Conference Rooms, Schools and Corporate Training environment.

Key benefits of using AC-EXO-444:

Extend 4K 60 4:4:4 and HDR Signals: Distance is no longer an obstacle.

Down Scaling: The AC-EXO-444 has a scaling circuit built into the transmitter. The scaler can scale 4K (and HDR) --> 1080P. A common application for this is when you have a 4K distribution and you have one or two displays that are older.

Total EDID Management: The AC-EXO-444 has robust EDID control. EDID management allows you to manage the input device and request specific video resolutions and/or audio codecs.

On Board Troubleshooting: This unit allows you to generate a 1080P or 4K test pattern to identify external problems (source, repeater, displays, etc...).

Total ARC Management: With Total ARC (Audio Return Channel) Management you can route audio from local displays back to the rack or head end for further distribution in a distributed audio system. Use Toslink or HDMI to manage ARC.

Future Proof: Using Fiber Optic infrastructure is the only way to future proof an installation, now you can run fiber in confidence and use the AC-EXO-444 to deliver beyond 18Gbps to your customers!

IR & RS232 Management: IR & RS-232 are bidirectional and can control the sources from the sinks or vice versa. In addition you can use the I-PASS port to plug you Control System emitter ports directly into the IR (I-PASS) port on the transmitter (via mono 3.5mm cable).

■ Product Overview

■ Model Numbers:

- **AC-EXO-444-T** ~ Fiber Optic Transmitter w/ Audio Extraction, IR, RS-232, EDID, ARC, Test Patterns and Scaler
- **AC-EXO-444-R** ~ Fiber Optic Receiver w/ IR, RS-232, ARC, Test Patterns

**Note - 1000FT (300M) Multi-mode, LC SFP included for free.

■ Features

- HDMI 2.0(a/b)
- Beyond 18Gbps Bandwidth Support (Using ICT)
- Up to 4K60 4:4:4 Support
- Full HDR Support (HDR 10 & 12 Bit)
- HDR, HDR10+ and HLG Support
- Dolby Vision Support
- 4K --> 1080P Down-scaling for mixed systems
- EDID Management and EDID emulate
- 4K & HD Test Patterns built into Tx and Rx for troubleshooting
- Toslink Multichannel Audio Extraction
- ARC Support (Toslink or HDMI)
- HDCP 2.2 (and all earlier versions supported)
- CEC Pass Through
- 3D Support
- 300m (1000ft) on full 4K (Multi-mode OM3)
- 2km (1.25 Miles) on full 4K (Single-mode Fiber)
- HDCP 2.2 & Earlier
- Bi Directional IR Passthrough
- Bi Directional RS232 Transport
- I-Pass Feature for control system "pass-through"
- 3-20v protection circuit built in for safe IR transport
- LED Status, Link, Power indication lights
- Use single fiber optic cable (Multi-mode or Single-mode)
- Removable/changeable SFP for even longer distances
- Supports uncompressed PCM 2- Ch., LPCM 5.1 & 7.1, Dolby Digital, DTS, Dolby TrueHD, DTS HD-Master Audio, Atmos (On HDMI)
- ESD protection circuitry (Inputs & Outputs) to 7KV
- Can Cascade
- Single LC Connector Type

Notice

AVProEdge reserves all rights to make changes in the hardware, packaging and any accompanying documentation without prior written notice.

Warning

To reduce the risk of fire, electric shock or product damage:



1. Do not expose this device to rain, moisture, dripping or splashing and ensure that objects filled with liquids are not placed on or near the devices.



6. Clean this device with a dry cloth only.



2. Do not install or place this unit in a bookcase, built-in cabinet or in another confined space. Ensure the unit is well ventilated.



7. Unplug this device during lightning storms or when unused for long periods of time.



3. To prevent risk of electric shock or fire hazard due to overheating, do not obstruct the unit's ventilation openings with newspapers, tablecloths, curtains, and similar items.



8. Protect the power cord from being walked on or pinched particularly at plugs.



4. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.



9. Only use attachments / accessories specified by the manufacturer.



5. Do not place sources of naked flames, such as lighted candles, on the unit.



10. Refer all servicing to qualified service personnel.

■ What's Included

Whats in the box?

- AC-EXO-444-TX (Transmitter)
- AC-EXO-444-RX (Receiver)
- 2x 48V Power Supply
- 1 x IR Tx Unit
- 1 x IR Rx Unit
- Mounting Ears
- Operating Instructions

Fiber Basics:

Fiber Cable Types

- Single-mode - Typically used for "long hauls" - Typically used for long distance buried cable (ie. used by telecommunication companies for country-wide distribution) - Single-mode should be used in applications over 1000FT (300M).
- Multi-mode - Most common in pro/custom electronics. For shorter runs, up to 1000FT (300M). Multi-mode is used in residential/commercial applications for on premise infrastructure.

Ways to purchase fiber cable:

- Simplex - Means a single strain of fiber optic cable. Comes in a single jacket. Any grade/type can be simplex.
- Duplex - Means two strains of fiber optic cable. Comes in a dual, fused, jacket.
- 6-Strain - Six strains of fiber, comes in a single jacket, each individual fiber will be color coded.
- 12-Strain - Twelve strains of fiber, comes in a single jacket, each individual fiber will be color coded.

OM Grades

OM grades are for multi-mode fiber (OM translates to Optical Multi-mode) only. The grade is determined by the clarity of the glass. The differences are:

- OM1 - (Legacy Fiber) - 200MHz - Typically **ORANGE** jacket - is compatible with AC-EXO-444 up to 100M.
- OM2 - 500MHz - Typically **ORANGE** jacket - is compatible with AC-EXO-444 up to 150M.
- OM3 - (Most Common, Recommended) 2000MHz - Typically **AQUA** jacket - is compatible with AC-EXO-444 up to 300M.
- OM4 - 4700MHz - Typically **VIOLET**, but can be **AQUA** jacket - Is compatible with AC-EXO-444 up to

OS Grades

OS grades are for single-mode fiber (OS translates to Optical Single-mode) only. The grade is determined by the clarity of the glass. For Pro AV applications the grade is of little meaning - there are two grades (OS1, OS2) OS1 is considered "legacy". If you buy Single-mode today it will be OS2. The jacket color of single-mode fiber is **YELLOW**. The AC-EXO-444.

Connectors:

- LC (Lucent Connector) - Universal style, most common (used in networking). Can be terminated in the field, some connectors support more than one strain. AC-EXO-444 uses this connector type.
- SC (Square Connector) - Universal, can be terminated in the field. Single strain of fiber only.
- MPO (Multi-fiber Push-On) - Mechanically terminated, for large fiber clusters. Not field friendly.
- Other Types- many other "custom" styles exist, however since there is no consistency, it is not effective in the field and becomes a single use cable.

What is a SFP (Small Form-Factor Pluggable Transceiver)?

An SFP is a great benefit of using fiber. It is a module that allows the user to modify the connector type or quantity, maximum distance, and even the type of fiber used. by using devices with SFP's, you are increasing the life because you can modify the capabilities as needed in the field. SFP Modules are easily and inexpensively attainable.

AVProEdge STRONGLY recommends Cleerline SSF. It has proven to be the strongest, safest, and easiest to terminate in the field.

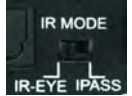
■ Specifications

Video:	
Video Resolutions	Up to 4K 60Hz 4:4:4
VESA Resolutions	Up to DCI 4K (4096x2160)
HDR Formats/Resolutions	420, 422, 444 (10 and 12 Deep Color) HDR10, HDR10+, HLG, Dolby Vision
Color Space	YUV (Component), RGB (CSC: Rec. 601, Rec. 709, BT2020, DCI, P3 D6500)
Chroma Subsampling	4:4:4, 4:2:2, 4:2:0 Supported
Deep Color	Up to 16 bit (1080), Up to 12 bit (4K)
Audio:	
Audio Formats Supported HDMI	PCM 2.0 Ch, LPCM 5.1 & 7.1, Dolby Digital, DTS 5.1, Dolby Digital Plus, Dolby TrueHD, DTS-HD Master Audio, DTS-X, Dolby Atmos
Audio Formats Supported Extracted: Transmitter (Toslink Out)	PCM 2.0 Ch, LPCM 6Ch & 7Ch, Dolby Digital, DTS 5.1, Dolby Digital Plus (No Downmixing) - Extract Local or ARC
Audio Formats Supported: Receiver (Toslink Input)	PCM 2.0 Ch, LPCM 6Ch & 7Ch, Dolby Digital, DTS 5.1, Dolby Digital Plus (No Downmixing) - Input for ARC
ARC (Audio Return Channel)	Via Toslink or HDMI
Fiber:	
Type	Multimode (OM3 Recommended) or Singlemode
Connector	LC (Lucent)
Recommend Fiber	Cleerline SSF
SFP (Small Form-factor Pluggable Transceiver)	Universal and changeable - 300m/2km is included
Distance:	
OM3 Multi-mode (Full 4K)	300M (1000 Feet)
Single-mode (Full 4K)	2KM (1.25 Miles)
HDMI Lead In/Out (up to 4K60 4:4:4)	Up to 50 Feet (Bullet Train HDMI)
HDMI Lead In/Out (w/ AOC Cable) (up to 4K60 4:4:4)	Up to 130 Feet (w/ Bullet Train AOC)
Other:	
Bandwidth	Beyond 18 Gbps
HDCP	HDCP 2.2 and Earlier
Ports:	
HDMI (Tx & RX)	Type A
Audio (extracted/embedded) (Tx & RX)	Toslink
IR Tx (Tx & RX)	3.5mm Mono (2 Conductor)
IR Rx (Tx & RX)	3.5mm Stereo (3 Conductor)
RS232 (Tx & RX)	3 pin terminal block
Power (Tx & Rx)	2 pin terminal block
Environmental:	
Operating Temperature	23 to 125°F (-5 to 51°C)
Storage Temperature	-4 to 140°F (-20 to 60°C)
Humidity Range	5-90% RH (No Condensation)
Power:	
Power Consumption (Total)	9 Watts Max Pair
Power Supply	Input: AC 100-240V ~ 50/60Hz Output: DC 48V .5A (Wall Version)
Dimensions:	
Dimensions (Single Unit Only, Tx or Rx are same) (Length/Width/Height) (Tx or Rx each alone)	mm: 131 x 85 x 21 inch: 5.15 x 3.34 x .82
Dimensions (Packaged Length/Width/Height) (Kit)	mm: 138 x 165 x 91 inch: 5.5 x 6.5 x 3.6
Weight (Unit) (Tx or Rx each alone)	1lbs (.13Kg)
Weight (Packaged)	5lbs (.90Kg)
*Specifications subject to change without notice. Mass & dimensions are approximate	

Functions & Setup of the Transmitter:

IR Mode Slide Switch: (On Front) This is used to select a preferred IR Mode - There are two modes:

- IR-EYE - The IR Input will be configured to operate with an IR Receiver Eye.
- I-PASS - The IR Input will be configured to safely operate with a direct connection from a control system using a mono or stereo 3.5mm cable. It's protected @ 3v-20v. Default mode is IR-EYE.



Using the Setting Button: (On Front) The setting button can be pressed in different combinations based on what is needed. The status light on the front will flash based on the selection. The selections are in series, meaning, for example, if you are on selection 5 (listed below), you can come back later and press it again to move you to 6, 7, 8, 1, 2, etc... Using an ink pen is best to press the button.

The SETTING BUTTON is located front of the transmitter next to the micro USB port. The indicator light is directly next to the button.

The SETTING BUTTON area looks like this:



EDID Management:

Quick press to select EDID

1. EDID BYPASS --- LED Flashes 1 Time (Default, from downstream device)
2. 1080P_2CH --- LED Flashes 2 Times
3. 1080P_8CH --- LED Flashes 3 Times
4. 4K60HzY420_3D_2CH --- LED Flashes 4 Times
5. 4K60HzY420_3D_8CH --- LED Flashes 5 Times
6. 4K60Hz_3D_2CH_HDR --- LED Flashes 6 Times
7. 4K60Hz_3D_8CH_HDR --- LED Flashes 7 Times
8. USER EDID --- LED Flashes 8 Times

While in the USER EDID state (8), press and hold the setting button (for 4 seconds) in order to copy the EDID from the connected display or downstream device to the user EDID and it will apply automatically.

Why do this?

This is commonly used when there is a need for a specific, known EDID that the installer may prefer. It can also be used if you want to bypass an EDID of an AVR or another connected device. (IE, plug the extender kit directly into a display and COPY the EDID. Plug it back into an AVR that may not have a current/good EDID).

Scaler Setting:

While in ANY state besides the USER EDID state, press and hold the setting button (for 4 seconds) to toggle the scaler mode. The options are:

1. Normal Mode(ICT Mode) --- LED Flashes 1 Time
2. Down Scaler Mode (4K->2K) --- LED Flashes 2 Times

Functions & Setup of the Transmitter Cont.:

Test Pattern Generator:

Press and hold the setting button (for 4 seconds) while powering up the transmitter. You should see the color bar pattern to the right on screen. When in this mode, you can quick press to toggle the resolution.

Quick press the setting button---Select the test pattern timing.

- 1080P --- LED Flashes 1 Time (3 sets of color bars)
- 4K --- LED Flashes 2 Times (5 sets of color bars)



This can be useful for checking your cabling and for troubleshooting. You can also ensure you have sufficient distance based on the resolution as well.

Using the "Extract From" Button: (On Front)

This function allows you to select where the Toslink audio output gets its signal. There are two options:

- Extract from HDMI - The **RED** light will be on. Audio will be extracted from the local HDMI input plugged into the transmitter. The supported formats are 2CH PCM, 6CH/7CH LPCM, DTS 5.1, Dolby Digital, Dolby Digital Plus. No down-mix, pass through only. Please see the AC-ADM-COTO for down-mixing.
- Extract From ARC (Audio Return Channel) - The RED light will be off. In this mode the audio will come the audio input on the receiver unit, the receiver can be set to HDMI ARC or Toslink (see the receiver section of the manual for more). The supported formats are 2CH PCM, 6CH/7CH LPCM, DTS 5.1, Dolby Digital, Dolby Digital Plus. No down-mix, pass through only. Please see the AC-ADM-COTO for down-mixing.
- NOTE: When "ARC" is selected on both Tx and Rx the HDMI ARC is open for appropriate devices. ie, you can plug into an AVR with ARC and a TV with ARC and get support via the HDMI Cable.

The button looks like this:

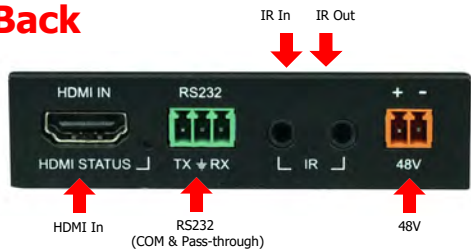


ARC Diagram:

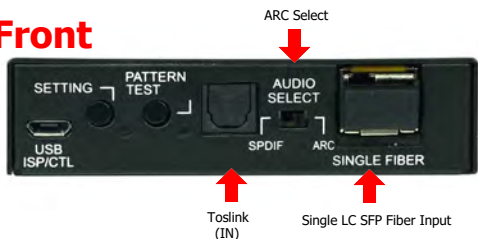
■ The Receiver



Back



Front



Indicator Troubleshooting Lights on the Receiver:

POWER - On the front (Setting Light): (Red) the setting light doubles as the POWER indicator. This is an indicator that the power is connected. There are only two states for light:

- Light Is On = Power supply is connected and functioning.
- Light Is Off = Power supply is not connected or there is no power present. (In order to have power: check the power supply, USP, Outlet, etc...)

HDMI STATUS - On the back (By HDMI Port): (Red) This indicator shows that the HDMI Sink is connected. The states are:

- Light Is On (Solid) = Sync w/ HDMI sink is correct and solid.
- Light Is Flashing = The light flashes during the sync process. If it is flashing continuously, you may still have a picture, but it is indicating that the Rx is correcting a BE (Bit Error) to make the picture show on the display.
- Light Is Off = HDMI is not communicating - Please check the cables.

If the **RED HDMI SIGNAL STATUS LIGHT** is flashing or off AND you have no picture, check the following:

1. The source. Plug it directly into the display to be sure it's functioning properly.
2. Try a longer HDMI cable. Some HDMI cables do not sync well at shorter lengths.
3. Try Cascade Mode (See below).
4. If these suggestions do not work, enable the "Test Pattern" (See Below). If you see the pattern, the problem is between the Receiver and display/sink please try a different sink input or HDMI cable.
5. Contact AVProEdge if these suggestions do not work.

Functions & Setup of the Receiver:

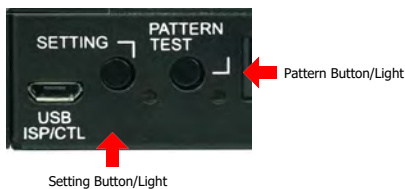
Audio Select Slide Switch: (On Front) This is used to select where ARC will come from - There are two modes:

- ARC (Default) - The audio sent back to the transmitter will be from the HDMI Audio Return Channel. The supported formats are 2CH PCM, 6CH/7CH LPCM, DTS 5.1, Dolby Digital, Dolby Digital Plus. No down-mix, pass through only. Please see the AC-ADM-COTO for down-mixing.
 - In this mode the SPDIF Input is inactive.
 - To use ARC via HDMI, make sure ARC is enabled on AVR and Display properly.
 - The SPDIF Out on the transmitter will be active for up to DD+
 - Dolby Atmos can pass over HDMI ARC
- SPDIF (Recommended) - The audio sent back to the transmitter will be from the SPDIF input. The supported formats are 2CH PCM, 6CH/7CH LPCM, DTS 5.1, Dolby Digital, Dolby Digital Plus. No down-mix, pass through only. Please see the AC-ADM-COTO for down-mixing.
 - NOTE - On the Tx, you can retrieve the signal from HDMI or SPDIF Toslink



Using the Setting Button: (On Front) The setting button can be pressed when the "Pattern" is enabled to toggle between 1080P and 4K Test Patterns.

The SETTING BUTTON is located front of the transmitter next to the micro USB port. The indicator light is directly next to the button.



Cascade Mode

This mode forces hot plug, which is useful when "daisy-chaining" extenders. It is also helpful for troubleshooting if there are sync problems with devices.

To set this mode press and hold the setting button (for 4 seconds):

- Disable --- Power LED Flashes 1 Time
- Enable --- Power LED Flashes 2 Times

Test Pattern Generator:

Press "Pattern" button on the receiver to enter pattern mode. The light will turn RED when enabled. The color bar pattern, as seen to the right will appear. When in this mode, you can short press "Setting" to toggle the resolution.

Quick press "Setting Button"---Select the test pattern timing

- 1080P --- LED Flashes 1 Time (3 Sets of color bars)
- 4K --- LED Flashes 2 Time (5 sets of color bars)

This is useful for checking cabling and for troubleshooting. It will check the link between the Rx and the display/sink.

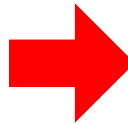


■ RS-232 Configuration

RS-232 can be used to pass control signals bi-directionally to & from any RS-232 compatible device. This is commonly used to route control signals in the following way:

1. Control System --> Display/Projector (ie, Power On/Off)
2. Display/Projector --> Control System (ie, Display Status, Volume Status etc...)
3. When ultra long-range serial communication is needed (think concerts, live events). Use the extender.

The unit comes with 3 pin connectors to allow for any wire an integrator would like. The pin out configuration Left=TX, Center=Ground, Right=RX and looks like this:



This is how the cable should look. If using the AC-CABLE-3.5-DB9F (Female) or AC-CABLE-3.5-DB9M (Male), the colors will be the same. With any other cable, please follow Tx, G, Rx as shown to the right. A RS-232 cable preparation diagram is on the next page.



■ RS-232 Cable Prep

RS-232 CABLE FOR AVPRO EDGE

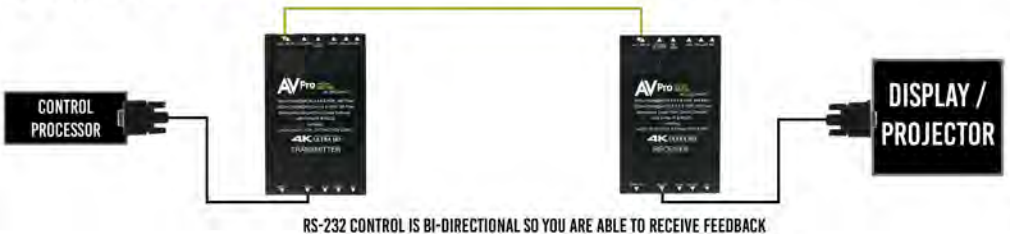
IN ORDER TO CONNECT YOUR COMPUTER TO THE SWITCH BY RS-232 YOU NEED TO MAKE YOUR OWN CABLE WITH ONE END A PHOENIX CONNECTOR AND THE OTHER END A RS-232 PORT. YOUR COMPUTER DOESN'T HAVE A RS-232 INPUT, GET A USB CONVERTER (AS SHOWN BELOW), AND PLUG THE USB END TO ANY COMPUTER



■ RS-232 Sample Application



RS-232 CONTROL



■ IR Configuration

IR can be used in three ways:

1. **From Rack (Control System Direct):** Plug a MONO 3.5mm cable into an emitter port of any control system directly into the "IR IN" port on the AC-EXO-444 Transmitter to pass IR signals directly to the remote end.
NOTE - Be sure the IR MODE Slide Switch is set to "I-PASS" on the Transmitter
2. **From Rack (Using IR-EYE):** Plug an IR-Receiver Eye into the "IR IN" of the AC-EXO-444 Transmitter in order to pass infrared signals generated from a device or IR Remote. NOTE - Be sure the IR MODE Slide Switch is set to "IR-EYE" on the Transmitter.
3. **From Remote End:** Use an IR-Receiver Eye on the AC-EXO-444 Receiver (IR In Port) in order to send IR signals BACK to the rack and out of the TRANSMITTER IR Out Port with an emitter.



I-PASS IR CONTROL

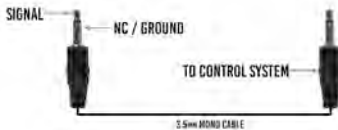


444 EXTENDER IR CONTROL

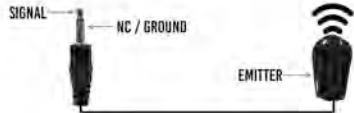


■ IR Connections to AC-EXO-444-T (Transmitter)

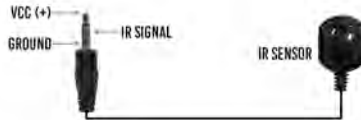
IR IN Direct Connect (I-PASS)



IR OUT Emitter (Non-Flashing)



IR IN w/ Receiver Eye ("IR-EYE" MODE)

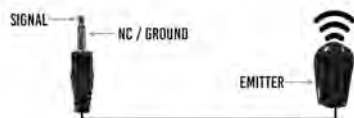


■ IR Connections to AC-EXO-444-R (Receiver)

IR IN (IR-EYE Only)

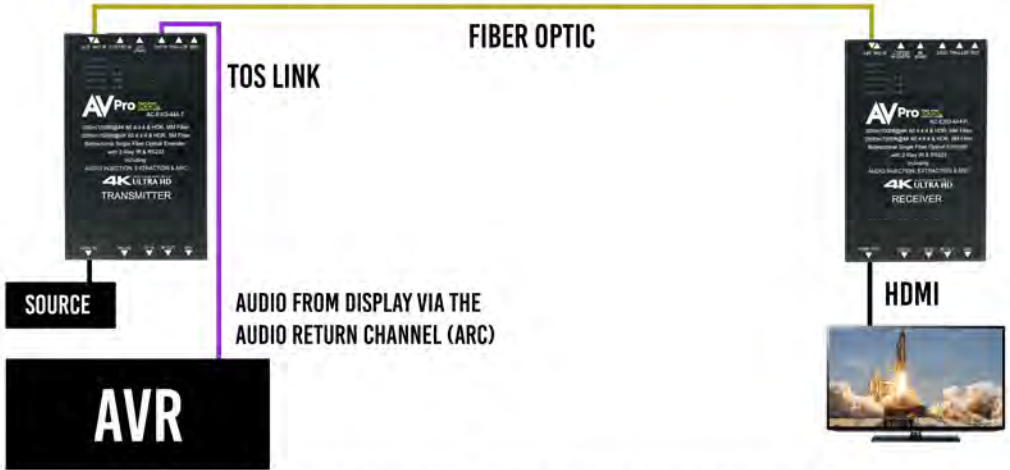


IR OUT Emitter (Non-Flashing)



■ ARC Functional Diagrams:

AUDIO RETURN CHANNEL APPLICATION



DELIVER AUDIO FROM THE DISPLAY INTO YOUR AVR OR AUDIO DISTRIBUTION SYSTEM

▪ **Maintenance**

To ensure reliable operation of this product as well as protecting the safety of any person using or handling this device while powered, please observe the following instructions.

- Use the power supplies provided. If an alternate supply is required, check voltage, polarity and that it has sufficient power to supply the device it is connected to.
- Do not operate these products outside the specified temperature and humidity range given in the above specifications.
- Ensure there is adequate ventilation to allow this product to operate efficiently.
- Repair of the equipment should only be carried out by qualified professionals as these products contain sensitive components that may be damaged by any mistreatment.
- Only use this product in a dry environment. Do not allow any liquids or harmful chemicals to come into contact with these products.
- Clean this unit with a soft, dry cloth. Never use alcohol, paint thinner or benzene to clean this unit.

▪ **Damage Requiring Service**

The unit should be serviced by qualified service personnel if:

- The DC power supply cord or AC adaptor has been damaged
- Objects or liquids have gotten into the unit
- The unit has been exposed to rain
- The unit does not operate normally or exhibits a marked change in performance
- The unit has been dropped or the housing damaged

▪ Support

Should you experience any problems while using this product, first, refer to the Troubleshooting section of this manual before contacting Technical Support.

When calling, the following information should be provided:

- Product name and model number
- Product serial number
- Details of the issue and any conditions under which the issue is occurring

▪ Warranty

If your product does not work properly because of a defect in materials or workmanship, AVProEdge (referred to as “the warrantor”) will, for the length of the period indicated as below, (Parts/Labor (10) Years), which starts with the date of original purchase (“Limited Warranty period”), at its option either (a) repair your product with new or refurbished parts, or (b) replace it with a new or a refurbished product. The decision to repair or replace will be made by the warrantor. During the “Labor” Limited Warranty period there will be no charge for labor. During the “Parts” warranty period, there will be no charge for parts. You must mail-in your product during the warranty period. This Limited Warranty is extended only to the original purchaser and only covers product purchased as new. A purchase receipt or other proof of original purchase date is required for Limited Warranty service.

This warranty extends to products purchased directly from AVPro or an authorized dealer. AVPro is not liable to honor this warranty if the product has been used in any application other than that for which it was intended, has been subjected to misuse, accidental damage, modification or improper installation procedures, unauthorized repairs or is outside of the warranty period. Please direct any questions or issues you may have to your local dealer before contacting AVPro.

Thank you for choosing AVProEdge!

Please contact us with any questions. We are happy to be of service!



AVProEdge
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support@avproedge.com