

**Kramer Electronics, Ltd.**



# **USER MANUAL**

**Model:**

**TP-576**

*HDMI CAT5 Line Driver*

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## 1 Introduction

Welcome to Kramer Electronics! Since 1981, Kramer Electronics has been providing a world of unique, creative, and affordable solutions to the vast range of problems that confront the video, audio, presentation, and broadcasting professional on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better! Our 1,000-plus different models now appear in 11 groups<sup>1</sup> that are clearly defined by function.

Congratulations on purchasing your Kramer MegaTOOLS® **TP-576 HDMI / CAT5 Line Driver** which is ideal for:

- Home theater, presentation and multimedia applications
- Rental and staging


The package includes the following:

- **TP-576**
- Power supply (12V DC)
- This user manual<sup>2</sup>
- Bracket installation kit

## 2 Getting Started

We recommend that you:

- Unpack the equipment carefully and save the original box and packaging materials for possible future shipment
- Review the contents of this user manual
- Use Kramer high-performance high-resolution cables<sup>3</sup>

	<p>You must use shielded Twisted Pair (STP) cabling with the TP-576, (refer to section <a href="#">3.1</a> for further details).</p>
<p><b>Note:</b></p>	

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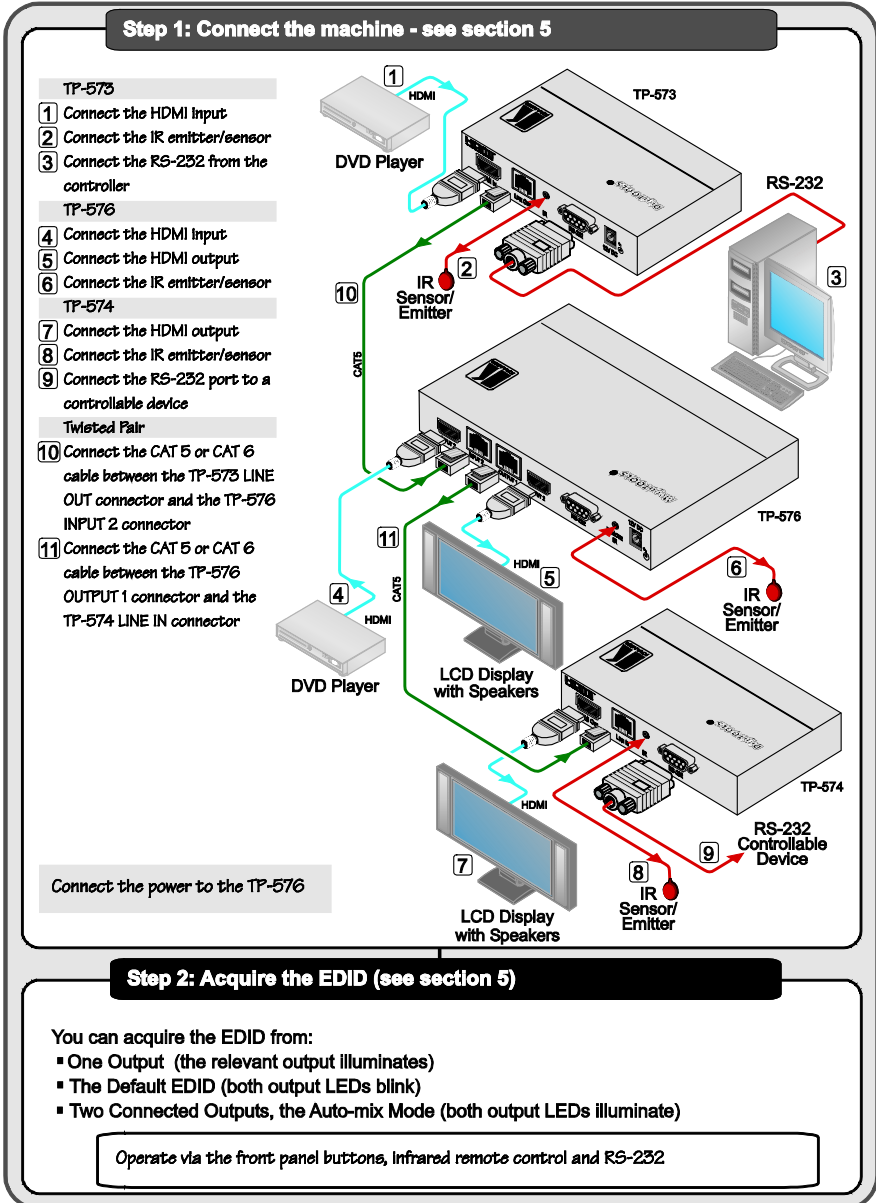
1 GROUP 1: Distribution Amplifiers; GROUP 2: Switchers and Matrix Switchers; GROUP 3: Control Systems; GROUP 4: Format/Standards Converters; GROUP 5: Range Extenders and Repeaters; GROUP 6: Specialty AV Products; GROUP 7: Scan Converters and Scalers; GROUP 8: Cables and Connectors; GROUP 9: Room Connectivity; GROUP 10: Accessories and Rack Adapters; GROUP 11: Sierra Products

2 Download up-to-date Kramer user manuals from the Internet at this URL: <http://www.kramerelectronics.com>

3 The complete list of Kramer cables is on our Web site at <http://www.kramerelectronics.com>

## 2.1 Quick Start

This quick start chart summarizes the basic setup and operation steps.



### 3 Overview

The **TP-576** is a twisted pair line driver for HDMI, bidirectional RS-232 and infrared signals. The **TP-576** receives an HDMI signal either from a local HDMI source or from a transmitter (for example, the Kramer **TP-573**) via the LINE IN RJ-45 connector. The **TP-576** decodes these input signals to the local outputs and simultaneously transmits them to a TP receiver (for example, the **TP-574**) which converts them back to HDMI, RS-232 and infrared signals.

Using the **TP-576**, you can pass via the twisted pair cable:

- EDID (Extended Display Information Data) and HDCP signals between the **TP-573** and **TP-574**
- HPD (Hot Plug Detect) signals from the display device to the source

The **TP-576** features:

- Up to 2.25Gbps bandwidth per graphic channel<sup>1</sup> (1.65Gbps for the twisted pair inputs and outputs)
- An RS-232 baud rate of up to 38.4kbps
- HDTV compatibility
- Bidirectional RS-232 and IR interfaces. The IR input/output transmits and receives IR commands over CAT 5 cable<sup>2</sup> between the transmitter and receiver
- A system range<sup>3</sup> of up to 90m (295ft) at 1080i, or up to 30m (98ft) at 1080p on shielded **BC-DGKat524** cable; 90m (295ft) at 1080i, or up to 70m (230ft) at 1080p on shielded **BC-DGKat623** cable; 100m (330ft) at 1080i or up to 90m (295ft) at 1080p on shielded **BC-DGKat7a23** cable.

Use only shielded cables with the **TP-576** in which the cable Ground shielding must be connected / soldered to the shield of both RJ-45 connectors

- HDMI Support – HDMI (V.1.4 with Deep Color<sup>4</sup>, x.v.Color™, HDMI Uncompressed Audio Channels, Dolby TrueHD, DTS-HD)
- 3D Pass-Through
- The Power Connect System™ – A single connection to the **TP-576** powers the transmitter, receiver and line driver units

<sup>1</sup> Suitable for resolutions up to UXGA at 60Hz, and for all HD resolutions

<sup>2</sup> Compatible with a Kramer transmitter and via a Kramer external remote receiver: C-A35M/IRR or C-A35M/IRE or C-A35M/2IRE

<sup>3</sup> Note that the transmission range depends on the signal resolution, graphics card and display used. The distance using non-Kramer CAT 5, CAT 6 and CAT 7a cables may not reach these ranges

<sup>4</sup> On the HDMI input

- The ability to read and store, in non-volatile memory, the default EDID, or the EDID<sup>1</sup> block from either or both of the output display devices, so it can then provide the EDID information to the HDMI sources even if the display device is not connected
- LEDs indicating the selected input and active output LED indicators

The **TP-576** is 12V DC fed and is housed in a MegaTOOLS® enclosure where two units can be rack mounted side-by-side in a 1U rack space with the optional **RK-T2B** rack adapter.

### 3.1 Using Twisted Pair Cable

Kramer engineers have developed special twisted pair cables to best match our digital twisted pair products; the Kramer: **BC-DGKat524** (CAT 5 24 AWG), the Kramer: **BC-DGKat623** (CAT 6 23 AWG cable), and the Kramer: **BC-DGKat7a23** (CAT 7a 23 AWG cable). These specially built cables significantly outperform regular CAT 5 / CAT 6 / CAT 7a cables.

Note: the **TP-573 / TP-574** cannot work with unshielded cables.

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<sup>1</sup> EDID is Extended Display Identification Data (see section [3.3](#) for a more detailed definition)

## 3.2 About HDMI

High-Definition Multimedia Interface (HDMI) is an uncompressed all-digital<sup>1</sup> audio/video interface, widely supported in the entertainment and home cinema industry. It delivers the highest high-definition image and sound quality.

In particular, HDMI<sup>2</sup>:

- Provides a simple<sup>3</sup> interface between any audio/video source, such as a set-top box, DVD player, or A/V receiver and video monitor, such as a digital flat LCD / plasma television (DTV), over a single lengthy<sup>4</sup> cable
- Supports standard, enhanced, high-definition video, and multi-channel digital audio<sup>5</sup> on a single cable
- Transmits all ATSC HDTV standards and supports 8-channel digital audio, with bandwidth to spare to accommodate future enhancements and requirements
- Benefits consumers by providing superior, uncompressed digital video quality via a single cable<sup>6</sup>, and user-friendly connector
- Is backward-compatible with DVI (Digital Visual Interface)
- Supports two-way communication between the video source (such as a DVD player) and the digital television, enabling new functionality such as automatic configuration and one-button play

HDMI has the capacity to support:

- Existing high-definition video formats (720p, 1080i, and 1080p/60), as well as standard definition formats such as NTSC or PAL

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1 Ensuring an all-digital rendering of video without the losses associated with analog interfaces and their unnecessary digital-to-analog conversions

2 HDMI, the HDMI logo and High-Definition Multimedia Interface are trademarks or registered trademarks of HDMI licensing LLC

3 With video and multi-channel audio combined into a single cable, the cost, complexity, and confusion of multiple cables currently used in A/V systems is reduced

4 HDMI technology has been designed to use standard copper cable construction at up to 15m

5 HDMI supports multiple audio formats, from standard stereo to multi-channel surround-sound HDMI has the capacity to support Dolby 5.1 audio and high-resolution audio formats

6 HDMI provides the quality and functionality of a digital interface while also supporting uncompressed video formats in a simple, cost-effective manner

### 3.3 Defining EDID

The Extended Display Identification Data (EDID<sup>1</sup>) is a data-structure, provided by a display, to describe its capabilities to a graphics card (that is connected to the display's source). The EDID enables the **TP-576** to "know" what kind of monitor is connected to the output. The EDID includes the manufacturer's name, the product type, the timing data supported by the display, the display size, luminance data and (for digital displays only) the pixel mapping data.

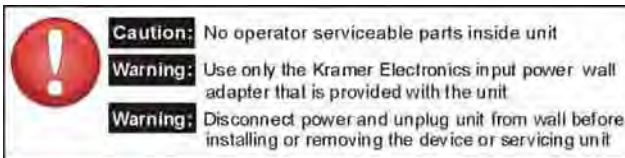
### 3.4 About the Power Connect™ Feature

The Power Connect™ feature here means that the **TP-576** unit can power both the transmitter and receiver when they are within 270 feet (90 meters) from the **TP-576**. The Power Connect™ feature applies as long as the cable can carry power. The distance does not exceed 90 meters on standard CAT 5 cable, for longer distances, heavy gauge cable should be used<sup>2</sup>.

### 3.5 Recommendations for Best Performance

To achieve the best performance:

- Connect only good quality connection cables, thus avoiding interference, deterioration in signal quality due to poor matching, and elevated noise levels (often associated with low quality cables)
- Avoid interference from neighboring electrical appliances and position your **TP-576** away from moisture, excessive sunlight and dust



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<sup>1</sup> Defined by a standard published by the Video Electronics Standards Association (VESA)

<sup>2</sup> CAT 5 cable is still suitable for the video/audio transmission, but not for feeding the power at these distances



## 4 Your TP-576 HDMI / CAT 5 Line Driver

[Figure 1](#) and [Table 1](#) define the **TP-576 HDMI / CAT 5 Line Driver**:

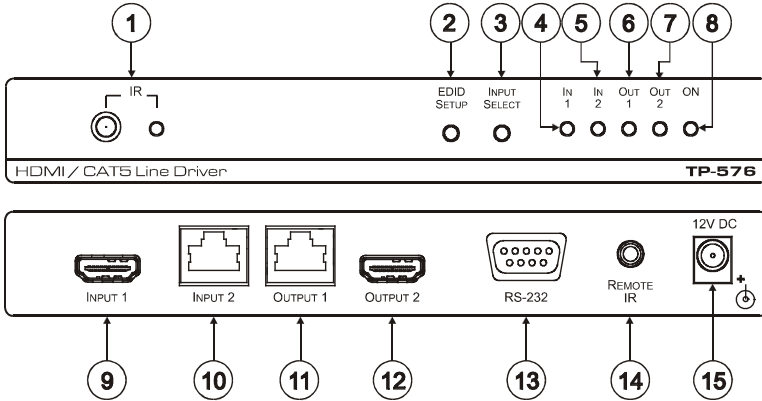


Figure 1: TP-576 HDMI /CAT 5 Line Driver

Table 1: TP-576 HDMI /CAT 5 Line Driver Features

#	Feature	Function
1	IR Receiver	The yellow LED lights when receiving signals from the infrared remote control transmitter
2	EDID SETUP Button	Press briefly to determine the type of EDID stored in the non-volatile memory Press and hold to select the desired EDID setup and then release to acquire EDID (see section 5.5)
3	INPUT SELECT Button	Press to select the input. The relevant IN LED illuminates
4	IN 1 LED	Illuminates when input 1 is selected
5	IN 2 LED	Illuminates when input 2 is selected
6	OUT 1 LED	Illuminates when output 1 is connected and active Blinks when the monitor does not support HDCP <sup>1</sup>
7	OUT 2 LED	Illuminates when output 2 is connected and active Blinks when the monitor does not support HDCP <sup>1</sup>
8	ON LED	Illuminates when receiving power
9	INPUT 1 HDMI Connector	Connects to the HDMI source
10	INPUT 2 RJ-45 Connector	Connects to the CAT 5 IN RJ-45 connector on the <b>TP-573</b> or <b>TP-571</b>
11	OUTPUT 1 RJ-45 Connector	Connects to the CAT 5 IN RJ-45 connector on the <b>TP-574</b> or <b>TP-572+</b>
12	OUTPUT 2 HDMI Connector	Connects to the HDMI acceptor
13	RS-232 9-pin D-sub Connector	Connects to a PC or other controller
14	REMOTE IR 3.5mm Mini Jack	Connects to an infrared receiver/emitter <sup>2</sup>
15	12V DC	+12V DC connector for powering the unit

<sup>1</sup> This LED also illuminates or blinks During EDID setup (see section 5.5)

<sup>2</sup> Compatible with a Kramer transmitter and via a Kramer external remote IR receiver: C-A35M/IRR or C-A35M/IRE or C-A35M/2IRE

## 5 Using the TP-576 HDMI / CAT 5 Line Driver

This section describes how to:

- Connect the **TP-576** (see section [5.1](#))
- Connect RS-232 ports (see section [5.2](#))
- Connect the IR emitters and sensors (see section [5.3](#))
- Wire the CAT 5 RJ-45 connectors (see section [5.4](#))
- Use the EDID SETUP button (see section [5.5](#)).

### 5.1 Connecting the TP-576 HDMI /CAT 5 Line Driver

To connect the **TP-576** together with the **TP-573 HDMI/RS-232/IR Line Transmitter** and the **TP-574 HDMI/RS-232/IR Line Receiver**, as illustrated in the example in [Figure 2](#), do the following:

On the **TP-573** connect:

1. An HDMI source (for example, a DVD player) to the HDMI IN connector.
2. An IR sensor or emitter to the IR 3.5mm mini jack connector (see section [5.3](#)).
3. A PC to the RS-232 9-pin D-sub connector.  
Alternatively, you can connect an RS-232 controllable device to the RS-232 port of the **TP-573** and a PC to the RS-232 port of the **TP-574**<sup>1</sup>.
4. A CAT 5<sup>2</sup> or CAT 6<sup>2</sup> cable to the LINE OUT RJ-45 twisted pair connector.

On the **TP-576** connect:

1. An HDMI source (for example, a DVD player) to the HDMI INPUT 1 connector.
2. The CAT 5 or CAT 6 cable<sup>2</sup> from the **TP-573** to the INPUT 2 RJ-45 twisted pair connector.
3. An IR sensor or emitter to the REMOTE IR 3.5mm mini jack connector (see section [5.3](#)).
4. The 12V DC power supply<sup>3</sup> to the **TP-576** (not shown in [Figure 2](#)).

On the **TP-574** connect:

5. The HDMI OUT connector to an HDMI acceptor (for example, an LCD display with speakers).
6. An IR emitter or sensor to the IR 3.5mm mini jack connector (see section [5.3](#)).

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<sup>1</sup> See section [5.2](#)

<sup>2</sup> Using the Kramer BC-DGKat524 or BC-DGKat623 cable, respectively

<sup>3</sup> To power the TP-576 as well as the TP-573 and TP-574

7. The RS-232 9-pin D-sub connector to an RS-232 acceptor (for example, an RS-232 controllable device).  
Alternatively, you can connect an RS-232 controllable device to the RS-232 port of the **TP-573** and a PC to the RS-232 port of the **TP-574**<sup>1</sup>.
8. The CAT 5<sup>2</sup> or CAT 6<sup>2</sup> cable from the **TP-576** to the LINE IN RJ-45 twisted pair connector.
9. The 12V DC power supply to the **TP-576** (not shown in [Figure 2](#)).

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<sup>1</sup> See section [5.2](#)

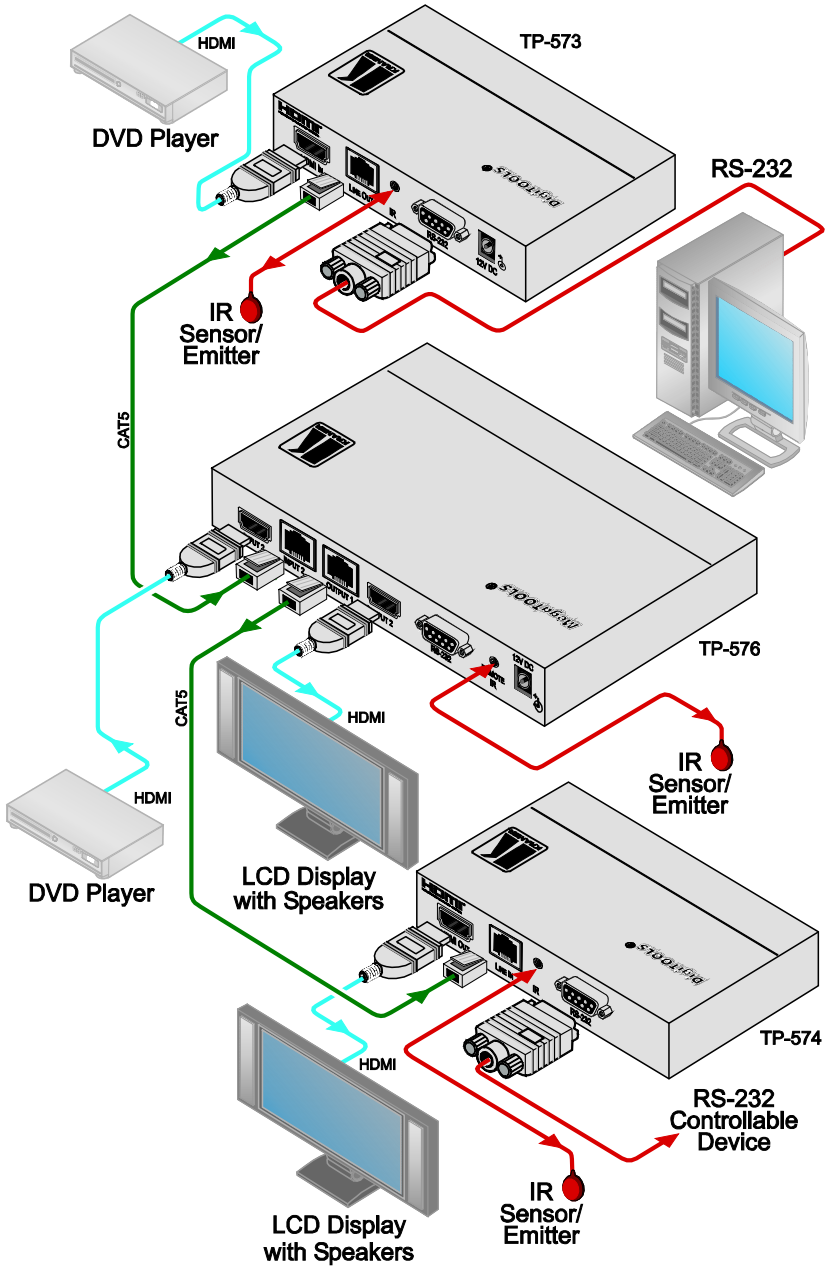


Figure 2: Connecting a TP-576 HDMI / CAT5 Line Driver

## 5.2 Using the RS-232 ports to control a device via a PC

The **TP-576** passes bidirectional RS-232 signals between the **TP-573** and the **TP-574**. For example, a PC connected to the RS-232 port on the **TP-573** can control an RS-232 controllable device on the **TP-574**.

You can connect a PC to the RS-232 port on the **TP-576** via a straight connection (see section [5.2.1](#)) to control the **TP-576** only.

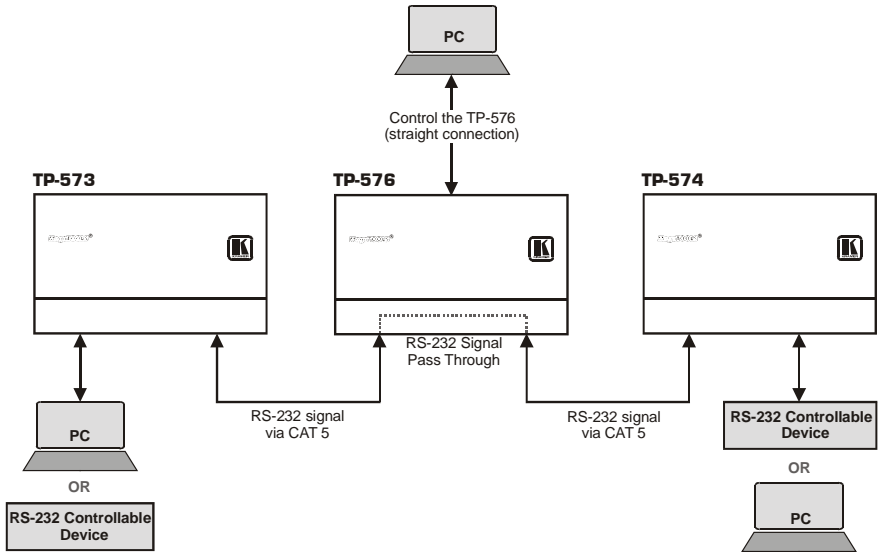


Figure 3: TP-576 RS-232 Signals

### 5.2.1 Connecting to the TP-576 via RS-232

You can connect to the **TP-576** via an RS-232 connection using, for example, a PC. Note that a null-modem adapter/connection is not required.

To connect to the **TP-576** via RS-232, connect the RS-232 9-pin D-sub rear panel port on the **TP-576** unit via a 9-wire straight cable (only pin 2 to pin 2, pin 3 to pin 3, and pin 5 to pin 5 need to be connected) to the RS-232 9-pin D-sub port on your PC.

### 5.3 Connecting an IR Emitter/Sensor

The **TP-576** consists of an IR receiver and a REMOTE IR 3.5mm mini jack connector that can connect to either an emitter or receiver.

In a transmitter-receiver configuration that includes, for example, the **TP-573** and **TP-574**, IR control behavior is determined by the IR items (emitter or receiver) that are connected to the REMOTE IR or IR (for the **TP-573** and **TP-574**) 3.5mm mini jack connectors.

To control any device in this configuration, use the appropriate IR remote control transmitter. For example, the Kramer remote controller will be able to control Kramer devices. For controlling an LCD display you will need to use the LCD remote controller unit, and so on.

Many IR control configurations are available; this section includes several options:

#### Controlling the System via IR – Example I

In the example illustrated in [Figure 4](#), IR emitters are attached to the DVD player connected to the **TP-573** and the LCD display connected to the **TP-574**.

Point the appropriate IR remote control transmitters to the **TP-576** IR receiver window (or IR sensor that is connected to the REMOTE IR 3.5mm mini jack connector) to control the **TP-576**, the DVD player and the LCD display.

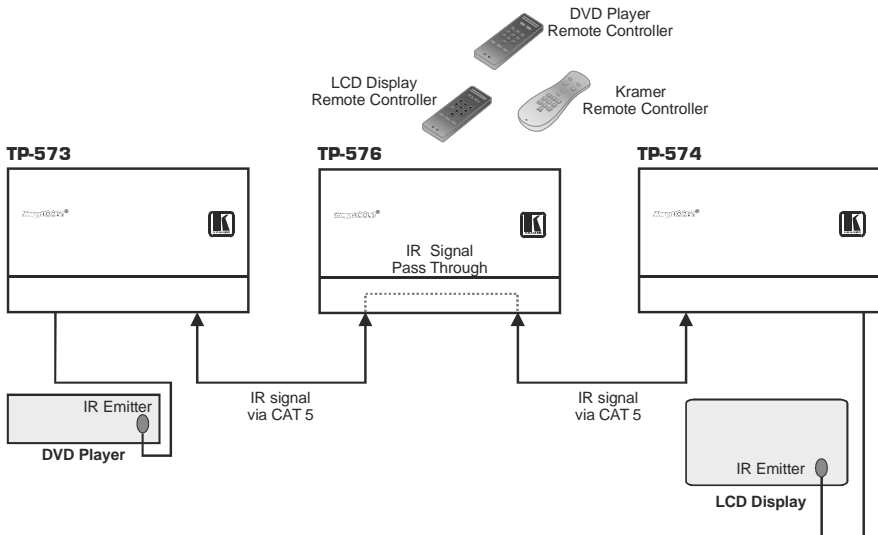


Figure 4: TP-576 IR Control – Example I

## Controlling the System via IR – Example II

In the example illustrated in [Figure 5](#), an IR sensor is connected to the IR 3.5mm mini jack connector of the **TP-573** and an IR emitter is attached to the LCD display connected to the **TP-574**.

Point the LCD display remote controller either to the IR sensor of the **TP-573** or the IR receiver window of the **TP-576** to control the LCD display. Point the Kramer remote controller to IR receiver window of the **TP-576** to control the **TP-576**.

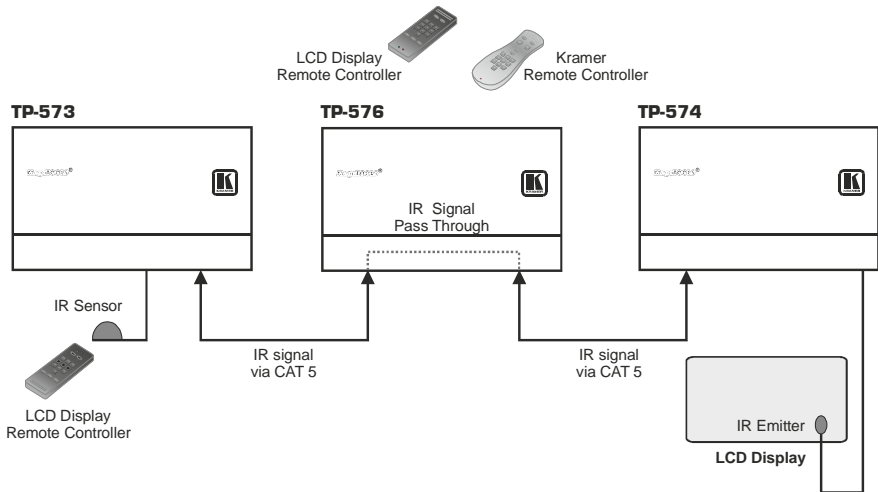


Figure 5: TP-576 IR Control – Example II

### Controlling the System via IR – Example III

In the example illustrated in [Figure 6](#), an IR sensor is connected to the IR 3.5mm mini jack connector of the **TP-574** and an IR emitter is attached to the DVD 1 player connected to the **TP-573**.

Point the DVD 1 player remote controller to the IR sensor of the **TP-574** to control the DVD 1 player, and also the DVD 2 player remote controller to control the DVD 2 player (that is connected to the **TP-576**).

In addition, an IR emitter is attached to the DVD 2 player that is connected to the **TP-576**. Once an IR emitter is connected to the IR REMOTE 3.5mm mini jack connector, IR control on the **TP-576** becomes local.

Point the Kramer remote controller to the IR receiver window of the **TP-576** to control the **TP-576**.

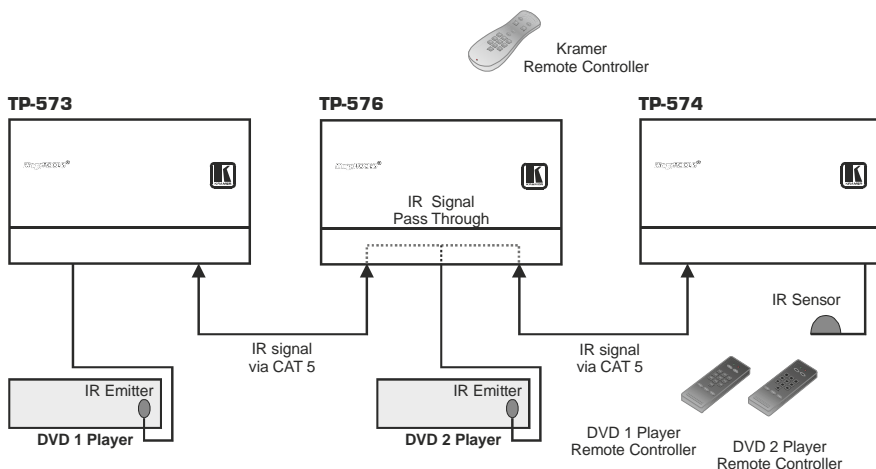


Figure 6: TP-576 IR Control – Example III



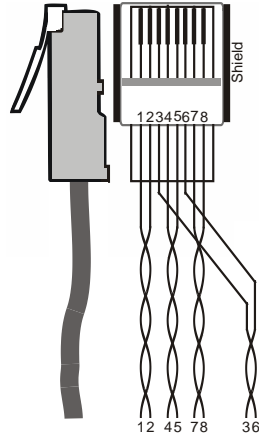
## 5.4 Wiring the CAT 5 LINE IN / LINE OUT RJ-45 Connectors

[Table 2](#) and [Figure 7](#) define the STP CAT 5 PINOUT<sup>1</sup>, using a straight pin-to-pin cable with RJ-45 connectors (**note, that the cable Ground shielding must be connected / soldered to the connector shield**):

Table 2: CAT 5 PINOUT

EIA /TIA 568A		EIA /TIA 568B	
PIN	Wire Color	PIN	Wire Color
1	Green / White	1	Orange / White
2	Green	2	Orange
3	Orange / White	3	Green / White
4	Blue	4	Blue
5	Blue / White	5	Blue / White
6	Orange	6	Green
7	Brown / White	7	Brown / White
8	Brown	8	Brown
<b>Pair 1</b> 4 and 5		<b>Pair 1</b> 4 and 5	
<b>Pair 2</b> 3 and 6		<b>Pair 2</b> 1 and 2	
<b>Pair 3</b> 1 and 2		<b>Pair 3</b> 3 and 6	
<b>Pair 4</b> 7 and 8		<b>Pair 4</b> 7 and 8	

Figure 7: CAT 5 PINOUT



<sup>1</sup> CAT 6 or similar (heavier gauge) cabling can also be used

## 5.5 Acquiring the EDID<sup>1</sup>

Initially, the **TP-576** operates with the factory default EDID<sup>2</sup>. This lets you connect the power before connecting one of the acceptors or sources.

You can acquire the EDID from:

- One Output<sup>3</sup> (the relevant output illuminates)
- Two Connected Outputs, the Auto-mix Mode<sup>4</sup> (both output LEDs illuminate)
- The Default EDID (both output LEDs blink)

To acquire the EDID, do the following:

1. Connect the power.
2. Connect the output or outputs from which you want to acquire the EDID.
3. Press and hold the EDID SETUP button to select the desired EDID. The OUT LEDs illuminate in the following cycle: OUT 1, OUT 2, both blink (Default) and both illuminate (Auto-mix<sup>4</sup>).
4. Release the button when reaching the desired set up<sup>5</sup>. The EDID is now acquired.

### 5.5.1 Disabling/Enabling Deep Color Support

You can disable EDID deep color support to prevent signal deterioration when using long twisted pair cables on INPUT 2.

To disable deep color and acquire EDID:

1. Disconnect the power.
2. Connect the output or outputs from which you want to acquire the EDID.
3. Connect the power while pressing the EDID SETUP button.
4. Perform steps 3 and 4 in section [5.5](#).

---

1 This is usually done only once, when the machine is being set up in an installation. Once acquired, the EDID is saved in non-volatile memory and further acquisition is not necessary.

2 The TP-576 reads the EDID, which is stored in the non-volatile memory.

3 The local output and the output on the transmitter.

4 The EDID acquired is a weighted average of all the connected outputs. For example, if several displays with different resolutions are connected to the outputs, the acquired EDID supports all the resolutions, as well as other parameters included in the EDID.

5 If you set the machine to acquire the EDID from an output that is not connected, the Default EDID will be acquired.

To enable deep color and acquire EDID:

1. Disconnect the power.
2. Connect the output or outputs from which you want to acquire the EDID.
3. Connect the power while pressing the INPUT SELECT button.
4. Perform steps 3 and 4 in section [5.5](#).

## 6 Default EDID

Monitor [Real-time 0x0031]

Model name..... TP576-r0  
Manufacturer..... KRM  
Plug and Play ID..... KRM0576  
Serial number..... 505-707455010  
Manufacture date..... 2009, ISO week 10  
Filter driver..... None

-----  
EDID revision..... 1.3  
Input signal type..... Digital  
Color bit depth..... Undefined  
Display type..... RGB color  
Screen size..... 520 x 320 mm (24.0 in)  
Power management..... Standby, Suspend, Active off/sleep  
Extension blocs..... 1 (CEA-EXT)  
-----  
DDC/CI..... Not supported

Color characteristics

Default color space..... Non-sRGB  
Display gamma..... 2.20  
Red chromaticity..... Rx 0.674 - Ry 0.319  
Green chromaticity..... Gx 0.188 - Gy 0.706  
Blue chromaticity..... Bx 0.148 - By 0.064  
White point (default)... Wx 0.313 - Wy 0.329  
Additional descriptors... None

Timing characteristics

Horizontal scan range.... 30-83kHz  
Vertical scan range..... 56-76Hz  
Video bandwidth..... 170MHz  
CVT standard..... Not supported  
GTF standard..... Not supported  
Additional descriptors... None  
Preferred timing..... Yes  
Native/preferred timing.. 1280x720p at 60Hz (16:10)  
Modeline..... "1280x720" 74.250 1280 1390 1430 1650 720 725 730 750 +hsync +vsync

Standard timings supported

720 x 400p at 70Hz - IBM VGA  
640 x 480p at 60Hz - IBM VGA  
640 x 480p at 75Hz - VESA  
800 x 600p at 60Hz - VESA  
800 x 600p at 75Hz - VESA  
1024 x 768p at 60Hz - VESA  
1024 x 768p at 75Hz - VESA  
1280 x 1024p at 75Hz - VESA  
1280 x 1024p at 60Hz - VESA STD  
1600 x 1200p at 60Hz - VESA STD  
1152 x 864p at 75Hz - VESA STD

## 7 Technical Specifications

[Table 3](#) includes the technical specifications<sup>1</sup> of the **TP-576**:

*Table 3: Technical Specifications of the TP-576*

INPUTS:	1 HDMI connector 1 CAT 5 on an RJ-45 connector
OUTPUTS:	1 CAT 5 on an RJ-45 connector 1 HDMI connector
PORTS:	1 bidirectional IR port on a 3.5mm mini jack 1 bidirectional RS-232 port on a 9-pin D-sub connector (for local control)
BANDWIDTH:	Supports up to 2.25Gbps bandwidth per graphic channel (1.65Gbps for the twisted pair inputs and outputs)
COMPLIANCE WITH HDMI STANDARD:	Supports HDMI and HDCP
RS-232 BAUD RATE:	Up to 38.4kbps
CONTROLS:	EDID SETUP button, input select button
INDICATOR LEDs:	IN 1, IN 2, OUT 1, OUT 2, and ON LEDs
POWER SOURCE:	12V DC, 950mA <sup>2</sup>
DIMENSIONS:	12.1cm x 7.18cm x 2.42cm (4.76" x 2.83" x 0.95"), W, D, H
WEIGHT:	0.3kg (0.67lbs) approx.
ACCESSORIES:	12V DC 2.1A power supply, bracket installation kit
OPTIONS:	RK-3T 19" rack mount, Kramer remote external receiver <sup>3</sup> , Kramer BC-DGKat524 (CAT 5 24AWG), BC-DGKat623 (CAT 6 23AWG) and BC-DGKat7a23 (CAT 7a 23 AWG) cables, HDMI/HDMI male-to-male cables

## 8 Default Communication Parameters

[Table 4](#) lists the default communication parameters for the **TP-576**.

*Table 4: Default Communication Parameters*

RS-232	
<b>Protocol 2000</b>	
Baud Rate:	9600
Data Bits:	8
Stop Bits:	1
Parity:	None
Command Format:	HEX
Example (Output 1 to Input 1):	0x01, 0x81, 0x81, 0x81

<sup>1</sup> Specifications are subject to change without notice

<sup>2</sup> Full load, for example, when connected with TP-573 and TP-574

<sup>3</sup> C-A35M/IRR or C-A35M/IRE or C-A35M/2IRE

## 9 Kramer Protocol 2000

This RS-232 communication protocol uses four bytes of information as defined below. The default data rate is 9600 baud, with no parity, 8 data bits and 1 stop bit.

Table 5: Protocol Definitions

MSB								LSB
	DESTINATION		INSTRUCTION					
0	D	N5	N4	N3	N2	N1	N0	
7	6	5	4	3	2	1	0	
1st byte								
	INPUT							
1	6	I5	I4	I3	I2	I1	I0	
7	6	5	4	3	2	1	0	
2nd byte								
	OUTPUT							
1	O6	O5	O4	O3	O2	O1	O0	
7	6	5	4	3	2	1	0	
3rd byte								
	MACHINE NUMBER							
1	OVR	X	M4	M3	M2	M1	M0	
7	6	5	4	3	2	1	0	
4th byte								

1<sup>st</sup> BYTE: Bit 7 – Defined as 0

D – “DESTINATION”: 0 - for sending information to the switchers (from the PC);

1 - for sending to the PC (from the switcher)

N5 N0 – “INSTRUCTION”

The function that is to be performed by the switcher(s) is defined by the INSTRUCTION (6 bits). Similarly, if a function is performed via the machine’s keyboard, then these bits are set with the INSTRUCTION NO., which was performed. The instruction codes are defined according to the table below (INSTRUCTION NO. is the value to be set for N5 N0).

2<sup>nd</sup> BYTE: Bit 7 – Defined as 1  
I6 I0 – “INPUT”

When switching (ie instruction codes 1 and 2), the INPUT (7 bits) is set as the input number which is to be switched. Similarly, if switching is done via the machine’s front-panel, then these bits are set with the INPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

3<sup>rd</sup> BYTE: Bit 7 – Defined as 1  
O6 O0 – “OUTPUT”

When switching (ie instruction codes 1 and 2), the OUTPUT (7 bits) is set as the output number which is to be switched. Similarly, if switching is done via the machine’s front-panel, then these bits are set with the OUTPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

4<sup>th</sup> BYTE: Bit 7 – Defined as 1  
Bit 5 – Don’t care  
OVR – Machine number override  
M4 M0 – MACHINE NUMBER

Used to address machines in a system via their machine numbers. When several machines are controlled from a single serial port, they are usually configured together with each machine having an individual machine number. If the OVR bit is set, then all machine numbers will accept (implement) the command, and the addressed machine will reply.

For a single machine controlled via the serial port, always set M4 M0 = 1, and make sure that the machine itself is configured as MACHINE NUMBER = 1.

Table 6: Instruction Codes for Protocol 2000

Note: All values in the table are decimal, unless otherwise stated

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
1	SWITCH VIDEO	Set equal to video input which is to be switched (0 = disconnect)	Set equal to video output which is to be switched (0 = to all the outputs)	2
61	IDENTIFY MACHINE	1 - video machine name 3 - video software version 9 - protocol 2000 version	0 - Request first 4 digits 1 - Request first suffix 2 - Request second suffix 3 - Request third suffix 10 - Request first prefix 11 - Request second prefix 12 - Request third prefix	13
62	DEFINE MACHINE	1 - number of inputs 2 - number of outputs	1 - for video 2 - for audio	14

NOTES on the above table:

NOTE 2 - These are bi-directional definitions. That is, if the switcher receives the code, it will perform the instruction; and if the instruction is performed (due to a keystroke operation on the front panel), then these codes are sent. For example, if the HEX code

01 85 88 83

was sent from the PC, then the switcher (machine 3) will switch input 5 to output 8. If the user switched input 1 to output 7 via the front panel keypad, then the switcher will send HEX codes:

41 81 87 83

to the PC.

When the PC sends one of the commands in this group to the switcher, then, if the instruction is valid, the switcher replies by sending to the PC the same four bytes that it was sent (except for the first byte, where the DESTINATION bit is set high).

NOTE 13 - This is a request to identify the switcher/s in the system. If the OUTPUT is set as 0, and the INPUT is set as 1, 2, 5 or 7, the machine will send its name. The reply is the decimal value of the INPUT and OUTPUT. For example, for a 2216, the reply to the request to send the audio machine name would be (HEX codes):

7D 96 90 81 (i.e. 128dec+ 22dec for 2nd byte, and 128dec+ 16dec for 3rd byte)

If the request for identification is sent with the INPUT set as 3 or 4, the appropriate machine will send its software version number. Again, the reply would be the decimal value of the INPUT and OUTPUT - the INPUT representing the number in front of the decimal point, and the OUTPUT representing the number after it. For example, for version 3.5, the reply to the request to send the version number would be (HEX codes):

7D 83 85 81 (i.e. 128dec+ 3dec for 2nd byte, 128dec+ 5dec for 3rd byte)

If the OUTPUT is set as 1, then the ASCII coding of the lettering following the machine's name is sent. For example, for the VS-7588YC, the reply to the request to send the first suffix would be (HEX codes):

7D D9 C3 81 (i.e. 128dec+ ASCII for "Y"; 128dec+ ASCII for "C")

NOTE 14 - The number of inputs and outputs refers to the specific machine which is being addressed, not to the system. For example, if six 16X16 matrices are configured to make a 48X32 system (48 inputs, 32 outputs), the reply to the HEX code

3E 82 81 82 (i.e. request the number of outputs)

would be HEX codes

7E 82 90 82

i.e. 16 outputs

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## LIMITED WARRANTY

Kramer Electronics (hereafter *Kramer*) warrants this product free from defects in material and workmanship under the following terms

### HOW LONG IS THE WARRANTY

Labor and parts are warranted for three years from the date of the first customer purchase

### WHO IS PROTECTED?

Only the first purchase customer may enforce this warranty

### WHAT IS COVERED AND WHAT IS NOT COVERED

Except as below, this warranty covers all defects in material or workmanship in this product. The following are not covered by the warranty:

- 1 Any product which is not distributed by Kramer, or which is not purchased from an authorized Kramer dealer. If you are uncertain as to whether a dealer is authorized, please contact Kramer at one of the agents listed in the Web site [www.kramerelectronics.com](http://www.kramerelectronics.com)
- 2 Any product, on which the serial number has been defaced, modified or removed, or on which the WARRANTY VOID IF TAMPERED sticker has been torn, reattached, removed or otherwise interfered with
- 3 Damage, deterioration or malfunction resulting from:
  - i) Accident, misuse, abuse, neglect, fire, water, lightning or other acts of nature
  - ii) Product modification, or failure to follow instructions supplied with the product
  - iii) Repair or attempted repair by anyone not authorized by Kramer
  - iv) Any shipment of the product (claims must be presented to the carrier)
  - v) Removal or installation of the product
  - vi) Any other cause, which does not relate to a product defect
  - vii) Cartons, equipment enclosures, cables or accessories used in conjunction with the product

### WHAT WE WILL PAY FOR AND WHAT WE WILL NOT PAY FOR

We will pay labor and material expenses for covered items. We will not pay for the following:

- 1 Removal or installation charges
- 2 Costs of initial technical adjustments (set-up), including adjustment of user controls or programming. These costs are the responsibility of the Kramer dealer from whom the product was purchased
- 3 Shipping charges

### HOW YOU CAN GET WARRANTY SERVICE

- 1 To obtain service on your product, you must take or ship it prepaid to any authorized Kramer service center
- 2 Whenever warranty service is required, the original dated invoice (or a copy) must be presented as proof of warranty coverage, and should be included in any shipment of the product. Please also include in any mailing a contact name, company, address, and a description of the problem(s)
- 3 For the name of the nearest Kramer authorized service center, consult your authorized dealer

### LIMITATION OF IMPLIED WARRANTIES

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This warranty gives you specific legal rights, and you may also have other rights, which vary from place to place

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This equipment has been tested to determine compliance with the requirements of:

- EN-50081: "Electromagnetic compatibility (EMC);  
generic emission standard  
Part 1: Residential, commercial and light industry"
- EN-50082: "Electromagnetic compatibility (EMC) generic immunity standard  
Part 1: Residential, commercial and light industry environment"
- CFR-47: FCC\* Rules and Regulations:  
Part 15: "Radio frequency devices  
Subpart B Unintentional radiators"

### CAUTION!

⊗ Servicing the machines can only be done by an authorized Kramer technician. Any user who makes changes or modifications to the unit without the expressed approval of the manufacturer will void user authority to operate the equipment.

⊗ Use the supplied DC power supply to feed power to the machine.

⊗ Please use recommended interconnection cables to connect the machine to other components.

\* FCC and CE approved using STP cable (for twisted pair products)



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**For the latest information on our products and a list of Kramer distributors, visit our Web site: [www.kramerelectronics.com](http://www.kramerelectronics.com), where updates to this user manual may be found. We welcome your questions, comments and feedback.**



**Caution**

**Safety Warning:**

Disconnect the unit from the power supply before opening/servicing.



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