pragmatic
Innovators in wired & wireless systems

User Guide for **CATS-HDMI-MX4**

4x4 HDMI over CAT5 Matrix with IR Pass-through

Full HD 1080

HDMI HIGH-DEFINITION MULTIMEDIA INTERFACE

HDCP HIGH-DEFINITION CONTENT PROTECTION

x.v.Color

RoHS Compliance

FC

CE

Made in Taiwan
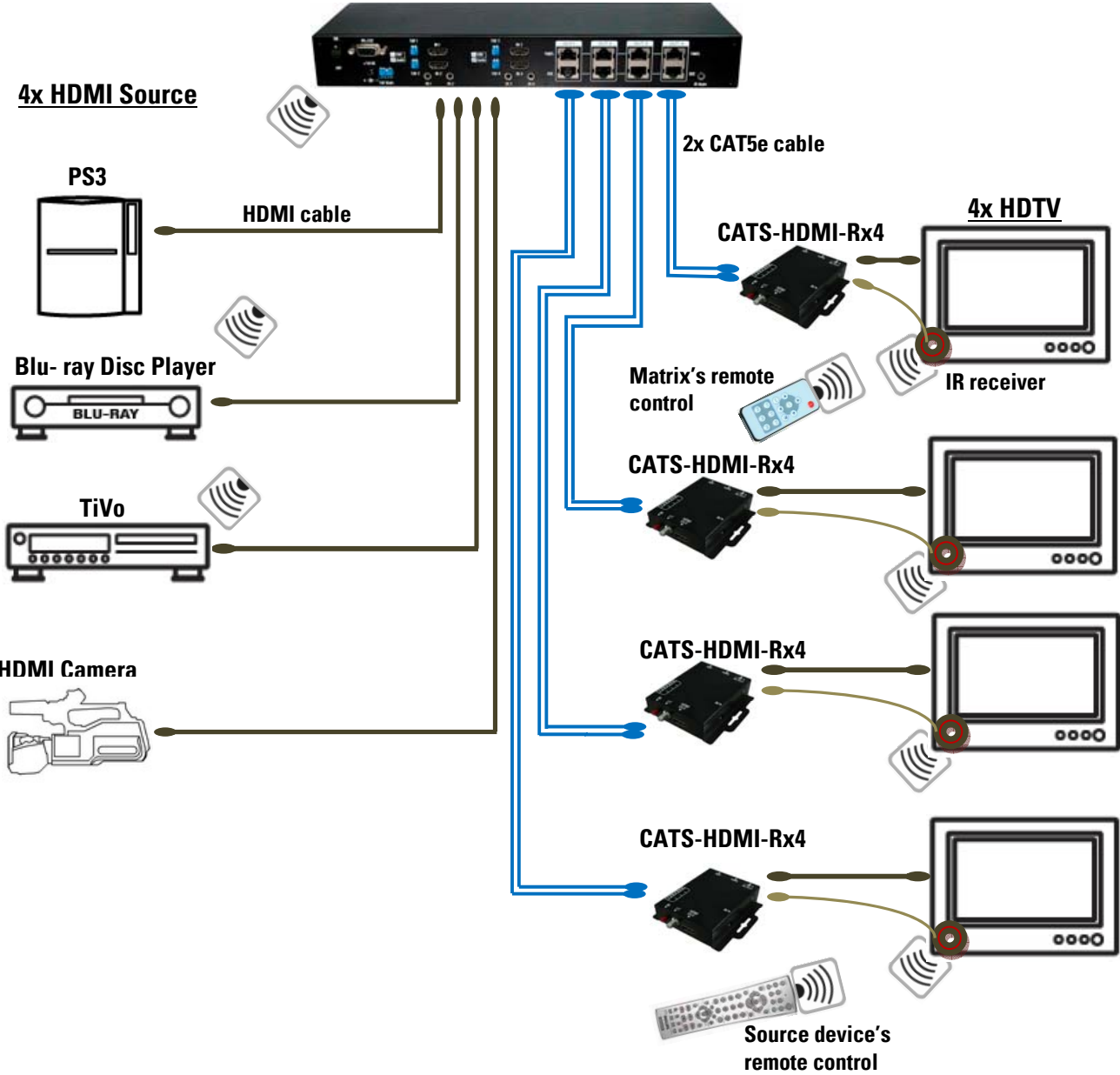
Safety and Notice

The **CATS-HDMI-MX4** *4x4 HDMI over CAT5 Matrix with IR Pass-through* has been tested for conformance to safety regulations and requirements, and has been certified for international use. However, like all electronic equipments, the CATS-HDMI-MX4 should be used with care. Please read and follow the safety instructions to protect yourself from possible injury and to minimize the risk of damage to the unit.

- Follow all instructions and warnings marked on this unit.

- Do not attempt to service this unit yourself, except where explained in this guide.

- Provide proper ventilation and air circulation and do not use near water.

- Keep objects that might damage the device and assure that the placement of this unit is on a stable surface.

- Use only the power adapter and power cords and connection cables designed for this unit.

- Do not use liquid or aerosol cleaners to clean this unit. Always unplug the power to the device before cleaning

.

The **CATS-HDMI-MX4** *4x4 HDMI over CAT5 Matrix with IR Pass-through* provides the most flexible and cost effective solution in the market to route high definition video sources plus multi-channel (up to 7.1-channel) digital audio from any of the four HDMI sources to the remote displays at the same time. Through low cost Cat-5/5e/6 LAN cables, not only high quality video and audio can be transmitted to the display sites, but also users can switch among four HDMI sources using the push-in button or remote control. With single power design at the source site, each remote module is easily installed without power supply. Furthermore, the built-in IR extension function makes users at display site access the DVD player, PS3 or any HDMI supported devices directly!

4x HDMI Source

PS3

HDMI cable

2x CAT5e cable

CATS-HDMI-Rx4

4x HDTV

Blu- ray Disc Player

Matrix's remote control

IR receiver

TiVo

CATS-HDMI-Rx4

CATS-HDMI-Rx4

HDMI Camera

CATS-HDMI-Rx4

Source device's remote control

Features

- State-of-the-art Silicon Image (founder of HDMI) chipset embedded for upmost compatibility and reliability

- HDMI 1.3c compliant

- HDCP compliant

- Allows any source to be displayed on multiple displays at the same time

- Allows any HDMI display to view any HDMI source at any time

- Supports up to 7.1 channel digital audio

- Supports default HDMI EDID and learns the EDID of displays

- The matrix master can switch every output channels to any HDMI inputs by push-in button, IR remote control, or RS-232 control

- Allows controlling local HDMI sources such as DVD and TiVo by attached IR extender from remote receiver to matrix master

- Allows to control matrix master through IR remote control at remote receiver's site

- Extends video signal up to 35m (115 feet) over CAT5e at 1080p and likely longer with better HDMI source device (such as PS3), better grade HDMI display (such as Sony X-series HDTV), and better quality solid Cat-6 cable

- Easy installation with rack-mounting and wall-mounting designs for master and receiver respectively

- Fast response time – 2~5 seconds for channel switch

Specifications & Package Contents

Model Name	CATS-HDMI-MX4	
Technical	CATS-HDMI-MX4	CATS-HDMI-Rx4
Role of usage	True 4x4 matrix switcher Transmitter [TX]	Receiver [RX]
HDMI compliance	HDMI 1.3c	
HDCP compliance	Yes	
Video bandwidth	Single-link 225MHz [6.75Gbps]	
Video support	480i / 480p / 720p / 1080i / 1080p60 36-bit color	
Audio support	Surround sound (up to 7.1ch) or stereo digital audio	
HDMI over CAT5 transmission range	Full HD (1080p): 35m (115ft) [CAT5e] / 40m (130ft) [CAT6] HD (720p/1080i): 50m (165ft) [CAT5e] / 55m (180ft) [CAT6]	
HDMI equalization	N/A	8-level digital rotary control
Input TMDS signal	1.2 Volts [peak-to-peak]	
Input DDC signal	5 Volts [peak-to-peak, TTL]	
ESD protection	[1] Human body model — ±15kV [air-gap discharge] & ±8kV [contact discharge] [2] Core chipset — ±8kV	
PCB stack-up	4-layer board [impedance control — differential 100Ω; single 50Ω]	
Input	4x HDMI 1x RS-232	1x RJ-45 TMDS 1x RJ-45 DDC 1x IR socket for IR receiver
Output	4x RJ-45 TMDS 4x RJ-45 DDC 5x IR socket for IR blaster	1x HDMI
HDMI Input selection	Push-in button/IR remote control/RS-232 control	Push-in button / IR remote control
HDMI source control	Controllable via IR pass-through from IR receiver at RX to IR blaster at TX	
IR remote control	Electro-optical characteristics: τ = 25° / Carrier frequency: 38kHz	
HDMI connector	Type A [19-pin female]	
RJ-45 connector	WE/SS 8P8C with 2 LED indicators	
RS-232 connector	DE-9 [9-pin D-sub female]	
3.5mm connector	Earphone jack for IR blaster [IR Main] IR control on all source devices [IR1~IR4] IR control on individual source device	Earphone jack for IR receiver [IR] Receives IR commands from remote control
DIP switch [CATS-HDMI-MX4 only]	[SW1~SW4] 2-pin for EDID and audio setting modes [SW Main] 4-pin operation mode & firmware update	
Mechanical	CATS-HDMI-MX4	CATS-HDMI-Rx4
Housing		Metal enclosure	
Dimensions (L x W x H) — Model	110 x 340 x 44mm [4.3"x1'1"x1.7"]	90x 85 x 25mm [3.5"x3.3"x1"]
Dimensions (L x W x H) — Package	230 x 545 x 110mm [9.1" x 1'10" x 4.3"]	
Dimensions (L x W x H) — Carton	580 x 570 x 260mm [1'11"x1'11"x10.2"]	
Weight — Model	1220g [2.7 lbs]	180g [6.3 oz]
Weight — Package	3.2 kg [7.0 lbs]	
Fixedness	1U rack-mount with ears Wall hanging holes	Wall-mount with screws
Power supply	5V 6A DC	Not necessarily required[1]

| Power consumption	20 Watts [max]	1 Watt [max] (provided by CATS-HDMI-MX4)
Operation temperature	0~40°C [32~104°F]	
Storage temperature	-20~60°C [-4~140°F]	
Relative humidity	20~90% RH [no condensation]	
Package Contents	1x CATS-HDMI-MX4 1x IR blaster[2] 2x Rack-mounting ear 1x IR remote control[2] 1x User Guide	4x CATS-HDMI-Rx4 4x IR receiver 8x Wall-mounting screws 1x 5V 6A in-line power adapter 1x C5-type power cord

[1] *The CATS-HDMI-Rx4 has been tested extensively and found that it doesn't require external power supply. If in rare situation you find it cannot work with the CATS-HDMI-MX4, please use any +5V power adapter to plug in the power jack and see if it can work. If not, please contact your technical support for further service.*

[2] *Additional IR remote controls and IR blasters can be purchased as optional accessories to control the HDMI sources located separately.*

CATS-HDMI-MX4
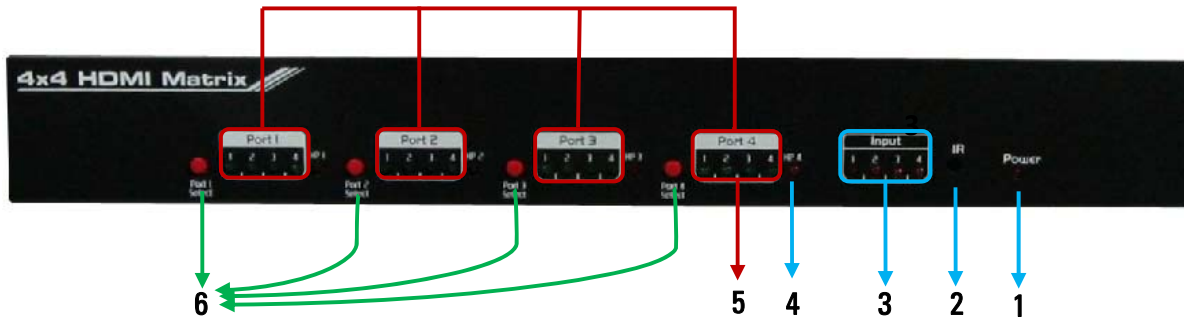
1. **Power**: Power indicator LED
2. **IR**: IR receiver
3. **Input**: Input source indicator LED
4. **HP1–HP4**: Connection status indicator LED for each output channel
5. **Port1–Port4**: Input source channels mapping LED for each output channel
6. **Port1 Select–Port4 Select**: Push-in button for selecting input channel
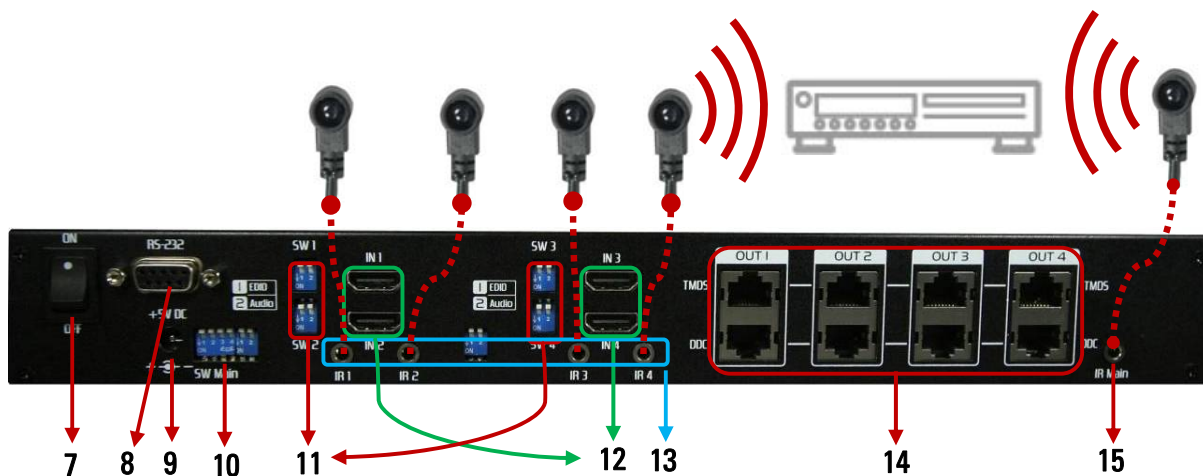
7. **ON–OFF:** Power ON/OFF
8. **RS-232**: RS-232 control port
9. **+5V DC**: 5V DC power jack
10. **SW Main**: DIP switches [see DIP Switch section in p.8]
11. **SW1–SW4**: DIP switch [see DIP Switch section in p.7]
12. **IN1–IN4**: HDMI inputs
13. **IR1–IR4**: IR extender jacks for individual HDMI source control with IR blasters
14. **OUT1–OUT4**: RJ-45 TMDS/DDC outputs for each output channel
15. **IR Main:** IR extender jack for all HDMI source control [default socket for IR blaster]

CATS-HDMI-Rx4

1 2 3 4   5

1. **IN**: Push-in button for switching input source channels in sequential order

2. **EQ**: Adjust the 8-level equalization rotary control switch to the received HDMI signals. 0-to-7 = strongest-to-weakest HDMI signal level to correspond for long-to-short transmission length. It is recommended to switch from 7 to 0 to find the optimal visual experience.

3. **Source LED**: Indicate the on-showing input source

4. **HDMI Out**: Connect to HDTV with a HDMI cable

5. **IR**: Plug in IR receiver

6   7   8

6. **+5V DC**: 5V power jack (optional*****)
7. **TMDS**: RJ-45 input for TMDS channel
8. **DDC**: RJ-45 input for DDC channel

> ******The CATS-HDMI-Rx4 has been tested extensively and found that it doesn't require external power supply. If in rare situation you find it cannot work with the CATS-HDMI-MX4, please use any +5V power adapter to plug in the power jack and see if it can work. If not, please contact your technical support for further service.*

SW1-SW4 for EDID/Audio setting

DIP Switch Position		Video	Audio	Description
Pin#1	Pin#2			
OFF [↑]	OFF [↑]	Up to 1080p	Stereo[1]	**Default Mode**[2] – Up to 1080p & stereo audio output for most HDTVs
OFF [↑]	ON [↓]	Up to 720p / 1080i	Stereo	**Safe Mode**[3] – Enforce the system output at 720p/1080i video and stereo audio for basic compatibility among HDTVs
ON [↓]	OFF [↑]	Bypass[4]	Bypass[4]	**EDID Learning Mode**[5] – for learning EDID from the display while playing any received HDMI audio format
ON [↓]	ON [↓]	Bypass	Stereo	**EDID Learning & Stereo Mode**[5] – for learning EDID from the display while enforcing stereo output if any HDTV cannot play surround sound normally

Note

[1] *If the HDTV shows video but without audio, please try to set audio mode to stereo.*

[2] *Factory default setting of* [SW1]-[SW4] *is pin#1-OFF[↑] & pin#2- OFF[↑] for 1080p with stereo.*

[3] *If you encounter any unsolved audio/video output problem during system installation, please turn any* [SW1]-[SW4] *to pin#1-OFF[↑] & pin#2-ON[↓] for safe mode to enforce the most compatible 720p stereo output for system check. However, the safe mode cannot be initiated if your HDMI source is set to enforce 1080p output. In this case, please reconfigure your HDMI source to all resolution output for troubleshooting.*

[4] *Bypass means the matrix will maintain playing the original format of HDMI signals in video and perhaps audio. By setting at this mode, the users may encounter compatibility issue among different kinds of HDMI sources and displays. If you cannot get the audio and/or video output normally at the system installation, please change the DIP switch setting to default mode or even safe mode to verify the functionality of the device.*

[5] *To learn the EDID of HDMI display for respective HDMI source devices, please see the* [EDID Learning] *section in the next page for more detail information.*

SW Main for firmware update (for technical support only)

DIP Switch Position	Pin#1	Pin#2	Pin#3	Pin#4
Normal Operation Mode[6]	OFF [⬆]	OFF [⬆]	ON [⬇]	OFF [⬆]
Firmware Update Mode[7]	ON [⬇]	ON [⬇]	OFF [⬆]	OFF [⬆]

> **Note**
>
> [6] *Factory default for* SW Main *is pin#1-OFF[⬆], pin#2-OFF[⬆], pin#3-ON[⬇], & pin#4-OFF[⬆].* PLEASE MAINTAIN THIS SETTING AT ANYTIME FOR REGULAR USE!
>
> [7] *Sequence for firmware update*
>   [1]. Power off the CATS-HDMI-MX4.
>   [2]. Set the DIP switch position to Firmware Update Mode.
>   [3]. Power on the CATS-HDMI-MX4.
>   [4]. Power off the CATS-HDMI-MX4.
>   [5]. Set the DIP switch position to Normal Operation Mode.
>   [6]. Power on the CATS-HDMI-MX4.

1. Power up the CATS-HDMI-MX4. Connect the HDMI display that its EDID needs to be learned to any of the HDMI **IN1-IN4** port where your source device has trouble to show the picture normally.

2. To learn the display's EDID for source device connected to respective HDMI **IN1-IN4** port, pull the both pints of respective DIP switch **SW1-SW4** up-and-down to stay at ON[⬇]-ON[⬇] and wait for about 5 seconds to complete the EDID learning process. You DON'T NEED to pull up the DIP switch again unless you want to learn another display's EDID by pulling both DIP switch pin#1 & pin#2 of **SW1-SW4** up-and-down one more time.

IR Cables

IR blaster   IR Receiver

IR Sockets

CATS-HDMI-MX4

IR Main: The default location for IR blaster to transmit all IR command signals received from any of the four remote receivers to all of the HDMI sources.
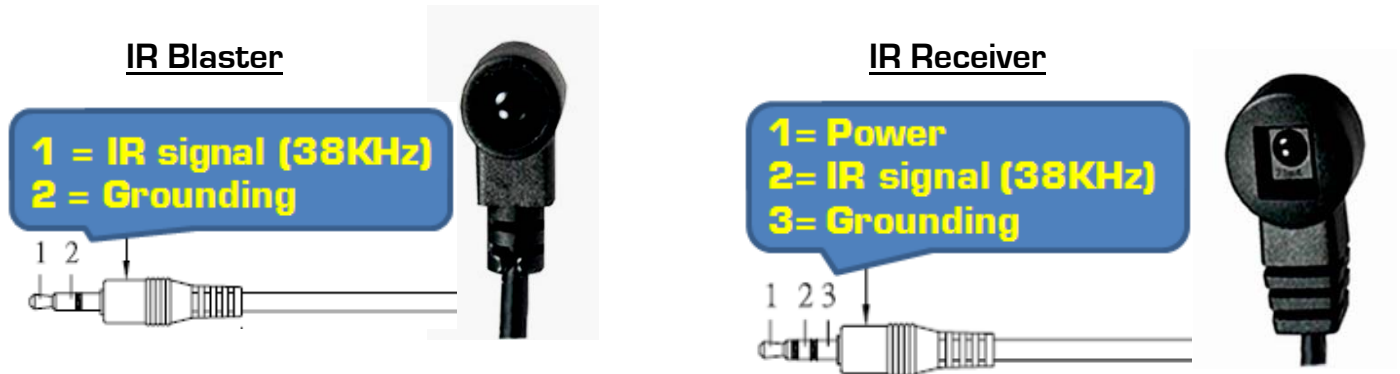
IR1: The IR blaster connected here can only transmit IR command signals from the remote receivers that are setting at the input channel 1.

IR2: The IR blaster connected here can only transmit IR command signals from the remote receivers that are setting at the input channel 2.

IR3: The IR blaster connected here can only transmit IR command signals from the remote receivers that are setting at the input channel 3.

IR4: The IR blaster connected here can only transmit IR command signals from the remote receivers that are setting at the input channel 4.

CATS-HDMI-Rx4

IR: The IR receiver connected here can receive all IR command signals from the IR remote controls of CATS-HDMI-MX4 and all other HDMI source devices.

Definition of IR Earphone Jack

IR Blaster

1 = IR signal (38KHz)
2 = Grounding

1 2

IR Receiver

1= Power
2= IR signal (38KHz)
3= Grounding

1 2 3

> ℹ️ You can buy any IR extension cables in the market that are compatible to the definition of the IR sockets for the matrix if necessary for replacement use.

Supported IR Data Formats

Data Format	Suitable	Not Recommended
NEC	☑	
RC5	☑	
TOSHIBA MICOM CODE	☑	
GRUNDIG CODE	☑	
SONY 12 BIT CODE	☑	
SONY 15 BIT CODE	☑	
SONY 20 BIT CODE	☑	
RCA CODE		☑
RCM CODE		☑
MATSUSHITA CODE		☑
MITSUBISHI CODE	☑	
ZENITH CODE	☑	
JVC CODE	☑	
M50560-001P	☑	
MN6125H	☑	
MN6125L	☑	
MN6014_C5D7	☑	
MN6014-C6D6	☑	
MC14457P	☑	
LC7464(AHEA)	☑	
GEMINI_CM	☑	

CATS-HDMI-MX4 as master

1. Connect all sources to HDMI Inputs on the 4x4 HDMI over CAT5 matrix master CATS-HDMI-MX4

2. Connect each DDC output on the CATS-HDMI-MX4 to respective DDC input on the remote receiver CATS-HDMI-Rx4

3. Connect each TMDS output on the CATS-HDMI-MX4 to respective TMDS input on the remote receiver CATS-HDMI-Rx4

4. Connect IR blaster to the CATS-HDMI-MX4 and direct the IR blaster to point towards the built-in IR receiver of the HDMI source devices

5. Connect the +5V 6A DC power supply to the CATS-HDMI-MX4

6. Power on all HDMI sources

7. Power on the CATS-HDMI-MX4

CATS-HDMI-Rx4 as receiver

1. Connect each HDMI output to HDMI displays

2. Connect the TMDS input on the CATS-HDMI-Rx4 to the TMDS output on the CATS-HDMI-MX4

3. Connect the DDC input on the CATS-HDMI-Rx4 to the DDC output on the CATS-HDMI-MX4

4. Connect IR receiver and place the IR receiver at the appropriate position that can receive the IR signals sent from the users

5. Dial the 8-level rotary control switch to adjust the HDMI signal level until the picture and sound are clear. It is recommended to dial from 7 to 0 to find the optimal visual experience.

Source Side

Method A: Push-in Button

Push the HDMI input switch buttons on the front panel, the source will be sequentially changed.

Method B: IR Remote Control

a. Please press F1 to F4 to enter IR control mode and decide which output port to be controlled by pressing F1 to F4, and wait a few seconds for audio/video of next channel coming out after the channel switch command is sent.

    Note
    If the setting is correct, the corresponding LED will flash. If not, please press output port select button again.

| F1	HDMI output #1
F2	HDMI output #2
F3	HDMI output #3
F4	HDMI output #4

b. Use ◀ or ▶ keys to select input source, and wait a few seconds for audio/video of next channel coming out after the channel switch command is sent.

    Note
    If the setting is correct, the corresponding LED will flash. If there is no response, please wait until the LED stops flashing, and try again.
    Left button to switch channels in ascending order (1, 2, 3, 4, 1, ...)
    Right button to switch channels in descending order (1, 4, 3, 2, 1, ...)
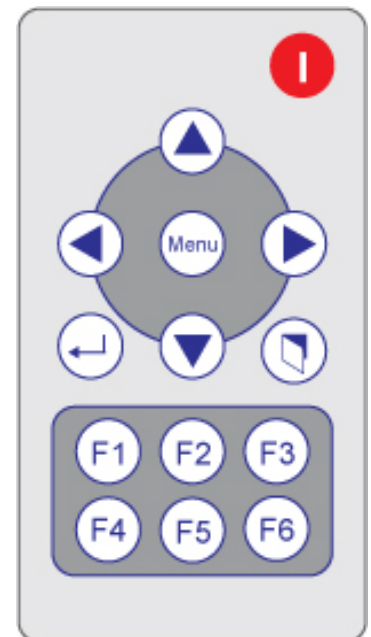
Display Side

Method A: Push-in button

Push the switch button [**IN**] of respective output channels then the output channel will switch from HDMI source 1 to source 4 in sequential order, and wait a few seconds for audio/video of next channel coming out after the channel switch command is sent.

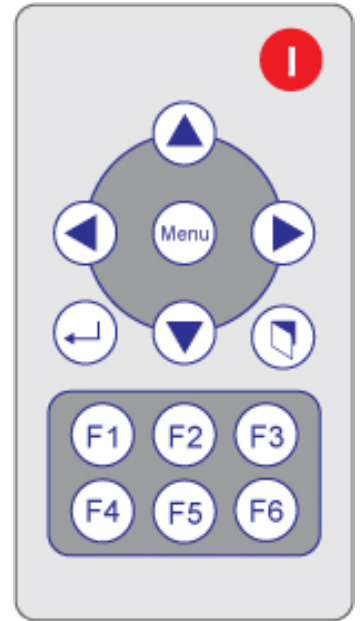## *Method B1: IR remote control for switching input channels*

Channel select switch must be set to zero.

a. Press Power on button to enable IR control function.
   Note: If CATS-HDMI-Rx4 receives the IR command, the LED will flash.
   If not, try it again.

b. Press hot key for input source:

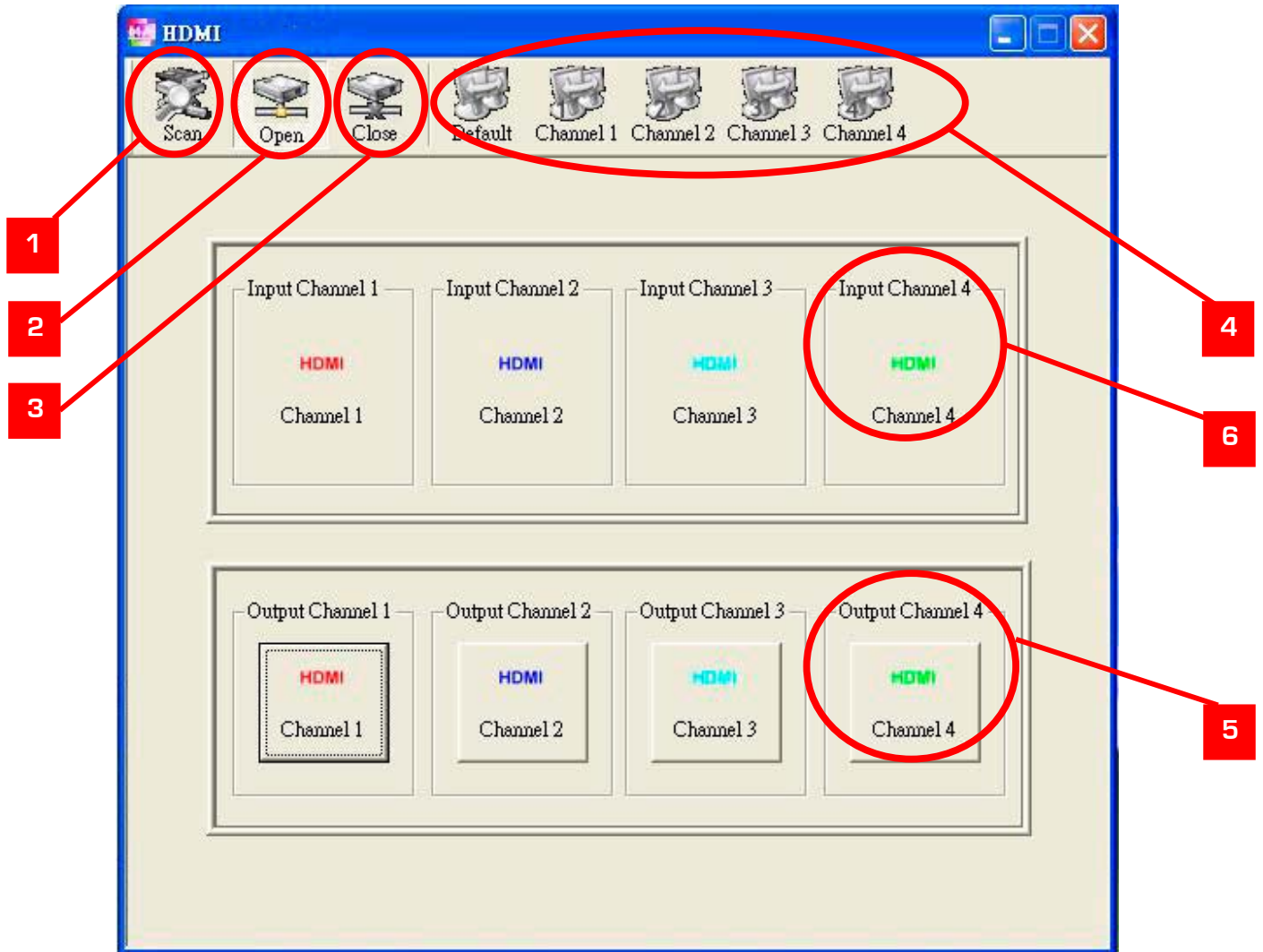| F1	HDMI source #1
F2	HDMI source #2
F3	HDMI source #3
F4	HDMI source #4

Method B2: IR remote control for controlling the HDMI source devices

Users can use the corresponding IR remote control to control respective DVD player or any HDMI compliant devices including CATS-HDMI-MX4 itself with IR control at any display site.

Method C: Software Control through RS-232

**1** Scan: Push this button will trigger the automatic search over all the available COM ports (1-255). If the matrix is detected, the message window below will show up.

Otherwise, an error message shows up to indicate no legal device can be found. Notice that successful connection is only established if there exists at least one available COM port.

2 Open: Open the COM port after scan to establish the connection between PC and the matrix.

3 Close: Release the COM port after scan.

4 Quick Setup Buttons: Provide the fast setup between inputs and outputs of the matrix. "Default" button makes input 1, 2, 3, 4 mapped to output 1, 2, 3, 4 respectively. "Channel 1" makes all outputs see input-1, same for the remaining buttons.

5 Output Channel Setup: Click on this button, a quick selection table of inputs will show up. Users can therefore easily select the input video for each output.

6 Input Channel Setup: The button will bring up the setup window for the inputs as below.
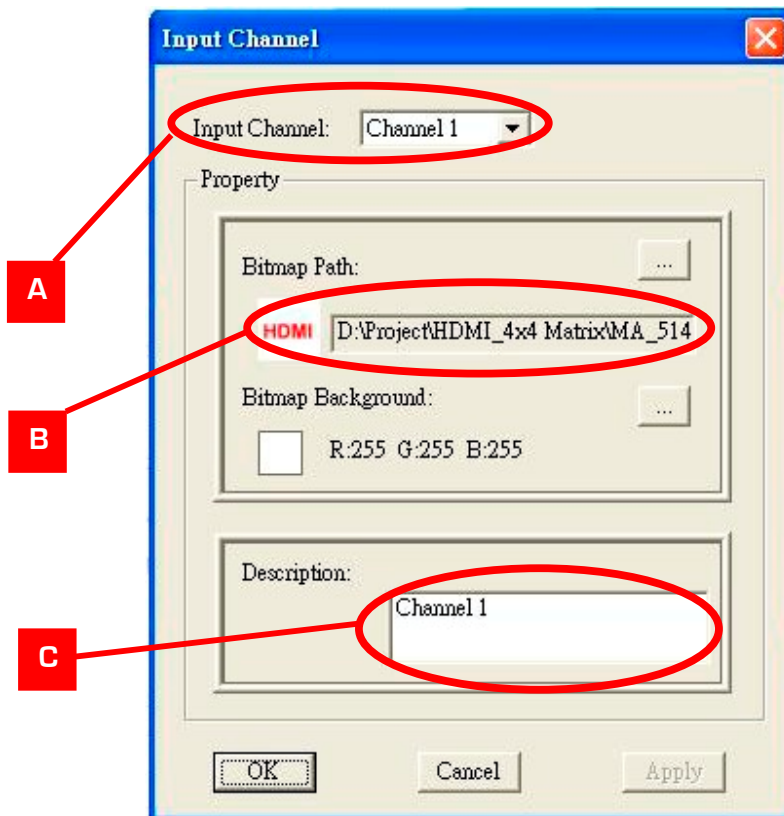
A Input Channel: Select the input channel to do bitmap and label change.

B Bitmap Path: Select the figure for each channel. Notice that only pictures in BMP format are supported.

C Description: Channel description.

RS-232 Commands

RS-232 transmission Format

Baud rate: 9600
Data bit: 8
Parity: None

Set Command

Command Code		Response	Description
Data	Check SUM	ACK	SET
0x08 0x4d 0x41 0x51 0x44 0x05 *0x01~0xff	0x31~0x2f	0xaa	SET CATS-HDMI-MX4 Device ID
0x0c 0x4d 0x41 0x51 0x44 Device_Id 0x02 port1 port2 port3 port4	0x0c+…+port4	0xaa	Set CATS-HDMI-MX4 Source Mapping of Output Port

Status Command

Command Code		Response		Description
Data	Check SUM	Get Status	Check SUM	Status
0x05 0x4d 0x4f 0x44	0xe5	0xaa 0x06 0x4d 0x41 0x51 0x44	0x29	Get Device Type (CATS-HDMI-MX4)
0x07 0x4d 0x41 0x53 0x57 0x04	0x43	0xaa 0x3 0x01~0xff	0x04~0x02	Get Device ID
0x08 0x4d 0x41 0x51 0x44 *0x01~0xFF 0x01	0x2e~0x2c	0xaa 0x06 port1 port2 port3 port4	0x06 + port1~port4	Get Source Mapping of Output Port
0x08 0x4d 0x41 0x51 0x44 *0x01~0xFF 0x04	0x30~0x2e	0xaa 0x08 0x56 0x33 0x2e 0x30 0x31 0x61	0x81	Software Version V.3.01a

Check sum:

Check sum = (Data value sum)%256 The check sum of response is not included 0xaa.

0x01 ~ 0xFF:

This data is device ID. The Device ID saved in the device, if the device ID of the controlled device is 0xff , the device will ignore its own ID and carry out the commands.

> ⚠️ ***Warning!***
> *There could be unexpected consequences resulted from inappropriate firmware update operation.*
> *Please do it with caution.*

1. Please unzip the **Matrix_Firmware_Update.zip** into your designated folder.

2. Please turn off the power of the MATRIX and set DIP location of [**SW Main**] at pin#1-ON[⬇], pin#2-ON[⬇], pin#3-OFF[⬆], & pin#4-OFF[⬆].

3. Please execute the file **Matrix_Firmware_Update.exe**

4. In the pop-up window, at [Select Chip], please select **W78E365**.

5. In the pop-up window, at [Select File], please choose the BIN file in the designated folder, as shown in the picture.
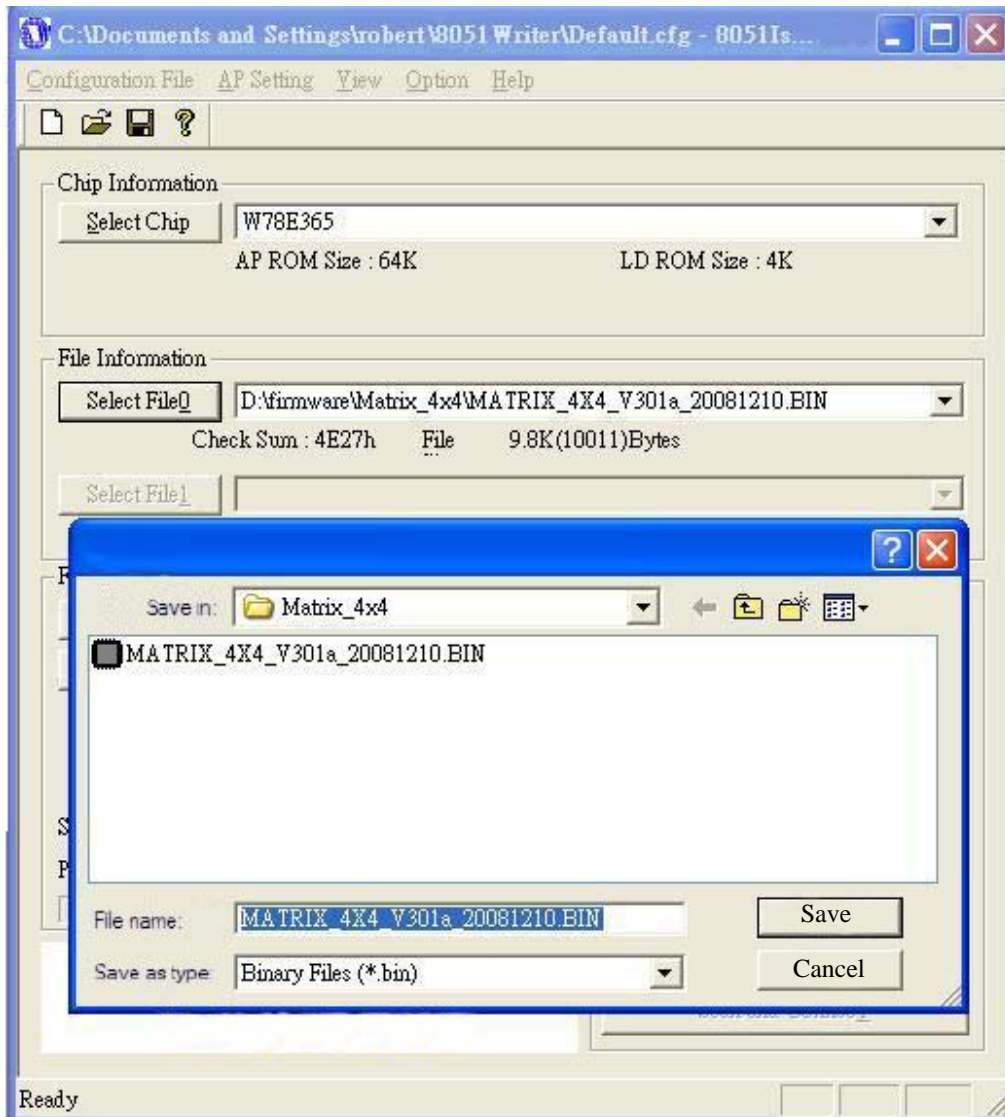
6. In the pop-up window, please select the [File Format] to **Binary**.
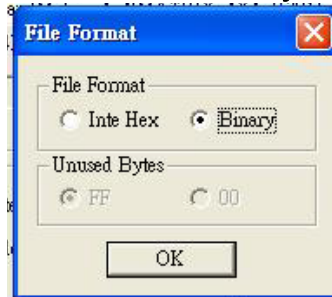
7. Please make sure your PC has direct connection to the RS-232 port of the MATRIX, as shown in the picture (left), that in [Communication Setting] the onlne status should be "Wait to connect". If the RS-232 connection is not firmly established, you will see the online status is "Disconnect." If so, please check the RS-232 connection until the online status becomes "Wait to Connect."
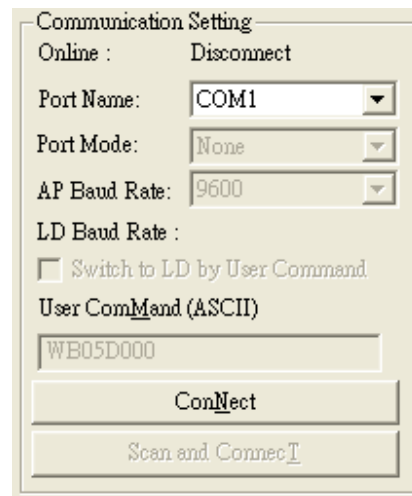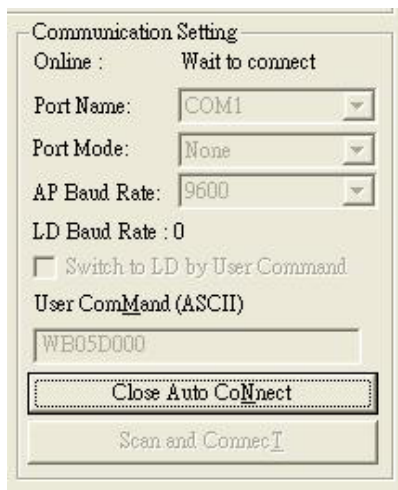
8. Please turn on the MATRIX. The firmware update process will automatically initiate. If nothing happens, please turn off and turn on the MATRIX again to initiate the automatic firmware update.

9. The firmware update process is successful if you see the [Information] window pops up to inform you that the process is complete. If you see the [Error] window pops up, please turn off the MATRIX and turn it on again. If necessary, please redo the whole sequences 1-9.
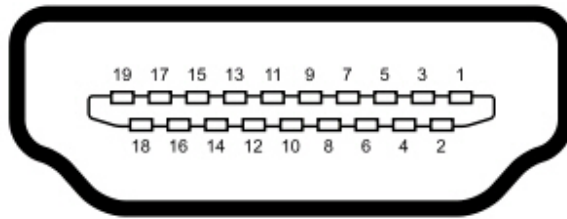

10. The message "Program: OK!" means the firmware update process is successful. If you see the [Error] window pops up after the message [Program: OK!], please ignore it.

11. Turn off MATRIX. Set DIP location of [SW Main] at pin#1-OFF(⬆), pin#2-OFF(⬆), pin#3-ON(⬇), & pin#4-OFF(⬆).

12. Turn the MATRIX back on and return to normal operation.

HDMI Pin Definition

Type A (Receptacle) HDMI

Pin 1	TMDS Data2+	Pin 8	TMDS Data0 Shield	Pin 15	SCL
Pin 2	TMDS Data2 Shield	Pin 9	TMDS Data0–	Pin 16	SDA
Pin 3	TMDS Data2–	Pin 10	TMDS Clock+	Pin 17	DDC/CEC Ground
Pin 4	TMDS Data1+	Pin 11	TMDS Clock Shield	Pin 18	+5 V Power
Pin 5	TMDS Data1 Shield	Pin 12	TMDS Clock–	Pin 19	Hot Plug Detect
Pin 6	TMDS Data1–	Pin 13	CEC		
Pin 7	TMDS Data0+	Pin 14	Reserved (N.C. on device)		

1. If the DVI or HDMI device requires the EDID information, please use EDID Reader/Writer to retrieve and provide DVI/HDMI EDID information.

2. All HDMI over CAT5 transmission distances are measured using Belden 1583A CAT5e 125MHz LAN cable and ASTRODESIGN Video Signal Generator VG-859C.

3. The transmission length is largely affected by the type of LAN cables, the type of DVI sources, and the type of DVI display. The testing result shows solid LAN cables (usually in bulk cable 300m/1000ft form) can transmit a lot longer signals than stranded LAN cables (usually in patch cord form). Shielded STP cables are better suited than unshielded UTP cables. A solid UTP CAT5e cable shows longer transmission range than stranded STP CAT6 cable. For long extension users, solid LAN cables are the only viable choice.

4. EIA/TIA-568-B termination (T568B) for LAN cables is recommended for better performance.

5. To reduce the interference among the unshielded twisted pairs of wires in LAN cable, one can use shielded LAN cables to improve EMI problems, which is worsen in long transmission.

6. Because the quality of the LAN cables has the major effect on how long the transmission limit can achieve and how good is the received picture quality, the actual transmission range is subject to one's choice of LAN cables. For desired resolutions greater than 1080i or 1280x1024, a Cat-6 cable is recommended.

7. If your HDMI display has multiple HDMI inputs, it is found that the first HDMI input [HDMI input #1] generally can produce better transmission performance among all HDMI inputs.

8. The CATS-HDMI-Rx4 has been tested extensively and found that it doesn't require external power supply. If in rare situation you find it cannot work with the CATS-HDMI-MX4, please use any +5V power adapter to plug in the power jack and see if it can work. If not, please contact your technical support for further service.

9. Additional IR remote controls and IR blasters can be purchased as optional accessories to control the HDMI sources located separately.

Performance Guide for HDMI over LAN Cable Transmission

Performance rating		Type of LAN cable		
Wiring	Shielding	CAT5	CAT5e	CAT6
Solid	Unshielded (UTP)	★★★	★★★★	★★★★★
Solid	Shielded (STP)	★★★	★★★	★★★★
Stranded	Unshielded (UTP)	★	★★	★★
Stranded	Shielded (STP)	★	★	★★
Termination		Please use **EIA/TIA-568-B** termination (**T568B**) at any time		