



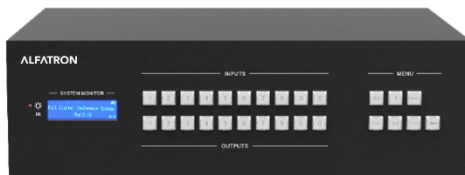
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ALFATRON ELECTRONICS GmbH

GERMANY

ALF-MMX1616-N

Modular Matrix Switcher 16x16



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Preface

Read this user manual carefully before using this product. Pictures shown in this manual is for reference only, different model and specifications are subject to the real product.

This manual is only for operation instruction, not for any maintenance usage. The functions described in this version are updated till March 2017. Any changes in functions and parameters since then will be informed separately. Please refer to the dealers for the latest details.

FCC Statement

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation.

Operation of this equipment in a residential area is likely to cause interference, in which case the user at their own expense will be required to take whatever measures may be necessary to correct the interference

Any changes or modifications not expressly approved by the manufacture would void the user's authority to operate the equipment.



Do not dispose of this product with the normal household waste at the end of its life cycle. Return it to a collection point for the recycling of electrical and electronic devices. This is indicated by the symbol on the product, user manual, or packaging. The materials are reusable according to their markings. By reusing, recycling, or other forms of utilization of old devices you make an important contribution to the protection of our environment. Please contact your local authorities for details about collection points.

SAFETY PRECAUTIONS

To ensure the best from the product, please read all instructions carefully before using the device. Save this manual for further reference.

- Unpack the equipment carefully and save the original box and packing material for possible future shipment.
- Follow basic safety precautions to reduce the risk of fire, electrical shock, and injury to persons.
- Do not dismantle the housing or modify the module. It may result in electrical shock or burn.
- Using supplies or parts not meeting the products' specifications may cause damage, deterioration, or malfunction.
- Refer all servicing to qualified service personnel.
- To prevent fire or shock hazard, do not expose the unit to rain, moisture or install this product near liquid.
- Do not put any heavy items on the extension cable in case of extrusion.
- Do not remove the housing of the device as opening or removing housing may expose you to dangerous voltage or other hazards.
- Install the device in a place with fine ventilation to avoid damage caused by overheat.
- Keep the module away from liquids.
- Spillage into the housing may result in fire, electrical shock, or equipment damage. If an object or liquid falls or spills on to the housing, unplug the module immediately.
- Do not twist or forcefully pull the ends of the optical cable. It can cause malfunction.
- Do not use liquid or aerosol cleaners to clean this unit. Always unplug the power to the device before cleaning.
- Unplug the power cord when left unused for a long period of time.
- Information on disposal for scrapped devices: do not burn or mix with general household waste, please treat them as normal electrical wastes.

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1. Product Introduction

The Alfatron ALF-MMX1616-N is a high-performance 16 x 16 video and audio modular matrix switcher. It supports different video signals with cross switching. Every AV signal is transmitted and switched independently to decrease signal attenuation. The ALF-MMX1616-N supports various changeable cards including HDMI, VGA, and HDBaseT etc. Users can choose to insert different signal cards for different applications.

The ALF-MMX1616-N has an RS232 port and a TCP/IP port for convenient control from third-party devices. With its flexible design, the ALF-MMX1616-N can be used for different projects and tends to be an all-in-one solution. It is the combo solution for multimedia conference rooms, control rooms, broadcasting rooms, shopping centers etc. It will handle all the audiovisual management, including the switching, driving, scaling etc.

1.1. Features

- Modular chassis with configurable I/O slots.
- Various I/O cards, includes HDMI, HDBaseT, and VGA cards (Compatible with YUV, YC & CVBS.) to configure any matrix.
- Truly cross-point switching, any input to any output, regardless signal format.
- Supports HDMI1.4a, 3D.
- Integrated HDBaseT technology.
- Controllable via button, RS232 & optional TCP/IP, also compatible with 3rd party control.
- HDCP compliant.
- LCD display.

1.2. Signal Card

The matrix supports multiple signal cards as listed in the following charts:

Signal	Model	Description
VGA	4I-VA	1080P seamless VGA input card with 4 VGA and 4 external L+R audio ports.
HDMI	4I-UH	4K HDMI input card with 4 HDMI, and 4 external L+R audio ports.
	4O-UH	4K HDMI output card with 4 HDMI and 4 external L+R audio ports.
	4I-UHS	4K seamless HDMI input card with 4 HDMI and 4 external stereo audio ports.
	4O-UHS	4K seamless HDMI output card with 4 HDMI and 4 external stereo audio ports.
HDBaseT	4I-BT	4K HDBaseT input card with 4 HDBT, 4 RS232 and 4 external stereo audio ports.
	4O-BT	4K HDBaseT output card with 4 HDBT, 4 RS232, and 4 external stereo audio ports.
	4I-BTS	1080P seamless HDBaseT input card with 4 HDBT, 4 RS232 and 4 external stereo audio ports.
	4O-BTS	1080P seamless HDBaseT output card with 4 HDBT, 4 RS232, and 4 external stereo audio ports.

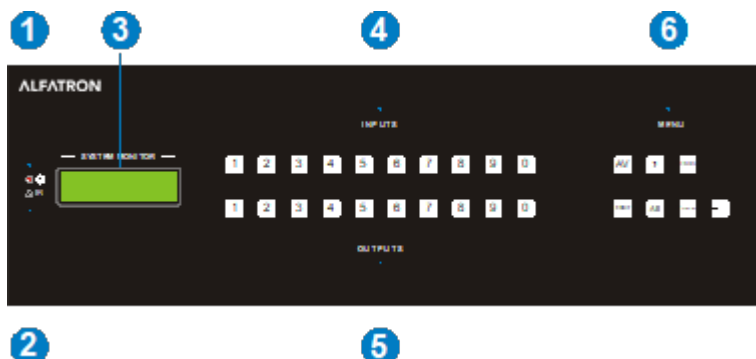
1.3. Package List

- 1x Modular Matrix Switcher 16x16
- 1x IR Remote
- 1x RS232 Cable
- 4x Plastic Cushions
- 1x Power Cord
- 1 x User Manual

Note: Please contact your distributor immediately should any damage or defect in the components be found.

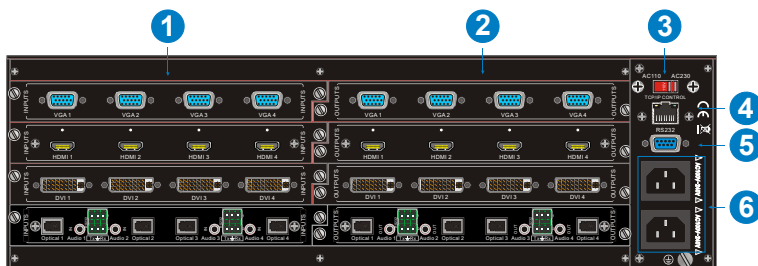
2. Panel Description

2.1. Matrix Front Panel



No.	Name	Description
①	IR	Built-in IR sensor to receive IR signal sent from IR remote.
②	Power LED	The LED illuminates red when powered.
③	LCD Screen	Shows real-time operation status.
④	INPUTS	Back-lit buttons for input selection, range from 0~ 9, 16 selectable channels in total.
⑤	OUTPUTS	Back-lit buttons for output selection, range from 0 ~ 9, 16 selectable channels in total.
⑥	MENU	AV: Switch AV signal from AV signal card & audio signal from audio card synchronously.
		,: Division button, to divide the output channels when switching to more than one channel.
		UNDO: Undo button, to undo the last performed action.
		ENTER: confirm the switching operation. The operation will not be executed by the matrix without confirmation.
		ALL: select all input / output channels
		THROUGH: To transfer the signals directly to the corresponding output channels.
		←: Backspace button, to backspace the last button pressed.

2.2. Matrix Rear Panel



No.	Name	Description
①	INPUTS	Signal card slots to insert necessary input cards.
②	OUTPUTS	Signal card slots to insert necessary output cards.
③	Power Switch	Switch between AC110V and AC230V to access different power
④	TCP/IP	(Optional) Used for TCP/IP control port
⑤	RS232	Serial control port, connect with RS232 port of control device.
⑥	Power ports	Connect with household alternating current power, including one redundant power.

Note: There are only four input and four output slots for the matrix, which enables only four input cards and four output cards to be installed. The input / output cards can be changed based on your requirements and supports hot plug and play.

2.3. Signal Card

The matrix supports expansion through various changeable input / output cards of different signals including HDMI, VGA, and HDBaseT. Here is a brief introduction to the changeable cards.

2.3.1. 4I-VA

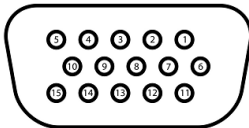
1080P seamless VGA input card with 4 VGA and 4 external L+R audio ports.



4I-VA

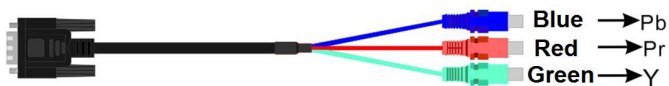
- Supports seamless switching, it can be used in combination with other seamless output signal card.
- Supports video upscaling, converting input video to 1080P or 1920x1200P.
- Supports input resolution selection.
- Manually select VGA (RGBHV), YPbPr, S-VIDEO, or C-VIDEO signal format.
- Compatible with HDMI and DVI signal input.
- Supports YCBCR or RGB chrominance space.
- Supports VGA input signal auto-correction.
- Supports 4 external L+R audio inputs and audio channel control.

Pin layout of female VGA connector:

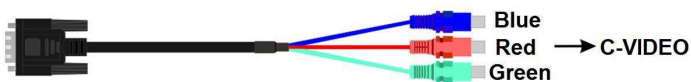


Pin	Signal	Pin	Signal
1	RED	9	KEY/PWR
2	GREEN	10	GND
3	BLUE	11	ID0/RES
4	ID2/RES	12	ID1/SDA
5	GND	13	HSync
6	RED_RTN	14	VSynC
7	GREEN_RTN	15	ID3/SCL
8	BLUE_RTN		

When connecting to YPbPr or C-VIDEO signal, insert converting cables according to specific pin definitions (see the figures below):

VGA- YPbPr:

Pin	Signal	Pin	Signal
1	RED	6	GND
2	GREEN	7	GND
3	BLUE	8	GND
Other pins are not used.			

VGA- C-VIDEO:

Pin	Signal	Pin	Signal
1	RED	6	GND
7	GND	8	GND
Other pins are not used.			

2.3.2. 4I-UH & 4O-UH

4K HDMI input card with 4 HDMI, and 4 external L+R audio ports.



4I-UH

- Supports HDMI 1.4 and HDCP 1.4.
- Compatible with DVI signal.
- Input resolution is up to 4Kx2K and supports 1080P 3D.
- Synchronously switch audio and video.
- Supports 4 external L+R audio inputs and audio channel control.

Note: When the 4I-UH input card is used with the 1080P output card, the video resolution must be set to 1080P to ensure reliable output.

4K HDMI output card with 4 HDMI, and 4 external L+R audio ports.



4O-UH

- Supports HDMI 1.4 and HDCP 1.4.
- Compatible with DVI signal.
- Output resolution is up to 4Kx2K and supports 1080P 3D.
- Synchronously switch audio and video.
- Supports 4 external L+R audio outputs.

2.3.3. 4I-UHS & 4O-UHS

4K seamless HDMI input card with 4 HDMI and 4 external stereo audio ports.



4I-UHS

- Supports HDMI 1.4 and HDCP 2.2.
- Compatible with DVI-D signal.
- Resolution is up to 4096x2160@60Hz 4:2:2.
- Input signal card has character overlay function, and character can be changed to relative attribute via commands.
- Supports audio embedded function.
- Input card supports OSD menu function.
- It can be used together with a 1080P seamless signal card.

4K seamless HDMI output card with 4 HDMI and 4 external stereo audio ports.

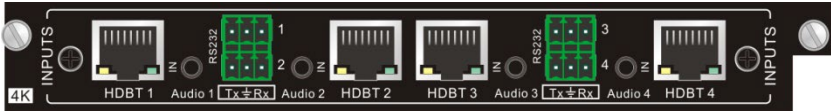


4O-UHS

- Supports HDMI 1.4 and HDCP 2.2.
- Compatible with DVI-D signal.
- Resolution is up to 4096x2160@60Hz 4:2:2.
- Supports various output resolutions: 1024x768@60Hz, 1360x768@60Hz, 1280x720@60Hz, 1920x1080@30Hz, 1920x1080@60Hz, 3840x2160@30Hz, 4096x2160@30Hz.
- Supports audio de-embedded function.
- Output card supports simple view splicing function.
- It can be used together with a 1080P seamless signal card.

2.3.4. 4I-BT & 4O-BT

4K HDBaseT input card with 4 HDBT, 4 RS232, and 4 external stereo audio ports.

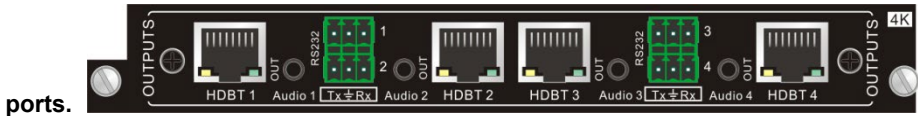


4I-BT

- Supports HDBT 1.0, HDMI 1.4, and HDCP 1.4.
- Input resolution is up to 4Kx2K and supports 1080P 3D.
- It is used with HDBaseT transmitter to extend video signal, the transmission distance can be up to 70 meters at 1080P or 40 meters at 4Kx2K.
- Features 4 RS232 ports for two-way RS232 pass-through.
- The RS232 baud rate supports 2400, 4800, 9600, 19200, 38400, 57600, and 115200.
- Supports 4 external stereo audio inputs and audio channel control.

Note: When the 4I-BT input card is used with the 1080P output card, the video resolution must be set to 1080P to ensure reliable output.

4K HDBaseT output card with 4 HDBT, 4 RS232, and 4 external stereo audio



ports.

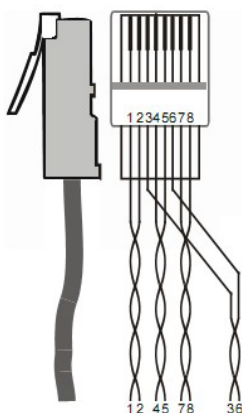
4O-BT

- Supports HDBT 1.0 and HDCP 1.4.
- Output resolution is up to 4Kx2K and supports 1080P 3D.
- It is used with HDBaseT receiver to extend video signal, the transmission distance can be up to 70 meters at 1080P or 40 meters at 4Kx2K.
- Features 4 RS232 ports for two-way RS232 pass-through.
- The RS232 baud rate supports 2400, 4800, 9600, 19200, 38400, 57600, and 115200.
- Supports 4 external stereo audio outputs and audio channel control.

How the indicators work:

Color	Definition	Status
Yellow	Power LED	The LED illuminates yellow when power is present.
Green	Link LED	The LED illuminates green when the port is successfully connected to other devices via the CAT6 cable.

Pin layout of the HDBT connector:



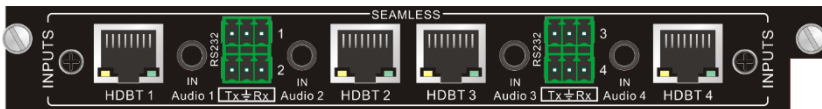
Pin	Color
1	orange white
2	orange
3	green white
4	blue
5	blue white
6	green
7	brown white
8	brown

1st Group	4--5
2nd Group	1--2
3rd Group	3--6
4th Group	7--8

Note: Cable connectors *MUST* be metal, and the shielded layer of cable *MUST* be connected to the connector's metal shell, this is to ensure grounding.

2.3.5. 4I-BTS & 4O-BTS

1080P seamless HDBaseT input card with 4 HDBT, 4 RS232, and 4 external stereo audio ports.



4I-BTS

- Supports seamless switching, and can be used in combination with other seamless output signal cards.
- Supports HDBT1.0 and HDCP 1.3.
- Supports input resolution selection, the default is 1920x1080P@60Hz.
- It is used with an HDBaseT transmitter to extend video signal, the transmission distance can be up to 70 meters at 1080P.
- Supports image brightness, contrast, chrominance, sharpness, color temperature, aspect ratio, and image mode setting.
- Features 4 RS232 ports for two-way RS232 pass-through.
- The RS232 baud rate supports 2400, 4800, 9600, 19200, 38400, 57600, and 115200.
- Supports 4 external stereo audio inputs and audio channel control.

1080P seamless HDBaseT output card with 4 HDBT, 4 RS232, and 4 external stereo audio ports.



4O-BTS

- Supports seamless switching, and can be used in combination with other seamless input signal card.
- Supports HDBT1.0 and HDCP 1.3.
- Supports output resolution selection, the default is 1920x1080P@60Hz.
- It is used with an HDBaseT receiver to extend video signal, the transmission distance can be up to 70 meters at 1080P.
- Features 4 RS232 ports for two-way RS232 pass-through.

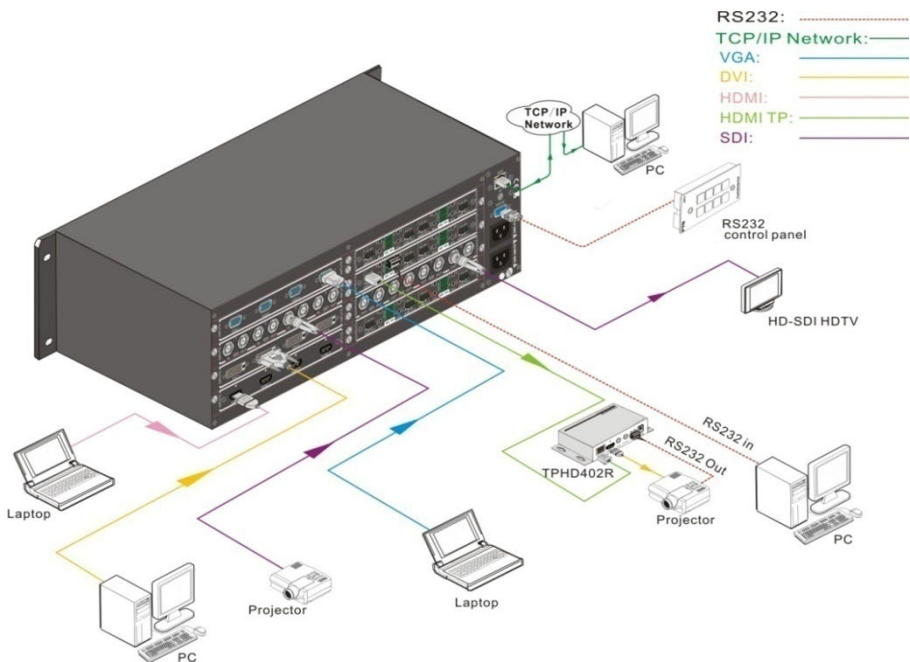
- The RS232 baud rate supports 2400, 4800, 9600, 19200, 38400, 57600, and 115200.
- Supports 4 external stereo audio outputs and audio channel control.

3. System Connection

3.1. Usage Precaution

- Ensure all components and accessories are included before installation.
- The system should be installed in a clean environment with adequate temperature and humidity control.
- All of the power switches, plugs, sockets, and power cords should be insulated and safe.
- All devices should be connected before powering on.

3.2. Connection Diagram



4. Button Control

The ALF-MMX1616-N matrix can be controlled via the front panel buttons. To switch the AV signal, please operate the buttons under the following sequence:

Sequence: **"Input Channel" + "AV" + "Output Channel" + "Enter"**

Note:

- *"Input Channel": Fill with the number of input channel to be controlled.*
- *"Output Channel": Fill with the number of output channels to be controlled. Press "All" to select all the outputs.*
- *Use "," button to separate multiple I/O channels, and press "ENTER" button to confirm the operation.*
- *The input / output channels on the rear panel are counted from left to right, top to bottom.*
- *The input delay time between two numbers of every input and output channel must be less than 5 seconds, or the operation will be canceled.*

Example:

- To switch input 1 to output 1, press input "1", output "1", and "ENTER"
- To switch signals from input 1 to all output channels, press "1", "All" and "ENTER"

Other Functional Buttons:

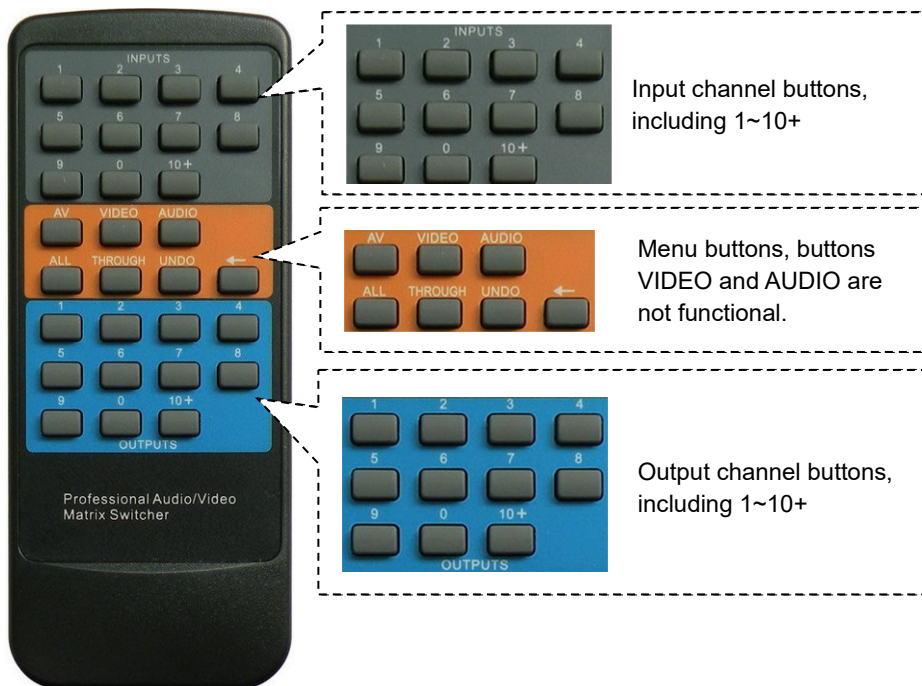
Button	Description	Operation
UNDO	Return to the previous status.	Status 1: Input 6 -> output 6 Press input "6" + "AV"+ output 4 to change the connection. Press "Undo" to return to Status 1.
←	Backspace the last operation.	If you press buttons "1", "AV", "2", "←" in order, then "2" will be canceled.
THROUGH	Get straight I/O connection, e.g. input 1 to output 1, input 2 to output 2.	Format: "Input Channel" + "Through" If you press buttons "ALL", "THROUGH" in order, then the result will be input 1 → output 1, input 2 → output 2, input 3 → output 3 ... input 16 → output 16.

5. IR Remote Control

The matrix can be controlled via the remote. As the function buttons on the IR remote are the same as that on the front panel, the IR remote shares the same operations and commands with the control panel.

Press the buttons in the following sequence:

“Input Channel” + “Switch Mode” + “Output Channel”

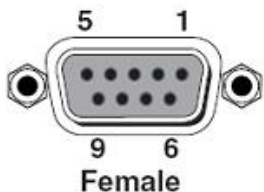


6. RS232 Control

6.1. RS232 Communication Port

Apart from the front control panel and IR remote, the matrix can be controlled by the far-end control system or through the Ethernet control via the RS-232 communication port.

This RS-232 communication port is a female DB-9 connector. The definition of its pin layout is shown in the table below.



No.	Pin	Function
1	N/u	Unused
2	Tx	Transmit
3	Rx	Receive
4	N/u	Unused
5	Gnd	Ground
6	N/u	Unused
7	N/u	Unused
8	N/u	Unused
9	N/u	Unused

6.2. RS232 Control Software

When the matrix is connected to the RS232 port of a computer, users can control it via that computer with the control software. To control the switcher, users need to use RS232 control software.

- **Installation:** Copy the control software file to the computer connected with the Transmitter.
- **Uninstallation:** Delete all the control software files in the corresponding file path.
- **Basic Setting**

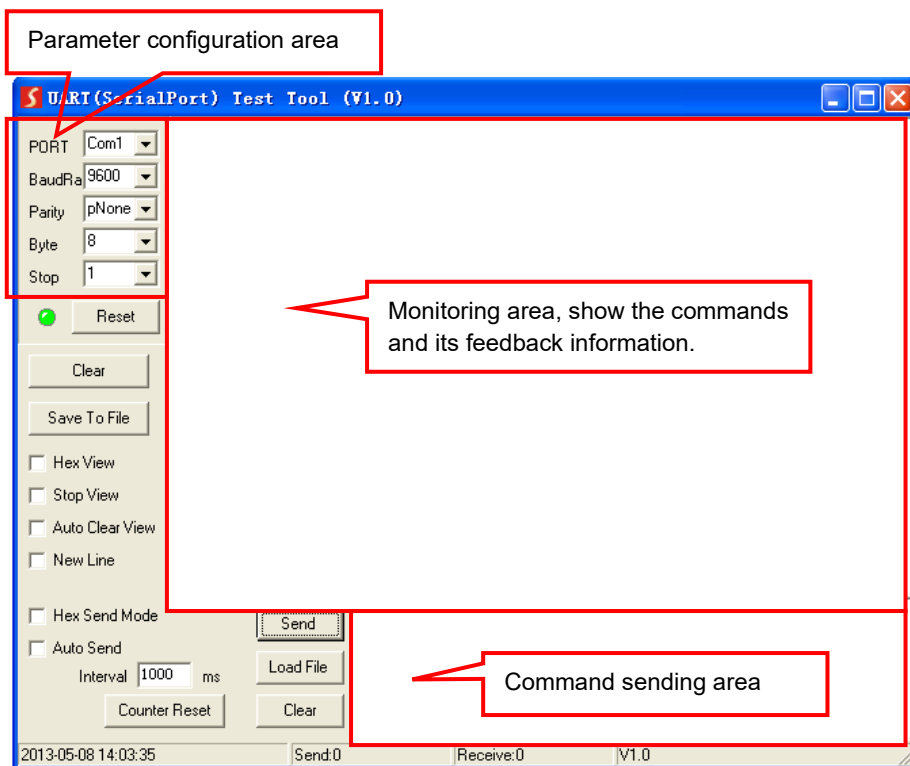
Connect the matrix to all input and output devices required, then connect it to a PC that has RS232 control software installed. Double-click the software icon to run the software.

Please refer to the software **CommWatch.exe** as an example. The icon is shown below:



CommWatch.exe

The interface of the control software is shown below:



Please set the parameters of COM number, baud rate, data bit, stop bit and the parity bit correctly, only then can the RS232 commands be sent in Command Sending Area.

6.3. RS232 Communication Command

With this command system, users are able to control and operate the matrix with RS232 software remotely.

Note:

- Please disconnect all the twisted pair CAT6 cables before sending command **EDIDUpgrade[X]**.
- In the commands, “[” and “]” are symbols for easy reading and do not need to be typed into the actual operation.
- Please remember to end the commands with the ending symbols “.” or “;”.
- Type the command carefully as it is case-sensitive.
- Commands pertaining to EDID only avails for signal cards that support EDID management.
- The matrix boasts 6 built-in EDID data, the chart below illustrates the detailed information:

No.	Detailed Information
1	1080P 2D 5.1CH
2	1080P 2D 2.0CH
3	720P 2D 5.1CH
4	720P 2D 2.0CH
5	4kx2k 2D 5.1CH
6	4kx2k 2D 2.0CH

Update built-in EDID data by sending command **UpgradeIntEDID[x]**..

Communication protocol:

Baud rate: 9600;

Data bit: 8;

Stop bit: 1;

Parity bit: none.

6.3.1. System Control Command

Command	Description	Feedback
/*Type;	Get the system model.	xxxxx
/%Lock;	Lock front panel buttons.	System Locked!
/%Unlock;	Unlock front panel buttons.	System Unlock!
/^Version;	Get the firmware version.	Vx.x.x
/:MessageOff;	Disable feedback message	Closed The Message Return.
/:MessageOn;	Enable feedback message (Default)	Enabled The Message Return.
Undo.	Cancel the previous operation	Undo
Demo.	Switch to testing mode, switch AV 1>1, 2>2, and so on...	Demo Mode AV: 01->001
PWON.	Power on the system.	PWON
PWOFF.	Turn the system to standby mode.	PWOFF
/V00.	Get the backboard software version.	Vx.x.x
%0911.	Restore factory default. All I/O connection will be restored to straight through 1->1, 2->2... saved operation status will remain the same.	

6.3.2. Signal Switching Command

Command	Description	Feedback
[x]All.	Switch input [x] AV to all outputs.	01 To All
All#.	Switch all input signal to the corresponding output channel	All Through.
All\$.	Switch off all outputs.	All Closed.
[x]#.	Switch input [x] to output [x].	01 Through.
[x]\$.	Switch off the output [x].	AV: 01 Closed.
All@.	Switch on all outputs.	All Open.
[x]@.	Switch on the output [x].	01 Open.
[x]V[y1](&[y2]....).	Switch input [x] video only to output [y1] (and all target output in [y2] and so on).	V: 01->001
[x1]B[y1](&[y2]....).	Switch input [x] AV signal to output [y1] (and all target output in [y2] and so on).	AV: 01->001
Status[x].	Get the input channel on output [x].	V: 01->001 A: 01->001
Status.	Get the input channel on the output channel one by one.	V: 01->001 A: 01->001

Command	Description	Feedback
	C

6.3.3. Preset Command

Command	Description	Feedback
Save[Y].	Store the current status to preset [Y]. [Y] ranges from 1 to 9.	Save To F8
Recall[Y].	Recall preset [Y]	Recall From F8 V: 01->001 A: 01->001
Clear[Y].	Clear the preset [Y]	Clear F8

6.3.4. EDID Management Command

Command	Description	Feedback
UpgradeIntEDID[x].	Upgrade built-in EDID data. When the command is applied, the system prompts you to upload the EDID file (.bin). [x] ranges 1 – 6.	Prompt to upload EDID file Upload EDID to system completed
EDIDUpgrade[x].	Upgrade the EDID data of the input port [x]. When the command is applied, the system prompts you to upload the EDID file (.bin). The operation will be canceled in 10 seconds.	Prompt to upload EDID file Upload EDID to input card completed
EDID/[x]/[y].	Set the built-in EDID data type [y] to input port [x]. [y]= 1~6.	Set system EDID[y] to input [x]
EDIDG[x].	Get the EDID data from the output port [x] and display it on the serial port.	
EDIDMInit.	Reset all input card EDID to all input card	EDIDMInit
EDIDM[x]B[y].	Set the EDID data of output [x] on input [y].	EDIDM2B1

6.3.5. 4I-VA Input Card Command

Command	Description	Feedback
USER/II/[x]:0622%;	Set the input [x] to the VGA signal.	0622%
USER/II/[x]:0623%;	Set the input [x] to the YPbPr signal.	0623%
USER/II/[x]:0624%;	Set the input [x] to the S-VIDEO signal.	0624%
USER/II/[x]:0625%;	Set the input [x] to C-VIDEO signal.	0625%
USER/II/[x]:0648%;	Switch on the audio of input [x].	0648%
USER/II/[x]:0649%;	Switch off the audio of input [x].	0649%
USER/II/[x]:0684%;	Set the color space of input [x] to YCBCR.	0684%
USER/II/[x]:0685%;	Set the color space of input [x] to RGB.	0685%
USER/II/[x]:0686%;	Set the signal format of input [x] to HDMI.	0686%
USER/II/[x]:0687%;	Set the signal format of input [x] to DVI.	0687%
USER/II/[x]:0626%;	Set the resolution of input [x] to 1024x768p@60Hz.	0626%
USER/II/[x]:0627%;	Set the resolution of input [x] to 1280x720P@60Hz.	0627%
USER/II/[x]:0628%;	Set the resolution of input [x] to 1280x800P@60Hz.	0628%
USER/II/[x]:0619%;	Set the resolution of input [x] to 1360x768p@60Hz.	0619%
USER/II/[x]:0621%;	Set the resolution of input [x] to 1600x1200P@60Hz.	0621%
USER/II/[x]:0629%;	Set the resolution of input [x] to 1920x1080P@60Hz.	0629%
USER/II/[x]:0620%;	Set the resolution of input [x] to 1920x1200P@60Hz.	0620%
USER/II/[x]:0617%;	Restore the input [x] signal card to factory default.	0617%
USER/II/[x]:0606%;	Automatically calibrate the VGA signal of input [x].	0606%
USER/II/[x]:0698%;	Upgrade the software of input [x].	0698%

6.3.6. 4I-UH Input Card Command

Command	Description	Feedback
AUDIO[x]I[z].	Select audio source for input [x] [x] is port number; [z] stands for audio source, it can be 0 (embedded HDMI audio) or 1 (analog audio)	AUDIO1I0.

6.3.7. 4I-UHS Input Card Command

Command	Description	Feedback
AUDIO[x]I[z].	Select audio source for input [x] [x] is port number; [z] stands for audio source, it can be 0 (embedded HDMI audio) or 1 (analog audio)	AUDIO1I0.
USER/I/[x]:<<*****>>%;	Add the characters <<*****>, [x] is for port number. Up to 10 characters.	<<xxxx >>%
USER/I/[x]:0900%;	Disable character overlay function.	0900%
USER/I/[x]:0901%;	Enable character overlay function.	0901%
USER/I/[x]:0902%;	Show characters in the top left corner.	0902%
USER/I/[x]:0903%;	Show characters in the top right corner.	0903%
USER/I/[x]:0904%;	Show characters in the bottom-left corner.	0904%
USER/I/[x]:0905%;	Show characters in the bottom-right corner.	0905%
USER/I/x:0906%;	Set the color of the characters to white.	0906%
USER/I/x:0907%;	Set the color of the characters to red.	0907%
USER/I/x:0908%;	Set the color of the characters to green.	0908%
USER/I/x:0909%;	Set the color of the characters to blue.	0909%
USER/I/x:0911%;	Set the character font to small.	0911%
USER/I/x:0912%;	Set the character font to large.	0912%
USER/I/x:0617%;	Restore the output [x] signal card to factory default.	0617%
USER/I/[x]:02xx%;	Set the image brightness of input [x] to xx, xx=00~99.	02xx%

Command	Description	Feedback
USER//[x]:03xx%;	Set the image contrast of input [x] to xx, xx=00~99.	03xx%
USER//[x]:04xx%;	Set the image saturation of input [x] to xx, xx=00~99.	04xx%
USER//[x]:05xx%;	Set the image sharpness of input [x] to xx, xx=00~99.	05xx%
USER//[x]:0607%;	Set the image color temperature of input [x] to user/cool/medium/warm.	0607%
USER//[x]:0608%;	Set the image aspect ratio of input [x] to 16:9/4:3/Auto/Panorama/Just scan/Zoom2/Zoom1.	0608%
USER//[x]:0614%;	Set the image mode of input [x] to the user/Dynamic/Standard/mild.	0614%
USER//[x]:0698%	Upgrade the software of input [x].	0698%

6.3.8. 40-UHS Output Card Command

Command	Description	Feedback
USER/O/[x]:0804%;	Set the resolution of output [x] to 1280x720P@60Hz.	Resolution Out02 1280x720 P
USER/O/[x]:0813%;	Set the resolution of output [x] to 1920x1080P@60Hz.	Resolution Out02 1920x1080P
USER/O/[x]:0824%;	Set the resolution of output [x] to 1024x768p@60Hz.	Resolution Out02 1024*768 60HZ
USER/O/x:0828%;	Set the resolution of output [x] to 1360x768p@60Hz.	Resolution Out02 1360*768 60HZ
USER/O/[x]:0840%;	Set the resolution of output [x] to 3840x2160@30Hz.	Resolution Out02 4K*2K 30HZ
USER/O/[x]:0841%;	Set the resolution of output [x] to 3840x2160@60Hz	Resolution Out02 4K*2K 60HZ
USER/O/[x]:0844%;	Set the resolution of output [x] to 4096x2160@30Hz.	Resolution Out02 4K*2K30HZ
USER/O/[x]:0845%;	Set the resolution of output [x] to 4096x2160@60Hz.	Resolution Out02 4K*2K 60HZ

Command	Description	Feedback
GetResolution[x].	Get the resolution of output [x].	Resolution Ou001 3840x2160 30Hz
USER/O/x:0617%;	Restore the output [x] signal card to factory default.	0617%
USER/O/[x]:24XX%;	The horizon direction of the output [x] signal is divided into XX blocks. The value of XX should be less than 9.	24xx%
USER/O/[x]:25XX%;	The vertical direction of the output [x] signal is divided into XX blocks. The value of XX should be less than 9.	25xx%
USER/O/[x]:26XX%;	Set the horizon direction of the output [x] signal to show block XX.	26xx%
USER/O/[x]:27XX%;	Set the vertical direction of the output [x] signal to show block XX.	27xx%
USER/O/[x]:0110%;	Enable the analog audio output [x].	0110%
USER/O/[x]:0111%;	Disable the analog audio output [x].	0111%
USER/O/[x]:0103%;	Set the signal format of output [x] to HDMI. The command is invalid when the output resolution is 4K@60Hz.	0103%
USER/O/[x]:0104%;	Set the signal format of output [x] to DVI. The command is invalid when the output resolution is 4K@60Hz.	0104%

6.3.9. 4I-BT Input Card Command

Command	Description	Feedback
AUDIO[x]I[z].	Select audio source for input [x] [x] is port number; [z] stands for audio source, it can be 0 (embedded HDMI audio) or 1 (analog audio)	AUDIO1I0.

6.3.10. 4I-BTS Input Card Command

Command	Description	Feedback
USER/I/[x]:02xx%;	Set the image brightness of input [x] to xx, xx=00~99.	0299%

Command	Description	Feedback
USER/II/[x]:03xx%;	Set the image contrast of input [x] to xx, xx=00~99.	0399%
USER/II/[x]:04xx%;	Set the image saturation of input [x] to xx, xx=00~99.	0499%
USER/II/[x]:05xx%;	Set the image sharpness of input [x] to xx, xx=00~99.	0599%
USER/II/[x]:0606%;	Automatically calibrate the VGA signal of input [x].	0606%
USER/II/[x]:0607%;	Set the image color temperature of input [x] to user/cool/medium/warm.	0607%
USER/II/[x]:0608%;	Set the image aspect ratio of input [x] to 16:9/4:3/Auto/Panorama/Just scan/Zoom2/Zoom1.	0608%
USER/II/[x]:0614%;	Set the image mode of input [x] to the user/Dynamic/Standard/mild.	0614%
USER/II/[x]:0617%;	Restore the input [x] signal card to factory default.	0617%
USER/II/[x]:0619%;	Set the resolution of input [x] to 1360x768 HD.	0619%
USER/II/[x]:0626%;	Set the resolution of input [x] to 1024x768 XGA.	0626%
USER/II/[x]:0627%;	Set the resolution of input [x] to 1280x720 720P.	0627%
USER/II/[x]:0628%;	Set the resolution of input [x] to 1280x800 WXGA.	0628%
USER/II/[x]:0629%;	Set the resolution of input [x] to 1920x1080 1080P.	0629%
USER/II/[x]:0620%;	Set the resolution of input [x] to 1920x1200 WUXGA.	0620%
USER/II/[x]:0621%;	Set the resolution of input [x] to 1600x1200 UXGA.	0621%
USER/II/[x]:0698%;	Upgrade the software of input [x].	0698%
USER/II/[x]:0686%;	Set the signal format of input [x] to HDMI.	0686%
USER/II/[x]:0711%;	Select HDMI embedded audio as the audio source for input [x].	0711%
USER/II/[x]:0712%;	Select external analog audio input as	0712%

Command	Description	Feedback
	the audio source for input [x].	

6.3.11. 40-BTS Output Card Command

Command	Description	Feedback
USER/O/[x]:0110%;	Enable the analog audio output [x].	0110%
USER/O/[x]:0111%;	Disable the analog audio output [x].	0111%
USER/O/[x]:0800%;	Set the resolution of output [x] to 720x480i@60Hz.	Resolution Ou01 720x480 I
USER/O/[x]:0801%;	Set the resolution of output [x] to 720x576i@50Hz.	Resolution Ou01 720x576 I
USER/O/[x]:0802%;	Set the resolution of output [x] to 720x480P@60Hz.	Resolution Ou01 720x480 P
USER/O/[x]:0803%;	Set the resolution of output [x] to 720x576p@50Hz.	Resolution Ou01 720x576 P
USER/O/[x]:0804%;	Set the resolution of output [x] to 1280x720P@60Hz.	Resolution Ou01 1280x720 P
USER/O/[x]:0805%;	Set the resolution of output [x] to 1280x720P@59Hz.	Resolution Ou01 1280x720 P
USER/O/[x]:0806%;	Set the resolution of output [x] to 1280x720P@50Hz.	Resolution Ou01 1280x720 P
USER/O/[x]:0807%;	Set the resolution of output [x] to 1280x720P@30Hz.	Resolution Ou01 1280x720 P
USER/O/[x]:0808%;	Set the resolution of output [x] to 1280x720P@25Hz.	Resolution Ou01 1280x720 P
USER/O/[x]:0809%;	Set the resolution of output [x] to 1280x720P@24Hz.	Resolution Ou01 1280x720 P
USER/O/[x]:0810%;	Set the resolution of output [x] to 1920x1080i@60Hz.	Resolution Ou01 1920x1080I
USER/O/[x]:0811%;	Set the resolution of output [x] to 1920x1080i@59Hz.	Resolution Ou01 1920x1080I
USER/O/[x]:0812%;	Set the resolution of output [x] to 1920x1080i@50Hz.	Resolution Ou01 1920x1080I
USER/O/[x]:0813%;	Set the resolution of output [x] to 1920x1080P@60Hz.	Resolution Ou01 1920x1080P

Command	Description	Feedback
USER/O/[x]:0814%;	Set the resolution of output [x] to 1920x1080P@59Hz.	Resolution Ou01 1920x1080P
USER/O/[x]:0815%;	Set the resolution of output [x] to 1920x1080P@50Hz.	Resolution Ou01 1920x1080P
USER/O/[x]:0816%;	Set the resolution of output [x] to 1920x1080P@30Hz.	Resolution Ou01 1920x1080P
USER/O/[x]:0817%;	Set the resolution of output [x] to 1920x1080P@29Hz.	Resolution Ou01 1920x1080P
USER/O/[x]:0818%;	Set the resolution of output [x] to 1920x1080P@25Hz.	Resolution Ou01 1920x1080P
USER/O/[x]:0819%;	Set the resolution of output [x] to 1920x1080P@24Hz.	Resolution Ou01 1920x1080P
USER/O/[x]:0820%;	Set the resolution of output [x] to 640x480P@60Hz.	Resolution Ou01 640x480 P
USER/O/[x]:0821%;	Set the resolution of output [x] to 640x480P@75Hz.	Resolution Ou01 640x480 P
USER/O/[x]:0822%;	Set the resolution of output [x] to 800x600P@60Hz.	Resolution Ou01 800x600
USER/O/[x]:0823%;	Set the resolution of output [x] to 800x600P@75Hz.	Resolution Ou01 800x600 P
USER/O/[x]:0824%;	Set the resolution of output [x] to 1024x768p@60Hz.	Resolution Ou01 1024x768
USER/O/[x]:0825%;	Set the resolution of output [x] to 1024x768p@75Hz.	Resolution Ou01 1024x768 P
USER/O/[x]:0826%;	Set the resolution of output [x] to 1280x1024p@60Hz.	Resolution Ou01 1280x1024
USER/O/[x]:0827%;	Set the resolution of output [x] to 1280x1024p@75Hz.	Resolution Ou01 1280x1024P
USER/O/[x]:0828%;	Set the resolution of output [x] to 1360x768p@60Hz.	Resolution Ou01 1360x768P
USER/O/[x]:0829%;	Set the resolution of output [x] to 1366x768p@60Hz.	Resolution Ou01 1366x768P
USER/O/[x]:0830%;	Set the resolution of output [x] to 1400x1050P@60Hz.	Resolution Ou01 1400x1050P

Command	Description	Feedback
USER/O/[x]:0831%;	Set the resolution of output [x] to 1600x1200P@60Hz.	Resolution Ou01 1600x1200P
USER/O/[x]:0832%;	Set the resolution of output [x] to 1440x900P@60Hz.	Resolution Ou01 1440x900 P
USER/O/[x]:0833%;	Set the resolution of output [x] to 1440x900P@75Hz.	Resolution Ou01 1440x900 P
USER/O/[x]:0837%;	Set the resolution of output [x] to 1920x1200P@60Hz.	Resolution Ou01 1920x1200
USER/O/[x]:0839%;	Set the resolution of output [x] to 1600x900P@60Hz.	Resolution Ou01 1600x900

7. TCP/IP Control (Optional)

7.1. Control Mode

TCP/IP default settings:

IP: 192.168.0.178

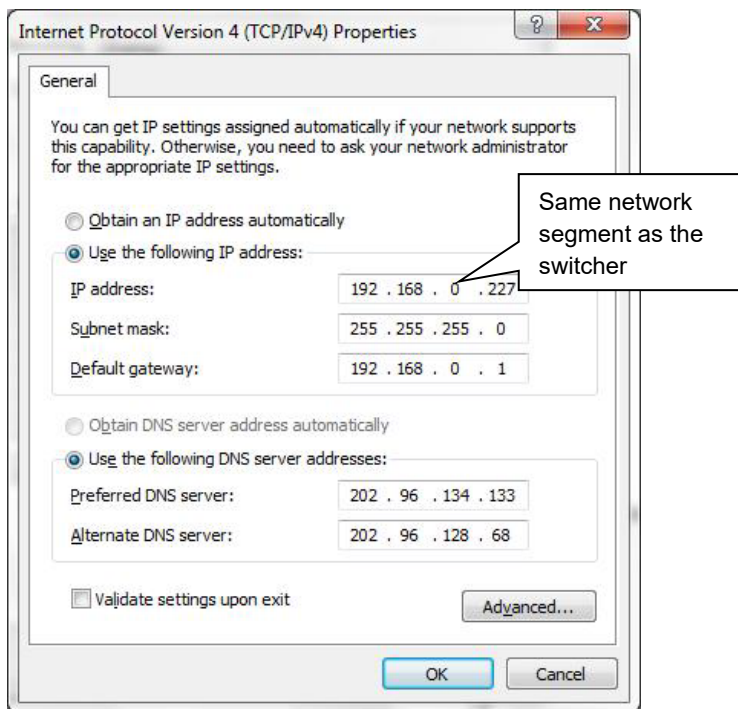
Gateway is 192.168.0.1

Serial Port: 4001.

IP and Gateway can be changed as you need, Serial Port cannot be changed.

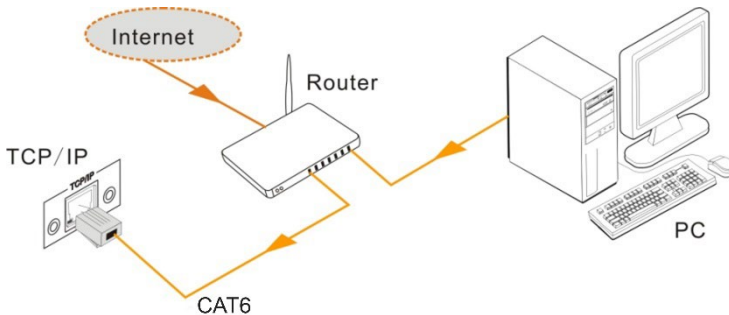
- **Controlled by Single PC**

Connect a computer to the TCP/IP port of the matrix, and set its network segment to the same as the default IP of the matrix (192.168.0.178).



- **Controlled by PC(s) in LAN**

The matrix can be connected with a router to make up a LAN with the PC(s), this enables it to be controlled in a LAN. When controlling, just make ensure the matrix's network segment is the same as the router. Connect as per the below figure for LAN control:



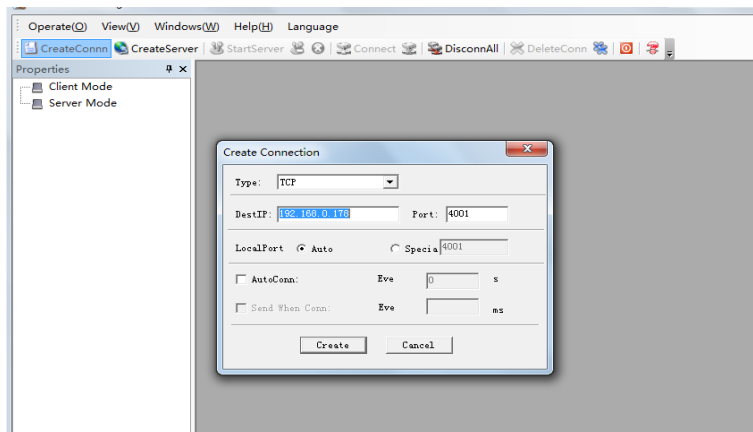
- Step1.** Connect the TCP/IP port of the matrix to the Ethernet port of the PC with a twisted pair.
- Step2.** Set the PC's network segment to the same as the matrix. Do please remember the PC's original network segment.
- Step3.** Set the matrix's network segment to the same as the router.
- Step4.** Set the PC's network segment to the original one.
- Step5.** Connect the matrix and PC(s) to the router. In the same LAN, each PC can control the matrix synchronously.

It is now able to control the device via TCP/IP communication software.

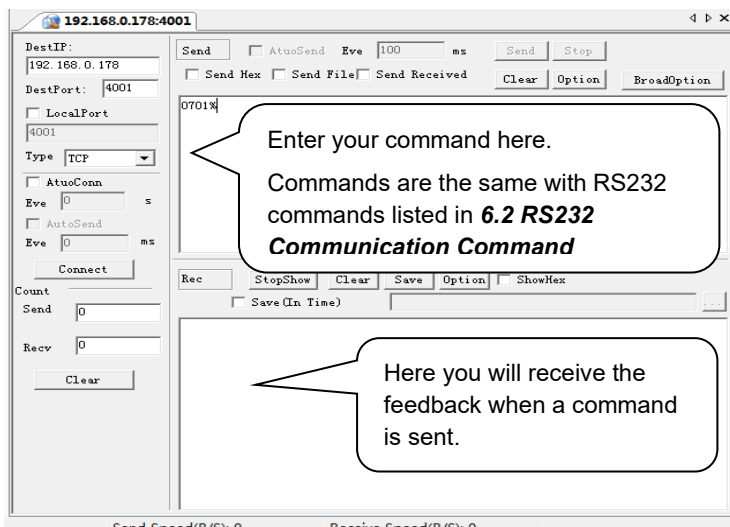
7.2. TCP/IP Communication Software

(Exemplated by TCPUDP software)

- 1) Connect a computer and the matrix to the same network. Open the TCPUDP software (or any other TCP/IP communication software), create a connection, then enter the IP address and port of the matrix (default IP: 192.168.0.178, port: 4001):



- 2) After successfully connected, enter commands to control the matrix, as below:



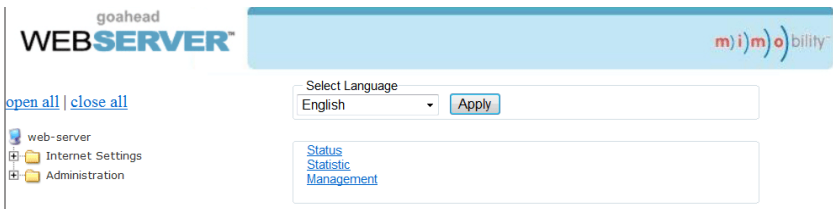
7.3. TCP/IP Configuration

Type the designed website 192.168.0.178:100 into your browser. Enter the correct username and password to log in the Webserver:

Username: admin

Password: admin

Here is the main configuration interface of the Webserver:



In this interface, you can:

- Change website display language.
- Modify network settings: Go to Internet Settings -> WAN.
- Upgrade TCP/IP module: Go to Administration -> Upload Program -> Select program file -> Start upgrading.
- Reboot the device after upgrading.

8. Specification

8.1. Main Unit

Control Part	
Serial Control Port	RS-232, 9- female D connector
Configuration	2 = TX, 3 = RX, 5 = GND
Installation	Rack-Mountable
Front Panel Control	Buttons
Option	TCP/IP control
General	
Power Supply	100VAC ~ 240VAC, 50/60Hz
Power Consumption	31W (Max, no load)
Operation Temperature	-10°C ~ +55°C
Storage Temperature	-25°C ~ +70°C
Relative Humidity	10% - 90%
Dimension (W*H*D)	483mm x 133mm x 320mm (3U high)
Net Weight	About 5KG (Excluding signal cards)

8.2. Signal Card

8.2.1. 4I-VA

Video	
Input	(4) VGA
Input Connector	(4) Female 15-pin HD VGA
Input Level	0.5 ~ 2.0Vp-p
Input Impedance	75Ω
Audio	
Input	(4) Audio
Input Connector	(4) 3-pin pluggable terminal block
CMRR	20Hz ~ 20KHz
Input Impedance	>10KΩ
General	
Gain	0 dB
Bandwidth	YPbPr:170MHz; C-video:150MHz; VGA:170MHz
Video Signal Format	VGA (RGBHV), YPbPr, S-video, C-video
Audio Signal Format	PCM
Resolution	Up to 1080P@60Hz
Crosstalk	<-50dB@5MHz

8.2.2. 4I-UH & 4O-UH

4I-UH	
Input	(4) HDMI, (4) Audio
Input Connector	(4) Female 19-pin type-A HDMI, (4) 3-pin pluggable terminal block
Input Level	T.M.D.S. 2.9V~3.3V
Input Impedance	75Ω
Frequency Response	20Hz~20K Hz
4O-UH	
Output	(4) HDMI, (4) Audio
Output Connector	(4) Female 19-pin type-A HDMI, (4) 3-pin pluggable terminal block
Output Level	T.M.D.S. 2.9V~3.3V
Output Impedance	75Ω
Frequency Response	20Hz~20K Hz
General	
Gain	0dB
Resolution	Up to 4Kx2K
Transmission Distance	1080P≤70m, 4Kx2K ≤ 40m
SNR	>70dB@ 100MHz-100M
Return Loss	<-30dB@ 5KHz
Audio Signal Format	Embedded HDMI audio: PCM, Dolby Digital, DTS, DTS-HD Analog audio: PCM
Standard	HDMI 1.4 and HDCP 1.4
EDID	Supports manual EDID management

8.2.3. 4I-UHS & 4O-UHS

4I-UHS	
Input	(4) HDMI, (4) Analog audio
Input Connector	(4) Female 19-pin type-A HDMI, (4) 3-pin pluggable terminal block
Power Consumption	6W
Color Depth	8bit
4O-UHS	
Output	(4) HDMI, (4) Analog audio
Output Connector	(4) Female 19-pin type-A HDMI, (4) 3-pin pluggable terminal block

Power Consumption	6W
Color Depth	8bit
General	
Signal Type	HDMI, DVI-D
Bandwidth	10.2Gbps
Operation Temperature	0°C ~ +50°C
Relative Humidity	10% ~ 90%
Audio Format	Embedded audio supports: PCM, Dolby Digital, DTS, DTS-HD format, external audio supports PCM format.
EDID Management	Supports EDID following function.

8.2.4. 4I-BT & 4O-BT

4I-BT	
Input	(4) HDBT, (4) Audio, (4) RS232
Input Connector	(4) Female RJ45 (with dual-color indicator), (4) 3.5mm mini-jack, (4) 3-pin pluggable terminal block,
Input Level	T.M.D.S 2.9V~3.3V
Input Impedance	75Ω
Frequency Response	20Hz~20K Hz
4O-BT	
Output	(4) HDBT, (4) Audio, (4) RS232
Output Connector	(4) Female RJ45 (with dual-color indicator), (4) 3.5mm mini-jack, (4) 3-pin pluggable terminal block,
Output Level	T.M.D.S 2.9V~3.3V
Output Impedance	75Ω
Frequency Response	20Hz~20K Hz
General	
Protocol	TCP/IP
Gain	0dB
Bandwidth	10.2Gbps
Resolution	Up to 4Kx2K
Crosstalk	<-50dB@5MHz
Transmission Distance	1080P≤70m, 4Kx2K ≤ 40m
Audio Signal Format	Embedded HDMI audio: PCM, Dolby Digital, DTS, DTS-

	HD Analog audio: PCM
HDMI Standard	HDBT 1.0, HDMI 1.4 and HDCP 1.4
EDID	Supports manual EDID management

8.2.5. 4I-BTS & 4O-BTS

4I-BTS	
Input	(4) HDBT, (4) Audio, (4) RS232
Input Connector	(4) Female RJ45 (with dual-color indicator), (4) 3.5mm mini-jack, (4) 3-pin pluggable terminal block,
Input Level	T.M.D.S 2.9V~3.3V
Input Impedance	70Ω
Frequency Response	20Hz~20K Hz
4O- BTS	
Output	(4) HDBT, (4) Audio, (4) RS232
Output Connector	(4) Female RJ45 (with dual-color indicator), (4) 3.5mm mini-jack, (4) 3-pin pluggable terminal block,
Output Level	T.M.D.S 2.9V~3.3V
Output Impedance	75Ω
Frequency Response	20Hz~20K Hz
General	
Protocol	TCP/IP
Gain	0dB
Bandwidth	10.2Gbps
Resolution	Up to 1080P@60Hz
Crosstalk	<-50dB@5MHz
Transmission Distance	1080P≤70m
Audio Signal Format	Embedded HDMI audio: PCM, Dolby Digital, DTS, DTS- HD Analog audio: PCM
HDMI Standard	HDBT 1.0, HDMI 1.3 and HDCP 1.3
EDID	Supports manual EDID management

9. Troubleshooting & Maintenance

Problems	Potential Causes	Solutions
Output image ghosting	Bad quality of the connecting cable	Try another high-quality cable
	Inappropriate image setting of the display	Adjust corresponding image settings
Output image with color loss or no video signal output	Failed connection	Reconnect the display and the matrix
No output image when switching	No signal at the input / output end	Check with oscilloscope or multimeter if there is any signal at the input/ output end.
	Failed or loose connection	Ensure the connection is good
	The switcher is broken	Send to authorized dealer for repair.
IR remote does not work	Battery is dead	Change batteries
	IR remote is broken	Send to authorized dealer for repair.
POWER indicator does not work or no response to any operation	Failed connection of power cord.	Ensure the power cord connection is good.
EDID management does not work normally	The HDMI cable is broken at the output end.	Change for another HDMI cable which is in good working condition.
There is a blank screen on the display when switching	The display does not support the resolution of the video source.	Switch again.
		Manage the EDID data manually to make the resolution of the video source automatically compliant with the output resolution.
Static becomes stronger when connecting the video connectors	Inadequate grounding	Check the grounding and make sure it is connected well.

Cannot control the device by control device (e.g., a PC) through RS232 port	Wrong RS232 communication parameters	Type in correct RS232 communication parameters.
	Broken RS232 port	Send to authorized dealer for inspection.
Cannot control the device via front panel buttons while control is possible through RS232 port	The front panel buttons are locked	Send command 50605% to unlock the front panel buttons.

Note: *If your issue persists after following the above troubleshooting steps, seek further assistance from an authorized dealer or our technical support.*

10. After-sales Service

Should you experience problems using the Alfatron ALF-MMX1616-N, please refer to the manual and troubleshooting and maintenance section (9). Should the error persist, note that any transport costs of the equipment to the distributor are borne by the user during the warranty.

- 1) Product Limited Warranty:** Alfatron warrants that its products will be free from defects in materials and workmanship for **seven years**, which starts from the first day of purchase.

Proof of purchase in the form of a bill of sale or receipted invoice which is evidence that the unit is within the warranty period must be presented to obtain warranty service.

2) What the warranty does not cover (servicing available for a fee):

- Warranty expiration.
- Factory applied serial number has been altered or removed from the product.
- Damage, deterioration, or malfunction caused by:
 - Normal wear and tear.
 - Use of supplies or parts not meeting product specifications.
 - No certificate or invoice as the proof of warranty.
 - The product model showed on the warranty card does not match with the product or if the product had been altered.
 - Damage caused by force majeure.
 - Servicing not authorized by Alfatron.
 - Any other causes which do not relate to a product defect.
 - Delivery, installation or labour charges for installation or setup of the product.

3) Technical Support: Contact our after-sales department at

www.alfatronelectronics.com

11. Warranty

1.1 This limited warranty covers defects in materials and workmanship in this product.

1.2 Should warranty service be required, proof of purchase must be presented to the Company. The serial number on the product must be clearly visible and not have been tampered with in any way whatsoever.

1.3 This limited warranty does not cover any damage, deterioration or malfunction resulting from any alteration, modification, improper or unreasonable use or maintenance, misuse, abuse, accident, neglect, exposure to excess moisture, fire, improper packing and shipping (such claims must be presented to the carrier), lightning, power surges, or other acts of nature. This limited warranty does not cover any damage, deterioration or malfunction resulting from the installation or removal of this product from any installation, any unauthorized tampering with this product, any repairs attempted by anyone unauthorized by the Company to make such repairs, or any other cause which does not relate directly to a defect in materials and/or workmanship of this product. This limited warranty does not cover equipment enclosures, cables or accessories used in conjunction with this product.

This limited warranty does not cover the cost of normal maintenance. Failure of the product due to insufficient or improper maintenance is not covered.

1.4 The Company does not warrant that the product covered hereby, including, without limitation, the technology and/or integrated circuit(s) included in the product, will not become obsolete or that such items are or will remain compatible with any other product or technology with which the product may be used.

1.5 Only the original purchaser of this product is covered under this limited warranty. This limited warranty is not transferable to subsequent purchasers or owners of this product.

1.6 Unless otherwise specified, the goods are warranted in accordance with the manufacturer's product specific warranties against any defect attributable to faulty workmanship or materials, fair wear and tear being excluded.

1.7 This limited warranty only covers the cost of faulty goods and does not include the cost of labor and travel to return the goods to the Company's premises.

1.8 In the event of any improper maintenance, repair or service being carried out by any third persons during the warranty period without the Company's written authorization, the limited warranty shall be void.

1.9 A 7 (seven) year limited warranty is given on the aforesaid product where used correctly according to the Company's instructions, and only with the use of the Company's components.

1.10 The Company will, at its sole option, provide one of the following three remedies to whatever extent it shall deem necessary to satisfy a proper claim under this limited warranty:

1.10.1 Elect to repair or facilitate the repair of any defective parts within a reasonable period of time, free of any charge for the necessary parts and labor to complete the repair and restore this product to its proper operating condition.; or

1.10.2 Replace this product with a direct replacement or with a similar product deemed by the Company to perform substantially the same function as the original product; or

1.10.3 Issue a refund of the original purchase price less depreciation to be determined based on the age of the product at the time remedy is sought under this limited warranty.

1.11 The Company is not obligated to provide the Customer with a substitute unit during the limited warranty period or at any time thereafter.

1.12 If this product is returned to the Company this product must be insured during shipment, with the insurance and shipping charges prepaid by the Customer. If this product is returned uninsured, the Customer assumes all risks of loss or damage during shipment. The Company will not be responsible for any costs related to the removal or re-installation of this product from or into any installation. The Company will not be responsible for any costs related to any setting up this product, any adjustment of user controls or any programming required for a specific installation of this product.

1.13 Please be aware that the Company's products and components have not been tested with competitor's products and therefore the Company cannot warrant products and/or components used in conjunction with competitor's products.

1.14 The appropriateness of the goods for the purpose intended is only warranted to the extent that the goods are used in accordance with the Company's installation, classification and usage instructions.

1.15 Any claim by the Customer which is based on any defect in the quality or condition of the goods or their failure to correspond with specification shall be notified in writing to the Company within 7 days of delivery or (where the defect or failure was not apparent on reasonable inspection by the Customer) within a reasonable time after discovery of the defect or failure, but, in any event, within 6 months of delivery.

1.16 If delivery is not refused, and the Customer does not notify the Company accordingly, the Customer may not reject the goods and the Company shall have no liability and the Customer shall pay the price as if the goods had been delivered in accordance with the Agreement.

1.17 THE MAXIMUM LIABILITY OF THE COMPANY UNDER THIS LIMITED WARRANTY SHALL NOT EXCEED THE ACTUAL PURCHASE PRICE PAID FOR THE PRODUCT