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ALFATRON ELECTRONICS GmbH GERMANY

ALF-MMX88A-N

Modular Matrix Switcher 8x8

Version: ALF-MMX88A-N_2021V1.6

Preface

Read this user manual carefully before using the product. Pictures are shown in this manual for reference only. Different models and specifications are subject to real product.

This manual is only for operation instruction, please contact the local distributor for maintenance assistance. The functions described in this version is updated as of December, 2019. In the constant effort to improve the product, we reserve the right to make functions or parameters changes without notice or obligation. 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 utilisation 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.

Table of Contents

1. Product Introduction

The Alfatron ALF-MMX88A-N is a high-performance 8x8 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-MMX88A-N supports various changeable cards including HDMI, VGA, and HDBaseT etc. Users can choose to insert different signal cards for different applications.

The ALF-MMX88A-N has an RS232 port and a TCP/IP port for convenient control from third-party devices. With its flexible design, the ALF-MMX88A-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.

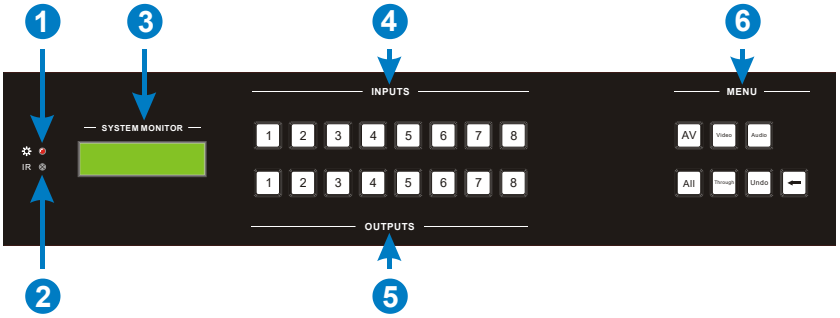
1.3. Package List

- 1x ALF-MMX88A-N Modular Matrix Switcher
- 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.*

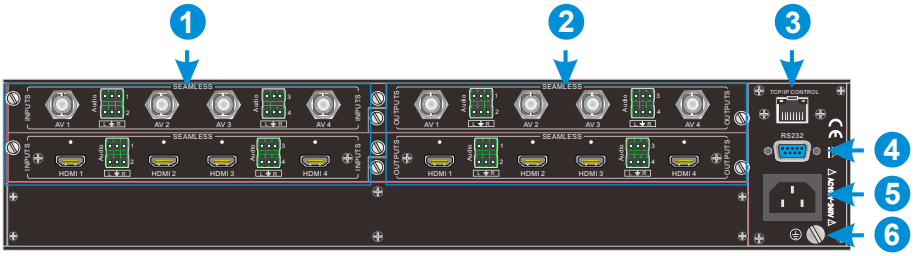
2. Panel Description

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, ranges from 1~ 8, corresponding to 1~8 sources on input signal cards (counting from left to right, top to bottom).
⑤	OUTPUTS	Back-lit buttons for output selection, ranges from 1~ 8, corresponding to 1~8 displays on output signal cards (counting from left to right, top to bottom).
⑥	MENU	**AV:** Switch AV signal from AV signal card and audio signal from audio card synchronously.
		VIDEO: Switch AV signal from AV signal card only.
		AUDIO: Switch audio signal from audio card only.
		ALL: Select all input or output channels.
		THROUGH: Switch the signals directly to the corresponding output channels.
		UNDO: Undo button, to resume the status before the command that was just performed.
		←: Backspace button, to backspace the last press.

2.2. Matrix Rear Panel



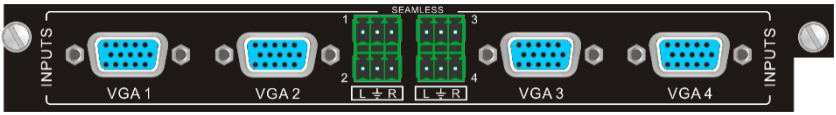
No.	Name	Description
①	INPUTS	Signal card slots to insert necessary input cards.
②	OUTPUTS	Signal card slots to insert necessary output cards.
③	TCP/IP	RJ45 connector for TCP/IP control.
④	RS232	Serial control port for RS232 control.
⑤	Power port	Connect with household alternating current power.
⑥	GND connector	System grounding.

2.3. Signal Card

The MMX88A-N 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

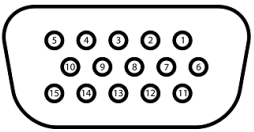
1080P seamless VGA input card with 4 VGA and 4 external L+R audio ports.



4I-VA

- Supports seamless switching and can be used in combination with other seamless output signal cards.
- 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.

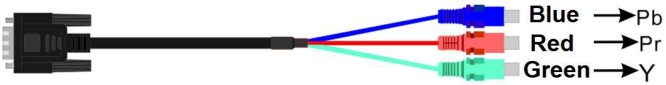
Pin layout of female VGA connector:



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	H-Sync
6	RED_RTN	14	V-Sync
7	GREEN_RTN	15	ID3/SCL
8	BLUE_RTN		

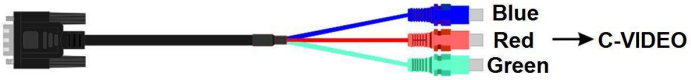
When connecting to YPbPr or C-VIDEO signal, insert converting cables according to specific pin definitions (see the figures below):

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

4I-UH

- Supports HDMI 1.4 and HDCP 2.2.
- Compatible with DVI-D signal.
- Resolution is up to 4096*2160@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.
- For use with 1080P seamless signal card.

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

4O-UH

- Supports HDMI 1.4 and HDCP 2.2.
- Compatible with DVI-D signal.
- Resolution is up to 4096*2160@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.
- For use with 1080P seamless signal card.

2.3.3. 4I-UHS & 4O-UHS

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

4I-HS

- Supports HDMI 1.4 and HDCP 2.2.
- Compatible with DVI-D signal.
- Resolution is up to 4096*2160@60Hz 4:2:2, supports up to 8 kinds of resolution.
- Input signal card has character overlay function, and character can be changed to relative attribute via commands.
- Supports audio embedded de-embedded function.
- Input card supports OSD menu function.
- For use with 1080P seamless signal card.

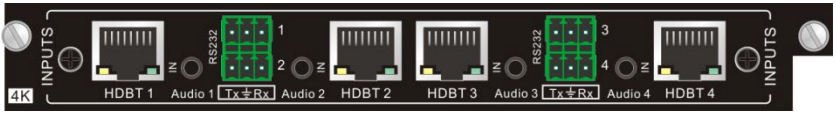
4K seamless HDMI output card with 4 HDMI and 4 external stereo audio ports.

4O-HS

- Supports HDMI 1.4 and HDCP 2.2.
- Compatible with DVI-D signal.
- Resolution is up to 4096*2160@60Hz 4:2:2, supports up to 8 kinds of resolution.
- Supports audio embedded de-embedded function.
- Output card supports simple view splicing function.
- Supports audio embedded de-embedded function.
- For use with 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, 57600,115200.
- 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.

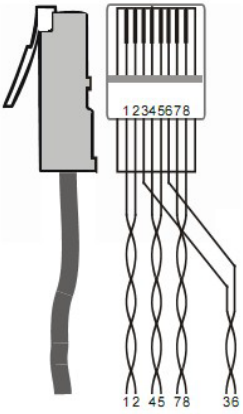
4O-BT

- 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 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, 57600,115200.
- 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 applied.
Green	Link LED	The LED illuminates green when the port is successfully connected to other device via 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 for grounding purposes.*

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, it can be used in combination with other seamless output signal card.
- Supports HDBT1.0 and HDCP 1.3.
- Supports input resolution selection, the default is 1920x1080P@60Hz.
- It is used with 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, 57600,115200.
- 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

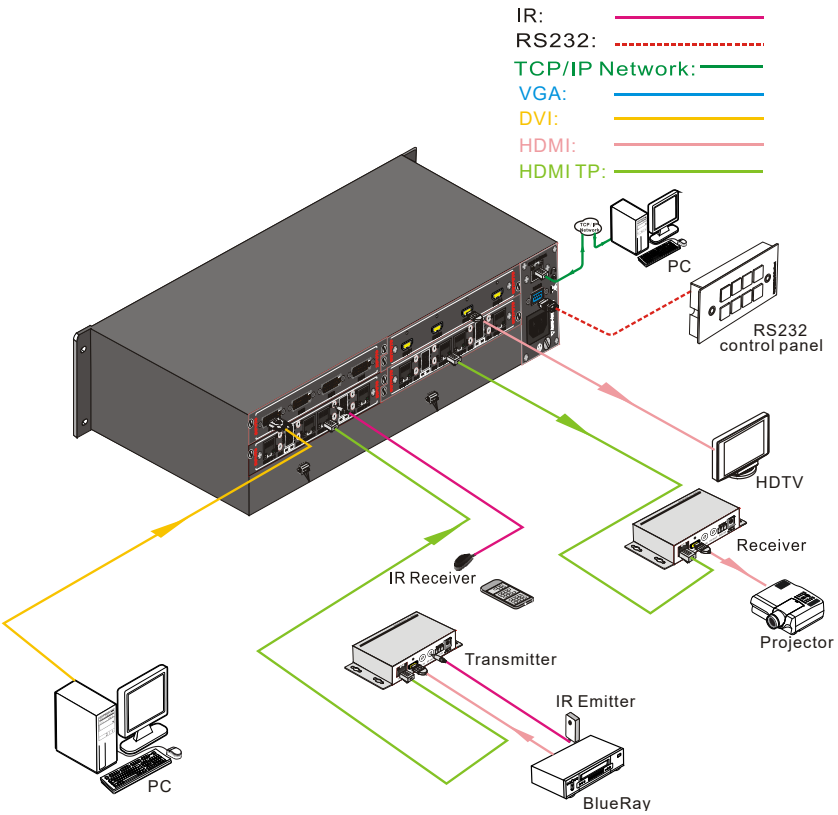
- Supports seamless switching and it can be used in combination with other seamless input signal card.
- Supports HDBT 1.0 and HDCP 1.3.
- Supports output resolution selection, the default is 1920x1080P@60Hz.
- It is used with HDBaseT receiver to extend video signal; the transmission distance can be 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, 57600,115200.
- Supports 4 external stereo audio outputs and audio channel control.

3. System Connection

3.1. Usage Precautions

- Ensure all components and accessories are included before installation.
- System should be installed in a clean environment with adequate temperature and humidity.
- 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



Note: *All the input and output signal cards do not support hot-swop, but the physical input and output ports on the signal cards support hot-plug.*

4. Button Control

The Matrix can be controlled via the front panel buttons. Here is a brief operation guide.

Format: "**Input Channel**" + "**Switch Mode**" +"**Output Channel**"

Note:

- *"Switch Mode":*
  - ✓ *AV: Switch AV signal from AV signal card and audio signal from audio card synchronously.*
  - ✓ *Video: Switch AV signal from AV signal card.*
  - ✓ *Audio: Switch audio signal from audio card.*
- *"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.*
- *The input / output channels on the rear panel are counting 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; otherwise, the operation will be cancelled.*

Example:

- To switch input 1 to output 1, press input "1", output "1".
- To switch signals from input 1 to all output channels, press buttons in this order: "1", "All".

Functional Buttons:

- **UNDO**: Return to the previous status

Example: Input 6 is connecting with output 6, press input "6" + "AV"+ output 4 to change the connection. Press "Undo" to enable input 6 to reconnect with output 6.

- **← :** When pressing buttons "1", "AV", "2", "←" in order, then "2" will be canceled**.**

- **THROUGH:** Get straight I/O connection, e.g., input 1 → output 1, input 2 → output 2.

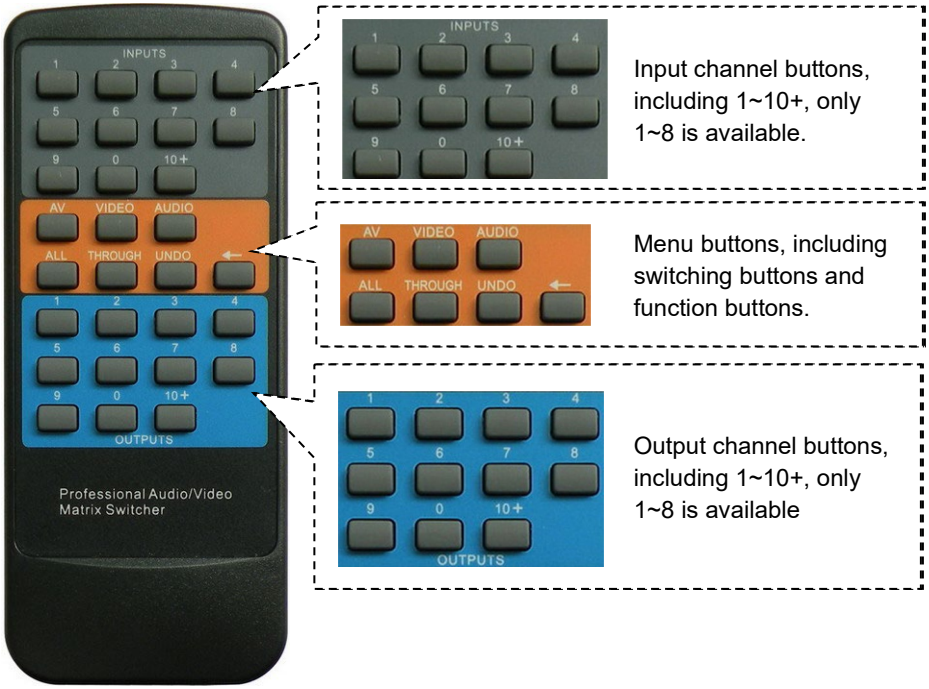
Press "Input Channel" + "Through"

Example: If you press buttons "ALL", "THROUGH" in order, then the result will be like input 1 → output 1, input 2 → output 2, input 3 → output 3 … input 8 → output 8.

5. IR Remote Control

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

Press the buttons under below format:
"**Input Channel**" + "**Switch Mode**" + "**Output Channel**"

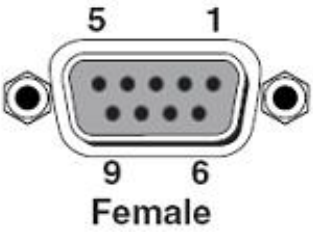


6. RS232 Control

6.1. RS232 Communication Port

Apart from the front control panel and IR remote control, the Matrix can also be controlled by a far-end control system via the RS-232 communication port.

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



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

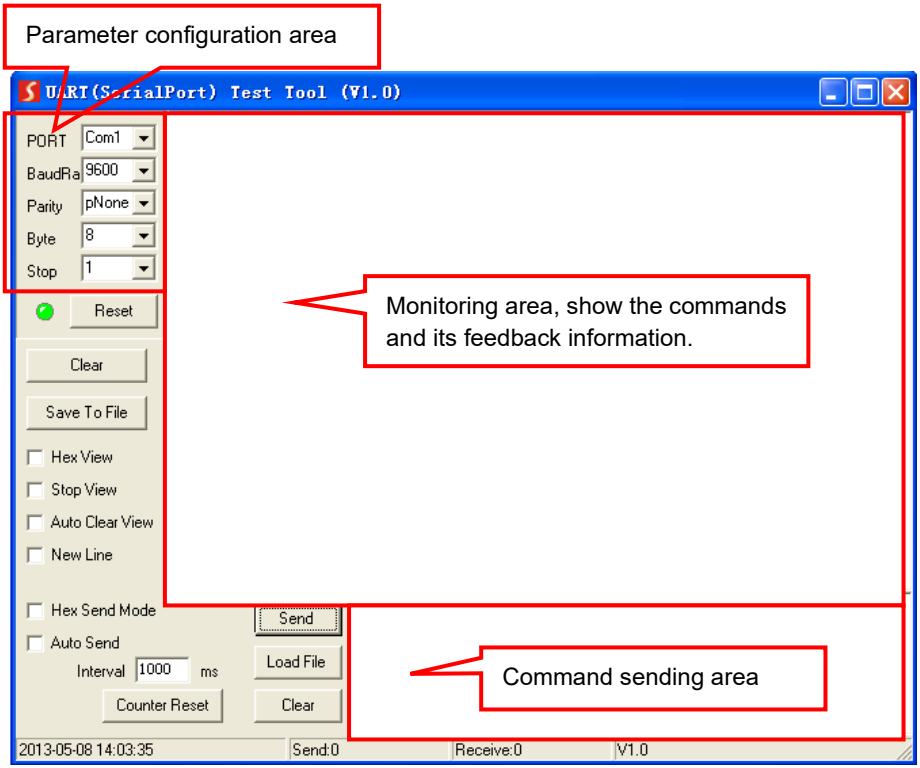
When the Matrix connects to the RS232 port of a computer with control software, users can control it via that computer. To control the switcher, users need to use RS232 control software.

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

- **Basic Setting**

Connect the Matrix to all input devices and output devices needed, then connect it to a PC which has RS232 control software installed. Double-click on the software icon to run the software. Here we use the software **CommWatch.exe** as example. The icon is shown below:

The interface of the control software is showed below:



Please set the parameters of COM number, baud rate, data bit, stop bit and the parity bit correctly, then only 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 pairs before sending command EDIDUpgrade[X].*
- *In the commands, "[" and "]" are symbols for easy reading and do not need to be typed in for actual operation.*
- *Please remember to end the commands with the ending symbols "." or ";".*
- *Type the command carefully, 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] only video 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

Command	Description	Feedback
Status.	Get the input channel on output channel one by one.	V: 01->001 A: 01->001 … …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 applied, system prompts 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 applied, system prompts to upload the EDID file (.bin). Operation will be cancelled 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 output port [x] and display on 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/I/[x]:0622%;	Set the input [x] to VGA signal.	0622%
USER/I/[x]:0623%;	Set the input [x] to YPbPr signal.	0623%
USER/I/[x]:0624%;	Set the input [x] to S-VIDEO signal.	0624%
USER/I/[x]:0625%;	Set the input [x] to C-VIDEO signal.	0625%
USER/I/[x]:0648%;	Switch on audio of input [x].	0648%
USER/I/[x]:0649%;	Switch off audio of input [x].	0649%
USER/I/[x]:0684%;	Set the color space of of input [x] to YCBCR.	0684%
USER/I/[x]:0685%;	Set the color space of of input [x] to RGB.	0685%
USER/I/[x]:0686%;	Set the signal format of input [x] to HDMI.	0686%
USER/I/[x]:0687%;	Set the signal format of input [x] to DVI.	0687%
USER/I/[x]:0626%;	Set the resolution of input [x] to 1024x768p@60Hz.	0626%
USER/I/[x]:0627%;	Set the resolution of input [x] to 1280x720P@60Hz.	0627%
USER/I/[x]:0628%;	Set the resolution of input [x] to 1280x800P@60Hz.	0628%
USER/I/[x]:0619%;	Set the resolution of input [x] to 1360x768p@60Hz.	0619%
USER/I/[x]:0621%;	Set the resolution of input [x] to 1600x1200P@60Hz.	0621%
USER/I/[x]:0629%;	Set the resolution of input [x] to 1920x1080P@60Hz.	0629%
USER/I/[x]:0620%;	Set the resolution of input [x] to 1920x1200P@60Hz.	0620%
USER/I/[x]:0617%;	Restore the input [x] signal card to factory default.	0617%
USER/I/[x]:0606%;	Automatically calibrate the VGA signal of input [x].	0606%
USER/I/[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 characters to white.	0906%
USER/I/x:0907%;	Set the color of characters to red.	0907%
USER/I/x:0908%;	Set the color of characters to green.	0908%
USER/I/x:0909%;	Set the color of 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%
USER/I/[x]:03xx%;	Set the image contrast of input [x] to	03xx%

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

6.3.8. 4O-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] to1920x1080P@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
GetResolution[x].	Get the resolution of output [x].	Resolution

Command	Description	Feedback
		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%

USER/O/[x]:0816%;	Set the resolution of output [x] to 1920x1080P@30Hz.	Resolution Ou01 1920x1080P

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.

Command	Description	Feedback
USER/I/[x]:02xx%;	Set the image brightness of input [x] to xx, xx=00~99.	0299%
USER/I/[x]:03xx%;	Set the image contrast of input [x] to xx, xx=00~99.	0399%
USER/I/[x]:04xx%;	Set the image saturation of input [x] to xx, xx=00~99.	0499%
USER/I/[x]:05xx%;	Set the image sharpness of input [x] to xx, xx=00~99.	0599%
USER/I/[x]:0606%;	Automatically calibrate the VGA signal of input [x].	0606%
USER/I/[x]:0607%;	Set the image color temperature of input [x] to user/cool/medium/warm.	0607%
USER/I/[x]:0608%;	Set the image aspect ratio of input [x] to 16:9/4:3/Auto/Panorama/Just scan/Zoom2/Zoom1.	0608%
USER/I/[x]:0614%;	Set the image mode of input [x] to user/Dynamic/Standard/mild.	0614%
USER/I/[x]:0617%;	Restore the input [x] signal card to factory default.	0617%
USER/I/[x]:0619%;	Set the resolution of input [x] to 1360x768 HD.	0619%
USER/I/[x]:0626%;	Set the resolution of input [x] to 1024x768 XGA.	0626%
USER/I/[x]:0627%;	Set the resolution of input [x] to 1280x720 720P.	0627%
USER/I/[x]:0628%;	Set the resolution of input [x] to 1280x800 WXGA.	0628%
USER/I/[x]:0629%;	Set the resolution of input [x] to 1920x1080 1080P.	0629%
USER/I/[x]:0620%;	Set the resolution of input [x] to 1920x1200 WUXGA.	0620%
USER/I/[x]:0621%;	Set the resolution of input [x] to 1600x1200 UXGA.	0621%
USER/I/[x]:0698%;	Upgrade the software of input [x].	0698%
USER/I/[x]:0686%;	Set the signal format of input [x] to HDMI.	0686%

Command	Description	Feedback
USER/I/[x]:0711%;	Select HDMI embedded audio as audio source for input [x].	0711%
USER/I/[x]:0712%;	Select external analog audio input as audio source for input [x].	0712%

6.3.10. 4O-BT 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] to1280x720P@24Hz.	Resolution Ou01 1280x720 P
USER/O/[x]:0810%;	Set the resolution of output [x] to1920x1080i@60Hz.	Resolution Ou01 1920x1080I
USER/O/[x]:0811%;	Set the resolution of output [x] to1920x1080i@59Hz.	Resolution Ou01 1920x1080I

Command	Description	Feedback
USER/O/[x]:0812%;	Set the resolution of output [x] to1920x1080i@50Hz.	Resolution Ou01 1920x1080I
USER/O/[x]:0813%;	Set the resolution of output [x] to1920x1080P@60Hz.	Resolution Ou01 1920x1080P
USER/O/[x]:0814%;	Set the resolution of output [x] to1920x1080P@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

Command	Description	Feedback
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
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

7.1. Control Mode

TCP/IP default settings:

IP: 192.168.0.178,

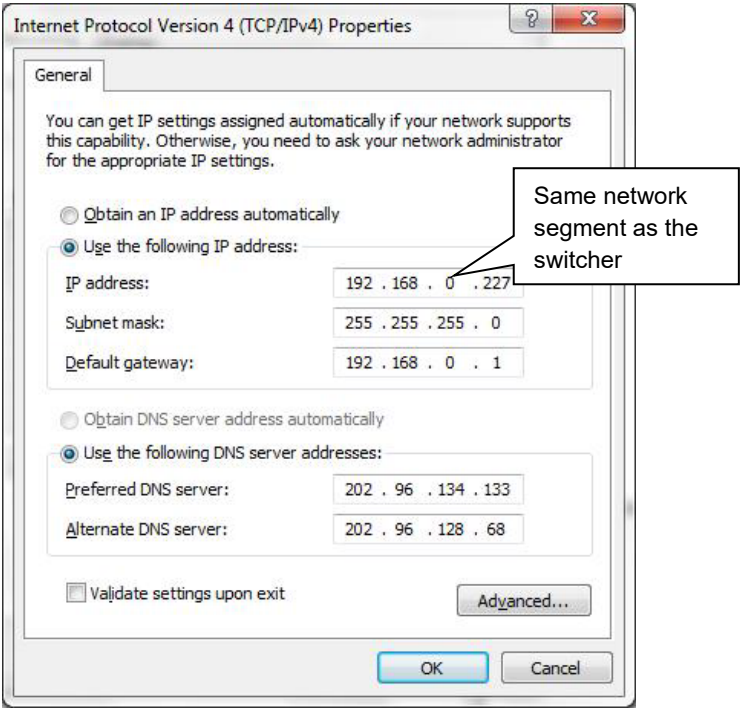
Gateway is 192.168.0.1,

Serial Port: 4001.

IP and Gateway can be changed as required; the Serial Port cannot be changed.

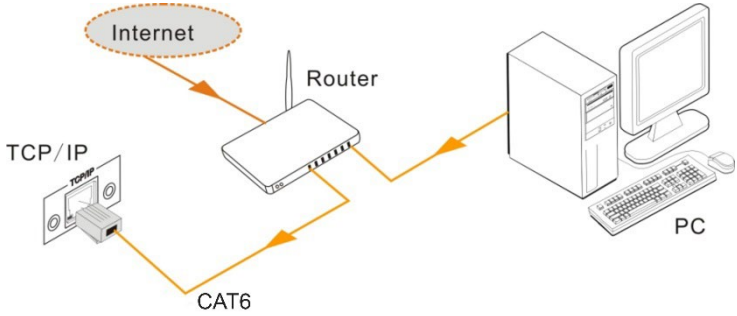
- **Control via Single PC**

Connect a computer to the TCP/IP port of the ALF-MMX88A-N and set its network segment to the same as the default IP of the ALF-MMX88A-N (192.168.0.178).



- **Control via PC(s) in LAN**

The ALF-MMX88A-N can be connected with a router to make up a LAN with the PC(s), this enables it to be controlled in a LAN. Ensure the ALF-MMX88A-N network segment is the same as the router. Please connect as the following figure for LAN control.



Step1. Connect the TCP/IP port of the ALF-MMX88A-N to Ethernet port of the PC with twisted pair.

Step2. Set the PC's network segment to the same as the ALF-MMX88A-N. Do please remember the PC's original network segment.

Step3. Set the ALF-MMX88A-N's network segment to the same as the router.

Step4. Set the PC's network segment to the original one.

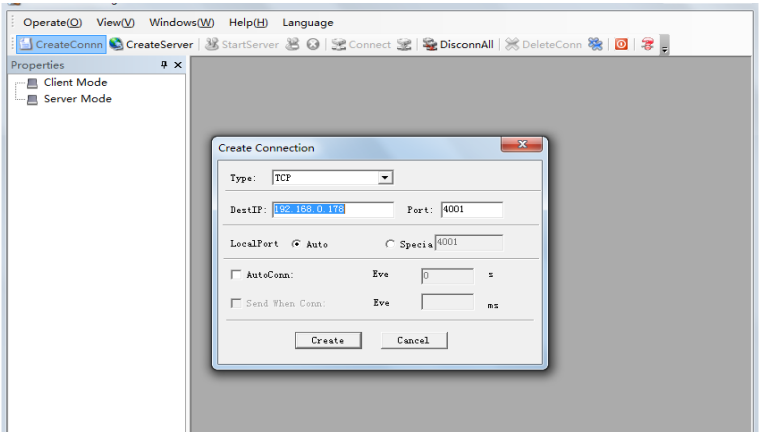
Step5. Connect the ALF-MMX88A-N and PC(s) to the router. In the same LAN, each PC is able to control the ALF-MMX88A-N asynchronously.

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

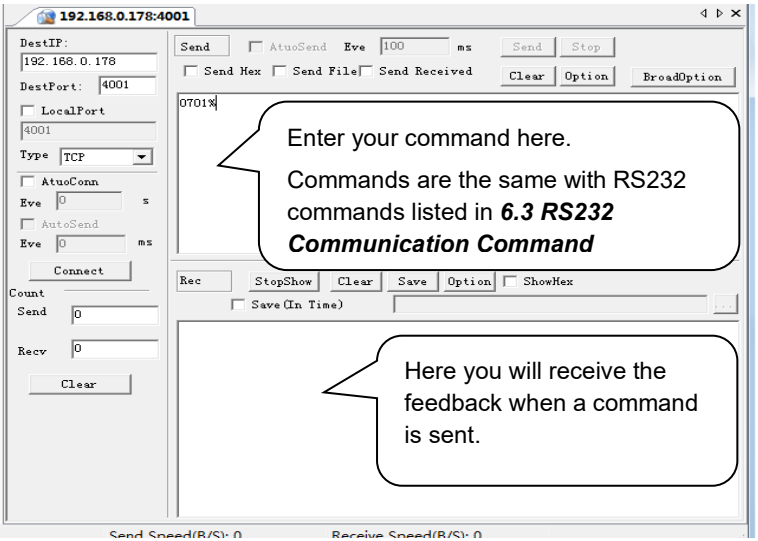
7.2. TCP/IP Communication Software

(Exampled by TCPUDP software)

1) Connect a computer and ALF-MMX88A-N to the same network. Open the TCPUDP software (or any other TCP/IP communication software) and create a connection, enter the IP address and port of ALF-MMX88A-N (default IP: 192.168.0.178, port:4001):



2) After successfully connecting, we can enter commands to control the ALF-MMX88A-N, as below:

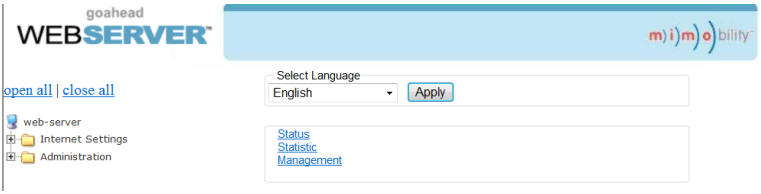


7.3. Port Management

Type 192.168.0.178:100 into your browser search bar. 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	RS232, 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	23W (Max, no load)
Operation Temperature	-10℃ ~ +55℃
Storage Temperature	-25℃ ~ +70℃
Relative Humility	10%-90%
Dimension (W*H*D)	483mm x 88mm x 320mm (2U high)
Net Weight	About 3KG (No signal card)

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, Dobly Digital, DTS, DTS-HD Analog audio: PCM
Standard	HDMI 1.4 and HDCP 1.4
EDID	Support 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℃~ +50℃
Relative Humidity	10%~ 90%
Audio Format	Embedded audio supports: PCM, Dobly 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, Dobly Digital, DTS, DTS-HD Analog audio: PCM
HDMI Standard	HDBT 1.0, HDMI 1.4 and HDCP 1.4
EDID	Support manual EDID management

8.2.1. 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, Dobly Digital, DTS, DTS-HD Analog audio: PCM
HDMI Standard	HDBT 1.0, HDMI 1.3 and HDCP 1.3
EDID	Support 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-MMX88A-N, please refer to the manual and troubleshooting and maintenance section (6). 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