

# USR-IO808-EWR User Manual

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## Contents

<b>USR-IO808-EWR User Manual .....</b>	<b>1</b>
<b>Features .....</b>	<b>3</b>
<b>1. Get Start .....</b>	<b>4</b>
<b>1.1. Product introduction.....</b>	<b>4</b>
<b>1.2. Basic parameters .....</b>	<b>4</b>
<b>1.3. Hardware .....</b>	<b>4</b>
<b>1.3.1. Interface .....</b>	<b>5</b>
<b>1.3.2. LED.....</b>	<b>5</b>
<b>1.3.3. Dimension .....</b>	<b>5</b>
<b>1.4. Test.....</b>	<b>6</b>
<b>1.4.1. Control by serial .....</b>	<b>7</b>
<b>1.4.2. Web Server .....</b>	<b>9</b>
<b>1.4.3. Control by USR Cloud .....</b>	<b>9</b>
<b>2. Product function .....</b>	<b>11</b>
<b>2.1. DI input .....</b>	<b>11</b>
<b>2.1.1. Electrical level detection.....</b>	<b>11</b>
<b>2.1.2. Buttons detection .....</b>	<b>11</b>
<b>2.1.3. Pulse counting .....</b>	<b>12</b>
<b>2.2. DO output.....</b>	<b>12</b>
<b>2.3. Work mode .....</b>	<b>12</b>
<b>2.3.1. Master mode.....</b>	<b>12</b>
<b>2.3.2. Slave mode .....</b>	<b>14</b>
<b>2.4. Upgrade firmware .....</b>	<b>15</b>
<b>2.5. Ethernet interface and WiFi .....</b>	<b>15</b>
<b>2.5.1. Ethernet interface .....</b>	<b>15</b>
<b>2.5.2. WiFi .....</b>	<b>15</b>
<b>2.6. Serial port.....</b>	<b>16</b>
<b>2.6.1. Basic parameters .....</b>	<b>16</b>
<b>2.6.2. Configuration method .....</b>	<b>16</b>
<b>2.7. Features.....</b>	<b>16</b>
<b>2.7.1. Relay output status hold .....</b>	<b>16</b>
<b>2.7.2. Conditional control.....</b>	<b>17</b>
<b>2.7.3. Connect to remote server .....</b>	<b>18</b>
<b>2.7.4. Reset to default by hardware .....</b>	<b>18</b>
<b>3. Modbus.....</b>	<b>19</b>
<b>3.1. Modbus frame .....</b>	<b>20</b>
<b>3.2. Register distribution .....</b>	<b>20</b>
<b>4. Contact Us.....</b>	<b>23</b>
<b>5. Disclaimer .....</b>	<b>24</b>
<b>6. Update History .....</b>	<b>24</b>

## Features

- Support 8-way Relay output.
- Support 8-way input, default is dry contact.
- Support 8 conditional control command.
- Support Web Server to configure IO808-EWR.
- Support various function code: 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x0F, 0x10.
- Support socket to connect to remote server and TCP Client.
- Support two work modes: Master mode and Slave mode. Master mode supports connecting to multiple Modbus RTU devices by RS485 cascading connection.
- Adopt Modbus RTU protocol data processing. Support Modbus TCP/RTU protocol adaptation.
- Support WAN/LAN interface and LAN interface network.
- Support AP and STA two WiFi modes.
- Support connecting to USR Cloud.
- Support FTP remote upgrade.
- Support upgrading by RS485.
- Support hardware watchdog.
- Support various LED to indicate work status.
- Support power supply over-current, over-voltage, anti-reverse connection protection.

## 1. Get Start

If user has any question, please submit it back to customer center: [h.usriot.com](http://h.usriot.com).

### 1.1. Product introduction

USR-IO808-EWR is network IO product which supports 8-way input/output and Modbus RTU/TCP protocol. Take 'Remote control' as core function and have high usability. User can easily and quickly integrate USR-IO808-EWR into own system to realize remote, LAN and local control which based on Ethernet, WiFi and RS485.

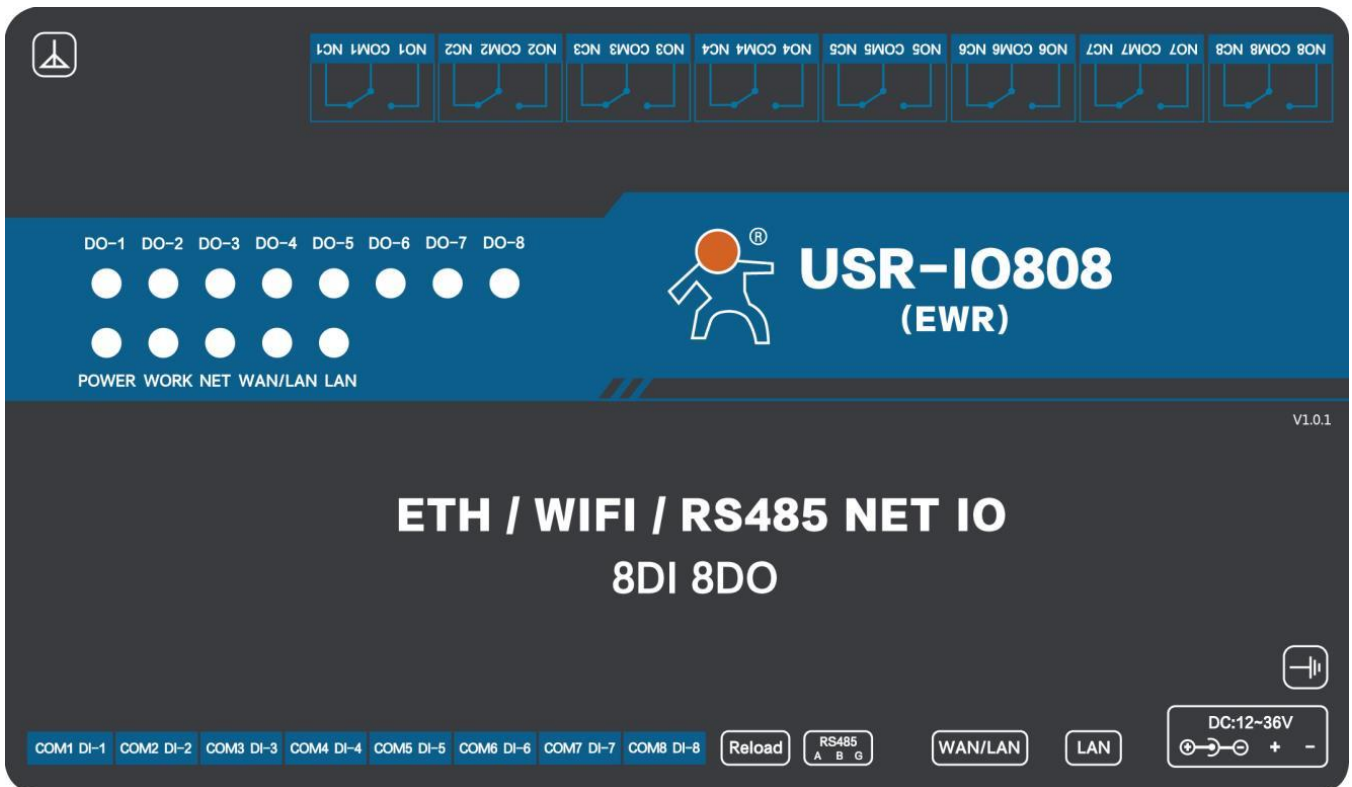
### 1.2. Basic parameters

Parameter		Value
<b>Ethernet interface</b>	Wired WAN/LAN interface	10/100M WAN/LAN interface
	Wired LAN interface	10/100M LAN interface
<b>WiFi parameters</b>	Standard	Support 802.11b/g/n
	Antenna	2.4G WiFi antenna
	Range	100 meters in open area
<b>Hardware parameters</b>	Data interface	Serial port: Support RS485. Baud rate: 300bps~230400bps
	Working voltage	DC: 12V~36V
	DI input	Dry contact input, just needing to short-circuit DI and COM
	DO output	AC 220V 10A DC 28V 10A
	Working temperature	-20°C ~ +70°C
	Storage temperature	-40°C ~ +85°C
	Working humidity	5%~95%
	Storage humidity	1%~95%
	Dimension	200*122*29mm
<b>Software parameters</b>	Work mode	Master mode, slave mode
	Configuration command	Modbus RTU
	Network protocol	Modbus TCP, Modbus RTU
	Application software	Support configuration software
<b>Software function</b>	DNS	Support
	Data transmission mode	Support TCP Client
<b>EMC level</b>	ESD	IEC61000-4-2, Level 4
	Surge	IEC61000-4-5, Level 3
	Group pulse	IEC61000-4-4, Level 3

Figure 1 Basic parameters

### 1.3. Hardware

### 1.3.1. Interface



**Figure 2 Product interface diagram**

- Antenna: WiFi antenna
- RS485: RS485 interface
- DO: DO1~DO8 are 8-way Relay output
- DI: 8-way input, default is dry contact
- WAN/LAN: Device WAN/LAN interface and can switch between WAN/LAN
- LAN: Device LAN interface
- DC: 12-36V. DC 12~36V power supply. Low power supply will cause IO808-EWR can't start.

### 1.3.2. LED

LED	Function	Status
POWER	Indicate power status	Light after powering module
WORK	Indicate system running status	Blink every 1 second after product system running; Blink every 0.2 second during upgrading firmware process.
NET	Indicate network connection status	Light after connecting to remote server
WAN/LAN	Indicate WAN/LAN interface status	Light after connecting to network. Blink if has data interaction.
LAN	Indicate LAN interface status	Light after connecting to network. Blink if has data interaction.

**Figure 3 LED**

### 1.3.3. Dimension

Unit: mm

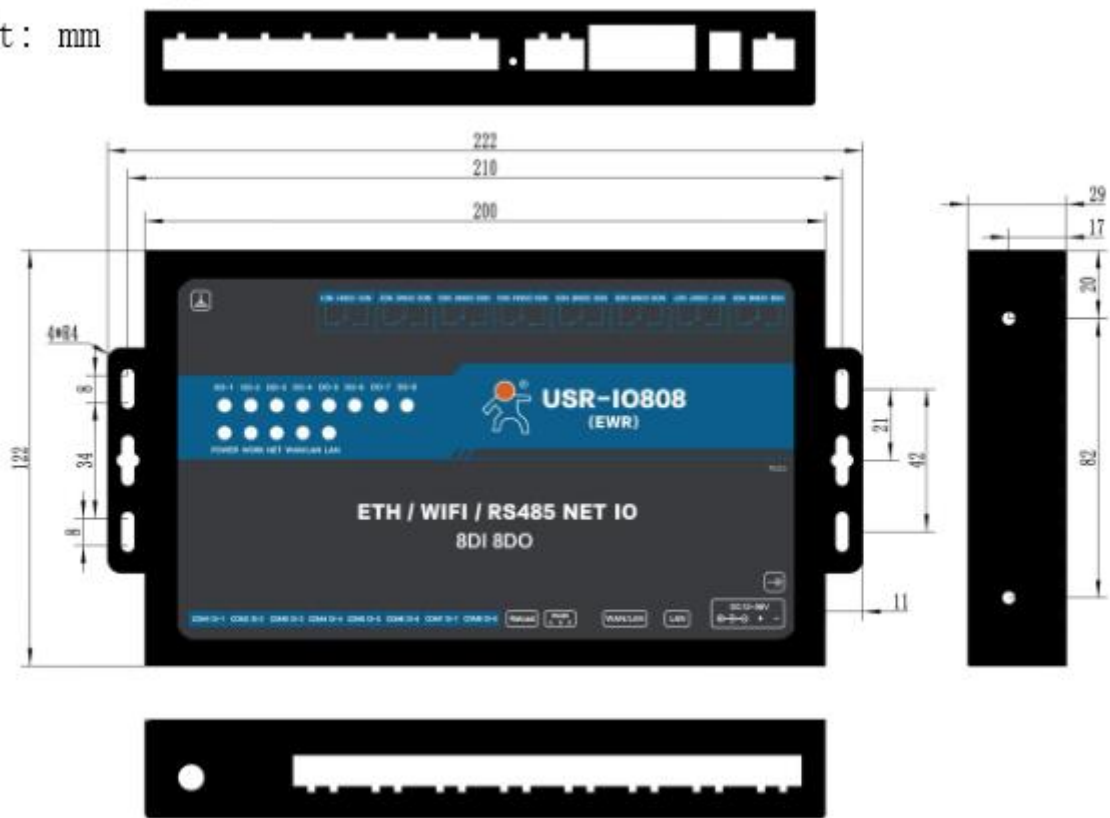


Figure 4 Dimension diagram

Fixed installation diagram as follow:

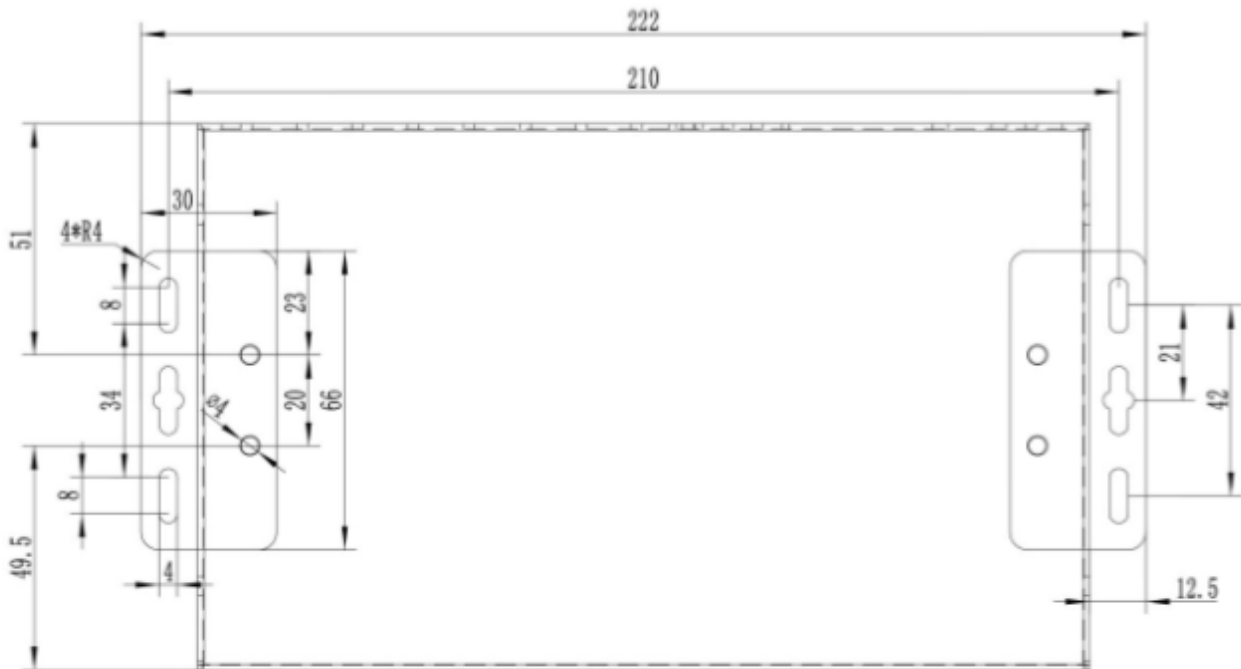


Figure 5 Fixed installation diagram

## 1.4. Test

- Connect PC to USR-IO808-EWR by USB -> RS485 cable.
- Connect IO808-EWR's WAN/LAN interface to router.
- Connect IO808-EWR's LAN interface to PC.
- Power the IO808-EWR.
- After powering on, please wait about 15 seconds and user's PC can access internet.

**Note:** If user uses USR-IO808-EWR firstly and can't access internet with correct connection, it maybe the following reason: LAN interface network segment is same as USR-IO808-EWR's LAN interface network segment. The solution is: Enter USR-IO808-EWR's Web Server(Default IP address is 192.168.10.1) and modify LAN interface IP address to other network segment, then restart device.

### 1.4.1. Control by serial

Power IO808-EWR and connect IO808-EWR's RS485 interface to PC. Run setup software **USR-IO V1.0.28.exe** and choose IO808-EWR. Choose correct COM and configure correct serial port parameters as follow(Default settings is 9600, None, 8, 1):



**Figure 6 Open serial**

After opening serial port, click 'Search' to search IO808-EWR and click '停止' to stop searching after finding IO808-EWR. Then choose IO808-EWR as follow:

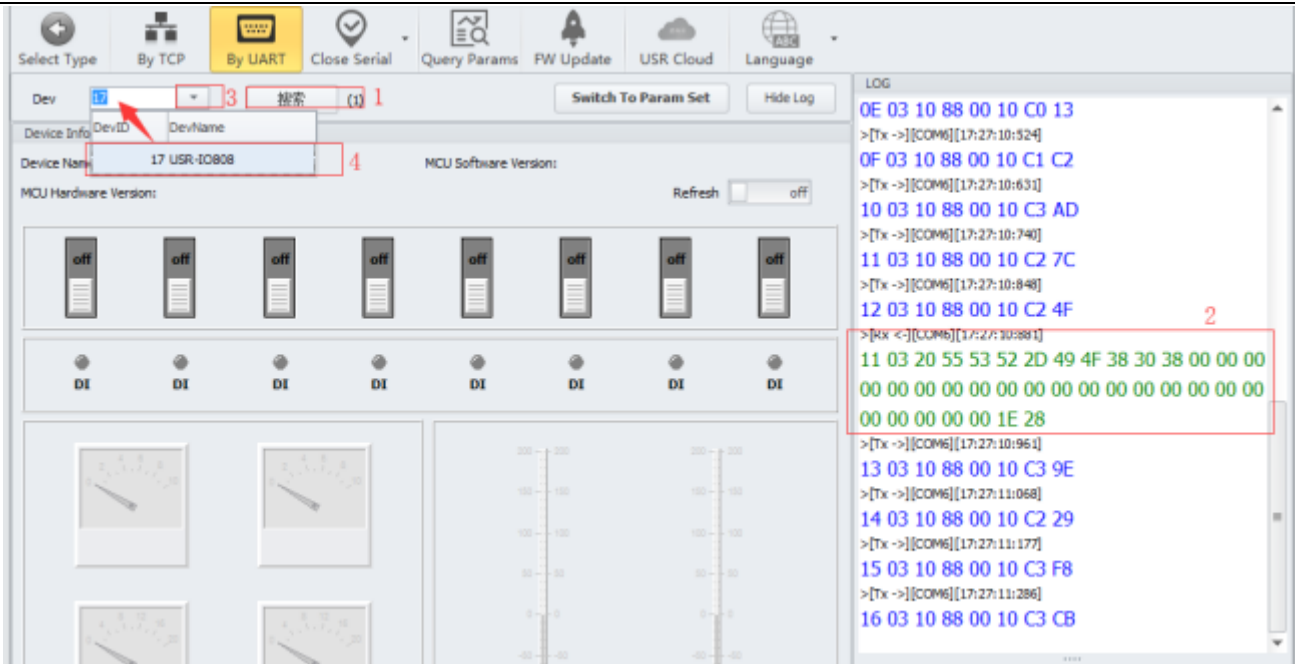


Figure 7 Search IO808-EWR

Then user can control devices.

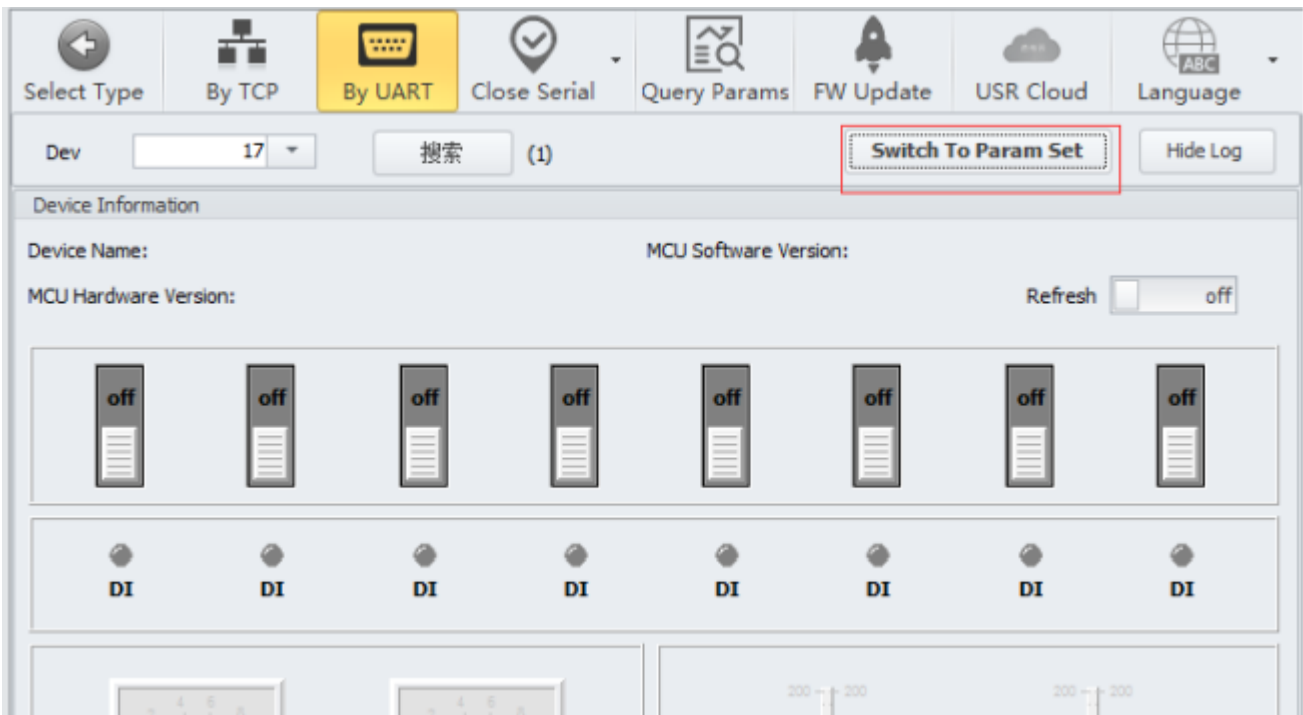
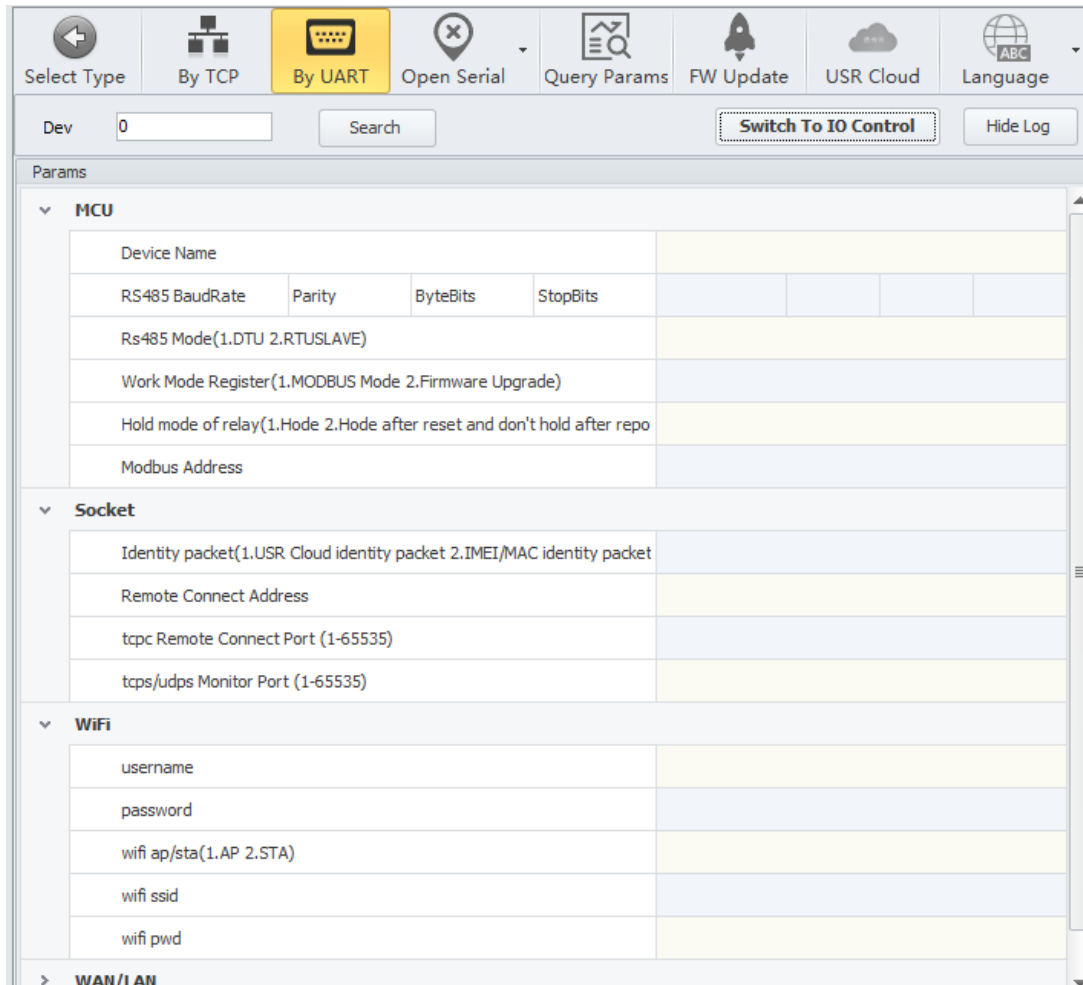


Figure 8 Control devices

User can also click 'Switch To Param Set' on above figure to enter IO808-EWR configuration page.





**Figure 9 Configuration page**

### 1.4.2. Web Server

The initial parameter of USR-IO808-EWR to enter Web Server as follow:

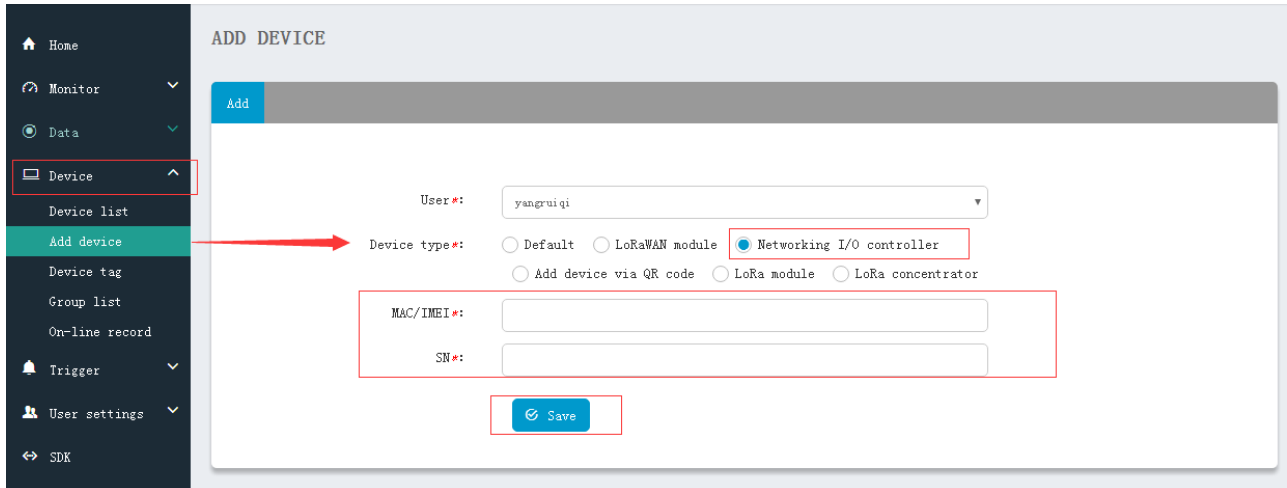
Work mode	Network data transparent transmission
Username	admin
Password	admin
LAN interface IP address	192.168.10.1

**Figure 10 Initial parameter of USR-IO808-EWR to enter Web Server**

Type 192.168.10.1 into browser address bar and log in with username and password(Both are admin). Then user can query and configure parameters of USR-IO808-EWR by Web Server.

### 1.4.3. Control by USR Cloud

User can type <http://console.usr.cn/> into browser address bar to enter USR Cloud web page and login with username and password. Then user can add device as follow:



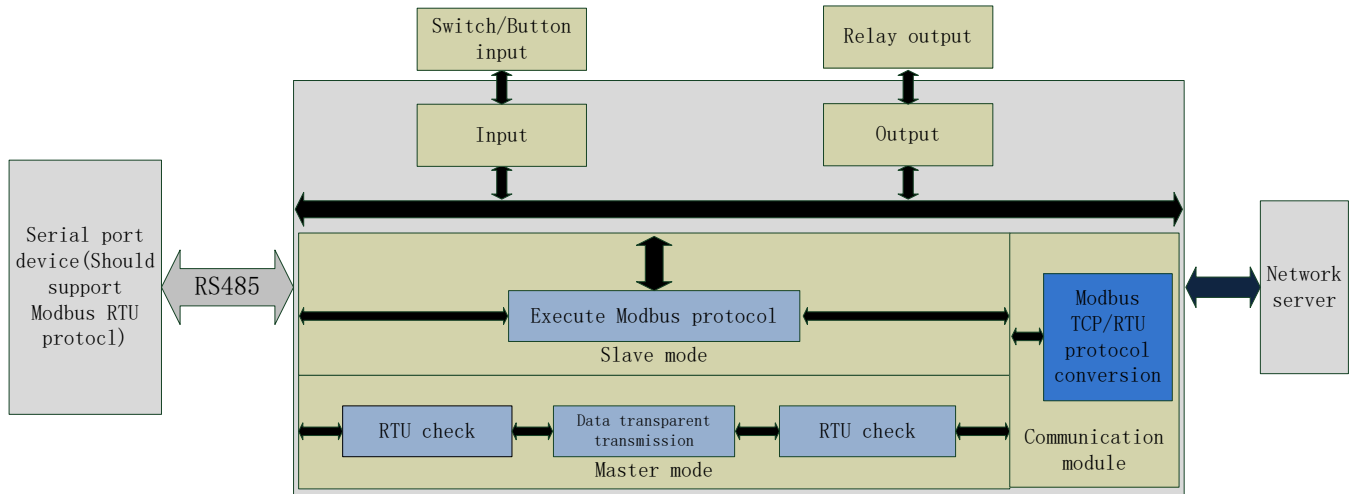
**Figure 11 Add IO808-EWR**

Choose 'Networking I/O controller' as 'Device type', write IMEI and SN on IO808-EWR's label and click 'Save' to add IO808-EWR.

After adding IO808-EWR, power IO808-EWR and wait LED 'NET' light which means IO808-EWR connects to USR Cloud. Then user can remotely look over, record and control IO808-EWR status in real time through USR Cloud(Monitor->Data list).

## 2. Product function

USR-IO808-EWR functional diagram as follow:



**Figure 12 Functional diagram**

### 2.1. DI input

#### 2.1.1. Electrical level detection

- Register address range: 32~39(0x0020~0x0027)
- Supported function code: 02(Read discrete input), 03(Read holding register)
- Connection: Default is dry contact input. Short-circuit DI and COM will change input status. If user needs wet contact input can contact to our sales personnel
- Electrical level detection: Default status is 0, after short-circuiting DI and COM, status will be 1. Detection method: 02 function code of Modbus protocol.

Example:

Detect input of the first way, send: 11 02 00 20 00 01 BA 90

Short-circuiting will return: 11 02 01 01 64 88

No short-circuiting will return: 11 02 01 00 A5 48

#### 2.1.2. Buttons detection

- Register address range: 48~55(0x0030~0x0037)
- Supported function code: 03(Read holding register), 04(Read input register)
- Connection: Default is dry contact input. Short-circuit DI and COM will change input status. If user needs wet contact input can contact to our sales personnel
- Electrical level detection: Default status is 0000, after short-circuiting DI and COM and then releasing, status will be FF00. Detection method: Read button register value by 03 function code of Modbus protocol. After reading once button register, status will recover to 0000; after executing conditional control, status will recover to 0000. too.

Example:

Detect the first way button, send: 11 03 00 30 00 01 86 95

No button will return: 11 03 02 00 00 79 87

Have button will return: 11 03 02 FF 00 38 77

### 2.1.3. Pulse counting

- Register address range: 64~71(0x0040~0x0047)
- Supported function code: 03(Read holding register), 04(Read input register)
- Connection: Default is dry contact input. Short-circuit DI and COM will change input status. If user needs wet contact input can contact to our sales personnel
- Pulse counting: Default status is 0, short-circuit DI and COM and then release will count 1. Detection method: Read pulse counting register value by 03 function code of Modbus protocol. Maximum value of pulse counting is 65535 and it will restart counting after exceeding 65535. Can't reset count to 0 and restart product won't save count.
- **Note:** Pulse counting won't filter input waveform and all pulse in the range of detection will be recorded. So input waveform should keep stable to ensure accurate count.

Example:

Detect count of the first way, send: 11 03 00 40 00 01 87 4E

Return: 11 03 02 00 00 79 87

## 2.2. DO output

- Register address range: 00~07(0x0000~0x0007)
- Supported function code: 01(Read coil), 05(Write single coil), 0F(Write multiple coil)
- Connection: DO output is Relay passive output. Don't power the coil, Relay COM and NC will close, COM and NO will open. After powering, the contrary is the case.

Take the first way Relay control as example:

Query: 11 01 00 00 00 04 3F 59

Control to close: 11 05 00 00 FF 00 8E AA

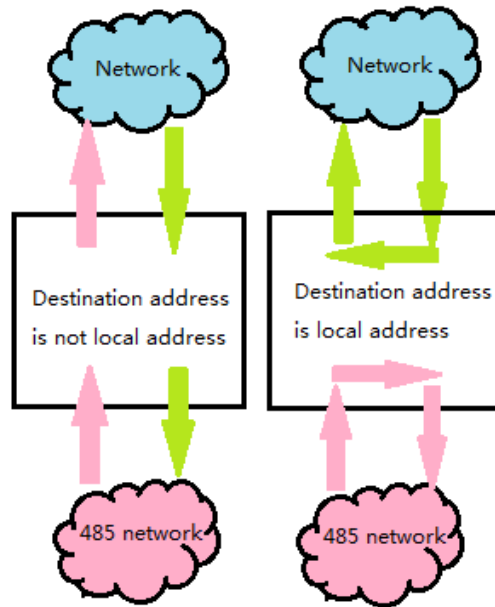
Control to disconnect: 11 05 00 00 00 00 CF 5A

## 2.3. Work mode

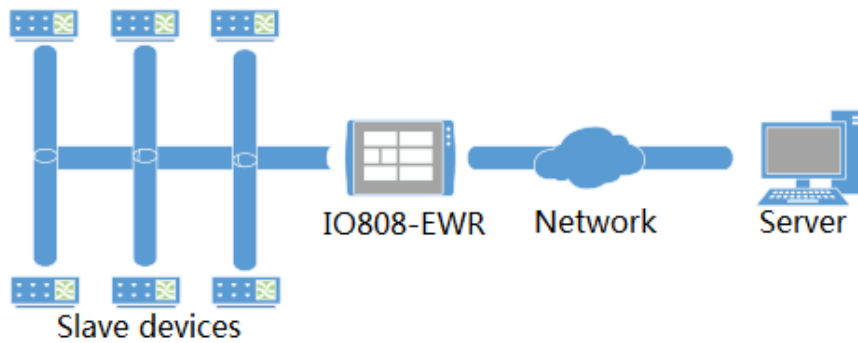
Default work mode of USR-IO808-EWR is slave mode. IO808-EWR will be slave both on network side and RS485 side and IO808-EWR will discard data if IO808-EWR receives data not for IO808-EWR local address.

### 2.3.1. Master mode

Master mode data flow diagram and connecting to network diagram as follows:



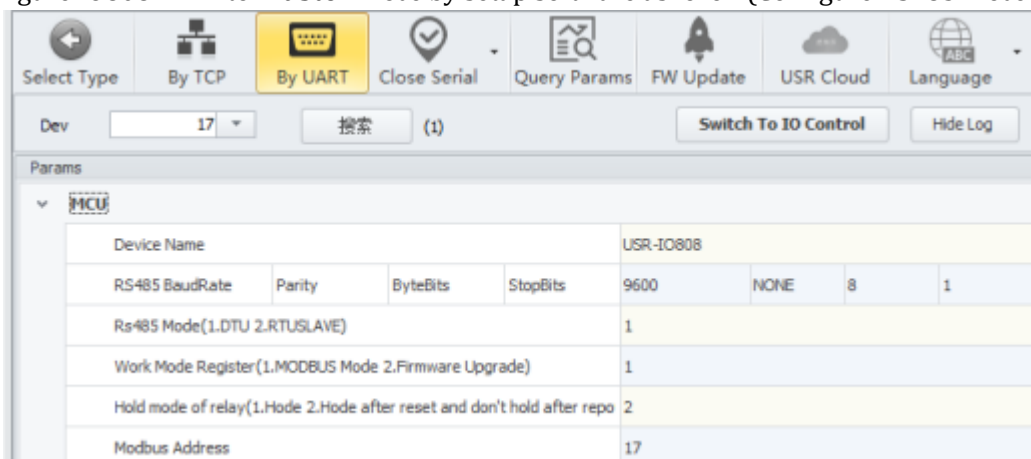
**Figure 13 Master mode data flow**



**Figure 14 Connecting to network in Master mode**

In master mode, server can communicate to network IO product IO808-EWR and Modbus devices which connect to IO808-EWR's RS485 interface. RS485 side can also transmit data to IO808-EWR directly.

User can configure IO808-EWR to Master mode by setup software as follow(Configure RS485 mode to 1.DTU):



**Figure 15 Configure IO808-EWR to Master mode**

### 2.3.2. Slave mode

Slave mode data flow diagram and connecting to network diagram as follows:

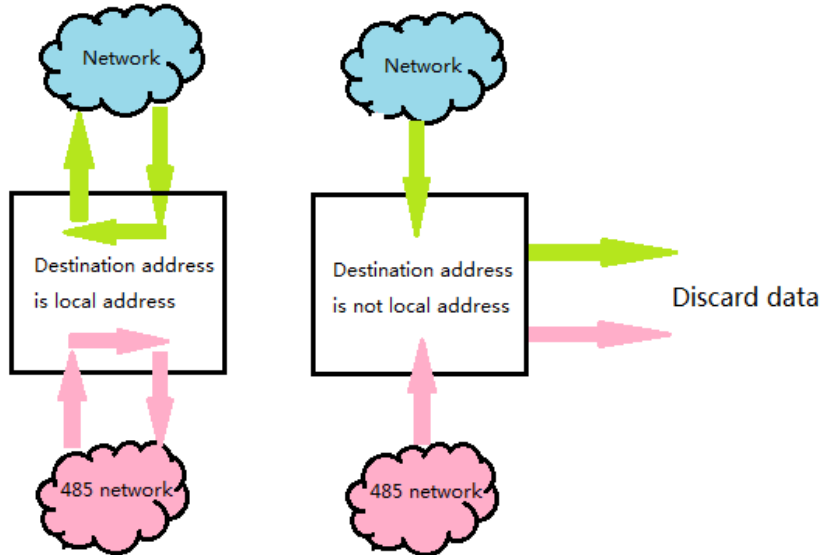


Figure 16 Slave mode data flow



Figure 17 Connecting to network in Slave mode

In this mode, IO808-EWR can communicate to network server and Modbus devices on RS485 network. But network server can't communicate to Modbus devices on RS485 network.

User can configure IO808-EWR to slave mode by setup software as follow(Configure RS485 mode to 2.RTUSLAVE):

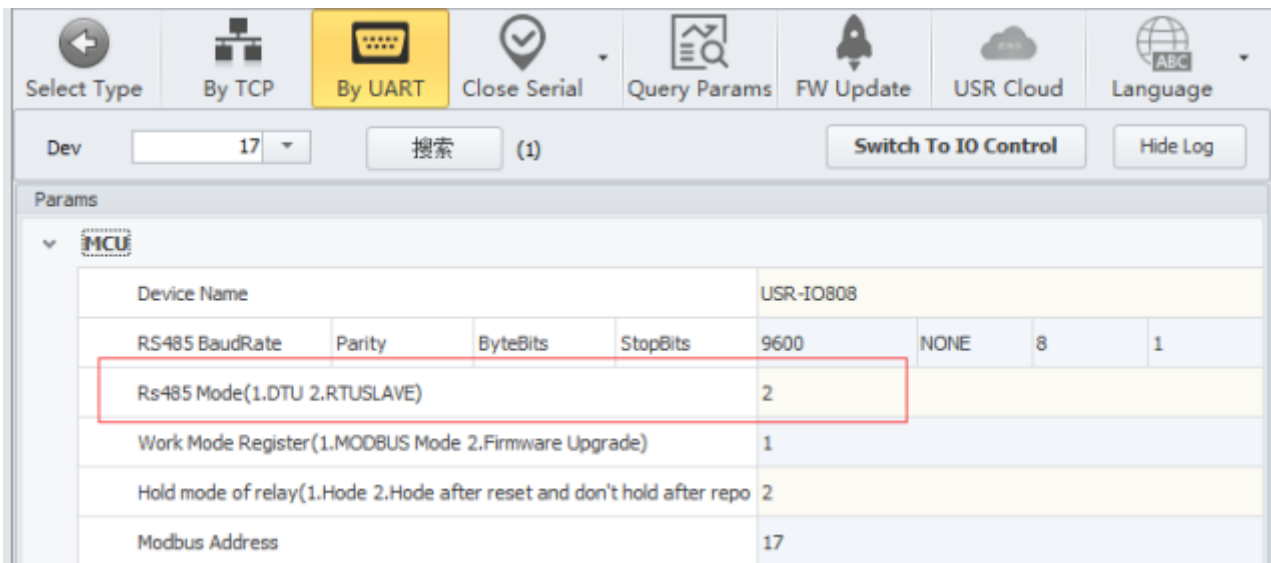


Figure 18 Configure IO808-EWR to Slave mode

## 2.4. Upgrade firmware

User can refer to FAQ <<[Upgrading firmware method of USR-IO808-EWR\\_V1.0.0](#)>>.

## 2.5. Ethernet interface and WiFi

### 2.5.1. Ethernet interface

USR-IO808-EWR has two Ethernet interface: WAN/LAN interface and LAN interface. WAN/LAN interface supports switching between WAN/LAN by modifying value of corresponding register. User can configure by setup software as follow:

WAN/LAN	
Wan/lan(1.WAN 2.LAN)	1
WAN-ipmode(1. DHCP 2.STATIC)	1
WAN-IP	192.168.0.7
WAN-netmask	255.255.255.0
WAN-gateway	192.168.0.1
Lan-ip	192.168.10.1
Lan-netmask	255.255.255.0
dns1	8.8.8.8

Figure 19 WAN/LAN switch

### 2.5.2. WiFi

USR-IO808-EWR supports WiFi function and AP/STA two WiFi modes,

AP mode:

1. Set WiFi mode to 1(AP mode) and AP'SSID/AP's password, then restart device.
2. After restarting successfully, use PC or mobile to search IO808-EWR and connect.

STA mode:

1. Set WiFi mode to 2(STA mode) and SSID/password of the target AP which user wants to connect IO808-EWR to, then restart device.
2. After restarting successfully, IO808-EWR will connect to target AP automatically.

WiFi	
username	admin
password	admin
wifi ap/sta(1.AP 2.STA)	1
wifi ssid	USR-IO424T-446C
wifi pwd	www.usr.cn

Figure 20 WiFi mode

## 2.6. Serial port

### 2.6.1. Basic parameters

Parameter	Range
Baud rate	300~230400
Data bits	7, 8
Stop bits	1, 2
Parity	NONE, EVEN, ODD

Figure 21 Serial port basic parameters

### 2.6.2. Configuration method

Serial port parameters occupy two registers. Length of protocol is 4 bytes and specific protocol content as follow(All examples are in HEX format):

Name	Baud rate	Parameter bit
Number of bytes	3	1
Description	Three bytes represent a baud rate value and high-order in the former	Refer to <b>Serial port parameter bit</b>
Example 1(115200, None, 8, 1)	01 C2 00	03
Example 2(9600, None, 8, 1)	00 25 80	03

Figure 22 Serial port parameters protocol

Bit number	Representation	Value	Description
1:0	Data bits	10	7 bits data bits
		11	8 bits data bits
2	Stop bits	0	1 bit stop bits
		1	2 bits stop bits
5:4:3	Parity	000	None
		001	ODD
		011	EVEN
7:6	No definition	00	Please write 0

Figure 23 Serial port parameter bit

## 2.7. Features

### 2.7.1. Relay output status hold

User can configure whether hold Relay output status: After restarting IO808-EWR or powering on IO808-EWR again, hold the Relay output status or reset to disconnect status.

- Register address: 182(0x00B6)
- Parameter values: 1(0x0001): All Relays hold status after restarting or powering off. 2(0x0002): All relays hold status after restarting and don't hold status after powering off. 3(0x0003): All relays don't hold status after restarting or powering off.



- Supported function code: 0x03, 0x04, 0x06, 0x10

Configuration will take effect after restarting.

## 2.7.2. Conditional control

Conditional control function supports user configuring the conditions to trigger IO changes. It can make using IO808-EWR more flexibly and extend application scenario. User only needs to modify conditional control function register parameters according to the instructions, it will realize corresponding function.

Conditional control function has 32 registers and 8 conditional control commands (Every command occupies 4 registers). Registers distribution as follow:

Storage content	Input register	Output register	Output action	Condition	Threshold	Reserved
<b>Length</b>	1 byte	1 byte	1 byte	1 byte	2 bytes	2 bytes
<b>Address</b>	Range: 16~109	Range: 1~16	1: Disconnect 2: Close 3: Reversal	1, 2, 255	'Compared register values'/The first two bytes of time-stamp	Reserved/ Last two bytes of time-stamp

**Figure 24 Conditional control function register**

- Output action (Relay output)
  - 1: Disconnect
  - 2: Close
  - 3: Reversal
- Condition
  - 1: Forward direction output follow
  - 2: Backward direction output follow
  - 255: Button action
- Control mode
  - Switching value control: DI input control DO output directly
  - Semaphore control: DI button semaphore control DO. Press button once, DO act once (Execute action in rising edge of releasing button).

Detailed explanation:

### 1. Forward direction output follow

Enable forward direction output follow: Set condition register to 1, input register is corresponding to one way register address of 8-way input and output register is corresponding to one way register address of 8-way output.

For example, if configure as 0x20 0x00 0x01 0x01 0x00 0x00 0x00 0x00, it represents status of DO1 will follow status of DI1 which means DO1 will close if DI1 close and DO1 will disconnect if DI1 disconnect.

### 2. Backward direction output follow

Enable backward direction output follow: Set condition register to 2, input register is corresponding to one way register address of 8-way input and output register is corresponding to one way register address of 8-way output.

For example, if configure as 0x20 0x00 0x01 0x02 0x00 0x00 0x00 0x00, it represents status of DO1 will be opposite as status of DI1 which means DO1 will close if DI1 disconnect and DO1 will disconnect if DI1 close.

### 3. Button control

Enable button control: Set condition register to 255, input register is DI button register and output register is DO output register. Action can be 1(disconnect ), 2(close), 3(reversal ), threshold register and reserved register can't work.

For example, if configure as 0x30 0x00 0x03 0xFF 0x00 0x00 0x00 0x00, it represents detecting DI1 button once will reverse status of DO1 once.

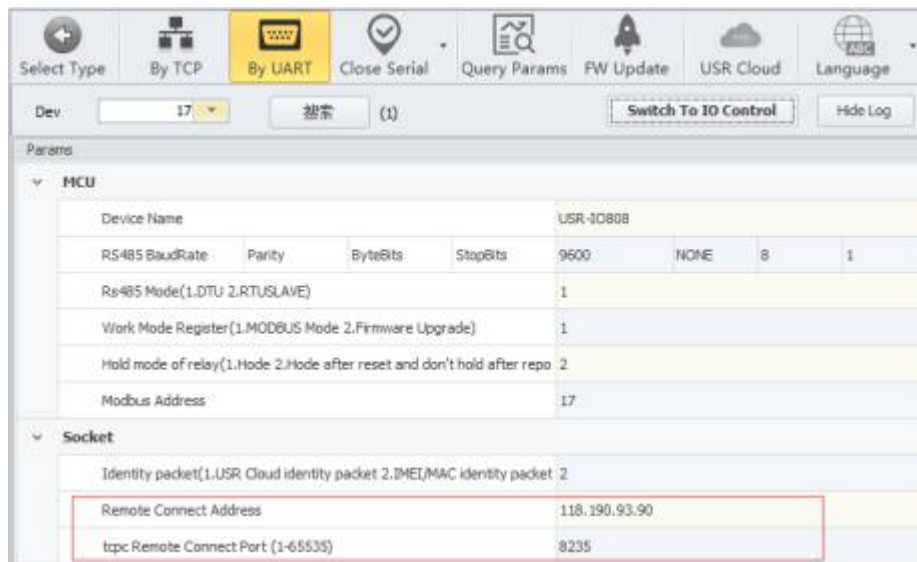
#### Note:

Input register is 0 means close this conditional control and execute button action once will clear button register. If multiple conditions will lead to paradoxical result, program will execute two results quickly. If forward direction output follow and backward direction output follow lead to paradoxical result, disconnecting and closing will revolve.

## 2.7.3. Connect to remote server

User can modify related register parameters of remote server to realize IO808-EWR connecting to remote server. Procedure as follow:

1. Power the IO808-EWR and connect IO808-EWR's RS485 interface to PC. Run setup software(User can refer to **1.4.1.Control by serial**), modify remote server address and remote port as follow:



**Figure 25 Configure remote server parameters**

2. Restart IO808-EWR to make configuration take effect.

3. Login remote server and open the port.

4. Wait IO808-EWR LED 'NET' light which means IO808-EWR connect to remote server successfully, Then user can transmit Modbus TCP/RTU command from server side to control IO808-EWR and receive response from IO808-EWR.

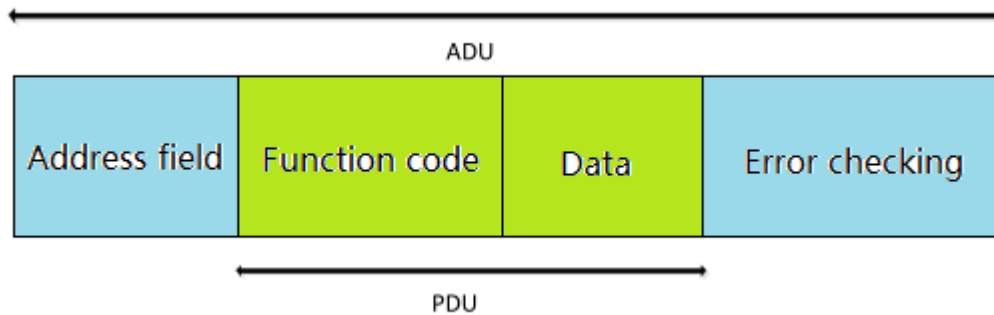
## 2.7.4. Reset to default by hardware

User can reset to default settings by pressing Reload button. After powering on, press Reload button 3 seconds to 15 seconds, then release it, IO808-EWR will reset to default settings. Less than 3 seconds or more than 15 seconds will be considered as misoperation and don't handle it.

### 3. Modbus

### 3.1. Modbus frame

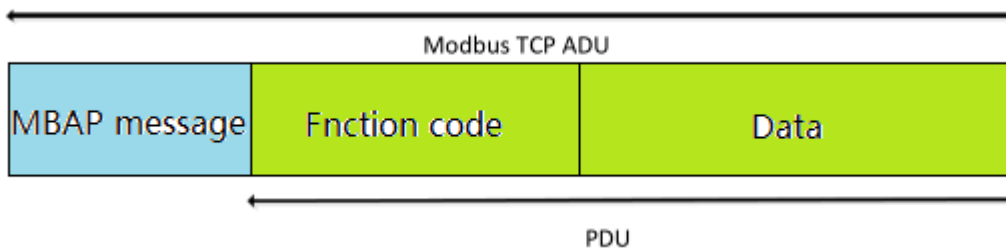
Modbus RTU:



**Figure 26 Modbus RTU frame**

USR-IO808-EWR data format conform to general Modbus frame format. IO808-EWR can analyse Modbus RTU protocol and execute related operations.

Modbus TCP:



**Figure 27 Modbus TCP frame**

USR-IO808-EWR can analyse received network Modbus TCP protocol data and transfer to Modbus RTU protocol to do data processing. IO808-EWR can also be used in Master mode and transfer Modbus RTU protocol to Modbus TCP protocol and transmit to server.

### 3.2. Register distribution

USR-IO808-EWR register instructions:

1. Register base address is 0x0000.
2. In following register distribution table, MCU parameters and communication module parameters must operate together.
3. Setup software USR-IO adopts UTF-8 coded format.
4. Register store HEX format data.

Register address	Register content	Parameter description	Applicable function code
<b>Device I/O</b>			
0x0000~0x0007	Switch value output	0xFF00 means ON, 0x0000 means OFF; 1 means ON, 0 means OFF	0x01, 0x05, 0x0F
0x0020~0x0027	Switch value input	1 means ON, 0 means OFF	0x02

0x0030~0x0037	Button input	Button detection. Reset to 0 after reading once	0x03, 0x04
0x0040~0x0047	Pulse counting	Count range: 0~65535. Reset to 0 after reaching maximum	0x03, 0x04
<b>MCU parameter</b>			
0x0068~0x0069	Time-stamp	Current time-stamp	0x03, 0x04
0x006A~0x006C	Year, month, day, hour, minute, second	The format of 'year, month, day, hour, minute, second' is Bcd code. Such as [0x18,0x01,0x01,0x08,0x24,0x56] represents 2018-1-1 8:24:56	0x03, 0x04, 0x10
0x006D	Week	0x0001-0x0007 represents Monday to Sunday	0x03, 0x04
0x008E~0x0091	Conditional control command 1	Refer to <b>2.7.2. Conditional control</b>	0x03, 0x04, 0x10
0x0092~0x0095	Conditional control command 2		
0x0096~0x0099	Conditional control command 3		
0x009A~0x009D	Conditional control command 4		
0x009E~0x00A1	Conditional control command 5		
0x00A2~0x00A5	Conditional control command 6		
0x00A6~0x00A9	Conditional control command 7		
0x00AA~0x00AD	Conditional control command 8		
0x00AE~0x00AF	RS485 interface	Refer to <b>2.6.2. Configuration method</b>	0x03, 0x04, 0x10
0x00B0	RS485 mode	Master mode(0x0001) Slave mode(0x0002)	0x03, 0x04, 0x06, 0x10
0x00B1	Modbus address	Slave address(0x0001~0x00FD)	0x03, 0x04, 0x06, 0x10
0x00B2	Work mode	Modbus mode(0x0001) Firmware upgrade(0x0002)	0x03, 0x04, 0x06, 0x10
0x00B3	Global parameters configuration	Default(0x0000), restart(0x0001), reset to user default settings(0x0002), reset to USR default settings(0x5555), save current	0x03, 0x04, 0x06, 0x10

		settings as user default settings(0xAAAA)	
0x00B4	MCU software version	For example, 0x0112 means version V1.1.2	0x03, 0x04
0x00B5	MCU hardware version	For example, 0x0110 means version V1.1	0x03, 0x04
0x00B6	Relay status after restarting	All relays hold status after restarting or powering off(0x0001); All relays hold status after restarting and don't hold status after powering off(0x0002) All relays don't hold status after restarting or powering off(0x0003)	0x03, 0x04, 0x06, 0x10
<b>Communication module parameters</b>			
0x1021	WiFi mode	AP(1)/STA(2)	0x03, 0x04, 0x06, 0x10
0x1022~0x1031	AP mode SSID	Character string format	0x03, 0x04, 0x10
0x1032~0x1041	AP mode password	Character string format	0x03, 0x04, 0x10
0x1042	WAN/LAN switch	WAN(1)/LAN(2)	0x03, 0x04, 0x06, 0x10
0x1043	Remote connection identity packet	USR Cloud(1)/MAC(2)/User editable(3)/Disable(4)	0x03, 0x04, 0x06, 0x10
0x1044~0x1045	LAN interface IP	0xC0A80007 represents 192.168.0.7	0x03, 0x04, 0x10
0x104A	WAN interface IP mode	DHCP(1)/Static IP(2)	0x03, 0x04, 0x06, 0x10
0x104B~0x104C	WAN interface IP	0xC0A80007 represents 192.168.0.7	0x03, 0x04, 0x10
0x104D~0x104E	WAN interface mask	0xC0A80007 represents 192.168.0.7	0x03, 0x04, 0x10
0x104F~0x1050	WAN interface gateway	0xC0A80007 represents 192.168.0.7	0x03, 0x04, 0x10
0x1051~0x1052	DNS1	0xC0A80007 represents 192.168.0.7	0x03, 0x04, 0x10
0x1055~0x1074	TCP Client remote server address	Remote server address	0x03, 0x04, 0x10
0x1075	TCP Client remote port	Remote server port	0x03, 0x04, 0x06, 0x10
0x1076	TCP Server/UDP Server listening port	LAN listening port	0x03, 0x04, 0x06, 0x10
0x1078~0x107F	Username	Character string format	0x03, 0x04, 0x10
0x1080~0x1087	Password	Character string format	0x03, 0x04, 0x10
0x1088~0x1097	Device name	Character string format	0x03, 0x04, 0x10
0x1098	Device software	For example, 0x0112 means	0x03, 0x04

	version	version V1.1.2	
0x1099	Device hardware version	For example, 0x0110 means version V1.1	0x03, 0x04
0x109A~0x10A9	Target AP's SSID in STA mode	Character string format	0x03, 0x04, 0x10
0x10AA~0x10B9	Target AP's password in STA mode	Character string format	0x03, 0x04, 0x10
0x10BA~0x10CD	User editable identity packet	Character string format	0x03, 0x04, 0x10
0x10CE	Identity packet sending method	Send identity packet after establishing connection(1)/Send before every data package(2)/Both way(3)	0x03, 0x04, 0x06, 0x10

**Figure 28 Register distribution**

## 4. Contact Us

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## 5. Disclaimer

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## 6. Update History

2018-05-29 V1.0.4.01 established based on Chinese version V1.0.4.