Protoss-PG46

RS485/Ethernet to 4G Router

User Manual

V 1.1

Overview of Characteristic

✧ Use MIPS MCU (32MB SRAM) and 16MB Flash, based on Linux OS

✧ Support LTE-TDD, LTE-FDD, WCDMA, TD-SCDMA, cellular network, sub-type to support specific cellular network

✧ Support RS485 to 2G/3G/4G Data Transmission, UART baud rate Up to 460800bps

✧ Support 10/100M Ethernet to 2G/3G/4G Data Transmission

✧ Supports Max 5 Channel TCP/UDP connections, Each Connection Supports 1400 Bytes of Data Cache

✧ Support Multiple Working Modes: Network Transparent Transmission Mode, HTTP Mode, MQTT, WebSocket

- ✧ Support Modbus Master Function
- ✧ Support IOTService Tool, Remotely and Dynamically Modify Module Parameters
- ✧ Support APN
- ✧ Support VPN(PPTP, L2TP, L2TP+IPSEC)
- ✧ Supports Registration Packet, Heartbeat Packet Function, and Packet Supports Combination of ICCID, IMEI, IMSI, Software Version, cellular network Connection Status.
- ✧ Support NTP
- ✧ Support Modbus TCP to Modbus RTU
- ✧ Support IOTBridge for Remote Control and Config.
- ✧ Support IOTBridge working time, for example only works from 10:00 to 10:30 to save the data flow charge.
- ✧ Support Network OTA Upgrade Firmware.
- ✧ Multiple Type of Different Power Input：
  - ■ Protoss-PG46-H：100～240VAC@50～60Hz
  - ■ Protoss-PG46-M：9～48VDC@1A
- ✧ Size: 102.03 x 64.95 x 27.50 mm (L x W x H)， C45 rail installation

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V 1.0 05-29-2020. First Version

V 1.1 11-18-2021. Update baudrate range

1. PRODUCT OVERVIER

1.1. General Description

The Protoss-PG46 support LTE-TDD, LTE-FDD, WCDMA, TD-SCDMA, cellular network full network. 4G network support maximum download data rate 150Mbps, upload data rate 50Mbps.

The Protoss-PG46 supports TCPIP protocol, with its RS485 interface, it makes traditional UART device easy connecting to IOT.

Protoss-PG46 include different sub-type, as following table.

Table1. Protoss-PG46 Series Defination

Model \ Function	Main Function	Interface						Band					
	Country	Input Voltage	4G	3G	2G	Serial	Support Serial Mode	TDD-LTE	FDD-LTE	TD-SCDMA	WCDMA	CDMA2000 1X/EVDO	GSM
Protoss-PG46-H	just China	100~240VAC	√	√	√	1	RS485	B38/39/40/41	B1/3/5/8	B34/39	B1/8	—	B3/8
Protoss-PG46-GL-H	global	100~240VAC	√	√	√	1	RS485	B38/39/40/41	B1/2/3/4/5/7/8/12/13/18/19/20/25/26/28	—	B1/2/4/5/6/8/19	—	B2/3/5/8
Protoss-PG46-CE-H	China	100~240VAC	√	√	√	1	RS485	B34/38/39/40/41	B1/3/5/8	B34/39	B1/8	BC0	B3/8
Protoss-PG46-EU-H	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	100~240VAC	√	√	√	1	RS485	B38/40/41	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-EC-H	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	100~240VAC	√	√	√	1	RS485	—	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-AF-H	Canada, USA	100~240VAC	√	√	—	1	RS485	—	B2/4/5/12/13/14/66/71	—	B2/4/5	—	—
Protoss-PG46-AU-H	Australia, Latin America, Taiwan(China), New Zealand, etc.	100~240VAC	√	√	√	1	RS485	B40	B1/2/3/4/5/7/8/28	—	B1/2/5/8	—	B2/3/5/8
Protoss-PG46-JP-H	Japan	100~240VAC	√	√	—	1	RS485	B41	B1/3/8/18/19/26	—	B1/6/8/19	—	—
Protoss-PG46-M	just China	9~48VDC	√	√	√	1	RS485	B38/39/40/41	B1/3/5/8	B34/39	B1/8	—	B3/8
Protoss-PG46-GL-M	global	9~48VDC	√	√	√	1	RS485	B38/39/40/41	B1/2/3/4/5/7/8/12/13/18/19/20/25/26/28	—	B1/2/4/5/6/8/19	—	B2/3/5/8
Protoss-PG46-CE-M	China	9~48VDC	√	√	√	1	RS485	B34/38/39/40/41	B1/3/5/8	B34/39	B1/8	BC0	B3/8
Protoss-PG46-EU-M	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	9~48VDC	√	√	√	1	RS485	B38/40/41	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-EC-M	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	9~48VDC	√	√	√	1	RS485	—	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-AF-M	Canada, USA	9~48VDC	√	√	—	1	RS485	—	B2/4/5/12/13/14/66/71	—	B2/4/5	—	—
Protoss-PG46-AU-M	Australia, Latin America, Taiwan(China), New Zealand, etc.	9~48VDC	√	√	√	1	RS485	B40	B1/2/3/4/5/7/8/28	—	B1/2/5/8	—	B2/3/5/8
Protoss-PG46-JP-M	Japan	9~48VDC	√	√	—	1	RS485	B41	B1/3/8/18/19/26	—	B1/6/8/19	—	—

1.2. Device Parameters

Table2. Protoss-PG46 Technical Specifications

Item	Parameters
System Information	
Processor/Frequency	320MHz
Flash/SDRAM	16MB/32MB
Operating System	OpenWRT Linux
2G/3G/4G Interface	
Transmit Power	LTE-TDD: Class 3(23dBm+1/-3dB) LTE-FDD: Class 3(23dBm±2dB) WCDMA: Class 3(24dBm+1/-3dB) TD-SCDMA: Class 3(24dBm+1/-3dB) GSM900: Class 4(33dBm±3dB) DCS1800: Class 1(30dBm±3dB) GSM900 8-PSK: Class E2(27dBm±3dB) DCS1800 8-PSK: Class E2(26dBm±3dB)

Receive Sensivity	FDD B1: -96dBm(10M) FDD B3: -96dBm(10M) FDD B5: -96dBm(10M) FDD B8: -96.5dBm(10M) TDD B38: -96dBm(10M) TDD B39: -97dBm(10M) TDD B40: -96.5dBm(10M) TDD B41: -96dBm(10M) WCDMA B1: -110dBm WCDMA B8: -111dBm TDSCDMA B34: -109dBm TDSCDMA B39: -109dBm GSM 900M: -109dBm GSM 1800M: -109dBm
LTE	Maximum Support non-CA CAT4 Support 1.4~20MHz RF Bandwidth Downstream Support Multiple Users MIMO FDD: Maximum Upstream Rate 50Mbpsm Maximum Downstream Rate 150Mbps TDD: Maximum Upstream Rate 35Mbpsm Maximum Downstream Rate 130Mbps
WCDMA	3GPP R8 DC-HSPA+ 16-QAM,64-QAM and QPSK Modulation Maximum Upstream 5.76Mbps Maximum Downstream 42Mbps
TD-SCDMA	CCSA Relese 3 Maximum Upstream 2.2Mbps Maximum Downstream 4.2Mbps
GSM/cellular network	R99： CSD Transmission Rate：9.6Kbps/14.4Kbps cellular network： Support cellular network multi-slot class 12 Code Method：CS-1/CS-2/CS-3/CS-4
Ethernet	
Port Number	1 WAN/LAN switchable
Interface	10/100M Base-T
Transformer	Integrated
Serial Port	
Port Number	1
Interface Standard	RS485
Data Bits	7,8
Stop Bit	1,2
Check Bit	None,Even,Odd
Baud Rate	TTL：2400 bps~460800 bps
Flow Control	No Flow Control Half-Duplex(RS485) Software Flow Contorl
Software	
Configuration	Serial AT Command IOTService Serial Port Configuration Software IOTService Network Configuration Software
Firmware Upgrade	UART or OTA Upgrade
Network Protocol	IP，TCP，UDP，DHCP，DNS，HTTP Server/Client，ARP，

	AutoIP， ICMP， Telnet，NTP， Modbus TCP
Encryption	TLS v1.2 AES 128Bit DES3
Basic Parameter	
SIM Card	Nano SIM card(1.8V/3V)
Size	102.03 x 64.95 x 27.50 mm
Operating Temp.	-40 ~ 70°C
Storage Temp.	-40 ~ 85°C, 5 ~ 95% RH（no condensation）
Input Voltage	Protoss-PG46-H：100～240VAC@50～60Hz Protoss-PG46-M：9～48VDC@1A
Average Working Current	~300mA@9V
Peak Current	2A

1.3. Key Applications

The Protoss-PG46 module connects the serial device to the Internet and conforms to the TCP/IP protocol for transmitting serial data.

- Remote device monitoring
- Production asset tracking and monitoring
- Security field
- Industrial sensors and controllers
- Health medical equipment
- ATM equipment
- Data acquisition equipment
- UPS power management equipment
- Telecommunication equipment
- Data display device
- Hand-held device
- Attendance system and terminal equipment

2. HARDWARE INTRODUCTION

Protoss-PG46 is a cellular network solution for serial device networking. Data transmission via cellular network makes product integration very easy. This product meets EMC Class B security level and can pass relevant certification tests in various countries.

2.1. APPEARANCE

Figure 1. Protoss-PG46 Appearance

2.2. Interface Definition

Figure 2. Protoss-PG46 Interface

Figure 3. Protoss-PG46-H Interface Definition

Pin	Description	Net Name	Signal Type	Comment
1	AC Power Input	L	Power	100～240VAC Input
2	AC Power Input	N	Power	
5		RS485_B-	IO	RS485 B-
6	Signal GND	GND	Power	Used for RS485 GND, usually leave it unconnected
7		RS485_A+	IO	RS485 A+
ANT	Antenna	ANT		2G/3G/4G SMA Antenna
RJ45	Ethernet	RJ45	I/O	10/100M Ethernet Default is LAN function, can be configured to WAN Function, connect to router LAN port for network access.
SIM	SIM Slot	Nano SIM		
Reload	Restore to factory setting button	Reload	I	**Detailed functions see <Notes>**
Reset	Reset button	Reset	I	Hardware reset button
Net	Network status LED	Net	O	Boot On: Bootup is OK. 2s Off -> 2s On: Cellular network Register is OK. 0.1s Off -> 0.1s On: Cellular network data is transferring.

Pin	Description	Net Name	Signal Type	Comment
Active	UART/Ethernet Data Transfer	Active	O	On: Ethernet connection OK Off: No Ethernet connection 0.1s Off -> 0.1s On: UART data transfer
Power	Power LED	Power	O	On: Power input OK Off: Power input NG.
Link	Server connection LED	Link	O	On: SOCK A connection OK. Off: no Socket A connection.

Figure 4. Protoss-PG46-H Interface Definition

Pin	Description	Net Name	Signal Type	Comment
1	DC Power Input	VCC+	Power	9～48VDC@1A Input
2	DC Power Input	GND-	Power	
Other Pin definition is the same as above				

<Notes>:

I — Input; O — Output; Power—Power Supply

nReload Pin (Button) function:

1.After module is powered up, long press this button (“Low” > 3s) and loose to make the module recover to factory setting.

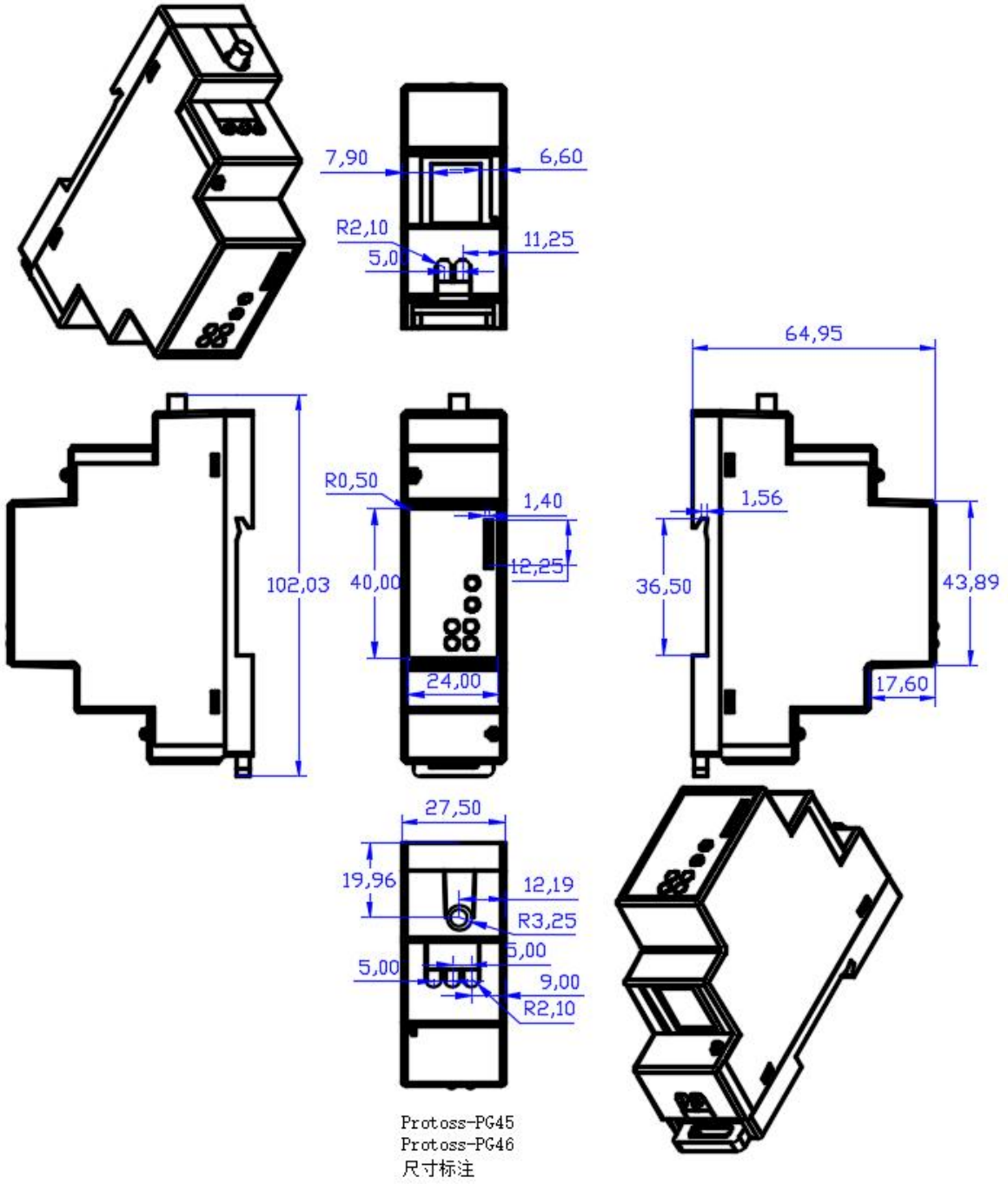
2.3. RS485 Interface

RS485 use two wire links, A(DATA+), B(DATA-). Connect A(+) to A(+), B(-) to B(-) for communication. Suggest to connect GND together when interference is very severe.

The RS485 interface support maximum 32 485 device, device. The cable maximum length is 1200 meters. Need to add 120Ohm terminal resistor for over 300 meters.

2.4. Mechanical Size

The dimensions of Protoss-PG46 are defined as following pictures(mm):



Protoss-PG45
Protoss-PG46
尺寸标注

Figure 5. Protoss-PG46 Mechanical Size

2.5. Product Installation

Figure 6. C45 Rail Installation

2.6. Product Order Information

Based on customers detailed requirements, we provide different configuration Protoss-PG11, details as below:

Model \ Function	Main Function	Interface						Band					
	Country	Input Voltage	4G	3G	2G	Serial	Support Serial Mode	TDD-LTE	FDD-LTE	TD-SCDMA	WCDMA	CDMA2000 1X/EVDO	GSM
Protoss-PG46-H	just China	100~240VAC	√	√	√	1	RS485	B38/39/40/41	B1/3/5/8	B34/39	B1/8	—	B3/8
Protoss-PG46-GL-H	global	100~240VAC	√	√	√	1	RS485	B38/39/40/41	B1/2/3/4/5/7/8/12/13/18/19/20/25/26/28	—	B1/2/4/5/6/8/19	—	B2/3/5/8
Protoss-PG46-CE-H	China	100~240VAC	√	√	√	1	RS485	B34/38/39/40/41	B1/3/5/8	B34/39	B1/8	BC0	B3/8
Protoss-PG46-EU-H	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	100~240VAC	√	√	√	1	RS485	B38/40/41	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-EC-H	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	100~240VAC	√	√	√	1	RS485	—	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-AF-H	Canada, USA	100~240VAC	√	√	—	1	RS485	—	B2/4/5/12/13/14/66/71	—	B2/4/5	—	—
Protoss-PG46-AU-H	Australia, Latin America, Taiwan(China), New Zealand, etc.	100~240VAC	√	√	√	1	RS485	B40	B1/2/3/4/5/7/8/28	—	B1/2/5/8	—	B2/3/5/8
Protoss-PG46-JP-H	Japan	100~240VAC	√	√	—	1	RS485	B41	B1/3/8/18/19/26	—	B1/6/8/19	—	—
Protoss-PG46-M	just China	9~48VDC	√	√	√	1	RS485	B38/39/40/41	B1/3/5/8	B34/39	B1/8	—	B3/8
Protoss-PG46-GL-M	global	9~48VDC	√	√	√	1	RS485	B38/39/40/41	B1/2/3/4/5/7/8/12/13/18/19/20/25/26/28	—	B1/2/4/5/6/8/19	—	B2/3/5/8
Protoss-PG46-CE-M	China	9~48VDC	√	√	√	1	RS485	B34/38/39/40/41	B1/3/5/8	B34/39	B1/8	BC0	B3/8
Protoss-PG46-EU-M	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	9~48VDC	√	√	√	1	RS485	B38/40/41	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-EC-M	Europe, Israel, South Korea, Southeast Asia India, Russia, Middle East, etc.	9~48VDC	√	√	√	1	RS485	—	B1/3/7/8/20/28A	—	B1/8	—	B3/8
Protoss-PG46-AF-M	Canada, USA	9~48VDC	√	√	—	1	RS485	—	B2/4/5/12/13/14/66/71	—	B2/4/5	—	—
Protoss-PG46-AU-M	Australia, Latin America, Taiwan(China), New Zealand, etc.	9~48VDC	√	√	√	1	RS485	B40	B1/2/3/4/5/7/8/28	—	B1/2/5/8	—	B2/3/5/8
Protoss-PG46-JP-M	Japan	9~48VDC	√	√	—	1	RS485	B41	B1/3/8/18/19/26	—	B1/6/8/19	—	—

Figure 7. Protoss-PG46 Product Order Information

3. FUNCTION DESCRIPTION

Refer to “IOT_Device_Series_Software_Funtion” document for more detailed function.

APPENDIX A: CONTACT INFORMATION

Address: Room1002 , #1Building, No.3000 Longdong Avenue, Pudong District, Shanghai, China 201202
Website: www.iotworkshop.com or www.hi-flying.com
Contact:
Sales：sales@iotworkshop.com
Support：support@iotworkshop.com
Service：service@iotworkshop.com
Business：business@iotworkshop.com

For more information about us, please visit our website: www.iotworkshop.com

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Protoss-PW21

RS485 to Wi-Fi/Ethernet

User Manual

V 1.2

Overview of Characteristic

- ✧ **MIPS MCU with 4MB Flash and 8MB SRAM. Run on eCos**
- ✧ **Support TCP/UDP/MQTT/HTTP/WebSocket Protocol**
- ✧ **Support Modbus TCP to RTU, Modbus Master Function**
- ✧ **Support RS485 to Ethernet/Wi-Fi Conversion, Serial Speed Upto 230400 bps**
- ✧ **Support STA/AP/AP+STA Mode**
- ✧ **Support Router or Bridge Network Working Mode.**
- ✧ **Support 10/100M Ethernet Auto-Negotiation**
- ✧ **Support Easy Configuration Through a Web Interface or PC IOTService Tool**
- ✧ **Support Security Protocol Such As TLS/AES/DES3**

- **Support Web OTA Wirelss Upgrade**
- **Multiple Type of Different Power Input：**
  - **Protoss-PW11-H：100～240VAC@50～60Hz**
  - **Protoss-PW11-M：9～48VDC@1A**
- **Size: 102.03 x 64.95 x 27.50 mm (L x W x H)， C45 rail installation**

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Ed. V1.0	02-11-2020	First Version
Ed. V1.1	03-18-2020	Update RS485 interface
Ed. V1.2	06-23-2020	Update Link LED description

1. PRODUCT OVERVIEW

1.1. General Description

The Protoss-PW21 provides RS485 interface to Ethernet/Wi-Fi connectivity to web enable any device. The Protoss-PW21 integrate TCP/IP controller, memory, 10/100M Ethernet transceiver, high-speed serial port and integrates a fully developed TCP/IP network stack and eCos OS. The Protoss-PW21 also includes an embedded web server used to remotely configure, monitor, or troubleshoot the attached device.

The Protoss-PW21 using highly integrated hardware and software platform. It has been optimized for all kinds of applications in the industrial control, smart grid, personal medical application and remote control that have lower data rates, and transmit or receive data on an infrequent basis.

1.2. Device Paremeters

Table1. Protoss-PW21 Technical Specifications

Item	Parameters
System Information	
Processor/Frequency	MIPS/320MHz
Flash/SDRAM	4MB/8MB
Operating System	eCos
Ethernet Port	
Port Number	1 RJ45 1 WAN/LAN switchable
Interface Standard	10/100 Base-T Auto-Negotiation
Protection	8KV Isolation
Transformer	Integrated
Network Protocol	IP, TCP, UDP, DHCP, DNS, HTTP Server/Client, ARP, BOOTP, AutoIP, ICMP, Web socket, Telnet, uPNP, NTP, Modbus TCP
Security Protocol	TLS v1.2 AES 128Bit DES3
Wi-Fi Interface	
Standard	802.11 b/g/n
Frequency	2.412GHz-2.484GHz
Network Mode	STA/AP/STA+AP
Security	WEP/WPAPSK/WPA2PSK
Encryption	WEP64/WEP128/TKIP/ AES
Tx Power	802.11b: +20dBm (Max.) 802.11g: +18dBm (Max.) 802.11n: +15dBm (Max.)
Rx Sensitive	802.11b: -89dBm

	802.11g: -81dBm 802.11n: -71dBm
Antenna	SMA Antenna Interface
Serial Port	
Port Number	1 RS485
Data Bits	8
Stop Bit	1,2
Check Bit	None, Even, Odd
Baud Rate	TTL: 2400 bps~230400 bps
Flow Control	No Flow Control Software Xon/ Xoff flow control
Software	
Web Pages	Http Web Configuration Customization of HTTP Web Pages
Configuration	Web CLI XML import Telnet IOTService PC Software
Firmware Upgrade	Web, IOTService tools
Basic Parameter	
Size	102.03 x 64.95 x 27.50 mm
Operating Temp.	-40 ~ 70°C
Storage Temp.	-40 ~ 85°C, 5 ~ 95% RH（no condensation）
Input Voltage	Protoss-PW21-H：100～240VAC@50～60Hz Protoss-PW21-M：9～48VDC@1A
Working Current	~200mA
Power	<700mW

1.3. Key Application

The Protoss-PW21 device connects serial device to Ethernet networks using the TCP/IP protocol:

- Remote equipment monitoring
- Asset tracking and telemetry
- Security Application
- Industrial sensors and controls
- Medical devices
- ATM machines
- Data collection devices
- Universal Power Supply (UPS) management units
- Telecommunications equipment
- Data display devices
- Handheld instruments
- Modems
- Time/attendance clocks and terminals

2. HARDWARE INTRODUCTION

The Protoss-PW21 unit is a complete solution for serial port device connecting to network. This powerful device supports a 10/100BASE-T Ethernet connection, a reliable and proven operating system stored in flash memory, an embedded web server, a full TCP/IP protocol stack, and standards-based (AES) encryption.

Figure 1. Protoss-PW21 Appearance

2.1. Interface Definition

Figure 2. Protoss-PW21 Interface

Table2. Protoss-PW21-H Interface Definition

Pin	Description	Net Name	Signal Type	Comment
1	AC Power Input	L	Power	100～240VAC Input
2	AC Power Input	N	Power	
5		RS485_B-	IO	RS485 B-
6	Signal GND	GND	Power	Used for RS485 GND, usually leave it unconnected
7		RS485_A+	IO	RS485 A+
ANT	Antenna	ANT		Wi-Fi 2.4G SMA Antenna
RJ45	Ethernet	RJ45	I/O	10/100M Ethernet Default is WAN function in AP mode (Can be configured to LAN Function), connect to router LAN port for network access. In STA mode, it works in LAN function.
Reload	Restore to factory setting button	Reload	I	**Detailed functions see <Notes>**
Reset	Reset button	Reset	I	Hardware reset button
Net	Network status LED	Net	O	On: Include the following condition.

Pin	Description	Net Name	Signal Type	Comment
				● Ethernt 2 connection OK ● Wi-Fi STA connect to AP ● Wi-Fi AP being connected by other STA device Off: No network connection
Active	UART Data Transfer	Active	O	Off: No data transfer 0.3s Off -> 0.9s On: UART TX Output 0.3s Off -> 0.3s On: UART RX Receive On: UART bidirection.
Power	Power LED	Power	O	On: Power input OK Off: Power input NG.
Link	Server connection LED	Link	O	On(9s)->Off(1s): netp Socket connection OK. On(1s)->Off(9s): Boot OK and no netp Socket connection.

Table3. Protoss-PW21-M Interface Definition

Pin	Description	Net Name	Signal Type	Comment
1	DC Power Input	VCC+	Power	9～48VDC@1A Input
2	DC Power Input	GND-	Power	
Other pin is same as above				

<Notes>

I — Input; O — Output; I/O: Digital I/O; Power—Power Supply

Reload Pin (Button) function:

1. **After module is powered up, long press this button ("Low" > 4s) and loose to make the module recover to factory setting.**

2.2. RS485 Interface

RS485 use two wire links, A(DATA+), B(DATA-). Connect A(+) to A(+), B(-) to B(-) for communication.

The RS485 interface support maximum 32 485 device, special hardware version can support max 255 device. The cable maximum length is 1200 meters. Need to add 120Ohm terminal resistor for over 300 meters.

2.3. RJ45 Interface

Ethernet port is 10M/100M adaptive, support AUTO MDI/MDIX which means it support direct connecting to PC with Ethernet cable.

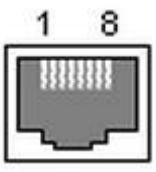


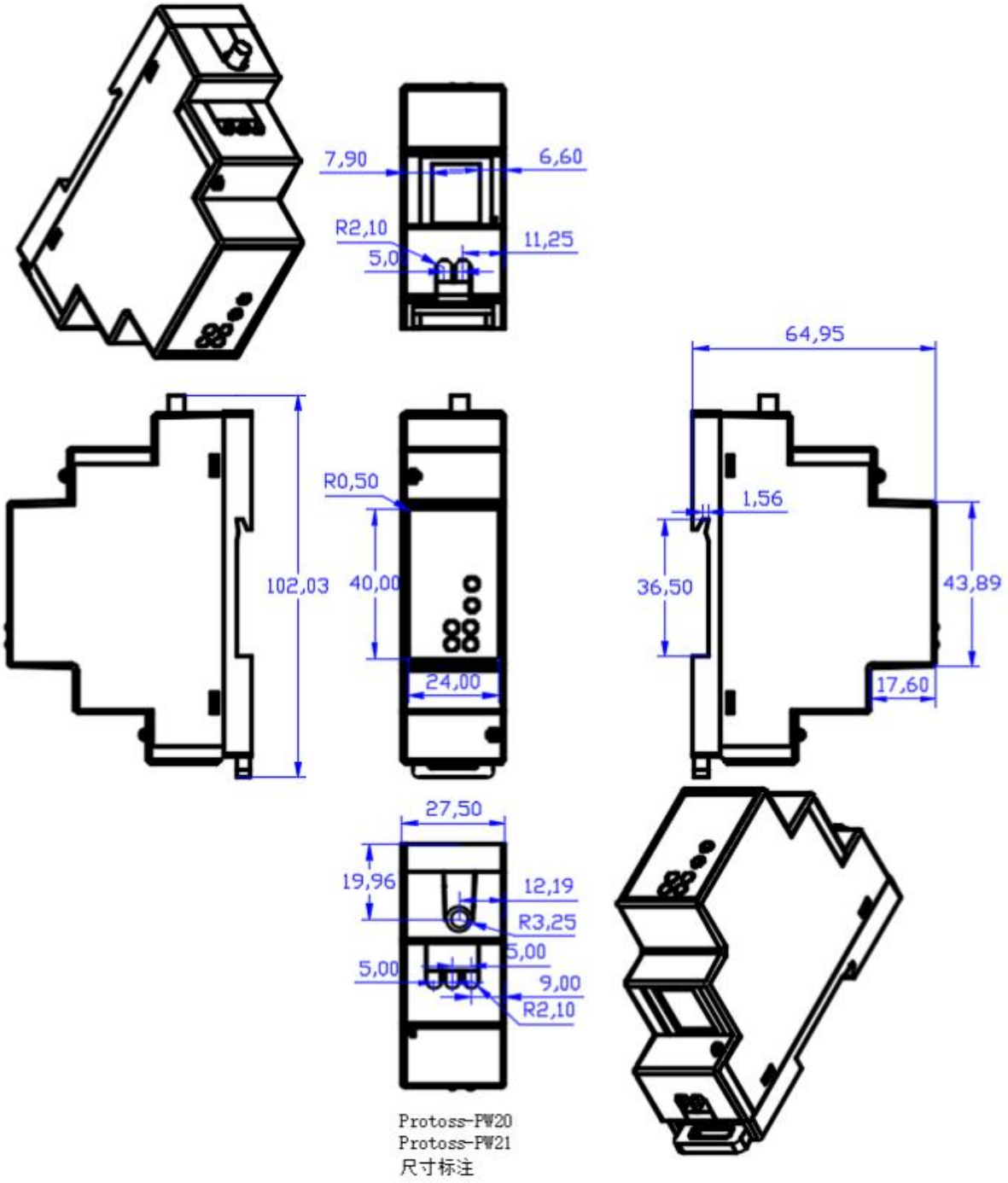
Figure 3. RJ45 Pin Defination

Table4. RJ45 Interface

Pin Number	Name	Description
1	TX+	Transfer Data+
2	TX-	Transfer Data-
3	RX+	Receive Data+
4	PHY-VCC	Transformer Tap Voltage
5	PHY-VCC	Transformer Tap Voltage
6	RX-	Receive Data-
7	N.C.	None Connect
8	N.C.	None Connect

2.4. Mechanical Size

The dimensions of Protoss-PW21 are defined as following picture (mm):



Protoss-PW20
Protoss-PW21
尺寸标注

Figure 4. Protoss-PW21 Mechanical Dimension

2.5. Product Installation

Figure 5. C45 Rail Installation

2.6. Order Information

Protoss-PW21 is defined as following:

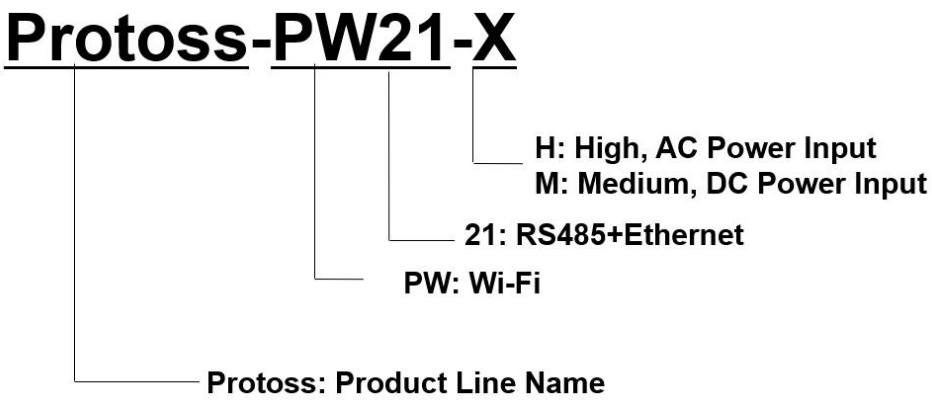


Figure 6. Protoss-PW21 Product Order Information

3. NETWORK STRUCTURE

3.1. Wireless Network

Protoss-PW21 can be set as a wireless STA and AP as well. And logically, it supports two wireless interfaces, one is used as STA and the other is AP. Other STA devices can join into the wireless network through AP interface. So the it can provide flexible networking method and network topology. Functions is as follow:

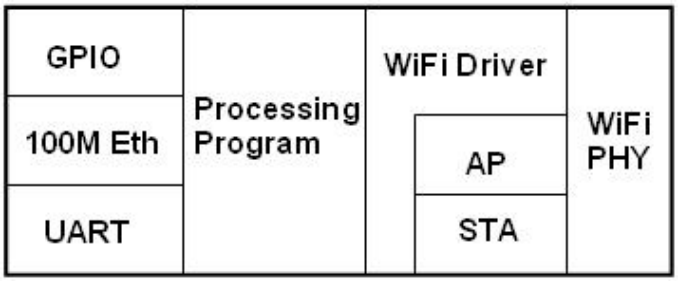


Figure 7. Protoss-PW21 Function Structure

<Introductions>

AP: Wireless access point which is the central joint. Usually, wireless router is a AP, other STA devices can connect with AP to join the network.

STA: Wireless station which is terminal of a wireless network. Such as laptop and pad etc.

3.1.1. AP Network

Protoss-PW21 can construct a wireless network as AP. All the STA devices will consider the AP as the centre of the wireless network. The mutual communication can be transponded by AP, shown as follow:

Figure 8. General AP Network

3.1.2. STA Wireless Network

Take the following picture as example. When router works in AP mode, Protoss-PW21 connects to the user’s devices by RS485 interface. In this topology, the whole wireless network can be easily stretched.

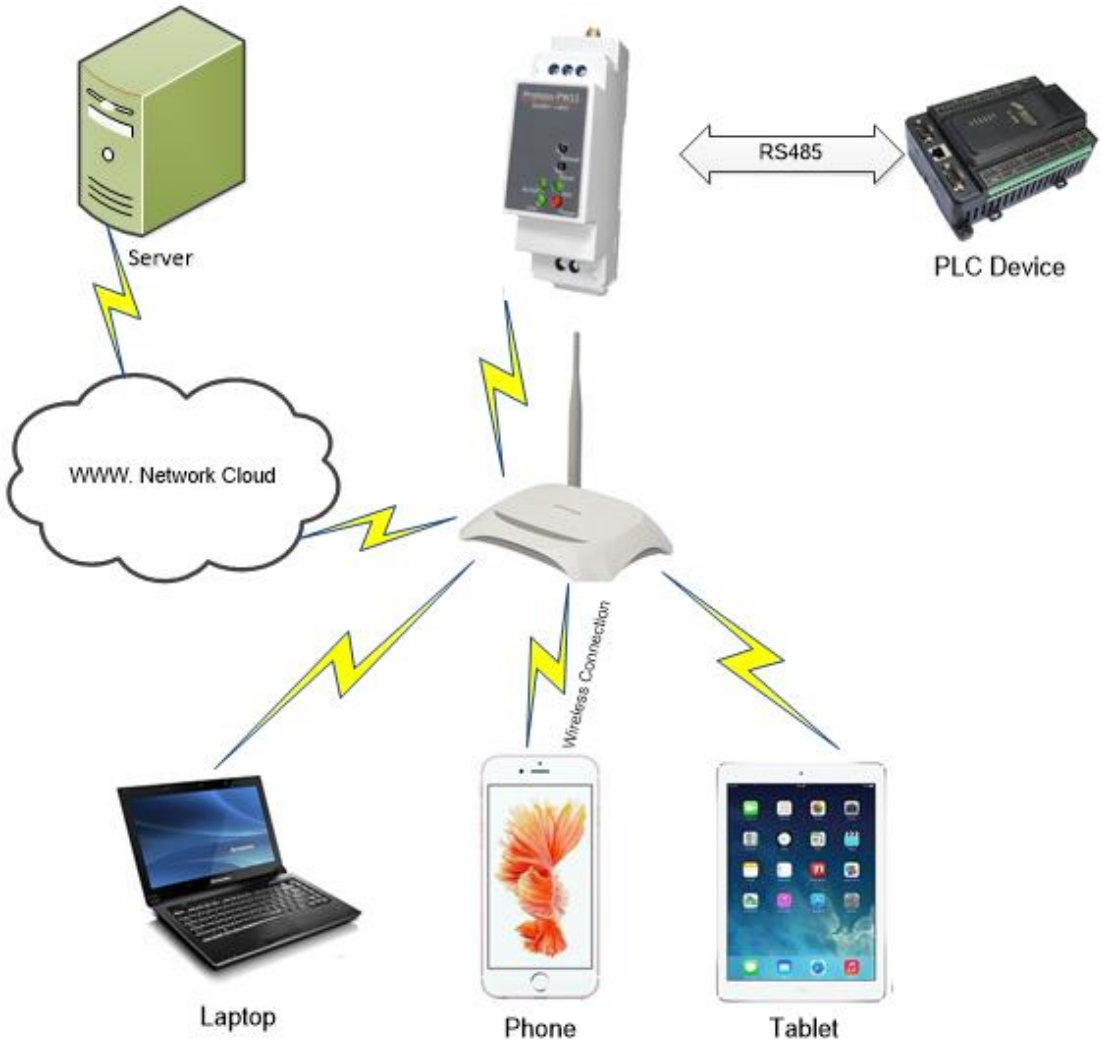


Figure 9. STA Application

3.1.3. AP+STA Wireless Network

Protoss-PW21 can support AP+STA method. It can support AP and STA interface at the same time.Shown as follow:

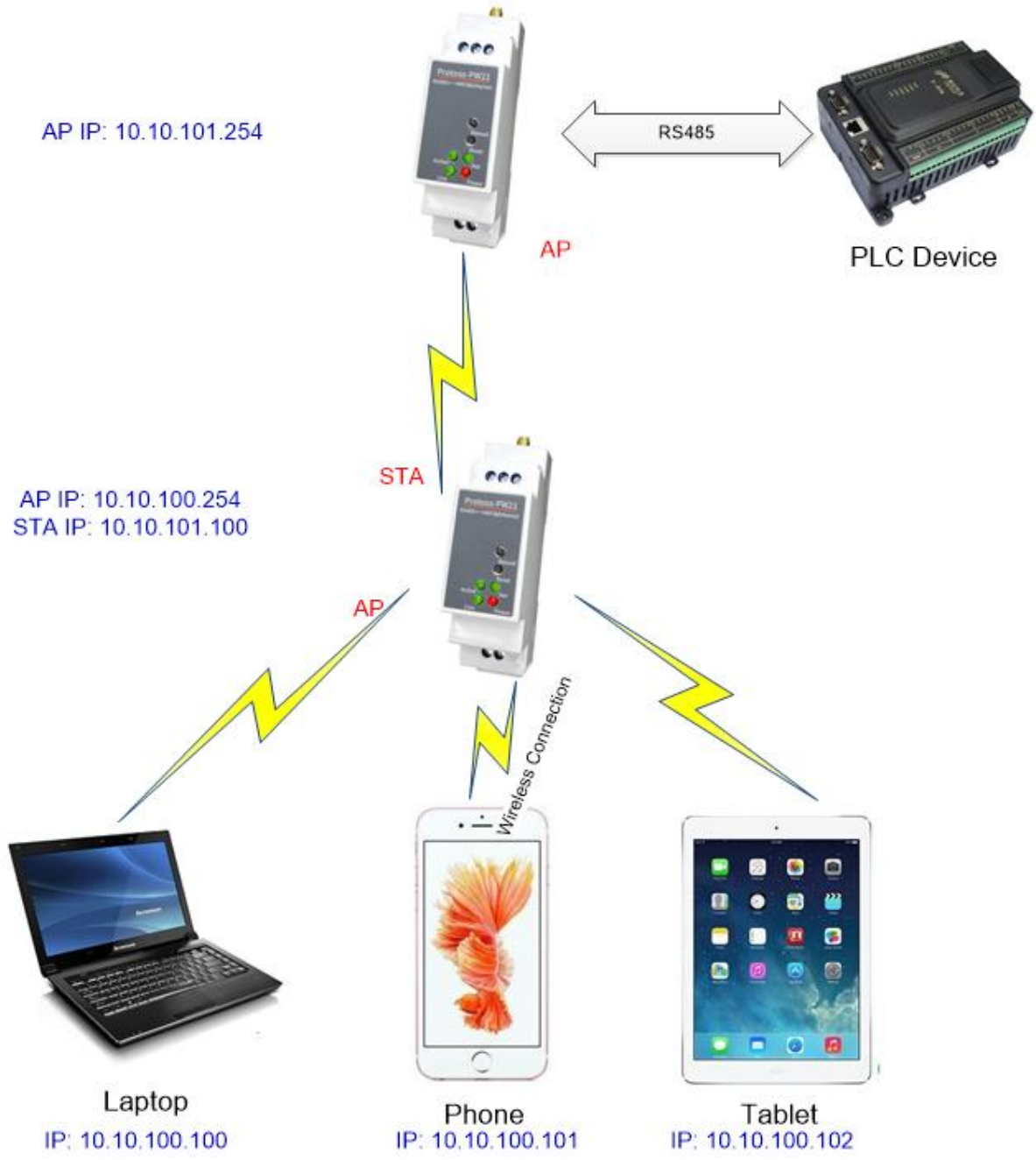


Figure 10. AP+STA Wireless Network

In this picture, Protoss-PW21 open the AP+STA function and the STA interface can be connected to the remote server by the router. Similarly, the AP interface can also be used. Phone/PAD can be connected to the AP interface and to control the serial devices or set itself.

Through AP+STA function, it is convenient to use Phone/PAD to monitor the user’s devices and not change its original settings.

Through AP+STA function, it is convenient to configure the product.And it solves the problem that the formal product can only configure by serial port.

Notes that:

When the AP+STA function is opened, the STA interface needs to connect to other router. Otherwise, STA interface will endlessly scan the router information nearby. When it is scanning, it will bring bad effects to the AP interface, like losing data etc.

AP and STA parts must set to the different sub-network for the product working as APSTA mode.

3.1.4. IOTService Software

Open the IOTService after connect to the AP hotspot generated by Protoss-PW21 or connect to Product Ethernet port to PC, then config the parameter.

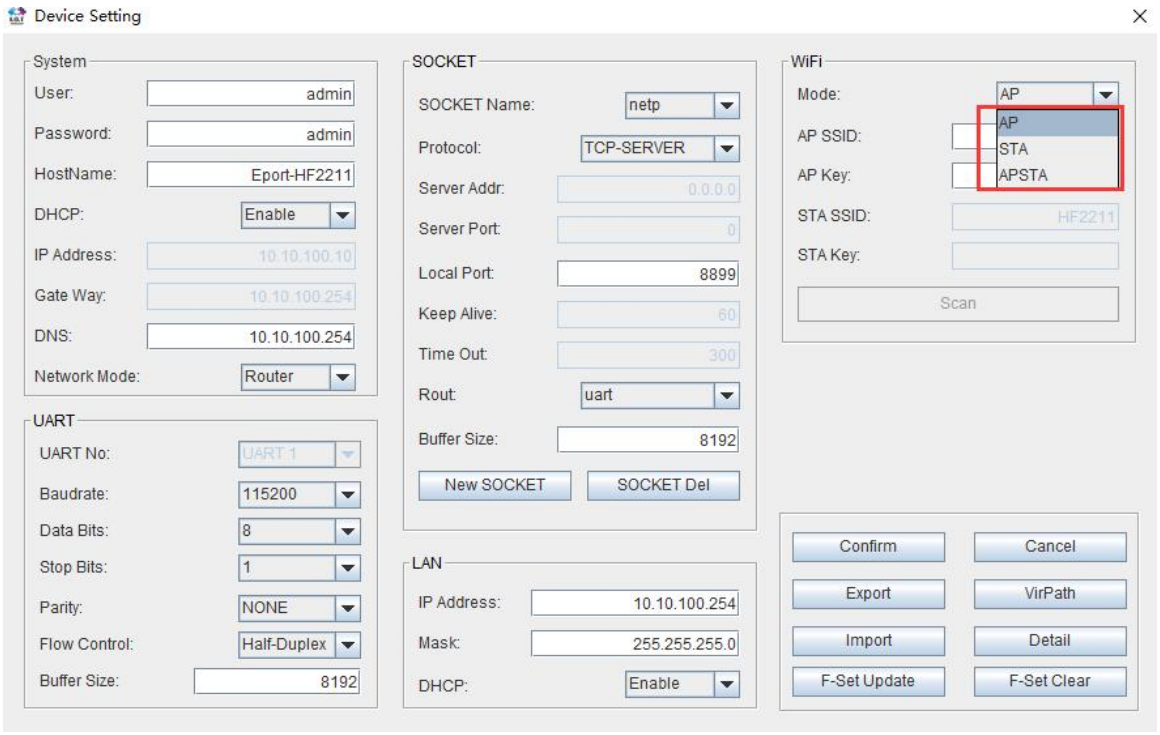


Figure 11. Configure Wi-Fi Parameter

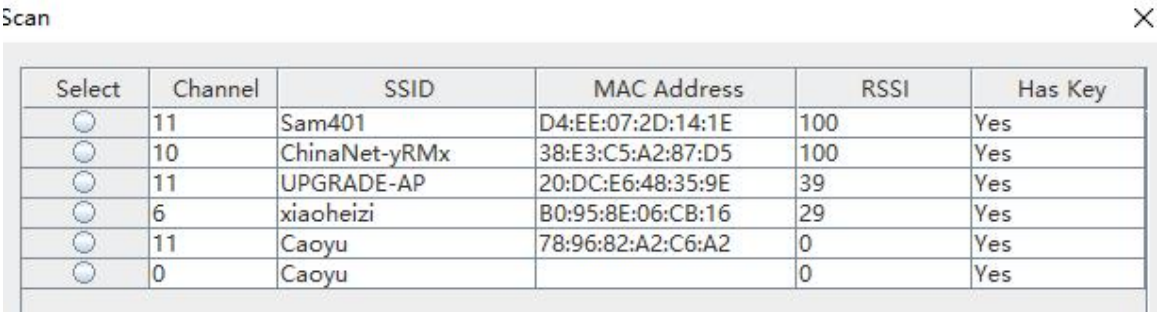


Figure 12. STA Scan Parameter

3.1.5. Webpage Configuration

Use PC to connect with Protoss-PW21 through its AP hotspot or Ethernet connection. Input the default IP(10.10.100.254, default username and password: admin/admin) to login the webpage to configure the parameter.

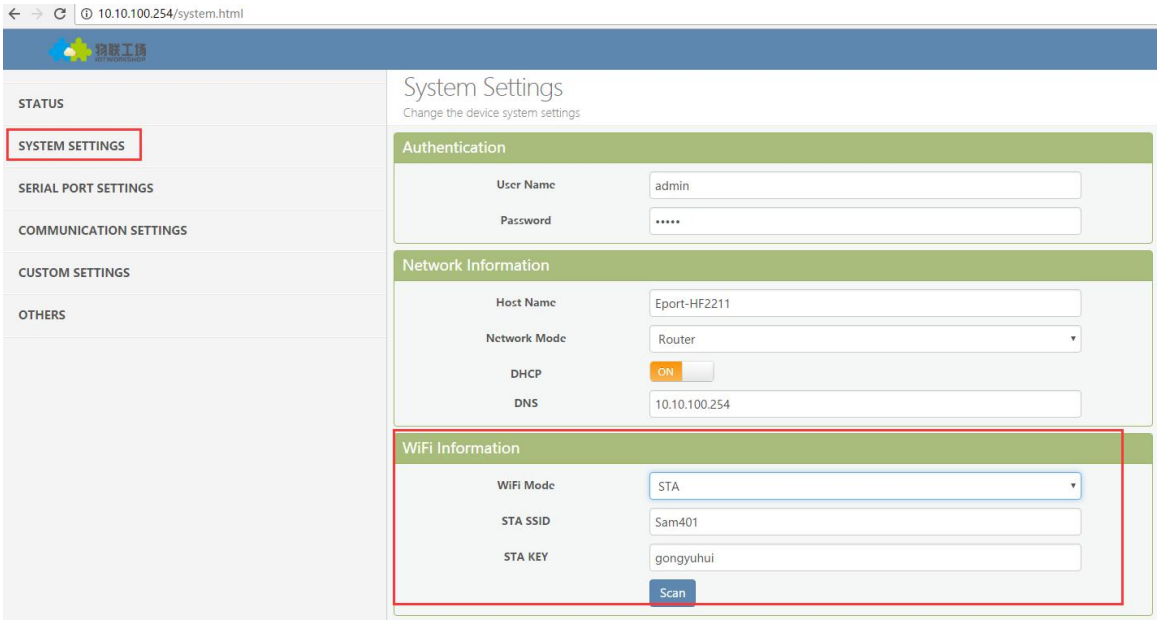
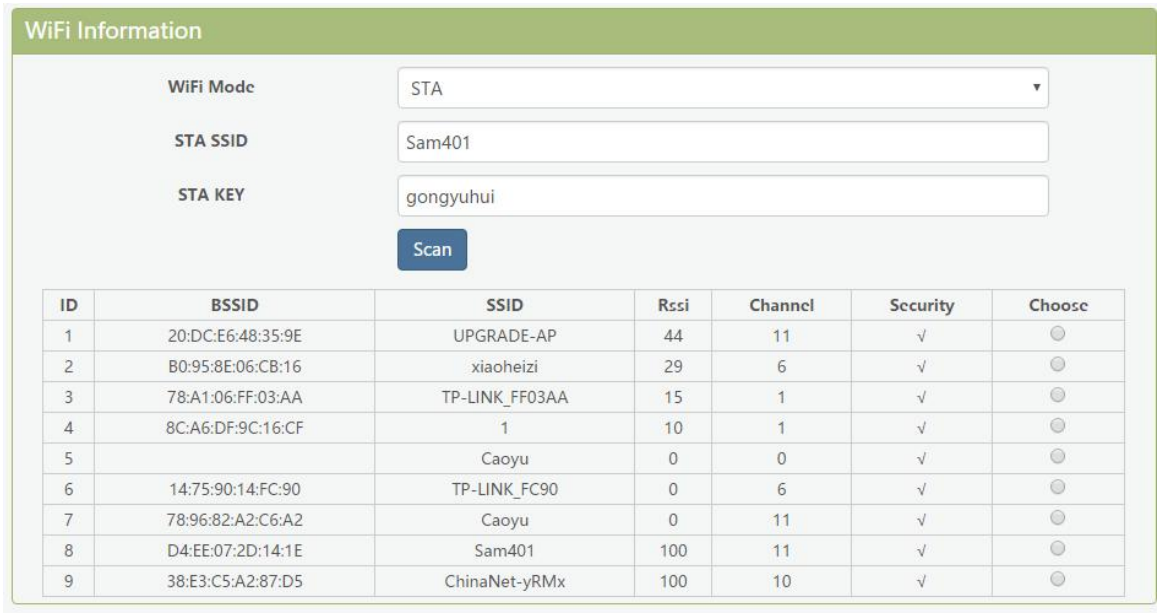


Figure 13. Configure the Wi-Fi Parameter



ID	BSSID	SSID	Rssi	Channel	Security	Choose
1	20:DC:E6:48:35:9E	UPGRADE-AP	44	11	√	
2	B0:95:8E:06:CB:16	xiaoheizi	29	6	√	
3	78:A1:06:FF:03:AA	TP-LINK_FF03AA	15	1	√	
4	8C:A6:DF:9C:16:CF	1	10	1	√	
5		Caoyu	0	0	√	
6	14:75:90:14:FC:90	TP-LINK_FC90	0	6	√	
7	78:96:82:A2:C6:A2	Caoyu	0	11	√	
8	D4:EE:07:2D:14:1E	Sam401	100	11	√	
9	38:E3:C5:A2:87:D5	ChinaNet-yRMx	100	10	√	

Figure 14. STA Scan

3.2. Ethernet Interface Function

Protoss-PW21 provides with a 100M Ethernet interface. Through the 100M Ethernet interface, user can achieve the connection among WIFI, serial port and Ethernet port. When work as AP mode, the

Ethernet works as WAN by default(can be set to LAN), connect to router LAN to get access to network. When work as STA/AP+STA, then Ethernet is LAN mode, usually for PC/PLC to connect it.

3.2.1. Ethernet Port with Wi-Fi

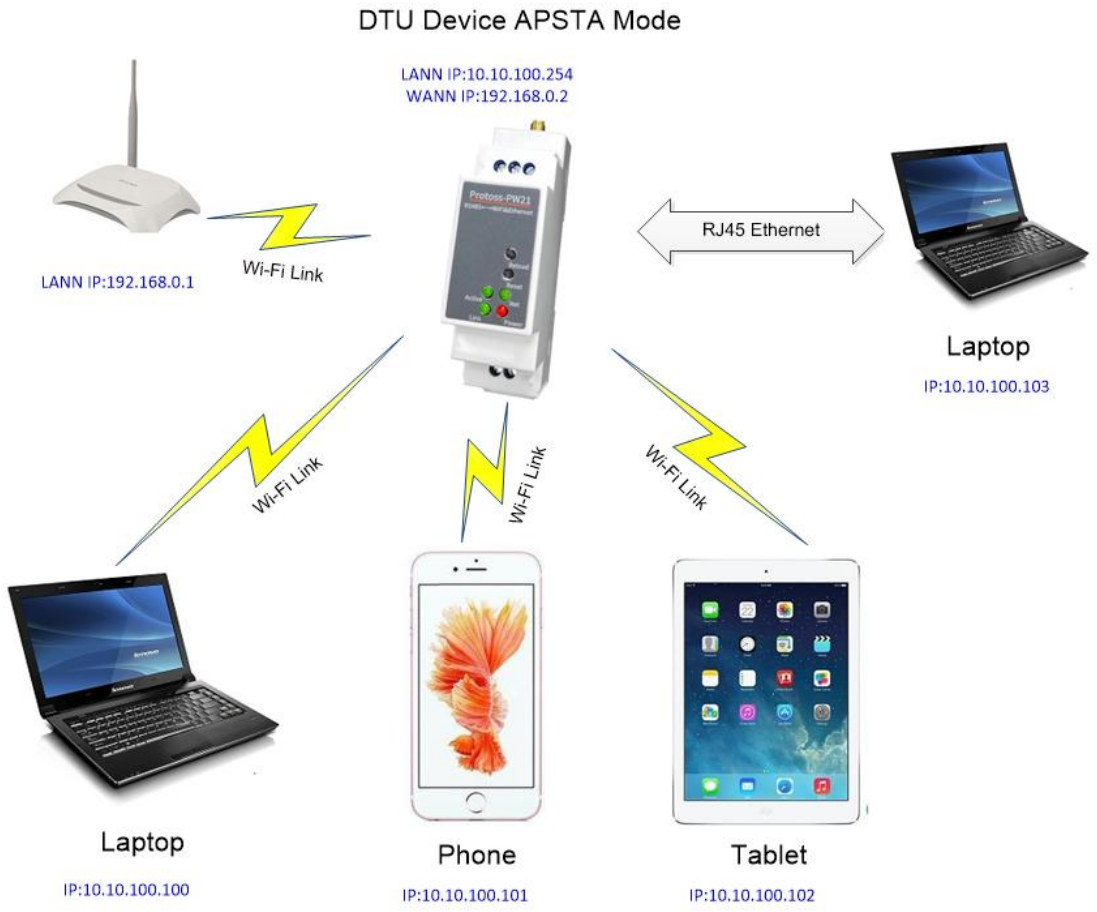
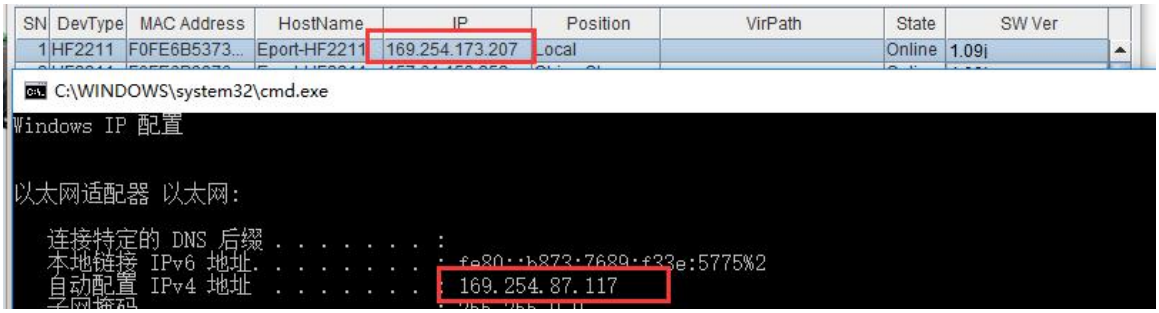


Figure 15. Ethernet Interface Function

Protoss-PW21 servers as APSTA and generate a central network. The IP addresses of all the devices and module's are in the same network segment.

Note：

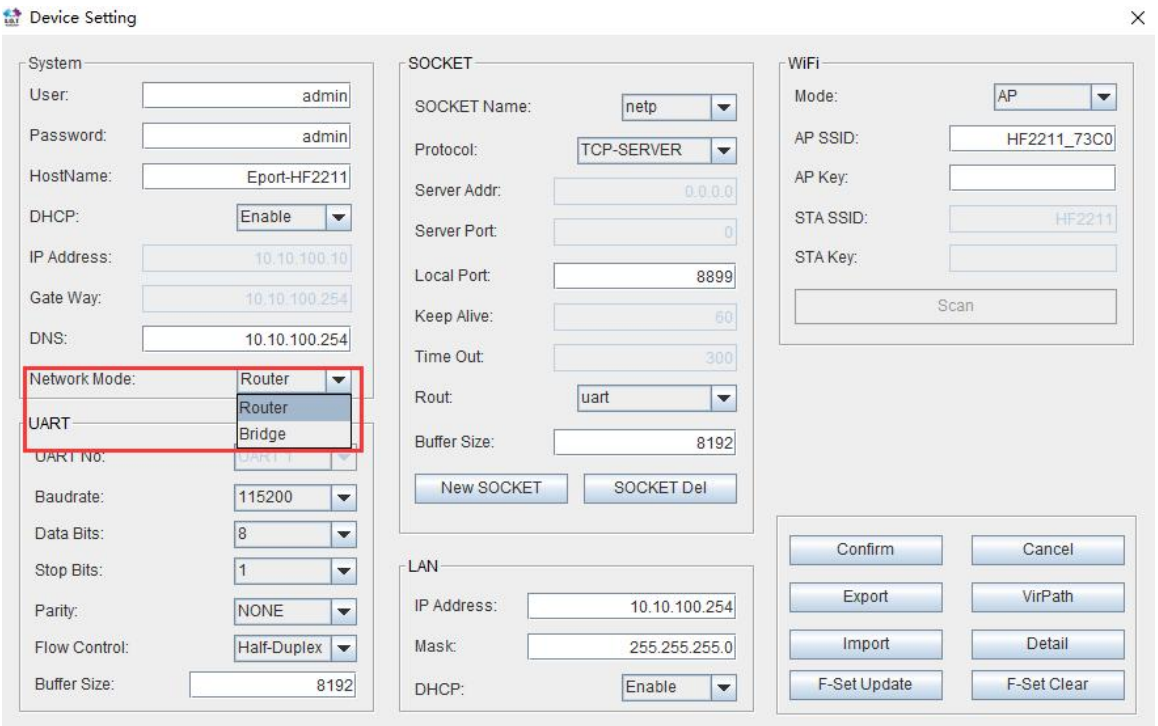
If product works in AP mode, then the Ethernet is working as WAN mode, PC will use Auto-IP to set its IP when connect via Ethernet. Better to change via Wi-Fi, then the PC and other devices are all in same subnetwork.(10.10.100.xxx)

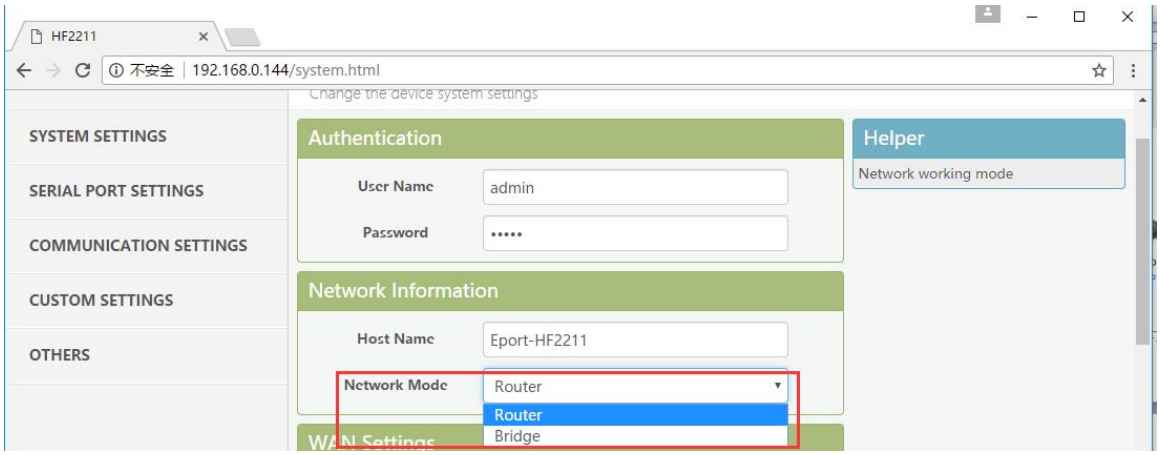


3.2.2. Ethernet Interface Function (Router Mode)

Figure 16. Ethernet Interface Function (Router Mode)

The Protoss-PW21 device Ethernet interface work in router mode. When connect to router, it will get IP address from router (as picture 192.168.1.100). The product itself generate a subnet (10.10.100.254 default). The device from the Ethernet interface is assigned with IP address by module (10.10.100.101). The device and the PC1 are in the same subnet for network communication. A connection fro PC1 to PC2, but PC2 cannot actively connect to PC1.





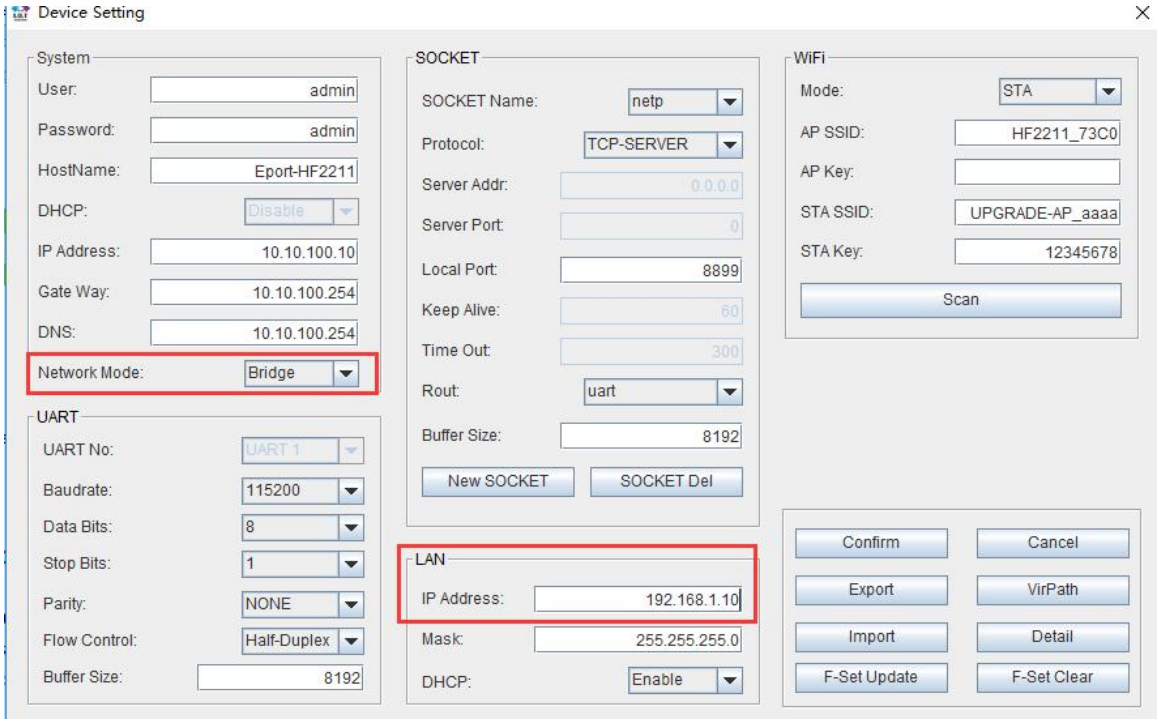
3.2.3. Ethernet Port Function (Bridge Mode)

Figure 17. Ethernet Port Function (Bridge Mode)

The Protoss-PW21 device Ethernet interface work in router mode. When connect to router, it will get IP address from router (as picture 192.168.1.101). AT the whole network, the product is like an invisible device. PC1 ad PC2 can communicated mutually without any constraint. But if product needs to connect with other devices, it needs set LAN IP address (192.168.1.10 as picture)

Notes:

Webpage, IOTService, or Cli command to set working mode, by default is router mode. **It need reboot when change its working mode.**


Device Setting
System
User: admin
Password: admin
HostName: Eport-HF2211
DHCP: Disable
IP Address: 10.10.100.10
Gate Way: 10.10.100.254
DNS: 10.10.100.254
Network Mode: Bridge
UART
UART No: UART 1
Baudrate: 115200
Data Bits: 8
Stop Bits: 1
Parity: NONE
Flow Control: Half-Duplex
Buffer Size: 8192
SOCKET
SOCKET Name: netp
Protocol: TCP-SERVER
Server Addr: 0.0.0.0
Server Port: 0
Local Port: 8899
Keep Alive: 60
Time Out: 300
Rout: uart
Buffer Size: 8192
New SOCKET
SOCKET Del
LAN
IP Address: 192.168.1.10
Mask: 255.255.255.0
DHCP: Enable
WiFi
Mode: STA
AP SSID: HF2211_73C0
AP Key:
STA SSID: UPGRADE-AP_aaaa
STA Key: 12345678
Scan
Confirm
Cancel
Export
VirPath
Import
Detail
F-Set Update
F-Set Clear

4. FUNCTION DESCRIPTION

Refer to “IOT_Device_Series_Software_Funtion” document for more detailed function.

APPENDIX A:REFERENCES

Address: Room 1002,Building 1,No.3000,Longdong Avenue,Pudong New Area,Shanghai,China,201203
Web: www.iotworkshop.com or www.hi-flying.com
Contact:
Sales: sales@iotworkshop.com
Support: support@iotworkshop.com
Service: service@iotworkshop.com
Business: business@iotworkshop.com

For more information about IOTworkshop modules, applications, and solutions, please visit our web site www.iotworkshop.com

<END OF DOCUMENT>

Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual

E96-DTU(400SL30-485)

Contents

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1 Introduction

1.1 Brief Introduction

E96-DTU (400SL30-485) is a wireless data transmission radio station that adopts military-grade LoRa modulation technology. It has a variety of transmission methods. It works in the frequency band (410.125MHz～493.125MHz) (default 433.125MHz). The radio provides a transparent RS485 interface. Adopt plastic shell, guide rail type installation structure, support AC 85～265V(110V) voltage input. LoRa spread spectrum technology will bring longer communication distance, and has the advantage of strong anti-interference ability.

As a communication medium, wireless data transmission station has a certain scope of application like optical fiber, microwave, and open wire: it provides real-time and reliable data transmission of monitoring signals in private networks under certain special conditions, with low cost, installation and maintenance Convenience, strong diffraction ability, flexible network structure, and long coverage. It is suitable for many and scattered locations and complex geographic environments. It can be connected with PLC, RTU, rain gauge, level gauge and other data terminals.

1.2 Features

- ★ The latest LoRa technology is adopted, which is farther than traditional LoRa digital radio stations and has more powerful performance;
- ★ With data encryption, the packet length can be set;
- ★ Adopt flame-retardant plastic shell and guide rail type installation structure, which is convenient and efficient to install
- ★ Hidden buttons are used to switch working modes to avoid false triggers, and the equipment is more reliable in operation;
- ★ Simple high-efficiency power supply design, support power supply configuration or line pressure mode, support AC 85～265V(110V) power supply;
- ★ The transmit power is up to30dBm, and supports multi-level adjustment, and all technical indicators meet industrial standards;
- ★ Support Modbus protocol transmission;
- ★ Support LBT function, the radio station automatically waits for transmission according to the current environmental noise intensity. Greatly improve the communication success rate of the radio station in harsh environments;
- ★ Support wireless sending of command data packets, remote configuration or reading radio station parameters;
- ★ Support communication key function, effectively prevent data from being intercepted;
- ★ Multi-level relay networking can be realized, effectively extending the communication distance, and realizing ultra-long-distance communication;
- ★ Using temperature compensation circuit, the frequency stability is better than ±1.5PPM;
- ★ Operating temperature range: -40℃ ～ +85℃, adapt to various harsh working environments, real industrial grade products;

★ Multiple protection functions such as power reverse connection protection, over-connection protection, antenna surge protection, etc., greatly increase the reliability of the radio;

★ The communication port and power interface adopt isolation and high protection;

★ Powerful software function, all parameters can be set by programming: such as power, frequency, air speed, address ID, etc.;

★ Built-in watchdog, and accurate time layout, once an abnormality occurs, the radio will automatically restart, and can continue to work according to the previous parameter settings.

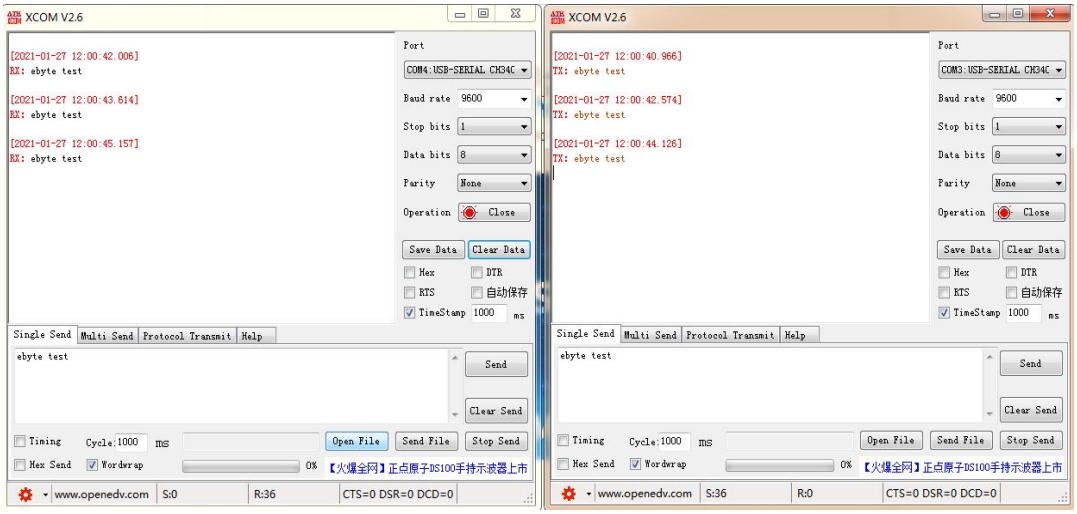
2 Quick Start

① You need to prepare two E96-DTU (400SL30-485)

② First install the antenna for the digital radio, and then install the power supply. The user selects the power adapter for power supply according to the needs.

③ Use USB to RS485 or other methods to connect the computer to the digital radio;

④ Start two serial port debugging assistants, select the serial port baud rate to be 9600bps (default), and the check method to be 8N1 to realize serial port transparent transmission;



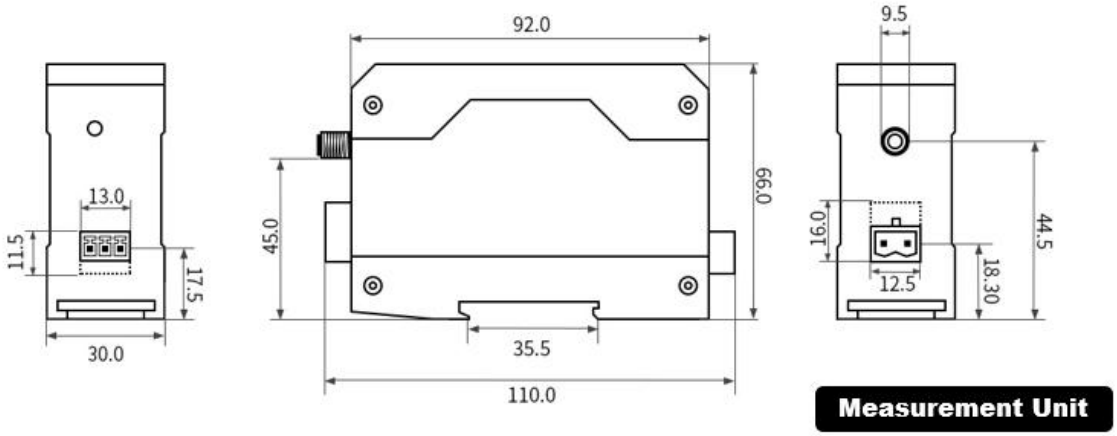
⑤ If the customer needs to switch the working mode, it can be controlled by the Mode button to switch between different working modes (M0 indicator, M1 indicator). Long press the Mode button for about 1ms and then release it to switch the mode once. The mode switching details are shown in the table below:

Serial number	Class	M1	M0	Note
mode 1	Transparent transmission mode	Lights off	Lights off	Serial port open, wireless open, transparent transmission (factory default mode), support special command air configuration.
mode 2	WOR mode	Lights off	Light on	Can be defined as WOR sender and WOR receiver, support air wakeup
mode 3	Configuration mode	Light on	Lights off	The user accesses the register through the serial port to control the working status of the radio station. The user can configure the radio station through the upper computer configuration software.

mode 4	Sleep mode	Light on	Light on	The radio goes to sleep

Note: The radio has a power-down save mode function (the factory default setting is transparent transmission mode), and the user needs to switch the corresponding mode according to the M1 and M0 indicators (effective immediately).

3 Installation Dimensions



4 Technical Index

4.1 General Specifications

Serial number	Item	Specification	Note
1	Product Size	92*66*30 mm	See installation dimensions for details
2	product weight	95 g	Weight tolerance 5g
3	Operating temperature	-40℃～+85℃	Industrial grade
4	voltage range	AC 85～265V	It is recommended to use 110V or 220V for AC
5	Communication	RS485	RS485
6	Baud rate	Factory default 9600	Baud rate range 1200～115200
7	address code	Factory default 0	A total of 65536 address codes can be set

4.2 Frequency Range and Number of Channels

Product Model	Default frequency（MHz）	Frequency Range（MHz）	Channel spacing（MHz）	Number of channels
E96-DTU(400SL22-485)	433.125M	410.125～493.125M	1M	84, Half duplex

Note: If multiple groups of digital radios are used in the same area to communicate one to one at the same time, it is recommended that each group of digital radios set a channel spacing of more than 2MHz.

4.3 Transmit Power Level

Product Model	30dBm	17dBm	13dBm	10dBm / 21dBm
E96-DTU(400SL22-485)	Factory default	√	√	√

Note: The lower the transmission power, the closer the transmission distance, but the working current will not decrease in the same proportion. It is recommended to use the maximum transmission power.

4.4 Air Speed Class

Product Model	Default air rate(bps)	Number of levels	Air speed class(kbps)
E96-DTU(400SL30-485)	Factory default	8	0.3\1.2\2.4\4.8\9.6\19.2\38.4\62.5

Note: The higher the air speed setting, the faster the transmission rate and the shorter the transmission distance; therefore, when the speed meets the requirements of use, it is recommended that the airspeed be as low as possible.

4.5 Sending and Receiving Length and Subcontracting Method

Product Model	Cache size	Subcontracting method
E96-DTU(400SL30-485)	1000 bytes	Can be set by instructions to sub-package 32/64/128/240 bytes to send

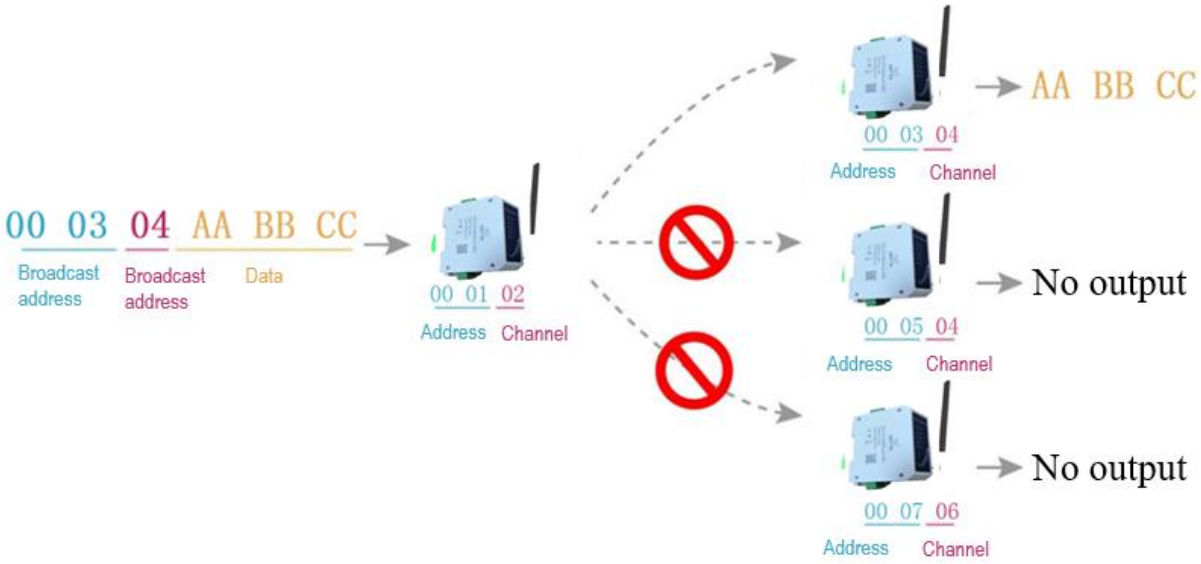
Note:

1. If the radio's single received data is greater than the single packet capacity, the excess data will be automatically allocated to the second transmission until the transmission is completed;

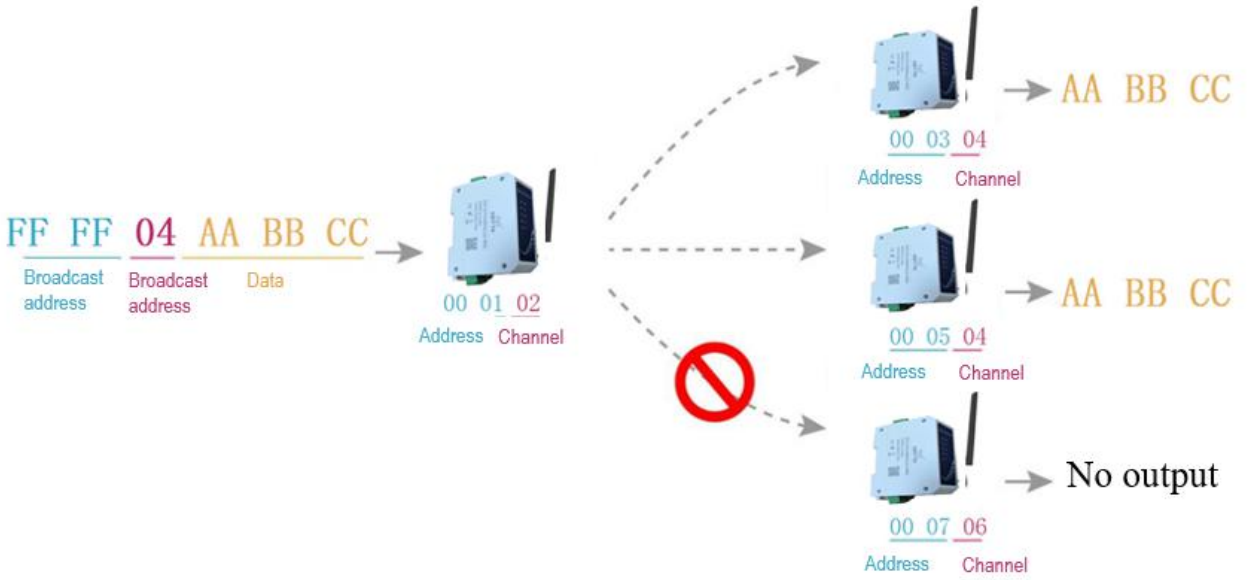
2. The single received data of the radio station cannot be larger than the buffer capacity.

5 Detailed Function

5.1 Fixed-point Transmission (Hexadecimal)



5.2 Broadcast Transmission (Hexadecimal)



5.3 Broadcast Address

- Example: Set the address of station A to 0xFFFF and the channel to 0x04.
- When station A is used as a transmitter (same mode, transparent transmission mode), all receiving stations under the 0x04 channel can receive data to achieve the purpose of broadcasting.

5.4 Listening Address

- Example: Set the address of station A to 0xFFFF and the channel to 0x04.
- When the station A is receiving, it can receive all the data under the 0x04 channel to achieve the purpose of monitoring.

6 Product selection

E95-DTU has four working modes. When there is no demanding low power consumption, it is recommended to configure the radio to transparent transmission mode (mode 0) if normal communication is required. The default setting of the radio at the factory is transparent transmission mode (mode 0).

Serial number	Category	M1	M0	Annotation
Mode 0	Transparent transmission mode	Lights off	Lights off	Serial port open, wireless open, transparent transmission (factory default mode), support

				special command air configuration.
Mode 1	WOR mode	Lights off	Light on	Can be defined as WOR sender and WOR receiver, support air wakeup
Mode 2	Configuration mode	Light on	Lights off	The user accesses the register through the serial port to control the working status of the radio station. The user can configure the radio station through the upper computer configuration software.
Mode 3	Deep sleep mode	Light on	Light on	The radio goes to sleep

Note: If there is no low power consumption requirement, there is no need to care about WOR mode (mode 1).

6.1 Transparent Transmission Mode (Mode 0)

Type	When the M0 indicator light is off and the M1 indicator light is off, the radio is working in mode 0
Emission	The user can input data through the serial port, and the radio will start wireless transmission.
Receive	The radio receiving function is turned on, and the wireless data will be output through the serial port TXD pin after receiving the wireless data.

6.2 WOR Mode (Mode 1)

Type	When the M0 indicator light is off and the M1 indicator light is off, the radio is working in mode 1
Emission	When defined as the transmitter, the wake-up code for a certain period of time will be automatically added before transmission
Receive	Data can be received normally, the receiving function is equivalent to mode 0

6.3 Configuration Mode (Mode 2)

Type	When the M0 indicator light is off and the M1 indicator light is on, the radio is working in mode 2
Emission	Can be configured wirelessly
Receive	Can be configured wirelessly
Configuration	The user can access the register to configure the working status of the radio

6.4 Deep Sleep Mode (Mode 3)

Type	When the M0 indicator light is on and the M1 indicator light is on, the radio is working in mode 3
Emission	Unable to transmit wireless data.
Receive	Cannot receive wireless data.

7 Register Read and Write Control

7.1 Instruction Format

In configuration mode (mode 2: M1 indicator light is on, M0 indicator light is off), the supported command list is as follows (when setting, only 9600, 8N1 format is supported):

Serial number	Instruction format	Detailed description
1	Set register	Command: C0+start address+length+parameter Response: C1+start address+length+parameter Example 1: Configure the channel as 0x09 Instruction start address length parameter Send: C0 05 01 09 Returns: C1 05 01 09 Example 2: Configure the radio address (0x1234), network address (0x00), serial port (9600 8N1), airspeed (1.2K) at the same time Send: C0 00 04 12 34 00 61 Return: C1 00 04 12 34 00 61
2	Read register	Command: C1+start address+length Response: C1+start address+length+parameter Example 1: Read the channel Instruction start address length parameter Send: C1 05 01 Returns: C1 05 01 09 Example 2: Read the radio address, network address, serial port, airspeed at the same time Send: C1 00 04 Return: C1 00 04 12 34 00 61

3	Set up temporary registers	Command: C2 + start address + length + parameters Response: C1 + start address + length + parameters Example 1: Configure the channel as 0x09 Instruction start address length parameter Send: C2 05 01 09 Returns: C1 05 01 09 Example 2: Configure the radio address (0x1234), network address (0x00), serial port (9600 8N1), airspeed (1.2K) at the same time Send: C2 00 04 12 34 00 61 Return: C1 00 04 12 34 00 61
5	Wireless configuration	Instructions: CF CF + regular instructions Response: CF CF + regular response Example 1: The wireless configuration channel is 0x09 Wireless command header command start address length parameter Send: CF CF C0 05 01 09 Returns: CF CF C1 05 01 09 Example 2: Wirelessly configure the radio address (0x1234), network address (0x00), serial port (9600 8N1), airspeed (1.2K) at the same time Send: CF CF C0 00 04 12 34 00 61 Return: CF CF C1 00 04 12 34 00 61
6	wrong format	Malformed response FF FF FF

7.2 Register Description

Serial number	Read and write	name	description	Remarks
00H	Read/ Write	ADDH	ADDH(Default 0)	High byte and low byte of radio address; Note: When the radio station address is equal to FFFF, it can be used as the broadcast and monitor address, that is: the radio station will not perform address filtering at this time
01H	Read/ Write	ADDL	ADDL(Default 0)	
02H	Read/ Write	NETID	NETID(Default 0)	Network address, used to distinguish networks; When communicating with each other, they should be set to the same.

<table>
<tr><td rowspan="15">03H</td><td rowspan="15">Read/ Write</td><td rowspan="15">REG0</td><td>7</td><td>6</td><td>5</td><td>UART Serial port rate (bps)</td><td rowspan="10">For two radios that communicate with each other, the serial port baud rate can be different, and the verification method can also be different;

When continuously transmitting large data packets, users need to consider the data congestion caused by the same baud rate, and may even be lost;

It is generally recommended that the baud rate of the two communication parties be the same.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Serial port baud rate1200</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Serial port baud rate2400</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Serial port baud rate4800</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Serial port baud rate9600 (Default)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Serial port baud rate19200</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Serial port baud rate38400</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Serial port baud rate57600</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Serial port baud rate115200</td></tr>
<tr><td>4</td><td>3</td><td colspan="2">Serial port check digit</td><td rowspan="5">The serial port mode of the two communication parties can be different;</td></tr>
<tr><td>0</td><td>0</td><td colspan="2">8N1(Default)</td></tr>
<tr><td>0</td><td>1</td><td colspan="2">8O1</td></tr>
<tr><td>1</td><td>0</td><td colspan="2">8E1</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">8N1 (equivalent to 00)</td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>Wireless air rate (bps)</td><td rowspan="10">The air rate of both parties must be the same

The higher the air rate, the smaller the delay and the shorter the transmission distance.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Air speed0.3k</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Air speed1.2k</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Air speed2.4k(Default)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Air speed4.8k</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Air speed9.6k</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Air speed19.2k</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Air speed38.4k</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Air speed62.5k</td></tr>
<tr><td rowspan="15">04H</td><td rowspan="15">Read/ Write</td><td rowspan="15">REG1</td><td>7</td><td>6</td><td colspan="2">Subcontracting settings</td><td rowspan="5">The data sent by the user is less than the sub-packet length, and the serial port output of the receiving end appears as an uninterrupted continuous output;

If the data sent by the user is larger than the packet length, the serial port of the receiving end will output in packets.</td></tr>
<tr><td>0</td><td>0</td><td colspan="2">240byte(Default)</td></tr>
<tr><td>0</td><td>1</td><td colspan="2">128byte</td></tr>
<tr><td>1</td><td>0</td><td colspan="2">64byte</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">32byte</td></tr>
<tr><td>5</td><td colspan="3">RSSI Environmental noise enable</td><td rowspan="3">After enabling, you can send commands C0 C1 C2 C3 in transmission mode or WOR sending mode to read registers;
Register 0x00: Current environmental noise RSSI;
Register 0X01: RSSI when receiving data last time
(The current channel noise is: dBm =-RSSI/2);
Instruction format: C0 C1 C2 C3 + start address + read length;
Return: C1 + address address + read length + read valid value; for example:</td></tr>
<tr><td>0</td><td colspan="3">Disabled (default)</td></tr>
<tr><td>1</td><td colspan="3">Enable</td></tr>
</table>

							send C0 C1 C2 C3 00 01 Return C1 00 01 RSSI
			4	3	2	Keep	
			1	0	Transmit power		The relationship between power and current is non-linear. At the maximum power, the power supply has the highest efficiency; the current will not decrease in the same proportion as the power decreases.
			0	0	30dBm(default)		
			0	1	17dBm		
			1	0	13dBm		
			1	1	10dBm / 21dBm		
05H	Read/ Write	REG2	Channel Control (CH) 0-83 respectively represent a total of 84 channels				Actual frequency = 410.125 + CH *1M
06H	Read/ Write	REG3	7	zEnable RSSI byte			After being enabled, the radio receives wireless data and outputs it through the serial port TXD, followed by an RSSI strength byte.
			0	Disabled (default)			
			1	Enable			
			6	transfer method			During fixed-point transmission, the radio will recognize the three bytes of serial data as: address high + address low + channel, and use it as a wireless transmission target.
			0	Transparent transmission (default)			
			1	Fixed-point transmission			
			5	Relay function			After the relay function is enabled, if the target address is not the radio station itself, the radio station will start a forwarding; In order to prevent data return, it is recommended to use it in conjunction with the fixed-point mode; that is, the destination address and the source address are different.
			0	Disable relay function (default)			
			1	Enable relay function			
			4	LBT enable			After enabling, the wireless data will be monitored before transmission, which can avoid interference to a certain extent, but it may cause data delay; The maximum stay time of LBT is 2 seconds, and it will be issued forcibly when it reaches 2 seconds.
			0	Disabled (default)			
			1	Enable			
			3	WOR mode transceiver control			Only valid for mode 1; After the WOR receiver receives the wireless data and outputs it through the serial port, it will wait 1000ms before entering the WOR again. During this period, the user can input the serial data and return it wirelessly; Each serial port byte will be refreshed for 1000ms; The user must initiate the first byte within 1000ms.
			0	WOR receiver (default) The radio transceiver is turned on, and when transmitting data, a wake-up code for a certain period of time is added.			
			1	WOR transmitter The radio cannot transmit data and works in WOR monitoring mode. The monitoring period is shown below (WOR period), which can save a lot of power consumption.			
			2	1	0	WOR cycle	Only valid for mode 1;

			0	0	0	500ms	Cycle T= (1+WOR)*500ms, the maximum is 4000ms, the minimum is 500ms; The longer the WOR monitoring interval period, the lower the average power consumption, but the greater the data delay; Both sender and receiver must agree (very important)
			0	0	1	1000ms	
			0	1	0	1500ms	
			0	1	1	2000ms	
			1	0	0	2500ms	
			1	0	1	3000ms	
			1	1	0	3500ms	
			1	1	1	4000ms	
07H	Write	CRYPT_H	High byte of key (default 0)				Only write, read returns 0; Used for encryption to avoid interception of wireless data in the air by similar radio stations; The radio station will use these two bytes as a calculation factor to transform and encrypt the wireless signal in the air.
08H	Write	CRYPT_L	Low byte of key (default 0)				
80H～86H	Read	PID	Product information 7 bytes				Product information 7 bytes

7.3 Factory Default Parameters

Product model	Factory default parameter value:C0 00 00 62 00 00						
Radio model	Frequency	Address	Channel	Air rate	Baud rate	Serial format	Transmit power
E96-DTU(400SL22-485)	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	30dBm (small power)

8 Relay Networking Mode Use

Serial number	Relay mode description
1	After setting the relay mode through the configuration mode, switch to the normal mode, and the relay starts to work.
2	In the relay mode, ADDH and ADDL are no longer used as the radio address, but correspond to the NETID forwarding pairing respectively. If one of the networks is received, it will be forwarded to the other network. The network ID of the repeater itself is invalid.
3	In the relay mode, the relay station cannot send and receive data, and cannot perform low-power operation.
4	When the user enters other modes from Mode 3 (sleep mode) or is in the reset process, the radio will reset the user parameters, during which AUX outputs low level.

Description of relay networking rules:

1. Forwarding rules, the relay can forward data in both directions between two NETIDs.
2. In the relay mode, ADDH\ADDL is no longer used as a radio address, but as a NETID forwarding pairing.

As shown in the figure:

①First level relay

"Node 1" NETID is 08.

"Node 2" NETID is 33.

The ADDH\ADDL of relay 1 are 08 and 33 respectively.

So the signal sent by node 1 (08) can be forwarded to node 2 (33)

At the same time, node 1 and node 2 have the same address, so the data sent by node 1 can be received by node 2.

②Secondary relay

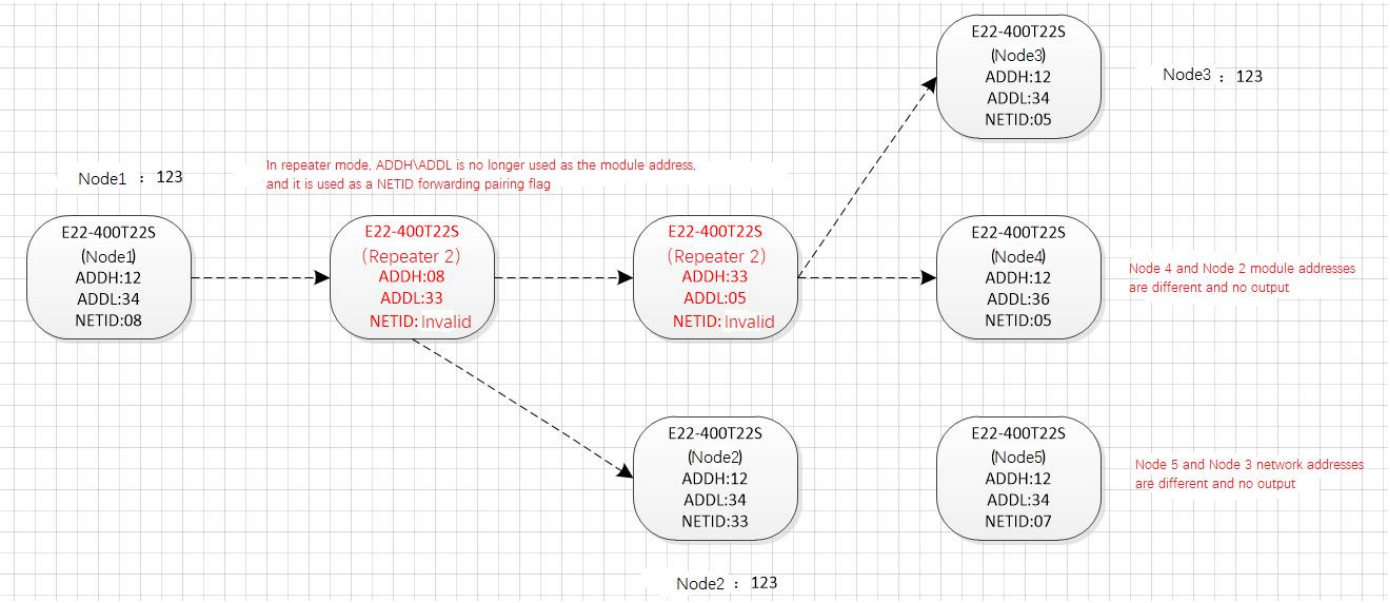
The ADDH\ADDL of relay 2 are 33 and 05 respectively.

So relay 2 can forward the data of relay 1 to the network NETID: 05.

Therefore, node 3 and node 4 can receive node 1 data. Node 4 normally outputs data, and node 3 has a different address from node 1, so no data is output.

③Two-way relay

As shown in the configuration: the data sent by node 1 can be received by nodes 2 and 4, and the data sent by nodes 2 and 4 can also be received by node



9 Relay Networking Mode Use

- The following figure shows the display interface of the E96-DTU (400SL30-485) configuration host computer. The user can switch to the configuration mode through the MODE button, and quickly configure and read the parameters on the host computer.

- In the configuration of the host computer, the radio address, frequency channel, network ID, and key are all displayed in decimal mode. The range of each parameter is:
  Network address: 0～65535
  Frequency channel: 0～83
  Network ID: 0～255
  Key: 0～65535
- When using the host computer to configure the relay mode, the user needs to pay special attention. Since the parameters in the host computer are in decimal display mode, the radio address and network ID need to be converted when filling in the radio station address and network ID. If the network ID input by the transmitting terminal A is 02 and the network ID input by the receiving terminal B is 10, when the relay terminal R sets the radio address, the hexadecimal value 0X020A is converted to the decimal value 522 as the relay terminal R. Radio address. That is, the radio address value that needs to be filled in by the relay terminal R at this time is 522.

10 Program the Radio

Operating mode	M1	M0	注释
Configuration mode	The indicator light is on	The indicator light is off	Only use the configuration software to program the radio in the current mode

1. Programming can only be carried out in a specific working mode (see the above table). If the programming fails, please confirm whether the working mode of the radio is correct.
2. If you don't need complicated programming to open the E96-DTU (400SL30-485) configuration software, you can modify the relevant parameters.

11 Related Products

Product Number	Interface Type	Working Frequency MHz	Transmit Power dBm	Communication Distance km	Features
E95-DTU(400SL22-485)	RS485	410.125 ～ 493.125	22	5	A new generation of LoRa, rail type, RS485, E90-DTU SL series intercommunication, DC power supply
E95-DTU(400SL22-232)	RS232	410.125 ～ 493.125	22	5	A new generation of LoRa, rail type, RS232, E90-DTU SL series intercommunication, DC power supply
E95-DTU(400SL30-485)	RS485	410.125 ～ 493.125	30	10	A new generation of LoRa, rail type, RS485, E90-DTU SL series intercommunication, DC power supply
E95-DTU(400SL30-232)	RS232	410.125 ～ 493.125	30	10	A new generation of LoRa, rail type, RS232, E90-DTU SL series intercommunication, DC power supply
E95-DTU(400SL22P-485)	RS485	410.125 ～ 493.125	22	5	A new generation of LoRa, rail type, RS485, E90-DTU SL series intercommunication, high protection, DC power supply
E95-DTU(400SL22P-232)	RS232	410.125 ～ 493.125	22	5	A new generation of LoRa, rail type, RS232, E90-DTU L series intercommunication, high protection, DC power supply
E95-DTU(400SL30P-485)	RS485	410.125 ～ 493.125	30	10	A new generation of LoRa, rail type, RS485, E90-DTU SL series intercommunication, high protection, DC power supply
E95-DTU(400SL30P-232)	RS232	410.125 ～ 493.125	30	10	A new generation of LoRa, rail type, RS232, E90-DTU SL series intercommunication, high protection, DC power supply
E96-DTU(400SL22-485)	RS485	410.125 ～ 493.125	22	5	A new generation of LoRa, rail type, RS485, E90-DTU SL series intercommunication, AC power supply
E96-DTU(400SL22-485)	RS232	410.125 ～ 493.125	22	5	A new generation of LoRa, rail type, RS232, E90-DTU SL series intercommunication, AC power supply
E96-DTU(400SL30-485)	RS485	410.125 ～ 493.125	30	10	A new generation of LoRa, rail type, RS485, E90-DTU SL series

					intercommunication, AC power supply
E96-DTU(400SL30-232)	RS232	410.125 ～ 493.125	30	10	A new generation of LoRa, rail type, RS232, E90-DTU SL series intercommunication, AC power supply

12 Precautions for Use

1. Do not operate this radio in the vicinity of some flammable places (such as coal mines) or explosive dangerous objects (such as detonators for detonation).
2. A suitable DC stabilized power supply should be selected, which requires strong anti-high frequency interference, low ripple, and sufficient load capacity; preferably, it should also have over-current, over-voltage protection and lightning protection functions to ensure data transmission The radio is working normally.
3. Do not use it in a working environment that exceeds the environmental characteristics of the digital radio, such as high temperature, humidity, low temperature, strong electromagnetic field or dusty environment.
4. Don't let the digital radio station continuously be in full load transmitting state, otherwise the transmitter may be burnt out.
5. The ground wire of the digital transmission radio station should be well connected with the ground wire of the external equipment (such as PC, PLC, etc.) and the ground wire of the power supply, otherwise the communication interface may be burnt out; do not plug or unplug the serial port with power on.
6. When testing the digital radio station, you must connect a matching antenna or a 50Ω dummy load, otherwise the transmitter will be easily damaged; if the antenna is connected, the distance between the human body and the antenna should be more than 2 meters to avoid injury. Do not touch the antenna while transmitting.
7. Wireless data transmission stations often have different communication distances in different environments. The communication distance is often affected by temperature, humidity, obstacle density, obstacle volume, and electromagnetic environment; in order to ensure stable communication, it is recommended to reserve 50 % Or more of the communication distance margin.
8. If the measured communication distance is not ideal, it is recommended to analyze and improve the communication distance from the antenna quality and antenna installation method. You can also contact support@cdebyte.com for help.
9. When selecting the power supply, in addition to retaining 50% of the current margin as recommended, it should also be noted that its ripple should not exceed 100mV.

13 Important Statement

1. Ebyte reserves the right of final interpretation and modification of all contents in this manual.
2. Due to the continuous improvement of the hardware and software of the product, this manual may be changed without prior notice. The latest version of the manual shall prevail.

Revision history

Version	Date	Description	Issued by
1.0	2020-10-23	Initial version	Li
1.1	2021-02-04	Integrated SL series	ken

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Chengdu Ebyte Electronic Technology Co.,Ltd.

1-CH pulse or 2-CH DI high speed counter, Modbus RTU module WJ150

Features：

>> Encoder decoding and converting into standard Modbus RTU protocol
>> Can be used as encoder counter or speed measurement
>> Support encoder counting, can identify forward and reverse
>> It can also be set as 2 independent DI high-speed counters
>> The count value supports automatic saving after power failure
>> DI input supports PNP and NPN input
>> Filter time can be set for relay and mechanical switch input
>> The count value can be cleared and set through the RS-485 interface
>> Wide power supply range: 8 ~ 32VDC
>> High reliability, convenient programming and easy application
>> Standard DIN35 rail installation, convenient for centralized wiring
>> User can programmatically set module address, baud rate, etc.

Figure 1 WJ150

Application:

>> Encoder pulse signal measurement
>> Flow meter pulse counting or flow measurement
>> Line product count
>> Counting the number of logistics packages
>> Proximity switch pulse signal measurement
>> The encoder signal is transmitted to the industrial computer
>> Water meter or electricity meter pulse count
>> Smart Factory and Industrial Internet of Things

Product Overview:

The WJ150 product realizes the signal acquisition between the sensor and the host, and is used to decode the encoder signal. WJ150 series products can be used in RS-485 bus industrial automation control systems, automated machine tools, industrial robots, three-coordinate positioning systems, displacement measurement, stroke measurement, angle measurement, rotational speed measurement, flow measurement, product counting, etc.

Products include signal acquisition, pulse signal capture, signal conversion and RS-485 serial communication. Each serial port can connect up to 255 WJ150 series modules. The communication method adopts ASCII code communication protocol or MODBUS RTU communication protocol. The baud rate can be set by code. It can be hung on the same RS-485 bus with other manufacturers' control modules, which is convenient for computer programming.

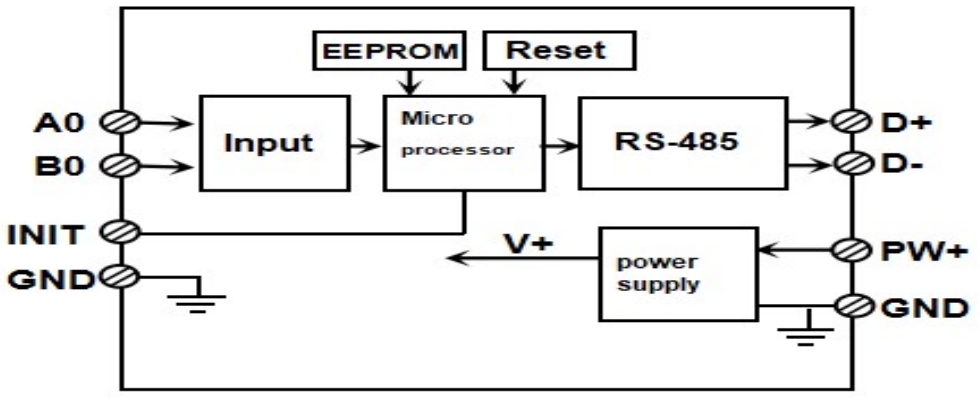


Figure 2: WJ150 Block Diagram

WJ150 series products are intelligent monitoring and control systems based on single-chip microcomputers. All configuration information such as address, baud rate, data format, checksum status, etc. set by the user are stored in the non-volatile memory EEPROM.

WJ150 series products are designed and manufactured according to industrial standards, with no isolation between signal input/output, strong anti-interference ability and high reliability. Operating temperature range -45℃～+85℃.

Function introduction:

WJ150 remote I/O module can be used to measure 1-channel encoder signal, and can also be set as 2-channel independent counter or DI state measurement.

1. Signal input

1-channel encoder signal input or 2-channel independent counter, which can be connected to dry contact and wet contact, and the input type can be set by command.

2. Communication protocol

Communication interface: 1 standard RS-485 communication interface.

Communication protocol: supports two protocols, the character protocol defined by the command set and the MODBUS RTU communication protocol. The module automatically recognizes the communication protocol, and can realize network communication with PLC, RTU or computer monitoring systems of various brands.

Data format: 10 bits. 1 start bit, 8 data bits, 1 stop bit. No verification.

The communication address (0～255) and baud rate (2400, 4800, 9600, 19200, 38400, 57600, 115200bps) can be set; the longest distance of the communication network can be up to 1200 meters, which is connected by twisted pair shielded cable.

The communication interface is designed with high anti-interference, ±15KV ESD protection, and the communication response time is less than 100mS.

3. Anti-interference

Checksums can be set as required. There are transient suppression diodes inside the module, which can effectively suppress various surge pulses, protect the module, and internal digital filtering, and can also well suppress power frequency interference from the power grid.

Product Selection:

WJ150 - □

Communication Interface

485： output is RS-485 interface

part No.: WJ150 -485 means output is RS-485 interface

WJ150 general parameters:

(typical @ +25℃, Vs is 24VDC)

Input type: Encoder AB signal input, 1 channel (A0/B0).

Low level: input <1V

High level: input 3.5 ~ 30V

The frequency range is 0-50KHz

Encoder counting range -2147483647 ~ +2147483647

DI counter range 0 ~ 4294967295

Input resistance: 30KΩ

Communication: Protocol RS-485 standard character protocol and MODBUS RTU communication protocol

Baud rate (2400, 4800, 9600, 19200, 38400, 57600, 115200bps) can be selected by software

Address (0～255) can be selected by software

Communication response time: 100 ms max

Working power supply: +8 ~ 32VDC wide power supply range, internal anti-reverse connection and overvoltage protection circuit

Power consumption: less than 1W

Working temperature: -45 ~ +80℃

Working humidity: 10 ~ 90% (non-condensing)

Storage temperature: -45 ~ +80℃

Storage humidity: 10 ~ 95% (no condensation)

Dimensions: 106 mm x 59mm x 24mm

Footprint Function:

PIN	Name	Function	PIN	Name	Function
1	PW+	Power supply +	14	INIT	initial state settings
2	GND	Power supply −	15	GND	digital signal output ground
3	DATA+	RS-485 signal +	16	A0	Encoder 0 signal A input
4	DATA-	RS-485 signal -	17	B0	Encoder 0 signal B input

Table 1 Pin Definition

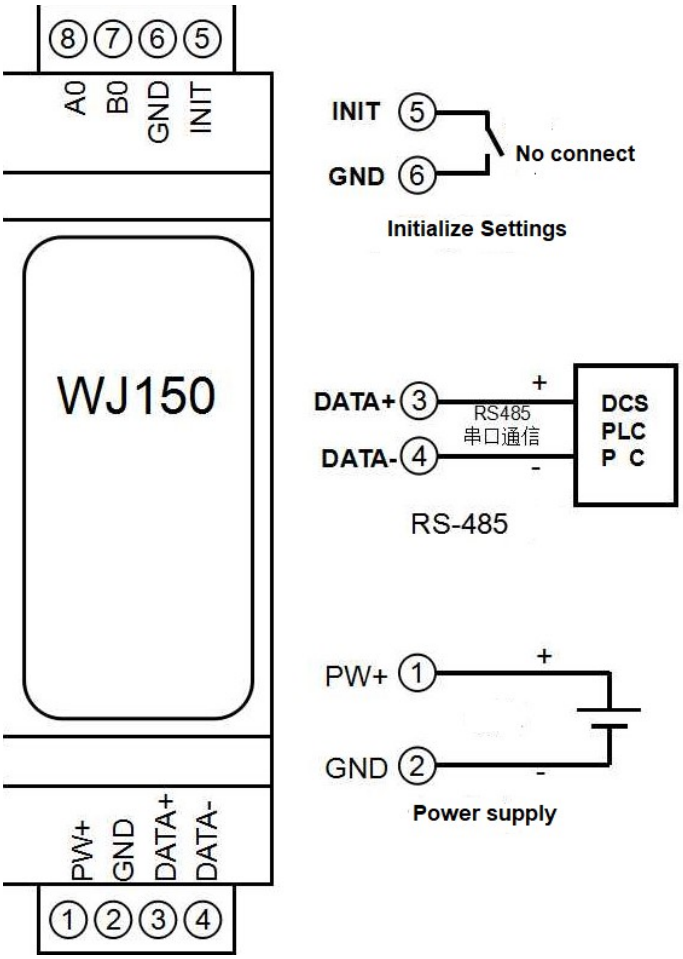
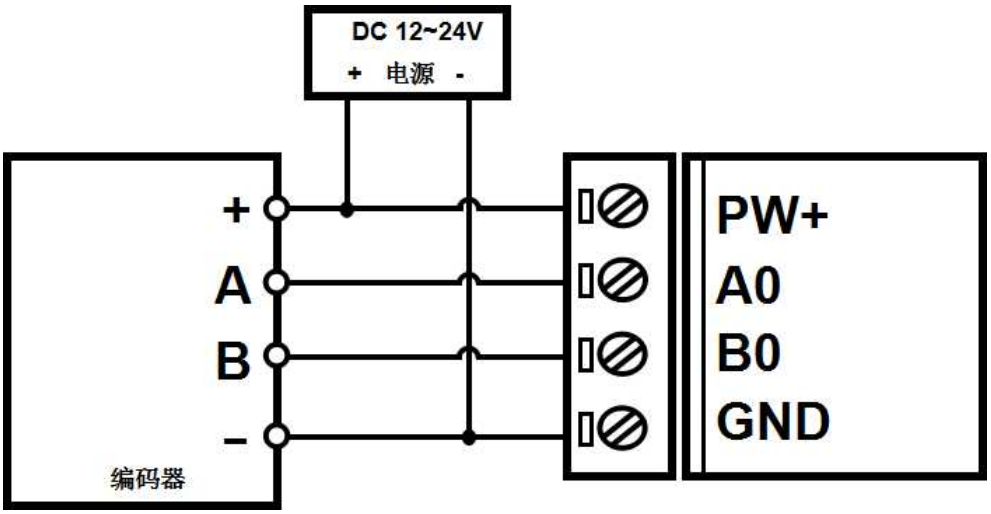


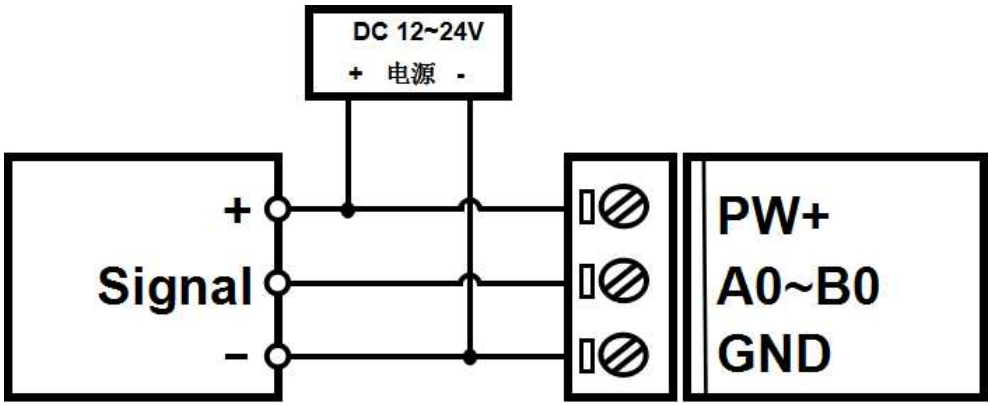
Figure 3 WJ150 wiring diagram

Encoder signal input wiring diagram (working mode 0)



Note: The factory default is to close the pull-up. If it is an NPN encoder, you need to open the internal pull-up resistor, set the 40082 register to 1, or send the character command $01Q1. Others such as NPN encoders with pull-up resistors, PNP encoders, push-pull encoders, etc. can be used directly. If you want to turn off the internal pull-up resistor, set the 40082 register to 0, or send the character command $01Q0

DI count input wiring diagram (working mode 1)



Note 1: The factory default is working mode 0, the DI count needs to be changed to working mode 1 by sending a command, method 1: send the command $0131, after receiving the reply !01, it will take effect after 10 seconds of shutdown. Method 2: The register 40001 is changed to 1. After receiving the reply, it will take effect after 10 seconds of shutdown.

Note 2: The factory default is to close the pull-up. If it is an NPN sensor, dry contact or switch input, you need to open the internal pull-up resistor, set the 40082 register to 1, or send the character command $01Q1. Others such as NPN sensors with pull-up resistors, PNP sensors, push-pull sensors, TTL level, etc. can be used directly. If you want to turn off the internal pull-up resistor, set the 40082 register to 0, or send the character command $01Q0

WJ150 character protocol command set:

The factory initial settings of the module are as follows:

Address code : 01

Baud rate: 9600 bps

Checksum is disable

If you use the RS-485 network, you must assign a unique address code. The address code is a hexadecimal number between 00 and FF. Since the address codes of the new modules are the same, their addresses will be the same as others. The modules are contradictory, so when you build the system, you must reconfigure each WJ69 module address. After connecting the WJ150 module power cord and RS485 communication line, you can modify the address of the WJ150 module through configuration commands. The baud rate and checksum status also need to be adjusted according to user requirements. Before modifying the baud rate and checksum status, the module must first enter the default state, otherwise it cannot be modified.

Let the module into the default state:

WJ150 module has a **INIT** switch, which is on the side of the module. Turn the **INIT** switch to the **INIT** position, and then turn on the power, the module enters the default state at this time. In this state, the module is configured as follows:

Address code 00

Baud rate 9600 bps

Checksum is disable

When you are not sure about the specific configuration of a certain module, you can also turn the **INIT** switch to the **INIT** position, then turn on the power to make the module enter the default state, and then reconfigure the module.

The character protocol command is composed of a series of characters, such as the first code, address ID, variables.

Note: 1. In some cases, many commands use the same command format. Make sure that the address you use is correct in a command. If you use the wrong address, and this address represents another module, the command will take effect in the other module, so an error will occur.

2. Commands must be entered in uppercase letters.

1. Set the encoder operating mode

Description: Set the encoder working mode, 0 or 1, and the factory default is 0. After the working mode is modified, the module must be restarted to take effect.

Working mode 0: encoder AB signal input

Working mode 1: two independent high-speed counter inputs

Note: The following command remark **(operating mode 0)** indicates that the data is valid only when the encoder operating mode is 0.

Note (operating mode 1) indicates that the data is valid only when the encoder operating mode is 1.

Command format: **$AA3B** sets the encoder working mode. It takes effect after restart.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

Answer format: **! AA (cr)** indicates setting successful

Parameter description: **B** represents the encoder working mode, and the value is 0: the working mode. Value is 1: operating mode 1

Example: User command (character format) **$0131**
Module response (character format) **! 01(cr)**
Note: Set the encoder to working mode 1 and two-way high-speed counter mode.

2. Read encoder operating mode

Description: Read the working mode of the encoder.
Command format: **$AA4** Read the encoder working mode
Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.
Answer format: **! B (cr)** represents the working mode of 8 encoder channels, 8 numbers, and the sequence is encoder 7 to encoder 0, Value 0: working mode 0. Value is 1: operating mode 1
Application example: User command (character format) **$014**
Module response (character format) **! 1 (cr)**
Note: encoder is working mode 1

3. Read switch status command

Description: Read back all encoder input channels the on-off status from the module.
Command format: **# AA (cr)**
Parameter description: # delimiter. Hexadecimal is 23H
AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.
Answer format: **>CC (cr)** command is valid.
? 01 (cr) command invalid or illegal operation.
Parameter Description: > Delimiter. Hexadecimal is 3EH
CC represents the read encoder input switch status, 8 numbers, and the sequence is B0A0, Value is 0: input low level; Value is 1: input high level
(cr) End character, upper computer enter key, hexadecimal is 0DH.
Example: User command (character format) **#01**
Module response (character format) **>01(cr)**
Note: The module input switch status is **01**, and the sequence is B0A0
A0: high level B0: low level

4. Read encoder counter data command (operating mode 0)

Description: Read the encoder counter data. "+" Represents forward rotation, and '-' represents reverse rotation.
Command format: **# AA2**
AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.
2 indicates the command to read encoder counter data.
Answer format: **!+AAAAAAAAA(cr)**
Example: User command (character format) **#012**
Module response (character format) **!+0012345678 (cr)**
Note: the encoder counting value is forward +12345678

5. Read encoder input frequency command (operating mode 0)

Description: Read the encoder input frequency. "+" Represents forward rotation, and '-' represents reverse rotation.

Command format: **# AA3**

AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

3 indicates the command to read the encoder input frequency.

Answer format: **! +AAAAAA.AA (cr)**

Application example: User command (character format) **#013**

Module response (character format) **!+001000.00 (cr)**

Note: The encoder input frequency value is forward +1KHz.

6. Read encoder input speed command (operating mode 0)

Description: Read the encoder speed input. "+" Represents forward rotation, and '-' represents reverse rotation.

Command format: **# AA4**

AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

4 indicates reading encoder 0~encoder 7 input speed command.

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **!+AAAAA (cr)**

Application example: User command (character format) # 014 (cr)

Module response (character format) + 01000 (cr)

Note: The input speed value of the encoder is forward+1000 revolutions.

7. Numerical command to modify encoder counter (operating mode 0)

Description: To modify the encoder counter value, you can also set it to zero and re-count.

Command format: **$AA1+AAAAAAAAAAAA** Modify the count value of the encoder.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AA (cr)** indicates setting successful

Example 1: User command (character format) **$011+0**

Module response (character format)! **01(cr)**

Note: Set the encoder count value to 0.

Example 2: User command (character format) **$011+3000**

Module response (character format) **! 01(cr)**

Note: Set the count value of the encoder to +3000.

8. Set the number of pulses per revolution of the encoder (operating mode 0)

Description: Set the encoder number of pulses per revolution. It is set according to the parameters of the connected encoder. The factory default value is 1000. The encoder speed can be read only after the correct pulse number is set.

Command format: **$AA5AAAAA** sets the number of pulses per revolution of the encoder.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is

converted into hexadecimal, it will be 30H and 31H.

5 Set the number of pulses per revolution command of the encoder.

AAAAA represents the number of pulses, such as 1000, 800 or 600.

Answer format: **! AA (cr)** indicates setting successful

Application example: User command (character format) **$01500300**

Module response (character format) **! 01(cr)**

Note: Set the encoder number of pulses per revolution to 300.

9. Read the pulses number of the encoder per revolution (operating mode 0)

Description: Read the pulses per revolution of all encoders.

Command format: **$AA6** reads the number of pulses per revolution of the encoder.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

Answer format: **! AAAAA (cr)** indicates the number of pulses per revolution of the encoder.

Application example: User command (character format) **$016**

Module response (character format) **! 01000 (cr)**

Note: The number of pulses per revolution of the encoder is 1000.

10. Read counter data command (operating mode 1)

Description: The counter data can be read from all channels or from a single channel.

Command format: **# AA5**

AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

5 indicates the command to read the counter data of channel A0~channel B0. Order A0, B0.

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AAAAAAAAAA, AAAAAAAAAA (cr)**

Command format: **# AA5N**

AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

5 indicates the command to read counter data.

N indicates the command to read the channel N counter data. N value: 01, corresponding to A0~B0

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AAAAAAAAAA(cr)**

Application Example 1: User Command (Character Format) **#015**

Module response (character format) **! 0012345678, 0012345678 (cr)**

Note: The count value of all channels is 12345678.

Application Example 2: User Command (Character Format) **# 0151**

Module response (character format) **! 0012345678(cr)**

Note: The count value of channel B0 is 12345678.

11. Read input frequency command (operating mode 1)

Description: The input frequency can be read from all channels or from a single channel.

Command format: **# AA6**

AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

6 indicates the input frequency command from channel A0 to channel B0.

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AAAAAA.AA,AAAAAA. AA (cr)**

Command format: **# AA6N** Read Channel N Input Frequency.

AA module address, ranging from 00 to FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

6 indicates the command to read the input frequency.

N represents the input frequency command of read channel N. N value: 01, corresponding to A0~B0

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AAAAAA. AA (cr)**

Application Example 1: User Command (Character Format) **#016**

Module response (character format) **!001000.00,001000.00 (cr)**

Note: The input frequency value of all channels is 1KHz.

Application Example 2: User Command (Character Format) **#0160(cr)**

Module response (character format) **!001000.00(cr)**

Note: The input frequency value of channel A0 is 1KHz.

12. Modify the numerical value command of DI counter (operating mode 1)

Description: Modify the DI counter value, or set it to zero to re-count.

Command format: **$AA2N+AAAAAAAAAA** Modify the count value of counter N. N is the counter code, and the value is 0 or 1, corresponding to A0~B0. Setting N to 'M' means that the count value of all channels is set at the same time.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AA (cr)** indicates successful setting

Example 1: User command (character format) **$0121+0**

Module response (character format) **! 01(cr)**

Note: Set the count value of channel B0 to 0.

Example 2: User command (character format) **$012M+0**

Module response (character format) **! 01(cr)**

Note: Set the count value of all channels to 0.

Example 3: User command (character format) **$012M+3000**

Module response (character format) **! 01(cr)**

Note: Set the count value of all channels to+3000.

13. Set the counting mode of DI counter (operating mode 1)

Description: Set whether the DI counter counts on the rising edge or the falling edge. The factory setting is 00. Default is rising edge count.The settings take effect after the module is restarted.

Command format: **$AA7BB** sets the counting method of DI counters.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AA (cr)** indicates successful setting

Parameter description: **BB** represents the channel status, 2 numbers, and the sequence is B0A0,

Value is 0: count the rising edge of the channel; Value is 1: the channel falling edge count

Application example: User command (character format) **$01711**

Module response (character format) **! 01(cr)**

Note: Set the falling edge count of B0~A0 channels.

14. Reading counting mode DI counter counting mode (operating mode 1)

Description: Read whether the DI counter counts on the rising edge or the falling edge.

Command format: **$AA8 (cr)** reads the counting method of DI counters.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! BB (cr)** indicates the counting mode of DI counter.

Parameter description: **BB** represents the channel status in the order of B0A0,

Value is 0: count the rising edge of the channel; Value is 1: the channel falling edge count

Application example: User command (character format) **$018(cr)**

Module response (character format) **! 11 (cr)**

Note: Count the falling edge of channel B1~A0.

15. Read DI input speed command (operating mode 1)

Description: Read the rotational speed of DI input, you can read all DI, or read single DI‘

Command format: **# 018** read DI0~DI7 input speed.

Answer format: **! AAAAA,AAAAA (cr)**

Command format: **# 018N** read DI channel N input speed

Answer format: **! AAAAA (cr)**

Application Example 1: User Command (Character Format) **# 018**

Module response (character format) **! 01000,01000 (cr)**

Note: The input speed of all DI channels is 1000 revolutions.

Application Example 2: User Command (Character Format) **# 0180**

Module response (character format) **! 01000(cr)**

Note: The input speed value of DI0 is 1000 revolutions.

16. Set the number of pulses per revolution of DI (operating mode 1)

Description: Set the number of pulses per revolution of DI. Set according to the parameters of the equipment connected to DI. The factory default value is 1000. The DI speed can be read only after the correct pulse number is set.

Command format: **$01DWNAAAAA** Set the per revolution pulses number of DI channel N. N is the counter code, 0

or 1, corresponding to A0~B0, AAAAA represents the number of pulses, such as 1000800 or 600, etc.

Answer format: **! 01 (cr)** indicates successful setting

Application example: user command (character format) **$01DW100300**

Module response (character format) **! 01(cr)**

Note: Set the number of pulses per revolution of DI1 to 300.

17. Read DI pulses per revolution (operating mode 1)

Description: Read the pulses per revolution of all DI channels.

Command format: **$01DR** reads the number of pulses per revolution of all DI in the order A0~B0.

Answer format: **! AAAAA, AAAAA**

Indicates the number of pulses per revolution of DI0~DI1.

Application example: User command (character format) **$01DR**

Module response (character format) **! 01000, 01000 (cr)**

Note: The number of pulses per revolution of all DI channels is 1000.

18. Set the DI filtering time (operating mode 1)

Description: Set the filtering time of DI. Unit: mS, factory default is 0. The photoelectric switch input is set to 0, and the mechanical switch or relay input is recommended to be set to 20~100mS. The settings will take effect after restart.

Command format: **$01LWNAAAAA** Set the filtering time of DI channel N. N is the counter code, with a value of 0 or 1, corresponding to A0~B0. AAAAA represents the filtering time, such as 0, 20 or 50.

Answer format: **! 01 (cr)** indicates successful setting

Application example: User command (character format) **$01LW100020**

Module response (character format) **! 01(cr)**

Note: Set the filtering time of DI1 as 20mS.

19. Read the DI filter time (operating mode 1)

Description: Read the filtering time of all DI channels.

Command format: **$01LR** reads the filtering time of all DIs in the order A0~B0.

Answer format: **! AAAAA, AAAAA** represents the filtering time of DI0~DI1.

Application example: User command (character format) **$01LR**

Module response (character format) **! 00020, 00020 (cr)**

Note: The filtering time of all DI channels is 20mS.

20. Set whether the count value is automatically saved after power failure

Description: Set whether the count value is automatically saved in case of power failure. The factory default value is 1 (automatically saved in case of power failure).

Command format: **$01SW**

Parameter description: **S** sets whether to automatically save the command when the count value is powered off.

W 0: Do not save automatically, power off and reset; 1: The count value is saved automatically after power failure.

Answer format: **! 01 (cr)** indicates successful setting

Application example: User command (character format) **$01S0**

Module response (character format) **! 01(cr)**

Note: The setting does not save the count value, and the count will be reset automatically after power failure.

21. Set DI pull-up switch

Description: Set the pull-up switch of DI. The factory default value is 0 (DI turns off pull-up function).

Command format: **$01QX**

Parameter description: **Q** sets the pull-up switch command of DI.

X 0: DI closing pull-up voltage; 1: DI is connected with pull-up voltage.

Answer format: **! 01 (cr)** indicates successful setting

Application example: User command (character format) **$01Q1**

Module response (character format) **! 01(cr)**

Note: Set DI connection pull-up voltage. When DI is NPN input, it can be set as DI pull-up voltage.

22. Command to configure WJ150 module

Description: Set the address, baud rate and parity of a WJ150 module. The configuration information is stored in the non-volatile memory EEPROM.

Command format: **% AANNTTCCFF**

Parameter description: **%** delimiter.

AA address module, ranging from 00 to FF (hexadecimal).

NN represents the new module hexadecimal address, and the value NN ranges from 00 to FF.

TT uses hex to represent type coding. WJ150 products must be set to 00.

CC is encoded in hexadecimal to represent the baud rate.

Baud rate code	Baud rate
04	2400 baud
05	4800 baud
06	9600 baud
07	19200 baud
08	38400 baud
09	57600 baud
0A	115200 baud

Table 2 Baud Rate Code

FF uses 8 bits in hex to represent parity.

00: No verification

10: Odd check

20: Even check

Answer format: **! AA (cr)** command is valid.

? AA (cr) command is invalid or operates illegally, or the configuration jumper is not installed before changing the baud rate or checksum.

Parameter description: **!** delimiter indicates that the command is valid.

? The delimiter indicates that the command is invalid.

AA represents the address of the input module

(cr) End character, upper computer enter key, hexadecimal is 0DH.

Other instructions: If you configure the module for the first time, AA=00, NN equals the new address.

If the format is wrong or the communication is wrong or the address does not exist, the module will not respond.

Application example: user command **% 0011000600**

Module answer **! 11(cr)**

Description: **%** delimiter.
00 means that the original address of the WJ150 module you want to configure is 00H.
11 indicates that the new module's hex address is 11H.
00 type code, WJ150 products must be set to 00.
06 indicates the baud rate of 9600 baud.
00 means no verification.

23. Read configuration status command

Description: Read the configuration of a designated WJ150 module.

Command format: **$AA2**

Parameter description: **$** delimiter.
AA address module, ranging from 00 to FF (hexadecimal).
2 indicates the command to read the configuration status
(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AATTCCFF (cr)** command is valid.
? AA (cr) command is invalid or illegal.

Parameter description: ! delimiter.
AA indicates the input module address.
TT indicates type code.
CC indicates baud rate coding. See Table 2
FF means verification
(cr) End character, upper computer enter key, hexadecimal is 0DH.

Other instructions: If the format is wrong or the communication is wrong or the address does not exist, the module will not respond.

Application example: user command **$012**
Module answer **! 01000600(cr)**

Description: **!** delimiter.
01 means the WJ150 module address is 01H.
00 indicates the input type code.
06 indicates the baud rate of 9600 baud.
00 means no verification.

24. Set all parameters set by the above character command to restore factory settings.

Description: The parameters set by the setting module with the above character command are restored to factory settings, and the module automatically restarts after completion.

Command format: **$AA900** set parameters to restore factory settings.

Parameter description: **AA** module address, value range 00~FF (hexadecimal). The factory address is 01, which is converted into hexadecimal to ASCII code of each character. For example, if the address 01 is converted into hexadecimal, it will be 30H and 31H.
(cr) End character, upper computer enter key, hexadecimal is 0DH.

Answer format: **! AA (cr)** indicates that the setting is successful and the module will restart automatically.

Application example: User command (character format) **$01900**
Module response (character format) **! 01(cr)**
Note: The parameters are restored to factory settings.

Modbus RTU communication protocol:

The factory default settings for the module are as follows:

Modbus address is 01

Baud rate 9600 bps

Data format: 10 bits. 1-bit start bit, 8-bit data bit, 1-bit stop bit. No calibration.

How to make the module enter the default state:

WJ150 modules have a special pin labeled INIT. After the INIT pin is short circuited to the GND pin, turn on the power, and the module will enter the default state. In this state, the module temporarily reverts to the default state: the address is 01 and the baud rate is 9600. When the specific configuration of a module is uncertain, the user can query the address and baud rate registers 40201-40202 to obtain the actual address and baud rate of the module, or modify the address and baud rate as required.

Support Modbus RTU communication protocol, and the command format follows the standard Modbus RTU communication protocol.

WJ150 register address description

Registers supporting function codes 01, 05 and 15

Address 0X（PLC）	Address （PC，DCS）	Data	Property	Data Description
00001	0	A0 counting mode	Read/write	Counting mode of channel A0~B0 (The default value is 0) 0 is the rising edge count, 1 is the count of falling edge The settings take effect after the module is restarted. It does not need to be modified normally, just use the default value.
00002	1	B0 counting mode	Read/write	
00033	32	A0 input switching value	Read only	Level state of encoder input point 0 indicates low level input, 1 indicates high level input
00034	33	B0 input switching value	Read only	

Registers supporting function codes 03, 06 and 16

Address 4X（PLC）	Address （PC，DCS）	Data	Property	Data Description
40001	0	Encoder working mode	Read/write	Encoder working mode, integer, 0 or 1, The factory default is 0 (it takes effect only after the modification is restarted) **Working mode 0**: encoder AB signal input **Working mode 1**: two independent counter inputs The following register remark (**operating mode 0**) indicates that the data is valid only when the encoder operating mode is 0. Note (**operating mode 1**) indicates that the data is valid only when the encoder operating mode is 1.
40017~40018	16~17	Encoder count	Read/write	Encoder counter (**operating mode 0**) The data is a signed long integer in hexadecimal format. Negative numbers use two's complement, Positive (0x00000000~0x7FFFFFFF), Negative (0xFFFFFFFF~0x80000001), The counter is cleared to write 0 directly to the corresponding register, You can also write other values as needed. The lower 16 bits are in register 40017, The upper 16 bits are in register 40018
40033~40034	32~33	Channel A0 Count	Read/write	Channel A0~B7 counter (**operating mode 1**) The data is an unsigned long integer in hexadecimal format (0x00000000~0xFFFFFFFF), The lower 16 bits of channel A0 are in register 40033, The upper 16 bits of channel A0 are in register 40034, The same rule applies to other channels. Clear the counter to write 0 directly to the corresponding register, or write other values as required.
40035~40036	34~35	Channel B0 Count	Read/write	
40041	40	Channel A0 pulses number	Read/write	Pulse number of channel A0~B0 (**operating mode 1**) Unsigned integer (factory default value is
40042	41	Channel B0 pulses	Read/write	

		number		60), which is set according to the number of pulses per revolution of the input signal. After setting, registers 40109~40110 are the speed of the corresponding channel.
40068	0067	Count clear register	Write	Unsigned integer, default is 0. Modify this register to clear the encoder counter or channel counter. After modification, the register will automatically return to 0. **Write 10: set the encoder count value to 0,** Write 20: Set the channel A0 count value to 0, Write 21: Set the channel B0 count value to 0, **Write 22: Set the channel A0 and B0 count value to 0.** Writing other values is invalid.
Address 4X（PLC）	**Address （PC，DCS）**	**Data**	**Property**	**Data Description**
40073	72	encoder 0 pulses number	Read/write	Encoder pulses number **(operating mode 0)** Unsigned integer (factory default value is 1000), which is set according to the number of pulses per revolution of the encoder. After setting, register 40101 is the speed of the corresponding channel.
40081	80	Count value is saved automatically	Read/write	0: Do not save automatically, power off and reset; 1: The count value is saved automatically after power failure. (The default value is 1)
40082	81	DI Pull up switch	Read/write	0: DI closing pull-up voltage; (The default value is 0) 1: DI is connected with pull-up voltage.
40089	88	Restore parameters to factory settings	Read/write	If it is set to FF00, the parameters of all registers of the module will return to the factory settings, and the module will restart automatically after completion
40101	100	Encoder speed	Read only	Speed of encoder **(operating mode 0)**

				Signed integer, positive and negative indicate positive and negative. The speed is converted according to the number of pulses set in register 40073.
40109	108	Channel A0 speed	Read only	Speed of channel **(operating mode 1)** Unsigned integer. The speed is converted according to the number of pulses set in registers 40041~40042.
40110	109	Channel B0 speed	Read only	
40129~40130	128~129	Encoder frequency	Read only	Pulse frequency of encoder **(operating mode 0)** Data is a 32-bit floating point number The lower 16 bits of floating point number are in register 40129 The upper 16 bits of floating point number are in register 40130
40145~40146	144~145	Channel A0 frequency	Read only	Pulse frequency of the channel **(operating mode 1)** Data is a 32-bit floating point number The lower 16 bits of channel A0 floating point number are in register 40145 The upper 16 bits of channel A0 floating point number are in register 40146 Channel B0 similar
40147~40148	146~147	Channel B0 frequency	Read only	
40181	180	Channel A0 filter time	Read/write	Filtering time of channel **(operating mode 1)** Unsigned integer. The unit is mS. The photoelectric switch input is set to 0, and the mechanical switch or relay input is recommended to be set to 20~100mS. The settings will take effect after restart.
40182	181	Channel B0 filter time	Read/write	
Address 4X（PLC）	**Address** （PC，DCS）	**Data**	**Property**	**Data Description**
40201	0200	Module address	Read/write	Integer, effective after restart, range:

				0x0000-0x00FF
40202	0201	Baud rate	Read/write	Integer, effective after restart, range: 0x0004-0x000A 0x0004 = 2400 bps， 0x0005 = 4800 bps 0x0006 = 9600 bps， 0x0007 = 19200 bps 0x0008 = 38400 bps， 0x0009 = 57600 bps 0x000A = 115200bps
40203	202	Parity check	Read/write	Integer, effective after restart 0: No verification 1: Odd check 2: Even check
40211	0210	Module address	Read only	High bit：0x01 Low bit：0x50

Table 5 Modbus Rtu Register Description

Communication example 1: If the module address is 01 and **010300100002C5CE** is sent in hexadecimal, the data in the register can be obtained.

01	03	00	10	00	02	C5	CE
Module address	read holding register	register address high	register address low	register number high	register number low	CRC check low	CRC check high

If the module replies: **010304CA90FFFFC476**, the data read is 0xFFFFCA90, and the decimal system is - 13680, it means that the current count value of encoder 0 is - 13680.

01	03	04	CA	90	FF	FF	C4	76
Module Address	read holding register	Data bytes	Data 1 high bit	Data 1 low bit	Data 2 high bit	Data 2 low bit	CRC check low	CRC check high

Communication example 2: If the module address is 01, send in hexadecimal: **010300200002C5C1** to obtain the data of the register.

01	03	00	20	00	02	C5	C1
Module Address	read holding register	Register address high	Register address low	Registers number high	Registers number low	CRC check low	CRC check high

If the module replies: **010304CA90FFFFC476**, the data read is 0xFFFFCA90, which is replaced by 4294953616 in decimal system, it means that the current count value of channel A0 is 4294953616.

Communication example 3: If the module address is 01, send **01060043000AF819** in hexadecimal, that is, reset the count value of encoder 0.

01	06	00	43	00	0A	F8	19
Module Address	Write a single holding register	Register address high	Register address low	Data high	Data low	CRC check low	CRC check high

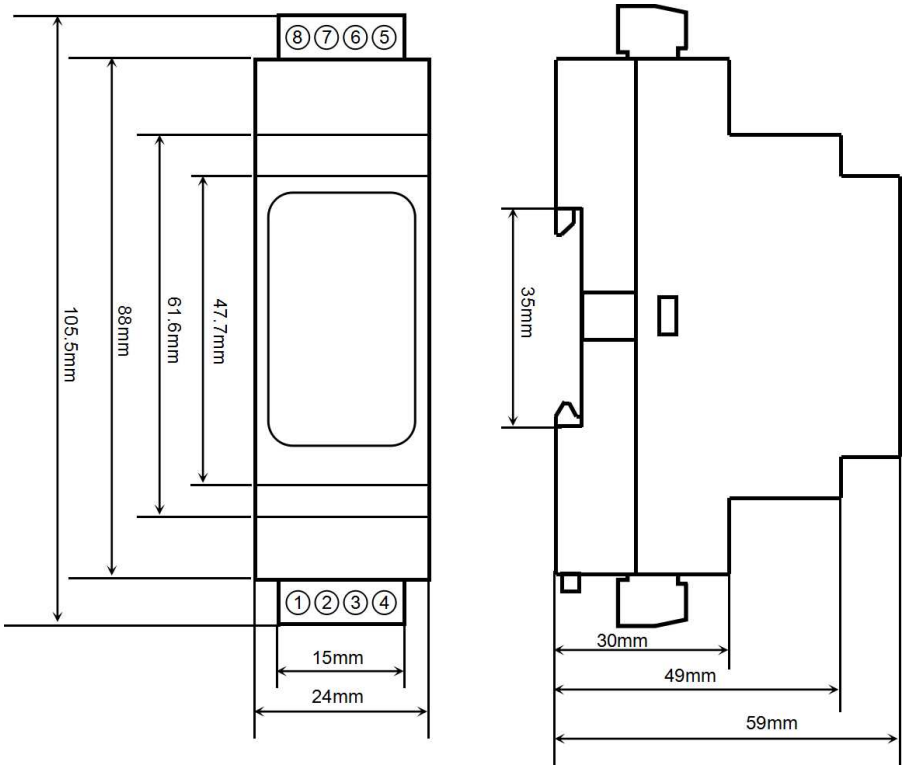
If the module replies: **01060043000AF819**, the setting is successful, and the count value of encoder 0 is modified to 0

01	06	00	43	00	0A	F8	19
Module Address	Write a single holding register	Register address high	Register address low	Data high	Data low	CRC check low	CRC check high

common problem:

1. Counting frequency? 50K
2. Counting range? 20 billion
3. How to reset? Software clearable 0
4. Do you want to save data after power failure? Data can be saved after power cut
5. Encoder type? Incremental encoder, NPN, PNP, push-pull, basically all except differential encoder
6. Type of photoelectric switch? NPN, PNP, TTL, push-pull
7. The read count data is 0? The operating mode needs to be modified according to the sensor
   Working mode 0: encoder AB signal input (factory default)
   Working mode 1: two independent high-speed counter inputs
8. How to change to working mode 1? Method 1: Send the command $0131 and receive a reply! After 01, it will take effect 10 seconds after shutdown
   Method 2: The register 40001 is changed to 1. After receiving the reply, the shutdown takes effect 10 seconds later
9. How to turn on the pull-up resistor for NPN or dry contact input? Send character command $01Q1, or set 40082 register to 1
10. How to turn on filtering when the count value increases a lot at a time of contact? Send commands $01LW000020 and $01LW100020, or change registers 40181 and 40182 to 20
11. Normal setting steps of rain gauge, mechanical water meter, flowmeter, electricity meter, etc.:
    1: Send character command $01Q1, or set 40082 register to 1
    2: Send commands $01LW000020 and $01LW100020 or change registers 40181 and 40182 to 20
    3: Send the command $0131 and receive the reply! After 01, the shutdown takes effect 10 seconds later, or the mask register 40001 is modified to 1. After receiving the reply, the shutdown takes effect 10 seconds later
12. Modify the address baud rate and other methods: short circuit - power on - send a command - wait for reply - remove the short circuit - power on
13. Download testing software: soft.wayjun.net
14. Does it support 4-fold counting? No, please select model WJ153

Overall dimension: (unit: mm)



Guarantee:

Within two years, if the user complies with the storage, transportation and use requirements, but the product quality is lower than the technical indicators, the product can be returned to the factory for free maintenance. In case of damage caused by violation of operating regulations and requirements, the component cost and maintenance cost shall be paid.

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Version No.: V1.1
Date: Aug. 2022