

**PRS-7961**

**Industrial Ethernet Switch  
Instruction Manual**

**CYG SUNRI CO., LTD.**



## **Preface**

### **User's Guideline**

This instruction manual contains full information of the equipment, including function descriptions, logic diagrams, input signals, output signals, setting parameters and technical parameters. It also list the operations on safe handling, commissioning and maintaining of this equipment. The instruction manual can be can be used as a technical reference during the whole product life cycle.

Documentation and manufactured equipments purchased from CYG SUNRI CO., LTD. are dispatched separately due to the necessary manufacturing period. Therefor, they sometimes may not reach the recipients at the same time. Therefore this manual is provided as a technical reference to commission the equipment.

The installation and commissioning personnel should read all relevant chapters carefully and get a thorough knowledge of the contents of this manual, before conducting any operation to the equipment. In this way, the personnel can get the required knowledge in handling electronic equipment.

This manual contains a security chapter which describes the safety precautions recommended when using the equipment. Before installing and using the equipment, this chapter is recommended to be thoroughly read and understood.

### **Personnel Security**

The content in this chapter specifically describes to prevent and reduce the safety accidents in electric power production and construction processures, to ensure the personal safety and health of employees in production activities and to ensure the power grids stable operation and reliable power supply.

Any kind of direcily touching with the metal parts of the electrical equipment should be avoided when electrical equipment is on operation, because of the potential electric shock risk. Neglecting warning notices should be prevent because the improperly operation may damage the device, even cause personnel injury.

The good operating condition of the equipment depends on proper shipping and handling, proper storage, installation, commissioning and maintenance. Therefore, only qualified personnel should be allowed to operate the equipment. Intended personnel are individuals who:

- Have a thorough knowledge of protection systems, protection equipment, protection functions and the configured functional logic in the IEDs;
- Have a basic knowledge in the installation, commissioning, and operation of the equipment;
- Are familiar with the working field where it is being installed;

- Are able to safely perform operations in accordance with accepted safety engineering steps;
- Are authorized to energize and de-energize equipment, and to isolate, ground, and label it;
- Are trained in the maintenance and use of safety apparatus in accordance with safety engineering regulations;
- Have been trained in first aid if any emergency situations happen.

## Warning Indications

The following indicators and standard definitions are used:



**DANGER!** means that death, severe personal injury and considerable equipment damage will occur if safety precautions are disregarded.



**WARNING!** means that death, severe personal and considerable equipment damage could occur if safety precautions are disregarded.



**CAUTION!** means that light personal injury or equipment damage may occur if safety precautions are disregarded.

**NOTICE!** is particularly applies to damage to device and to resulting damage of the protected equipment.



### **DANGER!**

**NEVER** allow the current transformer (CT) secondary circuit connected to this equipment to be opened while the primary system is live. Opening the CT circuit will produce a dangerously high voltage.



### **WARNING!**

**ONLY** qualified personnel should work on or in the vicinity of this device. This personnel **MUST** be familiar with all safety regulations and service procedures described in this manual. During operating of electrical device, certain part of the device is under high voltage. Severe personal injury and significant device damage could result from improper behavior.



### **WARNING!**

Do **NOT** touch the exposed terminals of this device while the power supply is on. The generated high voltage causes death, injury, and device damage.



### **WARNING!**

Thirty seconds is **NECESSARY** for discharging the voltage. Hazardous voltage can be present in the DC circuit just after switching off the DC power supply.

**CAUTION!**

- **Earthing**

Securely earthed the earthing terminal of the device.

- **Operating environment**

**ONLY** use the device within the range of ambient environment and in an environment free of abnormal vibration.

- **Ratings**

Check the input ratings **BEFORE** applying AC voltage/current and power supply to the device.

- **Printed circuit board**

Do **NOT** attach or remove printed circuit board if the device is powered on.

- **External circuit**

Check the supply voltage used when connecting the device output contacts to external circuits, in order to prevent overheating.

- **Connection cable**

Carefully handle connection cables without applying excessive force.

**NOTICE!**

The firmware may be upgraded to add new features or enhance/modify existing features, please **MAKE SURE** that the version of this manual is compatible with the product in your hand.

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The information in this manual is carefully checked periodically, and necessary corrections will be included in future editions. If

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nevertheless any errors are detected, suggestions for correction or improvement are greatly appreciated.

We reserve the rights to make technical improvements without notice.

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Version: 2.01

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## Documentation Outline

The manual provides a functional and technical description of this relay and a comprehensive set of instructions for the relay's use and application.

All contents provided by this manual are summarized as below:

### 1 Briefly Introduction

Briefly introduce the application scope, the selectable functions and product features about this equipment.

### 2 Technical Specifications

Introduce the technical specifications about this relay, including electrical specifications, mechanical specifications, ambient temperature and humidity range, communication interface parameters, type tests, setting ranges and accuracy limits etc.

### 3 IED Hardware

Introduce the main module functions of this relay and describe the definition of all terminals of each module.

### 4 Communication Interface

Introduce the communication interfaces and protocol that this relay contains. IEC60970-5-103 and IEC61850 protocols are introduced in details.

### 5 Installation

Recommend on unpacking, handling, inspection and storage of this relay. A guide to the mechanical installation and electrical wiring of this relay is also provided, including earthing recommendations. Some typical wiring connection is demonstrated in this manual as well.

### 6 Commissioning

Introduce how to commission this relay, check the calibration and test all the function of this relay.

### 7 Maintenance

A general maintenance steps for this device is outlined.

### 8 Decommissioning and Disposal

A general decommissioning and disposal steps for this relay is outlined.

**9 Manual Version History**

List the instruction manual versions and their corresponding modification history records.





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# 1 Briefly Introduction

CYG PRS-7961 Industrial Ethernet Switch, designed for Communications Networking Devices Installed in Electric Power Substations and harsh industrial environment. Widely used in smart grid, new energy, industrial control, transportation, water conservancy and other fields.

- ✧ IEC 61850-3 and IEEE 1613 (power substations) compliant. Ensure reliable transmission of information in power system.
- ✧ Adopt 10/100M BASE-TX Ethernet port, 100BASE-FX、1000BASE-SX optical port. The optical port type if of LC type.
- ✧ Flexible interface configuration, supporting 4 Gigabit interface + 24 fast interface or 24 Gigabit interface.
- ✧ 19 inch standard rack mounting supported.
- ✧ -40 to 85°C operating temperature range.
- ✧ Enclosure protection: IP40 .Natural Cooling Design.
- ✧ Redundant double power supply, switch between the main and standby power without causing any interruption.
- ✧ Power supply type and range: 110/220 VDC/VAC, -20%~+20% power deviation.
- ✧ Built-in MMS server, based on IEC 61850-90-4 switch modeling for power SCADA.
- ✧ Network management is flexible and compatible with SNMPv1/v2c/v3. .
- ✧ Simply configuration maintenance, support WEB, Console, Telnet.
- ✧ Supports RSTP and SR-Ring.
- ✧ SNTP 、IEEE 1588v2 PTP TC supported.

## 1.1 Product Function

### 1.1.1 Ethernet Switching

- 1) 10/100Base-T(X) Ethernet interface adopts standard RJ45 connector, with self-adaption function, can be automatically configured to 10M/100M status and full-duplex/half-duplex running mode, and support MDI/MDI-X self-identification function of cable, according with 10BASE-T/100BASE-TX standard , namely, it can be connected to terminal device and network device with straight-through cable or cross-over cable.
- 2) SFP slot of 100M optical port SFP slot, can be used in line with IEEE802.3 fiber Ethernet 100BASE-FX standard optical transceiver, support hot-swappable.
- 3) SFP slot of Gigabit optical port, can be used in line with IEEE802.3 Gigabit Ethernet (1.25GBd) 1000BASE-SX standard optical transceiver, support hot-swappable.

- 4) Non-blocking store and forward switching mode.
- 5) 802.3x Flow Control supported.

### **1.1.2 Flow Management**

- 1) Storm suppression: You can set the forwarding rate limit for broadcast packets, multicast packets, and unknown unicast packets.
- 2) Port rate control: You can set the packet forwarding rate limit for each port.
- 3) Port mirror: The incoming and outgoing data of other ports can be monitored on the specified port.
- 4) QoS: Supports IEEE 802.1p-based packet priority control, supports SP and WRR priority
- 5) Strategy.

### **1.1.3 Vlan**

- 1) Supports port-based VLAN.
- 2) Supports IEEE 802.1Q-based VLAN.
- 3) Supports VLAN TRUNK.
- 4) Supports inserting, modifying or deleting the VLAN tag of the packet.

### **1.1.4 Redundancy Protocol**

- 1) Supports STP(802.1D)和 RSTP(802.1w), quickly switch to the backup link when other link is interrupted.
- 2) Supports CYG Fast Ring Protection Protocol SR\_RING, quickly switch to the backup link when other link is interrupted .

### **1.1.5 Clock Synchronization**

- 1) Supports SNTP、IEEE 1588v2 PTP TC .

### **1.1.6 Management**

- 1) Supports Console, Telnet, and Web management methods.
- 2) Supports SNMPv1/v2c/v3 .

## **2 Technical Specifications**

### **2.1 Environment**

- 1) Working temperature: -40°C~85°C.
- 2) Relative humidity: 5%~95%(No frosting).

3) Ingress protection: IP40.

## 2.2 Electrical Insulation Properties

- 1) Insulation resistance: >20MΩ.
- 2) Dielectric strength: Power and Alarm to ground voltage: 2KV; Fast Ethernet Interface to ground voltage: 0.5KV.
- 3) Impulse voltage: Power and Alarm to ground voltage: 5KV; Fast Ethernet Interface to ground voltage: 1KV.

## 2.3 Security

- 1) Supports error source address filtering to filter packets whose source address belongs to broadcast address or multicast address.
- 2) Supports CRC check error filtering.
- 3) MAC address conflict: In addition to the conflict port, there is no crash, restart, loss of function or packet loss.

## 2.4 Power Supply

The power of PRS-7961 Industrial Ethernet Switch is less than 35W.

The power supply is completely complied with the IEC 60870-2-1:1995 standard.

## 2.5 Main Technical Parameter

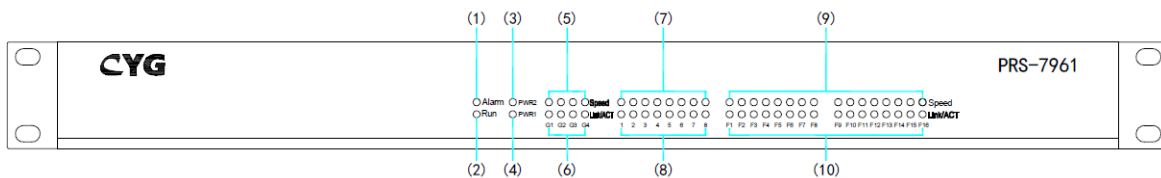
|                      |                                  |  |
|----------------------|----------------------------------|--|
| Technical parameters | Standard                         | IEEE 802.3i, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3z, IEEE802.3x, IEEE 802.1p, IEEE 802.1Q, IEEE 802.1s, 802.1x   |
|                      | Protocol                         | SR-Ring、VLAN、STP/RSTP、IGMP snooping、GMRP、SSH、HTTP、HTTPS、SNMPv1/v2c/v3、RMON、QoS、Port Aggregation、Port Mirror、802.1X、SNTP Client/Server、RTC、SSL、ACL、FTP、IEEE 1588v2 PTP TC |
| Switch features      | Priority queues                  | 4  |
|                      | VLAN entries                     | 512  |
|                      | VLAN ID                          | 1 ~ 4094   |
|                      | Multicast entries                | 512  |
|                      | MAC addresses                    | 8K   |
|                      | Packet buffer and control memory | 4Mbit  |
|                      | Packet forwarding rate           | 9.5Mpps  |
|                      | Latency                          | <5μs   |
| Interface            | 1000M optical interfaces         | 1000Base-X SFP   |

|   |                                 |  |
|---|---------------------------------|--|
|   | 100M optical interfaces         | 100Base-FX SFP   |
|   | Electrical interfaces           | 10/100Base-T(X) self-adaptive RJ45 connector                                       |
|   | Console                         | RJ45   |
|   | Management port                 | 10/100Base-T(X) self-adaptive RJ45 connector                                       |
|   | Alarm terminal                  | 3-core 5.08mm-spacing pluggable terminal block, 250VAC/220VDC Max, 2A Max, 60W Max |
| Indicator lights                                      | Indicator lights of front panel | Running indicator light :Run   |
|   |                                 | Alarm indicator light:Alarm  |
|   |                                 | Indicator light of power supply:PWR1, PWR2   |
|   |                                 | Interface indicator light:Link/ACT, Speed  |
|   | Indicator lights of back panel  | Interface link state indicator light (green light) :Link/ACT                       |
| Interface speed indicator light (yellow light) :Speed |                                 |  |
| Transmission distance                                 | Twisted pair                    | 100m(adopt Cable which satisfy CAT5 or CAT5e)                                      |
|   | Multimode fiber                 | 1310nm, 2km(100M)  |
|   |                                 | 850nm, 550m(1000M)   |
|   | Single mode fiber               | 1310nm, 40km/60km(100M)  |
|   |                                 | 1550nm, 60km/80km(100M)  |
|   |                                 | 1310nm, 10km/40km(1000M)   |
| 1550nm, 60km/80km(1000M)                              |                                 |  |
| Power   | Input rated voltage range       | 220V AC/DC(85-264V AC/77-300V DC)  |
|   | Connecting terminal             | 5-core 5.08mm-spacing pluggable terminal block                                     |
|   | Rated power                     | <35W   |
|   | Overload protection             | Support  |
|   | Wrong polarity protection       | Support  |
|   | Redundancy protection           | Support  |
| Mechanical structure                                  | Case                            | Cooling surface design of aluminum case, without fan                               |
|   | Ingress protection              | IP40   |
|   | Installation method             | 19-inch 1U rack mounting   |
| Environment   | Working temperature             | -40°C ~ +85°C  |
|   | Storage temperature             | -40°C ~ +85°C  |
|   | Relative humidity               | 5 ~ 95%,without condensation   |
| International standard                                | EMI                             | FCC CFR47 Part 15, EN55022/CISPR22, Class A  |
|   | EMS                             | IEC61000-4-2(Electrostatic discharge immunity test) ±8kV(contact),                 |

|             |   |
|-------------|---|
|             | ±15kV(air)  |
|             | IEC61000-4-3(Radiated, radio-frequency electromagnetic field immunity test) 10V/m(80MHz ~ 2GHz)                                 |
|             | IEC61000-4-4(Electrical fast transient/burst immunity test) Power Port:±4kV; Data Port:±2kV                                     |
|             | IEC61000-4-5(Surge immunity test) Power Port:±2kV/DM, ±4kV/CM; Data Port:±2kV   |
|             | IEC61000-4-6(Immunity to conducted disturbances, induced by radio-frequency fields) 3V(10kHz ~ 150kHz); 10V(150kHz ~ 80MHz)     |
|             | IEC61000-4-8(Power frequency magnetic field immunity test) 100A/m(cont.), 1000A/m(1s ~ 3s)                                      |
|             | IEC61000-4-9(Impulse magnetic field immunity test) 1000A/m  |
|             | IEC61000-4-10(Damped oscillatory magnetic field immunity test) 100A/m   |
|             | IEC61000-4-12(Oscillatory waves immunity test) 2.5kV/CM, 1kV/DM   |
|             | IEC61000-4-16(Test for immunity to conducted, common mode disturbances in frequency range 0 Hz to 150 kHz) 30V(cont.), 300V(1s) |
| Mechanics   | IEC60068-2-6(Vibration) IEC60068-2-27(Shock)<br>IEC60068-2-32(Free fall)  |
| Industry    | IEC61000-6-2  |
| Electricity | IEC61850-3, IEEE1613  |

### 3 IED Hareware

#### 3.1 Front Panel



**Figure 3.1.1 Label Diagram of PRS-7961 Front Panel**

**Table 3.1 Label Description of PRS-7961 Front Panel**

| Labe No. | Panel identifier | Description   |
|----------|------------------|---|
| 1        | Alarm            | Alarm indicator light                                     |
| 2        | Run              | Running indicator light                                   |
| 3        | PWR2             | Indicator light of power supply 2                         |
| 4        | PWR1             | Indicator light of power supply 1                         |
| 5        | G1-G4:Speed      | Speed indicator light of four gigabit interfaces          |
| 6        | G1-G4:Link/ACT   | Link state indicator light of four gigabit interfaces     |
| 7        | 1-8:Speed        | Speed indicator light of eight 100M electrical interfaces |

| Labe No. | Panel identifier | Description  |
|----------|------------------|--|
| 8        | 1-8:Link/ACT     | Link indicator light of eight 100M electrical interfaces |
| 9        | F1-F16:Speed     | Speed indicator light of 16 100M optical interfaces      |
| 10       | F1-F16:Link/ACT  | Link state indicator light of 16 100M optical interfaces |

### 3.2 Back Panel

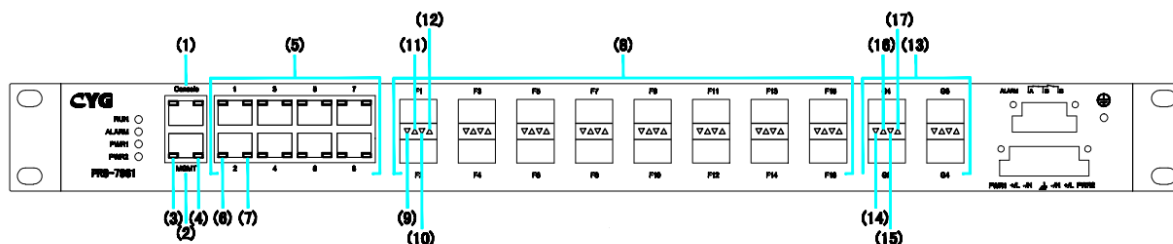


Figure 3.2.1 Label Diagram of PRS-7961 Back Panel

Table 3.2 Label Description of PRS-7961 Back Panel

| Label No. | Description   |
|-----------|---|
| 1         | Console interface   |
| 2         | 10/100Base-T(X) Ethernet management interface   |
| 3         | 10/100Base-T(X) Ethernet management interface data state indicator light (yellow)         |
| 4         | 10/100Base-T(X) Ethernet management interface link state indicator light (green)          |
| 5         | 10/100Base-T(X) Ethernet interface  |
| 6         | 10/100Base-T(X) Ethernet interface data state indicator light (yellow)                    |
| 7         | 10/100Base-T(X) Ethernet interface link state indicator light (green)                     |
| 8         | 100Base-FX 100M optical interface   |
| 9         | Data state indicator light of 100Base-FX 100M optical interface in the upper row (yellow) |
| 10        | Data state indicator light of 100Base-FX 100M optical interface in the lower row (yellow) |
| 11        | Link state indicator light of 100Base-FX 100M optical interface in the upper row (green)  |
| 12        | Link state indicator light of 100Base-FX 100M optical interface in the lower row (green)  |
| 13        | 1000Base-X gigabit interface  |
| 14        | Data state indicator light of 1000Base-X gigabit interface in the upper row (yellow)      |
| 15        | Data state indicator light of 1000Base-X gigabit interface in the lower row (yellow)      |
| 16        | Link state indicator light of 1000Base-X gigabit interface in the upper row (green)       |
| 17        | Link state indicator light of 1000Base-X gigabit interface in the lower row (green)       |

### 3.3 LED Indicator Light State

Table 3.3 Description of Indicator Lights of Front Panel

| LED | State | Description |
|-----|-------|-------------|
|-----|-------|-------------|



| LED  |   | State | Description   |
|--|---|-------|---|
| Indicator light of power supply 1            |   | On    | Input power supply 1 is connected and runs normally   |
|  |   | Off   | Input power supply 1 is not connected or runs abnormally  |
| Indicator light of power supply 2            |   | On    | Input power supply 2 is connected and runs normally   |
|  |   | Off   | Input power supply 2 is not connected or runs abnormally  |
| Running indicator light                      |   | On    | Running state of main board CPU is normal   |
|  |   | Off   | Main board CPU is not started or CPU runs abnormally or the device is in the process of electrifying and starting |
| Alarm indicator light                        |   | On    | Display of system alarm   |
|  |   | Off   | Display of no system alarm  |
| 100M interface speed indicator light         | 10/100Base-T(X) Ethernet interface speed indicator light      | On    | 100M working state (i.e. 100Base-TX)  |
|  |   | Off   | 10M working state (i.e. 10Base-T) or no connection  |
|  | 100Base-FX SFP optical module interface speed indicator light | On    | 100M working state (i.e. 100Base-FX)  |
|  |   | Off   | No connection   |
| 100M interface link state indicator light    |   | On    | The port has established effective network connection   |
|  |   | Blink | The port has network activity   |
|  |   | Off   | The port has not established effective network connection   |
| Gigabit interface speed indicator light      | Gigabit SFP optical module                                    | On    | 1000M working state (i.e. 1000Base-X)   |
|  |   | Off   | 100M working state (i.e. 100Base-FX) or no connection   |
| Gigabit interface link state indicator light |   | On    | The port has established effective network connection   |
|  |   | Blink | The port has network activity   |
|  |   | Off   | The port has not established effective network connection   |

## 4 Communication Interface

### 4.1 10/100Base-T(X) Ethernet Interface

10/100Base-T(X) Ethernet interface adopts standard RJ45 connector, with self-adaption function, can be automatically configured to 10M/100M status and full-duplex/half-duplex running mode, and support MDI/MDI-X self-identification function of cable, namely, it can be connected to terminal device and network device with straight-through cable or cross-over cable.

➤ **Definition of interface**

The number of RJ45 interface pins is as shown in the figure below.

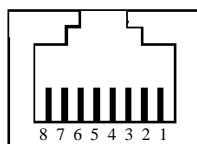


Figure 4.1.1 Number of RJ45 Interface Pins

The definitions of 10/100Base-T(X) RJ45 interface pins are shown in the table below.

Table 4.1 Definitions of 10/100Base-T(X) RJ45 Interface Pins

| Pin        | MDI-X signal name   | MDI signal name     |
|------------|---------------------|---------------------|
| 1          | Receive data+ (RD+) | Send data+ (TD+)    |
| 2          | Receive data- (RD-) | Send data- (TD-)    |
| 3          | Send data+ (TD+)    | Receive data+ (RD+) |
| 6          | Send data- (TD-)    | Receive data- (RD-) |
| 4, 5, 7, 8 | Unused              | Unused              |

**Notice !**

“+”and“-”mean the polarity of electrical level.

Line sequence of joints

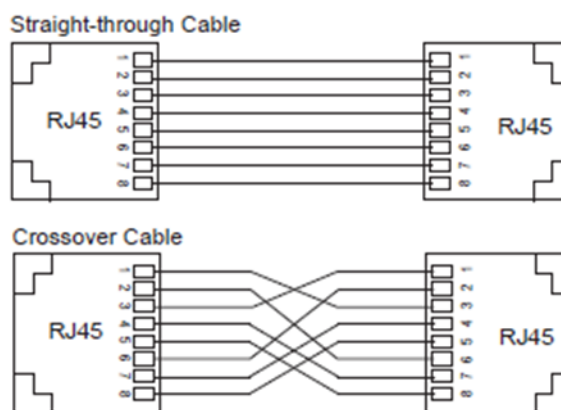


Figure 4.1.2 Interconnection of Straight-through Cable and Cross-over Cable of 10/100Base-T(X) RJ45 Joints

**Notice !**

The wiring of RJ45 joints complies with standard 568B (1-orange-white, 2-orange, 3-green-white, 4-blue, 5-blue-white, 6-green, 7-brown-white, 8-brown).

## 4.2 100Base-FX SFP Interface

100Base-FX SFP interface (i.e. 100M SFP interface) can be connected to cable to carry out communication only after SFP optical/electrical module is inserted. 100M SFP optical/electrical module (option) supported by the device is shown in Table 4-2.

**Table 4.2 PRS-7961 100M SFP Optical/Electrical Module**

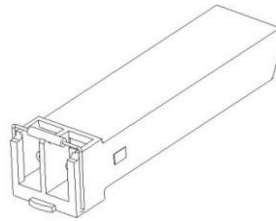
| Model                        | Interface            | Multi-module/single-module | Connector | Central wavelength | Transmission distance |
|------------------------------|----------------------|----------------------------|-----------|--------------------|-----------------------|
| HFBR<br>57E5APZ-M-LX-LC-1310 | 100Base-FX interface | Multi-module               | LC        | 1310nm             | 2km                   |

The parameters of 1000Base-X, 10/100/1000Base-T(X) SFP interface are shown in Table 4-3.

**Table 4.3 PRS-7961 100M SFP Optical/Electrical Module**

| Attribute  |            | SX               |
|--|------------|------------------|
| Type   |            | Multi-module (M) |
| Central wavelength (nm)                            |            | 1310             |
| Transmission distance (Km)                         |            | 2                |
| Scope of application of transmission distance (Km) |            | 0~2              |
| Transmitting optical power                         | Min. (dBm) | -20              |
|  | Max. (dBm) | -14              |
| Receiving sensitivity (dBm)                        |            | -31              |
| Over-loading optical power (dBm)                   |            | -14              |

100M SFP optical module



**Figure 4.2.1 100M SFP Optical Module**

100M SFP optical module interface adopts standard LC optical fiber connector, and each interface consists of a transmitting port (TX port) and a receiving port (RX port). To implement communication between Device A and Device B, TX port and RX port of Device A shall be connected to RX port and TX port of Device B. The wiring of 100M SFP optical module is shown in the figure below.



Figure 4.2.2 Wiring Diagram of 100M SFP Optical Module

#### ➤ Use method of 100M SFP optical module

First insert 100M SFP optical module into SFP slot of the device, and then insert the optical fiber into RX port and TX port of 100M SFP optical module.

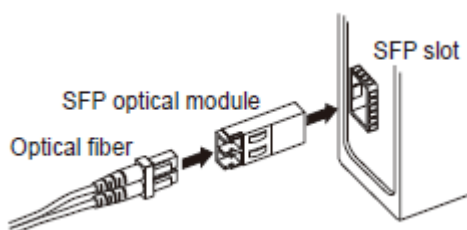


Figure 4.2.3 Use Method of 100M SFP Optical Module

Confirm RX port and TX port of 100M SFP optical module.

1. Insert two joints on one end of optical fiber into two interfaces of 100M SFP optical module, and then insert two joints on the other end of optical fiber into two interfaces of corresponding end.
2. After connecting the optical fiber, check the link state indicator light of corresponding interfaces of front panel:

If the light blinks, it means the optical fiber link has been connected; if the light is lit off, it means that the link is not connected, and it may be because of the error of connection between RX port and TX port of SFP optical module, and please try to exchange the two joints on one end of optical fiber.

#### **Notice !**

The device uses laser to transmit signals on optical cable. The laser meets the requirements of Grade-I laser product, so when the device is electrified, don't stare at the light emitting port of SFP module, in order to avoid hurting your eyes.

#### **Notice !**

For the module with the transmission distance greater than 60km, don't use short fiber (below 20km) to connect, in order to avoid causing light saturation over-power on the receiving end of module and damaging the module.

### 4.3 1000Base-X, 10/100/1000Base-T(X)SFP Interface

1000Base-X, 10/100/1000Base-T(X)SFP interface (i.e. gigabit SFP interface) can be connected to cable to carry out communication only after SFP optical/electrical module is inserted. Gigabit SFP

optical/electrical module (option) supported by the device is shown in Table 4-4.

**Table 4.4 PRS-7961 Gigabit SFP Optical/Electrical Module**

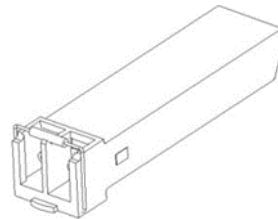
| Model                    | Interface            | Multi-module/single-module | Connector | Central wavelength | Transmission distance |
|--------------------------|----------------------|----------------------------|-----------|--------------------|-----------------------|
| AFBR-5710APZ-LC-850-0.55 | 1000Base-X interface | Multi-module               | LC        | 850nm              | 0.55km                |

The parameters of 1000Base-X, 10/100/1000Base-T(X) SFP interface are shown in Table 4-5.

**Table 4.5 PRS-7961 Gigabit SFP Optical/Electrical Module**

| Attribute  | SX               |     |
|--|------------------|-----|
| Type   | Multi-module (M) |     |
| Central wavelength (nm)                            | 850              |     |
| Transmission distance (Km)                         | 0.55             |     |
| Scope of application of transmission distance (Km) | 0~0.55           |     |
| Transmitting optical power                         | Min. (dBm)       | -11 |
|  | Max. (dBm)       | -2  |
| Receiving sensitivity (dBm)                        | -18              |     |
| Over-loading optical power (dBm)                   | 0                |     |

➤ Gigabit SFP optical module



**Figure 4.3.1 Gigabit SFP Optical Module**

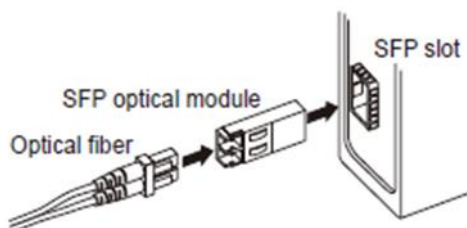
Gigabit SFP optical module interface adopts standard LC optical fiber connector, and each interface consists of a transmitting port (TX port) and a receiving port (RX port). To carry out communication between Device A and Device B, TX port and RX port of Device A shall be connected to RX port and TX port of Device B. The wiring of gigabit SFP optical module is shown in the figure below.



**Figure 4.3.2 Wiring Diagram of Gigabit SFP Optical Module**

- Use method of gigabit SFP optical module

First insert gigabit SFP optical module into SFP slot of the device, and then insert the optical fiber into RX port and TX port of gigabit SFP optical module



**Figure 4.3.3 Use Method of Gigabit SFP Optical Module**

Confirm RX port and TX port of gigabit SFP optical module.

1. Insert two joints on one end of optical fiber into two interfaces of gigabit SFP optical module, and then insert two joints on the other end of optical fiber into two interfaces of corresponding end.
2. After connecting the optical fiber, check the link state indicator light of corresponding interfaces of front panel:

If the light blinks, it means the optical fiber link has been connected; if the light is lit off, it means that the link is not connected, and it may be because of the error of connection between RX port and TX port of SFP optical module, and please try to exchange the two joints on one end of optical fiber.

#### **Notice!**

The device uses laser to transmit signals on optical cable. The laser meets the requirements of Grade-I laser product, so when the device is electrified, don't stare at the light emitting port of SFP module, in order to avoid hurting your eyes.

#### **Notice!**

For the module with the transmission distance greater than 60km, don't use short fiber (below 20km) to connect, in order to avoid causing light saturation over-power on the receiving end of module and damaging the module.

## **4.4 Console Interface**

Console interface is on front panel of device. Use DB9-RJ45 network management cable to connect 9-pin serial interface of control computer to Console interface of the device. And the hyper-terminal software which runs WINDOWS system can call the console software of this device, thus implementing functions of device configuration, maintenance and management.

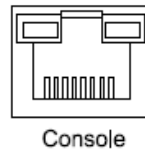


Figure 4.4.1 Console Interface

➤ **DB9-RJ45 network management cable**

On one end of DB9-RJ45 network management cable is DB9 plug, which shall be inserted into 9-pin serial interface of control computer; on the other end is crimp RJ45 joint, which shall be inserted into Console interface of the device

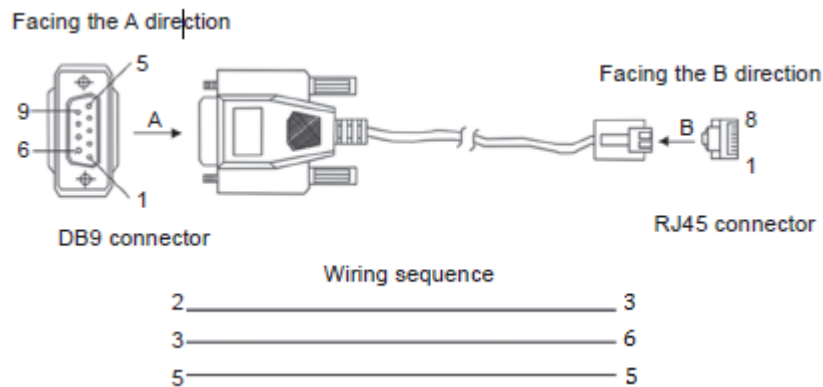


Figure 4.4.2 DB9-RJ45 Network Management Cable Sequence

| DB9 interface (9-pin serial interface on PC end) |                    | RJ45 interface (Console interface) |                    |
|--|--------------------|------------------------------------|--------------------|
| Pin  | Signal             | Pin                                | Signal             |
| 2  | RXD (receive data) | 3                                  | TXD (send data)    |
| 3  | TXD (send data)    | 6                                  | RXD (receive data) |
| 5  | GND (grounding)    | 5                                  | GND (grounding)    |

### 4.5 Grounding

As normal grounding of device is an important guarantee for lightning protection and anti-jamming of device, user must correctly connect the ground wire. And the ground wire shall be connected prior to electrifying, and after de-electrifying, disconnect the ground wire.

The back panel of device has a grounding screw, at the ground wire of chassis, called “chassis ground”. After crimping one end of ground wire to cold-pressed terminal, fix it with grounding screw at the “ground point” as indicated in the figure below, and connect the other end of ground wire to the ground.

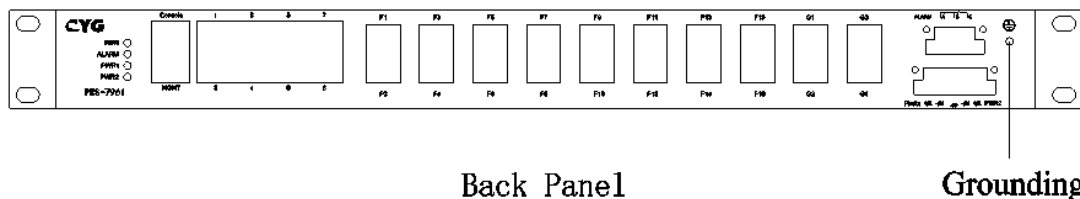


Figure 4.5.1 Grounding

**Notice !**

The sectional area of ground wire shall be more than 2.5mm<sup>2</sup>; and the grounding resistance shall be less than 5Ω.

### 4.6 Power Supply Terminal

The power supply terminal is on back panel of device, and the power wire is connected through the power supply terminal to supply power for the device. The device of this series supports both single power supply and redundant power supply, both of which adopt 5-core 5.08mm-spacing pluggable terminal block. The single power supply supports one-way power input; the redundant power supply supports two-way power input, and when one power supply is in failure, the device can run uninterruptedly, thus improving the running reliability of network.

**Notice !**

The sectional area of power wire shall be more than 0.75mm<sup>2</sup> (maximum sectional area of wire is 2.5mm<sup>2</sup>); and the grounding resistance shall be less than 5Ω.

The 5-core 5.08mm-spacing pluggable terminal block is as shown in the figure below.

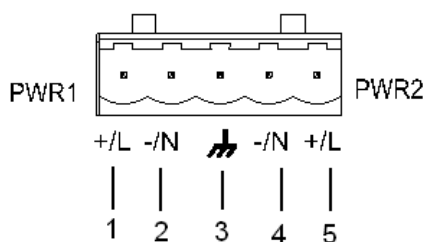


Figure 4.6.1 5-core 5.08mm-Spacing Pluggable Terminal Block (Socket)

| Terminal No. | Definition of DC wiring | Definition of AC wiring |
|--------------|-------------------------|-------------------------|
| 1            | PWR1: +                 | PWR1: L                 |
| 2            | PWR1: -                 | PWR1: N                 |
| 3            | Protective ground       | Protective ground       |
| 4            | PWR2: -                 | PWR2: N                 |



| Terminal No. | Definition of DC wiring | Definition of AC wiring |
|--------------|-------------------------|-------------------------|
| 5            | PWR2: +                 | PWR2: L                 |

**Notice !**

For the device of single power supply, it's only needed to connect Terminal 1, 2 and 3, and don't connect Terminal 4 and 5.

➤ **Wiring and installation**

First step: Ground the device according to Step 4.5.

Second step: Take down the plug of power supply terminal from the device.

Third step: Insert one end of power wire into the plug of power supply terminal according to requirement of Table 4-7, and fix the power wire.

Fourth step: Insert the plug of connected power wire back onto corresponding socket of power supply terminal.

Fifth step: According to power supply requirements labeled on the device, connect the other end of power wire onto corresponding external power supply system, check whether the corresponding power indicator light of front panel of device is lit on, and if it is lit on, it means the power supply connection is correct.

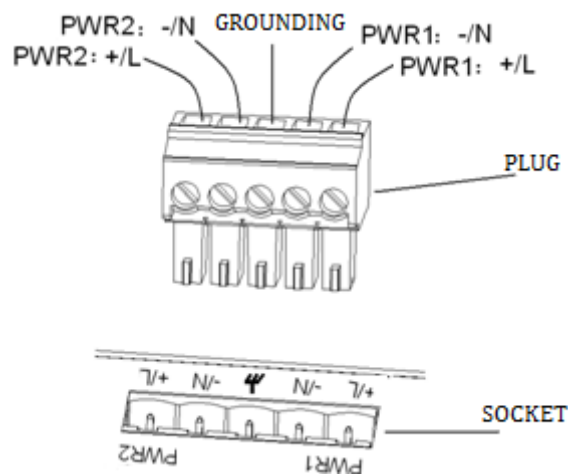


Figure 4.6.2 Wiring of 5-core 5.08mm-spacing Power Supply Terminal

**Notice !**

This device supports 220V AC/DC power supply. Prior to connection with power supply, please confirm that the power supply is consistent with the power supply requirements as labeled on the device, so as to avoid damaging the device.

**Alarm !**

Don't contact any exposed wire, terminal, and the dangerous voltage parts as marked on the product, in order to avoid hurting people.

**Alarm !**

Don't dismantle the parts, plug or unplug during electrifying.

## 4.7 Alarm Terminal

The alarm terminal is on back panel of device, and is used in alarm output. When the device works normally, the normally open end of alarm relay is closed, and the normally closed end is disconnected; in case of an alarm, the normally open end is disconnected, and the normally closed end is closed; in case of completely power-losing, the normally open end is disconnected, and the normally closed end is closed. The normally open end and normally closed end of relay output through 3-core 5.08mm-spacing pluggable terminal block.

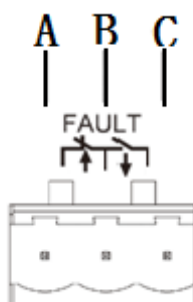


Figure 4.7.1 Alarm Terminal (Socket)

Electrical parameters of external interface of relay:

Maximum voltage: 250VAC/220VDC

Maximum current: 2A

Maximum power: 60W

Maximum withstand voltage: 2kV

**Notice !**

Switch between pins A and B is normally closed switch, switch between pins B and C is normally open switch. When the device works normally, switch between pins A and B is disconnected, switch between pins B and C is closed; and in case of an alarm, switch between pins A and B will be closed, switch between pins B and C will be disconnected; in case of completely power-losing, switch between pins A and B is closed, switch between pins B and C is disconnected.

## 5 Installation

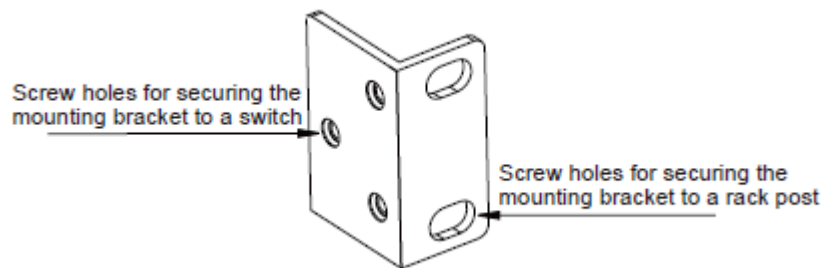
### 5.1 Installation Steps

The device is rack-mounted, and supports both front panel mounting and back panel mounting.

The description of this chapter takes front panel mounting as an example, and if back panel mounting is needed, please refer to the mounting and dismantling of front panel. Prior to installation of device, please confirm the following installation requirements:

- 1) Environmental requirements: Temperature is within  $-40^{\circ}\text{C}\sim+85^{\circ}\text{C}$ , and relative humidity is within 5%~95% (without condensation).
- 2) Power supply requirements: Confirm that the operating voltage is within the voltage range marked on the device.
- 3) Grounding resistance requirements:  $<5\Omega$ .
- 4) Avoid direct sunlight, and keep away from heat source or the area of strong electromagnetic interference.

➤ **Fix the mounting flange**

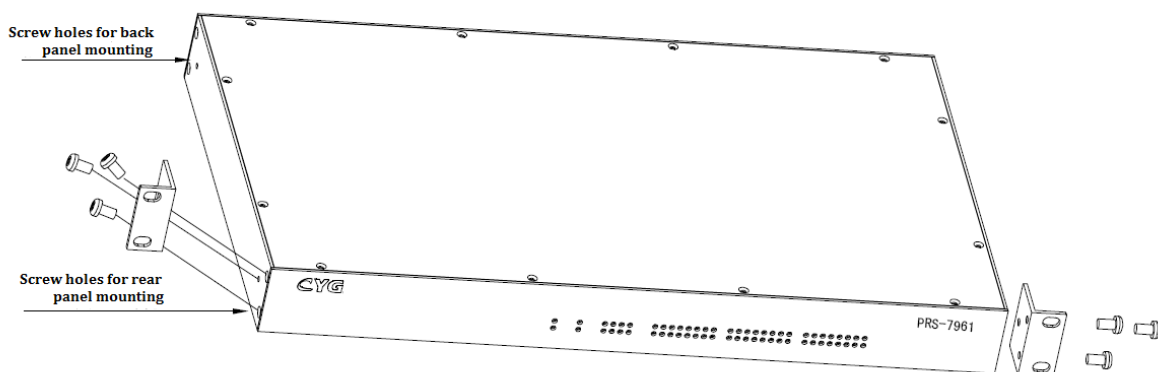


**Figure 5.1.1 Mounting Flange**

User may select the mounting screw holes of front panel or back panel to fix the mounting flange as required, so as to complete the mounting of front panel or back panel. If there are screws in the mounting screw holes, first screw off the screws and keep them properly, so as to be used when fixing the mounting flange.

**5.1.1 Front Panel Mounting**

As shown in the figure below, use the screw to go through three round holes of mounting flange, and fix two mounting flanges onto the switch.



**Figure 5.1.2 Mounting Flang of Front Panel**

### ➤ Installation

First step: Select the mounting position of device, and guarantee enough space and smooth heat dissipation (dimension of the chassis: 439.4mm×44mm×260mm).

Second step: Move the device according to the direction of Arrow 1 until aiming the long round holes of mounting flange at corresponding holes on mounting column, then fix the device with four screws and matching floating nuts, and the mounting is finished.

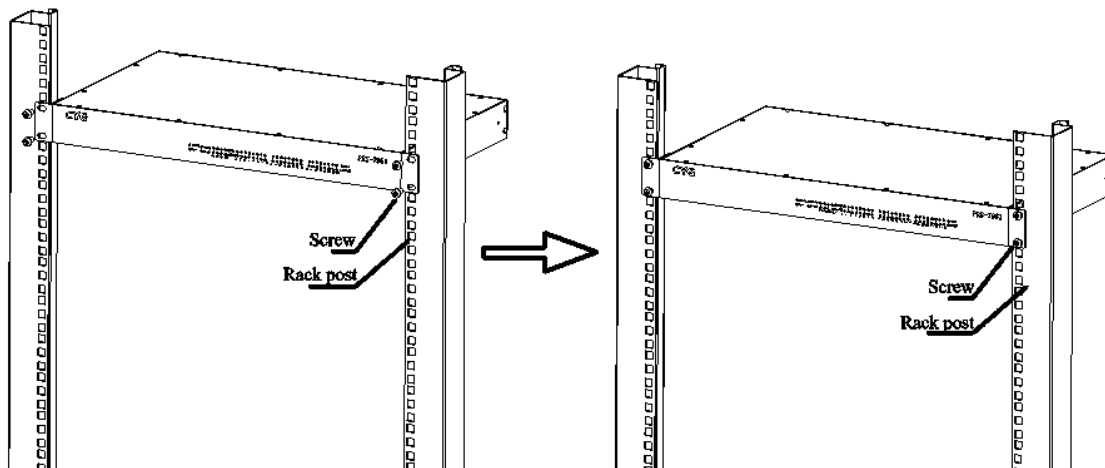


Figure 5.1.3 Installation of Front Panel

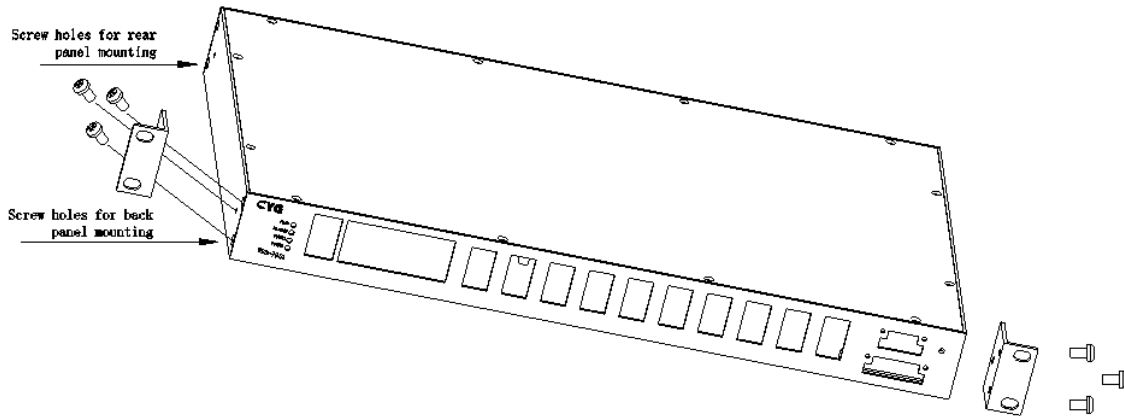
### ➤ Dismantle

First step: Screw off four screws and matching floating nuts in the long round holes of mounting flange.

Second step: Take out the device from the rack, dismantle the mounting flange, and the dismantling is finished.

### 5.1.2 Back Panel Mounting

As shown in the figure below, use the screw to go through three round holes of mounting flange, and fix two mounting flanges onto the switch

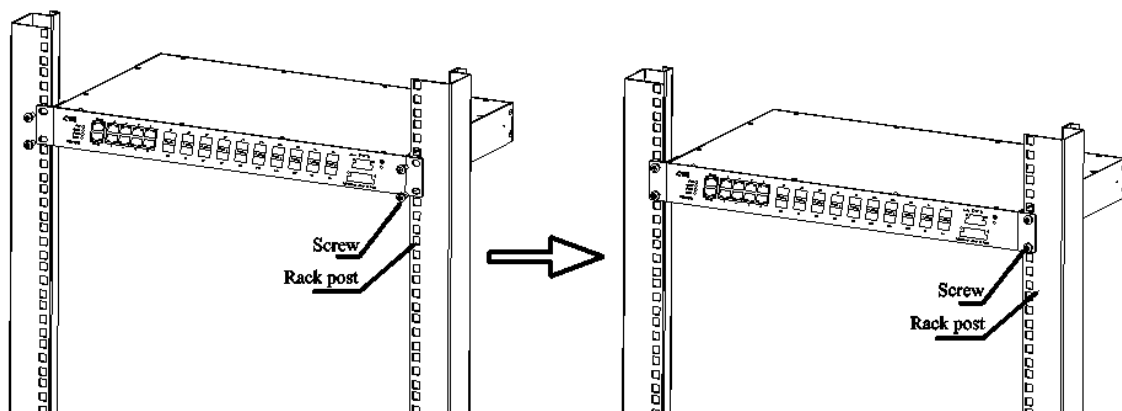


**Figure 5.1.4 Mounting Flang of Back Panel**

➤ **Installation**

First step: Select the mounting position of device, and guarantee enough space and smooth heat dissipation (dimension of the chassis: 439.4mm×44mm×260mm).

Second step: Move the device according to the direction of Arrow 1 until aiming the long round holes of mounting flange at corresponding holes on mounting column, then fix the device with four screws and matching floating nuts, and the mounting is finished.



**Figure 5.1.5 Installation of Back Panel**

➤ **Dismantle**

First step: Screw off four screws and matching floating nuts in the long round holes of mounting flange.

Second step: Take out the device from the rack, dismantle the mounting flange, and the dismantling is finished.

## 6 Commissioning

### 6.1 Arrival Checking

- 1) Check whether the packaging is complete.
- 2) Discharge: Discharging by site construction unit, avoid tilting the cabinet, bumping,
- 3) gantline falling off, pay attention to the safety of personnel.
- 4) Storage: Pay attention to anti-bump, rain proof, sunscreen, moisture-proof, dustproof, cabinet requires placed vertically.
- 5) Carry: Trailer cabinet vertically, with somebody's help, to avoid the cabinet down.

### 6.2 Unpacking Inspection

Receiving, unpacking and inspection procedures for the device:

- 1) Unpacking.
- 2) Check the appearance of the device.

Check whether the certificate, supporting documents, annex, spare parts of the device is consistent with the order requirements, Whether the device is the same as the type, name and quantity specified in the packing list.

Please contact the manufacturer timely if any damage found.

If the device is not installed and commissioned immediately, it should be stored in the original package, stored at the temperature of  $-40^{\circ} \sim +85^{\circ}$ , relative humidity of 10% to 95% without condensation, the surrounding air without acidic, alkaline or other harmful gases, rain-proof places.

### 6.3 Power On Check

#### 6.3.1 Power On Check

- 1) Check device case for damage.
- 2) Check whether the device is properly grounding.
- 3) Check whether the power supply is connected correctly.
- 4) Check whether the power input voltage meets the requirements, before the device is powered
- 5) On, check whether the voltage of the external power supply terminal is normal.
- 6) When the power is turned on, the power indicator will light on.
- 7) When the device is powered up, all port LEDs will remain on for 1 second and then

- 8) extinguished.
- 9) When the device works properly, RUN indicator light on, ALARM indicator light off and PWR1 PWR2 indicator light on.

### 6.3.2 Fast Ethernet Interface Inspection

When the fast ethernet interface of the switch is connected to an external device by a network cable, the LED of the port should be lit. If it does not light, the port is not connected. You can ping through the port of the switch and do not lose packets, In the process of sending and receiving messages, port LED lights should be flashing. When the switch is not connected to the electrical network cable or the device is not working properly, LED lights off.

### 6.3.3 Optical Port Inspection

When the optical port of the switch connects with the optical port of the external device, pay attention to the TX and RX of the optical port. The same as the fast Ethernet interface, when the optical port has established a connection, LED should always light, you can use the Ping command to inspect the connectivity.

## 7 Maintenance

### 7.1 Working Environment

- 1) During the operation, the indoor temperature : -40°C~85°C, Relative humidity: 5% to
- 2) 95% (no frost), pay attention to the dust.
- 3) The device power supply should be stable.
- 4) Cabinet should be locked.

### 7.2 Inspection Methods

- 1) Inspect normally, Detect alarm information in the monitoring system and pay attention to clear flashing, ,check whether the Switch Ethernet and optical fiber communication are normal by the alarm information.
- 2) During the normal operation of the device, check whether the switch power indicator is normal and the indicator lights should be flashing normally.
- 3) Inspect equipment, switch power, communication circuits and device appearance, sense the
- 4) temperature of the device surface, Pay attention to Whether the device smells unusual
- 5) smell,Whether the power supply has an abnormal sound.
- 6) Patrol once a week.

## 7.3 Maintenance Methods

- 1) Troubleshooting, causing abnormal communication, replacement of the whole machine.
- 2) The service life of the device is less than 10 years, trouble-free confirmation every year, especially the fiber port, the temperature is too high likely to cause damage to it.
- 3) Normal inspection (annual inspection, check), refer to PRS-7961B switch device debugging manual, check the parameter settings.

## 7.4 Attention

Enumeration of device anomalies during operation:

The switch becomes faulty, generally because port damaged or power supply damaged, determine whether the switch is faulty by information in the monitor system.

- 1) determine whether the port is faulty by ping command;
- 2) If all the LEDs lights off together, you can determine the switch problems.
- 3) The on and off periodically of all LEDs means abnormal of the switch.

# 8 Decommissioning and Disposal

## 8.1 Decommissioning

### 8.1.1 Turn Off The Power

Turn off the power: Disconnect the external power switch from the device.

### 8.1.2 Disconnect All Cables

Disconnect all cables connected to the device. (To avoid danger , make sure that the external power switch is disconnected, before disconnecting and connecting the DC cable to the power supply)

### 8.1.3 Remove From The Cabinet

After completing the above steps, loosen the fixing screw and remove the unit from the cabinet. (When other adjacent equipment is in operation, the safety distance between the removed device and other operating devices must be strictly confirmed, especially for an unskilled professional)

## 8.2 Disposal

When handling decommissioning equipment, follow the relevant regulations of the country where the product is used for disposal of electronic products. (We must strictly abide by the relevant regulations of the country where the product is used for the disposal of electronic products.)





## 9 Manual Version History

In the current version of the instruction manual, several descriptions on existing features have been modified.

**Table 8.2.1 Manual version and modification history records**

| Manual Version |      | Software Version | Date       | Description of change   |
|----------------|------|------------------|------------|---|
| Source         | New  |                  |            |   |
| Beta           | 1.00 | 1.00             | 2014-04-15 | Form the original manual.   |
| 1.00           | 1.01 | 1.01             | 2015-05-21 | Update the number of the binary inputs and binary outputs..<br>Add the binary input hardware demo diagrams in the binary input tables.<br>Update the description of IEC61850 dual-MMS Ethernet. |
| 1.01           | 1.02 | 1.02             | 2016-08-16 | Update the communication description.<br>Update the mechanical specifications.<br>Update the main CPU module picture.<br>Update the setting list.   |
| 1.03           | 2.01 | 2.01             | 2017-12-16 | Update all the document format.   |