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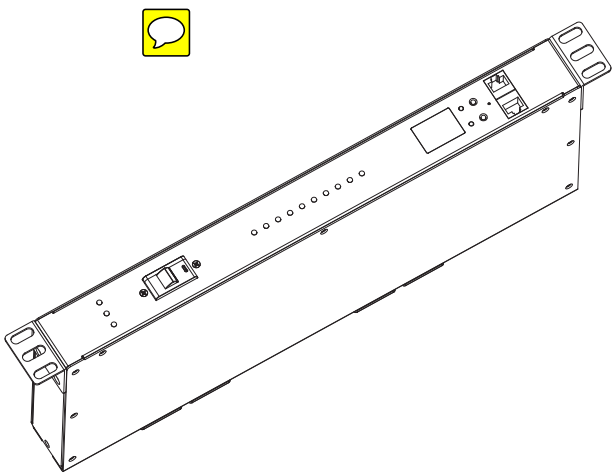
USA/CA Single-Phase
Cab-LS16-EIW1-MG6H4
User Manual



1. Overview

The PDU remote monitoring and management power distribution system is the latest scientific research achievement launched in 2025 in the field of power distribution technology. This product, based on the development trend of international power distribution monitoring and management technology and combining the technical and marke t demands of data center applications, adopts the latest core technol ogy with completely independent intellectual property rights, integrati ng serial communication, monitoring and control, and power distribut ion technologies, and is a carefully designed standard-level remote m onitoring and management power distributor.

2. Key Features

- **Basic Features:** LCD display, dual RS485 serial ports, self-organizing network with 10-unit cascading capability.
- **Input Monitoring:** Monitor phase/circuit load current, voltage, frequency, power factor, apparent power, active power, energy, and custom alarms; circuit breaker status monitoring.
- **Output Monitoring:** Output bit current, voltage, power factor, active power, energy metering, energy reset, and custom threshold alarms; output bit switch control, 1-second delay switch for power-up/down sequence, switch status power-up recovery.
- **System Management:** Buzzer control, screen backlight; supports serial port upgrade tool for firmware updates on master and execution boards; factory reset, device diagnostics.

3. Monitoring Method

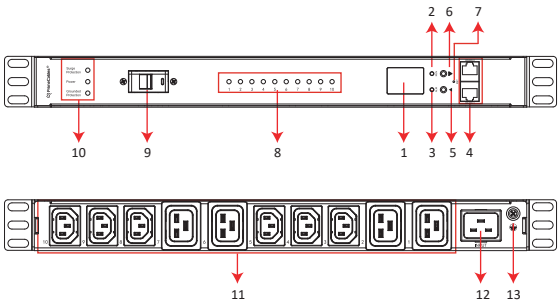
Realize centralized monitoring, control and management of equipment through MODBUS-RTU serial communication method.

4. Application

PDU is suitable for professional supporting of various network cabinets, server cabinets and other equipment in data centers of industries such as network communication, telecom and power, finance and insurance, aerospace, information processing, education and medical care, e-government, transportation, enterprise management, etc.

Applicable to 100V AC~240V AC single-phase AC, with a maximum output load current of 16A per phase, meeting the different needs of customers from various countries and regions; the output unit can be configured with the number of output units and the type of output sockets as needed.

5. Functional Module Description



1. **Display Screen**: Digital tube display
2. **RUN**: Running indicator
3. **ALM**: Fault/Alarm indicator
4. **RS-485 1/2**: Communication/Cascading port
5. **▲**: Page Up key
6. **▼**: Page Down key
7. **RESET**: Reset button
8. **1-10 Indicators**: Output switch status
9. **Hydraulic Magnetic Circuit Breaker**
10. **Surge Protection Module Indicators**:
    - **Surge Protection**: Lightning protection indicator
    - **Power**: Power indicator
    - **Grounded Protection**: Grounding indicator
11. **Output Modules**: C13 + C19 sockets
12. **Input**: C20 socket
13. **Grounding Screw**

6. RS485 Interface - RJ45 Terminal Pin Description

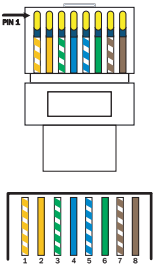


Figure 6-1

No.	Color	PIN Destription	Function
1	Orange-White	RS485-A+	Device Cascading
2	Orange	RS485-B-	
3	Green-White		
4	Blue	RS485-A+	MODBUS Communication
5	Blue-White	RS485-B-	
6	Green	GND	GND
7	Brown-White		
8	Brown		

7. Installation Method

The PDU is designed for rack-mounted horizontal installation to maximize space utilization and facilitate integration into existing server racks or cabinets. The installation process should be simple and easy to reduce the user's installation and maintenance costs. At the same time, the product should be designed with a good heat dissipation system to ensure good performance during long-term operation.

8. Hardware Description

8.1. Panel Function Introduction

RUN: Operation indicator light (Flashes at 1-second intervals);
ALM: Alarm indicator light (Overvoltage or overcurrent is always on);

RESET: Reset Button;

RS-485 1: Serial port (RS-485 cascading communication interface);

RS-485 2: Cascading port (RS-485 cascading communication interface);

▲: Display the previous page;

▼: Display the next page.

8.1.1. **Power-On Self-Test**

Power-on self-test, the buzzer beeps and the LED lights up. The RUN operation indicator light flashes, the product enters the normal working mode, and the screen displays the total current and total voltage by default.

8.2. **Screen Display**

8.2.1. **AC Single-Phase Single-Circuit Functional Display**

Screen 1: Current (0.0A) and Voltage (120V) (Figure 1);

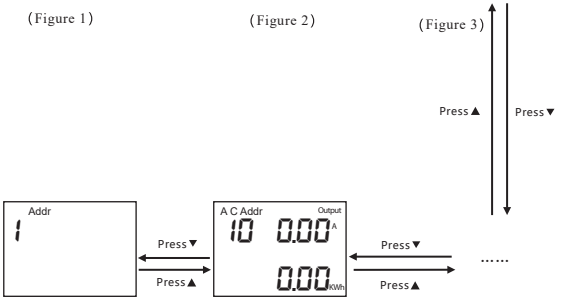
Screen 2: Power (0.0kW) and Energy (0.0kWh) (Figure 2);

Screen 3: Output Port 1 Power (0.0kW) and Energy (0.0kWh) (Figure 3);

Screens 4-12: Output Ports 2-10 Power (0.0kW) and Energy (0.0kWh) (Figure 4);

Screen 13: Device MODBUS Address (Figure 5).

(Figure 1) (Figure 2) (Figure 3)



(Figure 5) (Figure 4)

9. Communication Protocol

9.1. Protocol Description

- Reference Standard: Universal Modbus-RTU protocol;
- Underlying Protocol: RS-485;
- Physical Interface: The serial communication port adopts two-wire RS-485;
- Transmission Mode: Asynchronous, half-duplex mode, transmitting the least significant bit first.

Note: To ensure normal communication, the interval time of Modbus communication commands is recommended to be more than 1000ms.

9.1.1. Port Settings

接口	参数
Modbus-RTU	Baud Rate: 9600bps 14400bps 19200bps 38400bps 56000bps 57600bps 115200bps (Default) Data Bits: 8 Stop Bits: 1 Parity: None Flow Control: None

9.1.2. Protocol Rules

- All Modbus loop communications shall follow the master/slave mode. In this mode, information and data are transmitted between a single master and up to 127 slave monitoring devices. The broadcast address is 0, and the slave addresses are 1~127;
- Only after the master sends an instruction to the slave can the slave return data or execute the command, and only one slave responds to the master's

request at any time;

- The data packet sent by the master is called a request, and the data packet sent by the slave is called a response;
- The standard Modbus stipulates that the maximum range of each storage area is 65525, which is two bytes;
- The Modbus byte order is "big-Endian" to represent addresses and data items, which means that when multiple bytes are sent, the most significant bit is sent first. For example: a 16-bit register value is 0x12AB, the register value sending order is: high byte = 0x12; low byte = 0xAB. (0x12 0xAB)

9.1.3. **Modbus-RTU Communication Frame Structure**

Slave Machine Address (1 byte)	Function code (1 byte)	Data (2 * N bytes)	CRC Check (2 bytes)

- The low byte of the CRC check code comes first, followed by the high byte.

9.1.4. **Function Codes**

Function Code	**Name**	**Description**
0x01	Read Coils	Read one or multiple bits (Bit). Note: Coils can be understood as Bits.
0x03	Read Registers	Read two or more bytes (Byte). Note: Registers can be understood as 2 Bytes.
0x10	Write Multiple Registers	Write two or more bytes (Byte).
0x0F	Write Multiple Coils	Write one or multiple bits (Bit).

Note: Only the above 4 function codes are used in this protocol, others are not supported.

9.1.5. **Exception Codes**

Exception Code	Name	Description
0x01	Illegal Function Code	Indicates that the server does not understand or cannot process the function code in the request. Usually means the slave device does not support this function code.
0x02	Illegal Data Address	Indicates that the data address contained in the request is not within the authorized address range of the slave device, so the requested address is invalid.
0x03	Illegal Data Value	Indicates that the data value contained in the request is not within the allowable value range of the slave device, so the data value is invalid.
0x04	Server Failure	Indicates that the server has encountered an irreparable failure when executing the requested operation and cannot continue the operation.
0x05	Acknowledgment	Indicates that the server has received the request but needs more time to complete the operation. The client should wait for the server to complete the processing.
0x06	Server Busy	Indicates that the server is busy processing other commands, and the client should resend the request later.
0x0A	Gateway Failure	Indicates that the path of the gateway or router is invalid, which may be due to gateway overload or incorrect configuration.
0x0B	Gateway Target Device No Response	Indicates that the target slave device cannot be found in the network.

Notes:

1. The biggest difference between normal response and abnormal response starts from the function code. The function code of abnormal response is: normal function code + 0x80, followed by an exception code occupying 1 byte;
2. This protocol only returns 0x02 exception code when detecting exceptions, others are not supported.

9.2. **Serial Communication Cable**

As shown in Figure 6-1 in Chapter 6, the 4th and 5th wires are Modbus-RTU interfaces.

9.3. **Protocol Examples**

Modbus-RTU Communication Examples

9.3.1. **03H Read One or Multiple Word Registers Function Code Format**

Request Command:

Slave Machine Address (1 byte)	Function code (1 byte)	Starting Register Address (2 bytes)	Number of items read: N (2 bytes)	CRC Check (2 bytes)

Note: A data packet can read at least 1 register and up to 125 registers.

Response Command:

Slave Machine Address (1 byte)	Function code (1 byte)	Response Data Byte Count: 2 * N (2 bytes)	Data (2 * N bytes)	CRC Check (2 bytes)

Example:

Request: 01 03 1000 0004 C940

Function Code: 0x01;

Starting Register Address: 0x1000;

Number of Registers to Read: 0x0004

Return: 01 01 08 48 50 44 55 00 00 00 00 8242

Function Code: 0x01;

Response Data Byte Count: 0x08;

Returned Data: 48 50 44 55 00 00 00 00

Exception: 01 83 01 FO80

Function Code: 0x83 = 0x03 + 0x80;

Exception Code: 01

9.3.2. **10H Write One or Multiple Word Registers Function Code Format**

Send Command:

Slave Machine Address (1 byte)	Function code (1 byte)	Starting Register Address (2 bytes)	Number of Registers: N (2 bytes)	Number of bytes: 2 * N (1 byte)	Data (2N bytes)	CRC Check (2 bytes)

Response Command (This command may not be returned when sending a write command):

Slave Machine Address (1 byte)	Function code (1 byte)	Starting Register Address (2 bytes)	Number of Registers: N (2 bytes)	CRC Check (2 bytes)

Note: A data packet can write at least 1 register and up to 123 registers.

Example:

Send: 01 10 5000 0002 04 0001 0002 ADDF

Function Code: 0x10;

Register Address: 0x5000;

Number of Registers: 0x0002;

Number of Sent Bytes: 0x04;

Data: 0x0001 0x0002

Response: 01 10 5000 0002 C850

Function Code: 0x10;

Register Address: 0x5000;

Number of Registers: 0x0002

Exception: 01 83 01 FO80

Function Code: 0x83 = 0x03 + 0x80;

Exception Code: 01

9.3.3. **01H Read One or Multiple Bit Coils Function Code Format**

Request Command:

Slave Machine Address (1 byte)	Function code (1 byte)	Starting Coil Address (2 bytes)	Number of items read (2 bytes)	CRC Check (2 bytes)

Response Command:

Slave Machine Address (1 byte)	Function code (1 byte)	Number of response data (2 bytes)	Data (N bytes)	CRC Check (2 bytes)

Note: A data packet can write at least 1 register and up to 123 registers.

Example:

Request: 01 01 6000 000C 0F22

Function Code: 0x01;

Starting Coil Address: 0x6000;

Number of Outputs: 0x000C

Return: 01 01 02 FF 03 0DB8

Function Code: 0x01;

Byte Count: 0x02

One byte has 8 bits. To know 12 states, 2 bytes are needed, and the remaining high bits are filled with zeros.

Exception: 01 81 01 9081

Function Code: 0x81 = 0x01 + 0x80;

Exception Code: 01

9.3.4. **0FH Write One or Multiple Bit Coils Function Code Format**

Send Command:

Slave Machine Address (1 byte)	Function code (1 byte)	Starting Coil Address (2 bytes)	Number of Coils: N (2 bytes)	Number of bytes: N (1 byte)	Data (M byte)	CRC Check (2 bytes)

Note: A data packet can write at least 1 register and up to 123 registers; when N/8 is divisible, M=N/8; when N/8 is not divisible, M = (N/8) + 1.

Response Command:

Slave Machine Address (1 byte)	Function code (1 byte)	Starting Coil Address (2 bytes)	Number of Coils: N (2 bytes)	CRC Check (2 bytes)

Example:

Send: 01 0F 6000 000C 02 0F FF 6B92

Function Code: 0x0F;

Coil Address: 0x6000;

Number of Coils: 0x000C;

Number of Sent Bytes: 0x02;

Data: 0x0F 0xFF

Response: 01 0F 6000 000C C850

Function Code: 0x10;

Coil Address: 0x5000;

Number of Coils: 0x000C

Exception: 01 8F 01 FO85

Function Code: 0x8F = 0x0F + 0x80;

Exception Code: 01

9.4. **Register Description**

Please refer to the document "MODBUS Agreement.docx".

https://1drv.ms/w/c/79ea87c0841cad18/EST0Er3KmftJh3VWYiCZ2PEB3JMjJjSDa_FAsd3PN8ZYBA?e=czSakI

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