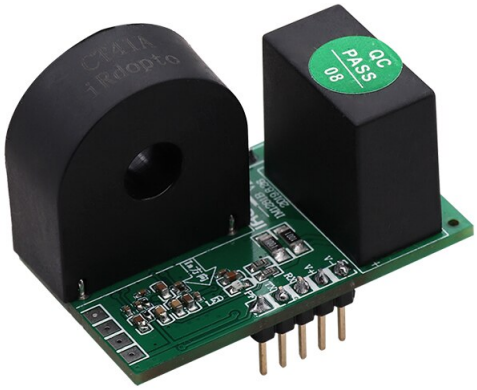

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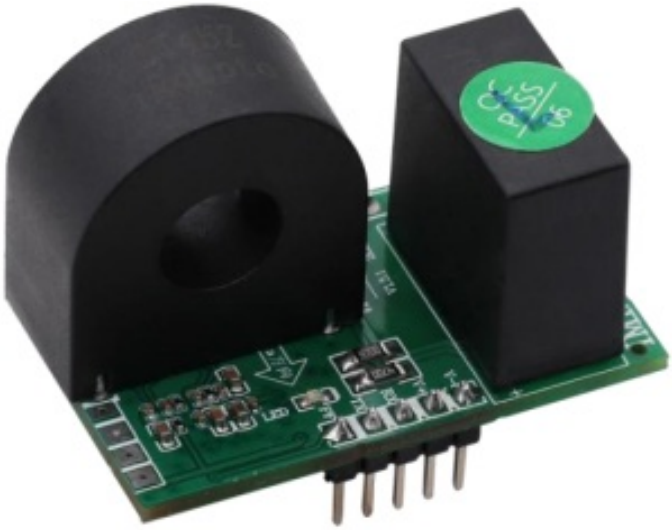
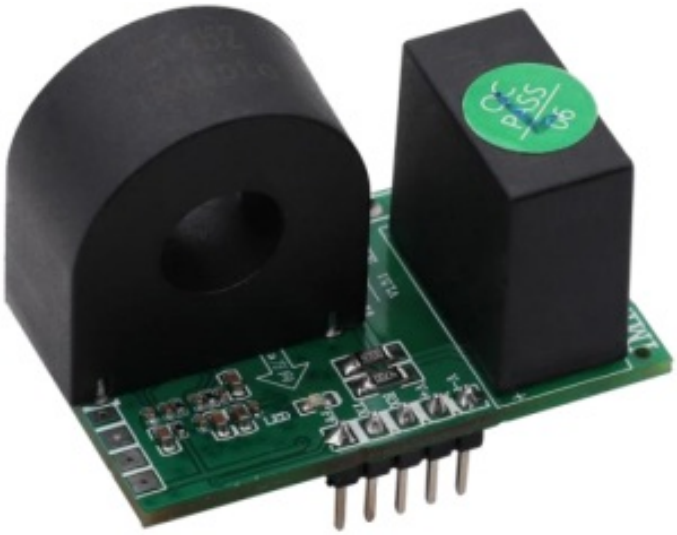


Contents

Overview



The IM1281B single-phase AC electricity metering module is developed in order to adapt to various manufacturers to monitor the power consumption of their products; it is also an suitable module for AC charging pile, street lamp, computer room, base station to save energy and monitor. The accuracy is better than the national level 1 standard;

The module uses an industrial-grade dedicated electricity metering SOC chip, and the voltage and current are fully isolated for sampling. It has the function of Higher integration and better reliability. The module is small in size, easy to integrate and embed into various systems.

Introduction

- A single module can collect single-phase AC parameters, including voltage, current, power, power factor, frequency, electric energy, temperature etc.
- It adopts industrial-grade dedicated electricity metering SOC chip with high measurement accuracy.
- The communication protocol adopts the general standard DL/T 645-2007 and the standard Modbus-RTU protocol (choose one of the two), which has good compatibility and is more convenient for communication and development.
- Data protection against power failure.
- The power storage is large. It can be turned over to restart the measurement while it is full.

- The product has obtained RoHS , CE , and test report of Metrology Institute.
- It meets the relevant measurement requirements in “JJG1148-2018 Electric Vehicle AC Charging Pile Measurement Verification Regulations”.
- It meets the relevant measurement requirements in “QZTT2301.4-2018 Base Station Intelligent Motion Monitoring
  Unit (FSU) Technical Requirements Part 4: Micro-Station Type”.

Application

The IM series AC and DC metering modules have been widely used in AC and DC charging piles, smart homes, dynamic environment monitoring FSU, smart security, lighting monitoring, smart parks, digital computer rooms, energy consumption management, battery monitoring etc. And it has been adopted and recognized by benchmarking companies in different industries. It is important supporting modules for entering the Internet of Things era.

Notes

- Please refer to the corresponding diagram for correct wiring according to product specifications and models. Be sure to disconnect all signal sources before wiring to avoid danger and damage to the device. After checking that the wiring is correct, turn on the power to test.
- After it is powered, the red LED indicator is always on, and during communication, the red LED indicator flashes
  synchronously during transmission.
- It is set to the default configuration: address No. 1, baud rate 4800bps, data format “n,8,1”.It can be reset through the IM-S11 software.

Parameter

Parameter	
Active Accuracy	1.0
Voltage Range	1-380V ±0.5%F.S
Current Range	10mA-50A ±0.5%F.S
Current Range Expansion	Extensible Range Customized

Frequency	AC45~65Hz
Temp.	Chip Temp.
Min. Power Variable	0.0001kW
Power Factor	Measurable
Min. Electric Power Variable	0.001kWh
Co^2	National standard formula calculation
Communication	
Interface Type	Uart Port TTL
Communication Protocol	DL/T 645-2007 & MODBUS-RTU

Data Format	“n,8,1”(No check data bits: 8 stop bit :1) by default
Baud rate	2400bps-19200bps 4800bps by default
Data refresh interval	≥250ms
Indicator	Power/Communication Red
Performance	

Typical Power Consumption	≤10mA
Power Supply	DC5.0V
Voltage Level	AC3000Vrms
Overload Capacity	1.2 * Range
Working Environment	
Working Temp.	-40 +80℃
Relative humidity	5 95% No dense under 40℃
Altitude	0 3000 m
Working Environment	place which there is no explosion, corrosive gas and conductive dust, no signi ficant vibration and impact
Dimension	
Dimension	43.4mmx 25.8mmx 28mm
Installation	2.54 pitch pin installation

Definition of Module Pin

Pin	Function
V-	Power Supply Ground
V+	Power Supply Positive
Notes The Voltage is the power supply voltage for the module, which generally consumes power with the MCU .5V by default.3.3V power supply is available when short-circuiting the K1 point of the module. At this time, the r everse connection protection function is invalid. Ensure correct wiring or it wil directly burn out.	
RX	UART TTL receive for external TX
TX	UART TTL send for external RX
PF	Pulse output pin for detecting energy accuracy (can be idle if there is no need)
UL	For fire line
UN	For zero line

Modbus Communication Protocol

Modbus Protocol Electric Parameter Register List 4 bytes per address, high byte first

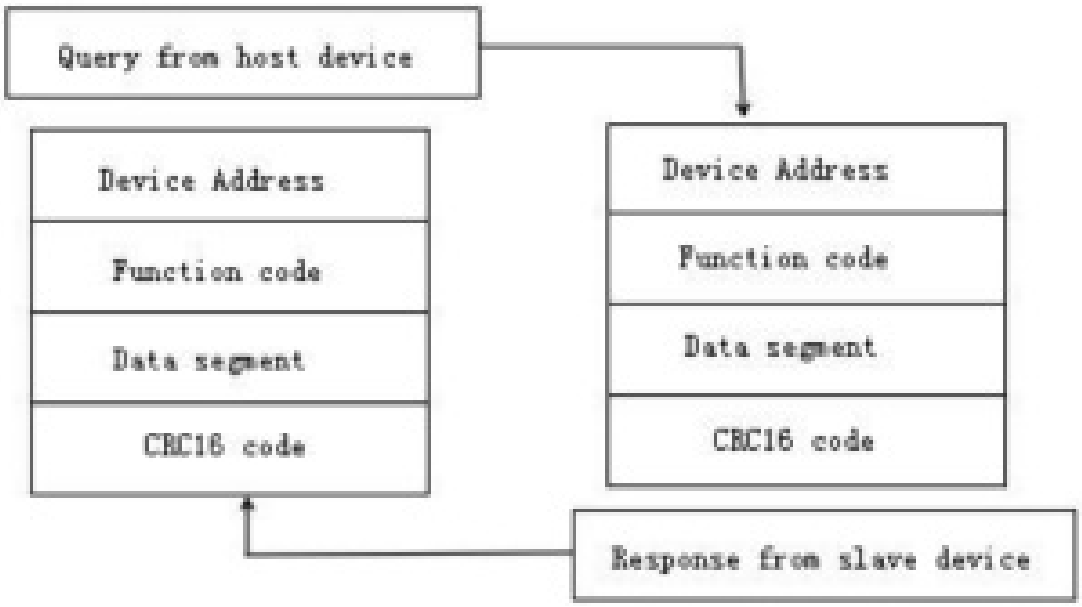
Serial No.	Items	Address	Length	Read/Write	Type and explanation
1	Voltage	0048H	4	Read	16 Unsigned numbers Unit 0.0001V Actual Value= HEX2DEC(Register Value) x Unit
2	Current	0049H	4	Read	16 Unsigned numbers Unit 0.0001A
3	Active	004AH	4	Read	16 Unsigned numbers Unit 0.0001W
4	Active Electric Energy	004BH	4	Read/Write 0	16 Unsigned numbers Unit 0.0001KWh
5	Power Factor	004CH	4	Read	16 Unsigned numbers Unit 0.001
6	Co2 Emission	004DH	4	Read	16 Unsigned numbers Unit 0.0001Kg
7	Temp.	004EH	4	Read	16 Unsigned numbers Unit 0.01℃
8	Frequency	004FH	4	Read	16 Unsigned numbers Unit 0.01Hz

21	Address Baud rate s	0004H	2	Read/Write	16 Default Value 0105H (Address 01H 8,N,1,4800) Default Address 1 High Bytes presents Address range 1~255 0 is Broad cast Address. Low Bytes High 2 bits data format (00: 10 bits data “8,N,1″) No check 1 end bit (01: 11 bits data “8,E,1″) Even Parity Check 1 end bit (10: 11 bits data “8,O,1″) Odd Parity Check 1 end bit Low Bytes Low 4 bits present Baud rates (3 1200bps 4 2400bps) (5 4800bps 6 9600bps) (7 19200bps

Modbus Communication Protocol

This instrument provides Uart TTL communication interface, which adopts standard Modbus-RTU protocol. All kinds of data information can be transmitted on the communication line. Each network instrument can set its communication address. And the communication connection should use shielded twisted-pair wire with copper net, whose diameter is no less than 0.5mm2. When wiring, keep the communication line away from strong electric cables or other strong electric field Environment.

Modbus protocol response data flow



The Modbus protocol uses a master-slave response communication connection method on a communication line. First, the signal of the host computer is addressed to a terminal device (slave) with a unique Address, and then the response signal sent by the terminal device is transmitted to the host in the opposite direction, that is: All communication data streams are transmitted in the opposite two directions along a communication line (half-duplex Working mode). The Modbus protocol only allows communication between the host (PC, PLC, etc.) and terminal devices, and does not allow data exchange between independent terminal devices, so that each terminal device will not occupy the communication line when they are initialized, but is limited to response Inquiry signal to the machine.

Host device query: The query message frame includes the device address, function code, data information code, and check code. The address code indicates the slave device to be selected; the function code tells the selected slave device what function to be performed, for example, the function code 03 or 04 requires the slave device to Read registers and return their contents; the data segment contains the slave device's requirements for any additional information of the execution function, the check code is used to check the correctness of a frame of information. The slave device provides a method to verify whether the message content is correct. It uses the CRC16 calibration rule.

Slave device response: If the slave device generates a normal response, the response message contains the address code, function code, data information code and CRC16 check code. The data information code includes the data collected from the device: such as register value or status. If an error occurs, we agree that the slave device will not respond.

We stipulate the communication data format used in this instrument: the bits of each byte (1 start bit, 8 data bits, Odd Parity Check or Even Parity Check or No check, 1 or 2 stop bits).

The structure of the data frame, that is, the message format:

Address	Function code	Data segment	CRC16 check code
1 byte	1 byte	N bytes	2 bytes(Low Byte first)

Device Address: Consists of one byte. The Address of each terminal device must be unique, and only the addressed
terminal will respond to the corresponding query.

Function code: tells what function the addressed terminal performs. The following table lists the function codes supported by this series of instruments and their functions.

Function Code	**Function**
03H	Read one or more register value
10H	Write one or more register value

Data segment: Contains the data required by the terminal to perform a specific function or the data collected when the
terminal responds to a query. The content of these data may be numerical values, reference addresses, or set values.

Check code: CRC16 occupies two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmitting device and then appended to the data frame. The receiving device recalculates the CRC value when receiving the data, and then compares it with the value in the received CRC field. If the two values are not equal, mistake will happens Process of generating a CRC16

1. Preset a 16-bit register as 0FFFFH (all 1s), which is called CRC register.

2. XOR the 8 bits of the first byte in the data frame with the low byte in the CRC register, and store the result back to the
   CRC register.
3. Shift the CRC register one bit to the right, fill the highest bit with 0, and shift the lowest bit out and check.
4. If the lowest bit is 0: repeat the third step (the next shift); if the lowest bit is 1: XOR the CRC register with a preset fixed
   value (0A001H).
5. Repeat the third and fourth steps until 8 shifts. A complete eight bits have been processed in this way.
6. Repeat steps 2 to 5 to process the next eight bits until all bytes are processed.
7. The final value of the CRC register is the value of CRC16.

Modbus RTU Communication Protocol cases

Function code 0x03 Read multi-port register

E.g The host device needs to read Address as 01, and start sending data from the 2 slave registers with Address as 0048H:

1	3	00 48	00 02	CRC		
Address	Function Code	Start Address	Length	CRC Code		
Slave device responds	1	3	8	HH HH	HH HH	CRC
	Address	Function Code	Return Bytes No.	Register Data 1	Register Data 2	CRC Code

Function code 0x10 Write multi-port Register

E.g The host device need save 0000,0000 to the slave Register whose Address is 000C,000D (the address code of the slave is 0x01)

Host Device send 01:	10	00 0C	00 02	4	00 00	00 00	F3 FA
Address	Function code	Start Address	Write Register Number	Bytes numbers	Data 1	Data 2	CRC code
Slave Device responds 01:	10	00 0C	00 02	81 CB			
Address	Function code	Start Address	Write Register Number	CRC code			

Notes: When setting parameters, do not write illegal data (that is, the data value that exceeds the limit of the data range);

Communication Messages Case

1. Read Data Register (Function code 03H) Read 8 Register value which starts with 48H Host device Read Data frame 01 03 00 48 00 08 C4

Address	Command	Start Address (High bytes first)	Register value (High bytes first)	Check code (Low bytes first)
01H	03H	00H,48H	00H,08H	C4H,1AH

Instrument responds Data frame 01 03 20 00 21 8D D8 00 01 38 75 01 0C 63 08 00 00 00 5A 00 00 03 E8 00 00 00 59 00 00 0C CB 00 00 13 88 1B C2

It is

Address 01

Voltage 219.9000V

Current 7.9989A

Power 1758.9000W

Electric Energy 0.0090kWh

Power Factor 1.000 Co2

0.0089Kg

Frequency 50.00Hz

E.g Voltage actual value= HEX2DEC(00 21 8D D8) Hexadecimal to Decimal x 0.0001V Unit = 219.9000V

Address	**Command**	**Data Length**	**Data (4 bytes/32 bytes),hexadecimal**	**Check code**
01H	03H	20H	00 21 8D D8 00 01 38 75 01 0C 63 08 00 00 005A 00 00 03 E8 00 00 00 59 00 00 0C CB 00 00 1388	1BH,C2H

2. Write Data Register (Function code 10H):

Clear Host device Write Data frame 01 10 00 4B 00 02

Address	**Command**	**Start Address**	**Register Value**	**Bytes**	**Data**	**Check code**
01H	10H	00H,4BH	00H,02H	04H	00H,00H,00H,00H	B6H,2CH

Instrument responds Data frame 01 10 00 4B 00 02 2B F0

Address	Command	Start Address	Register value	Check code
01H	10H	00H,4BH	00H,02H	2BH,F0H

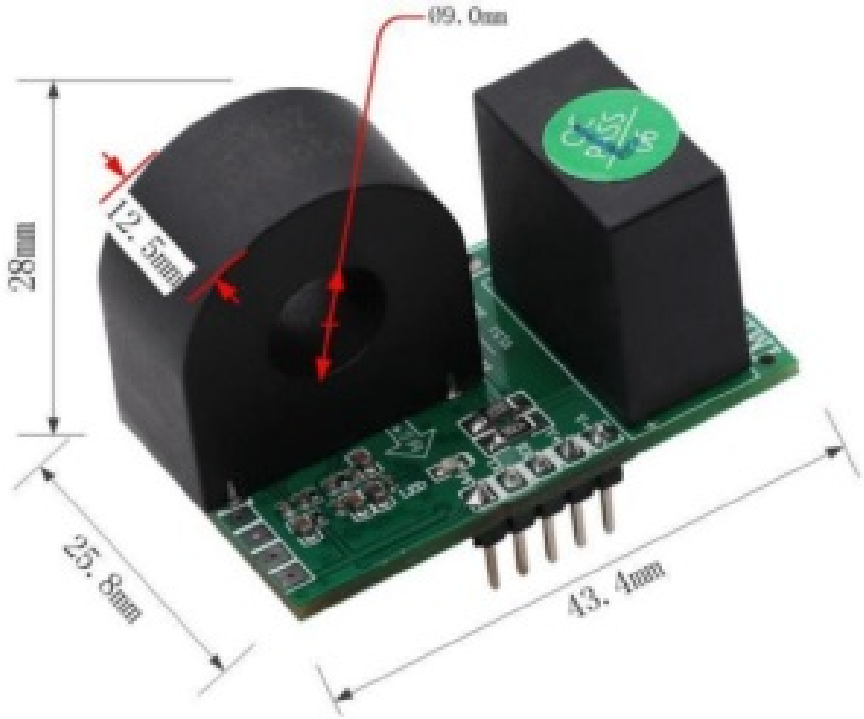
DL/T 645-2007 electricity meter Communication Protocol

The DL/T645 protocol is an industry communication protocol for meter communication. If you are not familiar with it, it is not recommended.

645 protocol electric parameter Register List

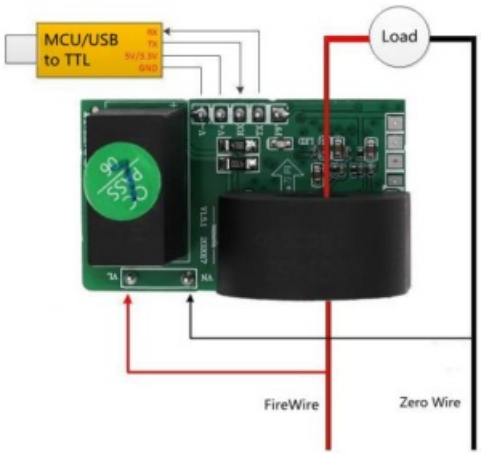
Serial No.	Definition	Register Address	Length	Read/Write	Data Type and explanation
1	Voltage	02010100	2	Read	XXX.X Unit 0.1V
2	Current	02020100	3	Read	XXX.XXX Unit 0.001A
3	Active Power	02030000	3	Read	XX.XXXX Unit 0.0001kW
4	Active Total Power	00000000	4	Read/Write 0	XXXXXX.XX Unit 0.01KWh
5	Extended total power	80800001	4	Read/Write 0	16 Unsigned numbers Unit 0.001KWh
6	Power Factor	02060000	2	Read	X.XXX Unit 0.001
7	Temp.	02800007	2	Read	XXX.X Unit 0.1℃
8	Frequency	02800002	2	Read	XX.XX Unit 0.01Hz
9	Address	04000401	6	Read/Write	NNNNNNNNNNNN Default 111111111111
10	Baud rates	04000703	1	Read/Write	16 Unsigned numbers(04 1200bps 08 2400bps) (10 4800bps 20
					9600bps) (40 19200bps

Dimension



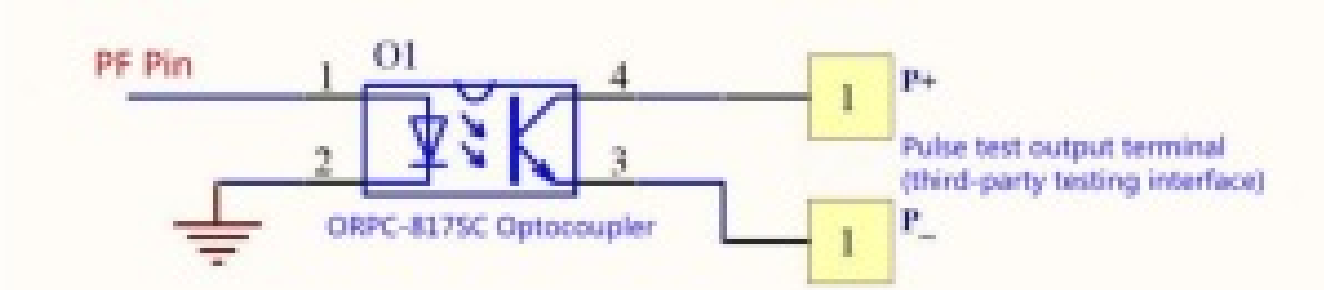
Wiring diagram

- **IM1281B Standard wiring diagram**

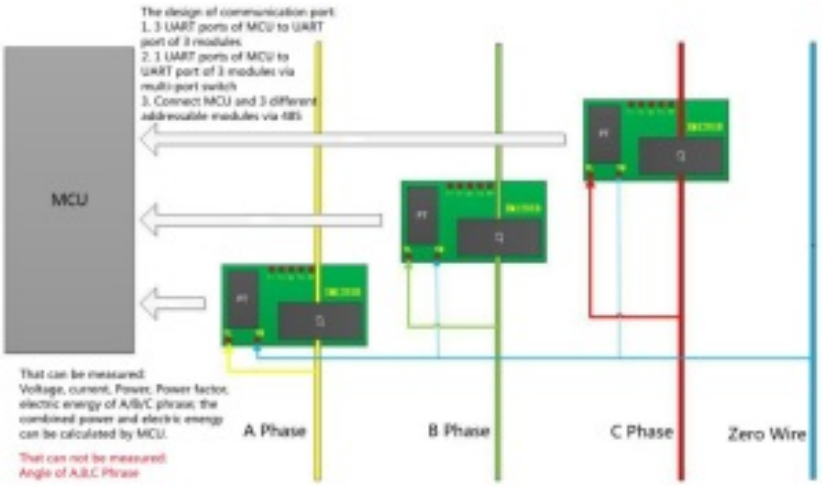


- **IM1281B Schematic diagram of pulse detection interface wiring**

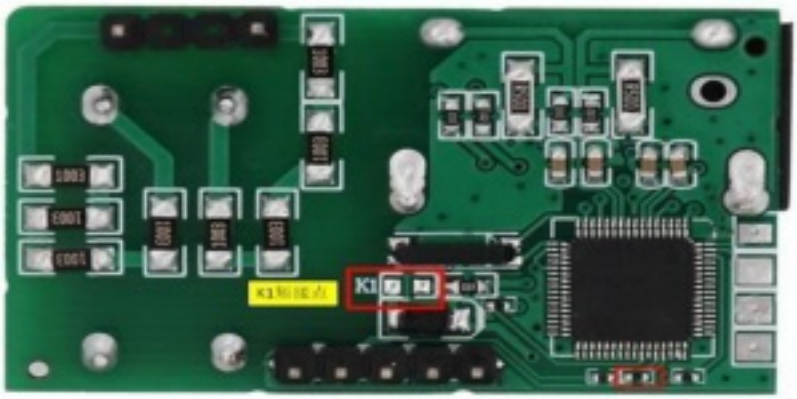
  Pulse Output detection Circuit



- **IM1281B Three-phase measurement application diagram**



- **IM1281B Typical Communication exception instructions and short-circuit point K1 indication diagram**



If the connection is correct, the communication indicator flashes, but the data does not return, please short-circuit this current-limiting resistor and then communicate.

Notes:

The reason for this exception is caused by the matching difference between different USB to TTL tools. If the actual use is direct communication between the module and the MCU, this situation does not exist.

Process requirements

- When welding this product, the highest welding Temp. 350℃, and the welding time ≤5 seconds
- This product contains quartz crystal, so ultrasonic cleaning is strictly prohibited.
- The surface of this product is sprayed with three-proof paint for protection, and it is strictly forbidden to clean the surface of the product

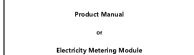
Precautions

- Please refer to the diagram for correct wiring according to the product specifications and models. Be sure to disconnect all signal sources and power before wiring to avoid danger and damage to the equipment. After checking that the wiring is correct, turn on the power to test.
- The voltage circuit or the secondary circuit of the PT cannot be short-circuited.
- When there is Current on the primary side of the CT, it is strictly forbidden to open the secondary circuit of the CT; it is strictly forbidden to connect live wires or unplug the terminals.
- When the product is used in an environment with strong electromagnetic interference, please pay attention to the

shielding of the input and output signal lines.

- For centralized installation, the Min. installation interval should not be less than 10mm.
- There is no lightning protection circuit in this series of products. When the input and output feeders of the module are exposed to the harsh outdoor environment, lightning protection is a must.

Documents / Resources

	global sources IM1281B Electricity Metering Module [pdf] User Manual IM1281B, Electricity Metering Module