F-PIC100 Power Meter User Manual

The user manual is suitable for the following model:

Model	Product Type
F-PIC100	

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Files Revised Record

Date	Version	Remark	Author
2018-07-16	V1.0		
2020-05-14	V1.0	Contents translation and layout	Zoe

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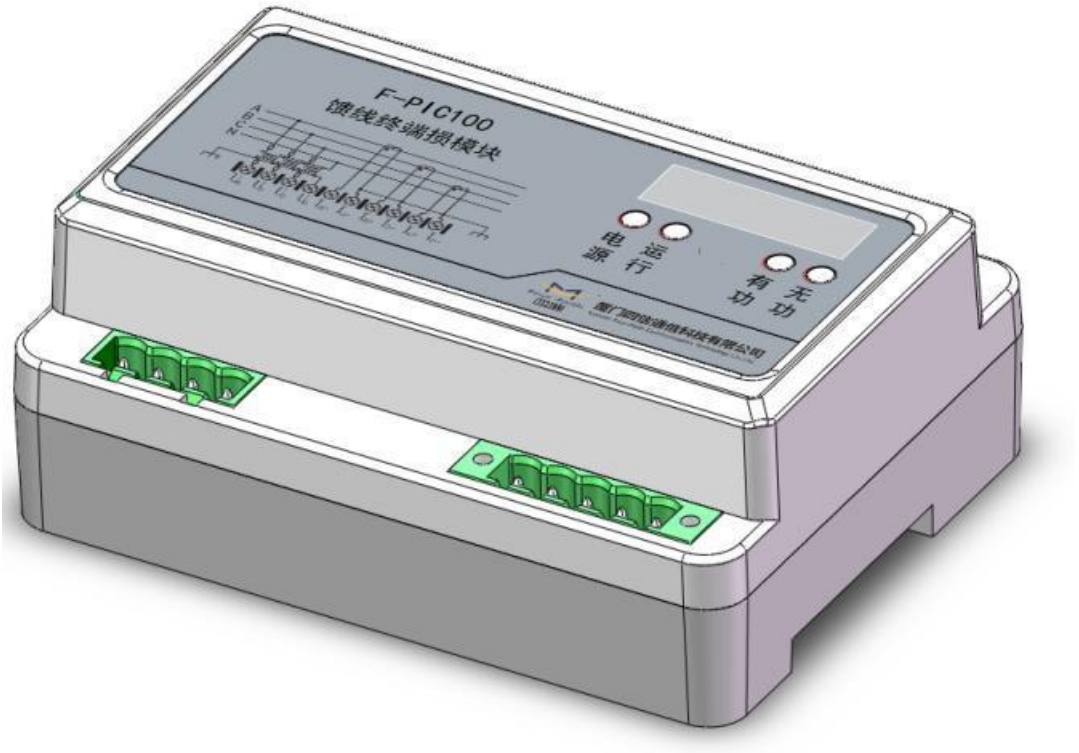

Note:Different types of accessories and interfaces may be different,please refer to the actual product.

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Content

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Chapter1 Introduction of Product

1.1 General

F-PIC100 power meter is a kind of 10kV distribution high voltage metering device which is based on voltage/current transformer and electromagnetic transformer. It is an important part of the line loss management system of 10KV distribution line, providing a solution for high-voltage energy measurement and real-time monitoring of equipment nodes such as segment point, branch point, switch devices on the column, ring main unit and so on. It integrates the functions of measurement, metering and communication, and supports RS232 or RS485 communication.

The active power measurement accuracy of the product conforms to the specification in GB/ t17215.322-2008 (Static active power meter: 0.5s); the passive power measurement accuracy of the product conforms to the specification in GB/ t17215.322-2008 (Static passive power meter : class 2) ; the communication complies with the DLT634.5101-2002.

1.2 Product Features

Design for Industrial Application

- High-powered industrial 32 bits CPU
- Embedded Real-Time Clock (RTC)
- Power range: DC 18~72V
- The internal power supply and the communication power supply all adopt the isolated power supply

Stability and Reliability

- Support WDT design, keep the system stable
- RS232/RS485 ports:15KV ESD protection
- Power port: reverse-voltage and over voltage protection.
- Outage detection and low voltage detection
- Built-in mini UPS can save important data in case of outage
- Conforms to the detection accuracy of the national standard
- Some of the ports adopt industrial pluggable terminal interface, which is especially suitable for industrial field application
- Support standard RS232/RS485 ports that can connect to serial devices directly
- Support intellectual mode, enter into communication state automatically when power is on
- Convenient configuration and maintenance interface

High-performance

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- Complete electrical parameter measurement function
- Measurement function of multi-type electrical energy data
- It can detect 2-ways voltage and 8-ways current at most
- A clock circuit with a temperature complement is provided
- Support automatic switching calendar, timing and leap year
- Support multiple measurement data freezing function
- Support multiple data storage
- Support SOE
- Support RS485/RS232 protocol
- Embed with the standard 101 protocol stack, support data transmission transparently

Standards Compliance

- Q/GDW-11-143 Communication protocol of power information acquisition and management system
- Q/GDW 514 Power distribution automation terminal/substation function specification
- DL/T 634.5101-2002 Statute implementation rules
- Insulation performance, vibration performance, anti-interference performance are all complied Q-GDW615-2011
- Immunity test of electrostatic discharge : Able to withstand class 4 test of GB/T 17626.2-2006
- Radio frequency electromagnetic radiation immunity test: Able to withstand class 4 test of GB/T 17626.3-2006
- Immunity test of fast transient pulse group disturbance : Able to withstand class 4 test of GB/T 17626.4-2008
- Surge (impact) immunity test: Able to withstand class 4 test of GB/T 17626.5-2008
- Damping oscillation wave immunity test: Able to withstand class 4 test of GB/T 17626.12
- Monitoring and protection of distribution transformers: Real-time monitoring and make statistics of line power consumption.

Application

- Metering monitoring of distribution lines: real-time monitoring and statistics of electricity consumption of distribution lines

1.3 Working principle

F-PIC100 power meter is mainly consists of current sampling unit, voltage sampling unit, MCU, internal storage unit, calendar clock unit, power and battery units, electrical pulse output interface and communication interface. The principle block diagram is shown in figure 1-2.

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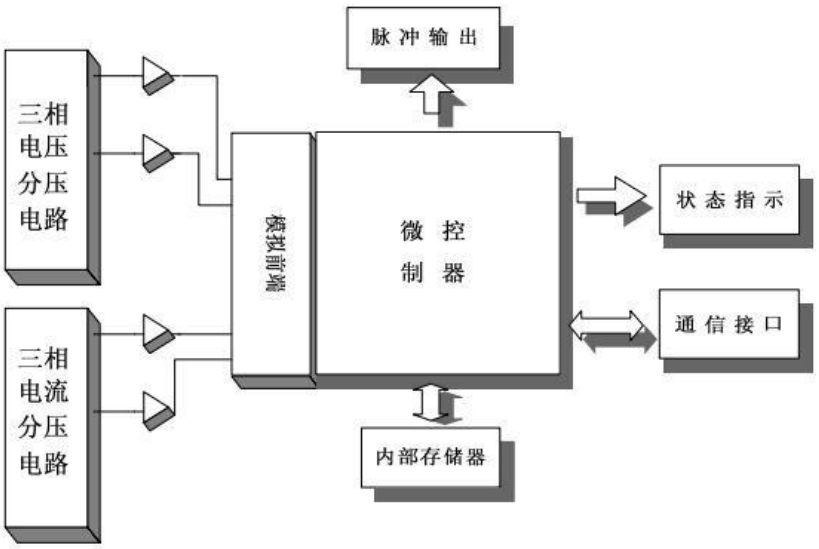

Figure 1-2

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Chapter2 Technical specification

2.1 Measurement and metering

Measurement and metering technical specification of F-PIC100 power meter, showing as table 2.1.

Table 2.1 Measurement and metering technical specification

Item		Specifications
Analog signal access way		Electromagnetic transformer
Voltage	Rated voltage	3X57.7/100V; 3X220V
	Measurement range	0.05UN~1.3UN
	Accuracy	RMS 0.2%
	Resolution	0.001V
Current	Ratio	In:1A; 5A
	Measurement range	0.005In~Imax
	Accuracy	RMS 0.2%
	Resolution	0.00001A
Power (Active power、reactive power、apparent power)	Accuracy	0.5%
	Resolution	0.001W/kVar/kVA
Frequency	Measurement range	45~55Hz
	Accuracy	0.5%
	Resolution	0.001Hz
Factor	Measurement range	0~1.000
	Accuracy	0.5%
	Resolution	0.001
Active power	Accuracy class	0.5S
	Resolution	0.001kWh
Reactive power	Accuracy class	2
	Resolution	0.001kVar

2.2 Operating voltage and consumption

The operating power input is electrically isolated from the internal current, the specific parameters are shown in table 3.2

Table 3.2 Rated operating voltage and power consumption

Model	Rated input	Allowable deviation	Consumption
F-PIC100	DC48V/24V	Support DC18V~72V Ripple is less than 5%	<1W

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2.3 Measuring voltage and current

F-PIC100 power meter has a built-in electromagnetic transformer, the input voltage and current are isolated from the internal circuit, the specific parameters are shown in table 2.3.

Table 2.3 Input voltage and current

Item	Access way	Parameters
Current	Electromagnetic transformer	Reference current In:1A;5A
Voltage	Electromagnetic transformer	Three-phase four-line: Un:57.5V;220V
		Three-phase three-line Un:100V;220V

2.4 Constant of pulse output

The pulse constant are shown as table 2.4.

Table 2.4 Constant of pulse output

Voltage	Maximum current	Recommend constant imp/kWh、imp/kvarh
3X57.5V/100	1.2	100000
3X57.5V/100	6	20000
3X100	1.2	100000
3X100	6	20000
3X220	1.	30000
3X220	6	6400

2.5 Environmental conditions

2.5.1 Reference Temperature and relative humidity

Reference temperature is 23℃, relative humidity is 45%~75%.

2.5.2 Range of temperature and humidity

Temperature ‘s range of F-PIC100 power meter is shown as table3.5.

Table 3.5 Temperature’s range

Item	Range
Rated operating temperature’s range	-25℃~+60℃
Limit operating temperature’s range	-40℃~+70℃
Storage and transportation limit temperature’s range	-40℃~+70℃

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Humidity's range F-PIC100 power meter is shown as table 3.6.

Table 3.6 Relative humidity

Item	Range
Annual mean	<75%
30 days (These days are distributed naturally throughout the year)	95%
It happens on other days	85%

2.5.3 Atmospheric pressure

F-PIC100 power meter can work normally below the altitude of 4000 m(63.0kPa~106.0kPa). High altitude area require that it can work normally in the range of 4000m~4700m .

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Chapter3 Function description

3.1 Measuring function

F-PIC100 power meter has complete electric parameter measurement function, showing as below :

- Voltage value of each phase.
- Current value of each phase.
- Active power, reactive power and apparent power of each phase.
- The phase angle value of voltage and current in each phase.
- Power factor value of each phase.
- Power grid frequency and measurement range are 45~55Hz.

3.2 Metering Function

F-PIC100 power meter can meter multiple types of electrical energy data:

- Combination of active and reverse active electrical energy.
- Combination of reactive and reverse reactive electrical energy.
- Active and reverse active electric energy, combined reactive electric energy of each phase.

3.3 Clock

- F-PIC100 power meter has a clock circuit with a temperature supplement, clock signal with a frequency of 1Hz can be output at normal temperature.
- Clock has calendar, timing and leap year automatic switching function.
- It uses an environmentally friendly lithium battery as a backup power source for the clock, the backup power source for the clock does not need to be replaced during the life cycle of power meter, it can maintain the normal working time of internal clock for not less than 5 years after outage, the power meter will give an alarm when the battery voltage is low.
- The power meter can calibrate time by RS232 or RS485.

3.4 Freezing function

- Examination day freezing : It can store the bidirectional total energy data of 12 examination days.
- Timing freezing: Freeze the electrical energy data at the agreed time and time interval, each frozen amount can be stored for 60 times.
- Instantaneous freezing: It can save the data for the last 3 times.
- Daily freezing: It stores electrical energy at zero o'clock per day, and can store 62 days' data.
- The frozen contents and marks comply with DL/ t634.5101-2002 and its filing requirements.

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3.5 SOE

◆ Record the total number of changes of power flow's direction and power's direction, record information such as the moment of the last 10 changes of power flow's direction and power's direction and the corresponding electrical energy data.

◆ Record the total times of calibrating time(excluding broadcast calibration) and the moment of last 10 times of calibrating time.

◆ Permanently record the time and the electrical energy data when the power meter reset .

3.6 Communication function

F-PIC100 power meter has one interface of RS232 or RS485, it can be used for parameter setting and all kinds of data reading. Additional notes on communications are described in the communications section below.

3.7 Digital pulse output function

3.7.1 Pulse output of Electric Quantity

F-PIC100 power meter provide pulse output of active power and reactive power, and internal optocoupler isolation. Pulse output width is (80±20)ms, maximum allowable current is 10mA(DC), and operating voltage range is 5V~80V(DC). The schematic diagram of its internal circuit is shown in figure 3.1.

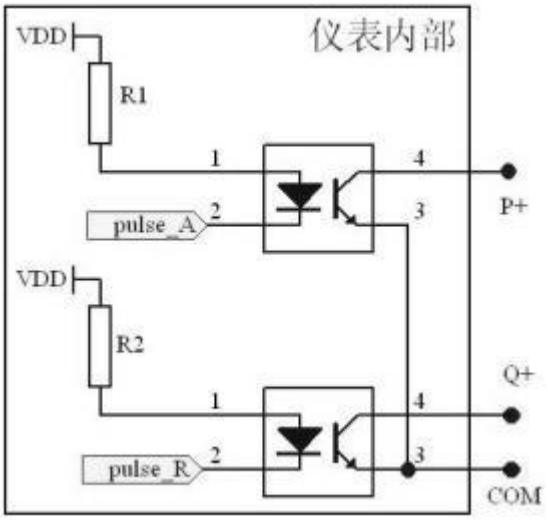

Figure 3.1 Schematic diagram of power pulse output interface circuit

3.7.2 Pulse output of second

The power meter provides pulse output and internal optical coupler isolation. The pulse duty ratio is 50%, the maximum allowable current is 10mA(DC), and the operating voltage range is 5V~80V(DC). The schematic diagram of the internal circuit is shown in figure 3.2 .

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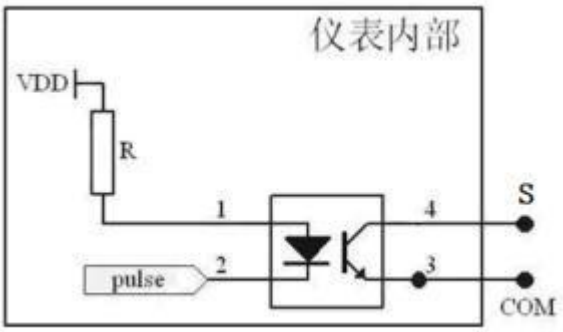

Figure 3.2 Circuit diagram of second pulse output interface

3.8 Indicator

F-PIC100 power meter provides power indicator, operation indicator, active pulse indicator and reactive pulse indicator , users can judge the status of the current module according to the indicator. The location and definition of the indicator are shown in figure 3.3.

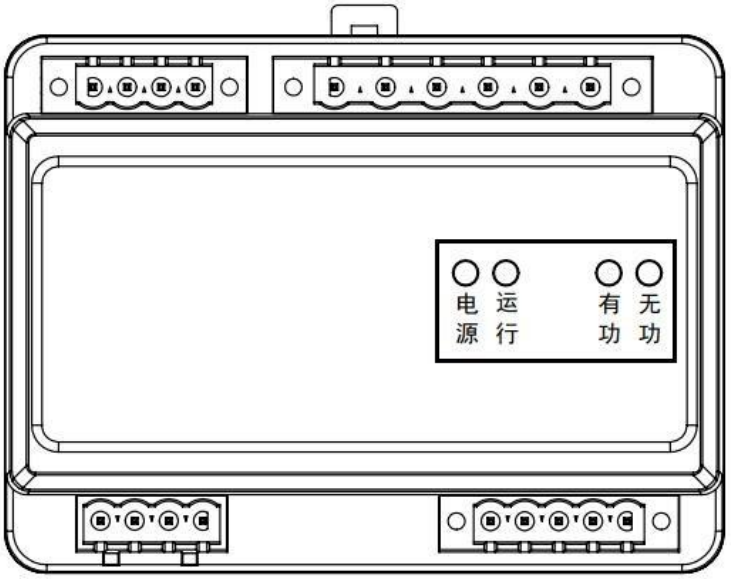

Figure 3.3 Location and definition of the indicator of F-PIC100 power meter

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Chapter4 Structure,installation, and interface definitions

4.1 Installation notes

- Equipment must be installed correctly to achieve the function of the design, usually the installation of equipment must be under the guidance of the company's approved qualified engineers.
- Live working is not allowed.
- The equipment should be installed as far as possible in a dry, well-ventilated place away from heat sources and strong electrical (magnetic) fields.
- Working environment temperature :-25℃~+60℃, humidity ≤95%(no condensation).
- It must be installed firmly to prevent vibration from causing safety accidents.
- The dimensions of the distribution cabinet shall have enough space for accommodating the safety boxes and ease of operation maintained by the power meter products.
- Requirements of electrical connection wire : The current input line shall be made of multi-strand flame retardant copper wire larger than 2.5mm², and the communication line shall be made of 1.0mm² shielded wire.
- Requirements of electrical connection: Working power supply circuit of the power meter shall be connected to a suitable fuse (e.g. 0.5A fuse).

4.2 packing list

Please take good care of the packing materials when you unpack, so that they can be used for future transshipment. List is as below:

- F-PIC100 : 1 pcs (According to customer order)
- User manual: 1pcs
- 4P-5.08 spacing without lock terminal connector: 1 pcs
- 4P-5.08 spacing with lock terminal connector: 1 pcs
- 5P-5.08 spacing with lock terminal connector : 1 pcs
- 6P-7.62 spacing with lock terminal connector : 1 pcs
- Manufacturer's Certificate Card
- Warranty Card

4.3 Dimensions and installation

Dimensions:

This series of products adopts 35mm standard guide rail installation method , as shown in the following figure :(Unit: mm)

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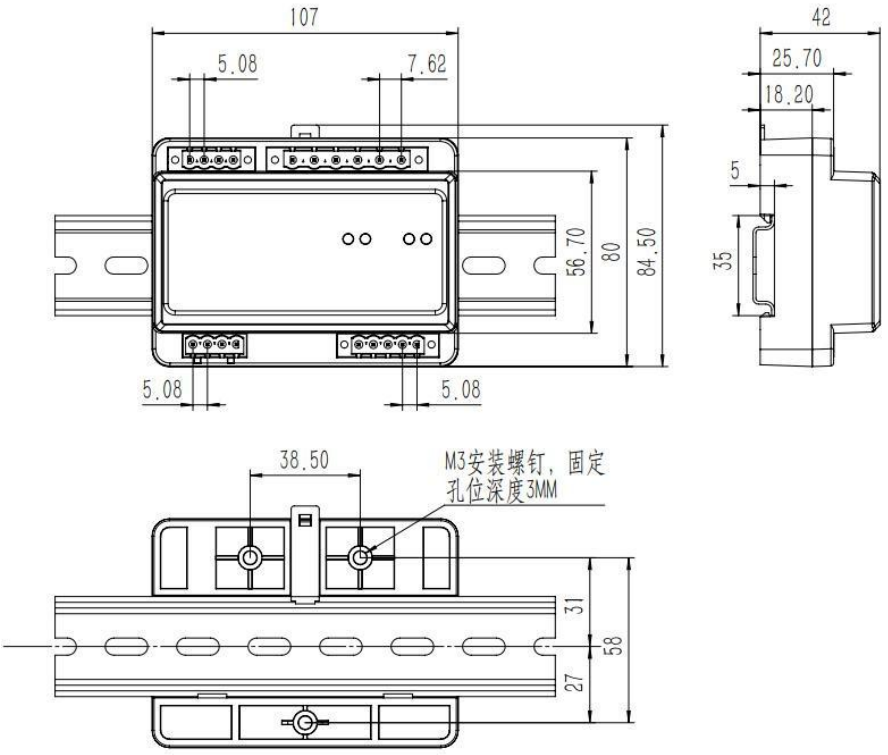

Figure 4.1 Dimensions and mounting drawing of F-PIC100 power meter

4.4 Interface definition

Current interfaces of F-PIC100 adopt adopts 7.62 spacing plug type terminal（6 core terminal with lock）; voltage interface adopts 5.08 spacing plug type terminal（4 core terminal with lock; communication and power supply interface adopts 5.08 spacing plug type wiring terminal（5P terminal with lock）; pulse interface adopts 5.08 spacing plug type wiring terminal (4 core terminal without lock) , the detailed interface definition is shown in figure 4.2 and table 4.1.

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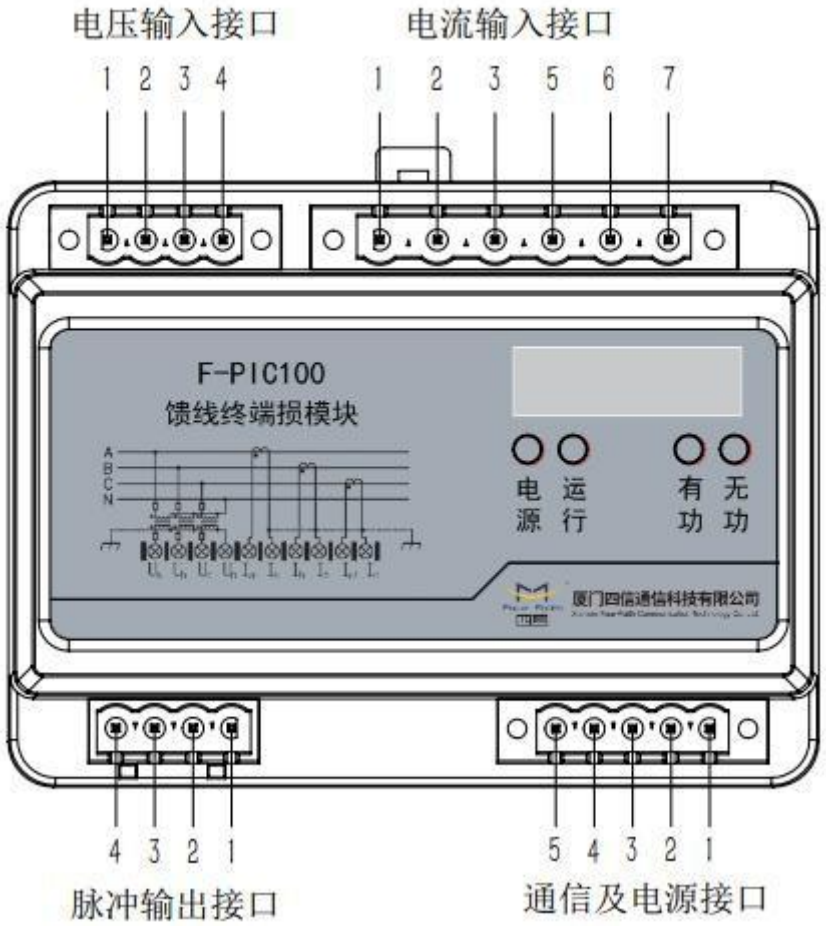
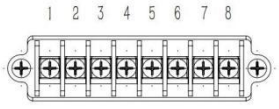


Figure 4.2 Terminal wiring diagram of F-PIC100

Table 4.1 Interface definition of F-PIC100

Pin definition and wiring requirements of current input interface					
PIN No.	Mark	Description	Cable specification	Remarks	Diagram
1	Ia+	Phase A current Positive	RVVP2.5mm²		
2	Ia-	Phase A current Negative	RVVP2.5mm²		
3	Ib+	Phase B current Positive	RVVP2.5mm²		
4	Ib-	Phase B current Negative	RVVP2.5mm²		
5	Ic+	Phase B current Positive	RVVP2.5mm²		
6	Ic-	Phase B current Negative	RVVP2.5mm²		
Pin definition and wiring requirements of voltage input interface					
Pin No.	Mark	Description	Cable	Remarks	Diagram

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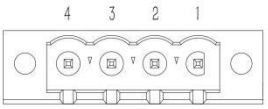
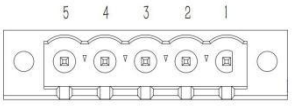
1	Ua	Phase A voltage	RVVP1.0mm²		
2	Ub	Phase B voltage【1】	RVVP1.0mm²		
3	Uc	Phase C voltage	RVVP1.0mm²		
4	Un	Common terminal【2】	RVVP1.0mm²		
Pin definition and wiring requirements of communication and power supply					
Pin No.	Mark	Description	Cable specification	Remarks	Diagram
1	V+	DC24V/DC48V	RVVP1.0mm²		
2	V-	DC24V/DC48V	RVVP1.0mm²		
3	GND	RS232GND	RVVP1.0mm²		
4	TX/A	RS232 send	RVVP1.0mm²		
5	RX/B	RS232	RVVP1.0mm²		
Pin definition and wiring requirements of pulse output					
Pin No.	Mark	Description	Cable specification	Remarks	Diagram
1	P	Active output pulse	RVVP0.2mm²		
2	Q	Reactive output pulse	RVVP0.2mm²		
3	S	Seconds pulse output	RVVP0.2mm²		
4	G	Common terminal	RVVP0.2mm²		

Note【1】： When connection way is three-phase three-wire mode, the secondary terminal can not be connected to phase-B, phase-B is connected to the Un terminal; If the phase-B is connected to the Ub terminal, the Ub terminal needs to be short-circuitedwith the Un terminal.

Note【2】： When connection way is three-phase three-wire mode, this terminal is connected to the phase-B; if the phase-B is connected to the Ub terminal, the Ub terminal needs to be short-circuited with it .

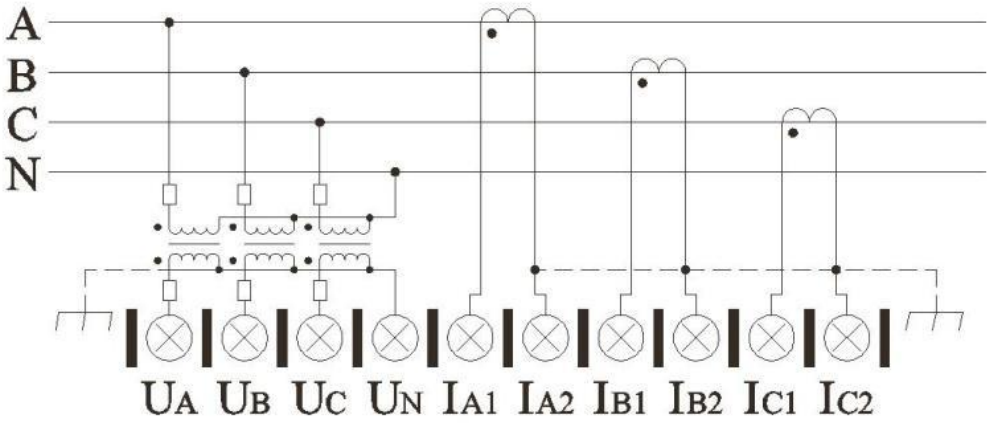


Figure 4.3 F-PIC100 wiring diagram (Three-phase four-wire)

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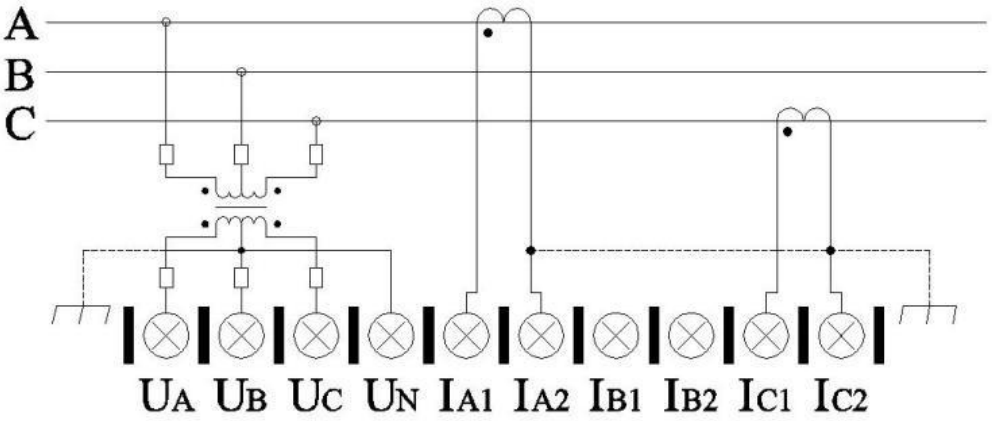

Figure 4.4 F-PIC100 wiring diagram (Three-phase three-wire)

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Chapter5 Communication

5.1 Communication instructions

Power meter's RS232 or RS485 communication interface support the DLT 634.5101-2002 communication protocol. The communication interface is electrically isolated from the internal circuit, and the circuit is effectively protected. Communication rate of RS232/485 can be set, the standard rates are 1200bps, 2400bps, 4800bps, and 9600bps, with a default of 9600bps.

Notes for using RS232/RS485:

- Wiring works shall be constructed strictly accord with the requirements.
- The shield layer of the cable connecting with the upper computer shall be effectively grounded (Protective ground: earth, shielding cabinet, case, etc.) to avoid multi-point grounding.
- Cable of RS232/RS485 must use shielded twisted pair wires and try to use different colors for the two twisted pairs.

5.2 101 Communication protocol

The protocol supports both non-balanced and balanced information transfer ways, protocol communication: Serial, asynchronous, one start bit, one stop bit, one parity bit, eight data bits. Communication message adopts longitudinal and check mode. Both sides shall strictly follow the process of FCB\ FCV's validity, invalidity, reverse confirmation and non-reverse resending.

5.3 Link layer

5.3.1 Transmission frame format

The two frames of FT1.2 (Format FT1.2: Hamming distance for 4 frame format) in the GB/ t18657.1-2002 of 6.2.4.2 were used. Fixed frame length and variable frame length. Link layer transmission sequence is low in front, high in the rear; the low byte is in the front, the high byte is behind.

5.3.2 Fixed frame length format

The fixed frame length format is mainly used for link state management, data call and message confirmation. See table 5.1 for the specific format.

Table 5.1 Structural definition of fixed frame length

Seq.	Item	Length
1	Start character (10H)	1 Byte
2	Control domain C	1 Byte
3	Link address domain A	2 Byte

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4	Frame checksum CS	1 Byte
5	End character(16H)	1 Byte

Start character: 1 byte, fixed for 10H.

Control domain C:1 byte,upload and download represent different meanings, the specific definition is shown in table 5.2.

Table 5.2 Definition of fixed frame length control domain of non-balanced link transmission mode

bit		D7	D6	D5	D4	D3	D2	D1	D0
Download		RES	PRM	FCB	FCV	Link function code FC			
Upload		RES	PRM	ACD	DFC				

Table 5.3 Definition of fixed frame length control domain of balanced link transmission mode

bit	D7	D6	D5	D4	D3	D2	D1	D0
Download	DIR	PRM	FCB	FCV	Link function code FC			
Upload	DIR	PRM	RES	DFC				

RES: Reserved bits,it's usually set to 0.

PRM: Start flag bit PRM=1: Indicates that this frame message is from the master station; PRM=0: Indicates that the frame message is from the slave station.

DIR: Transmission direction bit. DIR=0: Indicates that this frame message is the download text sent by the master station; DIR=1: Indicates that this frame message is the upload text sent by terminal.

FCB: Frame count bits.

When frame count valid bits FCV=1, represents a continuous send/confirm or request/response service change bit for each station to prevent loss and duplication of information transmission.

When the master station transmits a new send/confirm or request/response transport service to the slave station, the FCB is inverted. The master station saves the FCB value of each slave station. If master station didn't receive the message from the slave station when timeout , or if there is an error in receiving the message, the master station will not change the state of FCB and repeat the original sending/confirming or request/response service. FCB=0 in the reset command, FCB value is 0 after the slave station receives the reset command.

ACD: Request access bit, used in upload response messages. ACD=1: Means the distribution terminal has level 1 data waiting for access. ACD=0: Means the distribution terminal has no level 1 data waiting for access.

FCV: Frame count valid bits. FCV=1: Means FCB is valid; FCV=0: Means FCB is invalid.

DFC: Data flow control bits. DFC＝1: Indicates that the slave station cannot receive subsequent messages; DFC＝0: Indicates that the slave station can receive subsequent messages;

FC: Link function code, Link function codes are defined in accordance with DL/t634.5101-2002.

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Table 5.4 No-balanced link function code

Function codes and services of starting direction	FCV bits status of starting direction	Function codes and services allowed by the slave direction
<0> Reset remote link	0	<0>Confirmation: approval
		<1>Confirmation: no approval
<3> Send/confirm user data	1	<0>Confirmation: approval
		<1>Confirmation: no approval
<4> Send/no response for user data	0	Non response
<8> Access request	0	<11>Response: link status
<9> Request/response link status	0	<11>Response: link status
<10> Request/response level 1 user data	1	<8>Response: user data
		<9>Response: no user data requested
<11> Request/response level 2 user data	1	<8>Response: user data
		<9>Response: no user data requested

Table 5.5 Balanced link function code

Function codes and services of starting direction	FCV bits status of starting direction	Function codes and services allowed by the slave direction
<0> Reset remote link	0	<0>Confirmation: approval
		<1>Confirmation: no approval
<2> Send/confirm link test functionality	0	<0>Confirmation: approval
		<1>Confirmation: no approval
<3> Send/confirm user data	1	<0>Confirmation: approval
		<1>Confirmation: no approval
<4> Send/no response for user data	0	Non response
<9> Request/response request link status	0	<11>Response: link status

Address field A: 2 bytes, range: 0001H～FFFFH(65535 个), and FFFFH is the broadcast address, 0000H is invalid address.

Frame checksum CS:1 byte, is octet arithmetic sum of control domain C and address domain A, do not consider overflow bits. CS＝(C＋A)MOD 256

5.3.3 Variable frame length format

The variable frame length format is mainly used for information message and control command transmission, which is used for information exchange between the master station and the terminal.

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Table 6-6 Structural definition of variable frame length format

Seq.	Item	Length
1	Starting character(68H)	1 byte
2	Message length L	1 byte
3	Message length L	1 byte
4	Start character(68H)	1 byte
5	Control domain C	1 byte
6	Address domain A	2 byte
7	Application service data unit ASDU	Variable length
8	Frame checksum CS	1 byte
9	Ending character(16H)	1 byte

Message length L: The total length of the bytes from the control domain to the end of the application service data unit, length of the second message is the same as the first message L.

Frame checksum CS: 1 byte, is octet arithmetic sum of control domain C , address domain A and ASDU, do not consider overflow bits, CS＝(C＋A+ ASDU) MOD 256.

Frame transfer rules:

a) The spare line state is binary 1;

b) There is no spare line interval between the characters of the frame; A minimum of 33 bits is needed between frames;

c) If errors were detected accord to e), a minimum of 33 bits is required for the spare line interval between two frames;

d) Frame checksum (CS) is octet arithmetic sum of control domain C , address domain A and ASDU, do not consider overflow bits.

e) Receiver check:

①For each character: Check start bit, stop bit, and even bit.

②For each frame:

——Check the character and protocol identifier specified at the beginning and end of the fixed header of the frame;

——Identify 2 lengths L;

——The number of characters received per frame is L+6;

——Frame checksum;

——Ending character;

——When an error is checked, check the spare line interval according to c); if one of these checks fails, the frame is discarded. If there is no error, the frame data is valid.

5.4 Link transmission rule

Unbalanced transmission: The distribution master station and the distribution terminal communicate in the way of question and answer, and the distribution terminal can only respond when the power distribution master station calls or it accepts the command from the power distribution master station, it cannot send messages up.

Balanced transmission: In general, the power distribution master station and power distribution terminal communicate by means of question and answer. Under

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certain conditions (Such as event process, terminal local initialization process, etc.), the distribution terminal can actively send messages.

Please refer to DTL634.5101-2002 implementation rules for more detailed communication protocol content.

5.5 Information body address

Body address	Name	Unit
4001	Frequency of loop 1	Hz
4002	Phase A current of loop 1	A
4003	Phase B current of loop 1	A
4004	Phase C current of loop 1	A
4005	Phase A voltage of loop 1	V
4006	Phase B voltage of loop 1	V
4007	Phase C voltage of loop 1	V
4008	Phase A active power of loop 1	W
4009	Phase B active power of loop 1	W
400A	Phase C active power of loop 1	W
400B	Total active power of loop 1	W
400C	Phase A reactive power of loop 1	VAR
400D	Phase B reactive power of loop 1	VAR
400E	Phase C reactive power of loop 1	VAR
400F	The total reactive power of loop 1	VAR
4010	Phase A apparent power of loop 1	VA
4011	Phase B apparent power of loop 1	VA
4012	Phase C apparent power of loop 1	VA
4013	Total apparent power of loop 1	VA
4014	Phase A power factor of loop 1	
4015	Phase B power factor of loop 1	
4016	Phase C power factor of loop 1	
4017	Total power factor of loop 1	

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Body address	Name	Unit	Remarks
6401	Active energy of forward direction of loop 1 at present	kWh	Without time mark
6402	Reactive energy of forward direction of loop 1 at present	kvarh	
6403	First-quadrant reactive energy of of loop 1 at present	kvarh	
6404	Fourth-quadrant reactive energy of of loop 1 at present	kvarh	
6405	Active energy of backward direction of loop 1 at present	kWh	
6406	Reactive energy of backward direction of loop 1 at present	kvarh	
6407	Second-quadrant reactive energy of of loop 1 at present	kvarh	
6408	Third-quadrant reactive energy of of loop 1 at present	kvarh	
6409	Active energy of forward direction of loop 1 for 15-minute freeze	kWh	With time mark
640A	Reactive energy of forward direction of loop 1 for 15-minute freeze	kvarh	CP56Time2a
640B	First-quadrant Reactive energy of loop 1 for 15-minute freeze	kvarh	
640C	Fourth-quadrant Reactive energy of loop 1 for 15-minute freeze	kvarh	
640D	Active energy of backward direction of loop 1 for 15-minute freeze	kWh	
640E	Reactive energy of backward direction of loop 1 for 15-minute freeze	kvarh	
640F	Second-quadrant Reactive energy of loop 1 for 15-minute freeze	kvarh	
6410	Third-quadrant Reactive energy of loop 1 for 15-minute freeze	kvarh	
6411	Active energy of forward direction of loop 1 for daily freeze	kWh	
6412	Reactive energy of forward direction of loop 1 for daily freeze	kvarh	
6413	First-quadrant reactive energy of loop 1 for daily freeze	kvarh	
6414	Fourth-quadrant Reactive energy of loop 1 for daily freeze	kvarh	
6415	Active energy of backward direction of loop 1 for daily freeze	kWh	
6416	Reactive energy of backward direction of loop 1 for daily freeze	kvarh	
6417	Second-quadrant Reactive energy of loop 1 for daily freeze	kvarh	
6418	Third-quadrant Reactive energy of loop 1 for daily freeze	kvarh	

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6419	Active energy of forward direction of loop 1 for power flow changing freeze	kWh	
641A	Reactive energy of forward direction of loop 1 for power flow changing freeze	kvarh	
641B	First-quadrant reactive energy of loop 1 for power flow changing freeze	kvarh	
641C	Fourth-quadrant reactive energy of loop 1 for power flow changing freeze	kvarh	
641D	Active energy of backward direction of loop 1 for power flow changing freeze	kWh	
641E	Reactive energy of backward direction of loop 1 for power flow changing freeze	kvarh	
641F	Second-quadrant reactive energy of loop 1 for power flow changing freeze	kvarh	
6420	Third-quadrant reactive energy of loop 1 for power flow changing freeze	kvarh	

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