T306

DJSF1352-RN rail-mounted DC power meter

Installation and Operation Instruction T1.0

ACREL CO., Ltd

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This company reserve power of revision of product specification described in this manual, without notice. Before ordering, please consult local anget for the latest specification of product.

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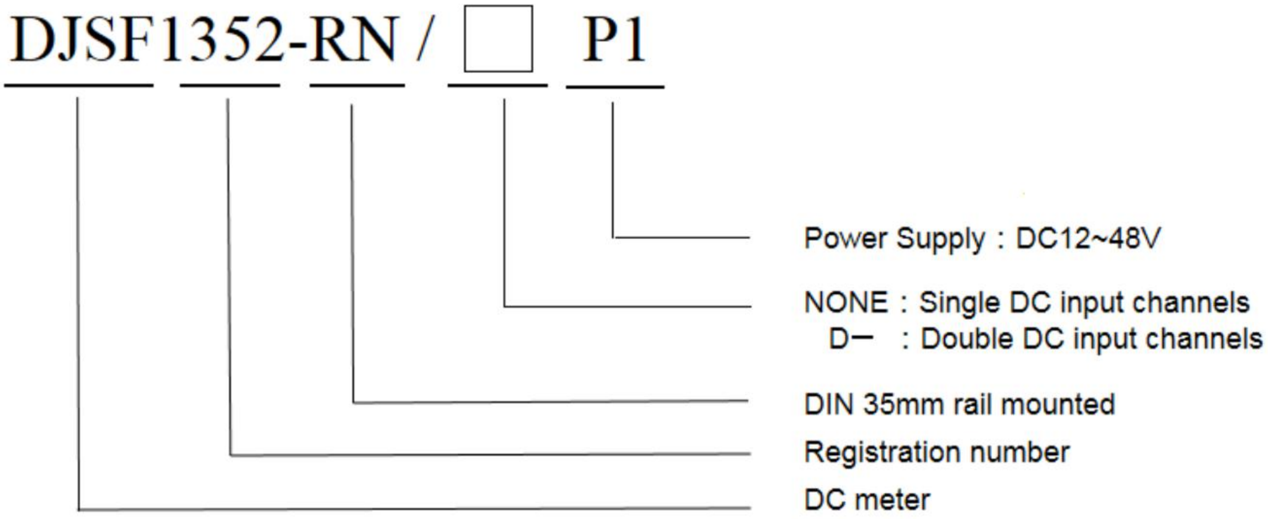
1 Overview

DJSF1352-RN rail-mounted DC power meter with double DC input channels, designed for telecommunications base stations, DC charging piles, solar photovoltaic and other applications, this series of meters can measure the voltage, current, power and forward and reverse energy and so on in the DC system.The actual use of the site, you can measure the total power, but also measure the energy within a specified period of time. The test results can be used for local display, but also with industrial control equipment, computers to form a measurement and control system. The meter needs to be installed in control panel.

The meter can have infrared communication interface and RS-485 communication interface, and supports Modbus-RTU protocol and DLT645-97 (07) protocol at the same time.The meter can have relay alarm output and digital input function;You can set the ratio, alarm, and communication through the meter panel keys according to different requirements.The meter can have event recording of switch (Modbus protocol), programming and event setting records (645 protocol), instantaneous and timing freeze function of data (645 protocol), maximum and minimum value recording function of voltage and current power.

2 Product specification



3 Technical parameters

Technical parameters		Index	
Input	Nominal value	Voltage input range	Current input
		DC 10-1000V See the physical wiring diagram	75mV （Sensor signal and current transformer can be adjusted）
	Voltage measurement input	CAT III	

	Overload	1.2 times rated (continuous); 2 times rated/1 second;
	Power consumption	Voltage: ≤0.2VA, current ≤0.1VA
Accuracy class		Class 1
Function	Display	8-bit segment LCD screen (LCD)
	Communication Interface	RS485（two options）
	Communication protocol	Modbus-RTU，DL/T 645-2007
		See the SYS->PLUS display in the meter menu settings. For example: The meter displays 100, which is 100imp/kWH
Power Supply	Voltage	DC 12~48V
	Power consumption	≤ 3W
Insulation resistance		≥ 40M Ω
Environment	Temperature	Normal operating temperature: -25 °C ~ 55 °C
	Humidity	≤95% (No condensation)
	Altitude	≤ 2000m
	Installation environment	Indoor use
	Pollution degree	2

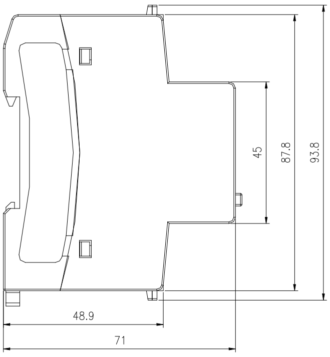
Pulse constant:

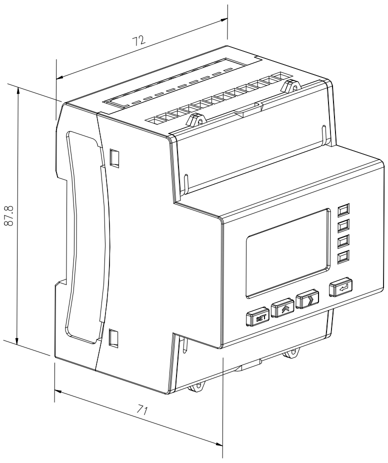
Maximum power	999.9W	10000	imp/kWh
	9.999kW	1000	imp/kWh
	99.99kW	100	imp/kWh
	999.9kW	10	imp/kWh
	9999kW	1	imp/kWh

Maximum power = rated voltage * voltage ratio * current ratio * 1.2

4 Installation guide

4.1 Shape and installation dimensions





NOTE: Labels can only be wiped with dry cloth.

5 Wiring and installation

5.1 Safety instruction

Information for your own safety

This manual does not contain all of the safety measures for operation of the equipment (module, device), because special operating conditions, and local code requirements or regulations may necessitate further measures. However, it does contain information which must be read for your personal safety and to avoid material damages. This information is highlighted by a warning triangle and is represented as follows, depending on the degree of potential danger.

The external transformer shall maintain double or enhanced insulation with the current measuring loop of this product

⚠The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

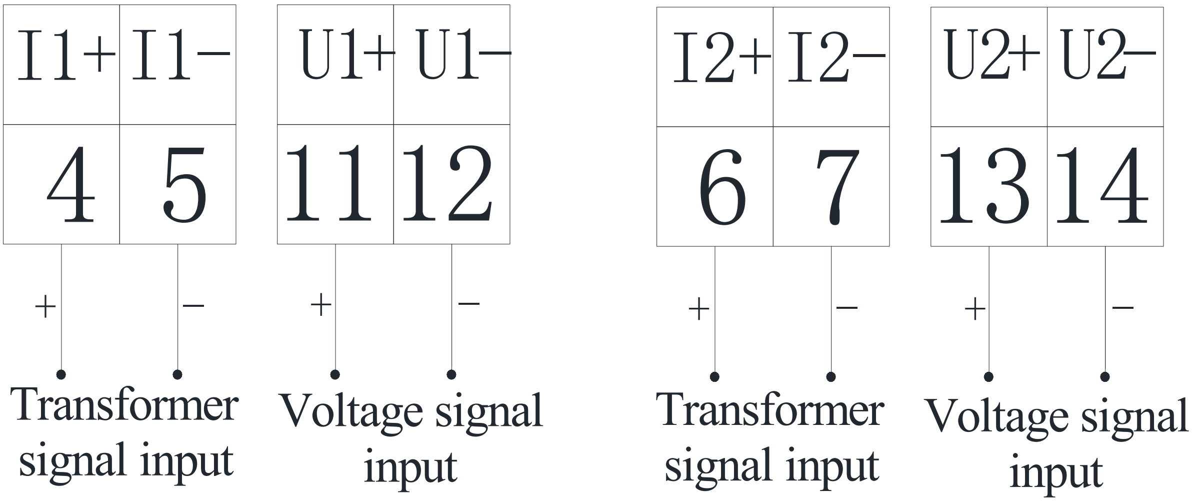
⚠L’apposition de ce symbole sur l’étiquette de sécurité «danger» ou «avertissement» indique la présence d’un danger électrique et le non-respect des instructions entraînera des blessures corporelles.

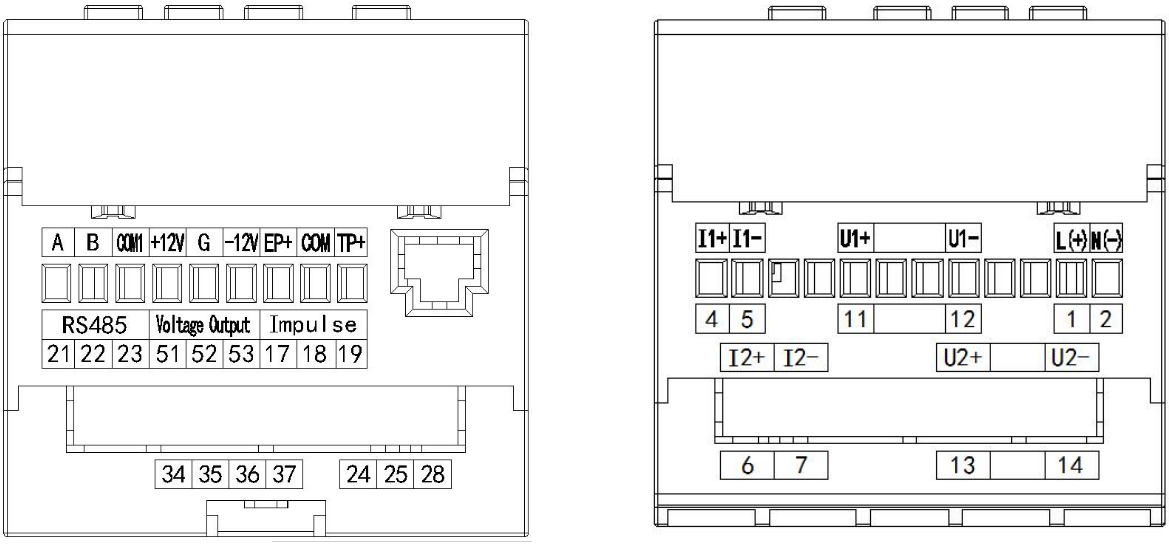
⚠This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠C’est un signe d’avertissement de sécurité. Utilisé pour vous alerter sur les risques potentiels de blessures corporelles. Suivez tous les conseils de sécurité derrière ce signe pour éviter d’éventuelles blessures ou décès.

5.2 Terminals and wiring

Four-wire connection


I1+
I1−
4
5
+
−
Transformer signal input
U1+
U1−
11
12
+
−
Voltage signal input
I2+
I2−
6
7
+
−
Transformer signal input
U2+
U2−
13
14
+
−
Voltage signal input


A
B
COM1
+12V
G
-12V
EP+
COM
TP+
RS485
Voltage Output
Impulse
21
22
23
51
52
53
17
18
19
34
35
36
37
24
25
28
I1+
I1−
U1+
U1−
L(+)
N(−)
4
5
11
12
1
2
I2+
I2−
U2+
U2−
6
7
13
14

product drawing

Note:24、25、28、34、35、36、37、51、52、53：No wiring required

If the model is DJSF1352-RN,6,7,13,14, no wiring is required

Port	Description	Remark
L(+)(1)	Live Line	
N(-)(2)	Neutral Line	

- Recommended cross section：0.08...3.3 mm2 (28...12 AWG)
- The necessary torque is 0.395 N•m (3.5 lb-in) .

⚠ WARNING

- Use copper wire rated for 1500V.
- Minimum temperature rating of the cable to be connected to the field wiring terminals, 80 °C.

Failure to follow these instructions can result in death, serious injury,

or equipment damage.

Port	Description	Remark
I1+(4)	I1 Current positive electrode	
I1-(5)	I1 Current negative electrode	
U1+(11)	U1 Voltage positive electrode	
U1-(12)	U1 Voltage negative electrode	

- Recommended cross section：0.08...3.3 mm2 (28...12 AWG)
- The necessary torque is 0.395 N•m (3.5 lb-in) .

WARNING

- Use copper wire rated for 1500V.
- Minimum temperature rating of the cable to be connected to the field wiring terminals, 80 °C.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Port	Description	Remark
A(21)	RS485 port A	
B(22)	RS485 port B	
COM1(23)	RS485 COM	
EP+(17)	Active Pulse Output +	
COM(18)	Pulse Output Common	
TP+(19)	Time Pulse Output +	

- Note1:17、18、19：active optocoupler output, Resistive load（Voltage is not more than 24V, current is not more than 5mA）
- Recommended cross section：0.08...3.3 mm2 (28...12 AWG)
- The necessary torque is 0.395 N•m (3.5 lb-in) .

WARNING

- Use copper wire rated for 1500V.
- Minimum temperature rating of the cable to be connected to the field wiring terminals, 80 °C.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

AVERTISSEMENT

- Utilisez un fil de cuivre évalué pour 1500V.
- Température nominale minimale du câble à connecter aux bornes de câblage sur le terrain, 80 °C.

Le non-respect de ces instructions peut entraîner la mort, des blessures graves ou des dommages à l'équipement.

Port	Description	Remark
I2+(6)	I2 Current positive electrode	
I2-(7)	I2 Current negative electrode	
U2+(13)	U2 Voltage positive electrode	
U2-(14)	U2 Voltage negative electrode	

- Recommended cross section：0.2...3.3 mm2 (24...12 AWG)
- The necessary torque is 0.565 N•m (5 lb-in) .

WARNING

- Use copper wire rated for 1500V.
- Minimum temperature rating of the cable to be connected to the field wiring terminals, 80 °C.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

AVERTISSEMENT

- Utilisez un fil de cuivre évalué pour 1500V.
- Température nominale minimale du câble à connecter aux bornes de câblage sur le terrain, 80 °C.

Le non-respect de ces instructions peut entraîner la mort, des blessures graves ou des dommages à l'équipement.

Installation Requirements

a) A circuit-breaker must be included in the installation.The circuit breaker should be installed with Din-Rail 35mm and installed near the power input front of the meter. The rated voltage of the circuit breaker shall be DC60V and the rated current shall not be less than 1A.

Conformity is checked by inspection.

b) check that the ambient air temperature and the ambient humidity are within their specified ranges in Environmental Specifications. Be sure that heat from surrounding equipment does not cause this product to exceed its standard operating temperature.

c) Din-Rail 35mm mounted device, open type, shall be installed within appropriate enclosures.

For use with listed Energy-Monitoring Current Transformers.

Leads of the current transformers shall be maintained within the same end-product enclosure.

The current transformer and its leads shall be segregated from other circuits.

The current transformers are intended for installation within the same enclosure as the equipment. These may not be installed within switchgears and panel boards.

⚠ CAUTION

For use with listed Energy-Monitoring Current Transformers.

⚠ Remarque

à utiliser avec les transformateurs de courant de surveillance d’énergie énumérés.

Disclaimer

If the equipment is not used in the manner specified by the manufacturer, the protection provided by the equipment may be weakened.

5.3 Precautions

5.3.1 Voltage input

The input voltage must not exceed 120% of the rated input voltage of the product. A 1A fuse must be installed on the voltage input.

5.3.2 Communication interface wiring

The meter provides asynchronous half-duplex RS485 communication interface using MODBUS-RTU protocol, a variety of data information can be transmitted on the communication line.Theoretically, up to 128 meters can be connected simultaneously on a single line. Each meter can be set with its address (Addr), baud rate, or setting selection

The communication connection is recommended to use three-core shielded cable, Cross-sectional area of each core is not less than 0.5mm2, is connected to A、 B respectively, shielding layer is connected to the earth. The wiring should be kept away from strong cables or other strong electric field environment.

It is recommended to add matching resistors between A and B of the meters at the beginning and end. The resistance range is 20Ω to 10kΩ.

6 Maintenance

Replacing the Battery

When the system date or time display is abnormal, it indicates that a battery in the controller needs to be replaced, please inform the manufacturer to replace the battery in time.

WARNING

- Replacing the Battery can only be operated by the manufacturer's personnel.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

AVERTISSEMENT

- le remplacement des piles ne peut être effectué que par le personnel du fabricant.

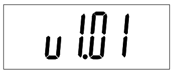
Le non-respect de ces instructions peut entraîner la mort, des blessures graves ou des dommages à l'équipement.

7 Operation guide

7.1 Key

Set	In the measurement mode, press this key to enter the programming mode. The meter prompts you to enter the password PASS. After you enter the correct password, you can program the instrument; in the programming mode, it returns to the previous menu.
︽	In the measurement mode, it is used to switch the display item and view the electrical parameters, see the display menu for details; In the programming mode, it is used to switch the menu of the same level or reduce the number of ones place.
»	In the measurement mode, it is used to switch the display item and view the electrical parameters, see the display menu for details; In the programming mode, it is used to switch the menu of the same level or add the number of ones place.
↵	In the programming mode, it is used to confirm the selection of menu items and modify the parameters.
︽+↵	In the programming mode, this key combination is used to reduce the number of hundreds place.
»+↵	In the programming mode, this key combination is used to add the number of hundreds place.

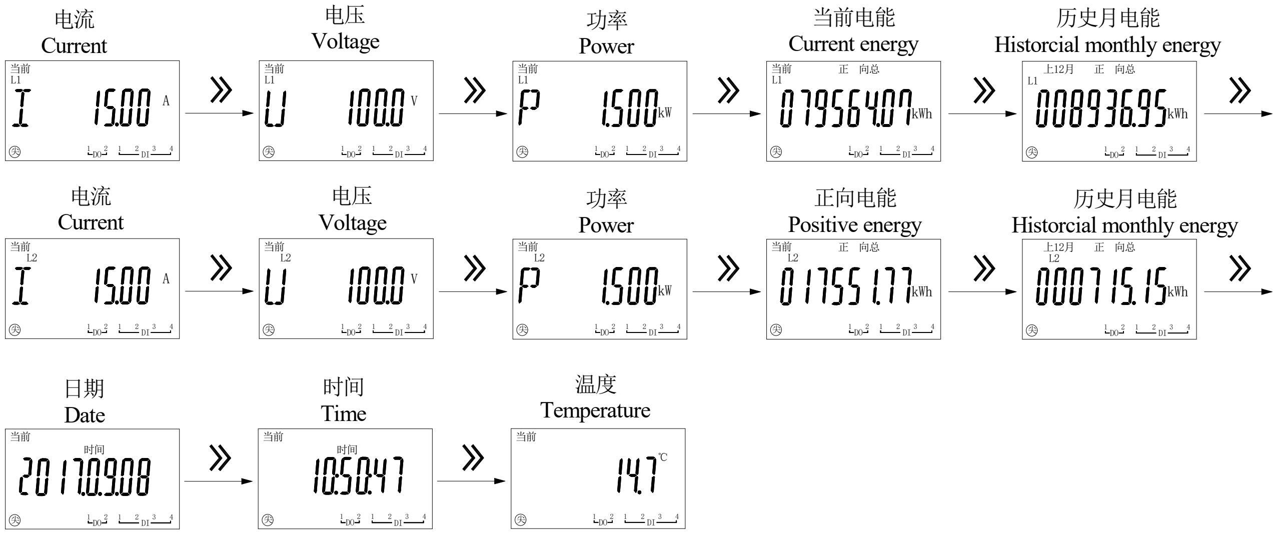
7.2 Meter displays the version information for the meter instantly when starts up.



7.3 Measurement parameters

7.3.1 Electrical parameter

Press the up and right key to switch display circularly ,as is shown in the following figure: Press the up or right key to switch display the other interface as follows: Current ← → Voltage ← → Power ← → Current positive active energy ← → History reverse active energy ← → Current date time ← → Temperature.

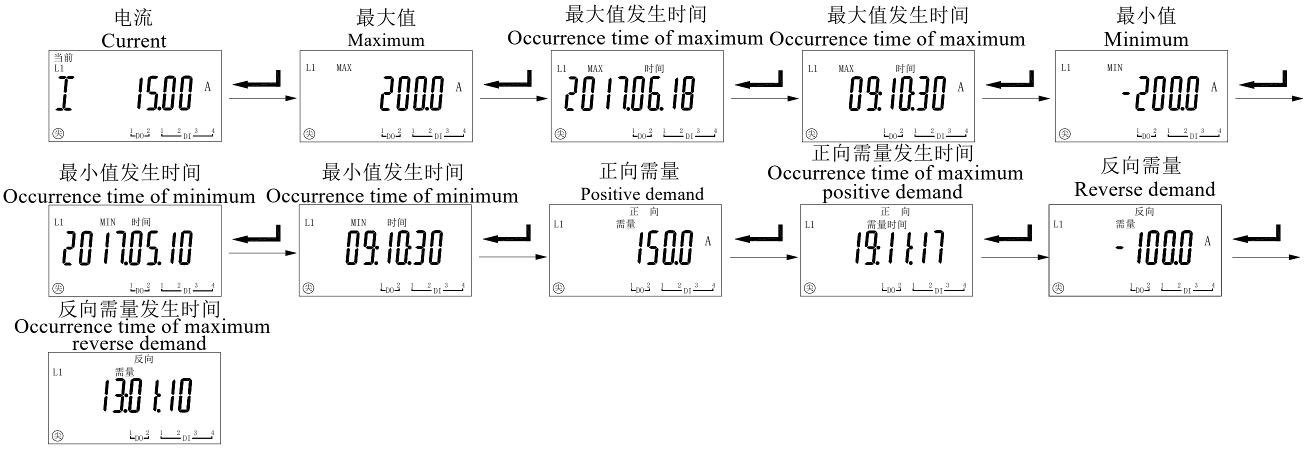

电流
Current
当前 L1
I 15.00 A
电压
Voltage
当前 L1
U 100.0 V
功率
Power
当前 L1
P 1.500 kW
当前电能
Current energy
当前 L1 正 向总
07956407 kWh
历史月电能
Historcial monthly energy
上12月 L1 正 向总
00893695 kWh
电流
Current
当前 L2
I 15.00 A
电压
Voltage
当前 L2
U 100.0 V
功率
Power
当前 L2
P 1.500 kW
正向电能
Positive energy
当前 L2 正 向总
01755177 kWh
历史月电能
Historcial monthly energy
上12月 L2 正 向总
00071515 kWh
日期
Date
当前 时间
2017.09.08
时间
Time
当前 时间
10.50.47
温度
Temperature
当前
14.7 ℃
DO DI

Note: 1. L1 and L2 represent the first and second DC input respectively. When the second DC input is not selected, the L2 parameter interface is not displayed.

2.When the power is negative, the screen flickers;

3.Multi-rate energy is only displayed when the instrument with this function.

The current display interface is displayed after the meter is powered on, press the enter key to switch the display: Maximum current → Occurrence time of maximum current (year, month, day) → Occurrence time of maximum current (hour, minute, second) →Minimum Current → Occurrence time of minimum current (year, month, day) → Occurrence time of minimum current (hour, minute, second) → Maximum positive demand → Occurrence time of maximum positive demand (month, day, hour, minute) → Reverse maximum demand → Occurrence time of reverse maximum demand (month, day, hour, minute).


电流
Current
当前 L1
I 15.00 A
最大值
Maximum
L1 MAX
200.0 A
最大值发生时间
Occurrence time of maximum
L1 MAX 时间
2017.06.18
最大值发生时间
Occurrence time of maximum
L1 MAX 时间
09.10.30
最小值
Minimum
L1 MIN
-200.0 A
最小值发生时间
Occurrence time of minimum
L1 MIN 时间
2017.05.10
最小值发生时间
Occurrence time of minimum
L1 MIN 时间
09.10.30
正向需量
Positive demand
L1 正 向 需量
150.0 A
正向需量发生时间
Occurrence time of maximum positive demand
L1 正 向 需量时间
19.11.17
反向需量
Reverse demand
L1 反向 需量
-100.0 A
反向需量发生时间
Occurrence time of maximum reverse demand
L1 反向 需量
13.01.10
DO DI

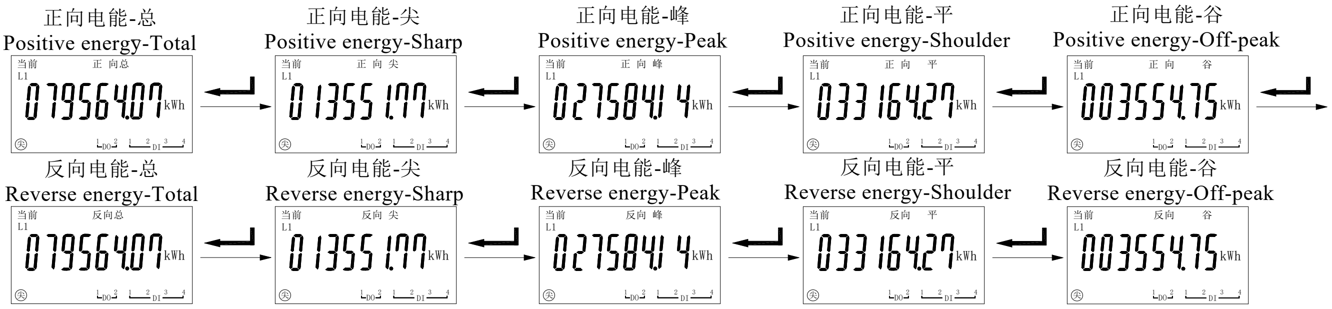
The current display interface is displayed after the meter is powered on, press the right key to switch to the voltage display interface, press the enter key to switch the display: Maximum voltage → Occurrence time of maximum voltage (year, month, day) → Occurrence time of maximum voltage (hour, minute, second) → Minimum voltage → Occurrence time of minimum voltage (year, month, day) → Occurrence time of minimum voltage (hour, minute, second).

The current display interface is displayed after the meter is powered on, press the left or right key to switch the power display interface. Press the enter key to switch the display: Maximum power → Occurrence time of maximum power (year, month, date) → Occurrence time of maximum power (hour , minutes, seconds) → Minimum power → Occurrence time of minimum power occurrence date (year, month, day) → power minimum occurrence time (hour, minute, second) → positive maximum demand → positive maximum demand occurrence time (month, day, hour, minute) → Reverse Maximum Demand → Reverse Maximum Demand Occurrence Time (month, day, hour, minute).

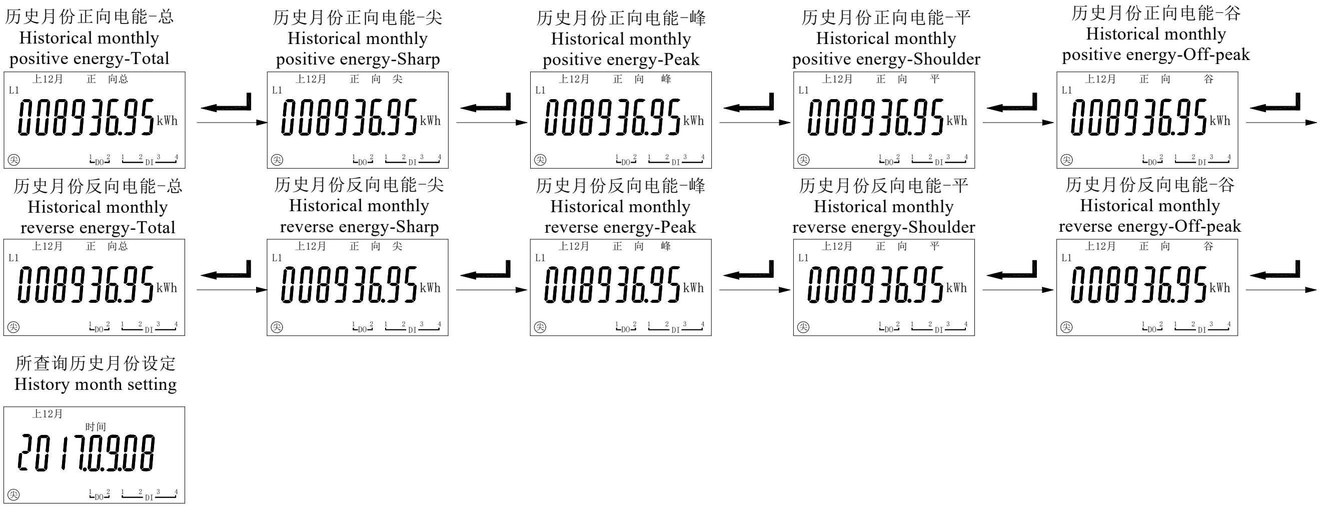
Note: The voltage and power demand display interfaces are the same as the current demand display interface.

7.3.2 Multi-rate

When the meter displays the current display interface after powering on, press the right key to switch to the total positive active energy display interface, press the enter key to switch the display: Total positive active energy → Total positive active energy (sharp) → Total positive active energy (Peak) → Total positive active energy (shoulder) → Total positive active energy (off—peak) → Total reverse active energy (sharp) → Total reverse active energy (peak) → Total reverse active energy (shoulder) → Total reverse active energy (off—peak).


正向电能-总
Positive energy-Total
当前 正 向总
L1
07956407 kWh
正向电能-尖
Positive energy-Sharp
当前 正 向 尖
0135517.7 kWh
正向电能-峰
Positive energy-Peak
当前 正 向 峰
02758414 kWh
正向电能-平
Positive energy-Shoulder
当前 正 向 平
03316427 kWh
正向电能-谷
Positive energy-Off-peak
当前 正 向 谷
00355475 kWh
反向电能-总
Reverse energy-Total
当前 反向总
07956407 kWh
反向电能-尖
Reverse energy-Sharp
当前 反向 尖
0135517.7 kWh
反向电能-峰
Reverse energy-Peak
当前 反向 峰
02758414 kWh
反向电能-平
Reverse energy-Shoulder
当前 反向 平
03316427 kWh
反向电能-谷
Reverse energy-Off-peak
当前 反向 谷
00355475 kWh
DO DI

When the meter displays the current display interface after powering on, press the right key to switch to the query display interface of historical energy for month, press the enter key to switch the display interface: the searched positive active energy for month (sharp) → the searched positive active energy for month (peak) → the searched positive active energy for month (shoulder)→ the searched positive active energy for month (off—peak) → the searched reverse active energy for month (total) → the searched reverse active energy for month (sharp) → the searched reverse active energy for month (peak) → the searched reverse active energy for month (shoulder) → the searched reverse active energy for month (off—peak) → Date setting of the query of the energy (year, month).

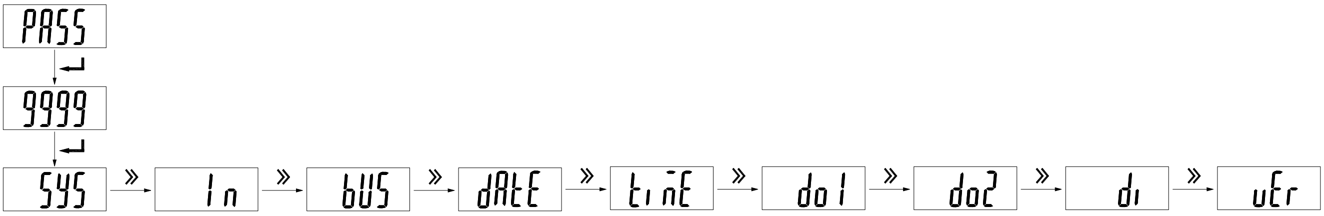

历史月份正向电能-总
Historical monthly positive energy-Total
历史月份正向电能-尖
Historical monthly positive energy-Sharp
历史月份正向电能-峰
Historical monthly positive energy-Peak
历史月份正向电能-平
Historical monthly positive energy-Shoulder
历史月份正向电能-谷
Historical monthly positive energy-Off-peak
历史月份反向电能-总
Historical monthly reverse energy-Total
历史月份反向电能-尖
Historical monthly reverse energy-Sharp
历史月份反向电能-峰
Historical monthly reverse energy-Peak
历史月份反向电能-平
Historical monthly reverse energy-Shoulder
历史月份反向电能-谷
Historical monthly reverse energy-Off-peak
所查询历史月份设定
History month setting
上12月
正 向总
L1
008936.95 kWh
上12月
时间
2017.09.08

Note: Right click on the “History month setting” interface to set the historical month to be queried.

8 Menu symbol and meaning

After the meter is turned on, the current display interface is displayed. Press the SET key to switch to PASS (press the right key to change the password to 0001) to enter the menu programming interface. Press the left and right keys to display the following

:


PASS
9999
SYS
In
bUS
dAtE
tinE
do1
do2
di
uEr

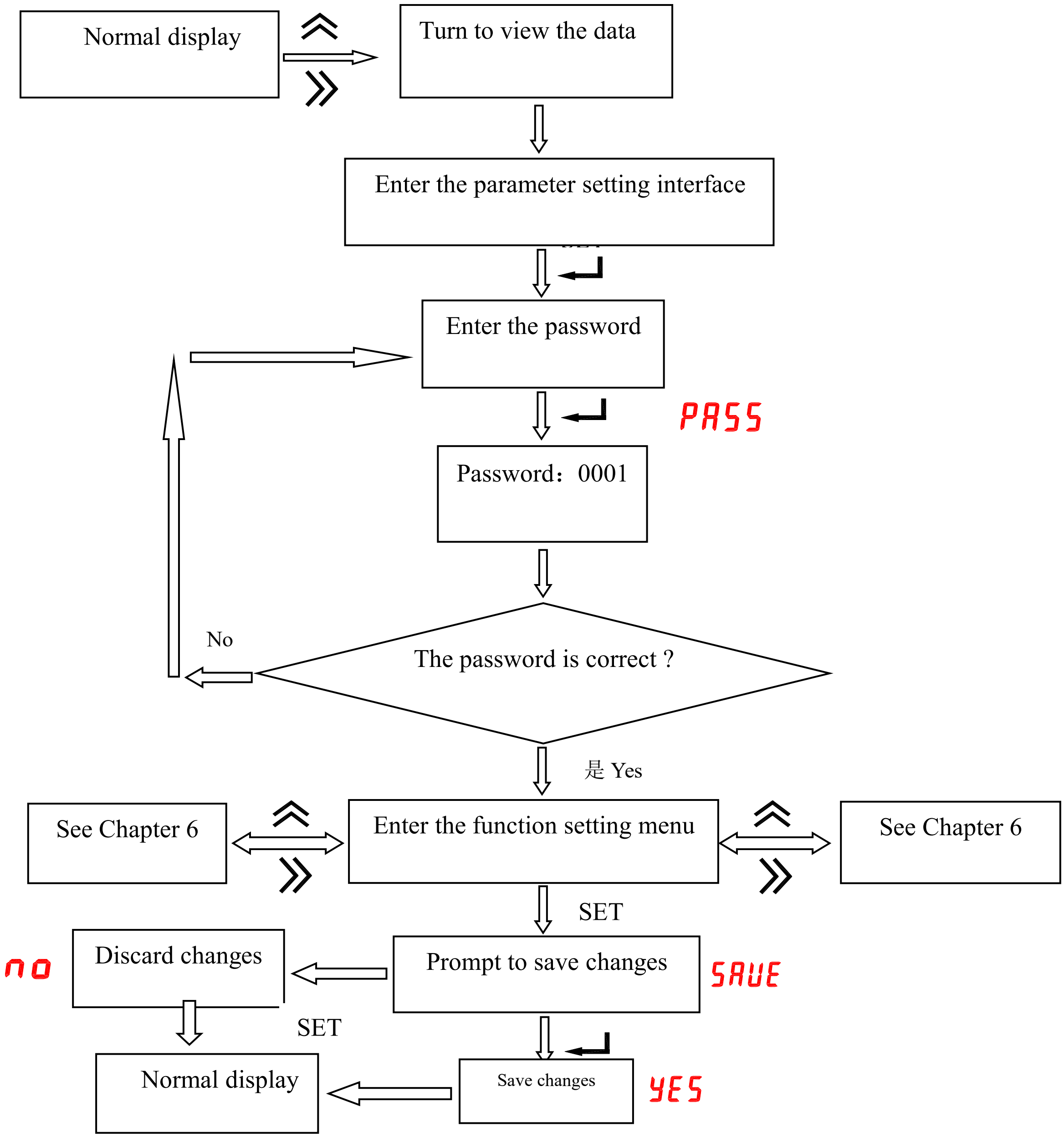
First level menu	Second level menu	Third level menu	Instructions
SYS	dISP	0001	Selection of boot display, zero means turning automatically
	bLCd	0 -255	When set to 0, the backlight is always on; when set to 1–255, the backlight is off after 1–255 seconds. Unit: 1 second
	CodE	0000-9999	Password setting (initial password is 0001)
	ALSt	0000H	The current alarm status, hexadecimal display, low bits for do1, high bits for do2, from bit0-bit7, followed by overvoltage, undervoltage, overcurrent, underload, overpower, underpower, DI1, DI2
	CLr.EP	000-9999 (Enter 9996 to confirm clear)	Clear energy
	CLr.dn		Clear demand
	CLr.nin		Clear extremum
	CLr.dio		Clear event records of switch action
	CLr.Frz		Clear frozen energy

	CLr.SoE		Clear time and programming event logs
	PLUS	1，10，100，1000，10000	Pulse constant (imp/kWh)
	FLASH	0=no，1=U，2=I，3=IU，4=P，5=PU，6=PI，7=PIU	Flicker when the input is negative, U means voltage, I means current, P means power
	EP.dot	2,3	Energy decimal point position setting: 2 digits or 3 digits after decimal point are displayed
	LESS. U	0-5.0	Masking value setting of voltage zero point, maximum to ±5%
	LESS. I	0-5.0	Masking value setting of current zero point, maximum to ±5%
In	In.PU	0001-9999	First Voltage transformation ratio
	In.PI	0001-9999	First current transformation ratio（Primary rated current）
	In2.PI	0001-9999	Second current transformation ratio（Primary rated current）
	nEg.t	on,off	on:Current connected to the negative off:Current connected to the positive
bUS	Addr	1-247	485 address
	bAUd	4800,9600,19200	485,645 Communication baud rate
	modE	None,2bit,odd,even	485,645 Communication Mode (No parity, 2 stop bits, odd parity, even parity)
	645.Adr	000000H (high 12-bit of address) 000000L (low 12-bit of address)	645 meter number, H represents the high 6-digit meter number BCD, L represents the low 6-digit meter number (can only be read on the panel, need to be set by the upper computer software)
	bAUd2	1200,2400,4800,9600	Infrared communication baud rate
	modE2	None,2bit,odd,even	Infrared communication mode (No parity, 2 stop bits, odd parity, even parity)
	dLt.4FE	add0，add4	Add the FE headers of sent back 645 message to: 0, 4
dAtE	17.11.22		Year, month, day, when the number is flashing, it means that it is selected and can be set
timE	15.07.18		Hour, minute, second, when the number is flashing, it means that it is selected and can be set
di	tYPE	00，01，10，11	Tens place indicates DI1 and ones place indicates DI2. 0 is normally closed and 1 is normally open (effective with DI linkage alarm. See 6.1 for details)
uEr	u1.01		Software version

Note: The query cannot be queried in the event log by menu. It can only be read via communication.

8.1 Programming process

Meter menu structure


Normal display
Turn to view the data
Enter the parameter setting interface
Enter the password
PASS
Password：0001
No
The password is correct ?
是 Yes
See Chapter 6
Enter the function setting menu
See Chapter 6
SET
no
Discard changes
Prompt to save changes
SAUE
SET
Normal display
Save changes
YES

8.2 Function setting and use

8.2.1 Magnification change settings

The voltage is based on the current rated voltage, and the current transformation ratio is based on 1A. According to the user's measurement range, the appropriate meter range is determined at the factory, and the signal of this range is input externally. If the current change ratio is "100", then the meter displays 100.0A. After the corresponding ratio is set, the meter will display the corresponding data.Users are not allowed to change the input size of the signal by themselves. If the user has set a 100A/75mV meter and found the voltage transmitter at the work site to be 500A/75mV, the current transformation ratio is changed from 100 to 500, but it must be confirmed that the output signal of the DC transmitter cannot be changed, in this case it is 75mV .

8.2.2 Communication function and parameter setting

Modbus-RTU protocol: The default is "9600,8,n,1".

8.2.3 Alarm function and parameter setting

In the normal measurement, an alarm is generated and an output is generated on the relay output (need to be added, normally open relay contact is closed), the corresponding display of the DO displays.

The alarm status can be read by communication. See the communication parameter address table for the parameter address.

The alarm function is turned off by default unless requested by the customer.

When the input signal is zero, the meter can be set to turn off or on the low alarm function.

9 Communication Guide

9.1 Overview

The DJSF1352-RN meter uses the Modbus-RTU protocol: “9600, 8, n, 1”, where 38400 is the default baud rate, which can be programmed to change to 1200, 2400, 4800, 9600, etc.; 8 means there are 8 data bits ;n indicates no parity; 1 indicates 1 stop bit

Error detection: CRC16 (Cyclic Redundancy Check)

DJSF1352-RN meter adopts DLT645 protocol, supports 07, 97 version. The meter number defaults to 12 digits after barcode. See menu settings for details.The protocol supports reading of voltage, current, power, forward and reverse direction and combined energy and reading of multi-rate energy. At the same time, the version 07 protocol also supports programming records, reading of 10 events of time setting, and 12 months of multi-rate energy and demand, 3 times data instantaneous freezing and 12 times frozen data query.

Note: When the meter is equipped with double DC input channels and the measurement data of second DC channel is read, the communication address is automatically added 1 to the original address.(The modbus device address plus 1,645 number is incremented by 1, and it occupies 2 numbers in total, equivalent to 2 meters).

9.2 DLT645 protocol

DJSF1352-RN meter adopts DLT645 protocol, supports 07, 97 version. The meter number defaults to 12 digits after barcode. See menu settings for details.The protocol supports reading of voltage, current, power, forward and reverse direction and combined energy, and multi-rate energy reading.

The 97 protocol only supports the reading of basic electrical parameters and electrical energy. The voltage of 97 protocol is up to 9999V. If the rated current exceeds the allowable value of the protocol, it will become smaller with a factor of 10 with the increase of the rated current, if the rated power exceeds the allowable value of the protocol ,it’s fixed 1000 times smaller.

The 07 protocol also supports programming records, reading of 10 events of time setting, reading of 12-month multi-rates and demand, 3 times instantaneous frozen data, and 12 times frozen data queries.

The reading voltage is positive and the input is negative absolute value display.Read current and power are signed number, maximum 0-799999 (current max. ±799.999A or KA, power max. 79.9999kw or (MW)). Whether or not the unit is switched is described in the following table.

Identifier	Length	Note
02010100	2	Read voltage, if 999.9V is read at this time, it is an out-of-bounds state, actual voltage exceeds 1000V, there is no negative number.
04000501	2	Bit0 means power reverse,bit2 means current direction, Bit3 means power reverse, bit8 means DI1，bit9 means DI2，bit12 means DO1，bit13 means DO2。
04808080	2	Read PT ratio (usually used when transferring secondary access voltage)
04808081	2	Read primary rated current (For example ,200A/75mV is read as 200)
04808082	2	Read out-of-bounds state, bit0 indicates over voltage exceeds 1000V, bit1 indicates that the current protocol is not enough to display, the actual data read by the identifier 02020100 is divided by 1000;bit2 indicates that the power protocol is not enough to display, and the 02030000 identifier actually reads data divided by 1000;
04808083	2	Actual current ratio, 1.2 times rated current within 999A is 1, over 999A is 1000 (02020100 reading value is divided by 1000)
04808084	2	Actual power ratio, 1.2 times rated power within 99KW is 1, over 99KW is 1000 (02030000 reading value is divided by 1000)
04808085	2	Set the corresponding alarm status of DO1, The first set of alarm thresholds is used to alarm. The alarm signal originates from the DO1 alarm selection. When DI is used as the alarm source, it can be read by the double input channels. The alarm status is shown in Note 2.
04808086	2	Set the corresponding alarm status of DO2. The second set of alarm thresholds is used to alarm using. The alarm signal is sourced from the DO2 alarm source selection. When DI is used as the alarm source, it can be read by the double input channels. The alarm status is shown in Note 2.
04808087	2	Read voltage value, same as 02010100, read value is divided by 10 times
04808088	2	Temperature

Note:1.AAAAAAAAAAAA writes the 645 protocol address using the 15H function, requiring the user to enter the password to enter the menu;

2.

7	6	5	4	3	2	1	0
DI2	DI1	L-P	H-P	L-I	H-I	L-U	H-U
No. 2 switch input	No. 1 switch input	Under power	Overpower	Undercurrent	Over current	Under voltage	Over voltage
DO1 alarm status							

3.The maximum reading voltage is 999V. If the rating exceeds, use the special command 04808087 to read;

4. According to the standard specification, if the rated current or power is not enough to display, the read communication value will be reduced by 1000 times.

9.3 Modbus protocol

When the data frame arrives at the terminal device, it enters the addressed device through a simple "port", the device removes the "envelope"(data header) of the data frame, reads the data, and if there is no error, executes the task requested by the data, then it will add its own data to the obtained "envelope" and return the data frame to the sender. The returned response data includes the following contents: the terminal slave address(Address), the executed command(Function), the requested data generated by executing command(Data), and a check code(Check). There will be no successful response to any error, or an error indication frame is returned.

9.3.1 Data frame format

Address	Function	Data	Check
8-Bits	8-Bits	N×8-Bits	16-Bits

9.3.2 Address domain

The address domain is at the beginning of the frame and consists of one byte (8-bits, 8-bit binary code). The decimal value is 0 to 255. Only 1 to 247 are used in our system, and other addresses are reserved. These bits indicate the address of the user-specified terminal device that will receive data from the host to which it is connected. The address of each terminal device must be unique. Only the terminal to which it is addressed will respond to a query containing the address. When the terminal sends back a response, the data of the slave address in the response tells the host which terminal is communicating with it.

9.3.3 Function domain

The function field code tells the functions of the addressed terminal. The following table lists the function codes used by this series of instruments, as well as their meanings and functions.

Code (hex)	Meaning	Function
03H	Read holding register	Get the current binary value in one or more holding registers
10H	Preset multiple registers	Load specific binary values into a series of consecutive holding registers

9.3.4 Data domain

The data domain contains the data required for the terminal to perform a specific function or the data collected when the terminal responds to a query. These data may be numeric values, parameter addresses, or setting values.

For example, the function domain tells the terminal to read a register, and the data domain needs to specify which register to start and how many data to read. The embedded address and data differ according to the type and the slave.

9.3.5 Error check domain

This domain uses a CRC16 cyclic redundancy check to allow hosts and terminals to check for errors during transmission. Sometimes due to electrical noise and other interference, when a group of data is transferred from one device to another, some changes may occur on the line. Error checking can ensure that the master or slave does not respond to those changed data. This improves the security, reliability, and efficiency of system.

9.3.6 Error check method

The error check (CRC) domain 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 domain. If the two values are not equal, it occurs error.

In the CRC operation, a 16-bit register is first preset to all ones, and then 8 bits in each byte in the data frame are successively operated on with the current value of the register, only 8 data bits per byte participate in generating a CRC, and neither the start and stop bits nor the parity bits that may be used affect the CRC. When the CRC is generated, the 8-bit of each byte is XORed with the contents of the register, and then the result is shifted to the low-order bit. The high-order bit is complemented with "0" and the LSB is shifted out and detected. If it is 1, This register is XORed with a preset fixed value (0A001H). If the least significant bit is 0, nothing is done.

CRC generation process:

1 Preset a 16-bit register to 0FFFFH (all 1s) and call it 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 in the CRC register.

3 Move the CRC register one bit to the right, fill “0” in the highest bit, and move the lowest bit out and detect it.

4 If the shifted out minimum bit is 0: Repeat step 3 (next shift); if the shifted out minimum bit is 1: XOR the CRC register with a preset fixed value (0A001H).

5 Repeat step 3 and 4 until 8 shifts to complete a complete 8-bit processing.

6 Repeat step 2 to 5 to process the next 8 bits until processing of all byte ends.

7 The final CRC register value is the CRC value.

In addition, there is a method for calculating CRC by using a look-up table. Its main feature is that the calculation speed is fast, but the table needs a large storage space. This method is not described here any more. Please refer to related material.

9.4 MODBUS communication description

9.4.1 Communication address table(Word)

RO: Read Only   R/W: Read/ Write

Address	Name	Type	Note		word
0	DC voltage value	RO	-9999~9999	For example: When the data is read as 5000 and the decimal point is 2, the actual data is 5000*10(2-3) = 500.0	1
1	Decimal Point of Voltage (DPT)	RO	0-9		1

2	DC current value	RO	-9999~9999		1
3	Decimal Point of Current (DCT)	RO	0-9		1
4	Broken wire detection indication	RO	1: Broken 0: Not broken		1
5	Internal temperature	RO	-400~1250, one decimal place, unit °C		1
6~7					
8	Power value	RO	-9999~9999	Reading = Effective value × $10^{(\text{Decimal point -3})}$	1
9	Power Decimal Point (DP)	RO	0-10		
10~11	Reserve				1
12~13	Total positive active energy	RO	Primary side energy, unit WH, high byte is first, low byte is later		2
14~15	Total reverse active energy	RO	Primary side energy, unit WH, high byte is first, low byte is later		2
16	Voltage transformation ratio	R/W	0001---9999		1
17	Primary rated current	R/W	0001---9999		1
18	Switch input and output status	R/W	View the table for details		1
19	Alarm status	R/W	View the table for details		1
20	Current total voltage percentage	RO	Reserve		1
21	DC content percentage of voltage	RO			1
22	AC content percentage of voltage	RO			1
23	Current total current percentage	RO			1
24	DC content percentage of current	RO			1
25	AC content percentage of current	RO			1
26	Current total power percentage	RO			1

27	DC content percentage of power	RO		1
28	AC content percentage of power	RO		1
29	Reserve	RO		6
30~32	Date and time settings	R/W	Each byte in order is in year, month, day, hour, minute, second and is decimal.	6
33 High byte	Current meter reading day	RO	1-31	6
33 Low byte	Current rate	RO	0-3 in order is the sharp、peak、shoulder、off-peak	6
34	Reserve			6
35	Software version number	RO		

Address	Name	Type		word
2000~2001	Total positive active energy	RO	Note: Unit WH, high byte is first, low byte is later 0-999999999	2
2002~2003	Total positive active energy(sharp)	RO		2
2004~2005	Total positive active energy(peak)	RO		2
2006~2007	Total positive active energy(should)	RO		2
2008~2009	Total positive active energy(off-peak)	RO		2
2010~2011	Total positive active energy for the current month	RO		2
2012~2013	Positive active energy for the current month(sharp)	RO		2
2014~2015	Positive active energy for the current month(peak)	RO		2
2016~2017	Positive active energy for the current month(should)	RO		2
2018~2019	Positive active energy for the current month(off-peak)	RO		2
2020-2139	Primary positive multi-rate energy for a period of 1-12 months, more than or equal to this month, is the multi-rate of last year			
2140~2141	Total reverse active energy	RO		2
2142~2143	Total reverse active energy(sharp)	RO		2

2144~2145	Total reverse active energy(peak)	RO		2
2146~2147	Total reverse active energy(should)	RO		2
2148~2149	Total reverse active energy(off-peak)	RO		2
2150~2151	Total reverse active energy for the current month	RO		2
2152~2153	Reverse energy for the current month(sharp)	RO		2
2154~2155	Reverse energy for the current month(peak)	RO		2
2156~2157	Reverse energy for the current month(should)	RO		2
2158~2159	Reverse energy for the current month(off-peak)	RO		2
2160-2279	Primary reverse multi-rate energy for a period of 1-12 months, more than or equal to this month, is the multi-rate of last year	RO		

Address (Decimal)	Name	Type	Note	word
Positive and reverse power and current demand				
2280	Positive power demand	RO	The current month's positive power demand, and other is similar	1
2281	Demand occurrence date (month, day)	RO	High 4 bits are year, lower 4 bits are month in high byte	1
2282	Demand occurrence time (hour, minute)	RO		1
2283-2318	Same as above	RO	1-12 month’s positive power demand records in turn	…
2319-2357	Reverse power demand	RO	Current and 1-12 month’s reverse power demand records in turn	…
2358-2396	Positive current demand	RO	Current and 1-12 month’s positive current demand records in turn	…
2397-2435	Reverse current demand	RO	Current and 1-12 month’s reverse current demand records in turn	…
Event record of switch action				
46	The latest switch event location	RO	0-9 cycles in turn, 0 is the address of 2460, 1 is the address of 2465, and so on	1
3005	Switch event record 1	RO	1.Switching action record, bit15 is 1 means closed, 0 means disconnected; bit12-bit8 is 1 means DO, 3 means DI, and lower 8 bit is 1 means 1st way. For example: 0x8102 means DO2 is closed, 0x0102 means DO2 is disconnected.	1
3006	Alarm status at switching events	RO		1
3007	Switch event (Year、month)	RO		1
3008	Switch event (Day、	RO		1

	hour)		2.View alarm status register for alarm status during operation	
3009	Switch event (Minute、second)	RO		1
3010-3084	Switch event records of group 2-16		Same as above	
2460	Switch event record 1	RO	1.Switching action record, bit15 is 1 means closed, 0 means disconnected; bit12-bit8 is 1 means DO, 3 means DI, and lower 8 bit is 1 means 1st way. For example: 0x8102 means DO2 is closed, 0x0102 means DO2 is disconnected. 2.View alarm status register for alarm status during operation	1
2461	Alarm status at switching events	RO		1
2462	Switch event (Year、month)	RO		1
2463	Switch event (Day、hour)	RO		1
2464	Switch event (Minute、second)	RO		1
2465-2539	Switch event records of group 2-16		Same as above	
Relay outputs one				
608	sets the DO output type	R/W	“0. do” means communication control. (If DLY is set to 0, the output is in level mode , otherwise it is in pulse mode. If DLY is set to 2, automatic shutdown will take 0.02 seconds after pull in. Open)	1
609	Output delay time	R/W	If it is DO output mode, when it is set to 0, it is the level control mode; when it is not 0, it is the pulse control mode, and is disconnected after the setted delay time, the delay setting range is 1-255, unit: 0.01 seconds; if it is alarm output mode, delay setting range is 1-9999, unit: 1 second;	1
610	Non action band	R/W		1
611	High voltage alarm, set by percentage	R/W		1
612	Low voltage alarm, set by percentage	R/W		1
613	High current alarm, set by percentage	R/W		1
614	Low current alarm,	R/W		1

	set by percentage			
615	High power alarm, set by percentage	R/W		1
616	Low power alarm, set by percentage	R/W		1
617	Manual reset/Zero alarm enable	R/W	high byte：Manual reset low byte：Zero alarm enable	
Relay outputs two				
618	sets the DO output type	R/W		1
619	Output delay time	R/W		1
620	Non action band	R/W		1
621	High voltage alarm, set by percentage	R/W		1
622	Low voltage alarm, set by percentage	R/W		1
623	High current alarm, set by percentage	R/W		1
624	Low current alarm, set by percentage	R/W		1
625	High power alarm, set by percentage	R/W		1
626	Low power arm, set by percentage	R/W		1
627	Manual reset/Zero alarm enable	R/W		1

9.4.2 Description:

①Calculation method of Voltage, current, power and other data :(example: 7.5.1 read data)

Reading = Effective value × $10^{(\text{Index -3})}$

18:Switch input/output status word:

15	...	10	9	8	7	...	2	1	0
——			Di2	Di1	——			Do2	Do1
Reserve			Switch input		Reserve			Switch output	

19:Alarm status word:

15	...	8	7	6	5	4	3	2	1	0
——			DI2	DI1	L-P	H-P	L-I	H-I	L-U	H-U
Same as the low 8 bits			No. 2 switch input	No. 1 switch input	Under power	Over power	Under current	Over current	Under voltage	Over voltage
DO2 alarm status			DO1 alarm status							

Description:

① "-" indicates a reserved word or reserved bit.

②Warning flag: 1 for alarm, 0 for no alarm.

10 Communication application

The examples in this section use the following table format as far as possible (the data is in hexadecimal)

	Data Start			Data#of		CRC 16	
Addr	Fun	reg Hi	reg Lo	reg Hi	reg Lo	Lo	Hi
01H	03H	00H	00H	00H	06H	C5H	C8H
Address	Function code	Data start bit		Number of data read		Cyclic redundancy check code	

Example 1: Reading current data

Query data frame	01 03 00 02 00 02 65 cb
Return data frame	01 03 04 03 b2 00 00 5a 50

Description:

01：Slave address

03：Function code

04：Hexadecimal, decimal is 4, indicates that the following 4 bytes of data

5a 50: Cyclic Redundancy Check Codes

The processing is as follows:

03 b2 (hexadecimal) = 946 (decimal current data)   00 00 (hexadecimal) = 0 (decimal data)

Calculation: 946×100-3 = 0.946; Unit: Ampere (A)

The meter displays:

I=0.946

Reading voltage data is similar to reading current, but the starting address is 00H, query frame: 01 03 00 00 00 02 c4 0b.

The query frame for reading other information is the same as this format, and each information address is in the communication parameter address table.

Note: The valid data and exponent bits of voltage, current, and power are both signed data. If a number is read as “FFFF”, it means the data is “-1”.

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