SIEMENS

SICAM P38 P39

3-phase Power Meter with Multi-Tariff function

V1.40

Manual

E50417-H8940-C564-4

NOTE

For your own safety, observe the warnings and safety instructions contained in this document, if available.

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Preface

Purpose of this manual

This manual describes the functions, operation, installation, and commissioning of devices 3-phase Current Power Meter-> In particular, one will find:

- Information regarding the configuration of the scope of the device and a description of the device functions > Chapter 3
- Instructions for Operation and Display > Chapter 4
- Technical Data > Chapter 2

Target Audience

Protection engineers, commissioning engineers, personnel concerned with adjustment, checking, and service of selective protective equipment, automatic and control facilities, and personnel of electrical facilities and power plants.

Additional Support

Should further information on the System SICAM be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the local Siemens representative.

Our Customer Support Center provides a 24-hour service.

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Notes on Safety

This document is not a complete index of all safety measures required for operation of the equipment (module or device). However, it comprises important information that must be followed for personal safety, as well as to avoid material damage. Information is highlighted and illustrated as follows according to the degree of danger:

DANGER

DANGER means that death or severe injury will result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid death or severe injuries.

WARNING

WARNING means that death or severe injury may result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid death or severe injuries.

CAUTION

CAUTION means that medium-severe or slight injuries can occur if the specified measures are not taken.

✧ Comply with all instructions, in order to avoid moderate or minor injuries.

NOTICE

NOTICE means that property damage can result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid property damage.

NOTE

Important information about the product, product handling or a certain section of the documentation which must be given particular attention.

Qualified Electrical Engineering Personnel

Only qualified electrical engineering personnel may commission and operate the equipment (module, device) described in this document. Qualified electrical engineering personnel in the sense of this manual are people who can demonstrate technical qualifications as electrical technicians. These persons may commission, isolate, ground and label devices, systems and circuits according to the standards of safety engineering.

Proper Use

The equipment (device, module) may be used only for such applications as set out in the catalogs and the technical description, and only in combination with third-party equipment recommended and approved by Siemens.
Problem-free and safe operation of the product depends on the following:

- Proper transport
- Proper storage, setup and installation
- Proper operation and maintenance

When electrical equipment is operated, hazardous voltages are inevitably present in certain parts. If proper action is not taken, death, severe injury or property damage can result:

- The equipment must be grounded at the grounding terminal before any connections are made.
- All circuit components connected to the power supply may be subject to dangerous voltage.
- Hazardous voltages may be present in equipment even after the supply voltage has been disconnected (capacitors can still be charged).
- Operation of equipment with exposed current-transformer circuits is prohibited. Before disconnecting the equipment, ensure that the current-transformer circuits are short-circuited.
- The limiting values stated in the document must not be exceeded. This must also be considered during testing and commissioning.

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Contents

Overview 1

1.1 Introduction

SICAM P38 & P39 3-phase Multi-function Power Meter integrate measurement, record, power metering, remote communication and control, large screen LCD and network communication functions. This meter can measure various parameters of power grid, such as voltage, current, power, power factor and frequency. It is provided with 2^{nd} to 50^{th} harmonic analysis and calculation of multiple power quality parameters. It can calculate active and reactive energy. It has multi-tariff energy and multi-tariff demand functions. P38 has two independent RS-485 ports; P39 has 1 RS-485 & 1 Ethernet port. Device supports MODBUS-RTU protocol (serial & TCP/IP). Besides, it has binary input and output.

This product is extensively applicable to power substation and distribution automation system, industrial control and industrial automation system, energy management system and community power monitoring, etc.

This 3-phase electronic multi-function power meter meets following standards:

- IEC 62052-11:2003 (Electricity metering equipment (a.c.) General requirements, tests and test conditions-Part 11: Metering equipment) standard
- IEC 62053-22:2003 static meters for active energy (classes 0.2 S and 0.5 S)
- IEC 62053-23:2003 static meters for reactive energy (classes 2 and 3)
- Modbus-RTU

1.2 Features

This meter uses high-precision sampling and metering unit and high-speed MCU data processing unit, supporting high-precision, wide-range and accurate measurement and quick data analysis; segmented multi-line WVA LCD, realizing various and abundant display; white backlight for LCD, satisfying the need for viewing data in dark environment; NVRAM, supporting long-time data storage without data loss even in the event of power failure; high-precision clock chip with temperature compensation, ensuring accuracy of clock within operating temperature range; double communication ports and industrial standard communication protocols, realizing flexible and convenient networking; and different communication modules, satisfying different interface need of different users.

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Technical Data 2

2.1 Technical Data

Item		Technical Data
Product standard		IEC61557-12:2007
Input connection		3-phase-3-wire, 3-phase-4-wire, single phase
Measurement	Voltage	Reference voltage U_n: AC380 V, AC220 V, AC100 V, AC57.7 V Measuring range: 10 V ... 276 V phase voltage Maximum measuring range: 400 V phase voltage Power consumption: < 0.1 VA (single phase @220VAC) Accuracy: RMS 0.2% Resolution: 0.01 V
	Current	Rated current I_n: 1 A, 5 A Measuring range: 0.015 A ... 6 A Maximum measuring range: 9 A Power consumption: < 0.3 VA (single phase @5A) Accuracy: RMS 0.2% Resolution: 0.001 A
	Power (active, reactive, apparent)	Accuracy: 0.5% Resolution: 0.001 kW/kVar/kVA
	Power grid frequency	Measuring range: 45 Hz ... 65 Hz Accuracy: 0.2% Resolution: 0.01 Hz
	Harmonic	Frequency: 2^{nd} ... 50^{th} Precision: 5%
Metering	Active power	Accuracy level: 0.5 S, Acc. To IEC 62053-22 Resolution: 0.01 kWh, 5000 imp/kWh
	Reactive power	Accuracy level: Class 2, Acc. To IEC 62053-23 Resolution: 0.01 kvarh, 5000 imp/kvarh
Digital signal	Power pulse output	2 electric energy (active and reactive) pulse outputs Opto-coupler isolation, 4,000 V_{RMS}
	Binary output	2 electromagnetic relay output Normal Open Contact Contact capacity: AC 250 V /3 A, DC 30 V /3 A
	Binary input	4 dry contact inputs Opto-coupler isolation, 4,000 V_{RMS}
Communication	RS-485 port	Interface type: Twisted Pair, Half Duplex Transmission Communication rate: 600 bps ... 38,400 bps Protocol: Modbus-RTU
Environment	Operating temp.	-25 ℃ ... +60 ℃

Item		Technical Data
Others	Operating temp. limit	-35 ℃ ... +70 ℃
	Relative humidity	≤ 95% (condensation free)
	Clock	< 0.5 sec./day (-40 ℃ .... +85 ℃)
	Operating power supply	AC or DC power supply Max. input range: 40 V ... 420 V Power consumption: ≤ 2 W, 4 VA
	Dimension	Total dimension (mm): 96×96×95 Panel cut out size (mm): 92×92 IP53
	Weight	Approx. 450 g

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Functions 3

3.1 Parameter Measurement

This meter is provided with various measuring functions. Power grid parameters and index measurable are as follows:

- Voltage of each phase and mean voltage
- Voltage of each line and mean voltage
- Current of each phase, average current and neutral current
- Total and separate active power, reactive power and apparent power of each phase
- Phase angle of voltage and current of each phase
- Total and separate power factor of each phase
- Power grid frequency and measuring range 45 Hz to 65 Hz
- Effective value and ratio of 2nd to 50th harmonic voltage and harmonic current of each phase
  - Harmonic voltage ratio:

$$HRU_h = \frac{U_h}{U_1} \times 100(\%)$$

where, U_h - No. h harmonic voltage (RMS); U_1 - fundamental voltage (RMS).

  - Harmonic current ratio:

$$HRI_h = \frac{I_h}{I_1} \times 100(\%)$$

where, I_h- No. h harmonic current (RMS); I_1 - fundamental current (RMS).

- Total harmonic voltage distortion and total harmonic current distortion of each phase
  - Total harmonic voltage distortion:

$$THD_u = \sqrt{\sum_{h=2}^{50}\left(\frac{U_h}{U_1}\right)^2} \times 100(\%)$$

  - Total harmonic current distortion:

$$THD_i = \sqrt{\sum_{h=2}^{50}\left(\frac{I_h}{I_1}\right)^2} \times 100(\%)$$

- Voltage wave crest factor (CF) of each phase, indicating peak of distorted waveform

$$CF = 1.414\sum_{h=1}^{50}\frac{U_h}{U_1}$$

- Current K coefficient K_f of each phase, a critical index measuring current quality

$$K_f = \frac{\sum_{h=1}^{k} (h \times I_h)^2}{\sum_{h=1}^{k} (I_h)^2}$$

where, I_h - effective value of No. h harmonic current (RMS); k - range 1 to 50, configurable with communication, factory default 50.

- Telephone harmonic form factor (THFF) of each phase

Harmonic interference will generate communication system noise, reducing quality of connection. Consultative Committee of International Telephone and Telegraph (CCITT) measures harmonic interference to telecommunication using weight coefficient P_h of noise, expressed with THFF.

$$THFF = \sqrt{\sum_{h=1}^{100} \left(\frac{50 \times h \times P_h \times U_h}{800 \times 1000 \times U_1} \right)^2} \times 100(\%)$$

where, P_h - weight coefficient of noise.

3.2 Power Metering

This meter can meter various energy:

- Combined active and supply and demand active energy
- Combined reactive and four-quadrant reactive energy
- Fundamental active power and total harmonic active energy
- Import and export active energy of each phase, combined reactive energy of each phase, fundamental active energy and harmonic active energy

3.3 Demand Measurement

1. Terms and Definitions

   Demand means average power within specified period. The maximum value of demand recorded within specified period is maximum demand.

   Current demand means average current within specified period. The maximum current value recorded within specified period is called maximum current demand.

   Demand cycle means continuous equal intervals for measuring average power.

   Sliding window time means time interval for measuring maximum demand through recursion. It is less than demand interval.

   Temporary unit means the memory unit of the meter, used for temporary storage of power value or current value when calculating maximum demand.

   Demand interval can be selected from 5, 10, 15, 30 and 60 min. Sliding window time can be selected from 1, 2, 3 and 5 min. Demand interval is five times the sliding window time and is 60 at maximum.

2. In the event of power-on, zero clearing, clock adjustment and interval change of voltage line, the meter will execute demand measurement depending on demand interval from current moment. When the first demand interval is completed, maximum demand will be recorded at slip interval. Maximum demand will not be recorded within an incomplete demand interval.

3. When power direction changes, temporary demand unit will be cleared. Temporary demand unit will not be cleared when across rate period to ensure continuity of maximum demand measurement. Zero clearing of temporary unit is necessary when:

   - Overall clearing of meter;
   - Clearing maximum demand upon communication command;
   - Clearing maximum demand manually through button;
   - Change of power direction;
   - Settlement among different months.

4. This meter is capable of various maximum demand calculation functions, including import/export active demand and occurrence time, combined reactive and four-quadrant reactive maximum demand and occurrence time, import/export apparent demand, maximum current demand of Phase A, Phase B and Phase C and occurrence time.

5. Combined reactive maximum demand means the quadrant with maximum demand value among reactive quadrant participating in combined computation. For example, value of reactive combined status character 2 is 05 H. Typical combined reactive 1 = 1st quadrant reactive + 2nd quadrant reactive. Assuming reactive maximum demand of 1st quadrant in a demand interval is 100kvar and the same of 2nd quadrant is 200 kvar, maximum demand value of combined reactive demand 1 within the same demand interval will be 200 kvar.

6. This meter is provided with two types of zero clearing for demand: clearing via communication and manual clearing with button. For description of the latter, see subsequent content.

7. For time generating maximum demand, minute synchronization or clock synchronization is available. This is controlled by parameter mode character 2. For mode character 2, see the table below. Such mode supports parameter setting and alteration through communication.

Bit	Function	Bit Value vs Function	Default
Bit 7	Reserved		0
Bit 6	Reserved		0
Bit 5	Demand synchronization mode	1: minute synchronization 0: clock synchronization	1
Bit 4	Extreme value settlement	1: daily 0: monthly	0
Bit 3	Reserved		0
Bit 2	Reserved		0

Bit	Function	Bit Value vs Function	Default
Bit 1	Reserved		0
Bit 0	Reserved		0

3.4 Settlement

1. Settlement means the meter can save current electric energy and demand data at the settlement time preset. It is also called cross month settlement.
2. Settlement day (automatic reading day) can be set through communication and any time within the 1st to 28th day can be set.
3. When crossing settlement day in case of power failure, cross month settlement will be applied depending on number of months crossed. But, when more than 3 months, data of only 3 months will be settled.
4. The meter can save historical settlement data of previous 12 months. Historical settlement data include electric energy data and demand data.

3.5 Time Division

1. The meter has a built-in high-precision real-time clock backed up by battery, carrying calendar and supporting automatic switching for leap year.
2. 6 tariffs, 14 periods, 8 daily periods, 14 yearly time zones and 100 public holidays can be set maximally and weekend period can be set. If tariff number of certain period is over number of tariffs (error), default tariff (tariff 1) will be used.
3. Electric energy and maximum demand data recorded by the meter include 6 tariffs, but time-shared data will not be recorded for each phase (A, B and C).

3.6 Event Record

1. Instantaneous extreme value of power grid will be recorded. The meter can record maximum value and minimum value of each phase voltage, line voltage, phase current, neutral current, active power, reactive power and apparent power within cycle time. Cycle time can be "month" or "day" and is set through parameter mode character 2. At most extreme values of three cycles can be saved.
2. Zero clearing, demand clearing and event clearing can be recorded. The meter records 10 latest zero clearing events.
3. Power failure event can be recorded. The meter records 10 latest power failure events, containing start time and end time of power failure.
4. Timing event can be recorded. The meter records 10 latest timing events, containing pre-timing time and post-timing time.
5. Voltage and current unbalance event can be recorded. The meter records 10 latest voltage unbalance events and 10 latest current unbalance events. Decision limit and decision delay time of voltage and current unbalance events are set by parameter.

   Voltage unbalance ratio = (3-phase voltage maximum difference / 3-phase voltage mean) x 100%, where 3-phase voltage maximum difference is the largest difference between effective values of each phase voltage (only Uab and Ubc for 3-phase-3-wire) and 3-phase voltage mean is the mean of effective values of 3-phase voltage.

   Current unbalance ratio = (3-phase current maximum difference / 3-phase current mean) x 100%, where 3-phase current maximum difference is the largest difference between effective values of each phase current (only Iab and Ibc for 3-phase-3-wire) and 3-phase current mean is the mean of effective values of 3-phase current.
6. Statistic data of voltage eligibility rate can be recorded. The meter records statistic voltage eligibility of each phase within recent 12 months. Upper and lower limits for voltage assessment are set by parameter. Statistic data of voltage eligibility include voltage monitoring time, voltage limit violation time, voltage eligibility and voltage limit violation rate.
7. Relay closing event can be recorded. The meter has 2 relay outputs. When manual control is set for relay, the meter will record 10 latest manual closing records of relay output. Closing time and status will be recorded.
8. SOE event can be recorded. The meter can record SOE events of 4 digital binary inputs and save 50 latest records. Time of switch motion (exact to 1 msec), shift status and switch port number are recorded.

3.7 Freezing

1. Cyclic freezing: The meter can save data of 72 latest cyclic freezing actions. Start time and interval of freezing are set with parameter. The content is import/export total active energy.
2. Daily freezing: The meter can save data of 8 latest daily freezing actions, including total active energy, total reactive energy, four-quadrant reactive energy and total active maximum demand.

3.8 Limit violation Alarm

1. This product is provided with limit violation alarm function. User may select from voltage, current, power, power factor and frequency parameters at most 6 data groups at the same time as detection object and set upper and lower limits and judgment condition for them. Alarm will be activated when measured value is over the set limit. This product is provided with 2 relay outputs. When alarm parameters are configured that output is made from certain relay which is at automatic mode (not manual), limit violation alarm signal can be output through such relay.

2. At most 6 limit violation alarm parameters can be set at the same time within the product. Configuration flow of each limit violation alarm parameter: select type of detected data-set threshold of detected data-set judgment condition-select output relay for alarm signal.

   • Code of various detected data: (hexadecimal number for Modbus-RTU code)

MODBUS code	Content of data	MODBUS code	Content of data
00	Phase A power factor	14	Phase A active power
01	Phase B power factor	15	Phase B active power
02	Phase C power factor	16	Phase C active power
03	Total power factor	17	Total active power
06	Frequency	18	Phase A reactive power
07	Phase A voltage	19	Phase B reactive power
08	Phase B voltage	1A	Phase C reactive power
09	Phase C voltage	1B	Total reactive power
0B	Uab line voltage	1C	Phase A apparent power
0C	Ubc line voltage	1D	Phase B apparent power
0D	Uca line voltage	1E	Phase C apparent power
0F	Phase A current	1F	Total phase apparent power
10	Phase B current	20	Active demand
11	Phase C current	21	Reactive demand
12	Neutral current	22	Apparent demand

When code of detected data is FF, limit violation alarm function of such group is off.

- Threshold of detected data: threshold judging whether detected value is limit violation; Different units for different data types: such as voltage-V, current-A, active-KW, reactive power-KVAR, apparent-KVA, frequency-Hz.
- Judging condition: 0 means alarm activated when exceeding limit; 1 means alarm activated when falling below limit.
- Alarm signal output relay: 0 means no alarm signal output; 1 means alarm signal outputted from relay 1; 2 means alarm signal outputted from relay 2; 3 means alarm signal outputted from relay 1 and relay 2 at the same time.

3. Example of alarm parameter setting. Set one limit violation alarm parameter to automatic detection and alarm for "Phase A voltage", assuming that alarm threshold is 240 V, judging criterion is "over limit" and signal is outputted from relay 2.

Use MODBUS RTU protocol to set alarm parameter: set 0110 address to "07", 0111 to "0000", 0112 to "5DC0" (multiply "240" by 100 to generate "24,000" and convert it into "00005DC0"), 0113 to "00" and 0114 to "02".

3.9 Display and Buttons

This product uses large-screen WVA multi-line LCD to provide visual and various display. The screen is provided with white backlight, enabling clear display in dark environment. Specific data information can be obtained through display with button operation. For details, see Chapter Operation and Display.

3.10 Communication

RS485 port is provided for parameter setting and reading of various data. Two independent RS485 communication ports are default configuration.

3.11 Permission and Security Management

1. This product is provided with programming permission management function.
   - L0 password: used for meter reset, setting all parameters and modifying L0, L2 and L4 passwords;
   - L2 password: used for meter reset, setting all parameters and modifying L2 and L4 passwords;
   - L4 password: used for parameter setting, demand clearing and modifying L4 password, not for meter reset, event clearing, clearing extreme values and PT/CT ratio setting.
   - **All level default PASSWORD is "000000"**
2. Parameter setting is available only when this product is in programmable state. Steps for entering programming state: press " ↵ " and " ⇄ " at the same time to enter "PASS" screen; input correct password and press " ↵ " to enter "SET" screen and enable programmable state. After entering programmable state, programmable state prompt appears on the bottom right corner of LCD. Programmable state will remain valid in 10 minutes after program button is pressed and become invalid after power down.
3. If incorrect password is used to set this product continuously (including communication setting and button programming) up to specific number of times (factory default 5 times), parameter setting function will be locked (factory default 60 minutes). Error count will be reset after setting once using correct password if such count is less than specific limit. Error count of password and lock time can be set (available in factory state).
4. Broadcast timing is available only once each day and time for adjustment is no more than 5 min.

3.12 Digital Input and Output Interface

Power Pulse Output

This meter provides two power pulse outputs: active and reactive, with internal opto-isolation, pulse output width (80±20) ms, maximum allowable passing current 10 mA (DC) and operating voltage range 5 V to 80 V (DC).

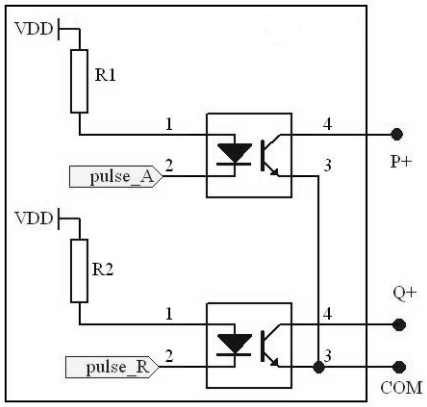

Figure 3-1 Circuit Diagram of Power Pulse Output Interface

Binary Input Interface

This product is provided with 4-digit binary inputs interface based on passive dry contact. Terminals are identified as DI1, DI2, DI3, DI4 and COM. COM is the common terminal.

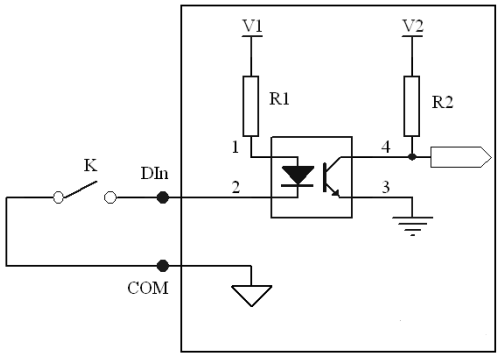

Figure 3-2 Circuit Diagram of Binary Input Interface

Relay Output Interface

This product is provided with two relay outputs interfaces for alarm indication or protection control output in many conditions. Electric parameter of internal relay: AC 250 V/DC 30 V, 3 A.

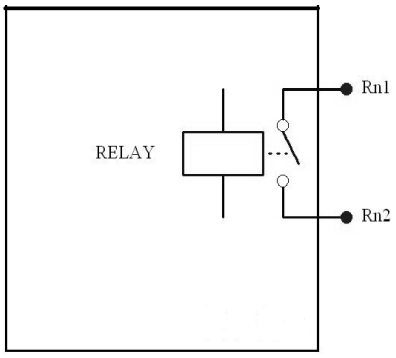

Figure 3-3 Circuit Diagram of Relay Output Interface

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Operation and Display 4

4.1 Full-screen Display

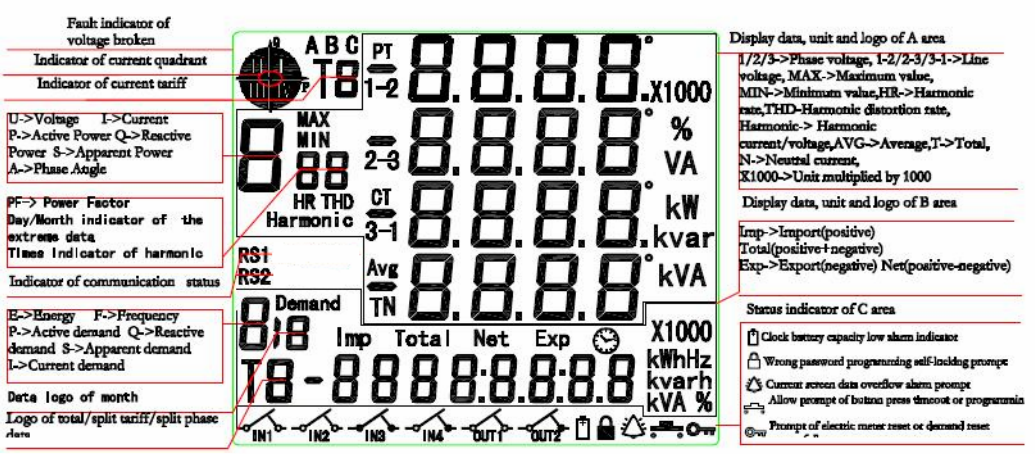


Figure 4-1 Description of LCD Indication

4.2 Cyclic Display

Key Functions at Cyclic Display Mode

Key symbol	▲	▼	↵	⇄
Function	Switching from cyclic display to buttom display		Lock/unlock blinking display	Switching between display areas A and B (blinking prompt)

Screen Lock in Cyclic Display State

Data in display area A or B can be locked in cyclic display state to enable long-time monitoring of data in certain area.

Steps: press "⇄", select the desired display area (target data will blink thrice), and press "↵" to lock, and vice versa for unlocking.

Cyclic Display Parameter

Duration: 1 to 99 sec., configurable;

Number of items: to be defined with one byte. 4 high 4 bits are number of items in display area A while 4 low 4 bits are number of items in display area B. 16 items are acceptable to each area. At any time, display area A and display area B should have at least one cyclic display item.

Cyclic Display State

Cyclic display data in areas A and B can be defined by user. User may develop cyclic display scheme previously through inquiring "Code list of optional settings in areas A and B".

Code list of optional settings in area A:

Data item	Data type (current value)			Data item	Data type (current value)	
	Tran-sient	Maximun (previous 1 to 3 months)	Minimum (previous 1 to 3 months)		Transient	2nd to 50th
Phase voltage	0	1 (2 ... 4)	5 (6 ... 8)	Voltage unbalance rate	66	/
Line voltage	9	10 (11 ... 13)	14 (15 ... 17)	Current unbalance rate	67	/
Current	18	19 (20 ... 22)	23 (24 ... 26)	Voltage eligibility rate	68	/
Neutral current	27	28 (29 ... 31)	V	Voltage distortion rate	69	/
Active power	36	37 (38 ... 40)	41 (42 ... 44)	Current distortion rate	70	/
Reactive power	45	46 (47 ... 49)	50 (51 ... 53)	Fundamental voltage	71	72 ... 120
Apparent power	54	55 (56 ... 58)	59 (60 ... 62)	Fundamental current	121	120 ... 170
Power factor	63	/	/	Second harmonic voltage ratio	171	172 ... 219
Phase angle	64	/	/	Second harmonic current ratio	220	221 ... 268

Code list of optional settings in area B:

Data item	Data: 7 continuous codes express total, tariff 1 to tariff 6 in order; 4 continuous codes express current month, previous 1 to 3 months in order.						
	Current	Previous 1 month	Previous 2 month	Previous 3 month	Phase A	Phase B	Phase C
Import active power	351 ... 357	358 ... 364	365 ... 371	372 ... 378	379 ... 382	383 ... 386	387 ... 390
Export active power	391 ... 397	398 ... 404	405 ... 411	412 ... 418	419 ... 422	423 ... 426	427 ... 430
Total active power	431 ... 437	438 ... 444	445 ... 451	452 ... 458	459 ... 462	463 ... 466	467 ... 470
Net active power	471 ... 477	478 ... 484	485 ... 491	492 ... 498	499 ... 502	503 ... 506	507 ... 510
Import reactive power	511 ... 517	518 ... 524	525 ... 531	532 ... 538	539 ... 542	543 ... 546	547 ... 550
Export reactive power	551 ... 557	558 ... 564	565 ... 571	572 ... 578	579 ... 582	583 ... 586	587 ... 590
Total reactive power	591 ... 597	598 ... 604	605 ... 611	612 ... 618	619 ... 622	623 ... 626	627 ... 630
Net reactive power	631 ... 637	638 ... 644	645 ... 651	652 ... 658	659 ... 662	663 ... 666	667 ... 670
Import active demand	671 ... 677	678 ... 684	685 ... 691	692 ... 698			
Export active demand	699 ... 705	706 ... 712	713 ... 719	720 ... 726			
Import reactive demand	727 ... 733	734 ... 740	741 ... 747	748 ... 754			
Export reactive demand	755 ... 761	762 ... 768	769 ... 775	776 ... 782			
Import apparent demand	783 ... 789	790 ... 796	797 ... 803	804 ... 810			
Export apparent demand	811 ... 817	818 ... 824	825 ... 831	832 ... 838			
Phase A forward current demand	839 ... 845	846 ... 852	853 ... 859	860 ... 866			
Phase B forward current demand	867 ... 873	874 ... 880	881 ... 887	888 ... 894			
Phase C forward current demand	895 ... 901	902 ... 908	909 ... 915	916 ... 922			
Frequency	923						
Data	924						

Data item	Data: 7 continuous codes express total, tariff 1 to tariff 6 in order; 4 continuous codes express current month, previous 1 to 3 months in order.						
	Current	Previous 1 month	Previous 2 month	Previous 3 month	Phase A	Phase B	Phase C
Time	250						
Error code	926						

Note

In flip-with-key state or parameter-set-with-key state, this product will automatically return to cyclic display state if no key operation within defined duration.

4.3 Key Definition

Key Functions at Flip-With-Key Display Mode

Key symbol	▲	▼	↵	⮌
Function	1) Switch from cyclic display state to key display state through pressing "▲" or "▼". 2) Flip over to previous screen with "▲" and to next screen with "▼".		Enter next menu	1) Switch between A and B display areas (symbol of selected area will flicker) 2) Return to previous menu

Data Item of Key Display

- Data items displayed in area A (mainly measuring data)

Level 1	Level 2	Level 1	Level 2
Voltage	Extreme value	Voltage unbalance rate	/
Line voltage	Extreme value	Current unbalance rate	/
Current	Extreme value	Voltage eligibility rate	/
Active power	Extreme value	Voltage distortion rate	/
Reactive power	Extreme value	Current distortion rate	/
Apparent power	Extreme value	Fundamental voltage	2^{nd} to 50^{th} harmonic voltage
Power factor	/	Fundamental current	2^{nd} to 50^{th} harmonic current
Phase angle	/	Second harmonic voltage ratio	3^{rd} to 50^{th}
PT and CT ratio	/	Second harmonic current ratio	3^{rd} to 50^{th}

- Data items displayed in area B (mainly measuring data)

Level 1										Level 2	Level 3
Electric energy		Import active	Export active	Total active	Net active	Import reactive	Export reactive	Total re-active	Net re-active		
	Total	(01)	(05)	(09)	(13)	(17)	(21)	(25)	(29)	Previous 1 to 3 months	0 to 6 Tariff
	Phase A	(02)	(06)	(10)	(14)	(18)	(22)	(26)	(30)	Previous 1 to 3 months	
	Phase B	(03)	(07)	(11)	(15)	(19)	(23)	(27)	(31)	Previous 1 to 3 months	
	Phase C	(04)	(08)	(12)	(16)	(20)	(24)	(28)	(32)	Previous 1 to 3 months	
Maximum demend		Import active	Export active	Import reactive	Export reactive	Import appar-ent	Export appar-ent	Current A/B/C			
		(33)	(34)	(35)	(36)	(37)	(38)	(39 ... 41)		Previous 1 to 3 months	0 to 6 Tariff
Frequency		(42)								/	/
Data		(43)								/	/
Time		(44)								/	/
Fault code		(45)								/	/
Version number		(46)								Active constant Reactive constant Modbus communi-cation address	/

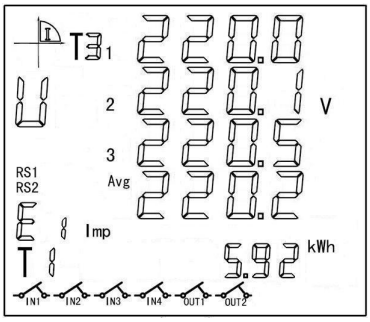
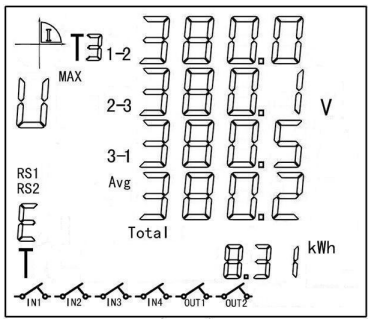
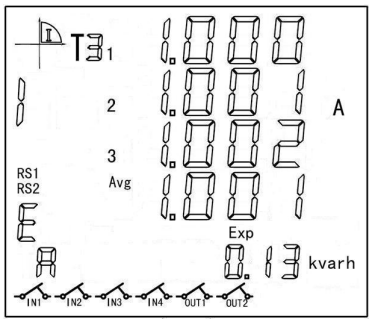
- Data items combined in area A and B:

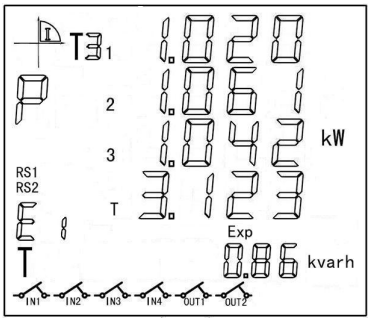
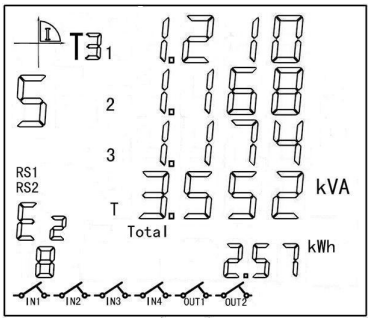
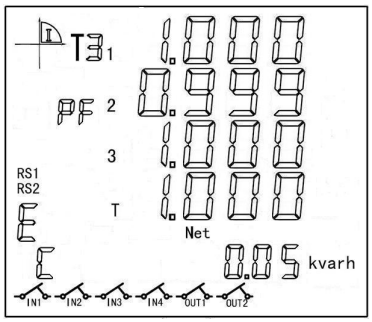
Firmware version number, active constant, reactive constant, Modbus communication address, etc.

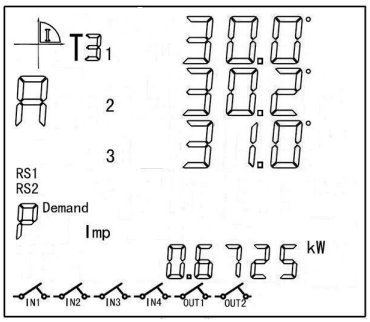
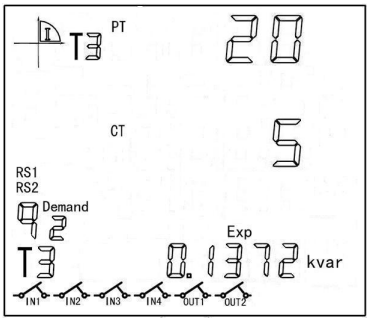
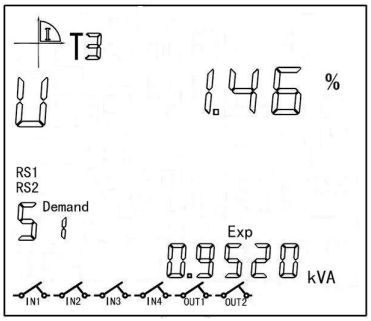
Note

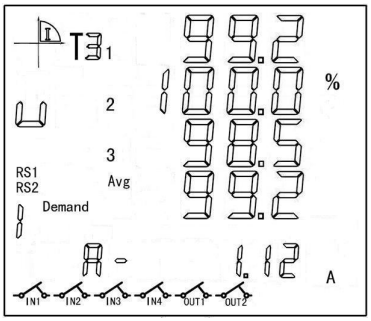
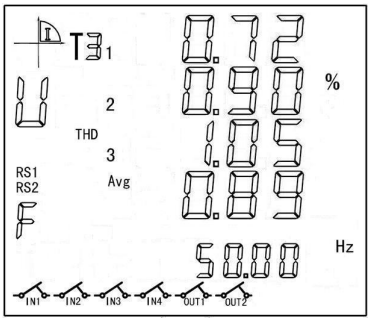
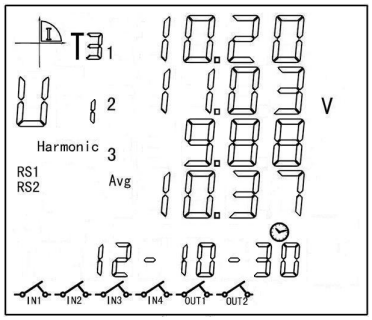
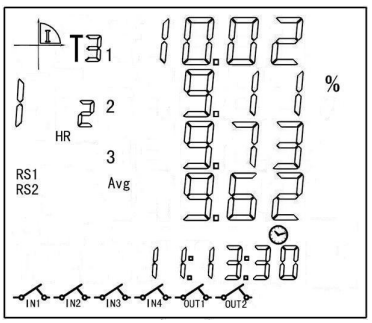
Full screen, firmware version number is displayed in order when the meter is power on.

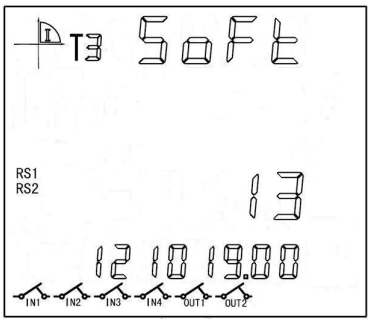
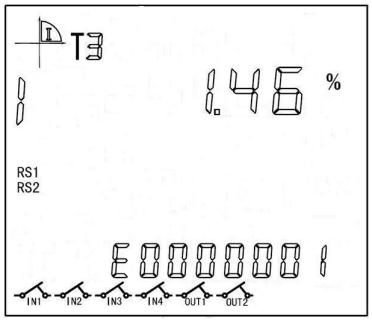
Examples for Flip-With-Key Operation

	**Example 1:** This screen shows A display area (phase voltage) and B display area (electric energy at import active tariff on previous settlement day). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" again to switch to voltage items. Press " ⮂ " to switch to area B. Press "▲" or "▼" to switch to current import active total energy display. Press " ↵ " to enter second level display. Press "▲" or "▼" to switch to import active total energy on previous settlement day. Press " ↵ " again to enter third level display. Press "▲" or "▼" to view import active energy at each tariff on previous settlement day. Press " ⮂ " to return to previous display. "RS1" and "RS2" show there are two RS485 ports and flickering symbol means communication in progress. "**T3**" on upper left corner means current operating tariff and " " means the meter runs in first quartile.
	**Example 2:** This screen shows A display area (upper limit of current line voltage) and B display area (current total active energy). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to switch to line voltage option and press " ↵ " to enter upper limit display. You can also press "▲" or "▼" to view other extreme values. Press " ⮂ " to return to previous display. Press " ⮂ " again to switch to area B. Press "▲" or "▼" to switch to current total active energy display. Press " ↵ " to enter second level display. Press "▲" or "▼" to view total active energy on previous 3 settlement days. Press " ↵ " again to enter third level display. Press "▲" or "▼" to view import active energy at each tariff on previous settlement day. Press " ⮂ " to return to previous display.
	**Example 3:** This screen shows A display area (phase current) and B display area (current phase A total export reactive energy). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" again to switch to current option. In the figure, L1=1.000 A, L2=1.001 A, L3=1.002 A and 3-phase average current=1.001 A. Press " ⮂ " to switch to area B. Press "▲" or "▼" to switch to current phase A total export reactive energy display. Press " ↵ " to enter second level display. Press "▲" or "▼" to view phase A total export reactive energy from previous 1 settlement day to 3 settlement days. Press " ⮂ " to return to previous display.

	**Example 4:** This screen shows A display area (current active power) and B display area (total export reactive energy on previous settlement day). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter active power items. In the figure of A, L1=1.020 kW, L2=1.061 kW, L3=1.042 kW and total active power=3.123 kW. Press " ⮌ " to switch to area B. Press "▲" or "▼" to switch to total current export reactive energy display. Then, press " ↵ " to enter total export reactive energy on previous settlement day. You can press "▲" or "▼" to view total export reactive energy from current to previous 3 settlement days. Press " ↵ " to view export reactive energy at each tariff. Press " ⮌ " to return to previous display.
	**Example 5:** This screen shows A display area (current apparent power) and B display area (total active energy on previous 2 settlement days at phase B). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter apparent power items. In the figure of A, L1=1.210 kW, L2=1.168 kVA, L3=1.174 kVA and total apparent power=3.552 kVA.Press " ⮌ " to switch to area B. Press "▲" or "▼" to switch to total current active energy of phase B. Press " ↵ " to enter total active energy of phase B on previous settlement day. You can press "▲" or "▼" to view total active energy from previous 1 to 3 settlement days. Press " ⮌ " to return to previous display.
	**Example 6:** This screen shows A display area (current power factor) and B display area (current net reactive energy of phase C). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to switch to power factor items. In the figure, L1=1.000, L2=0.999, L3=1.000 and total power factor=1.000. Press " ⮌ " to switch to area B. Press "▲" or "▼" to switch to current phase C net reactive energy. Press " ↵ " to enter second level display. Press "▲" or "▼" to view phase C net reactive energy from previous 1 settlement day to 3 settlement days. Press " ⮌ " to return to previous display.

	**Example 7:** This screen shows A display area (phase angle) and B display area (current total maximum import active demand). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" again to switch to phase angle items. In the figure, L1=30.0°, L2=30.2°, L3=31.0°. Press " " again to switch to area B. Press "▲" or "▼" to switch to current total maximum import active demand. Press " " to enter second level display. Press "▲" or "▼" to view total maximum import active demand from current to previous 3 settlement days. Press " " again to enter third level display. Press "▲" or "▼" to view maximum import active demand at each tariff. Press " " to return to previous display.
	**Example 8:** This screen shows A display area (PT and CT conversion ratio) and B display area (maximum export reactive demand at tariff 3 of previous 2 settlement days/combined reactive 2). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter PT and CT ratio display items. In the figure of A, PT conversion ratio=20.0, CT conversion ratio=5.0. Press " " to switch to area B. Press "▲" or "▼" to switch to maximum export reactive demand at tariff 3 of previous 2 settlement days/combined reactive 2. Press " " to enter second level display. Press "▲" or "▼" to switch to total maximum export reactive demand on previous 2 settlement days. Press " " again to enter third level display. Press "▲" or "▼" to view maximum reactive demand at each tariff on previous 2 settlement days.
	**Example 9:** This screen shows A display area (current voltage unbalance rate) and B display area (total maximum export apparent demand on previous settlement day). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" switch to current voltage unbalance rate option. In the figure of A, voltage unbalance rate = 1.46%. Press " " to switch to area B. Press "▲" or "▼" to switch to total maximum export apparent demand display. Press " " to enter second level display. Press "▲" or "▼" to view total maximum export apparent demand on previous 3 settlement days. Press " " again to enter third level display. Press "▲" or "▼" to view maximum export reactive demand at each tariff. Press " " to return to previous display.

	**Example 10:** This screen shows A display area (current voltage eligibility rate) and B display area (current phase A current maximum demand). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to enter voltage eligibility rate option. In the figure of A, L1=99.2%, L2=100.0%, L3=98.5% and mean voltage eligibility rate=99.2%. Press " " to switch to area B. Press "▲" or "▼" to switch to current phase A current maximum demand display. Press " " to enter second level display. Press "▲" or "▼" to view current phase A current maximum demand on previous 3 settlement days. Press " " again to enter third level display. Press "▲" or "▼" to view maximum demand at each tariff. Press " " to return to previous display.
	**Example 11:** This screen shows A display area (voltage distortion rate) and B display area (frequency). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" again to switch to voltage distortion rate option. In the figure of A, L1=0.72%, L2=0.90%, L3=1.05% and average voltage distortion rate=0.89%. Press " " to return to area B and press "▲" or "▼" to switch to frequency option.
	**Example 12:** This screen shows A display area (fundamental voltage) and B display area (current date). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to switch to fundamental voltage option. In the figure of A, L1=10.20 V, L2=11.03 V, L3=9.88 V and mean fundamental voltage=10.37 V. Press " " to enter second level display. You can press "▲" or "▼" to view 2nd to 50th harmonic voltage. Press " " to return to previous display. Press " " again to return to area B and press "▲" or "▼" to switch to current time display.
	**Example 13:** This screen shows A display area (2nd harmonic current ratio) and B display area (current time). At cyclic display mode, press "▲" or "▼" to enter key display mode. When area A is selected, press "▲" or "▼" to switch to 2nd harmonic current ratio option. In the figure of A, L1=10.02%, L2=9.11%, L3=9.73% and mean 2nd harmonic current ratio=9.62%. Press " " to enter second level display. You can press "▲" or "▼" to view 3rd to 50th harmonic voltage. Press " " to return to previous display. Press " " again to return to area B and press "▲" or "▼" to switch to current time display.

	**Example 14:** This screen shows B display area (software version). At cyclic display mode, press "▲" or "▼" to enter key display mode, press " " to switch to area B. Press "▲" or "▼" to switch to software version number display. "Soft" means software version, "13" means product specification, "1210119" means software version date and "00" means serial number of software production. Press " " to enter second level display. You can press "▲" or "▼" to view active pulse constant, reactive pulse constant, Modbus communication address. Press " " to return to previous display.
	**Example 15:** This screen shows A display area (current unbalance rate) and B display area (error code). At cyclic display mode, press "▲" or "▼" to enter key display mode. When A is selected, press "▲" or "▼" switch to current unbalance rate option. In the figure of A, current unbalance rate = 1.46%. Press " " to switch to area B. Press "▲" or "▼" to switch to error code display. "E" means error prompt, the 7 bits from right to left mean respectively Phase A loss, Phase B loss, Phase C loss, voltage phase reverse, Phase A current reverse, Phase B current reverse, Phase C current reverse. For example, "E0000001" means phase C current reverse fault occurs.

Key Setting Parameters

1. Key functions at parameter setting mode

Key symbol	▲	▼		
Function	a) "▲" to switch digit or flip over; b) "▼" to move cursor or flip over.		a) Press " " and " " at the same time to enter setting screen. b) Press " " to enter next menu or "confirm" parameter setting. c) Press " " to return to previous menu or "cancel" parameter setting [1].	

1.Press " " once after adjusting parameters with "▲" and "▼" to display "Sure", and press " " once again to alter parameters. Pressing " " immediately after "Sure" appears will cancel current alteration.

2. Data items configurable with key (Note 1)

NO.	1st level menu		2nd level menu			
	Symbol	Definition	Symbol	Definition	Range	Remarks
1	Conn	Communi-cation setting	bPS1	Baud rate	600 ... 38400	Default setting: 2400
			bPS2	Baud rate	600 ... 38400	Default setting: 2400
			PrY1	Parity	8E1/8o1/8n1/8n2	Default setting: 8E1
			PrY2	Parity	8E1/8o1/8n1/8n2	Default setting: 8E1
			nbUS	Modbus address	0 ... 247	Default setting: 0
			dLAY	Modbus sending delay	0 ... 2999	Unit: ms Default setting: 10
			rCP-rSt	Reset Ethernet port		
			rdLY	Ethernet communi-cation module sending time inter-val setting	2 ... 200	Unit: ms
2	PrCr	Ratio setting (Note 2)	Pr-A	Voltage ratio integer part	0 ... 9999	Combination 0 ... 9999.9999 Default setting: 1
			Pr-b	Voltage ratio decimal part	0 ... 9999	
			Cr-A	Current ratio integer part	0 ... 9999	Combination 0 ... 9999.9999 Default setting: 1
			Cr-b	Current ratio decimal part	0 ... 9999	

NO.	1st level menu		2nd level menu			
	Symbol	Definition	Symbol	Definition	Range	Remarks
3	SYS	System setting	dAtE	Data		
			TIME	Time		
			tYPE	Connection	3P4L 3P3L_2CT 3P3L_3CT AUto	3phase4wire 3phase3wire -2CT 3phase3wire -3CT Automatic
			PASS	Password		6 bits in total, Set L0 to L2 password Default setting: 000000
4	CLr	Clearing extreme value	EtrE			
		Clearing demand	dEMd			
		Meter reset	ALL			
5	dISP	Display setting	PrES	Time of returning to cyclic display state when no operation	1 ... 99	Unit: min. Default setting: 10
			LIGH	Time of backlight on when no operation (normally on when set to 0)	0 ... 99	Unit: min. Default setting: 10
			CYCL	Interval of cyclic display	1 ... 99	Unit: sec Default setting: 5

Note

Password level (1 bit, 0 to 2) and password (6 bits) should be entered at first for key setting. Password level and permission:

- L0 password-all parameters above are configurable;
- L1 password-all parameters above are configurable;
- L2 password-all parameters except for meter reset, clearing extreme value and PT/CT conversion ratio are configurable.

Note

The meter should be reset after altering PT/CT ratio to ensure reasonable correspondence between communication reading and displayed metering data.

Note

For P39 device, the second communication port parameter setting can not be changed.

3. Parameter setting with keys (take "Conn communication setting" for example)

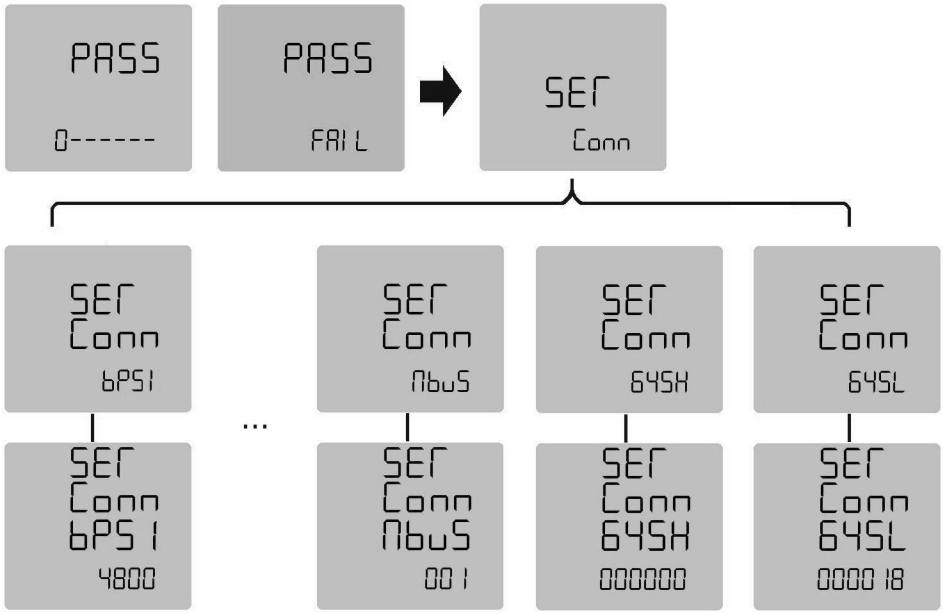


Figure 4-2 Parameter Setting with Keys

At any time, press " ↵ " and " ⮌ " simultaneously to enter "PASS" screen. The first digit of displayed data means password level and the remaining 6 data make up the password (press "▲" to change digits and "▼" to move cursor). Press " ↵ " to confirm. "FAIL" will appear if password level and password are wrong. To re-enter password, press " ↵ ". To quit and return to cyclic display state, enter " ⮌ " (if specified error count is reached, parameter setting function will be locked for certain period which is configurable in advance). If the password is validated, you may enter the first-level menu. The figure shows the read-write items under "Conn" menu: baud rate and communication address of RS485 port can be set.

Note

SurE "SURE" screen appears after selecting or inputting parameter and pressing " ↵ ". Press " ↵ " once again to activate new parameter. Pressing " ⮌ " at any time during parameter setting will cancel setting or return to previous menu.

■

Installation and Wiring 5

5.1 Total Dimension

The figure below shows the total dimension of this product. Panel cut out size: 92 mm×92 mm

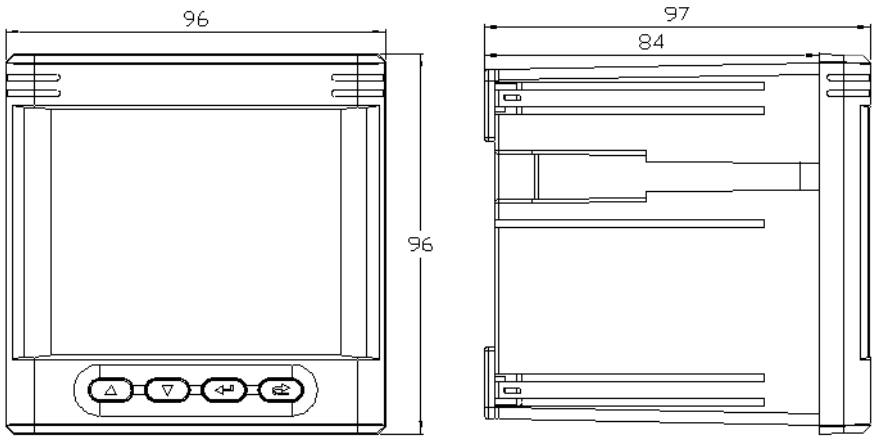


Figure 5-1 Total Dimension of Instrument

5.2 Precautions of Installation

1. Dry and well ventilated environment far away from thermal source and strong electric (magnetic) field is recommended for installation of this product.
2. Ambient temperature: -25 ℃ to +60 ℃ , humidity: ≤ 95% (no condensation)
3. This product should be firmly mounted to avoid accident arising from vibration.
4. For the reason of convenient installation, maintenance and operation and safety, enough space around this product should be reserved during installation (especially when one panel for multiple meters).
5. Requirement for electric wiring: Stranded fire-retarded copper wire over 2.5 mm^2 should be used for current circuit, 1.5 mm^2 stranded fire-retarded copper wire should be used for voltage circuit and power supply circuit, and 1.0 mm^2 Shielded Twisted Pair should be used for RS485 communication.
6. Requirement for electric connection: In voltage input circuit and operating power supply circuit, appropriate fuses (such as 0.5 A fuse) should be connected and a CT short-circuit box should be provided to prevent open circuit of CT wiring.

5.3 Terminals and Wiring Diagram

Definition of Terminals (viewed from rear to front and from left to right)

1. Upper main terminals

V+	V-	NC	NC	R11	R12	R21	R22
Power supply		Reserved	Reserved	Relay output 1		Relay output 2	

Note

NC means no connection, the same below.

2. Lower main terminals

V1	V2	V3	VN	I11	I12	I21	I22	I31	I32
Phase A voltage	Phase B voltage	Phase C voltage	Neutral	Phase A current input	Phase A current output	Phase B current input	Phase B current output	Phase C current input	Phase C current output

Note

Main terminals are barrier terminals which can be connected using fork or ring-type lug (no more than 6.5 mm wide). For cables to be connected to upper and lower main terminals, cold-pressed UT2.5-3 terminal is recommended before connection. The diagram of connection is below.

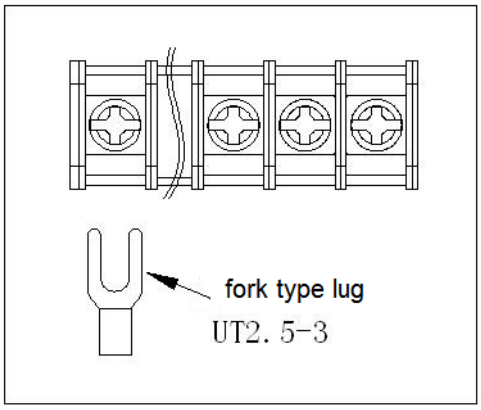


Figure 5-2 Connection Diagram of Main Terminal

3. Middle auxiliary terminal (For P38)

P+	Q+	COM1	DI1	DI2	DI3	DI4	COM2	A1	B1	A2	B2
Active pulse	Reactive pulse	Common pulse output terminal	Binary input 1	Binary input 2	Binary input 3	Binary input 4	Common binary input terminal	RS485 + 1	RS485 - 1	RS485 + 2	RS485 - 2

4. Middle auxiliary terminal (For P39)

RJ45	P+	Q+	COM1	DI1	DI2	DI3	DI4	COM2	A	B
Ethernet port	Active pulse output	Reactive pulse output	Common pulse output terminal	Binary input 1	Binary input 2	Binary input 3	Binary input 4	Common binary input terminal	RS485 +	RS485 -

Note

Auxiliary terminal is pluggable.

Wiring diagram

Wiring diagram of main terminal is showed below. "V+" and "V-" are power supply terminals. This product supports DC/AC input, with input voltage 40 V to 420 V. For 3-phase-3-wire connection, V_n and V_2 should be connected together, see Figure 5-5.

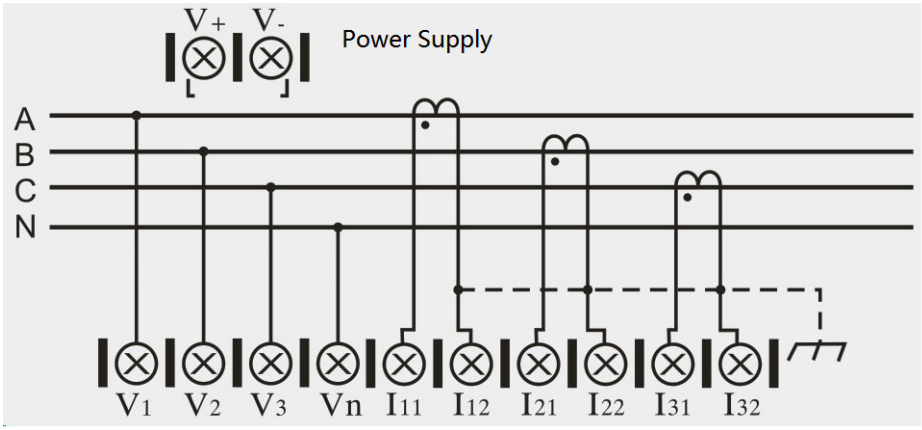


Figure 5-3 Wiring Diagram of 3-phase-4-wire (W/O PT)

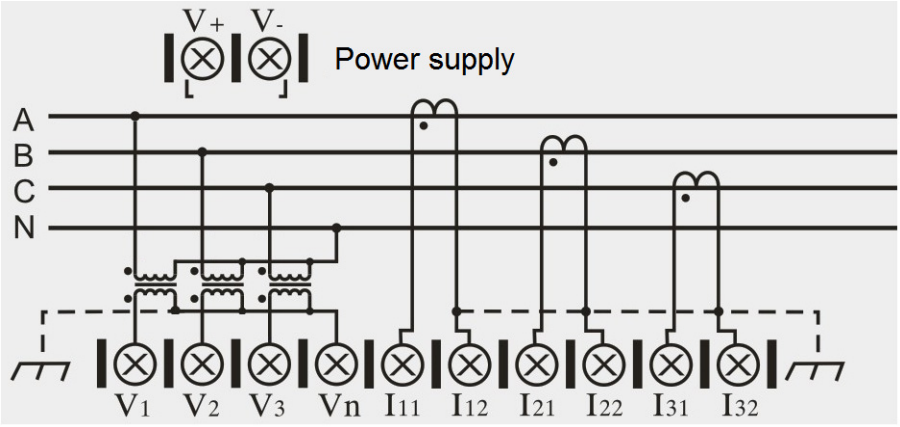


Figure 5-4 Wiring Diagram of 3-phase-4-wire (With PT)

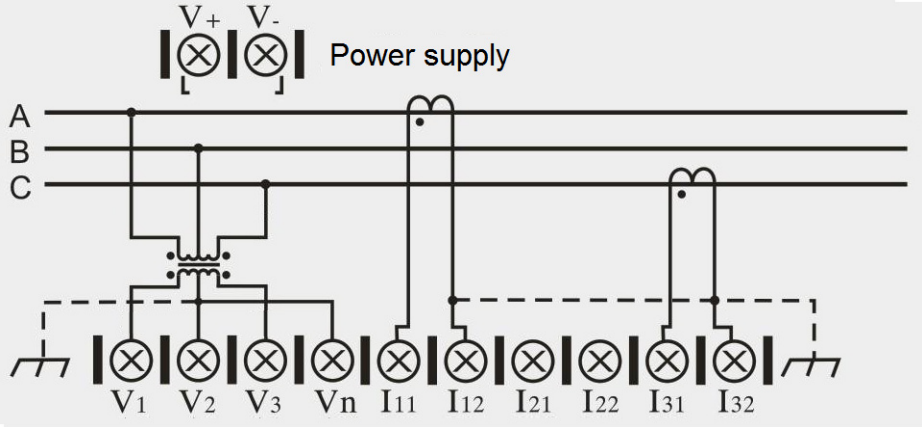


Figure 5-5 Wiring Diagram of 3-phase-3-wire

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Communication 6

6.1 Use of Communication

RS485 port of this meter supports MODBUS-RTU communication protocol. Even parity check is the default setting for data byte check. MODBUS-RTU communication protocol can also be configured to odd parity check or no verification (1 or 2 stop bits can be set without check). Baud rate of communication port could any of 600 bps, 1,200 bps, 2,400 bps, 4,800 bps, 9,600 bps, 19,200 bps and 38,400 bps.

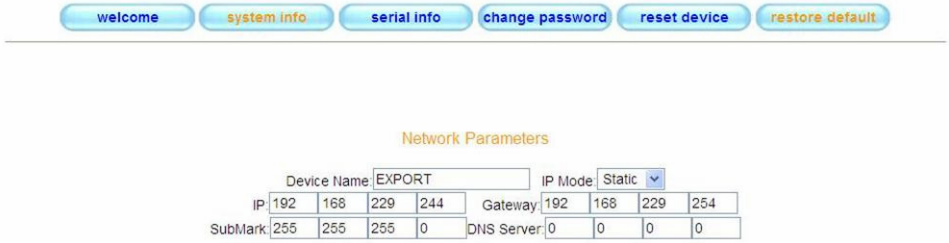
RS485 port of this product should be connected using Shield Twisted Pair. When wiring, layout of the entire network should be considered: length and orientation of communication cable, position of upper computer, matched resistance at network end-point, communication converter, network scalability, network coverage, EMI, etc.

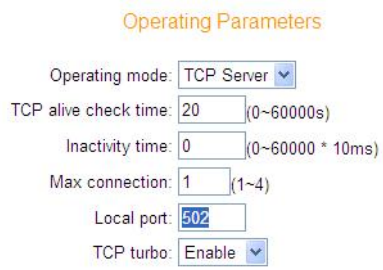
Note

1. Wiring should be conducted strictly in accordance with requirement.
2. The power meter requiring no communication temporarily should be connected to RS485 network for easy diagnosis and test.
3. The shielding layer side of cable connected with upper computer should be reliably earthed (PGND: ground, cubicle, cabinet, etc.) to avoid two-point or multi-point earthing.
4. Shield Twisted Pair should be used for RS485 bus cable. For two twisted pairs, different colors are recommended, one color for "A" side and another color for "B" side of 485 communication port.

The RJ45 Ethernet port supports 10M/100 bits/s, device work on TCP Server mode, Modbus TCP connection port fixed to 502.

Ethernet parameters are configured by WEB mode. Open the IE browser, enter device IP address in the address bar (factory default 192.168.0.7), shown below login interface. Password is 88888.





6.2 Introduction of MODBUS-RTU Communication Protocol

6.2.1 Overview

Type of Protocol

This is MODBUS RTU protocol applicable to real-time communication of embedded electric energy meter. This protocol defines the data exchange between terminal unit (slave) and Master, which is realized in the form of RTU (remote terminal unit) of MODBUS. Asynchronous master-slave half-duplex communication is used. Communication is initiated from master and slave responds after receiving request from master. Communication response time < 0.2 sec.

Physical Layer

- Transmission interface: RS-485
- Communication address: 0 to 247
- Communication baud rate: 600 bps to 38,400 bps
- Communication media: Shield Twisted Pair

Data Link Layer (DLL)

- Transmission manner: asynchronous master-slave half-duplex
- Data frame format: 1 start bit, 8-digit data, even parity check bit, 1 stop bit (default)
- Data packet format:

Address	Function	Data	CRC
8 bits	8 bits	n*8 bits	16 bits

Data packet transmission sequence always uses identical address, function code, data and check code. Each data packet should be transmitted as a continuous bit stream. When data packet from the master reaches slave, slave matching the address field in data packet will receive and check the data. If no error, slave will execute the request in data packet and send the responsive date packet to the master. The data packet sent back by slave contains slave Address, Function executed, Data generated from function execution and CRC.

- Address

Address is at the beginning of data packet and consists of an 8-bit data which means slave address specified by the master. Each slave address in the bus is unique. Valid address range is from 0 to 247. After the master sends data packet, only slave matching the inquire address of the master will respond.

- Function

It describes which function is executed by slave. Meanings of all function codes are given below.

Code	Definition	Function
03 H	Read data	Read current binary value of one or more variables
10 H	Preset multiple registers	Overwrite values of several variables using specific binary value

- Data

It contains data required for executing specific function by slave or data acquired when slave responds inquiry of master. Content of these data may be address code or data.

- CRC

Check code is 16-bit check data formed in data transmission for CRC of master and slave. Various interferences exist in communication, so data transmitted during communication may change. CRC will avoid data distortion during responsive transmission of master and slave and improves security and efficiency of system. For formation rule of check code, see Annex 1.

6.2.2 Function of Application Layer

Read Data Command (function code 03 H)

- Down frame format

Communication address (0-247)	Function code (03 H)	High byte of start address of data	Low byte of start address of data	High byte of length of data	Low byte of length of data	Low byte of CRC	High byte of CRC

- Response frame format

Communication address (0-247)	Function code (03 H)	Number of bytes of data length	Content of data	Content of data	Content of data	Low byte of CRC	High byte of CRC

- Example
  - Down frame of 3-phase voltage data read

Device address	03 H	10 H	00 H	00 H	03 H	Low check	High check

  - Response frame

Device address	03 H	06 H	Data 1	Data 2	...	Low check	High check

Preset Multi-Register Command (function code 10 H)

- Down frame format

Device address 0-247	Function code (10 H)	High byte of start address of variable	Low byte of start address of variable	High byte of variable number	Low byte of variable number	Byte n of data	Byte 1 of data	Byte of data	Byte n of data	Low byte of CRC	High byte of CRC

- Response frame format

Device address 0-247	Function code (10 H)	High byte of start address of variable	Low byte of start address of variable	High byte of variable number	Low byte of variable number	Low byte of CRC	High byte of CRC

- Example
  - Down frame when PT conversion ratio is 1234.5678 (hexadecimal notation of 12345678: 00BC 614EH)

Device address	10 H	00 H	03 H	00 H	02 H	04 H	00 H	BC H	61 H	4E H	Low check	High check

  - Response frame

Device address	10 H	00 H	03 H	00 H	02 H	Low check	High check

Exception Response

- Exception response frame format

Communication address (0-247)	Function code (80 H+03 H) (80 H+10 H)	Exception code (XX H)	Low byte of CRC	High byte of CRC

- Example
  - Address data of illegal register read

Device address	03 H	XX H	XX H	00 H	01 H	Low check	High check

  - Response frame

Device address	83 H	02 H	Low check	High check

- Exception code of MODBUS

Code	Meaning
02 H	Illegal data address
03 H	Illegal data
10 H	No permission
11 H	Register length overflow

6.2.3 CRC Method

CRC contains 2 bytes, namely 16-bit binary system. CRC is calculated with transmitting device and placed at the tail of transmitted message. Receiving device recalculates CRC of message received and compares whether CRC derived matches the received one. If not, error may occur.

To calculate CRC, preset all 16-bit registers to 1. Then, process each 8-bit data message one by one. Only 8-bit data bit is used for CRC calculation and start bit and stop bit and parity check bit (if any) are not involved.

Steps of calculating CRC:

- Preset 16-bit register to hexadecimal FFFF (namely all to 1), and this register is called CRC register.
- Execute exclusive OR of low bytes of 1st 8-bit data and 16-bit CRC register and put the result in CRC register.
- Shift the content of register rightwards by one bit (towards lower bit) and fill the highest bit with 0. Check the lowest bit.
- If the lowest bit is 0, repeat step 3 (shift again); if it is 1, execute exclusive OR of CRC register and polynomial A001 (1010 0000 0000 0001).
- Repeat step 3 and step 4 until shift rightwards 8 times. Now, all 8-bit data are processed.
- Repeat step 2 to step 5 to process next 8-bit data.
- The CRC register derived finally is CRC.

6.2.4 Information mapping table

Common Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Remark
Modbus address	0000 H	unsigned int	2 bytes	R/W	0 ... 247	
Baud rate of communication	0001 H	unsigned int	2 bytes	R/W	0 ... 6	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps 5: 600 bps 6: 1200 bps
High 16 bits of voltage conversion ratio	0002 H	unsigned long	4 bytes	R/W	0 ... 99999999	PT ratio=set value/10,000, 10,000 as default when PT=0
Low 16 bits of voltage conversion ratio	0003 H					
High 16 bits of current conversion ratio	0004 H	unsigned long	4 bytes	R/W	0 ... 99999999	CT ratio=set value/10,000, 10,000 as default when CT=0
Low 16 bits of current conversion ratio	0005 H					
Clearing extreme value	0006 H	unsigned int	2 bytes	W	Arbitrary value	
Control Ethernet port	000D H	unsigned int	2 bytes	R/W	0 ... 2	0: power down 1: power up 2: restart
Parity	0020 H	unsigned int	2 bytes	R/W	0 ... 3	0: 8E1 1: 8o1 2: 8n1 3: 8n2
Clearing demand	0021 H	unsigned int	2 bytes	W	Arbitrary value	

Relay Alarm Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Remark
Relay output 1	0100 H	unsigned int	2 bytes	R/W	0 ... 1	Write operation is valid when "alarm manner control byte" is 0 or 2
Relay output 2	0101 H	unsigned int	2 bytes	R/W	0 ... 1	Write operation is valid when "alarm manner control byte" is 0 or 1
Binary inputs	0102 H	unsigned int	2 bytes	R		High byte: binary input status (note) Low byte: binary output status

Parameter		Address	Data Type	Length	R/W	Data Range	Remark
Alarm manner control byte		0103 H	unsigned int	2 bytes	R/W	0 ... 3	0: turn off alarm function 1: relay output 1 is used for alarm 2: relay output 2 is used for alarm 3: output ports 1 and 2 are all used for alarm
Alarm status byte		0106 H	unsigned int	2 bytes	R	0 ... 0x3F	From low to high, each bit means status of an alarm group: 0: no alarm activated 1: in alarm status
BO1 Relay operation time		0107 H	unsigned int	2 bytes	R/W	0 or 100 ... 3000	Unit: ms. Value 0 is for latched output; value 100~3000 for pulse output
BO2 Relay operation time		0109 H	unsigned int	2 bytes	R/W	0 or 100 ... 3000	Unit: ms. Value 0 is for latched output; value 100~3000 for pulse output
Alarm 1	Out-of-limit data type	0110 H	unsigned int	2 bytes	R/W	0 ... 34	See alarm type table
	High 16 bits of out-of-limit threshold	0111 H	unsigned long	4 bytes	R/W	Arbitrary value	Threshold=set value/100
	Low 16 bits of out-of-limit threshold	0112 H					
	Out-of-limit detection type	0113 H	unsigned int	2 bytes	R/W	0 ... 1	0: over, 1: below
	Alarm port	0114 H	unsigned int	2 bytes	R/W	0 ... 3	0: off 1: alarm output to relay output 1 2: alarm output to relay output 2 3: alarm output to output ports 1 and 2
Alarm 2		0115 H ... 0119 H		10 bytes	R/W		See Alarm 1
Alarm 3		011A H ... 011E H		10 bytes	R/W		See Alarm 1
Alarm 4		011F H ... 0123 H		10 bytes	R/W		See Alarm 1
Alarm 5		0124 H ... 0128 H		10 bytes	R/W		See Alarm 1
Alarm 6		0129 H ... 012D H		10 bytes	R/W		See Alarm 1

Note

High bytes BIT0 to BIT3 respectively mean status of binary input 1 to 4. Bit value 0 means input is open while 1 means input is closed.

Low bytes BIT0 and BIT1 respectively mean status of relay output 1 and 2. Bit value 0 means contact is open (relay no operation) while 1 means contact is closed (relay closed).

Other Parameters

Parameter	Address	Data Type	Length	R/W	Data Range	Remark
Demand interval	0130 H	unsigned int	2 bytes	R/W	1 ... 60	Unit: min.
Sliding window time	0131 H	unsigned int	2 bytes	R/W	1 ... 60	Unit: min.
Voltage specification	0134 H	unsigned int	2 bytes	R/W	0 ... 3	3-phase-3-wire 0: 100 V; 3: 380 V; 3-phase-4-wire 1: 220 V; 2: 57.7 V;
Cyclic display time	0132 H	unsigned int	2 bytes	R/W	1 ... 99	Unit: sec
Number of cyclic display items	0133 H	unsigned int	2 bytes	R/W	00 ... FF	
1st screen of cyclic display item of screen A	0140 H	unsigned int	2 bytes	R/W	0 ... 999	See cyclic display code table of area A
Number n screen of cyclic display item of screen A	...	unsigned int	2 bytes	R/W	0 ... 999	
16th screen of cyclic display item of screen A	014F H	unsigned int	2 bytes	R/W	0 ... 999	
1st screen of cyclic display item of screen B	0150 H	unsigned int	2 bytes	R/W	0 ... 999	See cyclic display code table of area B
Number n screen of cyclic display item of screen B	...	unsigned int	2 bytes	R/W	0 ... 999	
16th screen of cyclic display item of screen B	015F H	unsigned int	2 bytes	R/W	0 ... 999	

Instantaneous Such as Voltage, Current, Active/Reactive and Apparent Power, Power Factor, Frequency, Unbalance and Current Demand

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A voltage	1000 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase B voltage	1001 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase C voltage	1002 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Average phase voltage	1003 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Uab line voltage	1004 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Ubc line voltage	1005 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Uca line voltage	1006 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Average line voltage	1007 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase A current	1008 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase B current	1009 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase C current	100A H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Average current	100B H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Neutral current	100C H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase A active power	100D H	signed int	2 bytes	R	-32767 ... 32767	1 W
Phase B active power	100E H	signed int	2 bytes	R	-32767 ... 32767	1 W
Phase C active power	100F H	signed int	2 bytes	R	-32767 ... 32767	1 W
Total active power	1010 H	signed int	2 bytes	R	-32767 ... 32767	1 W
Phase A reactive power	1011 H	signed int	2 bytes	R	-32767 ... 32767	1 var
Phase B reactive power	1012 H	signed int	2 bytes	R	-32767 ... 32767	1 var
Phase C reactive power	1013 H	signed int	2 bytes	R	-32767 ... 32767	1 var
Total reactive power	1014 H	signed int	2 bytes	R	-32767 ... 32767	1 var
Phase A apparent power	1015 H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Phase B apparent power	1016 H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Phase C apparent power	1017 H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Total apparent power	1018 H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Phase A power factor	1019 H	signed int	2 bytes	R	-1000 ... 1000	0.001
Phase B power factor	101A H	signed int	2 bytes	R	-1000 ... 1000	0.001
Phase C power factor	101B H	signed int	2 bytes	R	-1000 ... 1000	0.001
Total power factor	101C H	signed int	2 bytes	R	-1000 ... 1000	0.001
Frequency	101D H	unsigned int	2 bytes	R	0 ... 65535	0.01 Hz
Voltage unbalance rate	101E H	unsigned int	2 bytes	R	0 ... 65535	0.01%
Current unbalance rate	101F H	unsigned int	2 bytes	R	0 ... 65535	0.01%
Current active demand	1020 H	signed int	2 bytes	R	-32767 ... 32767	1 W
Current reactive demand	1021 H	signed int	2 bytes	R	-32767 ... 32767	1 var
Current apparent demand	1022 H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Phase A angle	1023 H	unsigned int	2 bytes	R	0 ... 3600	0.1
Phase B angle	1024 H	unsigned int	2 bytes	R	0 ... 3600	0.1
Phase C angle	1025 H	unsigned int	2 bytes	R	0 ... 3600	0.1
Current Phase A current demand	1026 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Current Phase B current demand	1027 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Current Phase C current demand	1028 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase A fundamental voltage	1100 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase B fundamental harmonic voltage	1101 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase C fundamental harmonic voltage	1102 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase A 2nd harmonic voltage	1103 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase B 2nd harmonic voltage	1104 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase C 2nd harmonic voltage	1105 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase A No. n harmonic voltage	...	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase B No. n harmonic voltage	...	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase C No. n harmonic voltage	...	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase A 50th harmonic voltage	1193 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase B 50th harmonic voltage	1194 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase C 50th harmonic voltage	1195 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase A fundamental current	1200 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase B fundamental current	1201 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase C fundamental current	1202 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase A 2nd harmonic current	1203 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase B 2nd harmonic current	1204 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase C 2nd harmonic current	1205 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase A No. n harmonic current	...	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase B No. n harmonic current	...	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase C No. n harmonic current	...	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase A 50th harmonic current	1293 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase B 50th harmonic current	1294 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase C 50th harmonic current	1295 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A voltage 2nd harmonic ratio	1303 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B voltage 2nd harmonic ratio	1304 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C voltage 2nd harmonic ratio	1305 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase A voltage No. n harmonic ratio	...	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B voltage No. n harmonic ratio	...	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C voltage No. n harmonic ratio	...	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase A voltage 50th harmonic ratio	1393 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B voltage 50th harmonic ratio	1394 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C voltage 50th harmonic ratio	1395 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase A current 2nd harmonic ratio	1403 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B current 2nd harmonic ratio	1404 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C current 2nd harmonic ratio	1405 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase A current No. n harmonic ratio	...	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B current No. n harmonic ratio	...	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C current No. n harmonic ratio	...	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase A current 50th harmonic ratio	1493 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B current 50th harmonic ratio	1494 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C current 50th harmonic ratio	1495 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase A voltage waveform distortion	1500 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B voltage waveform distortion	1501 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C voltage waveform distortion	1502 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase A current waveform distortion	1503 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase B current waveform distortion	1504 H	unsigned int	2 bytes	R	0 ... 10000	0.01%
Phase C current waveform distortion	1505 H	unsigned int	2 bytes	R	0 ... 10000	0.01%

Instantaneous such as voltage, current, active/reactive and apparent power (4 Bytes formate)

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A voltage higher 16 bits	1800 H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Phase A voltage lower 16 bits	1801 H					
Phase B voltage higher 16 bits	1802 H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Phase B voltage lower 16 bits	1803 H					
Phase C voltage higher 16 bits	1804 H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Phase C voltage lower 16 bits	1805 H					
Average phase voltage higher 16 bits	1806 H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Average phase voltage lower 16 bits	1807 H					
Uab line voltage higher 16 bits	1808 H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Uab line voltage lower 16 bits	1809 H					
Ubc line voltage higher 16 bits	180A H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Ubc line voltage lower 16 bits	180B H					
Uca line voltage higher 16 bits	180C H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Uca line voltage lower 16 bits	180D H					
Average line voltage higher 16 bits	180E H	unsigned long	4 bytes	R	0 ... 9999999	0.001 V
Average line voltage lower 16 bits	180F H					
Phase A current higher 16 bits	1810 H	unsigned long	4 bytes	R	0 ... 99999999	0.0001 A
Phase A current lower 16 bits	1811 H					
Phase B current higher 16 bits	1812 H	unsigned long	4 bytes	R	0 ... 99999999	0.0001 A
Phase B current lower 16 bits	1813 H					
Phase C current higher 16 bits	1814 H	unsigned long	4 bytes	R	0 ... 99999999	0.0001 A
Phase C current lower 16 bits	1815 H					
Average current higher 16 bits	1816 H	unsigned long	4 bytes	R	0 ... 99999999	0.0001 A
Average current lower 16 bits	1817 H					

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Neutral current higher 16 bits	1818 H	unsigned long	4 bytes	R	0 ... 99999999	0.0001 A
Neutral current lower 16 bits	1819 H					
Phase A active power higher 16 bits	181A H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 W
Phase A active power lower 16 bits	181B H					
Phase B active power higher 16 bits	181C H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 W
Phase B active power lower 16 bits	181D H					
Phase C active power higher 16 bits	181E H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 W
Phase C active power lower 16 bits	181F H					
Total active power higher 16 bits	1820 H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 W
Total active power lower 16 bits	1821 H					
Phase A reactive power higher 16 bits	1822 H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 var
Phase A reactive power lower 16 bits	1823 H					
Phase B reactive power higher 16 bits	1824 H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 var
Phase B reactive power lower 16 bits	1825 H					
Phase C reactive power higher 16 bits	1826 H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 var
Phase C reactive power lower 16 bits	1827 H					
Total reactive power higher 16 bits	1828 H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 var
Total reactive power lower 16 bits	1829 H					
Phase A apparent power higher 16 bits	182A H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 VA
Phase A apparent power lower 16 bits	182B H					
Phase B apparent power higher 16 bits	182C H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 VA
Phase B apparent power lower 16 bits	182D H					
Phase C apparent power higher 16 bits	182E H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 VA
Phase C apparent power lower 16 bits	182F H					
Total apparent power higher 16 bits	1830 H	signed long	4 bytes	R	-99999999 ... 99999999	0.1 VA
Total apparent power lower 16 bits	1831 H					

Power Parameters

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
Import	Phase A active power high 16 bits	2000 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Phase A active power low 16 bits	2001 H					
	Phase B active power high 16 bits	2002 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Phase B active power low 16 bits	2003 H					
	Phase C active power high 16 bits	2004 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Phase C active power low 16 bits	2005 H					
	Total active power high 16 bits	2006 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Total active power low 16 bits	2007 H					
	Phase A reactive power high 16 bits	2008 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Phase A reactive power low 16 bits	2009 H					
	Phase B reactive power high 16 bits	200A H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Phase B reactive power low 16 bits	200B H					
	Phase C reactive power high 16 bits	200C H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Phase C reactive power low 16 bits	200D H					
	Total reactive power high 16 bits	200E H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Total reactive power low 16 bits	200F H					
	T1 active power high16 bits	2010 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T1 active power low16 bits	2011 H					
	T2 active power high16 bits	2012 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T2 active power low16 bits	2013 H					
	T3 active power high16 bits	2014 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T3 active power low16 bits	2015 H					
	T4 active power high16 bits	2016 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T4 active power low16 bits	2017 H					

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
	T5 active power high16 bits	2018 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T5 active power low16 bits	2019 H					
	T6 active power high16 bits	201A H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T6 active power low16 bits	201B H					
	T1 reactive power high16 bits	201C H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T1 reactive power low16 bits	201D H					
	T2 reactive power high16 bits	201E H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T2 reactive power low16 bits	201F H					
	T3 reactive power high16 bits	2020 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T3 reactive power low16 bits	2021 H					
	T4 reactive power high16 bits	2022 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T4 reactive power low16 bits	2023 H					
	T5 reactive power high16 bits	2024 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T5 reactive power low16 bits	2025 H					
	T6 reactive power high16 bits	2026 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T6 reactive power low16 bits	2027 H					
Export	Phase A active power high 16 bits	2100 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Phase A active power low 16 bits	2101 H					
	Phase B active power high 16 bits	2102 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Phase B active power low 16 bits	2103 H					
	Phase C active power high 16 bits	2104 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Phase C active power low 16 bits	2105 H					
	Total active power high 16 bits	2106 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	Total active power low 16 bits	2107 H					
	Phase A reactive power high 16 bits	2108 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Phase A reactive power low 16 bits	2109 H					

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
	Phase B reactive power high 16 bits	210A H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Phase B reactive power low 16 bits	210B H					
	Phase C reactive power high 16 bits	210C H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Phase C reactive power low 16 bits	210D H					
	Total reactive power high 16 bits	210E H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	Total reactive power low 16 bits	210F H					
	T1 active power high16 bits	2110 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T1 active power low16 bits	2111 H					
	T2 active power high16 bits	2112 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T2 active power low16 bits	2113 H					
	T3 active power high16 bits	2114 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T3 active power low16 bits	2115 H					
	T4 active power high16 bits	2116 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T4 active power low16 bits	2117 H					
	T5 active power high16 bits	2118 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T5 active power low16 bits	2119 H					
	T6 active power high16 bits	211A H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
	T6 active power low16 bits	211B H					
	T1 reactive power high16 bits	211C H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T1 reactive power low16 bits	211D H					
	T2 reactive power high16 bits	211E H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T2 reactive power low16 bits	211F H					
	T3 reactive power high16 bits	2120 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T3 reactive power low16 bits	2121 H					
	T4 reactive power high16 bits	2122 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T4 reactive power low16 bits	2123 H					

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
	T5 reactive power high16 bits	2124 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T5 reactive power low16 bits	2125 H					
	T6 reactive power high16 bits	2126 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
	T6 reactive power low16 bits	2127 H					

Parameter List of Maximum Demand

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
Total maximum demand of current month	Import active demand	3000 H	unsigned int	2 bytes	R	0 ... 65535	W
	Occurrence time	3001 H	unsigned int	2 bytes	R	0 ... 65535	Year
	Occurrence time	3002 H	unsigned int	2 bytes	R	1 ... 12	Month
	Occurrence time	3003 H	unsigned int	2 bytes	R	1 ... 31	Day
	Occurrence time	3004 H	unsigned int	2 bytes	R	0 ... 23	Hour
	Occurrence time	3005 H	unsigned int	2 bytes	R	0 ... 59	Minute
	Occurrence time	3006 H	unsigned int	2 bytes	R	0 ... 59	Second
	Import active T1 demand	3007 H ... 300D H	unsigned int			Same as import active demand	
	Import active Tn demand	...	unsigned int			Same as import active demand	
	Import active T6 demand	302A H ... 3030 H	unsigned int			Same as import active demand	
	Export active demand	3031 H ... 3037 H	unsigned int			Same as import active demand	
	Export active T1 demand	3038 H ... 303E H	unsigned int			Same as import active demand	
	Export active Tn demand	...	unsigned int			Same as import active demand	
	Export active T6 demand	305B H ... 3061 H	unsigned int			Same as import active demand	
	Combined reactive 1 demand	3062 H ... 3068 H	unsigned int			Same as import active demand	var
	Combined reactive 1T1 demand	3069 H ... 306F H	unsigned int			Same as import active demand	
	Combined reactive 1Tn demand	...	unsigned int			Same as import active demand	
	Combined reactive 1T6 demand	308C H ... 3092 H	unsigned int			Same as import active demand	
	Combined reactive 2 demand	3093 H ... 3099 H	unsigned int			Same as import active demand	
	Combined reactive 2T1 demand	309A H ... 30A0 H	unsigned int			Same as import active demand	
	Combined reactive 2Tn demand	...	unsigned int			Same as import active demand	
	Combined reactive 2T6 demand	30BD H ... 30C3 H	unsigned int			Same as import active demand	
	Import apparent demand	30C4 H ... 30CA H	unsigned int			Same as import active demand	VA

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
	Import apparent T1 demand	30CB H ... 30D1 H	unsigned int			Same as import active demand	
	Import apparent Tn demand	...	unsigned int			Same as import active demand	
	Import apparent T6 demand	30EE H ... 30F4 H	unsigned int			Same as import active demand	
	Export apparent demand	30F5 H ... 30FB H	unsigned int			Same as import active demand	
	Export apparent T1 demand	30FC H ... 3102 H	unsigned int			Same as import active demand	
	Export apparent Tn demand	...	unsigned int			Same as import active demand	
	Export apparent T6 demand	311F H ... 3125 H	unsigned int			Same as import active demand	
A	Current demand	3126 H ... 312C H	unsigned int			Same as import active demand	
	T1 current demand	312D H ... 3133 H	unsigned int			Same as import active demand	
	Tn current demand	...	unsigned int			Same as import active demand	
	T6 current demand	3150 H ... 3156 H	unsigned int			Same as import active demand	
B	Current demand	3157 H ... 315D H	unsigned int			Same as import active demand	
	T1 current demand	315E H ... 3164 H	unsigned int			Same as import active demand	
	Tn current demand	...	unsigned int			Same as import active demand	
	T6 current demand	3181 H ... 3187 H	unsigned int			Same as import active demand	
C	Current demand	3188 H ... 318E H	unsigned int			Same as import active demand	
	T1 current demand	318F H ... 3195 H	unsigned int			Same as import active demand	
	Tn current demand	...	unsigned int			Same as import active demand	
	T6 current demand	31B2 H ... 31B8 H	unsigned int			Same as import active demand	

Extreme Value Parameters

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
Maximum	Phase A voltage	4000 H	unsigned int	2 bytes	R	0...65535	0.01 V
	Occurrence time	4001 H	unsigned int	2 bytes	R	0...65535	Year
	Occurrence time	4002 H	unsigned int	2 bytes	R	1 ... 12	Month
	Occurrence time	4003 H	unsigned int	2 bytes	R	1 ... 31	Day
	Occurrence time	4004 H	unsigned int	2 bytes	R	0 ... 23	Hour
	Occurrence time	4005 H	unsigned int	2 bytes	R	0 ... 59	Minute
	Occurrence time	4006 H	unsigned int	2 bytes	R	0 ... 59	Second
	Phase B voltage	4007 H ... 400D H	unsigned int			Same as Phase A voltage	
	Phase C voltage	400E H ... 4014 H	unsigned int			Same as Phase A voltage	
	Uab line voltage	4015 H ... 401B H	unsigned int			Same as Phase A voltage	
	Ubc line voltage	401C H ... 4022 H	unsigned int			Same as Phase A voltage	
	Uca line voltage	4023 H ... 4029 H	unsigned int			Same as Phase A voltage	
	Phase A current	402A H ... 4030 H	unsigned int			Same as Phase A voltage	0.001 A
	Phase B current	4031 H ... 4037 H	unsigned int			Same as Phase A voltage	
	Phase C current	4038 H ... 403E H	unsigned int			Same as Phase A voltage	
	Neutral current	403F H ... 4045 H	unsigned int			Same as Phase A voltage	
	Phase A active power	4046 H ... 404C H	unsigned int			Same as Phase A voltage	1 W
	Phase B active power	404D H ... 4053 H	unsigned int			Same as Phase A voltage	
	Phase C active power	4054 H ... 405A H	unsigned int			Same as Phase A voltage	
	Total active power	405B H ... 4061 H	unsigned int			Same as Phase A voltage	
	Phase A reactive power	4062 H ... 4068 H	unsigned int			Same as Phase A voltage	1 var
	Phase B reactive power	4069 H ... 406F H	unsigned int			Same as Phase A voltage	
	Phase C reactive power	4070 H ... 4076 H	unsigned int			Same as Phase A voltage	
	Total reactive power	4077 H ... 407D H	unsigned int			Same as Phase A voltage	
	Phase A apparent power	407E H ... 4084 H	unsigned int			Same as Phase A voltage	1 VA
	Phase B apparent power	4085 H ... 408B H	unsigned int			Same as Phase A voltage	
	Phase C apparent power	408C H ... 4092 H	unsigned int			Same as Phase A voltage	
	Total apparent power	4093 H ... 4099 H	unsigned int			Same as Phase A voltage	

Parameter		Address	Data Type	Length	R/W	Data Range	Unit
Minimum	Phase A voltage	4100 H ... 4106 H				Same as Phase A voltage	0.01 V
	Phase B voltage	4107 H ...410D H				Same as Phase A voltage	
	Phase C voltage	410E H ... 4114 H				Same as Phase A voltage	0.01 V
	Uab line voltage	4115 H ... 411B H				Same as Phase A voltage	
	Ubc line voltage	411C H ... 4122 H				Same as Phase A voltage	
	Uca line voltage	4123 H ... 4129 H				Same as Phase A voltage	
	Phase A current	412A H ... 4130 H				Same as Phase A voltage	0.001 A
	Phase B current	4131 H ... 4137 H				Same as Phase A voltage	
	Phase C current	4138 H ... 413E H				Same as Phase A voltage	
	Neutral current	413F H ... 4145 H				Same as Phase A voltage	
	Phase A active power	4146 H ... 414C H				Same as Phase A voltage	1 W
	Phase B active power	414D H ... 4153 H				Same as Phase A voltage	
	Phase C active power	4154 H ... 415A H				Same as Phase A voltage	
	Total active power	415B H ... 4161 H				Same as Phase A voltage	
	Phase A reactive power	4162 H ... 4168 H				Same as Phase A voltage	1 var
	Phase B reactive power	4169 H ... 416F H				Same as Phase A voltage	
	Phase C reactive power	4170 H ... 4176 H				Same as Phase A voltage	
	Total reactive power	4177 H ... 417D H				Same as Phase A voltage	
	Phase A apparent power	417E H ... 4184 H				Same as Phase A voltage	1 VA
	Phase B apparent power	4185 H ... 418B H				Same as Phase A voltage	
	Phase C apparent power	418C H ... 4192 H				Same as Phase A voltage	
	Total apparent power	4193 H ... 4199 H				Same as Phase A voltage	

Event Record

Parameter		Address	Data Type	Length	R/W	Data Range	Unit/Description
Relay 1 control event	Occurrence time of previous 1 event	5000 H	unsigned int	2 bytes	R	0...65535	Year
	Occurrence time of previous 1 event	5001 H	unsigned int	2 bytes	R	1 ... 12	Month
	Occurrence time of previous 1 event	5002 H	unsigned int	2 bytes	R	1 ... 31	Day
	Occurrence time of previous 1 event	5003 H	unsigned int	2 bytes	R	0 ... 23	Hour
	Occurrence time of previous 1 event	5004 H	unsigned int	2 bytes	R	0 ... 59	Minute
	Occurrence time of previous 1 event	5005 H	unsigned int	2 bytes	R	0 ... 59	Second
	Identifier of previous 1 event	5006 H	unsigned int			0 ... 1	0: trip, 1: close
	Record of previous 2 events	5007 H ... 500D H	unsigned int			Same as previous 1 event	
	Record of previous n events	...	unsigned int			Same as previous 1 event	
	Record of previous 9 events	5038 H ... 503E H	unsigned int			Same as previous 1 event	
	Record of previous 10 events	503F H ... 5045 H	unsigned int			Same as previous 1 event	
Relay 2	Record of previous 1 events	5046 H ... 504C H	unsigned int			Same as previous 1 event	
	Record of previous n events	...	unsigned int			Same as previous 1 event	
	Record of previous 10 events	5085 H ... 508B H	unsigned int			Same as previous 1 event	
SOE event	Occurrence time of previous 1 event	5100 H	unsigned int	2 bytes	R	0...65535	Year
	Occurrence time of previous 1 event	5101 H	unsigned int	2 bytes	R	1 ... 12	Month
	Occurrence time of previous 1 event	5102 H	unsigned int	2 bytes	R	1 ... 31	Day
	Occurrence time of previous 1 event	5103 H	unsigned int	2 bytes	R	0 ... 23	Hour
	Occurrence time of previous 1 event	5104 H	unsigned int	2 bytes	R	0 ... 59	Minute
	Occurrence time of previous 1 event	5105 H	unsigned int	2 bytes	R	0 ... 59	Second
	Occurrence time of previous 1 event	5106 H	unsigned int	2 bytes	R	0 ... 999	msec
	Identifier 1 of previous 1 event	5107 H	unsigned int	2 bytes	R	0 ... 3	Binary bit (1 to 4)
	Identifier 1 of previous 2 event	5108 H	unsigned int	2 bytes	R	0 ... 1	Shit status (1: open to close, 0: close to open)
	Record of previous 2 events	5109 H ... 5111 H	unsigned int			Same as previous 1 event	

Parameter		Address	Data Type	Length	R/W	Data Range	Unit/Description
	Record of previous n events	...					
	Record of previous 50 events	52B9 H ... 52C1 H	unsigned int			Same as previous 1 event	

Data bloak copy

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A import active power high 16 bits	7000 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
Phase A import active power low 16 bits	7001 H					
Phase B import active power high 16 bits	7002 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
Phase B import active power low 16 bits	7003 H					
Phase C import active power high 16 bits	7004 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
Phase C import active power low 16 bits	7005 H					
Total import active power high 16 bits	7006 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 Wh
Total import active power low 16 bits	7007 H					
Phase A voltage	7008 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase B voltage	7009 H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase C voltage	700A H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Average phase voltage	700B H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Uab line voltage	700C H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Ubc line voltage	700D H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Uca line voltage	700E H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Average line voltage	700F H	unsigned int	2 bytes	R	0 ... 65535	0.01 V
Phase A current	7010 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase B current	7011 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase C current	7012 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Average current	7013 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Neutral current	7014 H	unsigned int	2 bytes	R	0 ... 65535	0.001 A
Phase A active power	7015 H	signed int	2 bytes	R	-32767 ... 32767	1 W
Phase B active power	7016 H	signed int	2 bytes	R	-32767 ... 32767	1 W
Phase C active power	7017 H	signed int	2 bytes	R	-32767 ... 32767	1 W
Total active power	7018 H	signed int	2 bytes	R	-32767 ... 32767	1 W
Phase A reactive power	7019 H	signed int	2 bytes	R	-32767 ... 32767	1 var
Phase B reactive power	701A H	signed int	2 bytes	R	-32767 ... 32767	1 var
Phase C reactive power	701B H	signed int	2 bytes	R	-32767 ... 32767	1 var
Total reactive power	701C H	signed int	2 bytes	R	-32767 ... 32767	1 var

Parameter	Address	Data Type	Length	R/W	Data Range	Unit
Phase A apparent power	701D H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Phase B apparent power	701E H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Phase C apparent power	701F H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Total apparent power	7020 H	signed int	2 bytes	R	-32767 ... 32767	1 VA
Phase A power factor	7021 H	signed int	2 bytes	R	-1000 ... 1000	0.001
Phase B power factor	7022 H	signed int	2 bytes	R	-1000 ... 1000	0.001
Phase C power factor	7023 H	signed int	2 bytes	R	-1000 ... 1000	0.001
Total power factor	7024 H	signed int	2 bytes	R	-1000 ... 1000	0.001
Frequency	7025 H	unsigned int	2 bytes	R	0 ... 65535	0.01 Hz
Phase A import reactive power high 16 bits	7026 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
Phase A import reactive power low 16 bits	7027 H					
Phase B import reactive power high 16 bits	7028 H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
Phase B import reactive power low 16 bits	7029 H					
Phase C import reactive power high 16 bits	702A H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
Phase C import reactive power low 16 bits	702B H					
Total import reactive power high 16 bits	702C H	unsigned long	4 bytes	R	0 ... 4294967295	0.1 varh
Total import reactive power low 16 bits	702D H					
Voltage unbalance rate	702E H	unsigned int	2 bytes	R	0 ... 65535	0.01%
Current unbalance rate	702F H	unsigned int	2 bytes	R	0 ... 65535	0.01%
Binary inputs	7030 H	unsigned int	2 bytes	R	High byte: bit 0 to bit 3 express input 1 to input 4 status	
					Low byte: bit 0 to bit 1 express output 1 to output 2 status	

Note

X-0 means maximum value while X=1 means minimum value.

This manual applies to software version for 150910 and later released by the device.

■

Maintenance 7

7.1 Maintenance

- Voltage connection should be conducted strictly in accordance with voltage level marked on nameplate.
- Tighten the terminals and hang the meter securely to screen which is strong, refractory and vibration-free during installation. Upward view of the meter provides the best display effect, so it should be installed vertically.
- The meter should be stored in environment free of condensation at -35 ℃ to 70 ℃ and ≤ 95% humidity in original package. At most 5 layers are allowable for stacking. The meter is inappropriate for storing after unpacking. The meter should be stored in clean location free of hazardous substances or gas which may cause corrosion in air.
- In the operating environment of the meter, lightning protection should be provided.

■

Ordering Number 8

8.1 Ordering Number

Device name:	**SICAM**	**—**	**P**	**3**	
Function					
3-phase voltage, current, power, power factor, frequency, electric energy, pulse output, harmonic, demand, 4 Binary inputs, 2 Binary outputs, 2 RS485 ports					**8**
Phase voltage, current, power, power factor, frequency, electric energy, pulse output, harmonic, demand, 4 Binary inputs, 2 Binary outputs, 1 RS485 port, 1 Ethernet port					**9**

Model	**Ordering No.**
SICAM P38	7KG7331-1TA12
SICAM P39	7KG7331-1TA13

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