PMAC770 Multifunction Power Meter

Installation & Operation Manual

V2.0

ZHUHAI PILOT TECHNOLOGY CO., LTD.

Danger and warning!

This device can be installed only by professionals.

The manufacturer shall not be held responsible for any accident caused by the failure to comply with the instructions in this manual.

Risks of electric shocks, burning, or explosion

- This device can be installed and maintained only by qualified people.
- Before operating the device, isolate the voltage input and power supply and short-circuit the secondary windings of all current transformers.
- Use appropriate voltage tester to make sure the voltage has been cut-off.
- Put all mechanical parts, doors, or covers in their original positions before energizing the device.
- Always supply the device with the correct working voltage during its operation.

Failure to take these preventive measures could cause damage to equipment or injuries to people.

Operating environment

- Operating temperature: -10℃~+55℃
- Storage temperature: -40℃~+70℃
- Relative humidity: 5%~95%,non-condensing
- Operating power supply: (Have 2 options, please check the label on the meter)

  (1) 85Vac ~265Vac, 85Vdc ~265Vdc, 45-65Hz

  (2) 100~420Vac, 100~400Vdc, 45~60Hz

CONTENTS

1. General Information

PMAC770 Three Phase Multifunction Power Meter is designed for monitoring and displaying all kinds of electricity parameters. It's widely used in low voltage and medium voltage distribution/ automation system.

PMAC770 provide the main function as below:

- Real-time measuring data, true RMS
- All energy data (include real energy, multi-tariff energy, history energy, 1^{st} ~13^{th} harmonic energy.
- Power quality analysis
- Demand calculation
- Build-in clock and event log
- Over/ under limit alarm
- Phase sequence checking
- Modbus-RTU communication
- Digital input/ Digital output (DI/ DO)
- Analog input/ Analog output (AI/ AO, optional)
- 2 pulse output (optional) etc.

Measuring Function of PMAC770 Basic Unit	High class
Voltage, Current, Power (P, Q, S), Power factor, Energy (kwh, kvarh in 4 quadrant), Frequency, Phase Angle, Demand, Max./ min. value (U, I, P, Q), Multi-tariff energy, Load rate One RS485 (Modbus-RTU), Real-time clock,	√
3 status input + 2 relay output Over / under limit alarm SOE event log	√
Voltage/Current unbalance rate, THD, 31st harmonic, Harmonic RMS(0~31st), Harmonic energy (1~13th), Voltage crest factor, Current K factor, Voltage deviation, Frequency deviation Record for voltage/ frequency deviation, Record history multi-tariff energy Voltage unbalance rate record Record Demand Maximum value Record real time parameters maximum value Running time record	√

2. Order Information

Model No. PMAC770-E- ① -② -③ – ④ -⑤	
① Function of basic unit	
E	High class
② Optional Module **(multiple choice, one meter can add no more than 3 modules. One meter can add 2pcs of Module SW or SD, but only 1pcs of other modules.)**	
SW	DI module: 4 Digital Input (wet contact),
SD	DI module: 4 Digital Input (dry contact),
R	DO module: 2 Relay output
C	RS485 module: the 2nd RS485 port (Modbus-RTU protocol)
AO	AO module: 2 Analog output (4-20mA)
AI	AI module: 2 Analog input (4-20mA)
EP	Pulse module: 2 pulse output
BA	BACnet module: BACnet protocol
64M	64Mbit Memory (8M byte)
③ Rated input voltage(Vph-N/ Vph-ph) and current	
V1	57.7/100V (via PT), 5A
V2	57.7/100V (via PT), 1A
V3	220/380V (direct), 5A
V4	220/380V (direct),1 A
V5	120/208V (direct), 5A
V6	240/415V (direct), 5A

V7	277/480V (direct), 5A
V8	63.5/110V (via PT), 5A
V9	120/208V (direct),1 A
V10	240/415V (direct),1 A
V11	277/480V (direct),1 A
V12	63.5/110V (via PT),1 A
V13	398/690V(direct), 5A
④ Rated input frequency (Not choose will be deem as 50Hz)	
F1	50Hz
F2	60Hz
⑤ Aux. power supply (Not choose will be deem as P1)	
P1	85~265Vac, 85 ~ 265Vdc, 45-65Hz
P2	100 ~ 420Vac , 100 ~ 400Vdc, 45~60Hz

For example:

Order No.: PMAC770-E-AI-V3-F1-P1 indicates the meter is the basic type +2 Analog input, rated input 220/ 380V, 5A, rated input frequency 50Hz, and the Aux. power supply: 85~265Vac, 85 ~ 265Vdc.

3. Packing list

Packing box included:

1. PMAC770 Basic Unit (and optional modules)
2. User Manual

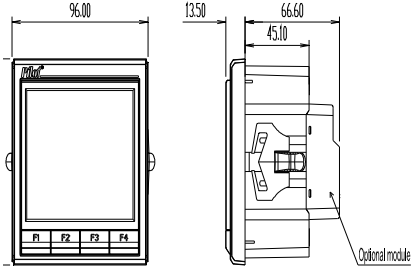
4. Figure and Terminals

4.1 Dimension

Unit: mm

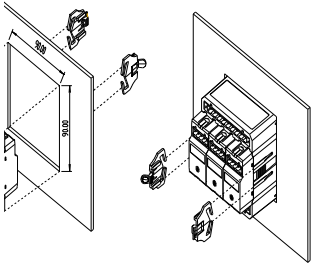
Cut size：90*90mm；panel size: 96x96mm

Depth：45.1mm（no module）；66.6mm（add module）



4.2 Installation

Unit: mm



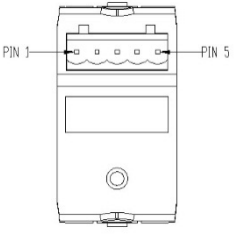
4.3 Terminals

4.3.1 Terminal of Basic Unit

No.	Mark	Definition
1	NC	Null
2	N/-	Negative wire, Aux. power supply AC/ DC 220V
3	L/+	Positive wire, Aux. power supply AC/ DC 220V
4	V1	Phase A voltage
5	V2	Phase B voltage
6	V3	Phase C voltage
7	VN	Voltage neutral line
8	485-	RS485 com port-1, negative wire
9	485+	RS485 com port -1, positive wire
10	RL21	Relay output 2, positive
11	RL22	Relay output 2, negative
12	RL11	Relay output 1, positive
13	RL12	Relay output 1, negative
14	SG	Digital input, common earth
15	S3	Digital input 3, positive
16	S2	Digital input 2, positive
17	S1	Digital input 1, positive
18	I1+	In line, phase A current
19	I1-	Out line, phase A current

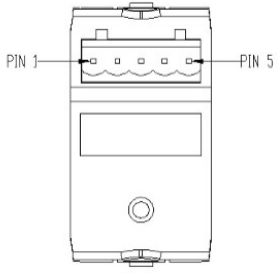
20	I2+	In line, phase B current
21	I2-	Out line, phase B current
22	I3+	In line, phase C current
23	I3-	Out line, phase C current

4.3.2 Terminals of DI module (PMAC770-SW):



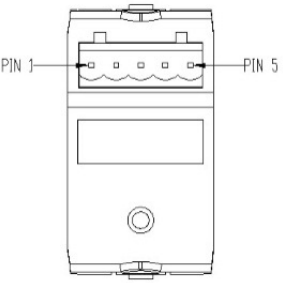
Digital Input Module (one meter maximum can add 2 DI module)		
No.	**Mark**	**Definition**
PIN1	EX S4(S8)	Digital input 4 (or 8) , positive
PIN2	EX S5(S9)	Digital input 5 (or 9) , positive
PIN3	EX S6(S10)	Digital input 6 (or 10) , positive
PIN4	EX S7(S11)	Digital input 7 (or 11) , positive
PIN5	EX SG1（SG2）	Common earth

Terminals of DI module (PMAC770-SD):



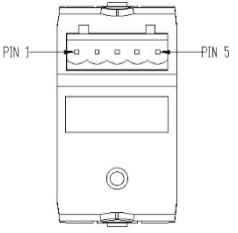
Digital Input Module (one meter maximum can add 2 DI module)		
No.	**Mark**	**Definition**
PIN1	EX S12(S16)	Digital input 12 (or 16) , positive
PIN2	EX S13(S17)	Digital input 13 (or 17) , positive
PIN3	EX S14(S18)	Digital input 14 (or 18) , positive
PIN4	EX S15(S19)	Digital input 15 (or 19) , positive
PIN5	EX SG3（SG4）	Common earth

4.3.3 Terminals of DO module (PMAC770-R):



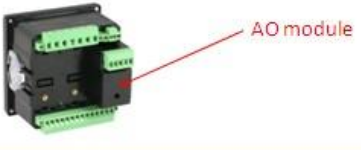
Relay Output Module (One meter can add one DO module only)		
No.	**Mark**	**Definition**
PIN1	EX RL22	Extend relay-2 output 2
PIN2	EX RL21	Extend relay-2 output 1
PIN3	NC	Null
PIN4	EX RL12	Extend relay-1 output 2
PIN5	EX RL11	Extend relay-1 output 1

4.3.4 Terminals of AO module (PMAC770-AO):

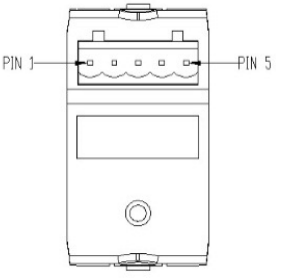


Analog Output Module (One meter can add one AO module only)		
No.	**Mark**	**Definition**
PIN1	EX AO2	Positive wire, analog output 2
PIN2	EX AG	Negative wire, analog output 2
PIN3	NC	Null
PIN4	EX AO1	Positive wire, analog output 1
PIN5	EX AG	Negative wire, analog output 1

Note: The AO module must be inserted to the 3rd interface from left to right, back view.

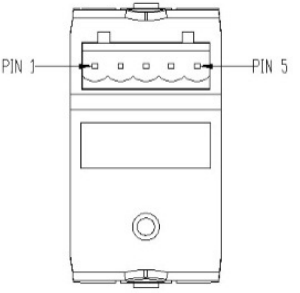


4.3.5 Terminals of AI module (PMAC770-AI):



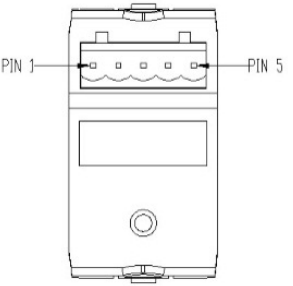
Analog Input Module (One meter can add one AI module only)		
No.	**Mark**	**Definition**
PIN1	EX AI1	Positive wire, analog input 1
PIN2	EX AG	Negative wire, analog input 1
PIN3	NC	Null
PIN4	EX AI2	Positive wire, analog input 2
PIN5	EX AG	Negative wire, analog input 2

4.3.6 Terminals of RS485 Module (PMAC770-C):



Extend RS485 Communication Module (One meter can add one C module only)		
No.	**Mark**	**Definition**
PIN1	NC	Null
PIN2	NC	Null
PIN3	NC	Null
PIN4	EX 485－	Extend RS485 output, negative
PIN5	EX 485+	Extend RS485 output, positive

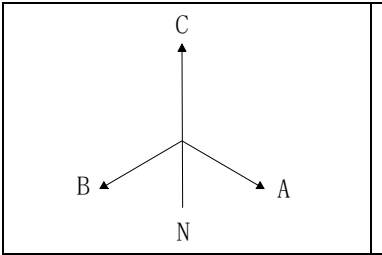
4.3.7 Terminals of Pulse Output Module (PMAC770-EP):



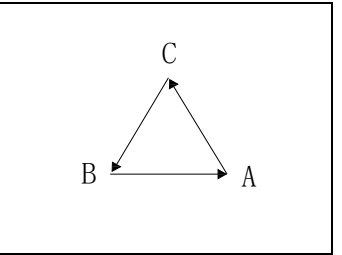
Pulse Output Module (One meter can add one EP module only)		
No.	**Mark**	**Definition**
PIN1	EX P1+	Pulse output for kWh, positive
PIN2	EX P1－	Pulse output for kWh, negative
PIN3	NC	Null
PIN4	EX P2+	Pulse output for kvarh, positive
PIN5	EX P2－	Pulse output for kvarh, negative

5. Connection Mode and Wiring

PMAC770 supports 2 kinds of connection mode: 3P4W and 3P3W..

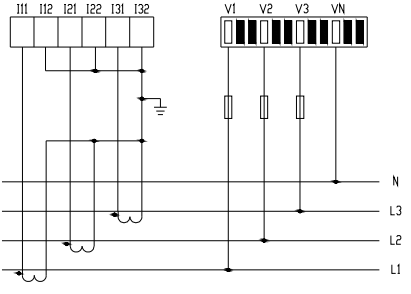


3-phase 4-wire

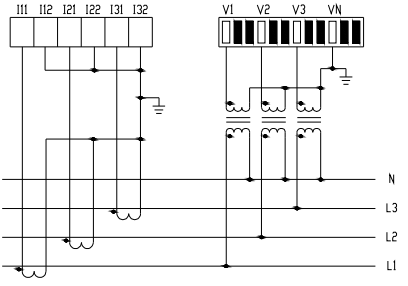


3-phase 3-wire

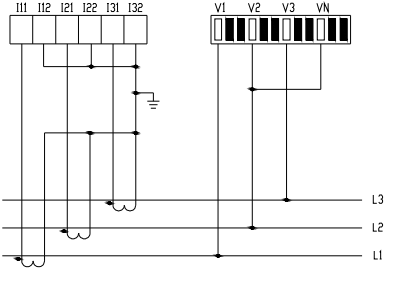
(1) 3-phase 4-wire, no PT, 3CT:



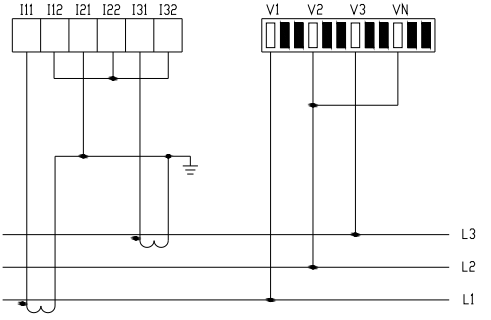
(2) 3-phase 4-wire, 3PT, 3CT:



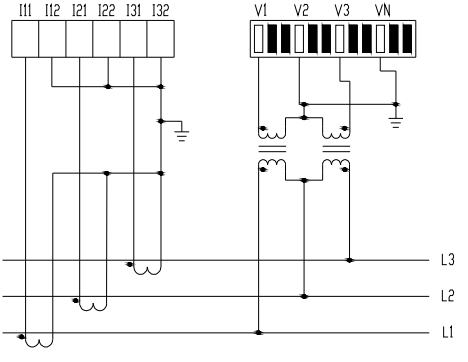
(3) 3-phase 3-wire, no PT, 3CT:



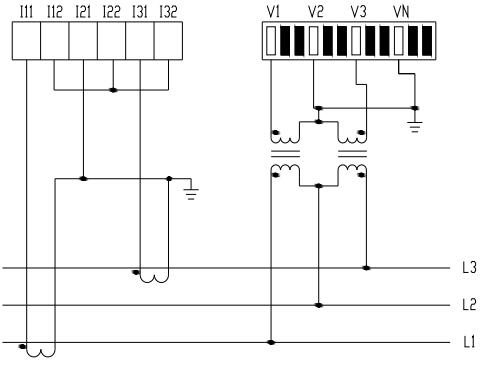
(4) 3-phase 3-wire , no PT, 2CT:



(5) 3-phase 3-wire , 2PT, 3CT:

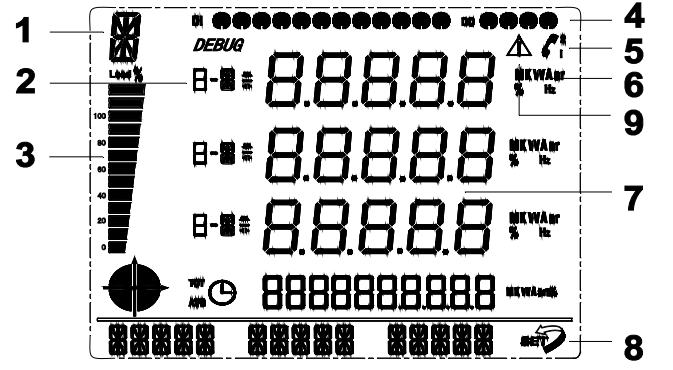


(6) 3-phase 3-wire, 2PT, 2CT:



6. Display and Key-press Operation

6.1 Display Instruction



1: Menu

2: Item

3: Load rate: Load rate= average current / rated current ×100%

4: DI/ DO status: ● means ON, ○ means OFF

5: Communication: means no communication,
means RS485 port 1, means RS485 port 1, 2.

6: Unit

7: Data display area

8: Key prompt area

9: Alarm: when display ⚠, it mean there is error.

6.2 Keys

6.2.1. General Information

PMAC770 has a back-light LCD, user-friendly display.

Users can query/ set different information by 4 keys according to the menu prompt.

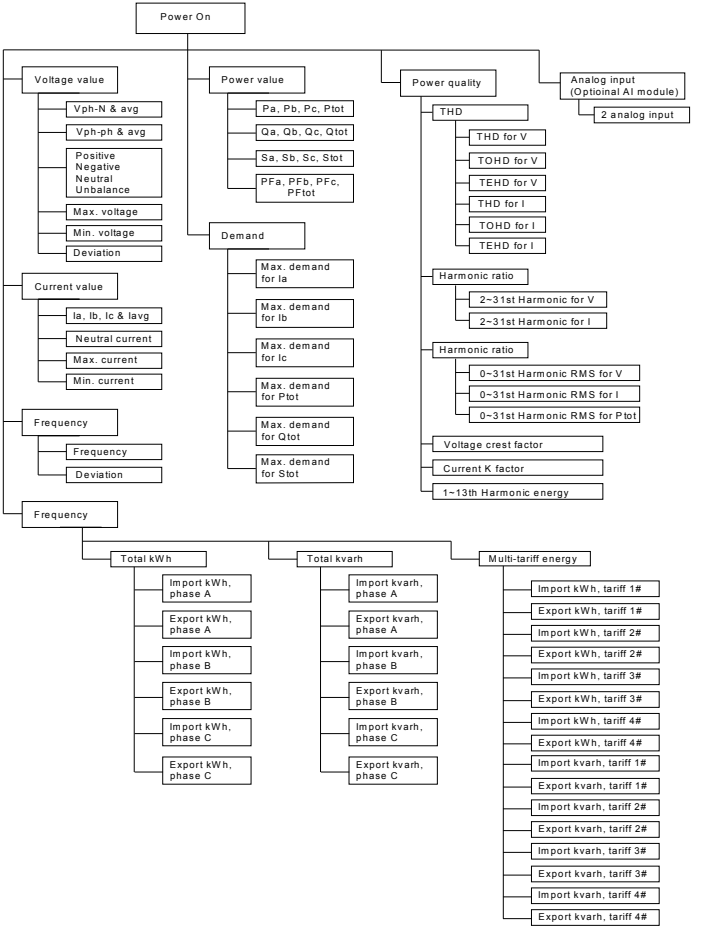
If press the keys, the back-light will be on lasting for 60s. If no continue pressing key, the back-light will be off.

Keys: F1, F2, F3, F4

6.2.2. Menu Prompt and Keys Instruction

Keys or Prompt	Instruction
- - - ->	To next item, it is for menu rolling search
	Return to previous menu or cancel
SET	Setting
Menu prompt	Enter into the menu of corresponding parameter.

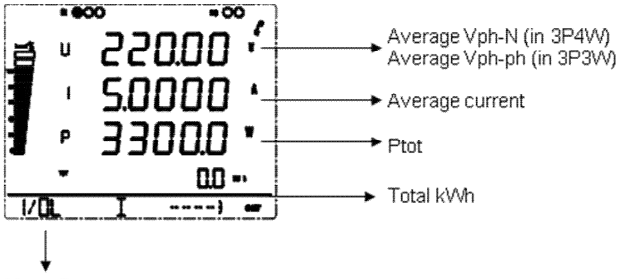
6.3 Map of Display Data


Power On
Voltage value
Vph-N & avg
Vph-ph & avg
Positive
Negative
Neutral
Unbalance
Max. voltage
Min. voltage
Deviation
Current value
Ia, Ib, Ic & Iavg
Neutral current
Max. current
Min. current
Frequency
Frequency
Deviation
Power value
Pa, Pb, Pc, Ptot
Qa, Qb, Qc, Qtot
Sa, Sb, Sc, Stot
PFa, PFb, PFc, PFtot
Demand
Max. demand for Ia
Max. demand for Ib
Max. demand for Ic
Max. demand for Ptot
Max. demand for Qtot
Max. demand for Stot
Power quality
THD
THD for V
TOHD for V
TEHD for V
THD for I
TOHD for I
TEHD for I
Harmonic ratio
2~31st Harmonic for V
2~31st Harmonic for I
Harmonic ratio
0~31st Harmonic RMS for V
0~31st Harmonic RMS for I
0~31st Harmonic RMS for Ptot
Voltage crest factor
Current K factor
1~13th Harmonic energy
Analog input (Optioinal AI module)
2 analog input
Frequency
Total kWh
Import kWh, phase A
Export kWh, phase A
Import kWh, phase B
Export kWh, phase B
Import kWh, phase C
Export kWh, phase C
Total kvarh
Import kvarh, phase A
Export kvarh, phase A
Import kvarh, phase B
Export kvarh, phase B
Import kvarh, phase C
Export kvarh, phase C
Multi-tariff energy
Import kWh, tariff 1#
Export kWh, tariff 1#
Import kWh, tariff 2#
Export kWh, tariff 2#
Import kWh, tariff 3#
Export kWh, tariff 3#
Import kWh, tariff 4#
Export kWh, tariff 4#
Import kvarh, tariff 1#
Export kvarh, tariff 1#
Import kvarh, tariff 2#
Export kvarh, tariff 2#
Import kvarh, tariff 3#
Export kvarh, tariff 3#
Import kvarh, tariff 4#
Export kvarh, tariff 4#

7. Query Procedure

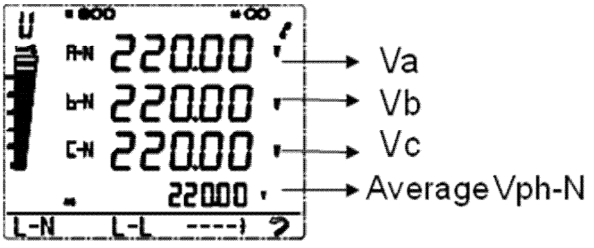
7.1 Initial Display

When PMAC770 is powered on, the initial display as below:



Menu Prompt:
VOL: Voltage menu
I: Current menu
FRE: Frequency menu
POWER: Power menu
ENERGY: Energy menu
PQ: Power quality menu
DMD: Demand menu
A-I: Analogy input menu
SET: Setting

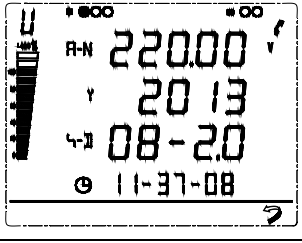
7.2 Voltage Value



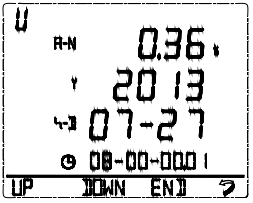
Menu Prompt:

L-N: Vph-N & average menu
L-L: Vph-ph & average menu
UNBAL: Positive (U-2), Negative (U-1), Neutral (U-0), Unbalance rate
MAX.: Max. Vph-N or Max. Vph-phit
MIN: Min. Vph-N or Min. Vph-ph & time stamp
REC: Voltage deviation record

Max. Voltage



Record of Voltage Deviation



Menu Prompt:

UP: Page up to next record

DOWN: Page down to previous record

START: Event occurs time

END: Event end time

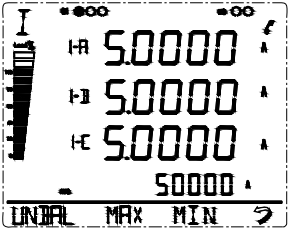
Special notice: the digit on the right of the number

08-00-00.01

It means: Hour, Minute, Second,

After decimal point, it means the records number

7.3 Current Value



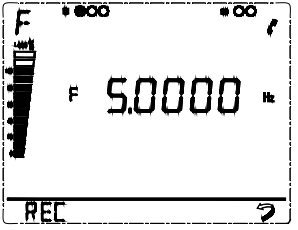
Menu Prompt:

UNBAL: Positive (I-2), Negative (I-1), Neutral (I-0)

Max.: Max. current & time stamp

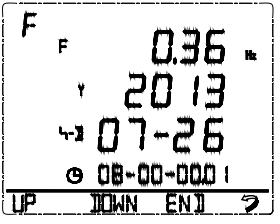
Min.: Min. current & time stamp

7.4 Frequency



Menu Prompt:

REC: Frequency deviation record【Display menu similar to Voltage Deviation Record】



Menu Prompt:

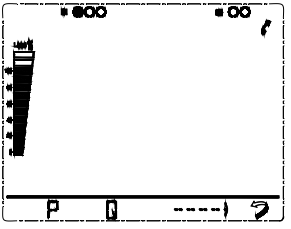
UP: Page up to previous record

DOWN: Page down to next record

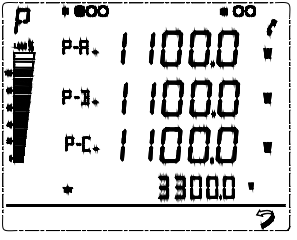
START: Event occurs time

END: Event end time

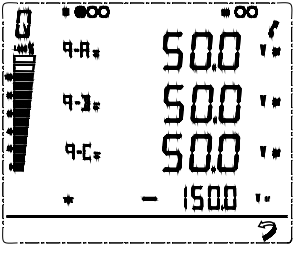
7.5 Power Value



picture 1



picture 2



picture 3

Menu Prompt:

Power display menu (Picture 1)

P: Active power, per phase & total (Picture 2)

Q: Reactive power, per phase & total (Picture 3)

S: Apparent power, per phase & total

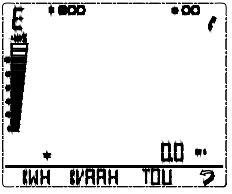
PF: Power factor, per phase & total

MAX: Maximum value record menu

MIN: Minimum value record menu

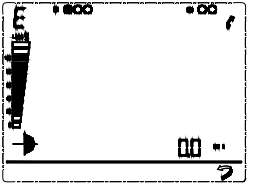
7.6 Energy

Total kWh



Picture 1

Import kWh, tariff-1



Picture 2

Menu Prompt:

KWH: Total kWh, Phase A/ B/ C kWh (Imp. & Exp) –Picture 3

KVARH: Total kvarh, Phase A/ B/ C kvarh (Imp. & Exp.)-Picture 4

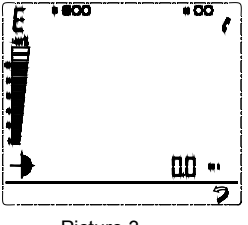
KVAH: Apparent energy (Total, A, B, C Phase)

TOU: Import kWh (or kvarh) of each tariff (tariff 1#, tariff 2#, tariff 3#, tariff 4#),

Export kWh (or kvarh) of each tariff (tariff 1#, tariff 2#, tariff 3#, tariff 4#).

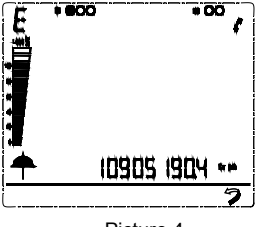
(Picture 2)

Import kWh, phase A



Picture 3

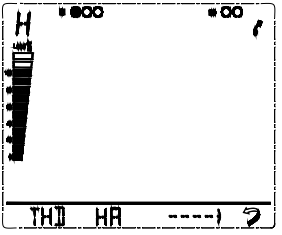
Import kvarh, phase A



Picture 4

7.7 Harmonic

Harmonic display



Menu Prompt:

THD: (Picture 2)

THD for V (or I)

TOHD for V (or I)

TEHD for V (or I)

HR (Harmonic ratio): (Picture 3)

2~31st harmonic for V

2~31st harmonic for I

RMS (Harmonic RMS): (Picture 4)

0~31st harmonic RMS for V

0~31st harmonic RMS for I

0~31st harmonic RMS for Ptot

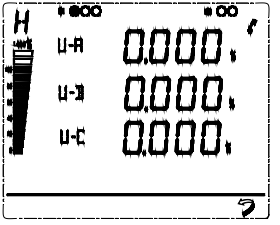
CF: Voltage crest factor **(Picture 5)**

K-FAC: Current K factor **(Picture 6)**

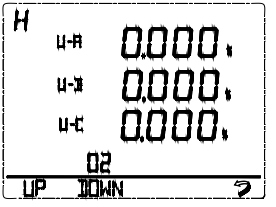
ENRGY: kWh of 1~13th harmonic

(Picture 7)

THD for V (Picture 2)



2nd harmonic for V (Picture 3)



RMS, DC component for V

(Picture 4)