Universal Measuring Device

User's Manual

Please read this manual carefully before doing installation, operation and maintenance of ZMP meter.

Following symbols are used in this user's manual and on ZMP meter to alert the dangerous or to prompt in the operating or set process.

Installation and maintenance of the ZMP meter should only be performed by qualified, competent personnel that have appropriate training and experience with high voltage and current device.

The information contained in this document is believed to be accurate at the time of publication, however, Zilug assumes no responsibility for any errors which may appear here and reserves the right to make changes without notice. Please ask the local represent for latest product specifications before ordering.

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Chapter 1
Introduction

The Purpose of ZMP

Powerful Multifunction Power Meter

ZMP Series Multifunction power meter was designed by used of latest microprocessor and digital signal process technology. Electric power parameters, energy and demand metering, power quality monitoring, remote control, statistics and records, all these functions are only in one pocket-size unit.

It combines high accuracy measurement with intelligent multifunction and simple HMI interface.

Ideal Choice for Electric Automation SCADA System

ZMP can be used to replace all traditional electric meters. It also can be used as Remote Terminal Unit (RTU) for monitoring and controlling in a SCADA system. All the measured data is available via digital RS485 communication ports running the Mobus™ protocol.

Energy Management

ZMP can measure double directions four quadrants kWh and kvarh with accuracy up to 0.5%. It can provide high standard energy data and energy demand data. All these data are important for statistics for each line feeder and total.

The Application Area of ZMP

- ✓ Power Distribution Automation
- ✓ Intelligent Electric Switch Gear
- ✓ Industry Automation
- ✓ Building Automation
- ✓ Energy Manage System
- ✓ Large UPS System

The Function of ZMP

Multifunction, High Accuracy

ZMP Series Intelligent power meter was designed by use of latest microprocessor and digital signal process technology. Electric power parameters metering, energy and demand recording, power quality monitoring, remote controlling, statistics and records, all these functions are only in one pocket size unit. Unbalance Factors, Demands and Pulse Output based on Energy or Reactive Energy in ZMP. It combines high accuracy measurement with intelligent multifunction and friendly HMI interface.

Small Size and Easy Installation

With the size of DIN96 × 96 and 55mm depth after mounting, the ZMP can be installed in a small cabin. The fixing clips are used for easy installation and remove.

Easy to Use

By using of large screen high density LCD, the display of ZMP is easy to read and use. All the setting parameters can be access by using panel keys or communication port. The setting parameters are protected in EPROM, which will maintain its content after the meter is power off. With the backlight of

the LCD, the display can be easily read in the dim environment. The back light "on" time is selectable.

Multiple Wiring Modes

In either high voltage or low voltage or three phase three wire or three phase four wire or single phase system, the ZMP can be easily used.

Powerful Multifunction Power Meter

The ZMP8800 II series multifunction digital power meter is designed using modern MCU and DSP technology. It integrates three-phase energy measuring and displaying, energy accumulating, power quality analysis, malfunction alarming, data logging and network communication. A vivid LCD display with large characters and, time of use programmable backlight provides a clear real time data readout.

An Ideal for Electric Automation SCADA Systems

The ZMP8800 II series meter is the ideal choice for replacing traditional, analog electric meters. In addition to providing clear real-time readings on the meter front, it can also be used as a remote terminal unit (RTU) for monitoring and controlling for a SCADA system. Users can access all measurement parameters via the standard RS485 communication port (or the optional Ethernet port) with the Modbus™ protocol.

Energy Management

The ZMP8800 II series meter is able to measure bidirectional, four quadrants kWh and kvarh. It provides maximum/minimum records for power usage and power demand parameters. All power and energy parameters can be viewed remotely via software in order to easily monitor various parameters. In addition, measurement tables can be viewed from the free ZMPView software.

Remote Power Control

This meter is designed for measuring and monitoring power quality parameters. Since different I/O modules can be added to the meter, this expands the capabilities and provides a very flexible platform for using the meter as a distributed RTU, for metering, monitoring and remote controlling, all in one unit.

Power Quality Analysis

Utilizing digital signal processing (DSP) technology, the ZMP8800 II series meter provides high accuracy power quality analysis and supports remote monitoring via the Ethernet module. The meter continuously updates metering results and allows users to access the meter online to monitor parameters such as voltage and current THD, harmonics up to the 31st, voltage crest factor, current K factor, and voltage and current unbalance factor etc.

Data Logging

The ZMP8800 meter contains 8 megabytes of onboard memory for data logging and historical trending. Since the meter contains a real-time clock, all events and logged data will be time stamped.

Energy Tariffs

User can assign up to 4 different tariffs to different time period within a day according to the billing requirements. The meter will calculate and accumulate energy to different tariffs according to the meter's internal clock timing.

Minimum and Maximum Logging

When a Minimum and Maximum event happens, such as voltage, etc., ZMP8800 will record the timestamp and the triggering condition of the event.

ZMP series

The ZMP series products have two kinds of products, the standard ZMP and the advanced ZMP+. Both these two products have multiple choice.
ZMP+ has the basic measuring function of ZMP. It also gets extra functions

Comparison of ZMP and ZMP+

Function	Parameter	ZMP	ZMP+
Phase Voltage	V1,V2,V3,Vlnavg	√	√
Line Voltage	V12,V23,V31,Vllavg	√	√
Current	I1,I2,I3,Iavg	√	√
Natural Current	Calculated		√
Natural Current	In (direct with separate CT) Measured	√	√
Power	P1,P2,P3,Psum	√	√
Reactive Power	Q1,Q2,Q3,Qsum	√	√
Apparent Power	S1,S2,S3,Ssum	√	√
Power Factor	PF1,PF2,PF3,PF	√	√
Frequency	Frequency	√	√
Energy	Ep_imp, Ep_exp, Ep_total, Ep_net	√	√
Reactive Energy	Eq_imp, Eq_exp, Eq_total, Eq_net	√	√
Demand	Dmd_P, Dmd_Q, Dmd_S	√	√
Voltage Unbalance Factor	U_unbl	√	√
Current Unbalance Factor	I_unbl	√	√
Voltage THD	THD_V1, THD_V2, THD_V3 THD_V1_Even, HD_V2_Even, THD_V3_Even THD_V1_Odd, THD_V2_Odd, THD_V3_Odd THD_V1+N, THD_V2+N, THD_V3+N		√
Current THD	THD_I1, THD_I2, THD_I3 THD_I1_Even, HD_I2_Even, THD_I3_Even THD_I1_Odd, THD_I2_Odd, THD_I3_Odd THD_I1+N, THD_I2+N, THD_I3+N TDD_I1, TDD_I2, TDD_I3		√
Harmonics	Harmonics 2nd to 31st		√
Voltage Crest Factor	Crest Factor		√
Current K factor	K_Factor		√
MAX with Time Stamp			√
MIN with Time Stamp			√
Switch Status(DI)	Isolated digital input		√
Relay Output(RO)	Two 2A output Relay		√
LED Pulse Output	MC for active , reactive , apparent energies		√

RS485 Port	Modbus Protocol (RTU)	√	√
Real Time Clock	Miladi , Shamsi , Daylight Saving	√	√
Real Time Clock	RTC Calibration		√
Astronomical timer	Lighting control relay		√
thermostat	Fan control relay		√
USB PORT	USB version 2 + safe Port	√	√
Digital input			√
Wi-Fi Modem	As access point or station (multi-client)		√
Voltage and current sequence		√	√
Unit Software Update		√	√
Power Supply	Switching power supply 80-260V input		√

Table 1.2 Comparisons of ZMP and ZMP+

Note:

1. There are One DI in the ZMP+.
2. The 2 DOs may be used as General purpose or Thermostat or Astronomical Timer controller.

Chapter 2
Installation

Appearance and Dimensions

Appearance

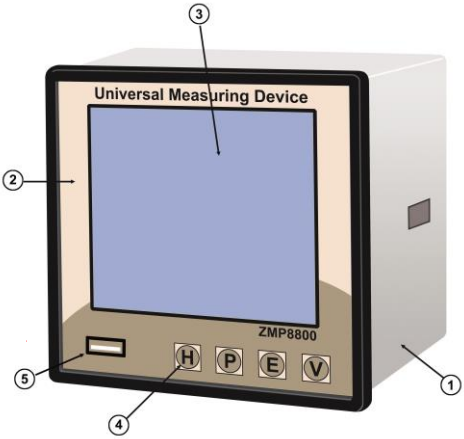


Figure2.1 Appearance of ZMP

Part Name	Description
1. Enclosure	The ZMP enclosure are made of high strength ant combustion engineering plastic
2. Front Casing	After the installation, this part is before the panel.
3. LCD Display	Large bright blue backlight LCD Display
4. Key	Four keys are used to select display and to set parameters of the meter
5.USB Port	Used data transfer and unit software upgrade

Table2.1 Part name of ZMP

Dimensions

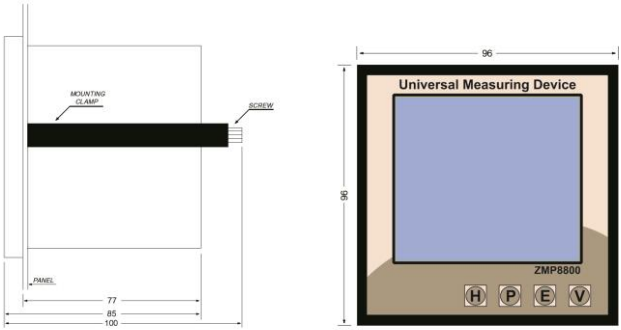


Fig.2.2Dimensions

Installation Method

Environmental

Please check the environment temperature and humidity to ensure the satisfaction of ZMP meter's requirement before the meter installation.

Temperature

Operation: -20°C to 70°C

Storage: -40°C to 85°C

Humidity

5% to 95% non-condensing ZMP meter should be installed in dry and dust free environment and avoid heat, radiation and high electrical noise source.

Maximum Altitude: 2,000m

Site Requirement: Indoor Use

Installation Steps

Normally, ZMP was installed on the panel of switch gear.

1. Firstly, cut a square hole on the panel of the switch gear.

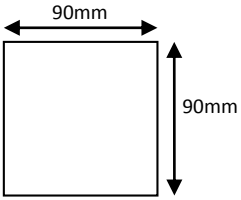


Fig.2.3 Panel cutting

2. Secondly, remove the clips from the meter and insert the meter into the square hole from the front side.
3. Finally, put clips back to the meter from the backside and push the clip tightly so that the meter is fixed on the panel.

Wiring of ZMP

Terminal Strips

There are four group terminals on the back of ZMP, Voltages & Currents and RS485 Input Terminal, Auxiliary Power Terminal.

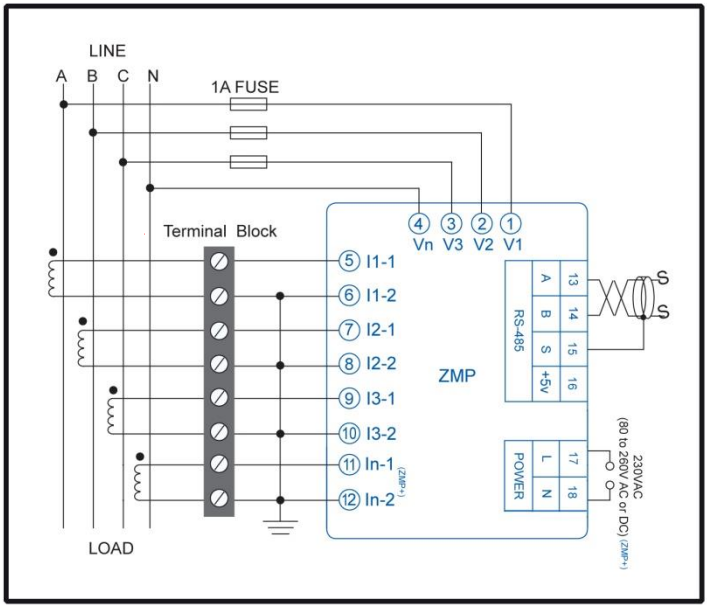


Fig.2.4 wiring diagram

Auxiliary Power

The auxiliary power supply of the ZMP meter is 230Vac or 80-260V ac or dc (on ZMP+). Typical power consumption of the meter is less than 2W. A regulator or a UPS should be used when the power supply undulates.

A switch or circuit-breaker shall be included in the building installation, and it shall be in close proximity to the equipment and within easy reach of the operator, and it shall be marked as the disconnecting device for the equipment. A fuse (typical 1A/250Vac) should be used in auxiliary power supply loop.

An isolated transformer or EMI filter should be used in the auxiliary power supply loop if there is power quality problem in the power supply.

Voltage Input

Two Voltage Input options are included in ZMP (100Vac and 400Vac). 100Vac is suitable for high or medium voltage system that the secondary of PT is 100Vac. 400Vac is suitable for low voltage

system that less than 480Vac. The voltage input could be directly connected to the terminal of ZMP without the use of PT. The input line to line voltage should be less than 480Vac. If the input voltage is higher than 480Vac, the PT should be used. A fuse (typical 1A/250Vac) should be used in voltage input loop.

PT should be used to transform the high voltage into measurement range of ZMP if it is used in high voltage system.

The wire number of voltage input could be AWG16-12 or 1.3-2.0mm^2

Current Input

In a practical engineering application, CTs should be installed in the loop of measuring. Normally the secondary of CT is 5A. 1A is possible in ZMP. A CT of accuracy over 0.5% (rating over 3VA) is recommended and it will influence the measuring accuracy. The wire between CT and ZMP should be as shorter as possible. The length of the wire may increase the error of the measurement. CTs must be required if the rated current over 5A.

The wire number of current input could be AWG15-10 or 1.5-2.5mm^2

The CT loop should not be open circuit in any circumstance when the power is on. There should not be any fuse or switch in the CT loop
and one end of the CT loop should be well connected to the ground.

Vn Connection

Vn is the reference point of ZMP voltage input. The lower is the wire resistance the less is the error.

Three phase wiring diagram

ZMP can satisfy almost all kinds of three phase wiring diagram. The current input wiring mode can be set separately in the meter parameter setting process. The current input wiring mode could be 3CT or 4CT. In 3CT wiring the natural current calculate from three phase currents and in 4CT wiring the natural current is measured from individual CT for natural line.

Voltage Input Wiring

3-Phase 4-Line Wye mode (3LN) the 3-Phase 4-Line Wye mode is popularly used in low voltage electric distribution power system. The power line can be connected to the meter voltage input directly. In the high voltage input system, 3PT Wye mode is often used.

Current Input Wiring

3CT

All the current input of three phase system can be looked as 3CT one, the current input mode of the ZMP should be set 3CT for this current input wiring mode.

4CT*

All the current input of three phase system and natural line can be looked as 4CT one, the current input mode of the ZMP should be set 4CT for this current input wiring mode to measure natural current directly.

Communication

The communication port and protocol of ZMP are RS485 and Modbus-RTU. The terminals of communication are A, B, S, +5V (as needed). A is differential signal +, B is differential signal - and S is connected to shield of twisted pair cable. Up to 32 devices can be connected on a RS485 bus. Use good quality shielded twisted pair cable, AWG22 (0.5mm2) or larger. The overall length of the RS485 cable connecting all devices cannot exceed 1200m (4000ft). ZMP is used as a slave device of master like PC, PLC, data collector or RTU.

If the master does not have RS485 communication port, a converter has to be used. Normally a RS232/RS485 or USB/RS485 is adopted. The topology of RS485 net can be line, circle and star.

1. Line

The connection from master to ZMP meter is one by one in the RS485 net as in fig 2.5.

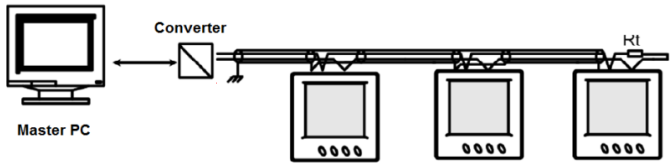


Fig 2.5 Line mode

In fig 2.5 the Rt is an anti-signal reflecting resistor 120-300 ohm/0.25W. Normally, it added into the end of the circuit beside the last ZMP meter, if the communication quality is not good.

2. Circle

ZMP meters are connected in a closed circle for the purpose of high reliability.
There is no need of anti-signal reflecting resistor.

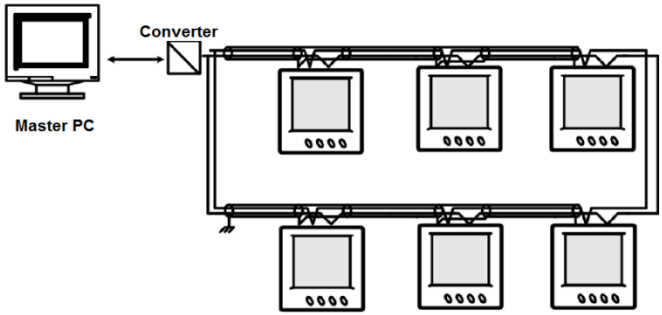


Fig 2.6 Circle mode

3. Star

The connection of RS485 net is in Wye mode. Anti-signal reflecting resistor may be needed in each line.

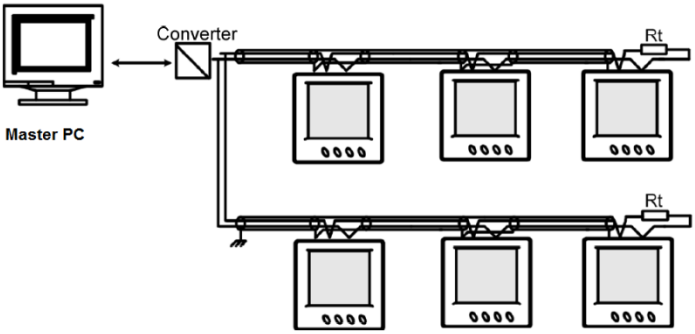


Fig 2.7 Star mode

The recommendations for the high quality communication, Good quality shielded twisted pair of cable AWG22 (0.6mm2) or larger is very important.

The shield of each segment of the RS485 cable must be connected to the ground at one end only. Keep communication cables away as much as possible from sources of electrical noise.

Use RS232/RS485 or USB/RS485 converter with optical isolated output and surge protection.

Chapter 3
Basic Operation and Setup

Detail human-machine interface of the meter will be described in this chapter.
This includes how to get the metering data and how to do the parameter setting.

Display panel and keys

There are one display panel and four keys in the front of ZMP. All the display segments are illustrated in fig 3.1.

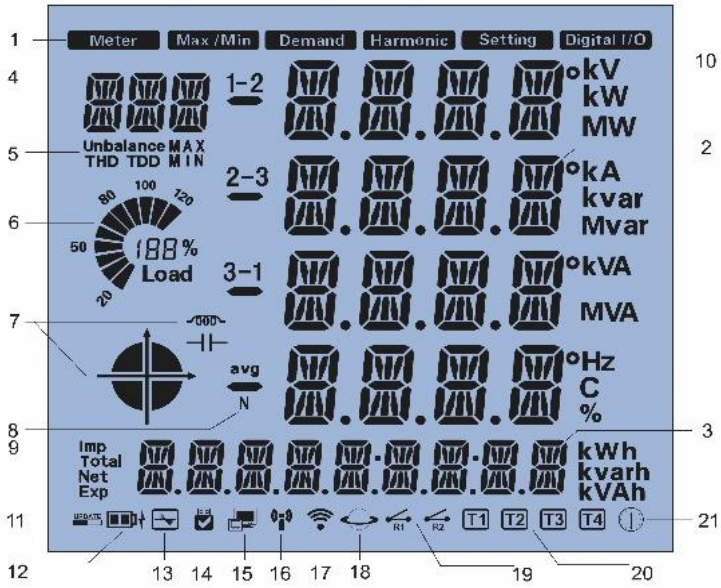
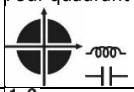
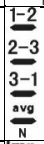
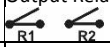


Fig 3.1 All Display Segments

SN	Display	Description
1	Display mode indication	Shows different modes on the display area. “Meter” for real-time measurement; “Max/Min” for statistic data; “Demand” for power demand data; “Harmonic” for harmonic data; “Setting” for parameters setting; “Digital I/O” for expanded IO module data.
2	Four lines of 8 letter in the metering area	Main display area: displays metering data such as voltage, current, power, power factor, frequency, unbalance, phase angle, etc. Displays statistics such as maximum and minimum, demand data, display settings and expanded I/O data.
3	Nine 8 digits energy area	Displays energy data and real-time clock. Also used for the setting mode and digital I/O mode display.
4	Three 8 digits	Item Icons: “U” for voltage; “I” for current; “P” for active power; “Q” for reactive power; “S” for apparent power;

		"PF" for power factor; "F" for frequency; "" for phase angles; "DMD" for demand. .
5	Unbalance MAX THD TDD MIN	Item Icons: "Unbalance" for unbalance of the voltage and current; "THD" for total harmonics distortion; "TDD" for total demand distortion; "MAX" for maximum and "MIN" for minimum
6	Load rate 	Displays the percentage of load current to the nominal current.
7	Four quadrant icon 	quadrant of the system power
8		1, 2, 3 for 3 phase A, B, C; 1-2, 2-3, 3-1 for 3 phase line to line AB, BC, CA; Avg for average and N for neutral.
9	Imp Total Net Exp	imp: consumption energy exp: generating energy total: absolute sum of imp and exp energy net: algebraic sum
10	Units measured	voltage: V, kV; current: A, kA; active power: kW, MW; reactive power: kvar, Mvar; apparent power: kVA, MVA; frequency: Hz; active energy: kWh; reactive energy: kvarh; apparent energy: kVAh; percentage: %; phase angle: °
11	Internal Software Update	When unit updated by USB or wirelessly this icon shown
12	Battery Charge Status 	Display internal battery charging or full status
13	Unit Logger indicator 	When unit logger started this indicator will be on
14	USB Stick insert indicator 	When USB stick is entered to unit
15	Communication indicator 	Any communication done by TCP-IP or RS485
16	Wi-Fi in Station mode 	
17	Wi-Fi in Access Point mode 	
18	Astronomical Timer is ON 	When astronomical timer enabled this indicator will be on
19	Output Relays Status 	Display status of each output relays
20	Energy Tariffs indicator	Display how many energy tariffs seted on unit

	T1 T2 T3 T4	
21	Time icon 	Time display in energy area

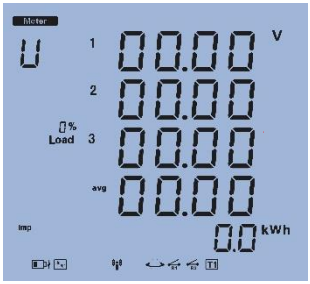
Table 3.1 Display Panel description

There are four delicacy keys labeled as H, P, E and V. Use these four keys to read metering data and do parameter setting.

Metering data reading

Normally, ZMP display the metering data, such as voltage, current, power etc. To read the metering data simply press the keys H, P, E and V.
Note:
In below items that marked with * displayed when FULL state selected in DISPLAY MODE.

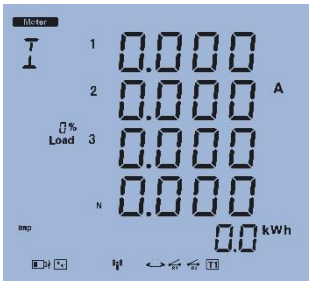
Press V to read voltage and current in the metering area.



The first screen:
display Va, Vb, Vc and Ulnavg
as in fig 3.2.

Fig 3.2 Three phase voltage

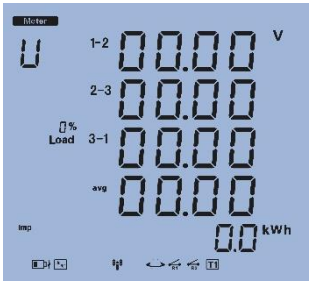
Press V, go to the second screen.



The second screen:
display current of each phase and neutral,
I1, I2, I3 and In,
as in fig 3.3.

Fig 3.3 Three phase current

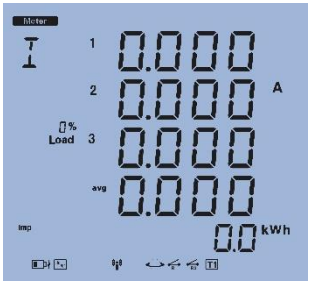
Press V, go to the third screen.



The third screen:
display voltage of line to line,
V12, V23, V31 and average Vllavg,
as in fig 3.4

Fig 3.4 Three phase to phase voltage

Press V, go to the fourth screen.

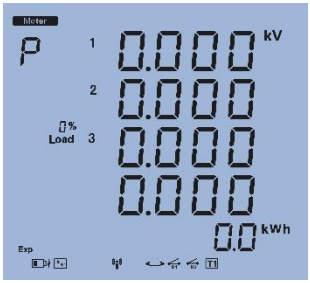


*The fourth screen:
display current of each phase and average current as in fig 3.5,

Fig 3.5 Three phase current

Press V, go back to the first screen.

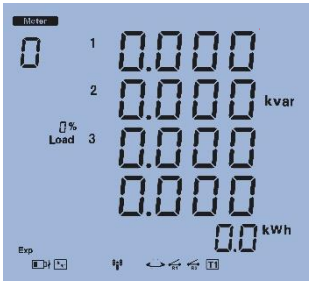
Press P, display power related data.



The first screen:
display power of each phase
P1, P2, P3 and system total power Psum.
As in fig 3.6,

Fig 3.6 Three phase power

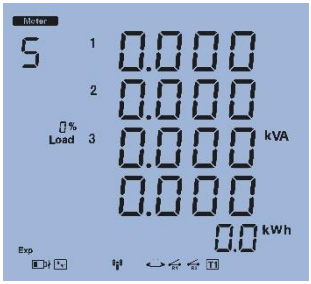
Press P, go to the second screen.



The second screen:
display reactive power of each phase,
Q1, Q2, Q3 and system total reactive power Qsum.
As in fig 3.7

Fig 3.7 Three phase reactive power

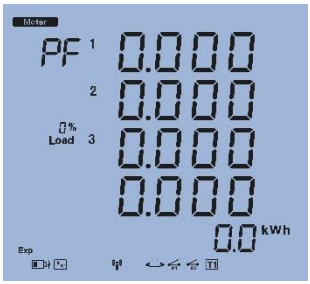
Press P, go to the third screen.



The third screen:
display apparent power of each phase
S1, S2, S3 and system total apparent Power Stot.
as in fig 3.8

Fig 3.8 Three phase apparent power

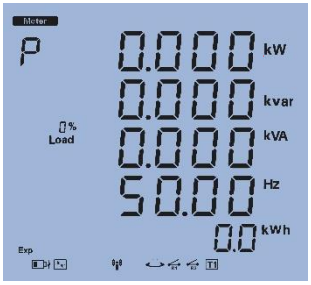
Press P, go to the fourth screen.



The fourth screen:
power factor of each phase
PF1, PF2, PF3 and system average power factor PF.
As in fig 3.9,

Fig 3.9 Three phase PF

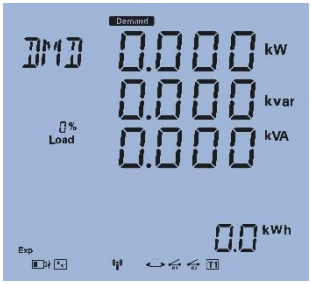
Press P, go to the fifth screen.



*The fifth screen:
system total power Psum,
system total reactive power Qsum,
system total apparent power Ssum and
system frequency F.
As in fig 3.10,

Fig 3.10 System power and frequency

Press P, go to seventh screen.

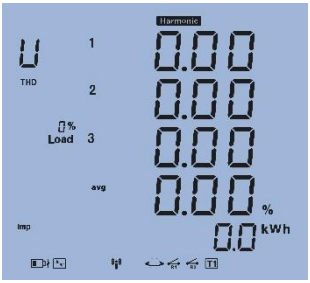


*The sixth screen:
display three phase system power demand,
power demand Dmd_P,
reactive power demand Dmd_Q
and apparent Dmd_S.
As in fig 3.11,

Fig 3.11 System power demand*

Press P, go back to the first screen.

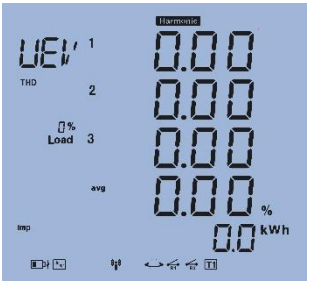
Press H, display power quality data.



The first screen:
display THD of voltages.
As in fig 3.12,

Fig 3.12 Unbalance factor

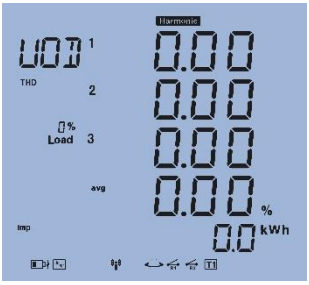
Press H key, go to the second screen.



*The second screen:
display voltages even harmonic distortion EVEN HD
and average percent.
As in fig 3.13

Fig 3.13 Sequence indicator

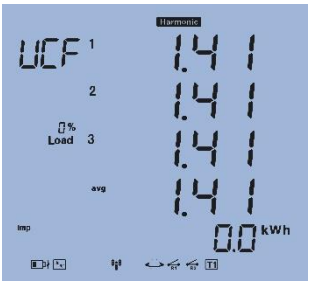
Press H key, go to the third screen.



*The third screen:
display voltage odd harmonic distortion ODD HD
and average percent.
As in fig 3.14

Fig 3.14 Sequence indicator

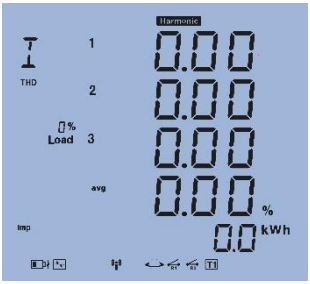
Press H key, go to the fourth screen.



*The fourth screen:
display voltages CREST FACTOR
and average.
As in fig 3.15

Fig 3.15 Sequence indicator

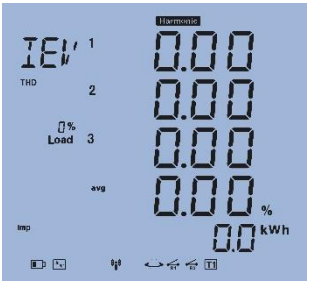
Press H key, go to the fifth screen.



The fifth screen:
display THD of currents
As in fig 3.16

Fig 3.16 Sequence indicator

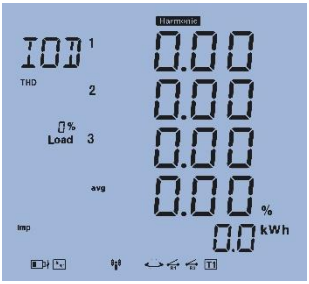
Press H key, go to the sixth screen.



*The sixth screen:
display currents even harmonic distortion EVEN HD
and average percent.
As in fig 3.17

Fig 3.17 Sequence indicator

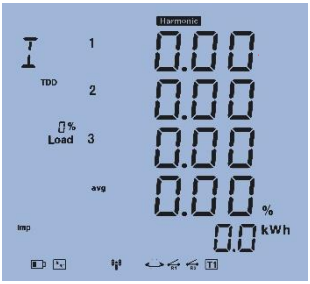
Press H key, go to the seventh screen.



*The seventh screen:
display currents odd harmonic distortion ODD HD
and average percent.
As in fig 3.18

Fig 3.18 Sequence indicator

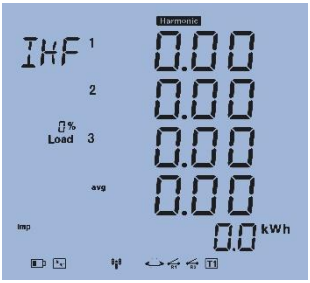
Press H key, go to the eighth screen.



The eighth screen:
display TDD of currents.
and average percent.
As in fig 3.19

Fig 3.19 Sequence indicator

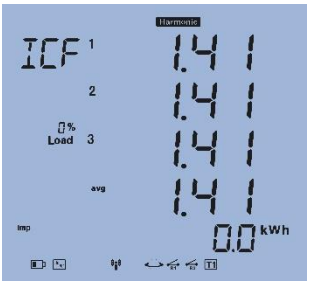
Press H key, go to the ninth screen.



*The ninth screen:
display K-FACTOR of currents.
As in fig 3.20

Fig 3.20 Sequence indicator

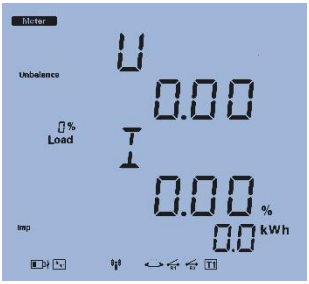
Press H key, go to the tenth screen.



*The tenth screen:
display CREST FACTOR of currents.
As in fig 3.21

Fig 3.21 Sequence indicator

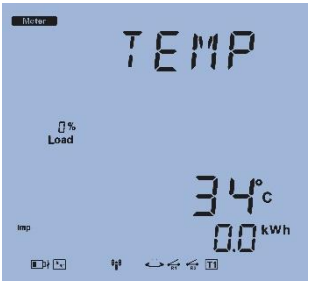
Press H key, go to the eleventh screen.



The eleventh screen:
Unbalance factor of voltages and currents.
As in fig 3.22

Fig 3.22 Sequence indicator

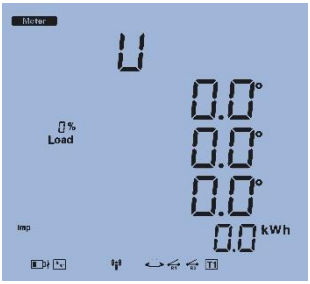
Press H key, go to the twelfth screen.



The twelfth screen:
Unit inside temperature.
As in fig 3.23

Fig 3.23 Sequence indicator

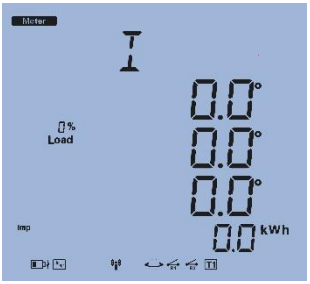
Press H key, go to the thirteenth screen.



The thirteenth screen:
display three phase voltage
phase displacement with each other in degree.
As in fig 3.24

Fig 3.24 Sequence indicator

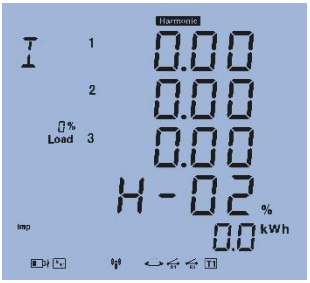
Press H key, go to the fourteenth screen.



The fourteenth screen:
display three phase currents
phase displacement with each other in degree.
As in fig 3.25

Fig 3.25 Sequence indicator

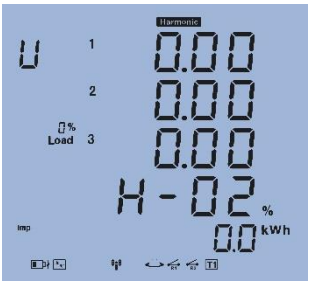
Press H key, go to the fifteenth screen.



*The fifteenth screen:
display three phase voltage
second harmonic ratio percent
As in fig 3.26

Fig 3.26 Sequence indicator

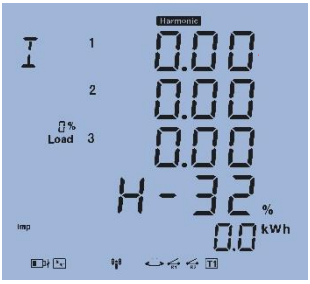
Press H key, go to the sixteenth screen.



The sixteenth screen:
display three phase current
second harmonic ratio percent
As in fig 3.27

Fig 3.27 Sequence indicator

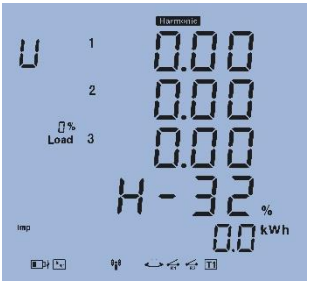
Press H key, go to the next screen and see other harmonic ratios until 32th.



display three phase current
32th harmonic ratio percent
As in fig 3.28

Fig 3.28 Sequence indicator

Press H key, go to the second screen.

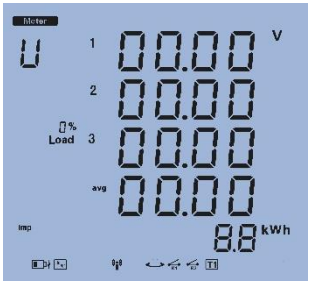


display three phase voltages
32th harmonic ratio percent
As in fig 3.29

Fig 3.29 Sequence indicator

Press H, go back to the first screen.

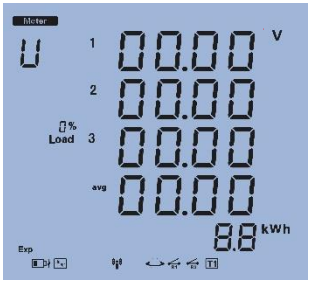
Press E key: display energy and real time clock.



The first screen:
display the consumption active energy (active import).

Fig 3.30 Import energy

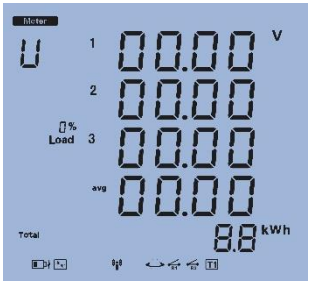
Press E key, go to the second screen.



The second:
Display the generation active energy (active export).
As in fig 3.31,

Fig 3.31 Export energy

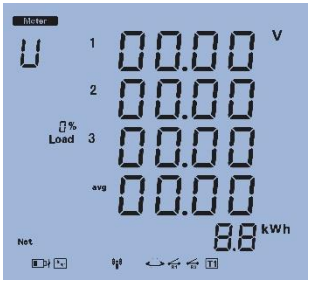
Press E key, go to the third screen.



The third screen:
Display absolute sum of import and export active energy (active total).
As in fig 3.132,

Fig 3.32 Total energy

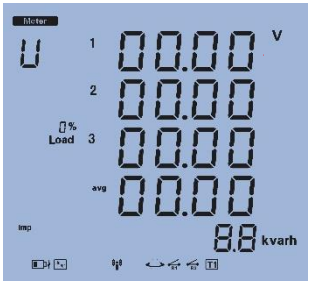
Press E key, go to the fourth screen.



The fourth screen:
Display algebraic sum of import and export active energy (active net).
As in fig 3.33,

Fig 3.33 Net energy

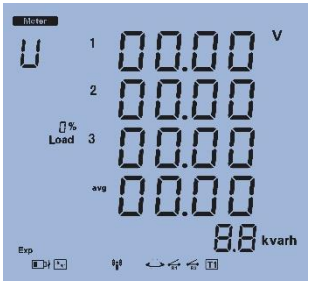
Press E key, go to the fifth screen.



The fifth screen:
Display inductive reactive energy (reactive import).
As in fig 3.34,

Fig 3.34 Inductive reactive energy

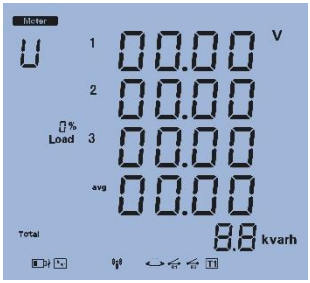
Press E key, go to the sixth screen.



The sixth screen:
Display the capacitive reactive energy (reactive export).
As in fig 3.35,

Fig 3.35 Capacitive reactive energy

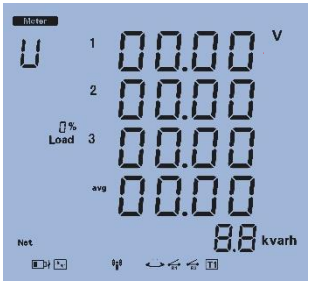
Press E key, go to the seventh screen.



The seventh screen:
display absolute sum of the reactive energy (reactive total).
As in fig 3.36,

Fig 3.36 Total reactive energy

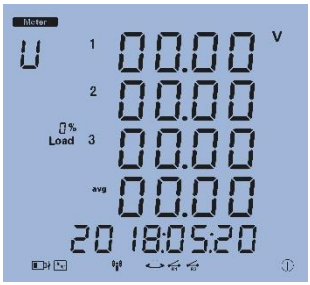
Press E key, go to the eighth screen.



The eighth screen:
Display algebraic sum of reactive energy (reactive net).
As in fig 3.37,

Fig 3.37 Net reactive energy

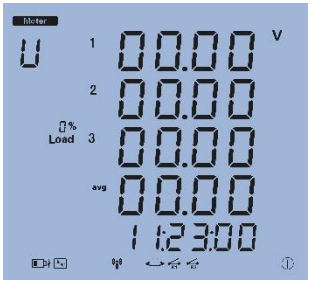
Press E key, go to the ninth screen.



The ninth screen:
Display date.
Format: YYYY: MM: DD
As in fig 3.38, the date is May. 20, 2018 or can be in Hijri (SHAMSI) mode.

Fig 3.38 Date

Press E key, go to the tenth screen.



The tenth screen:
Display time.
Format: HH: MM: SS.
As in fig 3.39, the time is 11:23:00.

Fig 3.39 Time

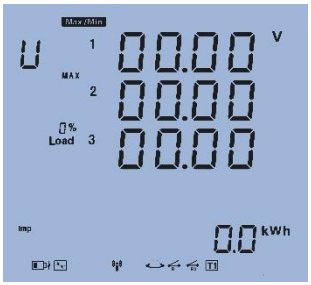
Press E key, go back to the first screen.

Note: If you select FULL state of display in setting you can see each tariff separately.

Statistics display

Press the P and V Keys simultaneously, the Max and Min value of metering data will display on the screen. The time stamp can be access through communication.

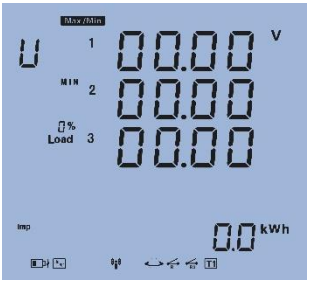
Press the P and V keys simultaneously, go to the statistics screen.



The first screen: Display the Max value of voltages.
The Max label display on up right of letter U.
As in fig 3.40,

Fig 3.40 Max phase voltage

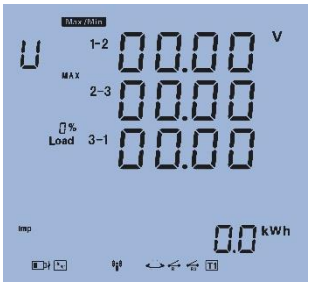
Press P key, to display the Min value of voltage. The Min label display on the low right of the letter U. Press P key again, go back to display the Max values of voltage.



Min value of voltages.
As in fig 3.41,

Fig 3.41 Min phase voltage

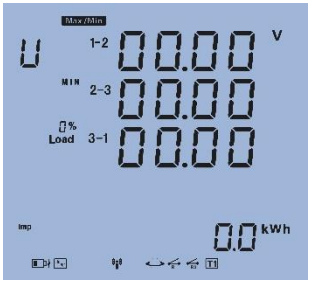
Press V key, go to the next screen.



The second screen: Max value of the line to line voltages.
As in fig 3.42,

Fig 3.42 Max line voltage

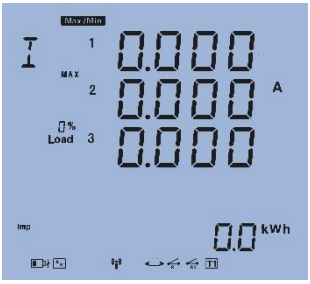
Press P key to change display from Max to Min and vice versa.



Min value of the line to line voltages.
As in fig 3.43,

Fig 3.43 Min line voltage

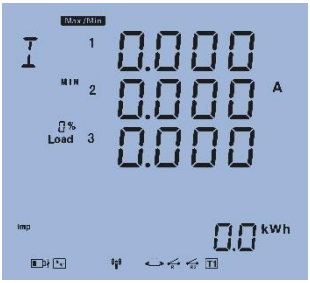
Press V key, go to the next screen.



The third screen: Max value of the currents.
As in fig 3.44,

Fig 3.44 Max Current

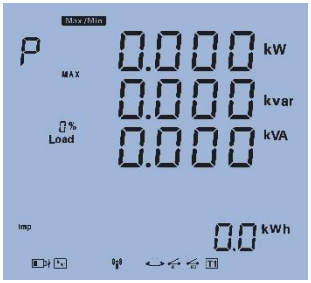
Press P key to change display from Max to Min and vice versa.



Min value of the currents.
As in fig 3.45,

Fig 3.45 Min Current

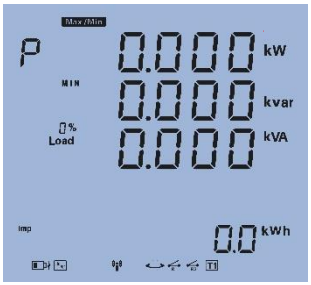
Press V key, go to the next screen.



The fourth screen: Max value of system total power, Max value of system reactive power, Max value of system apparent power. As in fig 3.46,

Fig 3.46 Max value of system power

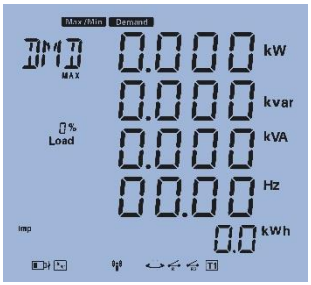
Press P key to change display from Max to Min and vice versa.



Min value of system total power, Min value of system reactive power, Min value of system apparent power. As in fig 3.47,

Fig 3.47 Min value of system power

Press V key, go to the next screen.



The fifth screen: Max value of system power demand, Max value of system reactive power demand, Max value of system total apparent power demand and Max value of system frequency.
as in fig 3.48,

Fig 3.48 Max value of demand & freq

Press P key to change display from Max to Min and vice versa.

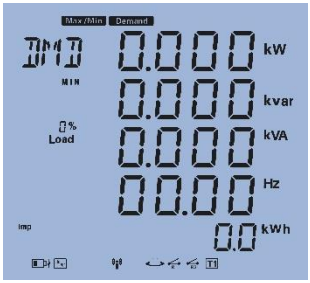


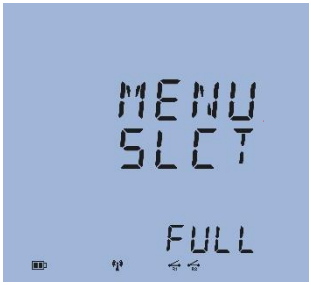
Fig 3.49 Min value of demand & freq

Min value of system power demand, Min value of system reactive power demand, Min value of system total apparent power demand and Min value of system frequency.
as in fig 3.49,

Press V key, go to the first screen.

Meter Parameter Setting

Under the metering data display mode, press the H and V key simultaneously, get into the meter parameter setting mode.
In the meter parameter setting mode, press H key to move cursor. The digit that cursor is on it will be blink to show which digit going to change and Right move one digit each time. Press P for increasing and press E for decreasing. Press V for acknowledgment and going to the next setting item page.
In any setting parameter if entered value is wrong the meter display Error message and will not save it.
Press H and V page keys simultaneously to exit in any setting item page.
Factory and Calibrate and Activate menus are used in production procedure.
Simple menu include usually and important settings of FULL setting.



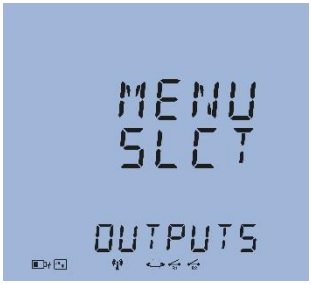
Press P or E key, go to the next screen

Fig 3.50 FULL MENU select

.

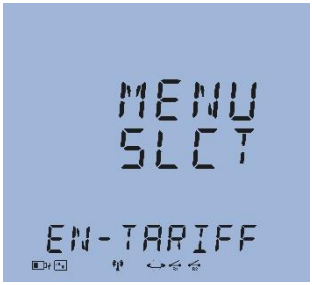
Press P or E key, go to the next screen.

Fig 3.51 CALIBRATION MENU select



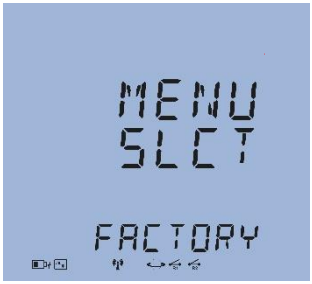
Press P or E key, go to the next screen.

Fig 3.52 OUTPUTS MENU select



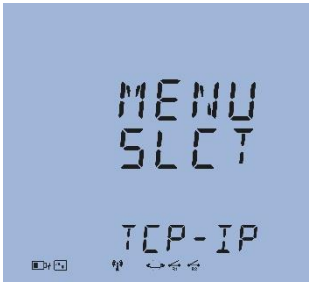
Press P or E key, go to the next screen.

Fig 3.53 ENERGY TARIFFS MENU select



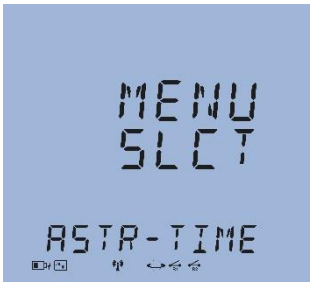
Press P or E key, go to the next screen.

Fig 3.54 FACTORY MENU select



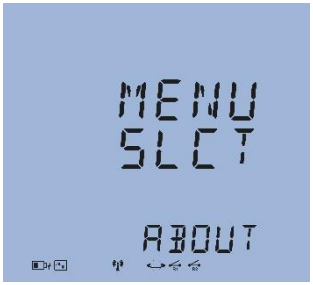
Press P or E key, go to the next screen.

Fig 3.55 TCP-IP MENU select



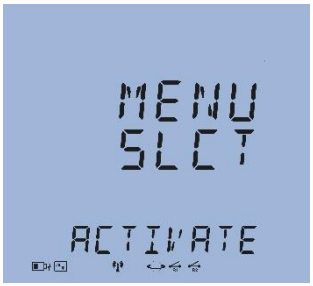
Press P or E key, go to the next screen.

Fig 3.56 ASTRONOMICAL TIMER MENU select



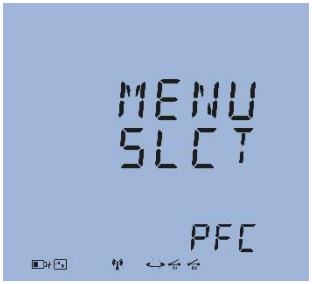
Press P or E key, go to the next screen.

Fig 3.57 ABOUT MENU select



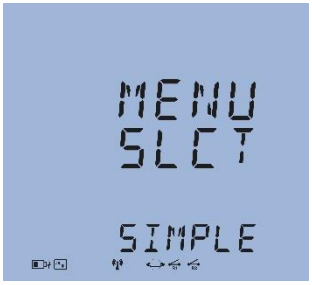
Press P or E key, go to the next screen.

Fig 3.58 ACTIVATE MENU select



Press P or E key, go to the next screen.

Fig 3.59 PFC MENU select



Press P or E key, go to the next screen.

Fig 3.60 SIMPLE MENU select

Press V key, go to the Its Menu.

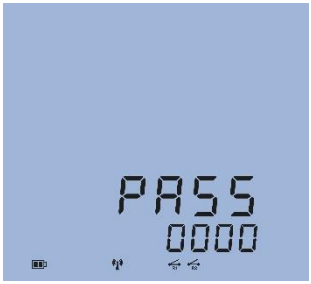


Fig 3.61 Access code page

Access code needed for going into the parameter setting of each menu. Only the person who knows the access code can do the parameter setting. The access code is 4 digits' decimal number. It is from 0000 to 9999. The factory default is 0000. After key in the right access code, press V to go to the first parameter setting page, otherwise display Error message and go back to the metering data display page.
As in fig 3.61 is access code page.

FULL MENU settings Parameters

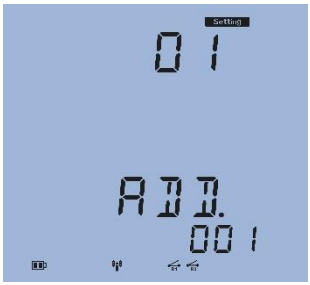


Fig 3.62 Address setting page

The first screen: setting ZMP address page for the communication purpose. It is any digit number from 1 to 247. As in fig 3.62, the ZMP Address is 1. Changing method is simple, press H to move the cursor to the digit that need to be changed, press P for increasing and press E for decreasing. Press V for the acknowledgment

Note: Each meter on same RS485 net should have different address according to the Modbus-RTU protocol.

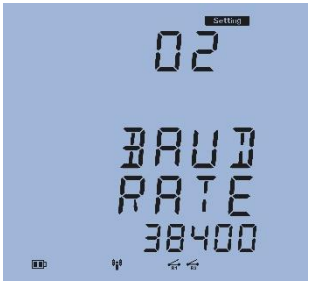


Fig 3.63 Baud rate setting page

The second screen: Baud rate setting page the asynchronies communication setting of the ZMP is 8 data bit, no parity, 1 start bit and 1 stop bit. Baud rate could be one of the six, 1200, 2400, 4800, 9600, 19200, 38400. As in fig3.33, the baud rate of the ZMP is 38400bps. Press P or E to select one. Press V key for acknowledgment and going to the next setting page.

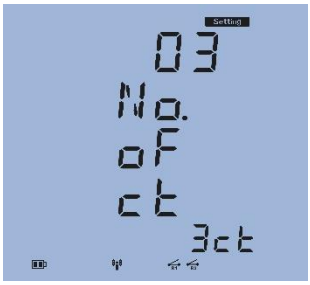


Fig 3.64 Number of CT setting page

The third screen: Current input wiring setting page. Current input wiring could be one of the two modes, 3CT and 4CT. (Refer to chapter 2)
This item is available only on ZMP+.
As in fig 3.34, current input mode setting is 3CT. Press P or E keys to select from 3CT and 4CT. Press V key for acknowledgment and going to the next setting page.

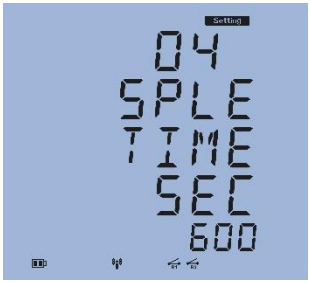


Fig 3.65 Interval time of records

The fourth screen: The interval time of between recordings of measured values on internal flash memory with time stamp. The interval can be set from 1 second to 900 second (15 minute).
After time interval elapse it records below items: Date stamp, Time stamp, V1, V2, V3, V12, V23, V31, I1, I2, I3, In(meas.), In(calc.) P1, P2, P3, Ptot, Q1, Q2, Q3, Qtot, S1, S2, S3, Stot, PF1, PF2, PF3, PFtot, Frequency, Temp, U_unbl, I_unbl, I1_THD, I2_THD, I3_THD, V1_THD, V2_THD, V3_THD, I1_TDD, I2_TDD, I3_TDD I1_KFACTOR, I2_KFACTOR, I3_KFACTOR, I1_CF, I2_CF, I3_CF, V1_CF, V2_CF, V3_CF, I1_THDF, I2_THDF, I3_THDF, V1_THDF, V2_THDF, V3_THDF.

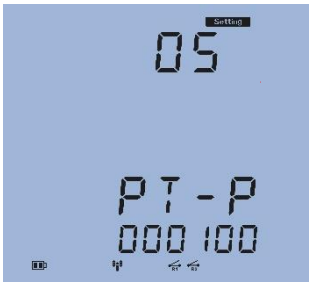


Fig 3.66 PT primary setting page

The fifth screen: PT primary rating voltage PT_P setting page. PT_P value is an integer from 100 to 400,000. The unit is volt. As in fig 3.36, PT_P=100V, press P, E and H to change the value. Press V key for acknowledgment and going to the next setting page.

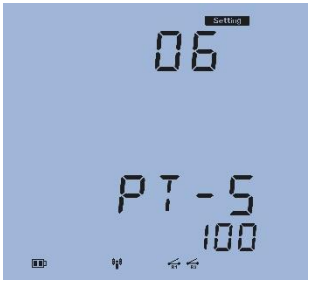


Fig 3.67 PT secondary setting page

The sixth screen: PT secondary rating voltage PT_S setting page. PT_S value is an integer from 100 to 400. The unit is volt.
As in fig 3.37, PT_S=100V, press P, E and H to change the value. Press V key for acknowledgment and going to the next setting page.

Note: If there is no PT on the voltage input side of ZMP, the PT_P and PT_S should be set to same number (for example both of them set to 100)

Fig 3.68 CT primary setting page

The seventh screen: CT primary rating current CT_P setting page. CT_P value is an integer from 5 to 8000. The unit is Amp.
As in fig 3.68, CT_P=5A, pressing P, E and H keys to change the value. Press V key for acknowledgment and going to the next setting page.

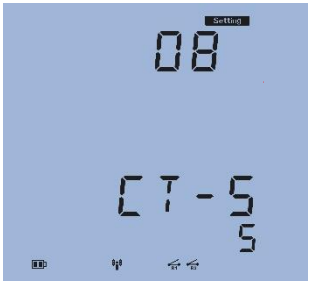


Fig 3.69 CT secondary setting page

The eighth screen: CT secondary rating current CT_S setting page. CT_S value is 1A or 5A. The unit is Amp. As in fig 3.39, CT_S=5A, press P, E to change the value. Press V key for acknowledgment and going to the next setting page.

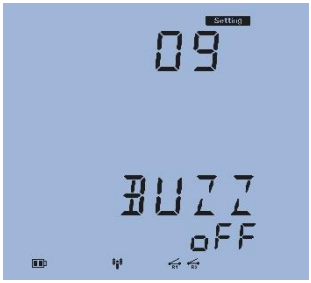


Fig 3.70 Type of data transfer

The ninth screen: Setting buzzer of unit to be on or off. Press V key for acknowledgment and going to the next setting page.

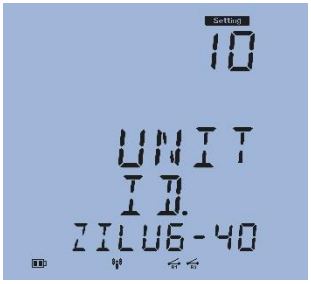


Fig 3.71 Unit ID setting page

The tenth screen: Display unit ID setting page, User can define an individual ID for each unit, this ID used by unit to create folder on USB stick with this name and Wi-Fi access point name.
This option causes to user can easily manage files and folders that created on common stick by different units.
Unit ID includes eight characters which could be selected from uppercase letters and numbers.
As fig 3.41 ID of this unit is: ZILUG-40. Press V key for acknowledgment and going to the next setting page.

Fig 3.72 Type of logger setting page

The eleventh screen: Display type of logger setting page. You can define the way to unit record parameters on internal flash. If you select FIFO after flash was full unit erases old ones and overwrites new ones, so you will access to recent measurement records when reading unit memory, and if select FILL AND HOLD the unit save items until internal memory be full after that unit stop recording. Press V key for acknowledgment and going to the next setting page.

Fig 3.73 Daylight saving setting page

The twelfth screen: Display enable and disable of daylight saving. The RTC of unit can perform day light saving time automatically by setting this item to ON. Press V key for acknowledgment and going to the next setting page.

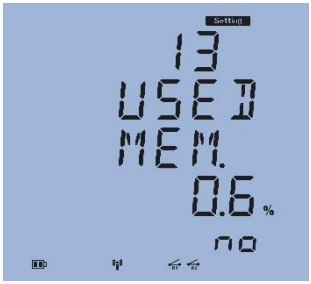


Fig 3.74 Internal memory status

The thirteenth screen: Display the internal memory status. This page displays the percent of used memory, if the whole of memory used the unit display FILL message and at bottom of LCD display the number of records displayed. By pressing P or E key EREASE message appear and you can erase internal memory by pressing of V. To prevent unwanted format of memory after pressing of V you should enter access code. After memory format is finished, unit display MEM ERASED message and going to the next setting page. Press V key going to the next setting page.

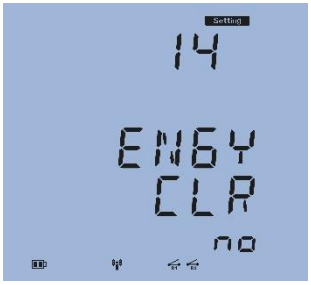


Fig 3.75 Energy values clear page

The fourteenth screen: Clearance of energy values. Select YES and press V key for clearing energy values and going to the next setting page.

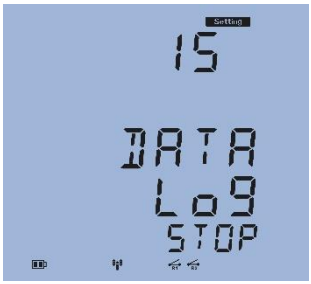


Fig 3.76 Logger starts and stop page

The fifteenth screen: Disable and enable of unit logger, select START and press V to run recording parameter and going to the next setting page.

Fig 3.77 Type of date setting page

The sixteenth screen: Display the type of date that unit used. Two types are selectable Georgian (MILADI) or Hijri (SHAMSI). Press V key for acknowledgment and going to the next setting page.

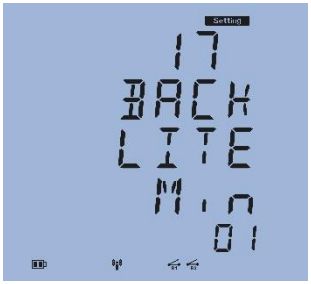


Fig 3.78 Backlight ON time

The seventeenth screen: Display back light “on” time setting page. The backlight will go to “off” for the purpose of energy saving and component duration if the key does not be touched for a period time. The “on” time can be set from 1 to 15 Minute. As in fig 3.78, the setting time of the back light is 1 minute. The back light will automatically go to “off” if there is no touch on the keys in 1 minute.

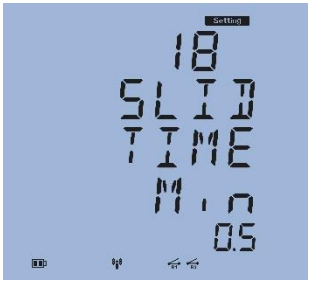


Fig 3.79 Sliding window time

The eighteenth screen: Sliding window time of demand setting page. Sliding window time of demand is from 1 to 30 Minute. The window slid once per Minute. As in fig 3.79, the sliding window time is 5 Minute.

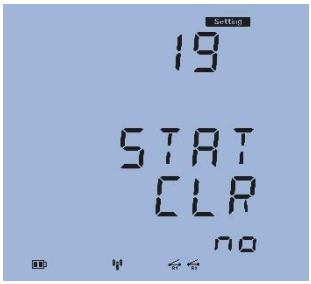


Fig 3.80 Clearance of MAX and MIN

The nineteenth screen: Clearance of the Max and Min value.
The Max and Min statistics value can be cleared by operating the front keys. Clear means to begin record new Max and Min statistics value.
As in fig 3.80, press E or P keys to select Yes or No. Yes: Clear the Max and Min statistics value No: Do not clear the Max and Min statistics value
Press V key, go to the next setting page.

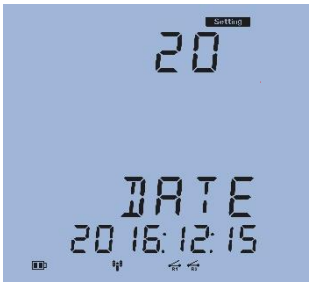


Fig 3.81 System date setting

The twentieth screen: System date setting page. Display format is YYYY: MM: DD
For MILADI type:
MM: 1 to 12
DD: 1 to 31
YYYY: 2014 to 2034
For SHAMSI type:
MM: 1 to 12
DD: 1 to 31
YYYY: 1392 to 1412
As in fig 3.81, the setting date is DEC. 15, 2016.

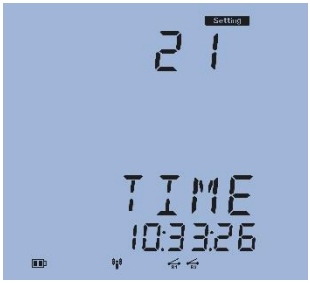


Fig 3.82 System time setting

The twenty first screen: system time setting page. the display format is HH:MM: SS
HH: 0 to 23
MM: 0 to 59
SS: 0 to 59
As in fig 3.82, the system time is 10:33:26

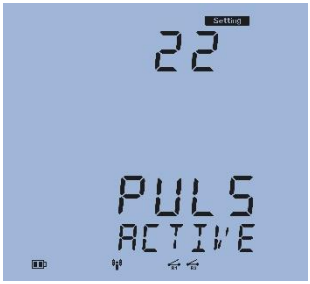


Fig 3.83 Select Energy of LED Pulse

The twenty third screen: LED pulse output based on active or reactive or apparent energy of system.

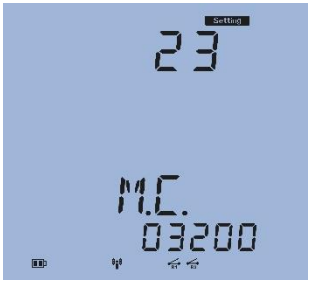


Fig 3.84 Meter Constant

The twenty third screen: The accumulated energy is converted to frequency of the LED pulses. One LED Pulse usually corresponds to 1KWh/MC or 1KVARH/MC or KVAH/MC (MC is Meter Constant, e.g. 3200 imp/kWh as fig 3.84),

Fig 3.85 RTC Calibration

The twenty fourth screen: Calibration of Real Time Clock, you can calibrate internal RTC by Adding or Subtracting seconds in 24hour. For example, if the RTC in 24 hours 3 seconds additive count you can set RTC calibration value to -3, so you will be able to accurate RTC. This value is between -99 to +99 seconds variable.

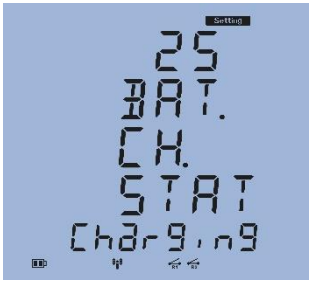


Fig 3.86 Internal Battery Status

The twenty fifth screen: in this screen you can see status of internal battery that keeps RTC of unit which shows Charging or Full.

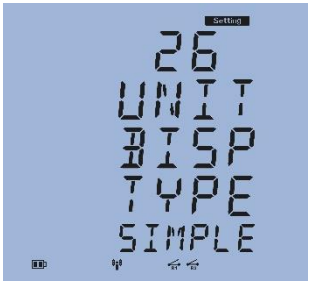


Fig 3.87 Display Type of unit

The twenty sixth screen: ZMP has two type of display, in simple version display pages are reduced and shows important values, and in Full version number of pages increased and all of measured data can be read by LCD, for example you can read out harmonics values in detailed.

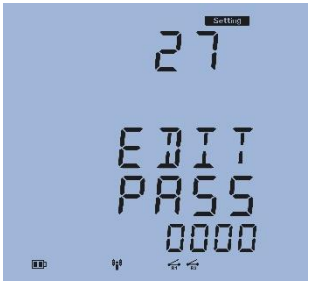


Fig 3.88 Access code setting

The twenty seventh screen: Access code setting page. The access code can be changed in this page. It is important to remember the new access code. As in fig 3.88, the access code is 0000. Press the V key and let the access code be stored in ZMP.

Press V Key, go to the first page.

SIMPLE MENU settings Parameters

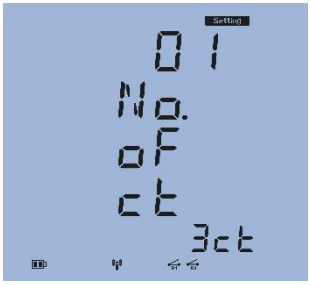


Fig 3.89 Number of CT setting page

The first screen: Current input wiring setting page. Current input wiring could be one of the two modes, 3CT and 4CT. (Refer to chapter 2)
This item is available only on ZMP+.
As in fig 3.89, current input mode setting is 3CT. Press P or E keys to select from 3CT and 4CT. Press V key for acknowledgment and going to the next setting page.

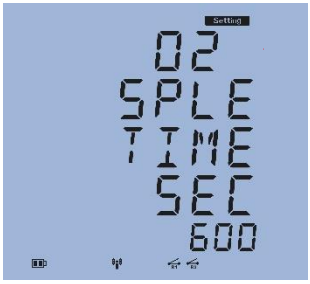


Fig 3.90 Interval time of records

The second screen: The interval time of between recordings of measured values on internal flash memory with time stamp. The interval can be set from 1 second to 900 second (15 minute).
After time interval elapse it records below items: Date stamp, Time stamp, V1, V2, V3, V12, V23, V31, I1, I2, I3, In(meas.), In(calc.) P1, P2, P3, Ptot, Q1, Q2, Q3, Qtot, S1, S2, S3, Stot, PF1, PF2, PF3, PFtot, Frequency, Temp, U_unbl, I_unbl, I1_THD, I2_THD, I3_THD, V1_THD, V2_THD, V3_THD, I1_TDD, I2_TDD, I3_TDD I1_KFACTOR, I2_KFACTOR, I3_KFACTOR, I1_CF, I2_CF, I3_CF, V1_CF, V2_CF, V3_CF, I1_THDF, I2_THDF, I3_THDF, V1_THDF, V2_THDF, V3_THDF.

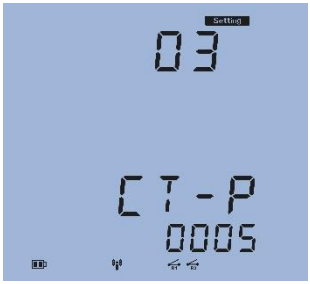


Fig 3.91 CT primary setting page

The third screen: CT primary rating current CT_P setting page. CT_P value is an integer from 5 to 8000. The unit is Amp. As in fig 3.91, CT_P=5A, pressing P, E and H keys to change the value.
Press V key for acknowledgment and going to the next setting page.

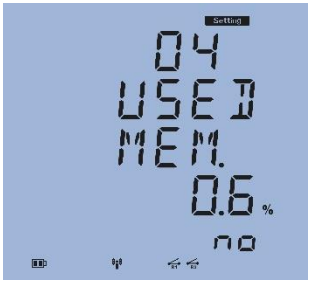


Fig 3.92 Internal memory status

The fourth screen: Display the internal memory status. This page displays the percent of used memory, if the whole of memory used the unit display FILL message and at bottom of LCD display the number of records displayed. By pressing P or E key EREASE message appear and you can erase internal memory by pressing of V. To prevent unwanted format of memory after pressing of V you should enter access code. After memory format is finished, unit display MEM ERASED message and going to the next setting page.
Press V key going to the next setting page.

Fig 3.93 Logger starts and stop page

The fifth screen: Disable and enable of unit logger, select START and press V to run recording parameter and going to the next setting page.

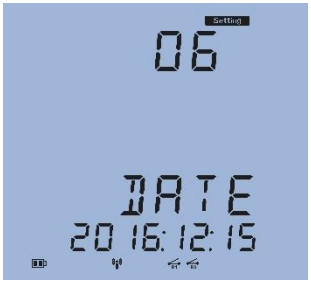


Fig 3.94 System date setting

The sixth screen: System date setting page. Display format is YYYY: MM: DD
For MILADI type:
MM: 1 to 12
DD: 1 to 31
YYYY: 2014 to 2034
For SHAMSI type:
MM: 1 to 12
DD: 1 to 31
YYYY: 1392 to 1412
As in fig 3.94, the setting date is DEC. 15, 2016.

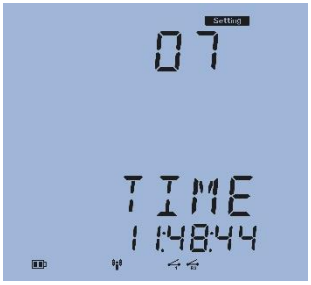


Fig 3.95 System time setting

The seventh screen: system time setting page the display format is HH:MM: SS
HH: 0 to 23
MM: 0 to 59
SS: 0 to 59
As in fig 3.95, the system time is 11:48:44
Press V key, go to next setting page.

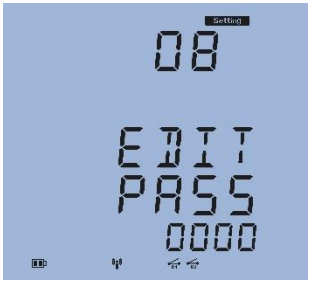


Fig 3.96 Access code setting

The eighth screen: Access code setting page. The access code can be changed in this page. It is important to remember the new access code. As in fig 3.96, the access code is 0000.
Press the V key and let the access code be stored in ZMP.

ABOUT MENU Parameters

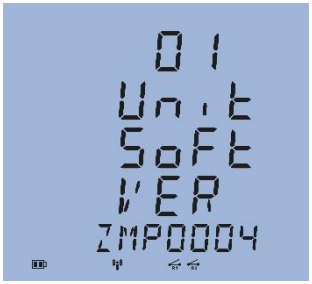


Fig 3.97 Unit software version

The first screen: Shows Unit software version
Press V Key, go to the next page.

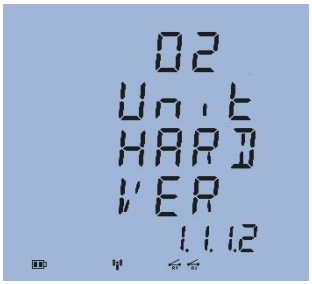


Fig 3.98 Unit hardware version

The second screen: Shows unit hardware version. Press V Key, go to the next page.

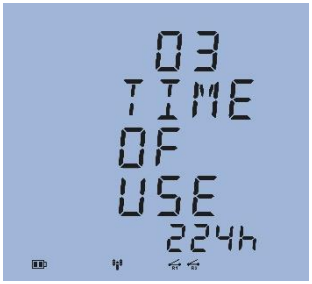


Fig 3.99 Time of use

The third screen: Shows time of use of unit
Press V Key, go to the next page.

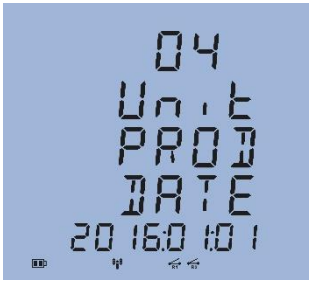


Fig 3.100 Unit production date

The fourth screen: Unit production date.
Press V Key, go to the next page.

Fig 3.101 Unit serial number

The fifth screen: Unit unique serial number.
Press V Key, go to the next page.

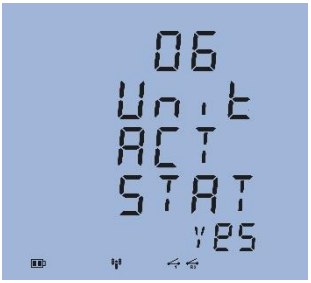


Fig 3.102 Unit activation status

The sixth screen: Unit reading by APN network active status.
Press V Key, go to the next page.

ASTRONOMICAL TIME MENU settings Parameters

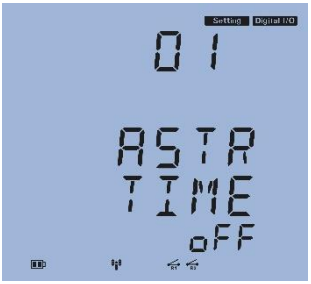


Fig 3.103 Astronomical timer

The first screen: Astronomical Timer is used to on and off lights with sunset and sunrise times as latitude and longitude of place by relay1 output if it set to off relay1 can use as general output relay. Press V key for acknowledgment and going to the next setting page.

Fig 3.104 Time zone setting page

The second screen: Set time zone
Press V key for acknowledgment and going to the next setting page.

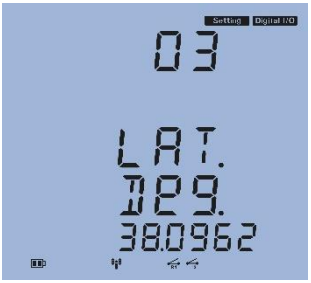


Fig 3.105 Latitude Degree

The third screen: Latitude degree of place without sign.
Press V key for acknowledgment and going to the next setting page.

Fig 3.106 Latitude Sign

The fourth screen: Latitude sign of place north or south.
Press V key for acknowledgment and going to the next setting page.

Fig 3.107 Longitude Degree

The fifth screen: Longitude degree of place without sign.
Press V key for acknowledgment and going to the next setting page.

Fig 3.108 Longitude Sign

The sixth screen: Longitude sign of place East or West.
Press V key for acknowledgment and going to the next setting page.

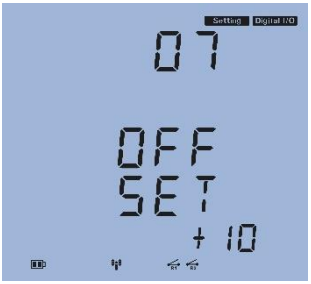


Fig 3.109 offset of astro. timer

The seventh screen: you can add offset time in minute to increment or decrement time lights on.
Press V key for acknowledgment and going to the next setting page.

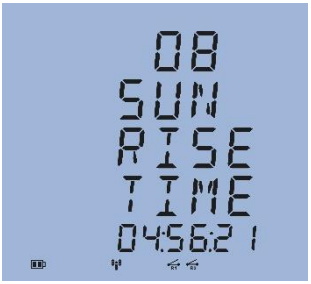


Fig 3.110 Sunrise Time

The eighth screen: After settings of above information of your place here you can see sunrise time of this place.
Press V key for acknowledgment and going to the next setting page.

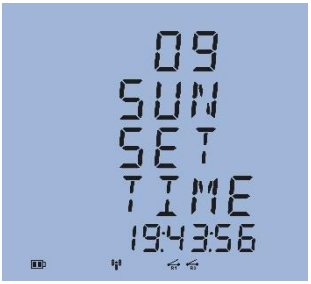


Fig 3.111 Sunset Time

The ninth screen: After settings of above information of your place here you can see sunset time of this place.
Press V key for acknowledgment and going to the next setting page.

TCP IP MENU settings Parameters

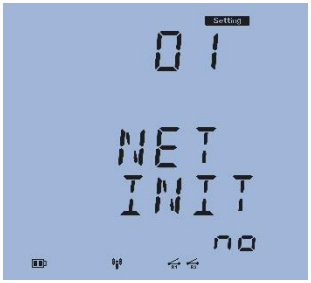


Fig 3.112 network initialize

The first screen:
If you select Yes, and press V key Wi-Fi network reset and initialized.
Press V key for acknowledgment and going to the next setting page.

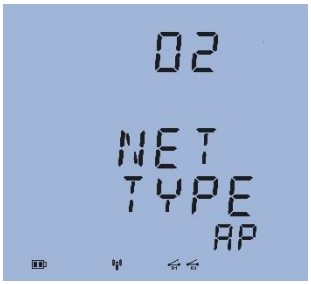


Fig 3.113 network type

The second screen:
Network is two type AP: Access Point ST: Station, in default AP was selected
Press V key for acknowledgment and going to the next setting page.

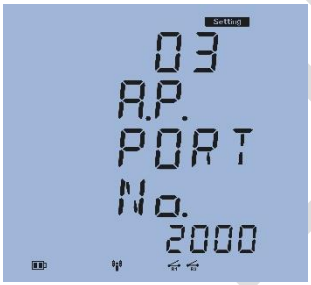
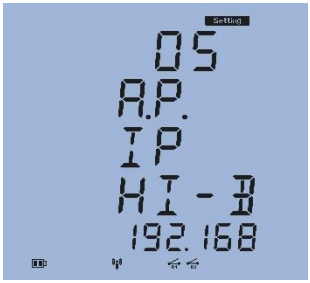


Fig 3.114 port number

The third screen:
Modbus TCP/IP port number can be selected between 1000 to 9999.
Press V key for acknowledgment and going to the next setting page.

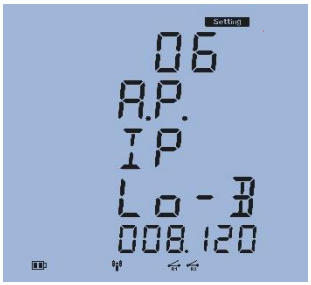
The fourth screen:
Set password for Wi-Fi access point by eight characters.
Press V key for acknowledgment and going to the next setting page.

Fig 3.115 access point password



The fifth screen:
Set two high number of unit IP, here as fig 3.116 192.168.xxx.xxx
Press V key for acknowledgment and going to the next setting page.

Fig 3.116 IP address two high no.



The sixth screen:
Set two low number of unit IP, here as fig 3.117 192.168.008.120
Press V key for acknowledgment and going to the next setting page.

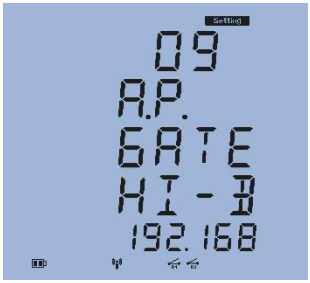
Fig 3.117 IP address two low no.

The seventh screen:
Set two high number of unit Subnet MASK, here as fig 3.118
255.255.xxx.xxx
Press V key for acknowledgment and going to the next setting page.

Fig 3.118 MASK address two high no.

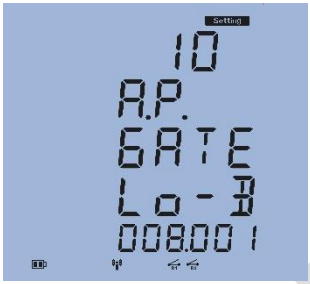
The eighth screen:
Set two high number of unit Subnet MASK, here as fig 3.119
255.255.255.000
Press V key for acknowledgment and going to the next setting page.

Fig 3.119 MASK address two low no.



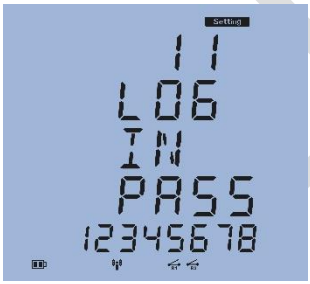
The ninth screen:
Set two high number of unit GATEWAY, here as fig 3.116
192.168.xxx.xxx
Press V key for acknowledgment and going to the next setting page.

Fig 3.120 GATEWAY address two high no.



The tenth screen:
Set two high number of unit GATEWAY, here as fig 3.116
192.168.008.001
Press V key for acknowledgment and going to the next setting page.

Fig 3.121 GATEWAY address two low no.



The eleventh screen:
Set log in password to login unit by Wi-Fi.
Press V key for acknowledgment and going to the next setting page.

Fig 3.120 LOG IN password

OUPUTS MENU settings Parameters

Fig 3.121 Relay1 output type

The first screen:
There are two modes selection for relay output, one is latching, and the other is momentary. For the latching mode, the relay can be used to output two statues on or off. For the momentary mode, the output of the relay changes from off to on.
Press V for the acknowledgment

Fig 3.122 Relay2 output type

The second screen:
There are two modes selection for relay output, one is latching, and the other is momentary.

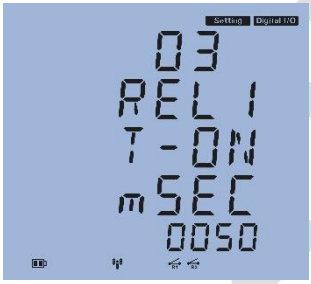


Fig 3.123 Relay1 on time in momentary

The third screen:
For the momentary mode, the output of the relay changes from off to on. for a period of time T-on and then goes off. Ton can be set from 50-3000ms.
Press V key for acknowledgment and going to the next setting page.

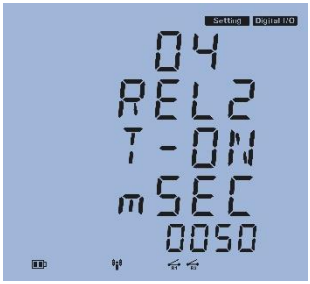
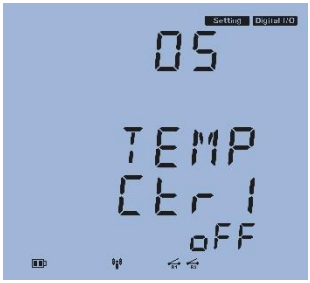


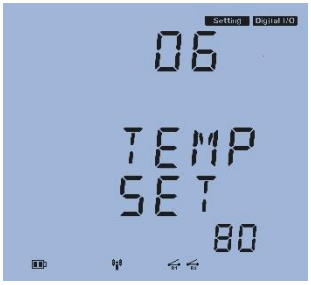
Fig 3.124 Relay2 on time in momentary

The fourth screen:
For the momentary mode, the output of the relay changes from off to on. for a period of time T-on and then goes off. Ton can be set from 50-3000ms.
Press V key for acknowledgment and going to the next setting page.



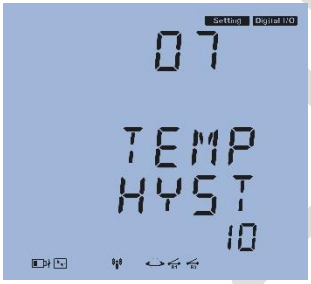
The fifth screen:
If you disable temperature controller, then you will be able to use relay2 as a general relay.
Press V key for acknowledgment and going to the next setting page.

Fig 3.125 temperature control enable/disable



The sixth screen:
Temperature controller relay set point temp. above this point the relay will be on below it goes off
Press V key for acknowledgment and going to the next setting page.

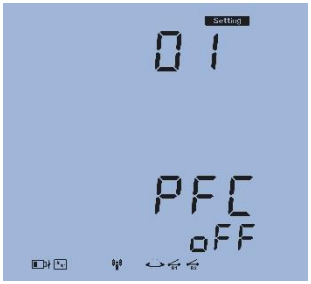
Fig 3.126 thermostat set point



The seventh screen:
To avoid unwanted connection and disconnection around set point you can define hysteresis, so above (set point + hysteresis) relays will be on and below (set point - hysteresis) relays will be off.
Press V key for acknowledgment and going to the next setting page.

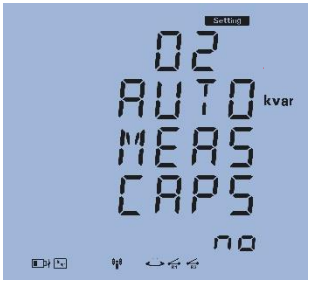
Fig 3.127 thermostat hysteresis value

PFC MENU settings Parameters



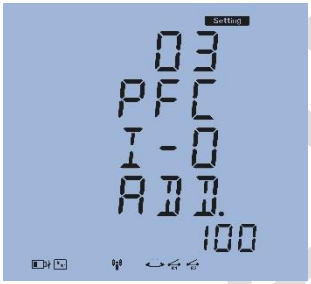
The first screen:
Enable or disable PFC module activity to correct network reactive by insert or out capacitors via PFC hardware module that connect to ZMP through RS485
Press V key for acknowledgment and going to the next setting page.

Fig 3.128 PFC module enable/disable



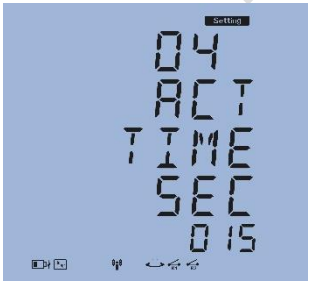
The second screen:
Select yes and press V for measurement of capacitors value automatically by insert of them into network step by step.
Press V key for acknowledgment and going to the next setting page.

Fig 3.129 start automatic measurement of capacitors



The third screen:
Slave address of PFC hardware module that connect to ZMP through RS485
Press V key for acknowledgment and going to the next setting page.

Fig 3.130 PFC module slave address



The fourth screen:
Action time of PFC is delay in seconds that after elapse of it PFC decide to insert or exit capacitors, in variable network to avoid more action, set this time to higher values.
Press V key for acknowledgment and going to the next setting page.

Fig 3.131 PFC action time

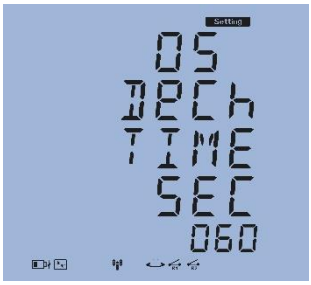


Fig 3.132 capacitors discharge time

The fifth screen:
Discharge time is period that PFC wait after exit of each capacitor to use it again.
Press V key for acknowledgment and going to the next setting page.

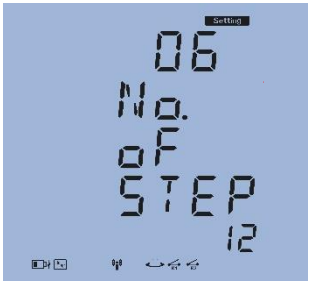


Fig 3.133 PFC step numbers

The sixth screen:
There are max. 12 outputs,
Set Number of steps that connected to PFC module.
Press V key for acknowledgment and going to the next setting page.

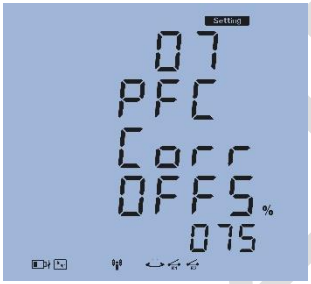


Fig 3.134 PFC correction offset

The seventh screen:
PFC correction offset, it is the sensitivity of the controller this value means that for how many kvar unit insert or exit capacitors, for example if you set this value to 80% and you need 8Kvar to correct network unit can insert 10Kvar step to compensate it.
Press V key for acknowledgment and going to the next setting page.

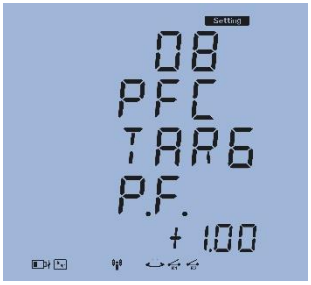


Fig 3.135 target Power Factor

The eighth screen:
The controller has to reach to target PF by switching capacitors.
Press V key for acknowledgment and going to the next setting page.

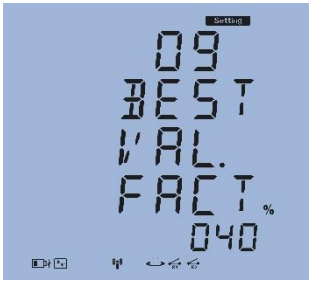


Fig 3.136 best value factor

The ninth screen:
There are four factor to adjust network reactive, and user can have weighted them to bold each strategy of correction, and can define them from 0% to 100% as their importance for correction.
If you adjust best value factor to high the unit try to select best combination closer to needed reactive.
Press V key for acknowledgment and going to the next setting page.

Fig 3.137 best contacts factor

The tenth screen:
If you adjust best contacts factor to high the unit try to select best combination that include with steps with fewer contacts count.
Press V key for acknowledgment and going to the next setting page.

Fig 3.138 best input/output factor

The eleventh screen:
If you adjust best input/output factor to high the unit try to select combination with minimum in or out capacitors to reach target PF.
Press V key for acknowledgment and going to the next setting page.

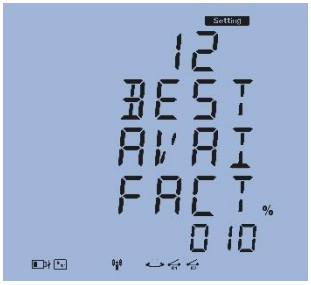
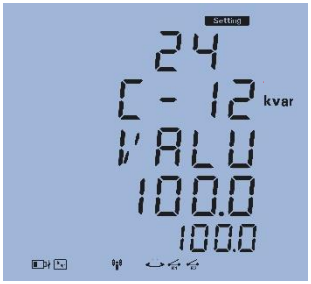


Fig 3.139 best available factor

The twelfth screen:
If you adjust best availability factor to high the unit try to select best combination with minimum wait time for unused capacitors.
Press V key for acknowledgment and going to the next setting page.

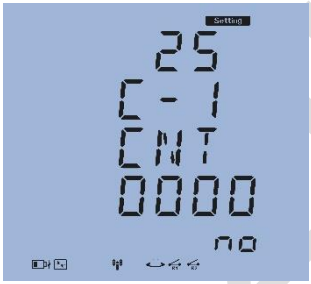
The thirteenth screen:
Size of Capacitor which connect to first step in kvar
Press V key for acknowledgment and going to the next capacitor step value and goes on to twelfth one.

Fig 3.140 capcitor1 value



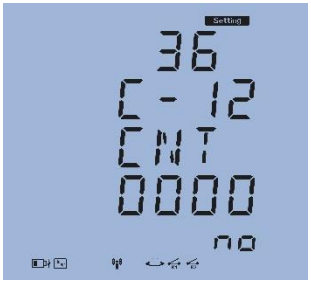
The twenty fourth screen:
Size of Capacitor which connect to twelfth step in kvar
Press V key for acknowledgment and going to the next setting page.

Fig 3.141 capacitor12 value



The twenty fifth screen:
Displays contactor1 how many time on and off by select yes and press V key you can clear this counter and go next contactor counter page.

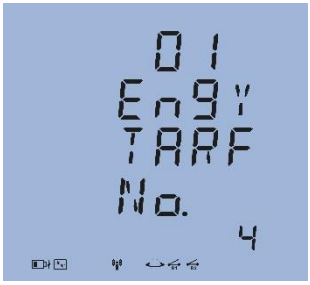
Fig 3.142 capacitor1 contacts number



The thirty sixth screen:
Displays contactor1 how many time on and off by select yes and press V key you can clear this counter.

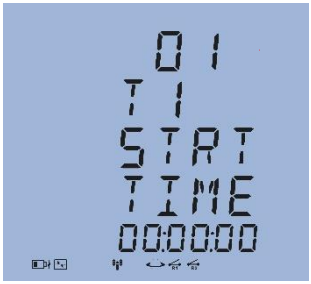
Fig 3.143 capacitor12 contacts number

ENERGY TARIFFS MENU settings Parameters



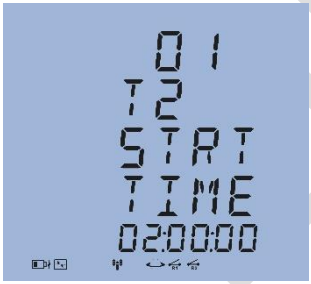
The first screen: setting number of energy tariffs
Press V key for acknowledgment and going to the next setting page.

Fig 3.144 energy tariff number



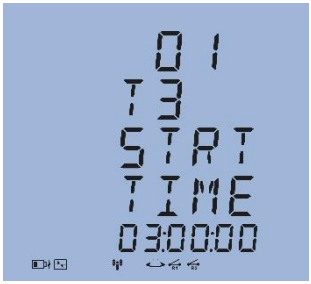
The second screen: set start time of energy tariff1
Press V key for acknowledgment and going to the next setting page.

Fig 3.145 tariff1 start time



The third screen: set start time of energy tariff2 that it is also end time of tariff1
Press V key for acknowledgment and going to the next setting page.

Fig 3.146 tariff2 start time



The fourth screen: set start time of energy tariff3 that it is also end time of tariff2
Press V key for acknowledgment and going to the next setting page.

Fig 3.147 tariff3 start time

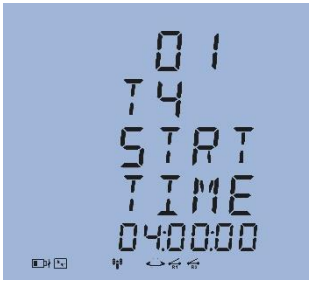


Fig 3.148 tariff4 start time

The fifth screen: set start time of energy tariff4 that it is also end time of tariff3
Press V key for acknowledgment and going to the next setting page.

Introduction of Measurement and Functions

Almost all electric parameters in power systems can be measured by ZMP series intelligent power meter. Some parameters that do not be familiar by users will be introduced in this part.

Voltage (V): True RMS value of three phase voltages, three line to line voltages and their average are measured and displayed in ZMP.

Current (I): True RMS value of three phase currents, neutral current and their average are measured and displayed in ZMP.

Power (P): Three phase power and system total power are measured and display in ZMP.

Reactive power (Q): Three phase reactive power and system total reactive power are measured and displayed in ZMP.

Apparent power (S): Three phase apparent power and system total apparent power are measured and displayed in ZMP.

Frequency (F): The frequency of V1 phase voltage input is measured as system frequency.

Energy (kWh): Energy is time integral of power. The unit is kWh. As power has direction, positive means consumption and negative means generating. So the energy has also the nature of consumption or generating.
Import (imp): Consumption energy
Export (exp): Generating energy
Total: Absolute sum of import and export energy
Net: Algebraic sum of import and export energy

Reactive Energy (kvarh): Reactive energy is time integral of reactive power. The unit is kvarh. As reactive power has direction, positive means inductive and negative means capacitive, so the reactive energy has also got the nature of inductive and capacitive.
Import (imp): Inductive reactive energy
Export (exp): Capacitive reactive energy
Total: Absolute sum of import and export reactive energy
Net: Algebraic sum of import and export reactive energy
Each of the four reactive energies is measured and stored independently.

Demand*: Demand of power, reactive power and apparent power. The demand statistics method in ZMP+ is sliding window. The sliding window time can be choosing between 1 to 30 minutes. The window slides one minute each time. For example, the sliding window time is supposed to be 3 minute. If average power of the first Minute is 12, average power of the second minute is 14 and average power of the third minute is 10, then the total demand of the 3 minutes is (12+14+10)/3=12 at the end of the three minute. If another minute passed, the average power of the minute is 8, then the total power demand of the last three minute is (14+10+8)/3=10 at the end of the fourth minute.

Three phase unbalance factor: three phase voltage unbalance factor and three phase current unbalance factor can be measured in ZMP+. The unbalance factor is express in percentage.

Voltage unbalance factor = $\frac{The\ Max\ different\ value\ of\ three\ voltages}{Average\ value\ of\ three\ voltages}$

Current unbalance factor = $\frac{The\ Max\ different\ value\ of\ three\ currents}{Average\ value\ of\ three\ currents}$

Max/Min statistics*: The maximum and minimum value of the metering data is stored in NV-RAM and can be accessed or cleared from front panel or through communication in ZMP+. These metering data are phase voltage, line to line voltage, current, power, reactive power, apparent power, power factor, frequency, demand.

Real time clock: There is a real time clock in the ZMP. The date, month, year, hour, minute and second can be read or set from front panel or through communication.

Chapter 4
Communication

Introducing Modbus Protocol

The Modbus RTU protocol is used for communication in ZMP. The data format and error check method is defined in Modbus protocol. The half-duplex query and respond mode is adopted in Modbus protocol. There is only one master device in the communication net. The others are slave devices, waiting for the query of the master.

Transmission mode

The mode of transmission defines the data structure within a frame and the rules used to transmit data. The mode is defined in the following which is compatible with Modbus RTU Mode*.

Coding System	8-bit binary
Start bit	1
Data bits	8
Parity	no parity
Stop bit	1
Error checking	CRC check

*Modbus is trademark of Modicon, Inc.

Framing

Address	**Function**	**Data**	**Check**
8-Bits	8-Bits	N x 8-Bits	16-Bits

Table4.1 Data Frame Format

Address Field

The address field of a message frame contains eight bits. Valid slave device addresses are in the range of 1~247 decimal. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

Function Field

The function code field of a message frame contains eight bits. Valid codes are in the range of 1~255 decimal. When a message is sent from a master to a slave device the function code field tells the slave what kind of action to perform.

Code	**Meaning**	**Action**
0x03	Read Holding Registers	Obtain current binary value in one or more registers
0x04	Read Input Registers	Obtain logged values from internal flash memory
0x06	Write Single Register	Place specific binary values into a register
0x10	Write Multiple registers	Place specific binary values into a series of consecutive Multiple-Registers

Table 4.2 Function Code

Data Field

The data field is constructed using sets of two hexadecimal digits, in the range of 0x00 to 0xFF hexadecimal. The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field. For example, if the master requests a slave to read a group of holding registers (function code 03), the data field specifies the starting register and how many registers are to be read. If the master writes to a group of registers in the slave (function code 0x10 hexadecimal), the data field specifies the starting register, how many registers to write, the count of data bytes to follow in the data field, and the data to be written into the registers.
If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken. The data field can be nonexistent (of zero length) in certain kinds of messages.

Error Check Field

Messages include an error's checking field that is based on a Cyclical Redundancy Check (CRC) method. The CRC field checks the contents of the entire message. It is applied regardless of any parity check method used for the individual characters of the message. The CRC field is two bytes, containing a 16bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message.
The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field If the two values are not equal, an error results. The CRC is started by first preloading a 16-bit register to all 1's. Then a process begins of applying successive 8-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC. During generation of the CRC, each 8-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined.
If the LSB was a1, the register is then exclusive ORed with a reset, fixed value.
If the LSB was a0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8-bit byte is exclusive ORed with the register current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value. When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

Format of the communication

Explanation of frame

Slave address	Function	Starting Address Hi	Starting Address Lo	No. of Registers Hi	No. of Registers Lo	CRC Lo	CRC Hi
0x01	0x03	0x00	0x01	0x00	0x21	0xD4	0x12

Table 4.3 Explanation of frame

In table 4.3, the meaning of each abbreviated word is:
Slave Address: Address of slave device
Function: Function code
Starting Address Hi: start register address high byte

Starting Address Lo: start register address low byte
No. of Registers Hi: number of register high byte
No. of Registers Lo: number of register low byte
CRC16 hi: CRC high byte
CRC16 lo: CRC low byte

3 Read Holding Registers (Function Code 0x03)

Query

This function allows the master to obtain the measurement results of ZMP.
Table 4.4 is an example to read the 3 measured data (Va, Vb and Vc) from slave device number 1, the data address of V1 is 0x01H, V2 is 0x02H and V3 is 0x03H.

Slave address	Function	Starting Address Hi	Starting Address Lo	No. of Registers Hi	No. of Registers Lo	CRC Lo	CRC Hi
0x01	0x03	0x00	0x01	0x00	0x03	0x54	0x0B

Table 4.4 Read V1, V2, V3 Query Message

Response

The ZMP response includes the ZMP address, function code, quantity of data byte, data, and error checking. An example response to read V1, V2 and V3 is: V1=0x07CBH (199.5V), V2=0x07CAH (199.4V), V3=0x07CAH (199.4V) is shown as Table4.5.

Slave address	Function	Byte Count	Register value Hi	Register value Lo	Register value Hi	Register value Lo	Register value Hi	Register value Lo	CRC Lo	CRC Hi
0x01	0x03	0x06	0x07	0xCB	0x07	0xCA	0x07	0xCA	0x54	0x0B

Table4.5 Read V1, V2 and V3 Message

4 Read Input Registers (Function Code 0x04)

Query

This function allows the master to obtain the logged values from internal flash.
Master by every request query can read one page that includes four recorded values. Table 4.6 is an example to read second page from slave device number 1.

Slave address	Function	Page Address Hi	Page Address Lo	Quantity of Input Reg. Hi	Quantity of Input Reg. Lo	CRC Lo	CRC Hi
0x01	0x04	0x00	0x02	0x00	0x6E	0xD0	0x26

Table 4.6 Read second page of internal flash

Response

The ZMP response includes the ZMP address, function code, quantity of data byte, data, and error checking.

Slave address	Function	Byte Count	Byte 1	Byte 2	.....	Byte 220	CRC Lo	CRC Hi
0x01	0x04	0xDC	0x--	0x--		0x--	0x--	0x--

Table 4.7 Transfer 220 byte of page2 of internal flash

6 Write Single Register (Function Code 0x06)

Query

Function 0x06 allows the user to modify the contents of one Register. Any Register that exists within the ZMP writable memory can have its contents changed by this message.

The example below is a request to a ZMP number 1 to Preset CT primary to 1250, while its Hex Value 0x04E2H. CT_P data address is 0x0130H.

Slave address	Function	Register Address Hi	Register Address Lo	Registers Value Hi	Registers Value Lo	CRC Lo	CRC Hi
0x01	0x06	0x01	0x30	0x04	0xE2	0x0A	0xB0

Table 4.8 Preset CT_P

Response

The normal response is an echo of the request, returned after the register contents have been written.

Slave address	Function	Register Address Hi	Register Address Lo	Registers Value Hi	Registers Value Lo	CRC Lo	CRC Hi
0x01	0x06	0x01	0x30	0x04	0xE2	0x0A	0xB0

Table 4.9 writes single register Response Message

16 Write Multiple Registers (Function Code 0x10)

Query

Function 0x10 allows the user to modify the contents of Multi-Register. Any Register that exists within the ZMP writable memory can have its contents changed by this message.

The example below is a request to a ZMP number 1 to Preset CT primary to 1250, while its Hex Value 0x04E2H and CT secondary to 5 with one query. CT_P data address is 0x0130H and CT_S is 0x0131H.

Slave address	Function	Starting Address Hi	Starting Address Lo	Quantity of Registers Hi	Quantity of Registers Lo	Byte Count	Registers Value Hi	Registers Value Lo	Registers Value Hi	Registers Value Lo	CRC Lo	CRC Hi
0x01	0x10	0x01	0x30	0x00	0x02	0x04	0x04	0xE2	0x00	0x05	0x0A	0x92

Table 4.10 Preset CT_P and CT_S

Response

The normal response returns the function code, starting address, and quantity of registers written.

Slave address	Function	Starting Address Hi	Starting Address Lo	Quantity of Registers Hi	Quantity of Registers Lo	CRC Lo	CRC Hi
0x01	0x10	0x01	0x30	0x00	0x02	0x40	0x3B

Table 4.11 writes multiple registers Response Message

Address table of ZMP

Basic Analog measurements

Address	Parameter	Range	Object Type	Type of access
Basic Analog Measurements (0x1000 to 0x1100)				
0x1000	Frequency (F)	4500~6500	word	R
0x1001	Phase Voltage V1	0~65535	word	R
0x1002	Phase Voltage V2	0~65535	word	R
0x1003	Phase Voltage V3	0~65535	word	R
0x1004	Average Phase Voltage Vlnavg	0~65535	word	R
0x1005	Line Voltage V12	0~65535	word	R
0x1006	Line Voltage V23	0~65535	word	R
0x1007	Line Voltage V31	0~65535	word	R
0x1008	Average Line Voltage Vllavg	0~65535	word	R
0x1009	Current I1	0~65535	word	R
0x100A	Current I2	0~65535	word	R
0x100B	Current I3	0~65535	word	R
0x100C	Average Current Iavg	0~65535	word	R
0x100D	Neutral Line Current In (calculated)	0~65535	word	R
0x100E	Neutral Line Current In (Measured)	0~65535	word	R
0x100F	Phase Power P1	-32768~32767	word	R
0x1010	Phase Power P2	-32768~32767	word	R
0x1011	Phase Power P3	-32768~32767	word	R
0x1012	System Power Ptot	-32768~32767	word	R
0x1013	Phase Reactive Power Q1	-32768~32767	word	R
0x1014	Phase Reactive Power Q2	-32768~32767	word	R
0x1015	Phase Reactive Power Q3	-32768~32767	word	R
0x1016	System Reactive Power Qtot	-32768~32767	word	R
0x1017	Phase Apparent Power S1	0~65535	word	R
0x1018	Phase Apparent Power S2	0~65535	word	R
0x1019	Phase Apparent Power S3	0~65535	word	R
0x101A	System Apparent Power Stot	0~65535	word	R
0x101B	Phase Power Factor PF1	-1000~1000	word	R
0x101C	Phase Power Factor PF2	-1000~1000	word	R
0x101D	Phase Power Factor PF3	-1000~1000	word	R
0x101E	System Power Factor PFtot	-1000~1000	word	R
0x101F	Voltage Unbalance Factor U_unbl	0~3000	word	R
0x1020	Current Unbalance Factor I_unbl	0~3000	word	R
0x1021	Power Demand Dmd_Ptot	76/67/82	word	R
0x1022	Reactive power Demand Dmd_Qtot	-32768~32767	word	R
0x1023	Apparent Power Demand Dmd_Stot	-32768~32767	word	R
0x1024	Load Type RT (L/C/R)	0~65535	word	R
0x1025	Import Energy Tariff1 Ep1_imp (hi word)	0~999999999	Double word	R
0x1026	Import Energy Tariff1 Ep1_imp (lo word)			
0x1027	Export Energy Tariff1 Ep1_exp (hi word)	0~999999999	Double word	R
0x1028	Export Energy Tariff1 Ep1_exp (lo word)			
0x1029	Import Reactive Energy Tariff1 Eq1_imp (hi word)	0~999999999	Double word	R
0x102A	Import Reactive Energy Tariff1 Eq1_imp (lo word)			
0x102B	Export Reactive Energy Tariff1 Eq1_exp (hi word)	0~999999999	Double word	R
0x102C	Export Reactive Energy Tariff1 Eq1_exp (lo word)			
0x102D	Import Energy Tariff2 Ep2_imp (hi word)	0~999999999	Double word	R
0x102E	Import Energy Tariff2 Ep2_imp (lo word)			
0x102F	Export Energy Tariff2 Ep2_exp (hi word)	0~999999999	Double word	R
0x1030	Export Energy Tariff3 Ep2_exp (lo word)			
0x1031	Import Reactive Energy Tariff2 Eq2_imp (hi word)	0~999999999	Double word	R
0x1032	Import Reactive Energy Tariff2 Eq2_imp (lo word)			

0x1033	Export Reactive Energy Tariff2 Eq2_exp (hi word)		0~999999999	Double word	R
0x1034	Export Reactive Energy Tariff2 Eq2_exp (lo word)				
0x1035	Import Energy Tariff3 Ep3_imp (hi word)		0~999999999	Double word	R
0x1036	Import Energy Tariff3 Ep3_imp (lo word)				
0x1037	Export Energy Tariff3 Ep3_exp (hi word)		0~999999999	Double word	R
0x1038	Export Energy Tariff3 Ep3_exp (lo word)				
0x1039	Import Reactive Energy Tariff3 Eq3_imp (hi word)		0~999999999	Double word	R
0x103A	Import Reactive Energy Tariff3 Eq3_imp (lo word)				
0x103B	Export Reactive Energy Tariff3 Eq3_exp (hi word)		0~999999999	Double word	R
0x103C	Export Reactive Energy Tariff3 Eq3_exp (lo word)				
0x103D	Import Energy Tariff4 Ep4_imp (hi word)		0~999999999	Double word	R
0x103E	Import Energy Tariff4 Ep4_imp (lo word)				
0x103F	Export Energy Tariff4 Ep4_exp (hi word)		0~999999999	Double word	R
0x1040	Export Energy Tariff4 Ep4_exp (lo word)				
0x1041	Import Reactive Energy Tariff4 Eq4_imp (hi word)		0~999999999	Double word	R
0x1042	Import Reactive Energy Tariff4 Eq4_imp (lo word)				
0x1043	Export Reactive Energy Tariff4 Eq4_exp (hi word)		0~999999999	Double word	R
0x1044	Export Reactive Energy Tariff4 Eq4_exp (lo word)				
Maximum Records 0x1100 to 0x1200					
0x1100	V1_max		0~65535	word	R
0x1101	Time Stamp of Va_max	year	2014~2034 or 1392~1412	word	R
0x1102		month	1~12	word	R
0x1103		day	1~31	word	R
0x1104		hour	0~23	word	R
0x1105		minute	0~59	word	R
0x1106		second	0~59	word	R
0x1107	V2_max		0~65535	word	R
0x1108	Time Stamp of Vb_max	year	2014~2034 or 1392~1412	word	R
0x1109		month	1~12	word	R
0x110A		day	1~31	word	R
0x110B		hour	0~23	word	R
0x110C		minute	0~59	word	R
0x110D		second	0~59	word	R
0x110E	V3_max		0~65535	word	R
0x110F	Time Stamp of Vc_max	year	2014~2034 or 1392~1412	word	R
0x1110		month	1~12	word	R
0x1111		day	1~31	word	R
0x1112		hour	0~23	word	R
0x1113		minute	0~59	word	R
0x1114		second	0~59	word	R
0x1115	V12_max		0~65535	word	R
0x1116	Time Stamp of Vab_max	year	2014~2034 or 1392~1412	word	R
0x1117		month	1~12	word	R
0x1118		day	1~31	word	R
0x1119		hour	0~23	word	R
0x111A		minute	0~59	word	R
0x111B		second	0~59	word	R
0x111C	V23_max		0~65535	word	R
0x111D	Time Stamp of Vbc_max	year	2014~2034 or 1392~1412	word	R
0x111E		month	1~12	word	R
0x111F		day	1~31	word	R
0x1120		hour	0~23	word	R
0x1121		minute	0~59	word	R
0x1122		second	0~59	word	R
0x1123	V31_max		0~65535	word	R
0x1124	Time Stamp of Vca_max	year	2014~2034 or 1392~1412	word	R
0x1125		month	1~12	word	R

0x1126		day	1~31	word	R
0x1127		hour	0~23	word	R
0x1128		minute	0~59	word	R
0x1129		second	0~59	word	R
0x112A	I1_max		0~65535	word	R
0x112B		year	2014~2034 or 1392~1412	word	R
0x112C		month	1~12	word	R
0x112D	Time Stamp of Ia_max	day	1~31	word	R
0x112E		hour	0~23	word	R
0x112F		minute	0~59	word	R
0x1130		second	0~59	word	R
0x1131	I2_max		0~65535	word	R
0x1132		year	2014~2034 or 1392~1412	word	R
0x1133		month	1~12	word	R
0x1134	Time Stamp of Ib_max	day	1~31	word	R
0x1135		hour	0~23	word	R
0x1136		minute	0~59	word	R
0x1137		second	0~59	word	R
0x1138	I3_max		0~65535	word	R
0x1139		year	2014~2034 or 1392~1412	word	R
0x113A		month	1~12	word	R
0x113B	Time Stamp of Ic_max	day	1~31	word	R
0x113C		hour	0~23	word	R
0x113D		minute	0~59	word	R
0x113E		second	0~59	word	R
0x113F	IN0_max		0~65535	word	R
0x1140		year	2014~2034 or 1392~1412	word	R
0x1141		month	1~12	word	R
0x1142	Time Stamp of Ib_max	day	1~31	word	R
0x1143		hour	0~23	word	R
0x1144		minute	0~59	word	R
0x1145		second	0~59	word	R
0x1146	IN1_max		0~65535	word	R
0x1147		year	2014~2034 or 1392~1412	word	R
0x1148		month	1~12	word	R
0x1149	Time Stamp of Ic_max	day	1~31	word	R
0x114A		hour	0~23	word	R
0x114B		minute	0~59	word	R
0x114C		second	0~59	word	R
0x114D	Ptot_max		-32768~32767	word	R
0x114E		year	2014~2034 or 1392~1412	word	R
0x114F		month	1~12	word	R
0x1150	Time Stamp of Ptot_max	day	1~31	word	R
0x1151		hour	0~23	word	R
0x1152		minute	0~59	word	R
0x1153		second	0~59	word	R
0x1154	Qtot_max		-32768~32767	word	R
0x1155		year	2014~2034 or 1392~1412	word	R
0x1156		month	1~12	word	R
0x1157	Time Stamp of Qtot_max	day	1~31	word	R
0x1158		hour	0~23	word	R
0x1159		minute	0~59	word	R
0x115A		second	0~59	word	R
0x115B	Stot_max		0~65535	word	R
0x115C		year	2014~2034 or 1392~1412	word	R
0x115D	Time Stamp of Stot_max	month	1~12	word	R
0x115E		day	1~31	word	R

0x115F		hour	0~23	word	R
0x1160		minute	0~59	word	R
0x1161		second	0~59	word	R
0x1162	Dmd_Ptot_max		-32768~32767	word	R
0x1163	Time Stamp of Dmd_Ptot_max	year	2014~2034 or 1392~1412	word	R
0x1164		month	1~12	word	R
0x1165		day	1~31	word	R
0x1166		hour	0~23	word	R
0x1167		minute	0~59	word	R
0x1168		second	0~59	word	R
0x1169	Dmd_Qtot_max		-32768~32767	word	R
0x116A	Time Stamp of Dmd_Qtot_max	year	2014~2034 or 1392~1412	word	R
0x116B		month	1~12	word	R
0x116C		day	1~31	word	R
0x116D		hour	0~23	word	R
0x116E		minute	0~59	word	R
0x116F		second	0~59	word	R
0x1170	Dmd_Stot_max		0~65535	word	R
0x1171	Time Stamp of Dmd_Stot_max	year	2014~2034 or 1392~1412	word	R
0x1172		month	1~12	word	R
0x1173		day	1~31	word	R
0x1174		hour	0~23	word	R
0x1175		minute	0~59	word	R
0x1176		second	0~59	word	R
0x1177	PFtot_max		-1000~1000	word	R
0x1178	Time Stamp of PFtot_max	year	2014~2034 or 1392~1412	word	R
0x1179		month	1~12	word	R
0x117A		day	1~31	word	R
0x117B		hour	0~23	word	R
0x117C		minute	0~59	word	R
0x117D		second	0~59	word	R
0x117E	Fr_max		4500~6500	word	R
0x117F	Time Stamp of Fr_max	year	2000~2099	word	R
0x1180		month	1~12	word	R
0x1181		day	1~31	word	R
0x1182		hour	0~23	word	R
0x1183		minute	0~59	word	R
0x1184		second	0~59	word	R
Minimum Records (0x1200 to 0x1300)					
0x1200	V1_min		0~65535	word	R
0x1201	Time Stamp of Va_min	year	2014~2034 or 1392~1412	word	R
0x1202		month	1~12	word	R
0x1203		day	1~31	word	R
0x1204		hour	0~23	word	R
0x1205		minute	0~59	word	R
0x1206		second	0~59	word	R
0x1207	V2_min		0~65535	word	R
0x1208	Time Stamp of Vb_min	year	2014~2034 or 1392~1412	word	R
0x1209		month	1~12	word	R
0x120A		day	1~31	word	R
0x120B		hour	0~23	word	R
0x120C		minute	0~59	word	R
0x120D		second	0~59	word	R
0x120E	V3_min		0~65535	word	R
0x120F	Time Stamp of Vc_min	year	2014~2034 or 1392~1412	word	R
0x1210		month	1~12	word	R
0x1211		day	1~31	word	R

0x1212		hour	0~23	word	R
0x1213		minute	0~59	word	R
0x1214		second	0~59	word	R
0x1215	V12_min		0~65535	word	R
0x1216	Time Stamp of Vab_min	year	2014~2034 or 1392~1412	word	R
0x1217		month	1~12	word	R
0x1218		day	1~31	word	R
0x1219		hour	0~23	word	R
0x121A		minute	0~59	word	R
0x121B		second	0~59	word	R
0x121C	V23_min		0~65535	word	R
0x121D	Time Stamp of Vbc_min	year	2014~2034 or 1392~1412	word	R
0x121E		month	1~12	word	R
0x121F		day	1~31	word	R
0x1220		hour	0~23	word	R
0x1221		minute	0~59	word	R
0x1222		second	0~59	word	R
0x1223	V31_min		0~65535	word	R
0x1224	Time Stamp of Vca_min	year	2014~2034 or 1392~1412	word	R
0x1225		month	1~12	word	R
0x1226		day	1~31	word	R
0x1227		hour	0~23	word	R
0x1228		minute	0~59	word	R
0x1229		second	0~59	word	R
0x122A	I1_min		0~65535	word	R
0x122B	Time Stamp of Ia_min	year	2014~2034 or 1392~1412	word	R
0x122C		month	1~12	word	R
0x122D		day	1~31	word	R
0x122E		hour	0~23	word	R
0x122F		minute	0~59	word	R
0x1230		second	0~59	word	R
0x1231	I2_min		0~65535	word	R
0x1232	Time Stamp of Ib_min	year	2014~2034 or 1392~1412	word	R
0x1233		month	1~12	word	R
0x1234		day	1~31	word	R
0x1235		hour	0~23	word	R
0x1236		minute	0~59	word	R
0x1237		second	0~59	word	R
0x1238	I3_min		0~65535	word	R
0x1239	Time Stamp of Ic_min	year	2014~2034 or 1392~1412	word	R
0x123A		month	1~12	word	R
0x123B		day	1~31	word	R
0x123C		hour	0~23	word	R
0x123D		minute	0~59	word	R
0x123E		second	0~59	word	R
0x123F	IN0_min		0~65535	word	R
0x1240	Time Stamp of Ib_min	year	2014~2034 or 1392~1412	word	R
0x1241		month	1~12	word	R
0x1242		day	1~31	word	R
0x1243		hour	0~23	word	R
0x1244		minute	0~59	word	R
0x1245		second	0~59	word	R
0x1246	IN1_min		0~65535	word	R
0x1247	Time Stamp of Ic_min	year	2014~2034 or 1392~1412	word	R
0x1248		month	1~12	word	R
0x1249		day	1~31	word	R
0x124A		hour	0~23	word	R

0x124B		minute	0~59	word	R
0x124C		second	0~59	word	R
0x124D	Ptot_min		-32768~32767	word	R
0x124E	Time Stamp of Ptot_min	year	2014~2034 or 1392~1412	word	R
0x124F		month	1~12	word	R
0x1250		day	1~31	word	R
0x1251		hour	0~23	word	R
0x1252		minute	0~59	word	R
0x1253		second	0~59	word	R
0x1254	Qtot_min		-32768~32767	word	R
0x1255	Time Stamp of Qtot_min	year	2014~2034 or 1392~1412	word	R
0x1256		month	1~12	word	R
0x1257		day	1~31	word	R
0x1258		hour	0~23	word	R
0x1259		minute	0~59	word	R
0x125A		second	0~59	word	R
0x125B	Stot_min		0~65535	word	R
0x125C	Time Stamp of Stot_min	year	2014~2034 or 1392~1412	word	R
0x125D		month	1~12	word	R
0x125E		day	1~31	word	R
0x125F		hour	0~23	word	R
0x1260		minute	0~59	word	R
0x1261		second	0~59	word	R
0x1262	Dmd_Ptot_min		-32768~32767	word	R
0x1263	Time Stamp of Dmd_Ptot_min	year	2014~2034 or 1392~1412	word	R
0x1264		month	1~12	word	R
0x1265		day	1~31	word	R
0x1266		hour	0~23	word	R
0x1267		minute	0~59	word	R
0x1268		second	0~59	word	R
0x1269	Dmd_Qtot_min		-32768~32767	word	R
0x126A	Time Stamp of Dmd_Qtot_min	year	2014~2034 or 1392~1412	word	R
0x126B		month	1~12	word	R
0x126C		day	1~31	word	R
0x126D		hour	0~23	word	R
0x126E		minute	0~59	word	R
0x126F		second	0~59	word	R
0x1270	Dmd_Stot_min		0~65535	word	R
0x1271	Time Stamp of Dmd_Stot_min	year	2014~2034 or 1392~1412	word	R
0x1272		month	1~12	word	R
0x1273		day	1~31	word	R
0x1274		hour	0~23	word	R
0x1275		minute	0~59	word	R
0x1276		second	0~59	word	R
0x1277	PFtot_min		-1000~1000	word	R
0x1278	Time Stamp of PFtot_min	year	2014~2034 or 1392~1412	word	R
0x1279		month	1~12	word	R
0x127A		day	1~31	word	R
0x127B		hour	0~23	word	R
0x127C		minute	0~59	word	R
0x127D		second	0~59	word	R
0x127E	Fr_min		4500~6500	word	R
0x127F	Time Stamp of Fr_min	year	2000~2099	word	R
0x1280		month	1~12	word	R
0x1281		day	1~31	word	R
0x1282		hour	0~23	word	R
0x1283		minute	0~59	word	R

0x1284		second	0~59	word	R
I1 Harmonics (0x1300 to 0x1400)					
0x1300	Current I1 - Harmonic - 2		0~16384	word	R
0x1301	Current I1 - Harmonic - 3		0~16384	word	R
0x1302	Current I1 - Harmonic - 4		0~16384	word	R
0x1303	Current I1 - Harmonic - 5		0~16384	word	R
0x1304	Current I1 - Harmonic - 6		0~16384	word	R
0x1305	Current I1 - Harmonic - 7		0~16384	word	R
0x1306	Current I1 - Harmonic - 8		0~16384	word	R
0x1307	Current I1 - Harmonic - 9		0~16384	word	R
0x1308	Current I1 - Harmonic - 10		0~16384	word	R
0x1309	Current I1 - Harmonic - 11		0~16384	word	R
0x130A	Current I1 - Harmonic - 12		0~16384	word	R
0x130B	Current I1 - Harmonic - 13		0~16384	word	R
0x130C	Current I1 - Harmonic - 14		0~16384	word	R
0x130D	Current I1 - Harmonic - 15		0~16384	word	R
0x130E	Current I1 - Harmonic - 16		0~16384	word	R
0x130F	Current I1 - Harmonic - 17		0~16384	word	R
0x1310	Current I1 - Harmonic - 18		0~16384	word	R
0x1311	Current I1 - Harmonic - 19		0~16384	word	R
0x1312	Current I1 - Harmonic - 20		0~16384	word	R
0x1313	Current I1 - Harmonic - 21		0~16384	word	R
0x1314	Current I1 - Harmonic - 22		0~16384	word	R
0x1315	Current I1 - Harmonic - 23		0~16384	word	R
0x1316	Current I1 - Harmonic - 24		0~16384	word	R
0x1317	Current I1 - Harmonic - 25		0~16384	word	R
0x1318	Current I1 - Harmonic - 26		0~16384	word	R
0x1319	Current I1 - Harmonic - 27		0~16384	word	R
0x131A	Current I1 - Harmonic - 28		0~16384	word	R
0x131B	Current I1 - Harmonic - 29		0~16384	word	R
0x131C	Current I1 - Harmonic - 30		0~16384	word	R
0x131D	Current I1 - Harmonic - 31		0~16384	word	R
0x131E	Current I1 - Harmonic - 32		0~16384	word	R
0x131F	Current I1 - Harmonic - THD		0~16384	word	R
I2 Harmonics(0x1400 to 0x1500)					
0x1400	Current I2 - Harmonic - 2		0~16384	word	R
0x1401	Current I2 - Harmonic - 3		0~16384	word	R
0x1402	Current I2 - Harmonic - 4		0~16384	word	R
0x1403	Current I2 - Harmonic - 5		0~16384	word	R
0x1404	Current I2 - Harmonic - 6		0~16384	word	R
0x1405	Current I2 - Harmonic - 7		0~16384	word	R
0x1406	Current I2 - Harmonic - 8		0~16384	word	R
0x1407	Current I2 - Harmonic - 9		0~16384	word	R
0x1408	Current I2 - Harmonic - 10		0~16384	word	R
0x1409	Current I2 - Harmonic - 11		0~16384	word	R
0x140A	Current I2 - Harmonic - 12		0~16384	word	R
0x140B	Current I2 - Harmonic - 13		0~16384	word	R
0x140C	Current I2 - Harmonic - 14		0~16384	word	R
0x140D	Current I2 - Harmonic - 15		0~16384	word	R
0x140E	Current I2 - Harmonic - 16		0~16384	word	R
0x140F	Current I2 - Harmonic - 17		0~16384	word	R
0x1410	Current I2 - Harmonic - 18		0~16384	word	R
0x1411	Current I2 - Harmonic - 19		0~16384	word	R
0x1412	Current I2 - Harmonic - 20		0~16384	word	R
0x1413	Current I2 - Harmonic - 21		0~16384	word	R
0x1414	Current I2 - Harmonic - 22		0~16384	word	R
0x1415	Current I2 - Harmonic - 23		0~16384	word	R

0x1416	Current I2 - Harmonic - 24	0~16384	word	R
0x1417	Current I2 - Harmonic - 25	0~16384	word	R
0x1418	Current I2 - Harmonic - 26	0~16384	word	R
0x1419	Current I2 - Harmonic - 27	0~16384	word	R
0x141A	Current I2 - Harmonic - 28	0~16384	word	R
0x141B	Current I2 - Harmonic - 29	0~16384	word	R
0x141C	Current I2 - Harmonic - 30	0~16384	word	R
0x141D	Current I2 - Harmonic - 31	0~16384	word	R
0x141E	Current I2 - Harmonic - 32	0~16384	word	R
0x141F	Current I2 - Harmonic - THD	0~16384	word	R
I3 Harmonics(0x1500 to 0x1600)				
0x1500	Current I3 - Harmonic - 2	0~16384	word	R
0x1501	Current I3 - Harmonic - 3	0~16384	word	R
0x1502	Current I3 - Harmonic - 4	0~16384	word	R
0x1503	Current I3 - Harmonic - 5	0~16384	word	R
0x1504	Current I3 - Harmonic - 6	0~16384	word	R
0x1505	Current I3 - Harmonic - 7	0~16384	word	R
0x1506	Current I3 - Harmonic - 8	0~16384	word	R
0x1507	Current I3 - Harmonic - 9	0~16384	word	R
0x1508	Current I3 - Harmonic - 10	0~16384	word	R
0x1509	Current I3 - Harmonic - 11	0~16384	word	R
0x150A	Current I3 - Harmonic - 12	0~16384	word	R
0x150B	Current I3 - Harmonic - 13	0~16384	word	R
0x150C	Current I3 - Harmonic - 14	0~16384	word	R
0x150D	Current I3 - Harmonic - 15	0~16384	word	R
0x150E	Current I3 - Harmonic - 16	0~16384	word	R
0x150F	Current I3 - Harmonic - 17	0~16384	word	R
0x1510	Current I3 - Harmonic - 18	0~16384	word	R
0x1511	Current I3 - Harmonic - 19	0~16384	word	R
0x1512	Current I3 - Harmonic - 20	0~16384	word	R
0x1513	Current I3 - Harmonic - 21	0~16384	word	R
0x1514	Current I3 - Harmonic - 22	0~16384	word	R
0x1515	Current I3 - Harmonic - 23	0~16384	word	R
0x1516	Current I3 - Harmonic - 24	0~16384	word	R
0x1517	Current I3 - Harmonic - 25	0~16384	word	R
0x1518	Current I3 - Harmonic - 26	0~16384	word	R
0x1519	Current I3 - Harmonic - 27	0~16384	word	R
0x151A	Current I3 - Harmonic - 28	0~16384	word	R
0x151B	Current I3 - Harmonic - 29	0~16384	word	R
0x151C	Current I3 - Harmonic - 30	0~16384	word	R
0x151D	Current I3 - Harmonic - 31	0~16384	word	R
0x151E	Current I3 - Harmonic - 32	0~16384	word	R
0x151F	Current I3 - Harmonic - THD	0~16384	word	R
V1 Harmonics(0x1600 to 0x1700)				
0x1600	Voltage V1 - Harmonic - 2	0~16384	word	R
0x1601	Voltage V1 - Harmonic - 3	0~16384	word	R
0x1602	Voltage V1 - Harmonic - 4	0~16384	word	R
0x1603	Voltage V1 - Harmonic - 5	0~16384	word	R
0x1604	Voltage V1 - Harmonic - 6	0~16384	word	R
0x1605	Voltage V1 - Harmonic - 7	0~16384	word	R
0x1606	Voltage V1 - Harmonic - 8	0~16384	word	R
0x1607	Voltage V1 - Harmonic - 9	0~16384	word	R
0x1608	Voltage V1 - Harmonic - 10	0~16384	word	R
0x1609	Voltage V1 - Harmonic - 11	0~16384	word	R
0x160A	Voltage V1 - Harmonic - 12	0~16384	word	R
0x160B	Voltage V1 - Harmonic - 13	0~16384	word	R
0x160C	Voltage V1 - Harmonic - 14	0~16384	word	R

0x160D	Voltage V1 - Harmonic - 15	0~16384	word	R
0x160E	Voltage V1 - Harmonic - 16	0~16384	word	R
0x160F	Voltage V1 - Harmonic - 17	0~16384	word	R
0x1610	Voltage V1 - Harmonic - 18	0~16384	word	R
0x1611	Voltage V1 - Harmonic - 19	0~16384	word	R
0x1612	Voltage V1 - Harmonic - 20	0~16384	word	R
0x1613	Voltage V1 - Harmonic - 21	0~16384	word	R
0x1614	Voltage V1 - Harmonic - 22	0~16384	word	R
0x1615	Voltage V1 - Harmonic - 23	0~16384	word	R
0x1616	Voltage V1 - Harmonic - 24	0~16384	word	R
0x1617	Voltage V1 - Harmonic - 25	0~16384	word	R
0x1618	Voltage V1 - Harmonic - 26	0~16384	word	R
0x1619	Voltage V1 - Harmonic - 27	0~16384	word	R
0x161A	Voltage V1 - Harmonic - 28	0~16384	word	R
0x161B	Voltage V1 - Harmonic - 29	0~16384	word	R
0x161C	Voltage V1 - Harmonic - 30	0~16384	word	R
0x161D	Voltage V1 - Harmonic - 31	0~16384	word	R
0x161E	Voltage V1 - Harmonic - 32	0~16384	word	R
0x161F	Voltage V1 - Harmonic - THD	0~16384	word	R
V2 Harmonics (0x1700 to 0x1800)				
0x1700	Voltage V2 - Harmonic - 2	0~16384	word	R
0x1701	Voltage V2 - Harmonic - 3	0~16384	word	R
0x1702	Voltage V2 - Harmonic - 4	0~16384	word	R
0x1703	Voltage V2 - Harmonic - 5	0~16384	word	R
0x1704	Voltage V2 - Harmonic - 6	0~16384	word	R
0x1705	Voltage V2 - Harmonic - 7	0~16384	word	R
0x1706	Voltage V2 - Harmonic - 8	0~16384	word	R
0x1707	Voltage V2 - Harmonic - 9	0~16384	word	R
0x1708	Voltage V2 - Harmonic - 10	0~16384	word	R
0x1709	Voltage V2 - Harmonic - 11	0~16384	word	R
0x170A	Voltage V2 - Harmonic - 12	0~16384	word	R
0x170B	Voltage V2 - Harmonic - 13	0~16384	word	R
0x170C	Voltage V2 - Harmonic - 14	0~16384	word	R
0x170D	Voltage V2 - Harmonic - 15	0~16384	word	R
0x170E	Voltage V2 - Harmonic - 16	0~16384	word	R
0x170F	Voltage V2 - Harmonic - 17	0~16384	word	R
0x1710	Voltage V2 - Harmonic - 18	0~16384	word	R
0x1711	Voltage V2 - Harmonic - 19	0~16384	word	R
0x1712	Voltage V2 - Harmonic - 20	0~16384	word	R
0x1713	Voltage V2 - Harmonic - 21	0~16384	word	R
0x1714	Voltage V2 - Harmonic - 22	0~16384	word	R
0x1715	Voltage V2 - Harmonic - 23	0~16384	word	R
0x1716	Voltage V2 - Harmonic - 24	0~16384	word	R
0x1717	Voltage V2 - Harmonic - 25	0~16384	word	R
0x1718	Voltage V2 - Harmonic - 26	0~16384	word	R
0x1719	Voltage V2 - Harmonic - 27	0~16384	word	R
0x171A	Voltage V2 - Harmonic - 28	0~16384	word	R
0x171B	Voltage V2 - Harmonic - 29	0~16384	word	R
0x171C	Voltage V2 - Harmonic - 30	0~16384	word	R
0x171D	Voltage V2 - Harmonic - 31	0~16384	word	R
0x171E	Voltage V2 - Harmonic - 32	0~16384	word	R
0x171F	Voltage V2 - Harmonic - THD	0~16384	word	R
V3 Harmonics (0x1800 to 0x1900)				
0x1800	Voltage V3 - Harmonic - 2	0~16384	word	R
0x1801	Voltage V3 - Harmonic - 3	0~16384	word	R
0x1802	Voltage V3 - Harmonic - 4	0~16384	word	R
0x1803	Voltage V3 - Harmonic - 5	0~16384	word	R

0x1804	Voltage V3 - Harmonic - 6	0~16384	word	R
0x1805	Voltage V3 - Harmonic - 7	0~16384	word	R
0x1806	Voltage V3 - Harmonic - 8	0~16384	word	R
0x1807	Voltage V3 - Harmonic - 9	0~16384	word	R
0x1808	Voltage V3 - Harmonic - 10	0~16384	word	R
0x1809	Voltage V3 - Harmonic - 11	0~16384	word	R
0x180A	Voltage V3 - Harmonic - 12	0~16384	word	R
0x180B	Voltage V3 - Harmonic - 13	0~16384	word	R
0x180C	Voltage V3 - Harmonic - 14	0~16384	word	R
0x180D	Voltage V3 - Harmonic - 15	0~16384	word	R
0x180E	Voltage V3 - Harmonic - 16	0~16384	word	R
0x180F	Voltage V3 - Harmonic - 17	0~16384	word	R
0x1810	Voltage V3 - Harmonic - 18	0~16384	word	R
0x1811	Voltage V3 - Harmonic - 19	0~16384	word	R
0x1812	Voltage V3 - Harmonic - 20	0~16384	word	R
0x1813	Voltage V3 - Harmonic - 21	0~16384	word	R
0x1814	Voltage V3 - Harmonic - 22	0~16384	word	R
0x1815	Voltage V3 - Harmonic - 23	0~16384	word	R
0x1816	Voltage V3 - Harmonic - 24	0~16384	word	R
0x1817	Voltage V3 - Harmonic - 25	0~16384	word	R
0x1818	Voltage V3 - Harmonic - 26	0~16384	word	R
0x1819	Voltage V3 - Harmonic - 27	0~16384	word	R
0x181A	Voltage V3 - Harmonic - 28	0~16384	word	R
0x181B	Voltage V3 - Harmonic - 29	0~16384	word	R
0x181C	Voltage V3 - Harmonic - 30	0~16384	word	R
0x181D	Voltage V3 - Harmonic - 31	0~16384	word	R
0x181E	Voltage V3 - Harmonic - 32	0~16384	word	R
0x181F	Voltage V3 - Harmonic - THD	0~16384	word	R
Remaining registers				
0x1900	Temperature (1°C resolution)	0~100	word	R
0x1901	Voltage V2 angle	-180~180	word	R
0x1902	Voltage V3 angle	-180~180	word	R
0x1903	Load Percent	0~100	word	R
0x1904	Number of records	0000~9999	word	R
0x1905	Internal Battery Status	0~1	word	R
0x1907	Year (Miladi)	2000~2099	word	R
0x1908	Month (Miladi)	1~12	word	R
0x1909	Day(Miladi)	1~31	word	R
0x190A	Hour	0~23	word	R
0x190B	Minute	0~59	word	R
0x190C	Second	0~59	word	R
Accurate Float Values				
0x2000-0x2001	Frequency (F)		float	R
0x2002-0x2003	Phase Voltage V1		float	R
0x2004-0x2005	Phase Voltage V2		float	R
0x2006-0x2007	Phase Voltage V3		float	R
0x2008-0x2009	Average Phase Voltage Vlnavg		float	R
0x200A-0X200B	Line Voltage V12		float	R
0x200C-0x200D	Line Voltage V23		float	R
0x200E-0x200F	Line Voltage V31		float	R
0x2010-0x2011	Average Line Voltage Vllavg		float	R
0x2012-0x2013	Current I1		float	R
0x2014-0x2015	Current I2		float	R
0x2016-0x2017	Current I3		float	R
0x2018-0x2019	Average Current Iavg		float	R
0x201A-0x201B	Neutral Line Current In (calculated)		float	R
0x201C-0x201D	Neutral Line Current In (Measured)		float	R

0x201E-0x201F	Phase Power P1		float	R
0x2020-0x2021	Phase Power P2		float	R
0x2022-0x2023	Phase Power P3		float	R
0x2024-0x2025	System Power Ptot		float	R
0x2026-0x2027	Phase Reactive Power Q1		float	R
0x2028-0x2029	Phase Reactive Power Q2		float	R
0x202A-0x202B	Phase Reactive Power Q3		float	R
0x202C-0x202D	System Reactive Power Qtot		float	R
0x202E-0x202F	Phase Apparent Power S1		float	R
0x2030-0x2031	Phase Apparent Power S2		float	R
0x2032-0x2033	Phase Apparent Power S3		float	R
0x2034-0x2035	System Apparent Power Stot		float	R
0x2036-0x2037	Phase Power Factor PF1		float	R
0x2038-0x2039	Phase Power Factor PF2		float	R
0x203A-0x203B	Phase Power Factor PF3		float	R
0x203C-0x203D	System Power Factor PFtot		float	R
0x203E-0x203F	Voltage Unbalance Factor U_unbl		float	R
0x2040-0x2041	Current Unbalance Factor I_unbl		float	R
0x2042-0x2043	Power Demand Dmd_Ptot		float	R
0x2044-0x2045	Reactive power Demand Dmd_Qtot		float	R
0x2046-0x2047	Apparent Power Demand Dmd_Stot		float	R
0x2048-0x2049	Temperature		float	R
0x204A-0x204B	Load Percent		float	R
0x204C-0x204D	Voltage V1 angle		float	R
0x204E-0x204F	Voltage V2 angle		float	R
0x2050-0x2051	Voltage V3 angle		float	R
0x2052-0x2053	Current I1 angle		float	R
0x2054-0x2055	Current I2 angle		float	R
0x2056-0x2057	Current I3 angle		float	R
0x2058-0x2059	Current I1 TDD		float	R
0x205A-0x205B	Current I2 TDD		float	R
0x205C-0x205D	Current I3 TDD		float	R
0x205E-0x205F	Current I1 K_FACTOR		float	R
0x2060-0x2061	Current I2 K_FACTOR		float	R
0x2062-0x2063	Current I3 K_FACTOR		float	R
0x2064-0x2065	Voltage V1 THD+N		float	R
0x2066-0x2067	Voltage V2 THD+N		float	R
0x2068-0x2069	Voltage V3 THD+N		float	R
0x206A-0x206B	Current I1 THD+N		float	R
0x206C-0x206D	Current I2 THD+N		float	R
0x206E-0x206F	Current I3 THD+N		float	R
0x2070-0x2071	Current I1 THD		float	R
0x2072-0x2073	Current I2 THD		float	R
0x2074-0x2075	Current I3 THD		float	R
0x2076-0x2077	Voltage V1 THD		float	R
0x2078-0x2079	Voltage V2 THD		float	R
0x207A-0x207B	Voltage V3 THD		float	R
0x207C-0x207D	Current I1 THD ODD		float	R
0x207E-0x207F	Current I2 THD ODD		float	R
0x2080-0x2081	Current I3 THD ODD		float	R
0x2082-0x2083	Voltage V1 THD ODD		float	R
0x2084-0x2085	Voltage V2 THD ODD		float	R
0x2086-0x2087	Voltage V3 THD ODD		float	R
0x2088-0x2089	Current I1 THD EVEN		float	R
0x208A-0x208B	Current I2 THD EVEN		float	R
0x208C-0x208D	Current I3 THD EVEN		float	R
0x208E-0x208F	Voltage V1 THD EVEN		float	R

0x2090-0x2091	Voltage V2 THD EVEN		float	R
0x2092-0x2093	Voltage V3 THD EVEN		float	R
0x2094-0x2095	Current I1 CF		float	R
0x2096-0x2097	Current I2 CF		float	R
0x2098-0x2099	Current I3 CF		float	R
0x209A-0x209B	Voltage V1 CF		float	R
0x209C-0x209D	Voltage V2 CF		float	R
0x209E-0x209F	Voltage V3 CF		float	R
0x20A0-0x20A1	Current I1 THDF		float	R
0x20A2-0x20A3	Current I2 THDF		float	R
0x20A4-0x20A5	Current I3 THDF		float	R
0x20A6-0x20A7	Voltage V1 THDF		float	R
0x20A8-0x20A9	Voltage V2 THDF		float	R
0x20AA-0x20AB	Voltage V3 THDF		float	R
0x20AC-0x20AD	Current I1 FUNDEMENTAL		float	R
0x20AE-0x20AF	Current I2 FUNDEMENTAL		float	R
0x20B0-0x20B1	Current I3 FUNDEMENTAL		float	R
0x20B2-0x20B3	Voltage V1 FUNDEMENTAL		float	R
0x20B4-0x20B5	Voltage V2 FUNDEMENTAL		float	R
0x20B6-0x20B7	Voltage V3 FUNDEMENTAL		float	R
Read and Write capable settings(0x3000~0x4000)				
0x3000	Slave address	1~247	word	R/W
0x3001	Baud rate (1200-2400-4800-9600-19200-38400bps)	1200~38400	word	R/W
0x3002	Sample time for logging (second)	1~900	word	R/W
0x3003	PT primary (hi word)	100~400000	Double word	R/W
0x3004	PT primary (lo word)			
0x3005	PT secondary	100~400	word	R/W
0x3006	CT primary	5~8000	word	R/W
0x3007	CT secondary	1 or 5	word	R/W
0x3008	Light time for LCD backlight (minute)	1~15	word	R/W
0x3009	Slide time for demand measuring (minute)	1~30	word	R/W
0x300A	Meter constant (pulse of energy)	600~32000	word	R/W
0x300B	Relay1 on time	50~3000	word	R/W
0x300C	Relay2 on time	50~3000	word	R/W
0x300D	RTC calibration value	-99~99	word	R/W
0x300E	Number of Tariff	1~4	word	R/W
0x300F	Tariff1 start Hour	0~23	word	R/W
0x3010	Tariff1 start Minute	0~59	word	R/W
0x3011	Tariff1 start Second	0~59	word	R/W
0x3012	Tariff2 start Hour	0~23	word	R/W
0x3013	Tariff2 start Minute	0~59	word	R/W
0x3014	Tariff2 start Second	0~59	word	R/W
0x3015	Tariff3 start Hour	0~23	word	R/W
0x3016	Tariff3 start Minute	0~59	word	R/W
0x3017	Tariff3 start Second	0~59	word	R/W
0x3018	Tariff4 start Hour	0~23	word	R/W
0x3019	Tariff4 start Minute	0~59	word	R/W
0x301A	Tariff4 start Second	0~59	word	R/W
0x301B	Number of CT	3~4	word	R/W
0x301C	Buzzer(ON = 1 ; OFF = 0)	0~1	word	R/W
0x301D	Unit ID letter(8)	ASCII	word	R/W
0x301E	Unit ID letter(7)	ASCII	word	R/W
0x301F	Unit ID letter(6)	ASCII	word	R/W
0x3020	Unit ID letter(5)	ASCII	word	R/W
0x3021	Unit ID letter(4)	ASCII	word	R/W
0x3022	Unit ID letter(3)	ASCII	word	R/W
0x3023	Unit ID letter(2)	ASCII	word	R/W

0x3024	Unit ID letter(1)	ASCII	word	R/W
0x3025	Type of logging (FIFO:0 and FILL and HOLD:1)	0~1	word	R/W
0x3026	Daylight Saving(ON = 1 ; OFF = 0)	0~1	word	R/W
0x3027	Type of date (shamsi:0 and miladi:1)	0~1	word	R/W
0x3028	Pulse Output(ACTIVE = 2 ; REACTIVE = 1 ; APPERANT = 0)	0~2	word	R/W
0x3029	Relay1 Type(Momentary = 1 ; Latch = 0)	0~1	word	R/W
0x302A	Relay2 Type(Momentary = 1 ; Latch = 0)	0~1	word	R/W
0x302B	Status of logger (START: 1 and STOP: 0)	0~1	word	R/W
0x302C	Type of Display (FULL = 1 ; SIMPLE = 0)	0~1	word	R/W
0x302D	PASSWORD1	0000~9999	word	R/W
0x302E	PASSWORD2	0000~9999	word	R/W
0x302F	PASSWORD3	0000~9999	word	R/W
0x3030	Access Point Password(letter 1)		word	R/W
0x3031	Access Point Password(letter 2)		word	R/W
0x3032	Access Point Password(letter 3)		word	R/W
0x3033	Access Point Password(letter 4)		word	R/W
0x3034	Access Point Password(letter 5)		word	R/W
0x3035	Access Point Password(letter 6)		word	R/W
0x3036	Access Point Password(letter 7)		word	R/W
0x3037	Access Point Password(letter 8)		word	R/W
0x3038	Port Number	1000~9999	word	R/W
0x3039	IP(xxx.aaa.aaa.aaa)	0~255	word	R/W
0x303A	IP(aaa.xxx.aaa.aaa)	0~255	word	R/W
0x303B	IP(aaa.aaa.xxx.aaa)	0~255	word	R/W
0x303C	IP(aaa.aaa.aaa.xxx)	0~255	word	R/W
0x303D	MASK(xxx.aaa.aaa.aaa)	0~255	word	R/W
0x303E	MASK(aaa.xxx.aaa.aaa)	0~255	word	R/W
0x303F	MASK(aaa.aaa.xxx.aaa)	0~255	word	R/W
0x3040	MASK(aaa.aaa.aaa.xxx)	0~255	word	R/W
0x3041	GATEWAY(xxx.aaa.aaa.aaa)	0~255	word	R/W
0x3042	GATEWAY(aaa.xxx.aaa.aaa)	0~255	word	R/W
0x3043	GATEWAY(aaa.aaa.xxx.aaa)	0~255	word	R/W
0x3044	GATEWAY(aaa.aaa.aaa.xxx)	0~255	word	R/W
0x3045	UTC	-1200~1400	word	R/W
0x3046	Latitude(HI word)	0~900000	Double word	R/W
0x3047	Latitude(LO word)			
0x3048	Longitude(HI word)	0~1800000	Double word	R/W
0x3049	Longitude(LO word)			
0x304A	Astro timer(ON = 1 ; OFF = 0)	0~1	word	R/W
0x304B	Latitude Sign(North = + = 1 ; South = - = 0)	0~1	word	R/W
0x304C	Longitude Sign (East = + = 1 ; West = - = 0)	0~1	word	R/W
0x304D	Thermostat (ON = 1 ; OFF = 0)	0~1	word	R/W
0x304E	Thermostat set point	1~99	word	R/W
0x304F	Thermostat Hysteresis	1~20	word	R/W
0x3050	Astro Offset minute	-60~60	word	R/W
0x3051	Login Password (letter 1)		word	R/W
0x3052	Login Password (letter 2)		word	R/W
0x3053	Login Password (letter 3)		word	R/W
0x3054	Login Password (letter 4)		word	R/W
0x3055	Login Password (letter 5)		word	R/W
0x3056	Login Password (letter 6)		word	R/W
0x3057	Login Password (letter 7)		word	R/W
0x3058	Login Password (letter 8)		word	R/W
0x3059	Trip detected status		word	R/W
Read only settings				
0x4000	Sunrise Hour	0~23	word	R
0x4001	Sunrise Minute	0~59	word	R

0x4002	Sunrise Second	0~59	word	R
0x4003	Sunset Hour	0~23	word	R
0x4004	Sunset Minute	0~59	word	R
0x4005	Sunset Second	0~59	word	R
0x4006	Relay1 Status	0~1	word	R
0x4007	Relay2 Status	0~1	word	R
0x4008	Time of use of UNIT		word	R
0x4009	Production Year	2014~2050	word	R
0x400A	Production Month	1~12	word	R
0x400B	Production Day	1~31	word	R
0x400C	Unit version (letter1)	ASCII	word	R
0x400D	Unit version (letter2)	ASCII	word	R
0x400E	Unit version (letter3)	ASCII	word	R
0x400F	Unit version (letter4)	ASCII	word	R
0x4010	Unit version (letter5)	ASCII	word	R
0x4011	Unit version (letter6)	ASCII	word	R
0x4012	Unit version (letter7)	ASCII	word	R
0x4013	Hardware version(x.a.a.a)	1~9	word	R
0x4014	Hardware version(a.x.a.a)	1~9	word	R
0x4015	Hardware version(a.a.x.a)	1~9	word	R
0x4016	Hardware version(a.a.a.x)	1~9	word	R
0x4017	Serial Number(letter 1)	ASCII	word	R
0x4018	Serial Number(letter 2)	ASCII	word	R
0x4019	Serial Number(letter 3)	ASCII	word	R
0x401A	Serial Number(letter 4)	ASCII	word	R
0x401B	Serial Number(letter 5)	ASCII	word	R
0x401C	Serial Number(letter 6)	ASCII	word	R
0x401D	Serial Number(letter 7)	ASCII	word	R
0x401E	Serial Number(letter 8)	ASCII	word	R
0x401F	Serial Number(letter 9)	ASCII	word	R
0x4020	Seed key for login (HI)		word	R
0x4021	Seed key for login (LO)		word	R
0x4022	Digital Input Status	0~1	word	R
0x4023	Power Failure Status	0~1	word	R
Write only settings				
0x5000				W
0x5001	Clear Memory(CLEAR = 1)	1	word	W
0x5002	Clear Energy(CLEAR = 1)	1	word	W
0x5003	Clear Statistics(CLEAR = 1)	1	word	W
0x5004	RTC Second	0~59	word	W
0x5005	RTC Minute	0~59	word	W
0x5006	RTC Hour	0~23	word	W
0x5007	RTC Day	1~31	word	W
0x5008	RTC Month	1~12	word	W
0x5009	RTC Year	2014~2050	word	W
0x500A	Relay1 (ON = 1 ; OFF = 0)	0~1	word	W
0x500B	Relay2 (ON = 1 ; OFF = 0)	0~1	word	W
0x500C	Reset Unit (RESET = 1)	1	word	W
0x500D	Key for Login to update (hi word)		word	W
0x500E	Key for Login to update (lo word)		word	W
0x500F	Clear Contactors Counters(CLEAR = 1)	1	word	W
Settings of PFC (write in single mode)				
0x6000	PFC (ON = 1 ; OFF = 0)	0~1	word	R/W
0x6001	PFC I/O slave address	1~247	word	R/W
0x6002	PFC action time second	1~120	word	R/W
0x6003	PFC Discharge Time second	1~240	word	R/W
0x6004	Value of Capacitor1	0~9999	word	R/W

0x6005	Value of Capacitor2	0~9999	word	R/W
0x6006	Value of Capacitor3	0~9999	word	R/W
0x6007	Value of Capacitor4	0~9999	word	R/W
0x6008	Value of Capacitor5	0~9999	word	R/W
0x6009	Value of Capacitor6	0~9999	word	R/W
0x600A	Value of Capacitor7	0~9999	word	R/W
0x600B	Value of Capacitor8	0~9999	word	R/W
0x600C	Value of Capacitor9	0~9999	word	R/W
0x600D	Value of Capacitor10	0~9999	word	R/W
0x600E	Value of Capacitor11	0~9999	word	R/W
0x600F	Value of Capacitor12	0~9999	word	R/W
0x6010	Percent of value effect on correction	1~100	word	R/W
0x6011	Percent of contactor count effect on correction	1~100	word	R/W
0x6012	Percent of number of in or out effect on correction	1~100	word	R/W
0x6013	Percent of availability effect on correction	1~100	word	R/W
0x6014	Number of steps	1~12	word	R/W
0x6015	Percent of PFC correction offset	1~100	word	R/W
0x6016	PFC target Power Factor	-100~100	word	R/W
0x6017	Contactor1 Counter	0~9999	word	R/W
0x6018	Contactor2 Counter	0~9999	word	R/W
0x6019	Contactor3 Counter	0~9999	word	R/W
0x601A	Contactor4 Counter	0~9999	word	R/W
0x601B	Contactor5 Counter	0~9999	word	R/W
0x601C	Contactor6 Counter	0~9999	word	R/W
0x601D	Contactor7 Counter	0~9999	word	R/W
0x601E	Contactor8 Counter	0~9999	word	R/W
0x601F	Contactor9 Counter	0~9999	word	R/W
0x6020	Contactor10 Counter	0~9999	word	R/W
0x6021	Contactor11 Counter	0~9999	word	R/W
0x6022	Contactor12 Counter	0~9999	word	R/W

Table 4.12 Metering data address table

The Relationship between numerical value in register of ZMP and the real physical value is as following table. (Rx is the numerical value in register of ZMP)

Parameter	Relationship	Unit
V1, V2, V3, V12, V23, V31, Vllavg, Vlnavg	U = Rx × (PT_P/PT_S) / 100	Volt(V)
I1, I2, I3, Iavg, In	I = Rx × (CTP/CT_S) / 1000	Amp(A)
P1, P2, P3, Ptot, Dmd_Ptot	P = Rx × (PT_P/PT_S) × (CT_P/ CT_S)	Watt(W)
Q1, Q2, Q3, Qtot, Dmd_Qtot	Q = Rx × (PT_P/PT_S) × (CT_P/ CT_S)	Var
S1, S2, S3, Stot, Dmd_Stot	S = Rx × (PT_P/PT_S) × (CT_P/ CT_S)	VA
PF1, PF2, PF3, PFtot	PF = Rx / 1000	NA
Frequency	F = Rx / 100	Hz
Load Type (L/C/R)	ASCII of L, C, R	NA
U_unbl, I_unbl	Unbl = Rx / 100	%
Active Energy	P = Rx / 10	Kwh
Reactive Energy	Q = Rx / 10	Kvarh
Apparent Energy	S = Rx / 10	KVAh
H2 to H32 ,THD	THD=Rx / 163.84	%
Longitude	Rx / 10000	
Latitude	Rx / 10000	
UTC	Rx / 100	
Capacitor values	Rx / 10	Kvar
Target PF	Rx / 100	

Table 4.13 Measuring data convert table

Each Page of internal flash memory includes four records.
By per query of Modbus function code 0x04 we can read one page from internal memory of logged values.
Below table show arrange of measured values that recorded in one page of flash memory.

record	type
Year(hi byte)	Word
Year(lo byte)	
Month	Byte
Day	Byte
Hour	Byte
Minute	Byte
Second	Byte
P total	Float
Pa	Float
Pb	Float
Pc	Float
Q total	Float
Qa	Float
Qb	Float
Qc	Float
S total	Float
Sa	Float
Sb	Float
Sc	Float
PF total	Float
PFa	Float
PFb	Float
PFc	Float
In	Float
Va	Float
Vb	Float
Vc	Float
In	Float
Ia	Float
Ib	Float
Ic	Float
Frequency	Float
Temperature	Float
V unbl	Float
I unbl	Float
Vab	Float
Vbc	Float
Vca	Float
Ia THD	Float
Ib THD	Float
Ic THD	Float
Va THD	Float
Vb THD	Float
Vc THD	Float
Ia TDD	Float
Ib TDD	Float
Ic TDD	Float
Ia KFACTOR	Float
Ib KFACTOR	Float
Ic KFACTOR	Float
Ia CF	Float
Ib CF	Float
Ic CF	Float
Va CF	Float
Vb CF	Float
Vc CF	Float
Ia THDF	Float
Ib THDF	Float
Ic THDF	Float
Va THDF	Float
Vb THDF	Float
Vc THDF	Float

Table 4.14 arrange of logged value in one page

Appendix

METERING	REAL TIME MEASURING	Phase Voltage	V1-V2-V3-Vlnavg	V - KV
		Line Voltage	V12-V23-V31-Vllavg	V - KV
		Current	I1-I2-I3-In*-Iavg	Separate Input for Neutral Line CT*
		Power	P1-P2-P3-Ptotal	KW - MW
		Reactive Power	Q1-Q2-Q3-Qtotal	KVAR - MVAR
		Apparent Power	S1-S2-S3-Stotal	KVA - MVA
		Power Factor	PF1-PF2-PF3-PFtotal	Cap. or Ind.
		Frequency	Frequency	Hz
	ENERGY AND DEMAND	Energy	P_import P_export P_total P_net	KWH
		Reactive Energy	Q_import Q_export Q_total Q_net	KVARH
		Demand*	Demand_P Demand_Q Demand_S	

MONITORING	POWER QUALITY	Voltage Unbalance Factor		%
		Current Unbalance Factor		%
		R,S,T Detector	Voltage and Current Phase Sequence Indications	
	MAX & MIN	MAXIMUM* VALUES	Display and Record	
		MINIMUM* VALUES	Display and Record	
OTHERS	COMMUNICATION	RS485 Port	Modbus Protocol	MODBUS RTU
		Baud Rate	1200 to 38400 bps	
		Slave Address	from 1 to 247	
	TIME	Real Time Clock	Year, Month, date, Hour, minute, Second (shamsi and milady)	Daylight saving Correction (on/off)
	DISPLAY		Clear and Large character LCD display	with backlight
DATA LOGGER	INTERNAL MEMORY	Erasable Flash Memory	Record metering data in a user defined time interval. Periodic or one period	1 ~ 900sec
	READ SAMPLES	Created files for recorded samples	Unique character ID for unit	
			Via USB Stick	
Voltage input	Voltage rating	100V option	0 to 400 KV AC (with external PT)	
		400V option	0 to 480 V AC (direct)	
	Frequency range		45～65Hz	
	Overload	Permissible overload	1.5 Vn	
	Voltage range through PT		1 ~ 400000V (secondary)	
	Measuring		True RMS	
Current input	Current rating	Adjustable from 5 A to 8000 A	5Amp AC nominal F.S. input with 20% over range	
	secondary	1 A or 5 A		
	Overload		10A for continues 100A for 1 second (None recurrence)	
	Measuring		True RMS	
Dimension		DIN43700	96x96mm	

Technical Data and Specification