## 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.

# 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 is 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.

## 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,In,Iavg | √ | √ |
| Natural Current | In (direct with separate CT) | | √ |
| 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 | √ | √ |
| Current THD | Current Total Harmonic Distortion | | √ |
| MAX with Time Stamp | | | √ |
| MIN with Time Stamp | | | √ |
| Pulse Output | | | √ |
| RS485 Port | Modbus Protocol (RTU) | √ | √ |
| Real Time Clock | | √ | √ |
| USB PORT | | √ | √ |
| Voltage and current sequence | | √ | √ |

Table 1.2 Comparisons of ZMP and ZMP+

# Chapter 2
# Installation

## Appearance and Dimensions

### Appearance

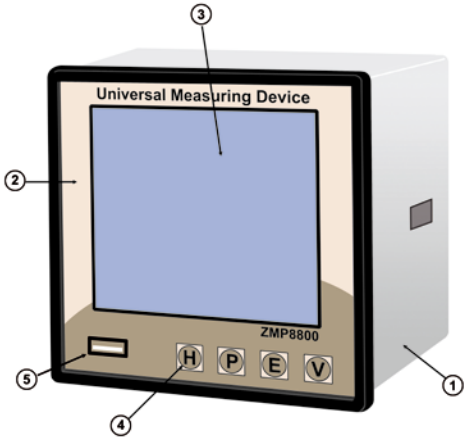



Figure2.1 Appearance of ZMP

| 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

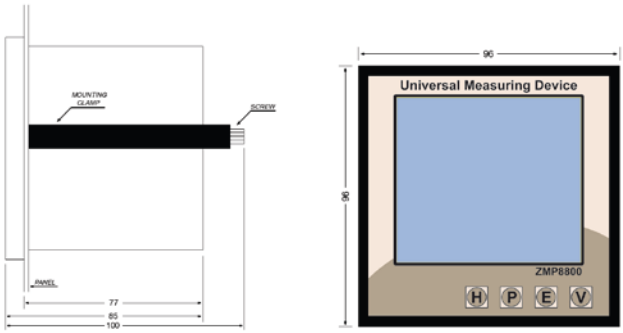



Fig.2.2Dimensions

## 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.

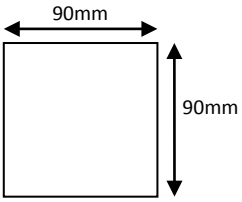



Fig.2.3 Panel cutting

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.

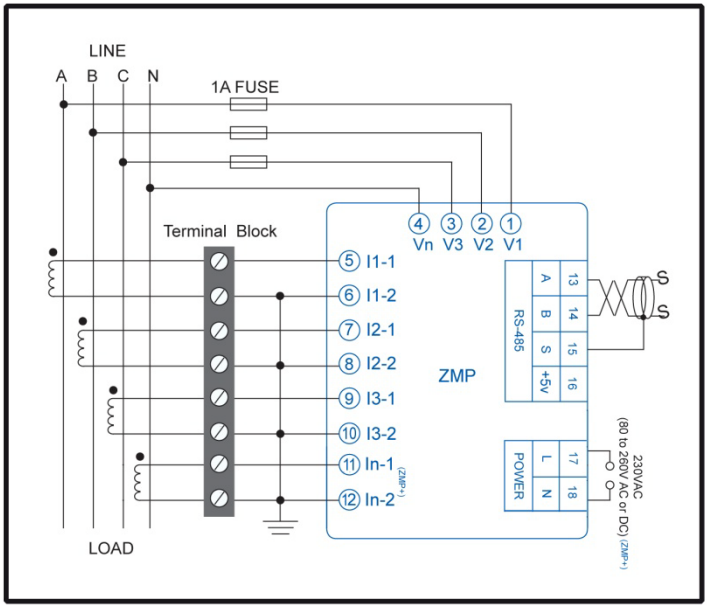



Fig.2.4 wiring diagram

## 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.

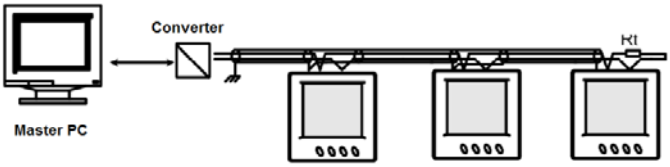



Fig 2.5 Line mode

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.

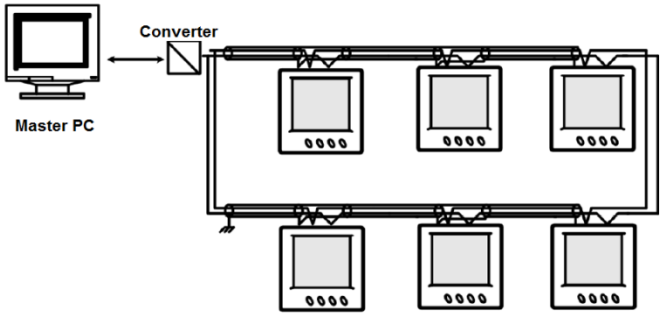



Fig 2.6 Circle mode

3. Star

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

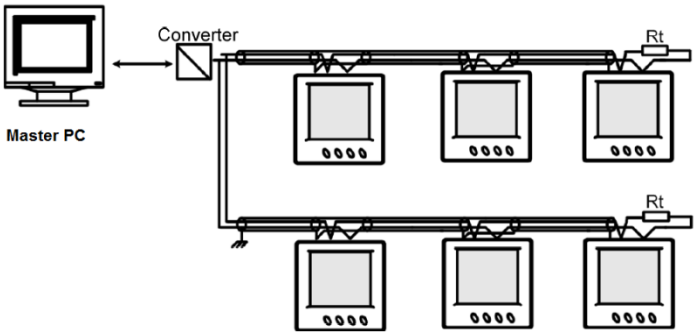



Fig 2.7 Star mode

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.

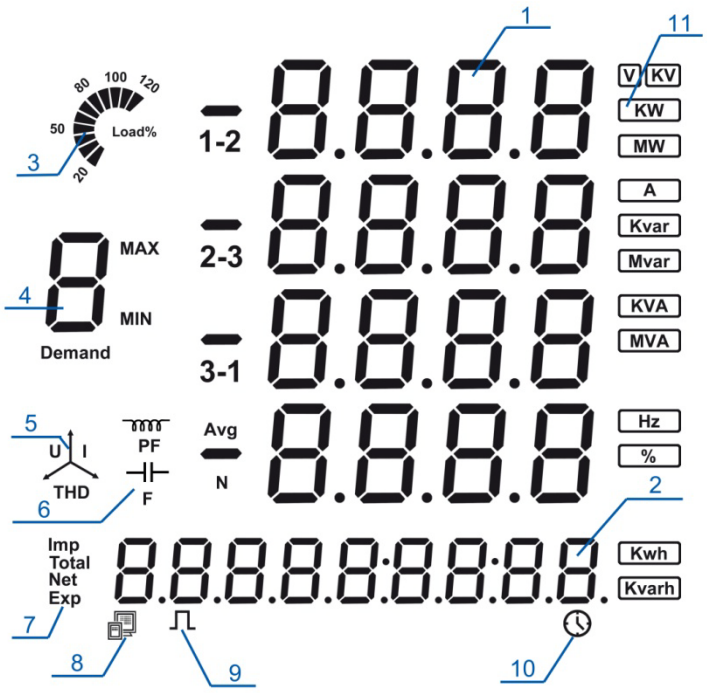



Fig 3.1 All Display Segments

| SN | Display | Description |
|---|---|---|
| 1 | Four lines of 8. letter in the metering area | Display metering data voltage, current, power, power factor, frequency, demand, unbalance factor, max, min, etc. |
| 2 | One line of 8. letter in the | Energy data display or real time clock |

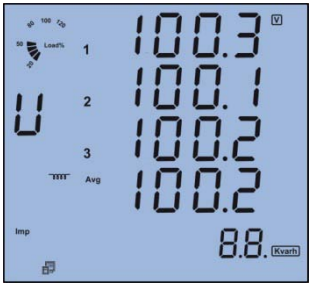
| | | |
|---|---|---|
| | energy area | |
| 3 | Load rate | Display load current to rating current percentage |
| 4 | Item label 8 letter, MAX, MIN, Demand, PF, F | Item label:<br>U: voltage, I: current, P: power, q: reactive power, S:<br>apparent power, PF: power factor, F: frequency, MAX: Maximum value, MIN: Minimum Value, Demand:<br>Demand value, Avg: average value, I with N: neutral Current, PF, F, Avg and N indicate the fourth line data. |
| 5 | Three phase unbalance label | With letter U: voltage unbalance factor<br>With letter I: Current unbalance factor |
| 6 | Load characteristic | Capacitor label: capacitive load<br>Inductor label: inductive load |
| 7 | Energy label | imp: consumption energy<br>exp: generating energy<br>total: absolute sum of imp and exp energy<br>net: algebraic sum |
| 8 | Communication indicator | No label: no communication<br>One label: inquiry<br>Two labels: inquiry and answer |
| 9 | Energy pulse output indicator | No label: no pulse output<br>With label: pulse output |
| 10 | Time label | Time display in energy area |
| 11 | Unit | Indicate data unit<br>Voltage: V, kV, Current: A, Power: kW and MW,<br>Reactive Power: kvar and Mvar,<br>Apparent Power: kVA<br>and MVA, Frequency: Hz, Energy: kWh,<br>Reactive energy: kvarh, Percentage: % |

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. 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.
V1=100.3V, V2=100.1V, V3=100.2V and Vlnavg=100.2V.
Load rate is 50%, inductive load, imp energy is 8.8kwh, communication state normal,

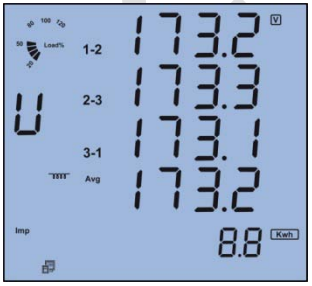
Fig 3.2 Three phase voltage

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.
I1=2.498, I2=2.499, I3=2.491, In=0.008A.

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
V12=173.2V, V23=173.3V, V31=173.1V, Vllavg=173.2V.

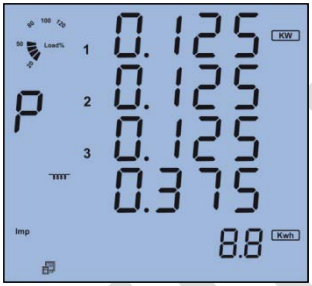
Fig 3.4 Three phase to phase voltage

Press V, go to the fourth screen.


The fourth screen: display current of each phase and average current as in fig 3.5, I1=2.498A, I2=2.499A, I3=2.491A, Iavg=2.496A.

Fig 3.5 Three phase current

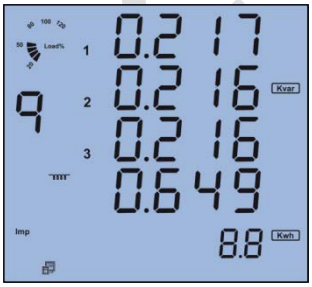
Press V, go back to the first screen.




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, P1=0.125kW, P2=0.125kW, P3=0.125kW, Ptot=0.375kW.

Fig 3.6 Three phase power

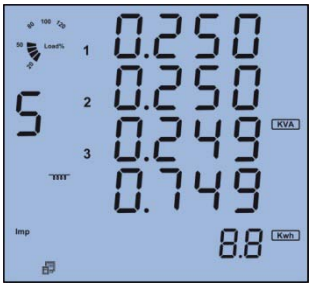
Press P, go to the second screen.




The second screen, display reactive power of each phase, Q1, Q2, Q3 and system total reactive power Qsum. As in fig 3.7 Q1=0.217kvar, Q2=0.216kvar, Q3=0.216kvar and Qtot=0.649kvar

Fig 3.7 Three phase reactive power

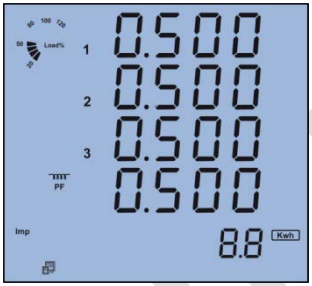
Press P, go to the third screen.




The third screen: display apparent power of each phase S1, S2, S3 and system total apparent Power Stot As in fig 3.8 S1=0.250kVA, S2=0.250kVA, S3=0.249kVA and Stot=0.749kVA.

Fig 3.8 Three phase apparent power

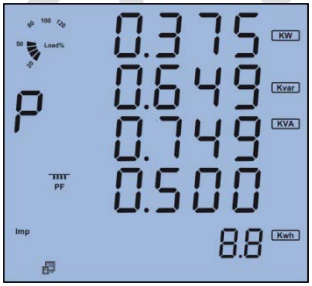
Press P, go to the fourth screen.




The fourth screen: power factor of each phase PF1, PF2, PF3 and system average power factor PF. As in fig 3.9, PF1=0.500, PF2=0.500, PF3=0.500 and PFtot=0.500.

Fig 3.9 Three phase PF

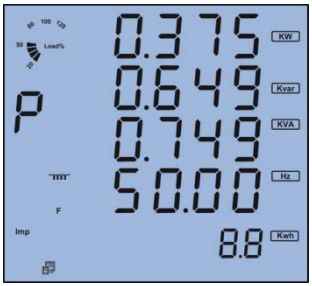
Press P, go to the fifth screen.




The fifth screen: system total active power Ptot, system total reactive power Qtot, system total apparent power Stot and system average power factor. As in fig 3.10, Ptot=0.375, Qtot=0.649Kvar, Stot=0.749 and PFtot=0.500.

Fig 3.10 System powers and power factor

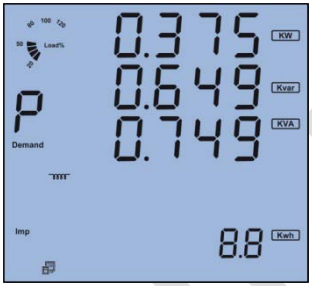
Press P, go to the sixth screen.




The sixth screen: system total power Psum, system total reactive power Qsum, system total apparent power Ssum and system frequency F. As in fig 3.11, Ptot=0.375kW, Qtot=0.649kvar, Stot=0.749 kVA and F=50.00Hz.

Fig 3.11 System power and frequency

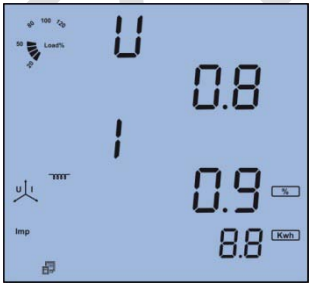
Press P, go to seventh screen.




The seventh screen: display three phase system power demand, power demand Dmd_P, reactive power demand Dmd_Q and apparent Dmd_S. As in fig 3.12, Dmd_P=0.375kW, Dmd_Q=0.649kvar, Dmd_S=0.749kVA.

Fig 3.12 System power demand*

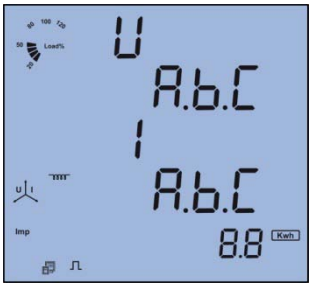
Press P, go back to the first screen.




Press H, display power quality data.
The first screen: display three phase voltage unbalance factor and three phases current unbalance factor.
As in fig 3.16,
Voltage unbalance factor=0.8%, current unbalance factor=0.9%.

Fig 3.13 Unbalance factor

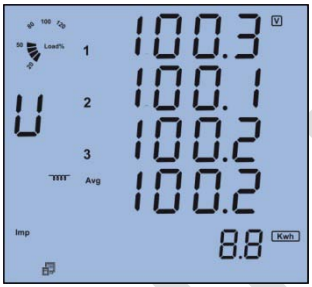
Press H key, go to the second screen.




The second screen: display three phase voltage and three phase current Sequence of wiring.
As in fig 3.14
Press H , go back to the first screen.

Fig 3.14 Sequence indicator

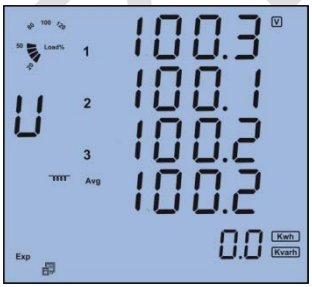
Press E key: display energy and real time clock.




The first screen: display the consumption energy Ep_imp=8.8kwh

Fig 3.15 Import energy

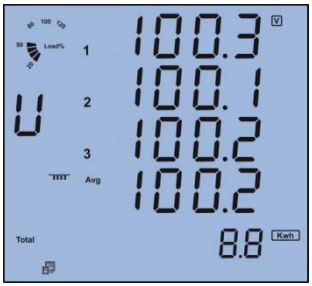
Press E key, go to the second screen.




The second: Display the generation energy Eq_exp As in fig 3.16, Ep_exp=0.0kwh

Fig 3.16 Export energy

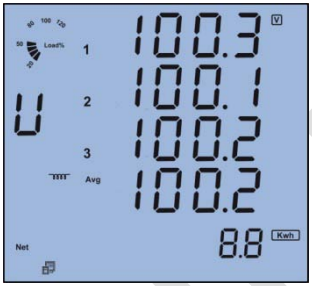
Press E key, go to the third screen.




The third screen: Display absolute sum of imp and exp energy Ep_total.
As in fig 3.17, Ep_total=8.8kwh

Fig 3.17 Total energy

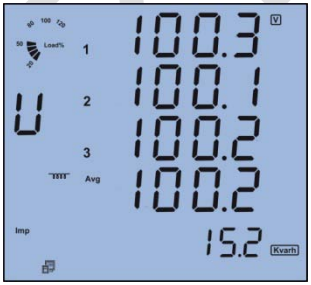
Press E key, go to the fourth screen.




The fourth screen: Display algebraic sum of imp and exp energy Ep_net.
As in fig 3.18, Ep_net=8.8kwh.

Fig 3.18 Net energy

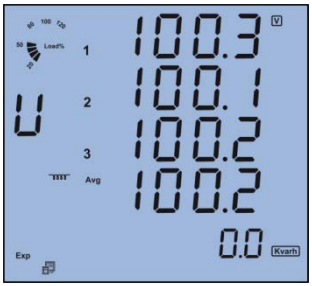
Press E key, go to the fifth screen.




The fifth screen: Display inductive reactive energy Eq_imp.
As in fig 3.19, Eq_imp=15.2kvarh

Fig 3.19 Inductive reactive energy

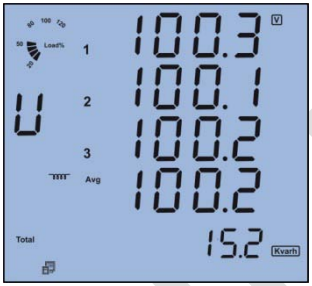
Press E key, go to the sixth screen.




The sixth screen: Display the capacitive reactive energy Eq_exp.
As in fig 3.20, Eq_exp=0.0kvarh.

Fig 3.20 Capacitive reactive energy

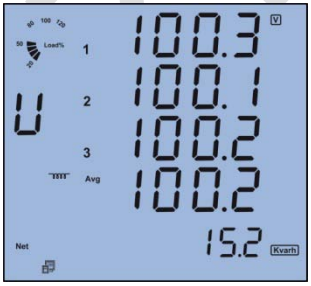
Press E key, go to the seventh screen.




The seventh screen: display absolute sum of the reactive energy Eq_total.
As in fig 3.21, Eq_total=15.2kvarh.

Fig 3.21 Total reactive energy

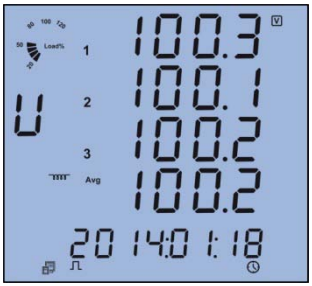
Press E key, go to the eighth screen.




The eighth screen: Display algebraic sum of reactive energy.
As in fig 3.22, Eq_net=15.2kvarh.

Fig 3.22 Net reactive energy

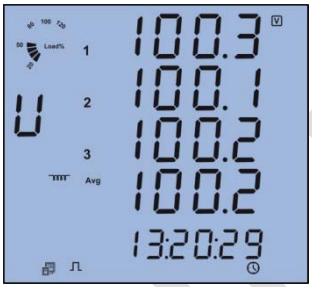
Press E key, go to the ninth screen.




The ninth screen: Display date.
Format: YYYY: MM: DD
As in fig 3.23, the date is Jan. 18, 2014 or can be in Hijri (SHAMSI) mode.

Fig 3.23 Date

Press E key, go to the tenth screen.

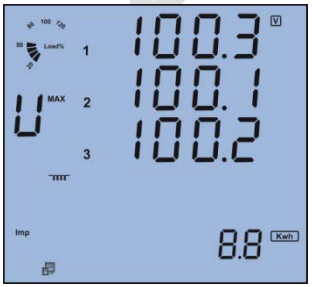



The tenth screen: Display time.
Format: HH: MM: SS.
As in fig 3.24, the time is 13:20:29.
Press E key, go back to the first screen.

Fig 3.24 Time

## 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 voltage.
The Max label display on up right of letter U.
As in fig 3.25, V1_max=100.3V, V2_max=100.1 and V3_max=100.2V.

Fig 3.25 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 value of voltage.
As in fig 3.26, V1_min=0.0V, V2_min=0.0V and V3_min=0.0V.

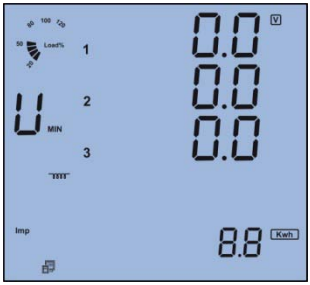



Fig 3.26 Min phase voltage

Press V key, go to the next screen.

The second screen: Max value of the line to line voltage.
As in fig 3.27, V12_max=173.2V, V23_max=173.3V and V31_max=173.1V
Press P key to change display from Max to Min and vice versa.

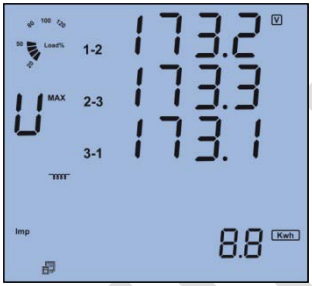



Fig 3.27 Max line voltage

Press V key, go to the next screen.

The third screen: Max value of the current.
As in fig 3.28, I1_max=2.498A, I2_max=2.499A and I3_max=2.491A.
Press P key to change display from Max to Min and vice versa.


Fig 3.28 Max Current

Press V key, go to the next screen.

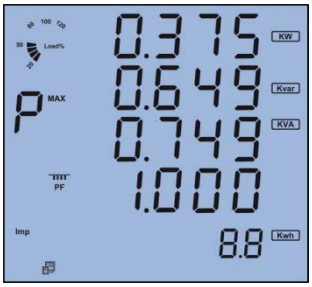



Fig 3.29 Max value of system power

The fourth screen: Max value of power and power factor.
As In fig 3.29, Max value of system total power P_max=0.375W, Max value of system reactive power Q_max=0.649Kvar, Max value of system apparent power S_max=0.749kVA and Max value of system power factor PF_max=1.00.
Press P key to change display from Max to Min and vice versa.

Press V key, go to the next screen.

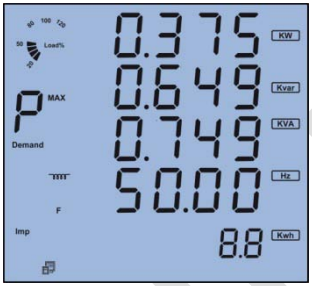



Fig 3.30 Max value of demand & freq

The fifth screen: Max value of demand and frequency as in fig 3.30, Max value of system power demand Dmd_P_max=0.375kW, Max value of system reactive power demand Dmd_P_max=0.649kvar, Max value of system total apparent power demand Dmd_P_max=0.749kVA and Max value of system frequency.
Press P key to change display from Max to Min and vice versa.
Press V key, go to the next screen.

**Note:** Only ZMP+ has the function of Max and Min record function.

## 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.

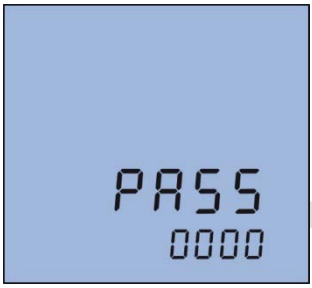



Fig 3.31 Access code page

Access code needed for going into the parameter setting mode. 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 3.31 is access code page.

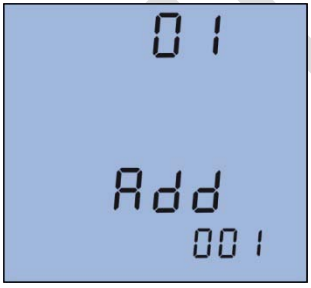



Fig 3.32 Address setting page

The first screen: setting ZMP address page for the communication purpose. It is any digit number from 1 to 247. As in fig 3.32, 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.

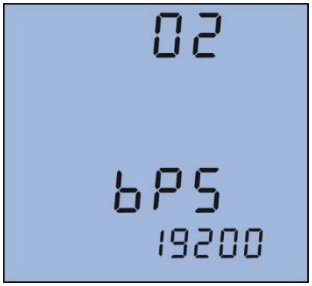



Fig 3.33 Baud rate setting page

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 19200bps. Press P or E to select one.

Press V Key, go to the next page.

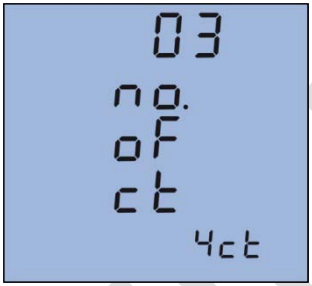



Fig 3.34 Number of CT setting page

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.

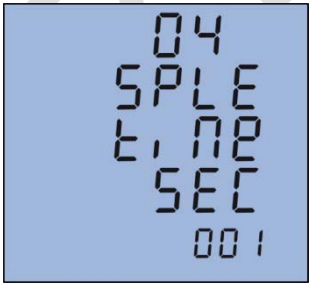



Fig 3.35 Interval time of records

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 ,P1 , P2, P3, Ptot, Q1, Q2, Q3, Qtot, S1, S2, S3, Stot, PF1, PF2, PF3, PFtot, Frequency.

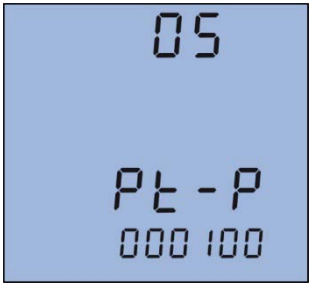



Fig 3.36 PT primary setting page

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.

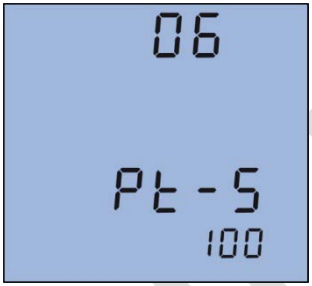



Fig 3.37 PT secondary setting page

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 400)

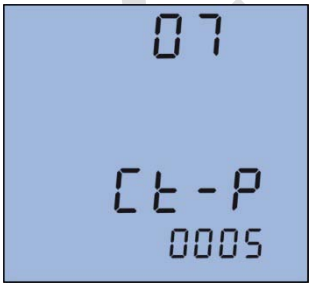
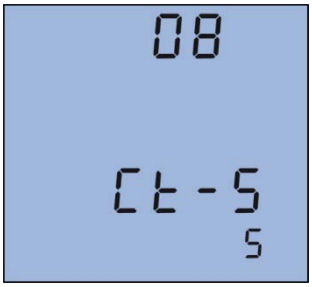


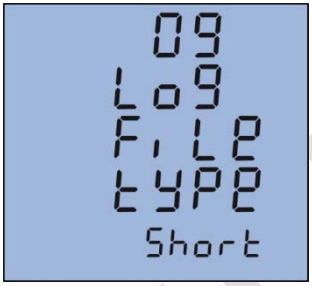

Fig 3.38 CT primary setting page

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 3.38, 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.




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 3.39 CT secondary setting page




The ninth screen: Setting speed of data transfer and type of created file on stick, ZMP has three different options for creating log file when inserting flash stick.

Fig 3.40 Type of data transfer

**Long:** in this type below header is created inside of text file, items separated with TAB to easy open by EXEL or other software to analyze. Transferring data from internal flash to USB stick take longer time in this type, but created file is complete and when the flash writing is ongoing you can use unit and perform other works.
"YEAR, MONTH, DAY, HOUR, MINUTE, SECOND, I1, I2, I3, I_AVG, IN, V1, V2, V3, VPH_AVG, V12, V23, V31, VL_AVG, P1, P2, P3, PTOT, Q1, Q2, Q3, QTOT, S1, S2, S3, STOT, PF1, PF2, PF3, PFT, FREQUENCY, U_UNB, I_UNB".

**Short:** In this type below header is created inside of text file, some items is omitted in this type for increasing of data transfer speed, but the omitted items can be calculate with available items. For example user can calculate I_AVG by this formula: I_AVG = (I1+I2+I3)/3,
This formula easily could be done by EXEL. Also like as above type you can use the unit during the transfer.
"YEAR, MONTH, DAY, HOUR, MINUTE, SECOND, I1, I2, I3, IN, V1, V2, V3, P1, P2, P3, Q1, Q2, Q3, S1, S2, S3,PF1, PF2, PF3, FREQUENCY".

**Short and Fast:** the third type header is like Short but for more increasing of data transfer speed in this type you can't use other functions of unit and the unit only focus to transfer data to USB stick. This type has fastest transfer speed.

Note1: unit create a folder with name equal unit ID, then inside of this folder create a text file that its name is YY_MM_DD.TXT to display time of unit data reading.

Note2: In ZMP+ another text file with the name of MIN_MAX.TXT that include recorded minimum and maximum values of parameters created.

Note3: recorded parameters on unit transferred into a text file like a table on stick and arranged with time of occurrences.

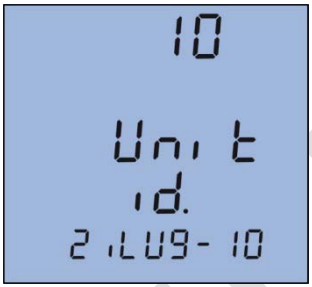



Fig 3.41 Unit ID setting page

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.
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-10.

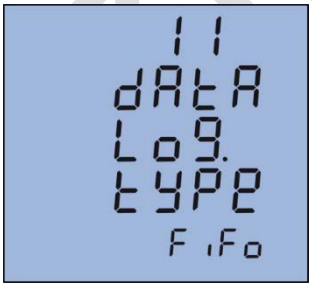



Fig 3.42 Type of logger setting page

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 type 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 to internal memory be full after that unit stop recording. Press V key for acknowledgment and going to the next setting page.


Fig 3.43 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.

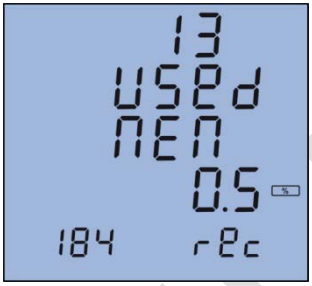



Fig 3.44 Internal memory status

The thirteenth screen: Display the internal memory status. This page display 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. 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.

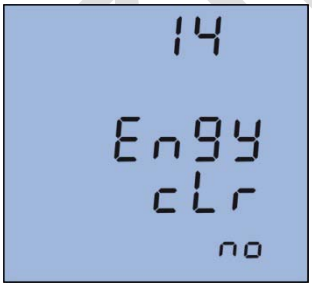



Fig 3.45 Energy values clear page

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

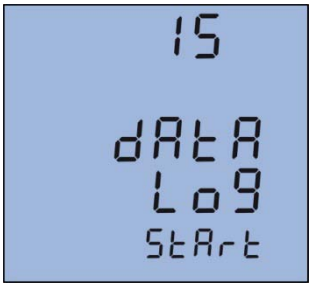



Fig 3.46 Logger starts and stop page

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.

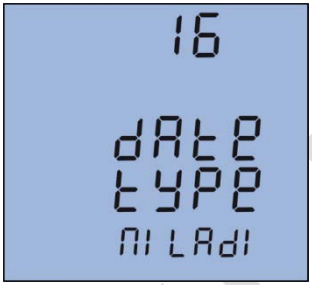



Fig 3.47 Type of date setting page

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.

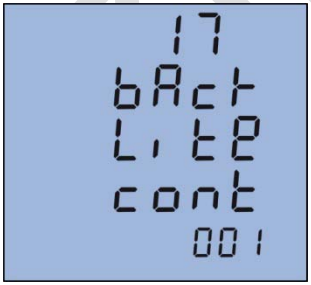



Fig 3.48 Backlight ON time

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 3.48, 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.

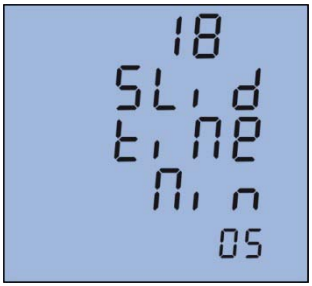



Fig 3.49 Sliding window time

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 3.49, the sliding window time is 5 Minute.

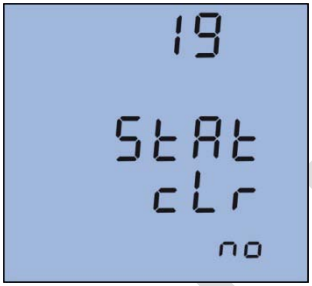
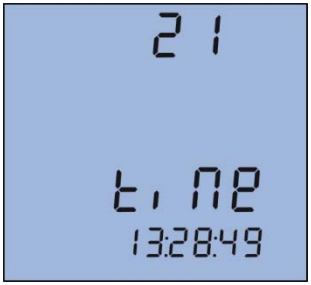



Fig 3.50 Clearance of MAX and MIN

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 3.50, 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.

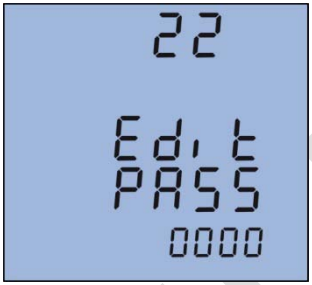

Fig 3.51 System date setting

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 3.51, the setting date is Jan. 18, 2014.



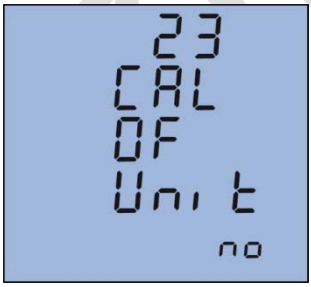

The twenty first screen: system time setting page the display format is HH:MM:SS
HH: 0 to 23
MM: 0 to 59
SS: 0 to 59
As in fig 3.52, the system time is 13:28:49
Press V key, go to next setting page.

Fig 3.52 System time setting



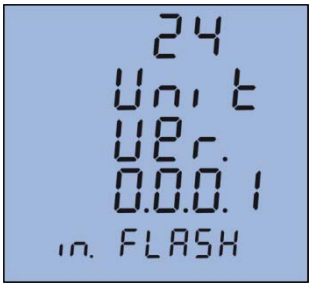

The twenty second screen: Access code setting page. The access code can be changed in this page. It is important to remember the new access code. As in fig 3.53, the access code is 0000. Press the V key and let the access code be stored in ZMP.

Fig 3.53 Access code setting




The twenty third screen: Calibration of unit. Through this page you can re-calibrate of unit. These processes can be done in two ways SIMPLE and ADVANCED.
The SIMPLE process have less complicity and can be done fast but ADVANCED is more accurate and need more time.
For entering calibration menu you need access code that differs from original access code.
You need multifunction calibrator to do it.

Fig 3.54 Recalibrate of unit




The twenty fourth screen: Update of unit software through USB port. The company releases new software for upgrade and solve of unit problems as needed. You can get these updates file from company web page or by email.
Update files name are in format of AKUPXXXX.ENC that XXXX shows version of update file.

Fig 3.55 Unit software upgrade page

For upgrade you should done below steps:
1. Copy update file to flash stick.
2. Go to setting menu by pressing H and V buttons simultaneously
3. Go to twenty fourth screen page
4. Now insert stick to USB port
5. Unit display current version of unit software and version of software on stick memory
6. In this step if you press V button you accept to do update process and otherwise you can exit by pressing H and V button simultaneously.
7. If you press V key unit check update file on stick and if it was true unit start updating process.
8. Wait to finish this process and restart of unit.

## 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 | 0x84 | 0x65 |

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 | 0x0A | 0x92 |

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 0x0190H.

| Slave address | Function | Register Address Hi | Register Address Lo | Registers Value Hi | Registers Value Lo | CRC Lo | CRC Hi |
|---|---|---|---|---|---|---|---|
| 0x01 | 0x06 | 0x01 | 0x90 | 0x04 | 0xE2 | 0x0A | 0x92 |

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 | 0x90 | 0x04 | 0xE2 | 0x0A | 0x92 |

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. CT_P data address is 0x0190H.

| 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 | 0x90 | 0x04 | 0xE2 | | | | | | 0x0A | 0x92 |

Table 4.10 Preset CT_P

**Response**

The normal response is an echo of the request, returned after the register contents have been 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 | 0x90 | 0x04 | 0xE2 | 0x0A | 0x92 |

Table 4.11 writes single register Response Message

# Address table of ZMP

## Basic Analog measurements

| Address | Parameter | Range | Object Type | Type of access |
|---|---|---|---|---|
| 0x0000 | Frequency (F) | 4500~6500 | word | R |
| 0x0001 | Phase Voltage V1 | 0~65535 | word | R |
| 0x0002 | Phase Voltage V2 | 0~65535 | word | R |
| 0x0003 | Phase Voltage V3 | 0~65535 | word | R |
| 0x0004 | Average Phase Voltage Vlnavg | 0~65535 | word | R |
| 0x0005 | Line Voltage V12 | 0~65535 | word | R |
| 0x0006 | Line Voltage V23 | 0~65535 | word | R |
| 0x0007 | Line Voltage V31 | 0~65535 | word | R |
| 0x0008 | Average Line Voltage Vllavg | 0~65535 | word | R |
| 0x0009 | Current I1 | 0~65535 | word | R |
| 0x000A | Current I2 | 0~65535 | word | R |
| 0x000B | Current I3 | 0~65535 | word | R |
| 0x000C | Average Current Iavg | 0~65535 | word | R |
| 0x000D | Neutral Line Current In | 0~65535 | word | R |
| 0x000E | Phase Power P1 | -32768~32767 | word | R |
| 0x000F | Phase Power P2 | -32768~32767 | word | R |
| 0x0010 | Phase Power P3 | -32768~32767 | word | R |
| 0x0011 | System Power Ptot | -32768~32767 | word | R |
| 0x0012 | Phase Reactive Power Q1 | -32768~32767 | word | R |
| 0x0013 | Phase Reactive Power Q2 | -32768~32767 | word | R |
| 0x0014 | Phase Reactive Power Q3 | -32768~32767 | word | R |
| 0x0015 | System Reactive Power Qtot | -32768~32767 | word | R |
| 0x0016 | Phase Apparent Power S1 | 0~65535 | word | R |
| 0x0017 | Phase Apparent Power S2 | 0~65535 | word | R |
| 0x0018 | Phase Apparent Power S3 | 0~65535 | word | R |
| 0x0019 | System Apparent Power Stot | 0~65535 | word | R |
| 0x001A | Phase Power Factor PF1 | -1000~1000 | word | R |
| 0x001B | Phase Power Factor PF2 | -1000~1000 | word | R |
| 0x001C | Phase Power Factor PF3 | -1000~1000 | word | R |
| 0x001D | System Power Factor PFtot | -1000~1000 | word | R |
| 0x001E | Voltage Unbalance Factor U_unbl | 0~3000 | word | R |
| 0x001F | Current Unbalance Factor I_unbl | 0~3000 | word | R |
| 0x0020 | Load Type RT (L/C/R) | 76/67/82 | word | R |
| 0x0021 | Power Demand Dmd_Ptot | -32768~32767 | word | R |
| 0x0022 | Reactive power Demand Dmd_Qtot | -32768~32767 | word | R |
| 0x0023 | Apparent Power Demand Dmd_Stot | 0~65535 | word | R |
| 0x0024 | Import Energy Ep_imp (hi word) | 0~999999999 | Double word | R |
| 0x0025 | Import Energy Ep_imp (lo word) | | | R |
| 0x0026 | Export Energy Ep_exp (hi word) | 0~999999999 | Double word | R |
| 0x0027 | Export Energy Ep_exp (lo word) | | | R |
| 0x0028 | Import Reactive Energy Eq_imp (hi word) | 0~999999999 | Double word | R |
| 0x0029 | Import Reactive Energy Eq_imp (lo word) | | | R |
| 0x002A | Export Reactive Energy Eq_exp (hi word) | 0~999999999 | Double word | R |
| 0x002B | Export Reactive Energy Eq_exp (lo word) | | | R |
| 0x002C | Absolute Sum of Energy Ep_total (hi word) | 0~999999999 | Double word | R |
| 0x002D | Absolute Sum of Energy Ep_total (lo word) | | | R |
| 0x002E | Algebra Sum of Energy Ep_net (hi word) | 0~999999999 | Double word | R |
| 0x002F | Algebra Sum of Energy Ep_net (lo word) | | | R |
| 0x0030 | Absolute Sum of Energy Eq_total (hi word) | 0~999999999 | Double word | R |
| 0x0031 | Absolute Sum of Energy Eq_total (lo word) | | | R |
| 0x0032 | Algebra Sum of Energy Eq_net (hi word) | 0~999999999 | Double | R |

| | | | | | |
|---|---|---|---|---|---|
| 0x0033 | Algebra Sum of Energy Eq_net (lo word) | | | word | R |
| | **Maximum Records*** | | | | |
| 0x0034 | V1_max | | 0~65535 | word | R |
| 0x0035 | Time Stamp of Va_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0036 | | month | 1~12 | word | R |
| 0x0037 | | day | 1~31 | word | R |
| 0x0038 | | hour | 0~23 | word | R |
| 0x0039 | | minute | 0~59 | word | R |
| 0x003A | | second | 0~59 | word | R |
| 0x003B | V2_max | | 0~65535 | word | R |
| 0x003C | Time Stamp of Vb_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x003D | | month | 1~12 | word | R |
| 0x003E | | day | 1~31 | word | R |
| 0x003F | | hour | 0~23 | word | R |
| 0x0040 | | minute | 0~59 | word | R |
| 0x0041 | | second | 0~59 | word | R |
| 0x0042 | V3_max | | 0~65535 | word | R |
| 0x0043 | Time Stamp of Vc_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0044 | | month | 1~12 | word | R |
| 0x0045 | | day | 1~31 | word | R |
| 0x0046 | | hour | 0~23 | word | R |
| 0x0047 | | minute | 0~59 | word | R |
| 0x0048 | | second | 0~59 | word | R |
| 0x0049 | V12_max | | 0~65535 | word | R |
| 0x004A | Time Stamp of Vab_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x004B | | month | 1~12 | word | R |
| 0x004C | | day | 1~31 | word | R |
| 0x004D | | hour | 0~23 | word | R |
| 0x004E | | minute | 0~59 | word | R |
| 0x004F | | second | 0~59 | word | R |
| 0x0050 | V23_max | | 0~65535 | word | R |
| 0x0051 | Time Stamp of Vbc_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0052 | | month | 1~12 | word | R |
| 0x0053 | | day | 1~31 | word | R |
| 0x0054 | | hour | 0~23 | word | R |
| 0x0055 | | minute | 0~59 | word | R |
| 0x0056 | | second | 0~59 | word | R |
| 0x0057 | V31_max | | 0~65535 | word | R |
| 0x0058 | Time Stamp of Vca_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0059 | | month | 1~12 | word | R |
| 0x005A | | day | 1~31 | word | R |
| 0x005B | | hour | 0~23 | word | R |
| 0x005C | | minute | 0~59 | word | R |
| 0x005D | | second | 0~59 | word | R |
| 0x005E | I1_max | | 0~65535 | word | R |
| 0x005F | Time Stamp of Ia_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0060 | | month | 1~12 | word | R |
| 0x0061 | | day | 1~31 | word | R |
| 0x0062 | | hour | 0~23 | word | R |
| 0x0063 | | minute | 0~59 | word | R |
| 0x0064 | | second | 0~59 | word | R |
| 0x0065 | I2_max | | 0~65535 | word | R |
| 0x0066 | Time Stamp of Ib_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0067 | | month | 1~12 | word | R |
| 0x0068 | | day | 1~31 | word | R |
| 0x0069 | | hour | 0~23 | word | R |
| 0x006A | | minute | 0~59 | word | R |

| | | | | | |
|---|---|---|---|---|---|
| 0x006B | | second | 0~59 | word | R |
| 0x006C | I3_max | | 0~65535 | word | R |
| 0x006D | Time Stamp of Ic_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x006E | | month | 1~12 | word | R |
| 0x006F | | day | 1~31 | word | R |
| 0x0070 | | hour | 0~23 | word | R |
| 0x0071 | | minute | 0~59 | word | R |
| 0x0072 | | second | 0~59 | word | R |
| 0x0073 | Ptot_max | | -32768~32767 | word | R |
| 0x0074 | Time Stamp of Ptot_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0075 | | month | 1~12 | word | R |
| 0x0076 | | day | 1~31 | word | R |
| 0x0077 | | hour | 0~23 | word | R |
| 0x0078 | | minute | 0~59 | word | R |
| 0x0079 | | second | 0~59 | word | R |
| 0x007A | Qtot_max | | -32768~32767 | word | R |
| 0x007B | Time Stamp of Qtot_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x007C | | month | 1~12 | word | R |
| 0x007D | | day | 1~31 | word | R |
| 0x007E | | hour | 0~23 | word | R |
| 0x007F | | minute | 0~59 | word | R |
| 0x0080 | | second | 0~59 | word | R |
| 0x0081 | Stot_max | | 0~65535 | word | R |
| 0x0082 | Time Stamp of Stot_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x0083 | | month | 1~12 | word | R |
| 0x0084 | | day | 1~31 | word | R |
| 0x0085 | | hour | 0~23 | word | R |
| 0x0086 | | minute | 0~59 | word | R |
| 0x0087 | | second | 0~59 | word | R |
| 0x0088 | PFtot_max | | -1000~1000 | word | R |
| 0x0089 | Time Stamp of PFtot_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x008A | | month | 1~12 | word | R |
| 0x008B | | day | 1~31 | word | R |
| 0x008C | | hour | 0~23 | word | R |
| 0x008D | | minute | 0~59 | word | R |
| 0x008E | | second | 0~59 | word | R |
| 0x008F | Fr_max | | 4500~6500 | word | R |
| 0x0090 | Time Stamp of Fr_max | year | 2000~2099 | word | R |
| 0x0091 | | month | 1~12 | word | R |
| 0x0092 | | day | 1~31 | word | R |
| 0x0093 | | hour | 0~23 | word | R |
| 0x0094 | | minute | 0~59 | word | R |
| 0x0095 | | second | 0~59 | word | R |
| 0x0096 | Dmd_Ptot_max | | -32768~32767 | word | R |
| 0x0097 | Time Stamp of | year | 2014~2034 or 1392~1412 | word | R |
| 0x0098 | Dmd_Ptot_max | month | 1~12 | word | R |
| 0x0099 | | day | 1~31 | word | R |
| 0x009A | | hour | 0~23 | word | R |
| 0x009B | | minute | 0~59 | word | R |
| 0x009C | | second | 0~59 | word | R |
| 0x009D | Dmd_Qtot_max | | -32768~32767 | word | R |
| 0x009E | Time Stamp of | year | 2014~2034 or 1392~1412 | word | R |
| 0x009F | Dmd_Qtot_max | month | 1~12 | word | R |
| 0x00A0 | | day | 1~31 | word | R |
| 0x00A1 | | hour | 0~23 | word | R |
| 0x00A2 | | minute | 0~59 | word | R |
| 0x00A3 | | second | 0~59 | word | R |

| | | | | | |
|---|---|---|---|---|---|
| 0x00A4 | Dmd_Stot_max | | 0~65535 | word | R |
| 0x00A5 | Time Stamp of Dmd_Stot_max | year | 2014~2034 or 1392~1412 | word | R |
| 0x00A6 | | month | 1~12 | word | R |
| 0x00A7 | | day | 1~31 | word | R |
| 0x00A8 | | hour | 0~23 | word | R |
| 0x00A9 | | minute | 0~59 | word | R |
| 0x00AA | | second | 0~59 | word | R |
| **Minimum Records*** | | | | | |
| 0x00AB | V1_min | | 0~65535 | word | R |
| 0x00AC | Time Stamp of Va_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00AD | | month | 1~12 | word | R |
| 0x00AE | | day | 1~31 | word | R |
| 0x00AF | | hour | 0~23 | word | R |
| 0x00B0 | | minute | 0~59 | word | R |
| 0x00B1 | | second | 0~59 | word | R |
| 0x00B2 | V2_min | | 0~65535 | word | R |
| 0x00B3 | Time Stamp of Vb_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00B4 | | month | 1~12 | word | R |
| 0x00B5 | | day | 1~31 | word | R |
| 0x00B6 | | hour | 0~23 | word | R |
| 0x00B7 | | minute | 0~59 | word | R |
| 0x00B8 | | second | 0~59 | word | R |
| 0x00B9 | V3_min | | 0~65535 | word | R |
| 0x00BA | Time Stamp of Vc_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00BB | | month | 1~12 | word | R |
| 0x00BC | | day | 1~31 | word | R |
| 0x00BD | | hour | 0~23 | word | R |
| 0x00BE | | minute | 0~59 | word | R |
| 0x00BF | | second | 0~59 | word | R |
| 0x00C0 | V12_min | | 0~65535 | word | R |
| 0x00C1 | Time Stamp of Vab_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00C2 | | month | 1~12 | word | R |
| 0x00C3 | | day | 1~31 | word | R |
| 0x00C4 | | hour | 0~23 | word | R |
| 0x00C5 | | minute | 0~59 | word | R |
| 0x00C6 | | second | 0~59 | word | R |
| 0x00C7 | V23_min | | 0~65535 | word | R |
| 0x00C8 | Time Stamp of Vbc_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00C9 | | month | 1~12 | word | R |
| 0x00CA | | day | 1~31 | word | R |
| 0x00CB | | hour | 0~23 | word | R |
| 0x00CC | | minute | 0~59 | word | R |
| 0x00CD | | second | 0~59 | word | R |
| 0x00CE | V31_min | | 0~65535 | word | R |
| 0x00CF | Time Stamp of Vca_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00D0 | | month | 1~12 | word | R |
| 0x00D1 | | day | 1~31 | word | R |
| 0x00D2 | | hour | 0~23 | word | R |
| 0x00D3 | | minute | 0~59 | word | R |
| 0x00D4 | | second | 0~59 | word | R |
| 0x00D5 | I1_min | | 0~65535 | word | R |
| 0x00D6 | Time Stamp of Ia_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00D7 | | month | 1~12 | word | R |
| 0x00D8 | | day | 1~31 | word | R |
| 0x00D9 | | hour | 0~23 | word | R |
| 0x00DA | | minute | 0~59 | word | R |
| 0x00DB | | second | 0~59 | word | R |

| | | | | | |
|---|---|---|---|---|---|
| 0x00DC | I2_min | | 0~65535 | word | R |
| 0x00DD | Time Stamp of Ib_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00DE | | month | 1~12 | word | R |
| 0x00DF | | day | 1~31 | word | R |
| 0x00E0 | | hour | 0~23 | word | R |
| 0x00E1 | | minute | 0~59 | word | R |
| 0x00E2 | | second | 0~59 | word | R |
| 0x00E3 | I3_min | | 0~65535 | word | R |
| 0x00E4 | Time Stamp of Ic_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00E5 | | month | 1~12 | word | R |
| 0x00E6 | | day | 1~31 | word | R |
| 0x00E7 | | hour | 0~23 | word | R |
| 0x00E8 | | minute | 0~59 | word | R |
| 0x00E9 | | second | 0~59 | word | R |
| 0x00EA | Ptot_min | | -32768~32767 | word | R |
| 0x00EB | Time Stamp of Ptot_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00EC | | month | 1~12 | word | R |
| 0x00ED | | day | 1~31 | word | R |
| 0x00EE | | hour | 0~23 | word | R |
| 0x00EF | | minute | 0~59 | word | R |
| 0x00F0 | | second | 0~59 | word | R |
| 0x00F1 | Qtot_min | | -32768~32767 | word | R |
| 0x00F2 | Time Stamp of Qtot_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00F3 | | month | 1~12 | word | R |
| 0x00F4 | | day | 1~31 | word | R |
| 0x00F5 | | hour | 0~23 | word | R |
| 0x00F6 | | minute | 0~59 | word | R |
| 0x00F7 | | second | 0~59 | word | R |
| 0x00F8 | Stot_min | | 0~65535 | word | R |
| 0x00F9 | Time Stamp of Stot_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x00FA | | month | 1~12 | word | R |
| 0x00FB | | day | 1~31 | word | R |
| 0x00FC | | hour | 0~23 | word | R |
| 0x00FD | | minute | 0~59 | word | R |
| 0x00FE | | second | 0~59 | word | R |
| 0x00FF | PFtot_min | | -1000~1000 | word | R |
| 0x0100 | Time Stamp of PFtot_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x0101 | | month | 1~12 | word | R |
| 0x0102 | | day | 1~31 | word | R |
| 0x0103 | | hour | 0~23 | word | R |
| 0x0104 | | minute | 0~59 | word | R |
| 0x0105 | | second | 0~59 | word | R |
| 0x0106 | Fr_min | | 4500~6500 | word | R |
| 0x0107 | Time Stamp of Fr_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x0108 | | month | 1~12 | word | R |
| 0x0109 | | day | 1~31 | word | R |
| 0x010A | | hour | 0~23 | word | R |
| 0x010B | | minute | 0~59 | word | R |
| 0x010C | | second | 0~59 | word | R |
| 0x010D | Dmd_Ptot_min | | -32768~32767 | word | R |
| 0x010E | Time Stamp of Dmd_Ptot_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x010F | | month | 1~12 | word | R |
| 0x0110 | | day | 1~31 | word | R |
| 0x0111 | | hour | 0~23 | word | R |
| 0x0112 | | minute | 0~59 | word | R |
| 0x0113 | | second | 0~59 | word | R |
| 0x0114 | Dmd_Qtot_min | | -32768~32767 | word | R |

| | | | | | |
|---|---|---|---|---|---|
| 0x0115 | Time Stamp of Dmd_Qtot_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x0116 | | month | 1~12 | word | R |
| 0x0117 | | day | 1~31 | word | R |
| 0x0118 | | hour | 0~23 | word | R |
| 0x0119 | | minute | 0~59 | word | R |
| 0x011A | | second | 0~59 | word | R |
| 0x011B | Dmd_Stot_min | | 0~65535 | word | R |
| 0x011C | Time Stamp of Dmd_Stot_min | year | 2014~2034 or 1392~1412 | word | R |
| 0x011D | | month | 1~12 | word | R |
| 0x011E | | day | 1~31 | word | R |
| 0x011F | | hour | 0~23 | word | R |
| 0x0120 | | minute | 0~59 | word | R |
| 0x0121 | | second | 0~59 | word | R |
| 0x0122 | Phase B (phase angle between Voltage B and Voltage A) | | 0~360 | word | R |
| 0x0123 | Phase C (phase angle between Voltage C and Voltage A) | | 0~360 | word | R |
| 0x0124 | Temperature (1°C resolution) | | 0~100 | word | R |
| 0x0125 | Firmware version | | 0001~9999 | word | R |
| 0x0126 | Current page number | | 0~65535 | word | R |
| 0x0127 | Internal flash memory overflow (overflow occure:1) | | 0~1 | word | R |
| 0x0128 | Main password | | 0000~9999 | word | R/W |
| 0x0129 | Calibration password | | 0000~9999 | word | R/W |
| 0x012A | Slave address | | 1~247 | word | R/W |
| 0x012B | Baud rate (1200-2400-4800-9600-19200-38400bps) | | 1200~38400 | word | R/W |
| 0x012C | Number of ct | | 3~4 | word | R/W |
| 0x012D | PT primary (hi word) | | 100~400000 | Double word | R/W |
| 0x012E | PT primary (lo word) | | | | |
| 0x012F | PT secondary | | 100~400 | word | R/W |
| 0x0130 | CT primary | | 5~8000 | word | R/W |
| 0x0131 | CT secondary | | 1 or 5 | word | R/W |
| 0x0132 | Light time for LCD backlight (minute) | | 0~120 | word | R/W |
| 0x0133 | Slide time for demand measuring (minute) | | 1~30 | word | R/W |
| 0x0134 | Sample time for logging (second) | | 1~900 | word | R/W |
| 0x0135 | Type of date (shamsi:0 and miladi:1) | | 0 or 1 | word | R/W |
| 0x0136 | Type of logging ( FIFO:0 and FILL and HOLD:1) | | 0 or 1 | word | R/W |
| 0x0137 | Status of logger (START: 1 and STOP: 0) | | 0 or 1 | word | R/W |
| 0x0138 | Time out value for Modbus communication (ms) | | 20~2500 | word | R/W |
| 0x0139 | Year | | 2014~2034 or 1392~1412 | word | R/W |
| 0x013A | Month | | 1~12 | word | R/W |
| 0x013B | Day | | 1~31 | word | R/W |
| 0x013C | Hour | | 0~23 | word | R/W |
| 0x013D | Minute | | 0~59 | word | R/W |
| 0x013E | Second | | 0~59 | word | R/W |
| 0x013F | Unit ID letter(8) | | A~Z and 0~9 | word | R/W |
| 0x0140 | Unit ID letter(7) | | A~Z and 0~9 | word | R/W |
| 0x0141 | Unit ID letter(6) | | A~Z and 0~9 | word | R/W |
| 0x0142 | Unit ID letter(5) | | A~Z and 0~9 | word | R/W |
| 0x0143 | Unit ID letter(4) | | A~Z and 0~9 | word | R/W |
| 0x0144 | Unit ID letter(3) | | A~Z and 0~9 | word | R/W |
| 0x0145 | Unit ID letter(2) | | A~Z and 0~9 | word | R/W |
| 0x0146 | Unit ID letter(1) | | A~Z and 0~9 | word | R/W |
| 0x0147 | Type of reading logged file(shortandfast:0 – short:1 -long:2) | | 0 or 1 or 2 | word | R/W |
| 0x0148 | USB port status (not available:0 available:1) | | 0 or 1 | word | R/W |
| 0x0149 | Internal flash status (not available:0 available:1) | | 0 or 1 | word | R/W |
| 0x014A | RTC status (not available:0 available:1) | | 0 or 1 | word | R/W |
| 0x014B | Flash stick status (not available:0 available:1 saving:2 saved:3 no data:4) | | 0~4 | 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,<br>V12, V23, V31,<br>Vllavg, Vlnavg | U = Rx×(PT_P/PT_S)/10 | 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/1000)×100% | % |
| Energy<br>Ep_imp, Ep_exp, Ep_total, Ep_net | Ep = Rx / 10 | Kwh |
| Reactive Energy<br>Eq_imp, Eq_exp, Eq_total, Eq_net | Eq = Rx / 10 | Kvarh |
| THD | THD=Rx / 10000×100% | NA |

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.

| First record | Second record | Third record | Fourth record |
|---|---|---|---|
| Year(hi byte) | Year(hi byte) | Year(hi byte) | Year(hi byte) |
| Year(lo byte) | Year(lo byte) | Year(lo byte) | Year(lo byte) |
| Month | Month | Month | Month |
| Day | Day | Day | Day |
| Hour | Hour | Hour | Hour |
| Minute | Minute | Minute | Minute |
| Second | Second | Second | Second |
| I1(hi byte) | I1(hi byte) | I1(hi byte) | I1(hi byte) |
| I1(lo byte) | I1(lo byte) | I1(lo byte) | I1(lo byte) |
| I2(hi byte) | I2(hi byte) | I2(hi byte) | I2(hi byte) |
| I2(lo byte) | I2(lo byte) | I2(lo byte) | I2(lo byte) |
| I3(hi byte) | I3(hi byte) | I3(hi byte) | I3(hi byte) |
| I3(lo byte) | I3(lo byte) | I3(lo byte) | I3(lo byte) |
| In(hi byte) | In(hi byte) | In(hi byte) | In(hi byte) |
| In(lo byte) | In(lo byte) | In(lo byte) | In(lo byte) |
| V1(hi byte) | V1(hi byte) | V1(hi byte) | V1(hi byte) |
| V1(lo byte) | V1(lo byte) | V1(lo byte) | V1(lo byte) |
| V2(hi byte) | V2(hi byte) | V2(hi byte) | V2(hi byte) |
| V2(lo byte) | V2(lo byte) | V2(lo byte) | V2(lo byte) |
| V3(hi byte) | V3(hi byte) | V3(hi byte) | V3(hi byte) |
| V3(lo byte) | V3(lo byte) | V3(lo byte) | V3(lo byte) |
| P1(hi byte) | P1(hi byte) | P1(hi byte) | P1(hi byte) |
| P1(lo byte) | P1(lo byte) | P1(lo byte) | P1(lo byte) |
| P2(hi byte) | P2(hi byte) | P2(hi byte) | P2(hi byte) |
| P2(lo byte) | P2(lo byte) | P2(lo byte) | P2(lo byte) |
| P3(hi byte) | P3(hi byte) | P3(hi byte) | P3(hi byte) |
| P3(lo byte) | P3(lo byte) | P3(lo byte) | P3(lo byte) |
| Ptot(hi byte) | Ptot(hi byte) | Ptot(hi byte) | Ptot(hi byte) |
| Ptot(lo byte) | Ptot(lo byte) | Ptot(lo byte) | Ptot(lo byte) |
| Q1(hi byte) | Q1(hi byte) | Q1(hi byte) | Q1(hi byte) |
| Q1(lo byte) | Q1(lo byte) | Q1(lo byte) | Q1(lo byte) |
| Q2(hi byte) | Q2(hi byte) | Q2(hi byte) | Q2(hi byte) |
| Q2(lo byte) | Q2(lo byte) | Q2(lo byte) | Q2(lo byte) |
| Q3(hi byte) | Q3(hi byte) | Q3(hi byte) | Q3(hi byte) |
| Q3(lo byte) | Q3(lo byte) | Q3(lo byte) | Q3(lo byte) |
| Qtot(hi byte) | Qtot(hi byte) | Qtot(hi byte) | Qtot(hi byte) |
| Qtot(lo byte) | Qtot(lo byte) | Qtot(lo byte) | Qtot(lo byte) |
| S1(hi byte) | S1(hi byte) | S1(hi byte) | S1(hi byte) |
| S1(lo byte) | S1(lo byte) | S1(lo byte) | S1(lo byte) |
| S2(hi byte) | S2(hi byte) | S2(hi byte) | S2(hi byte) |
| S2(lo byte) | S2(lo byte) | S2(lo byte) | S2(lo byte) |
| S3(hi byte) | S3(hi byte) | S3(hi byte) | S3(hi byte) |
| S3(lo byte) | S3(lo byte) | S3(lo byte) | S3(lo byte) |
| Stot(hi byte) | Stot(hi byte) | Stot(hi byte) | Stot(hi byte) |
| Stot(lo byte) | Stot(lo byte) | Stot(lo byte) | Stot(lo byte) |
| PF1(hi byte) | PF1(hi byte) | PF1(hi byte) | PF1(hi byte) |
| PF1(lo byte) | PF1(lo byte) | PF1(lo byte) | PF1(lo byte) |
| PF2(hi byte) | PF2(hi byte) | PF2(hi byte) | PF2(hi byte) |
| PF2(lo byte) | PF2(lo byte) | PF2(lo byte) | PF2(lo byte) |
| PF3(hi byte) | PF3(hi byte) | PF3(hi byte) | PF3(hi byte) |
| PF3(lo byte) | PF3(lo byte) | PF3(lo byte) | PF3(lo byte) |
| PFtot(hi byte) | PFtot(hi byte) | PFtot(hi byte) | PFtot(hi byte) |
| PFtot(lo byte) | PFtot(lo byte) | PFtot(lo byte) | PFtot(lo byte) |
| Fr(hi byte) | Fr(hi byte) | Fr(hi byte) | Fr(hi byte) |
| Fr(lo byte) | Fr(lo byte) | Fr(lo byte) | Fr(lo byte) |

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<br>P_export<br>P_total<br>P_net | KWH |
| | | Reactive Energy | Q_import<br>Q_export<br>Q_total<br>Q_net | KVARH |
| | | Demand* | Demand_P<br>Demand_Q<br>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 | 1sec ~ 60min |
| | 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% overrange |
| | **secondary** | 1 A or 5 A | |
| | **Overload** | | 10A for continues<br>100A for 1 second<br>(None recurrence) |
| | **Measuring** | | True RMS |
| **Dimension** | | DIN43700 | 144x144mm or 96x96mm |

Technical Data and Specification