FU2200A POWER METER MANUAL

CONTENT

CHAPTER 1—BRIEF INTRODUCTION

What can FU2200A series do?

Powerful multi-functional digital instrument

FU2200A series multi-function digital electrical integrated monitor is designed by the advanced 32-bit MCU and high-speed mixed signal DSP technology etc. It can implement the functions like: three phase electrical parameters measurement, energy metering, power quality analysis, data logging, digital input and output, network communications and so on. It has big screen, high-resolution LCD with backlight and easy to operate.

The ideal choice of electrical SCADA system

FU2200A can be used as an instrument independently; it took place of a variety of traditional analog instrument. Also it can be used as the analog component in electricity Supervisory Control and Data Acquisition (SCADA) system, to adopt and control the remote data. Industry standard RS - 485 port, optional Ethernet network and MODBUS, SNMP protocol make the network easy and convenient. It is the ideal choice of SCADA integration system.

Energy management

FU2200A can accumulate bilateral active energy, reactive energy, the precision meet the standard of IEC60687 Class 0.5, it can provide a gate level measuring data. , It has embedded logging function for parameters max/min value and demand measuring function. Cooperating with the upper monitor and control software help users to statistic the energy consumption status and the load trend each line, implement electricity meter reading and generate all kinds of electricity reports automatically

Remote power control

FU2200A is a rich, flexible I/O measuring instrument which makes it completely qualified for Modbus RTU, and it combines the remote signaling with remote metering.

Power quality analysis (option)

Compare with the conventional meter, FU2200A introduces the digital signal processin g technology, which makes the on-line power quality analysis possible. Measure the total harmonic distortion (THD) of each voltage and current, every harmonic component (2nd-49st) and voltage unbalance and current unbalance in real time.

Trend logging

FU2200A instrument can record 2 M bytes of trend logging, and the logging capacity can extend to 16 MB; it used to record the history trend. Phase voltage, line voltage, current, active energy, reactive energy, apparent energy, power factor, frequency, three-phase imbalance, active power, reactive power, apparent power and phase all can set storage, the storage time interval 1 - 60 minutes can be set arbitrarily. There is a precise real-time clock internal, each trend record with a time scale.

Table 1.1 Main function of FU2200A series

REAL-TIME MEASUREMENT	ENERGY AND DEMAND
Phase voltage: V1, V2, V3, Vlnavg Line voltage: V12, V23, V31, Vllavg Current: I1, I2, I3, Iavg, In Active power: per phase and total active power Reactive power: per phase and total reactive power Apparent power: per phase and total apparent power Power factor: per phase and total power factor Total frequency	Four quadrant active energy: Import, Export, Total, Net Four quadrant reactive energy: Import, Export, Total, Net Four quadrant apparent energy: Import, Export, Total, Net Active, Reactive, Apparent demand
STATISTICS	**POWER QUALITY ANALYSIS**
Multiple real-time max measured values (with time stamp) Multiple real-time min measured values (with time stamp) Max Demand	Voltage unbalance Current unbalance Voltage THD (Total harmonic distortion), Odd-even harmonic distortion Voltage individual harmonics Current THD, Odd-even harmonic distortion Current individual harmonics
COMMUNICATION	**REMOTE CONTROL**
RS485 communication port Ethernet 10/100M network port(option) MODBUS RTU, SNMP communication protocol	2 digital output
TREND LOGGING	**SETTABLE LOGGING INTERVAL**
Phase voltage Line voltage Frequency Current Three-phase unbalance Active power Active energy Reactive power Reactive energy Apparent power Apparent energy Power factor Phase	Logging from 1min to 60min, interval settable
SOFTWARE ACCESSIBILITY	
4 Tariffs (DataLog) Sharp, peak, flat, valley in different season and schedule (TOU)	

FU2200A series application

Energy management system
Substation automation
Industrial automation
Community power monitoring
Distribution network automation
Intelligent building
Intelligent switchboard
Switchgear
Large UPS system

FU2200A features

Multi-function, High precision

FU2200A is a multi-functional intelligent meter with powerful functions of data gathering and processing, can measure dozens of electrics parameters, as well as the demand measurement, harmonic analysis, max/min value statistics, over value event alarm, energy accumulation and trend logging.
Voltage and Current measuring accuracy class: 0.2%
Power and Electric energy measuring accuracy class: 0.5% or 0.5s

Subcompact design, easy to install

FU2200A appearance size meets the IEC standard 92X92mm DIN (Square) shape and ANSIC39.1 standard (4 "Round) shape, the thickness of installation is only 51mm, even in the small-interval draw-out type switchgear cabinet, FU2200A can be placed steady, it adopts the self-locking type of installation, without screws, easy to install and remove.

Visual display, easy to learn and use

Wide screen, high-definition LCD display, clearly marked, direct display, easy to learn and use. All measuring parameters can be easily read by buttons, the setting parameters can be carried out by panel button, or by communication port. When the setting parameters stored in non-volatile EEPROM, it will not be lost even if the power supply is cut. Back-lit LCD can help you use in a bad light environment.

Convenient wiring

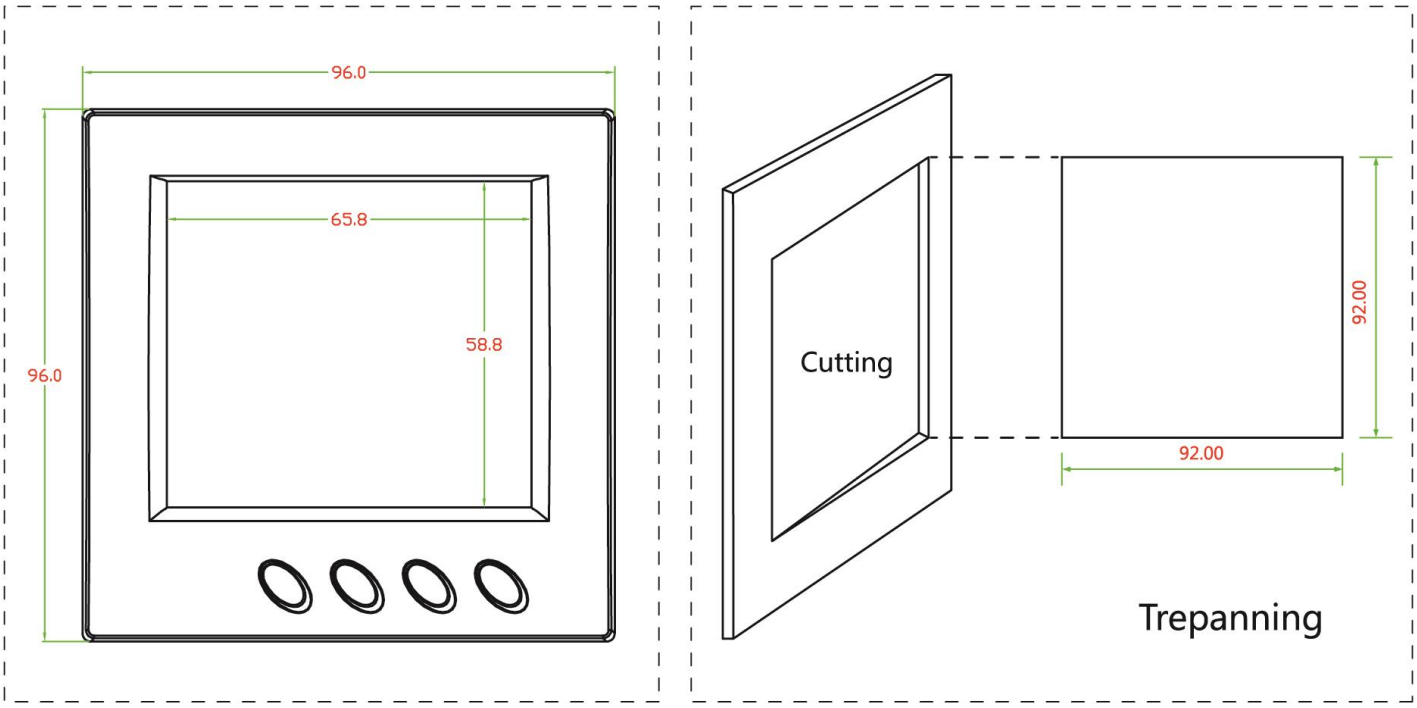
Whatever the system is high or low voltage, 3P3W or 3P4W or whatever the component numbers for voltage channel and current channel is, all conditions can choose the appropriate connection mode connecting to the meter. FU2200A meter support multiple connection mode, can cover almost all of the three-phase system, and it also can be used in single phase system.

High safety and reliability

FU2200A meter adopt many kinds of isolation and the anti-interference measures, can reliably run in high interference environments, it has passed CE certification and electromagnetic compatibility test of IEC standard.

CHAPTER 2—INSTALLATION

Dimension



Environment

Before installing the FU2200A meter, please observe the installation location of your surroundings, and confirm that meet the following conditions.

Temperature

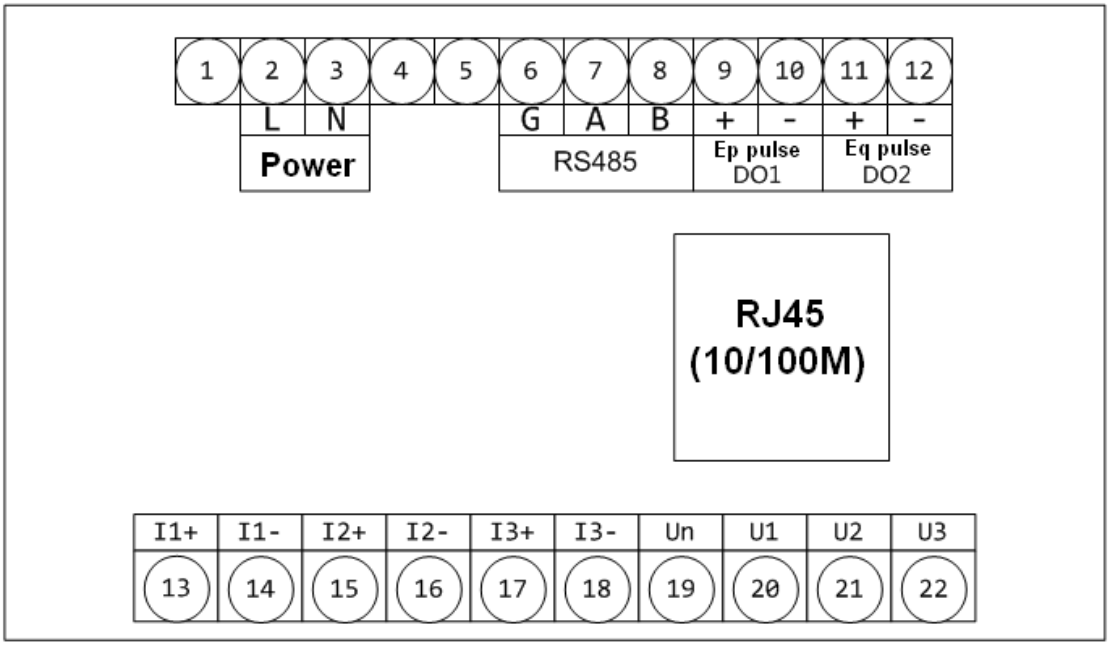
FU2200A working environment temperature: -5 to 50°C (regular), -25°C to 70°C (extension), which meet the general requirements of the users, if you need a wider temperature range, please contact the manufacturing plant. Please note that the meter work long hours at a very high or low temperatures, which would adversely affect the life.FU2200A storage temperature is -40°C to 80°C.

Humidity

FU2200A humidity environment range: 5%-95% (Without condensation).

Location

FU2200A meter should be installed in a dry, dust-free place, and avoid in the surrounding of the heat, radiation, strong interference sources.



Terminal distribution

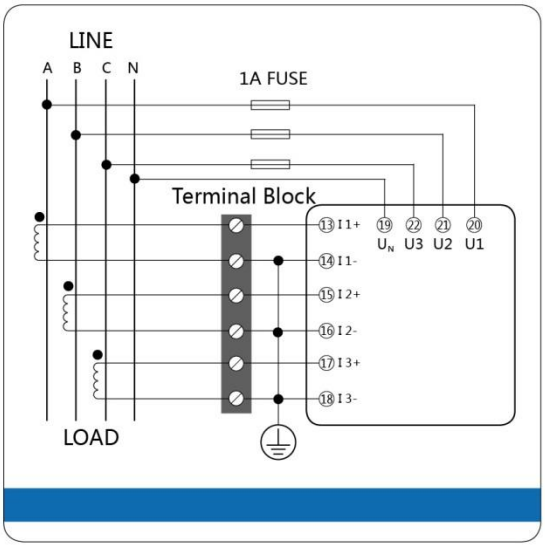
There are two terminal blocks on FU2200A backplane, this manual will use the 1,2,3 separately express the three-phase voltage, three-phase current circuit, it may also uses the A, B, C or R , S, T in other materials to represent the same meaning.

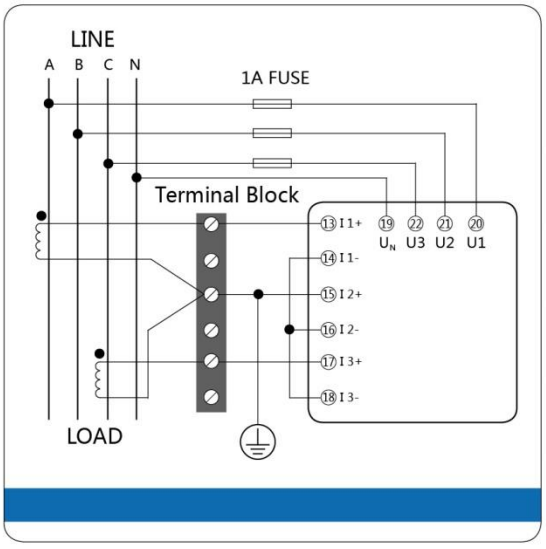
The communication, RS485 communication, 2 DO terminals: 1-12

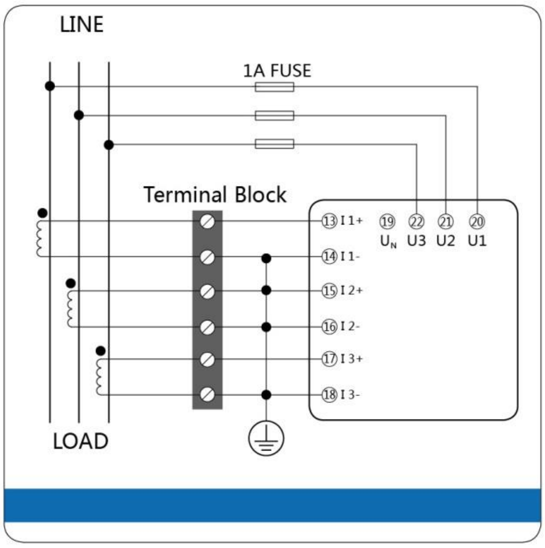
Voltage and current input terminals: 13 to 22

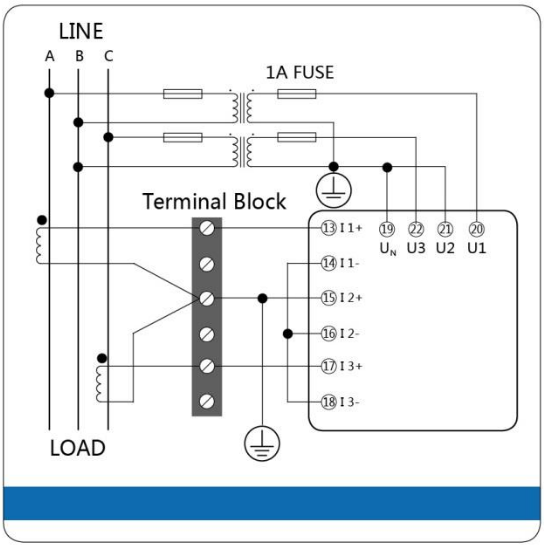
No.	Symbol	Meaning
1	NC	
2	L/DC+	Meter Power Supply
3	N/DC-	
4	NC	
5	NC	
6	485G	RS485 communication, 485G under strong interference occasion to connect the shield of communications cable
7	485A	
8	485B	
9	EP+/DO1+	Active energy pulse test output 1 digital output
10	EP-/DO1-	1 digital output
11	EQ+/DO2+	Reactive energy pulse test output 2 digital outputs
12	EQ-/DO2-	
13	I1+	A phase current I/O
14	I1-	
15	I2+	B phase current I/O
16	I2-	
17	I3+	C phase current I/O
18	I3-	
19	Un	Neutral voltage
20	U1	A phase voltage
21	U2	B phase voltage
22	U3	C phase voltage

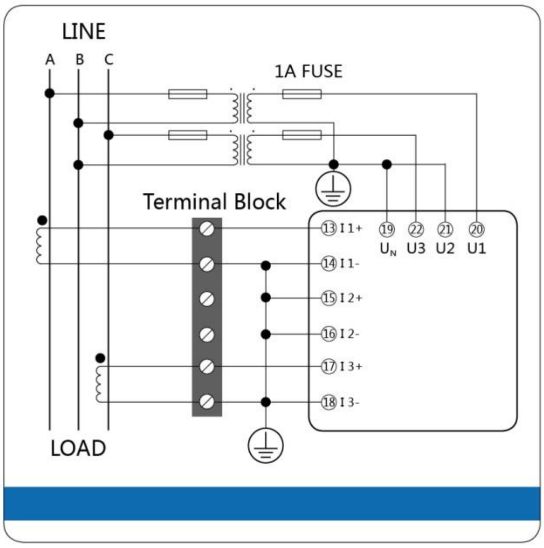
Wiring diagram

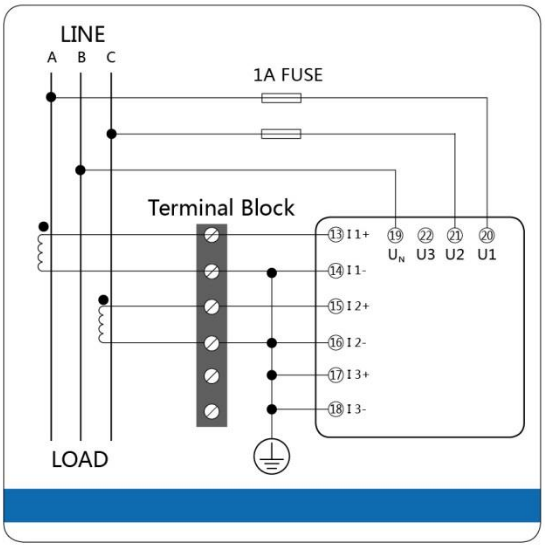


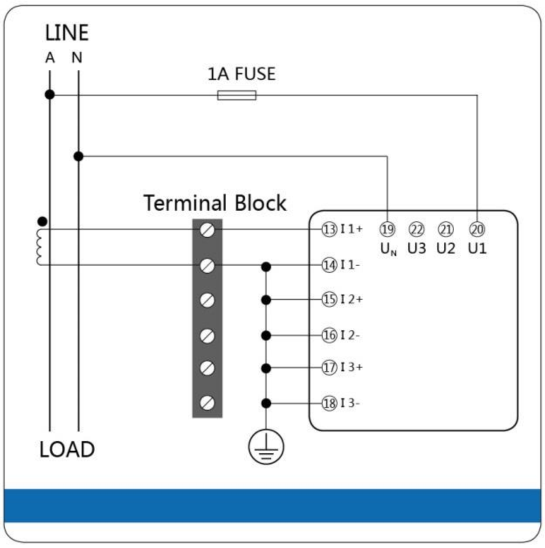



LINE
1A FUSE
Terminal Block
13 I1+
14 I1-
15 I2+
16 I2-
17 I3+
18 I3-
19 UN
22 U3
21 U2
20 U1
LOAD


LINE
A B C
1A FUSE
Terminal Block
13 I1+
14 I1-
15 I2+
16 I2-
17 I3+
18 I3-
19 UN
22 U3
21 U2
20 U1
LOAD


LINE
A B C
1A FUSE
Terminal Block
13 I1+
14 I1-
15 I2+
16 I2-
17 I3+
18 I3-
19 UN
22 U3
21 U2
20 U1
LOAD


LINE
A B C
1A FUSE
Terminal Block
13 I1+
14 I1-
15 I2+
16 I2-
17 I3+
18 I3-
19 UN
22 U3
21 U2
20 U1
LOAD


LINE
A N
1A FUSE
Terminal Block
13 I1+
14 I1-
15 I2+
16 I2-
17 I3+
18 I3-
19 UN
22 U3
21 U2
20 U1
LOAD

CHAPTER 3—MAIN FUNCTION AND TECHNICAL SPECIFICATIONS

This chapter explains FU2200A main functions and technical specifications

Functions

Real-time measurement

U1, U2, U3, Ulnavg
U12, U23, U31, Ullavg
I1, I2, I3, Iavg, In
P1, P2, P3, Psum
Q1, Q2, Q3, Qsum
S1, S2, S3, Ssum
PF1, PF2, PF3, PFsum
LCR (Nature of load)
Frequency
AngleU1, AngleU2, AngleU, AngleI1, AngleI2, AngleI3

Energy

EPimp(Input), EPexp(Output), EPtotal(Total=Input+Output), EPnet(Net=Input-Output)
EQimp(Input), EQexp(Output),EQtotal(Total=Input+Output), EQnet(Net=Input-Output)
ESimp(Input), ESexp(Output), EStotal(Total=Input+Output), ESnet(Net=Input-Output)

Demand

DemandP, DemandQ, DemandS

TOU (Time of Use)

4 Tariffs (1-Sharp, 2-Peak, 3-Flat, 4-Valley)
6 Season Schedule
6 Day Schedule Table
Day Schedule Table can be divided into 14 schedules

Max/Min value statistics

The following data record the maximum and minimum value with time stamp.
U1, U2, U3
U12, U23, U31
I1, I2, I3
Psum, Qsum, Ssum, PFsum
Frequency
DemandP, DemandQ, DemandS
Extreme can be cleared by button or communication command

Power Quality

Uunbalance, Iunbalance
Voltage and current harmonics, 2nd to 49th (option)
Voltage and current waveforms (option)
Vector (option)

Data logging

4 groups DataLog, logging space for each group is 512KB, 2MB (option); 8MB or 16MB

storage can be extended

Each group can customize data logger: Vln, Vll, I, P, Q, S, PF, Frequency, Uunbalance, Iunbalance, Demand, EP, EQ, ES, Angle, EPrate, EQrate, ESrate, which can define the logging interval and log the start time and end time.

Serial Communications

RS485, 300-38400bps, 1 start bit, 1 stop bit, 8 data bits, No parity

MODBUS-RTU

Human Machine Interface (HMI)

320 Character Type Fields STN-LCD, white blue-lit,

4 buttons

Real-time clock

RTC, travel-time automatically if the supply fails

Network communication (option)

10/100M auto adaptable, TCP/IP

MODBUS over TCP, supporting 10 connections

Web Server, supporting 5 connections

SNMP

Index

Parameters	Accuracy	Resolution	Measuring range	Show on the display
Voltage	0.2%	0.01V	0-400V	0.5-500kV
Current	0.2%	0.01mA	0-6.5A	5mA-50000A
Active power	0.5%	0.2W	0-2400W/phase	-9999MW to +9999MW
Reactive power	2%	0.2var	0-2400var/phase	-9999Mvar to +9999Mvar
Apparent power	0.5%	0.2VA	0-2400VA/phase	0-9999MVA
Active demand	0.5%	0.2W	0-2400W/phase	-9999MW to +9999MW
Reactive demand	2%	0.2var	0-2400var/phase	-9999Mvar to +9999Mvar
Apparent demand	0.5%	0.2VA	0-2400VA/phase	0 to 9999MVA
Power factor	0.005	0.0001	-1.0000-0-1.0000	-1.0000-0-1.0000
Frequency	0.01Hz	0.01Hz	45.000-65.000Hz	45.000-65.000Hz
Active energy	0.5%,0.2% (Option)	0.001kWh	0-999999.999kWh	0-99999999.9kWh
Reactive energy	2%	0.001kvarh	0-999999.999kvarh	0-99999999.9kvarh
Apparent energy	0.5%	0.001VAh	0-999999.999kVAh	0-99999999.9kVAh
Phase angle	0.1°	0.01°	0-359.99°	0-359.99°
Unbalance	2%	0.01%	0-300.00%	0-300.00%
PT ratio		1		1-10000
CT ratio		1		1-10000
Address code		1		1-253

Current inputs

Rated current: 5A/1A ac — Measuring range: 0-6A ac

Overload: 10A continuous, 50A 1Sec — Load: 0.5VA @5A RMS

Starting current: 0.1% rated value — Accuracy: 0.2%

Voltage inputs

Rated voltage: 400Vac L-N, 690Vac L-L

Input impedance: 1MΩ/phase
Overload: 1500Vac continuous,2500Vac 50/60Hz 1min
Frequency Range: 45Hz-65Hz
Accuracy: 0.2%

Energy Accuracy

Active Energy: 0.5S class, 0.2S class (Option) (IEC62053-22, GB/T17215.322-2008)
Reactive Energy: 2 class (IEC62053-23)

Power supply

Range: 100-240Vac, 50/60Hz; 100-300Vdc Power Consumption: 5W
Permissible Overload: 2000Vac, 50/60Hz, 1min

Anti-jamming capability

Surge: 2KV Burst: 2kV
Attenuated Oscillatory Wave: 4kV Electrostatic discharge: 8KV

Safety Performance

Impulse withstand voltage: 4kV Dielectric withstand: 2kV
Insulation Resistance: 10MΩ

Working Condition

Operating Temperature: -5 to 50℃ (Regular), -25℃to +70℃ (Option)
Storage temperature: -40℃ to +85℃
Humidity: 5% - 95% (Without Condensation)

CHAPTER 4—OPERATION

This chapter explains the details of HMI including search measuring data through button and the right setting for concerned parameters. Besides, this chapter clarifies measuring concerned parameters' definition and functions.

Display screen and buttons

Figure 4-1 shows all characters, fields and indications when lightening. Please note that these contents would not display all at one time except the machine starts up.

Meter display when starts up

FU2200A has four buttons in front panel, labeled as the S, E, P and VA from left to right. You can see the different measuring data display and set parameters by four button operations. The four buttons can display real-time measuring data and set parameters.

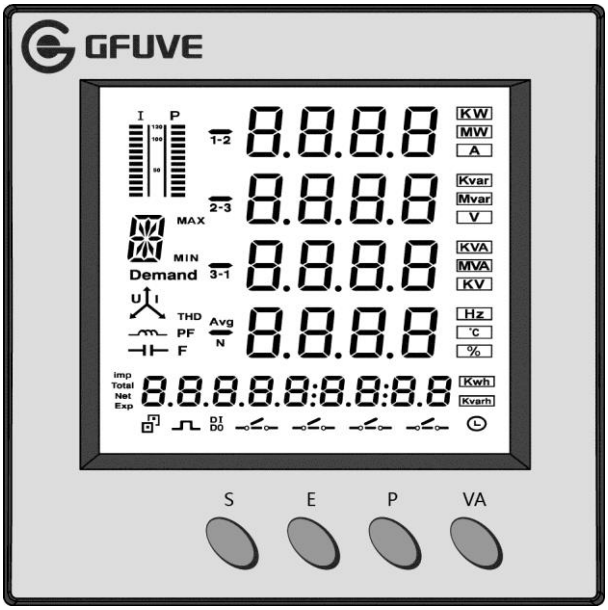
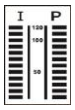
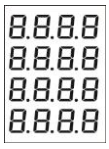
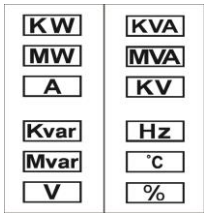


Figure 4-1

No.	Display	Description
1	 Load indication	Displays the percentage of current and apparent power to the rated current.
2	 Measuring data icon 8 characters include MAX, MIN, Demand, Character, PF, F, etc.	Letters indicate the parameters type displaying in measuring data area. Frequency: F Voltage: U Current: I Active power: P Reactive power: Q Apparent power: S Power factor: PF MAX or MIN visible: indicates the maximum(max) or minimum(min) value Demand visible: indicates Demand

No.	Display	Description
2		Avg visible: indicates the average value I attached N: indicates neutral current
3	 Three-phase unbalance icon Nature of load icon	U: indicates voltage unbalance I: indicates current unbalance Capacitance icon visible: indicates capacitive load Inductance icon visible: indicates inductive load
4	 Negative sign Phase icon	1,2,3 indicates each phase voltage 1-2,2-3,3-1 indicates line voltage Negative sign visible: power is negative
5		Display main measuring data Voltage, current, power, power factor, frequency, THD, demand, unbalance, max, min etc.
6	Unit icon 	Units of measuring data voltage: V, KV current: A active power: KW, MW reactive power: Kvar, Mvar apparent power: KVA, MVA frequency: Hz active energy: Kwh reactive energy: Kvarh percentage: %
7	 Energy mode indicating imp, Total, Net, Exp	Imp: forward energy Exp: reverse energy Total=|Imp|+|Exp| Net=|Imp|-|Exp|
8	 Energy display area One row 8 characters	Displays energy values. Also can show real time and other parameters.
9	 Communication icon (front and back computer icon)	Two signs visible: indicating no communication. Front icon visible: indicating 1st RS485 communication. Back icon visible: indicating 2nd RS485 communication or Ethernet communication is normal.
10	 Active energy pulse output icon	Pulse icon visible: indicating there is active power pulse output; Pulse icon not visible: indicating there is active power pulse output.
11	 DI,DO status indication	1-4 switches is corresponding status for DI1-DI4 respectively
12	 Clock icon	Icon visible: energy display area shows real time

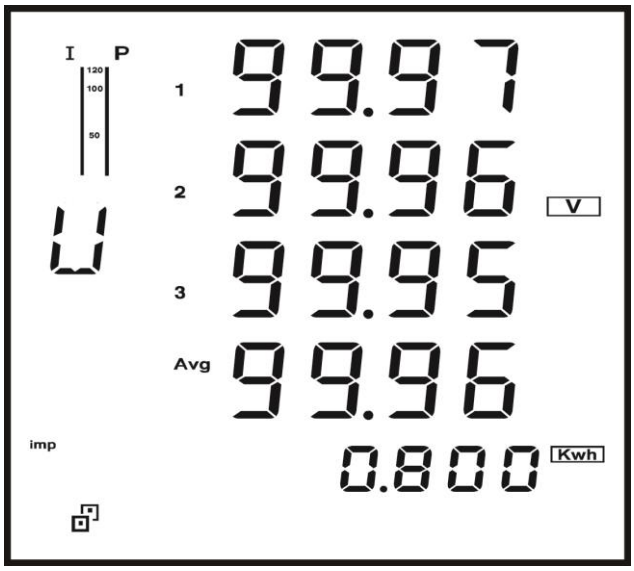
Operation of measuring data display

FU2200A in working condition, various real-time measuring values will display on the screen, such as voltage, current, power…parameters. Displaying has following operating: press S, press E, press P, press VA.

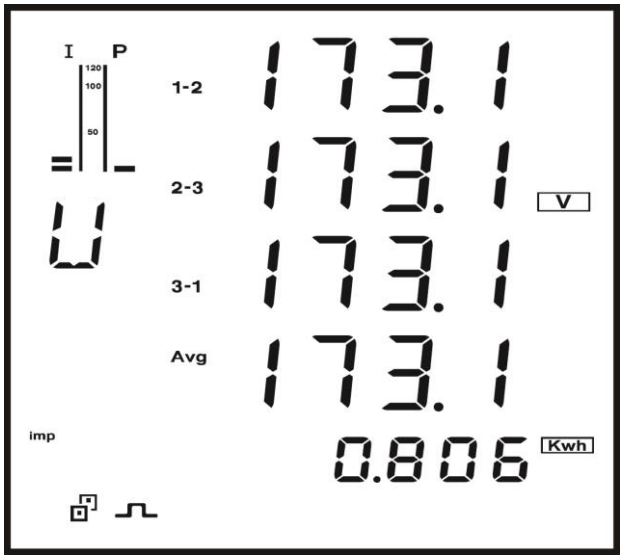
Press VA

Display voltage and current in the measuring data display area. Screen turns to next one when press VA every time.

1st screen: display every phase voltage U1, U2, U3 and the phase voltage average Ulnavg. See figure below:
U1=99.97V; U2=99.96V;
U3=99.95V; Ulnavg=99.96V;
The actual current load is 0% of rated current load, no current; imp active energy is 0.800Kwh; the communication in good condition; energy and basic measuring data display belong to different display areas and is controlled by different buttons (E control the energy display) as press E can change to energy item without affect basic measuring data in display area. Likewise, pressing VA will not affect data in energy display area.

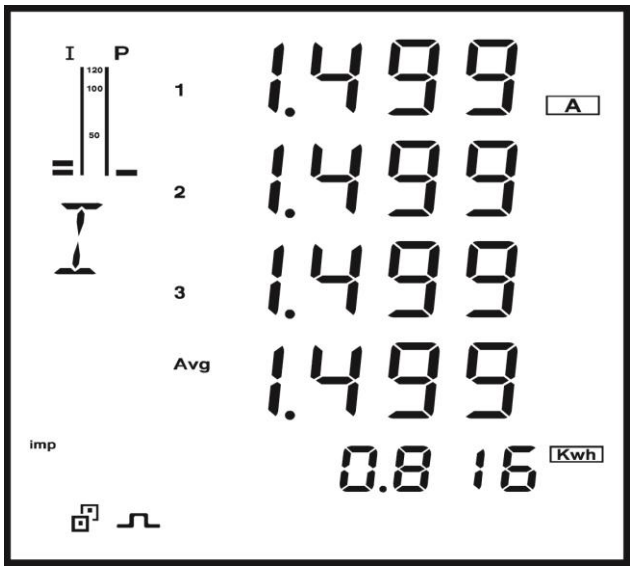


Press VA again, access 2nd screen.
2nd screen: Display every line voltage U12, U23, U31 and the line voltage average Ullavg. See figure below: U12=173.1V; U23=173.1V; U31=173.1V; Ullavg=173.1V.



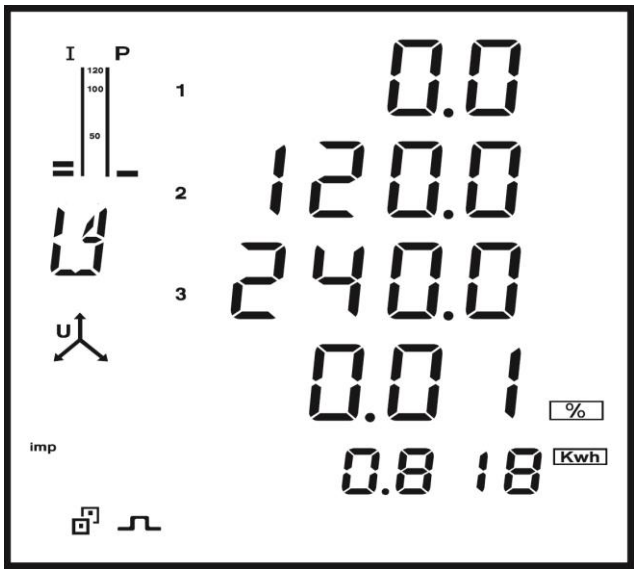
Press VA again, access 3rd screen.

3rd screen: Display every phase current I1, I2, I3 and the current average Iavg. See figure below: I1=1.499A; I2=1.499A; I3=1.499A; Iavg=1.499A.



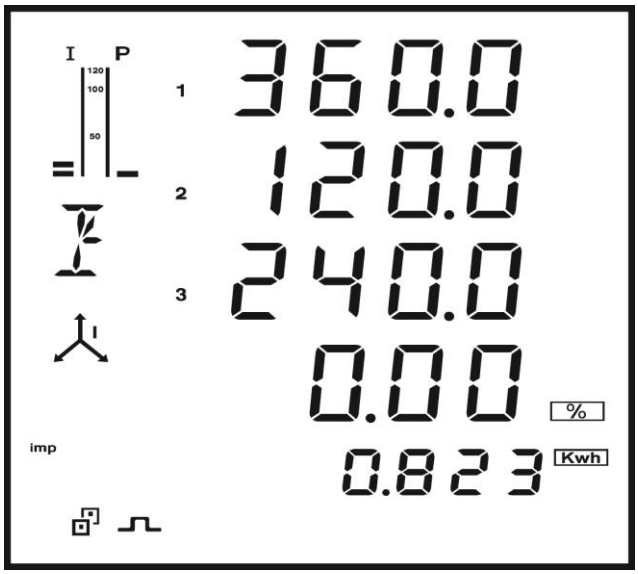
Press VA again, access 4th screen.

4th screen: Display every phase voltage angle and voltage unbalance U1, U2, U3. See figure below: voltage unbalance: 0.01%.



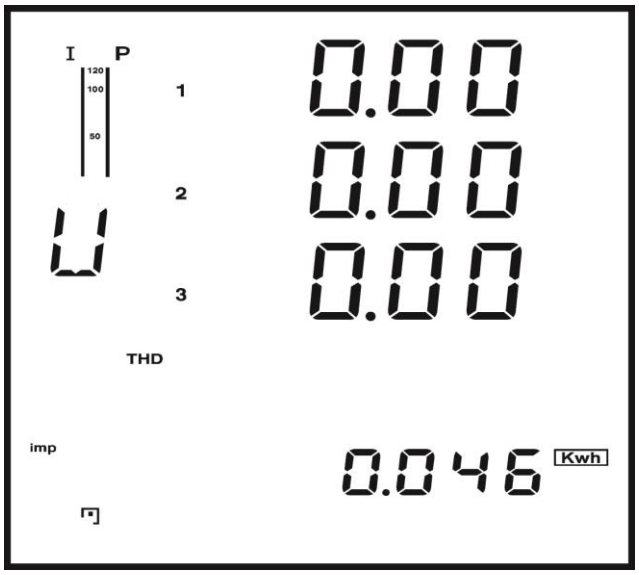
Press VA again, access 5th screen.

5th screen: Display every phase current angle and voltage unbalance I1, I2, I3. See figure below: current unbalance: 0.00%.



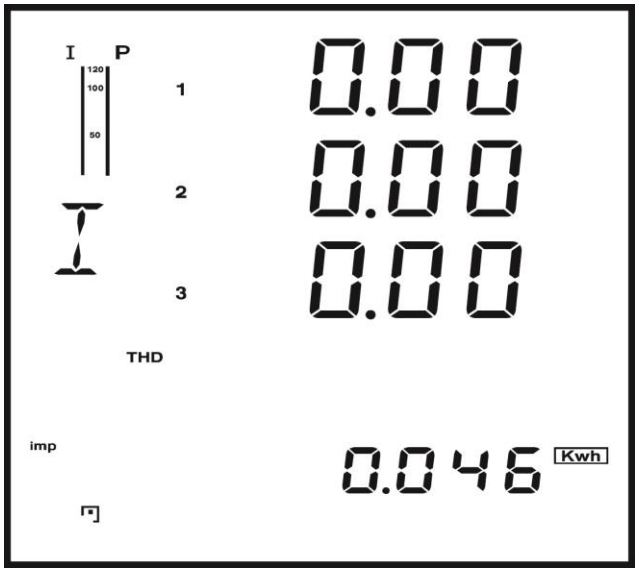
Press VA again, access 6th screen.

6th screen: Display every phase voltage THD. See figure below:



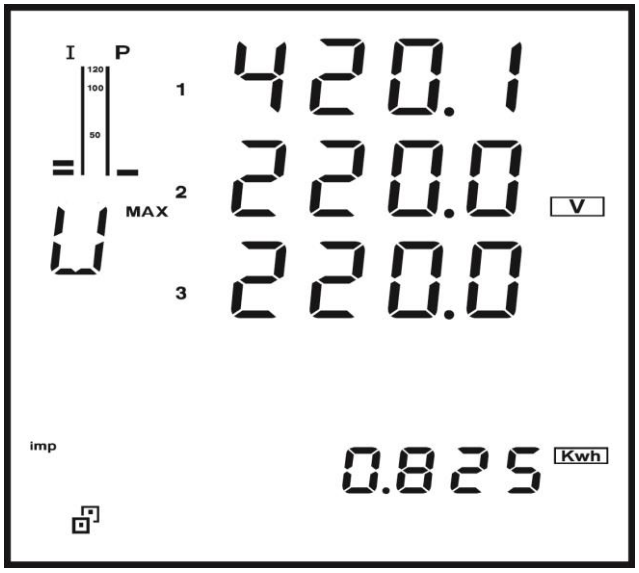
Press VA again, access 7th screen.

7th screen: Display every phase current THD. See figure below:



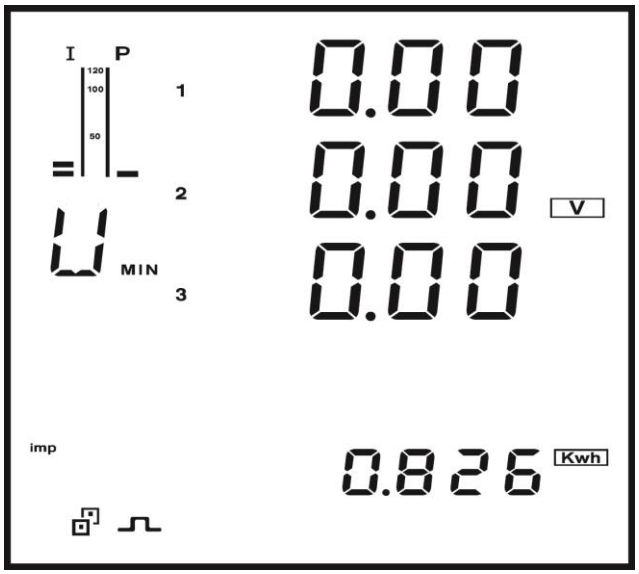
Press VA again, access 8th screen.

8th screen: Display the every max phase voltage. See figure below:



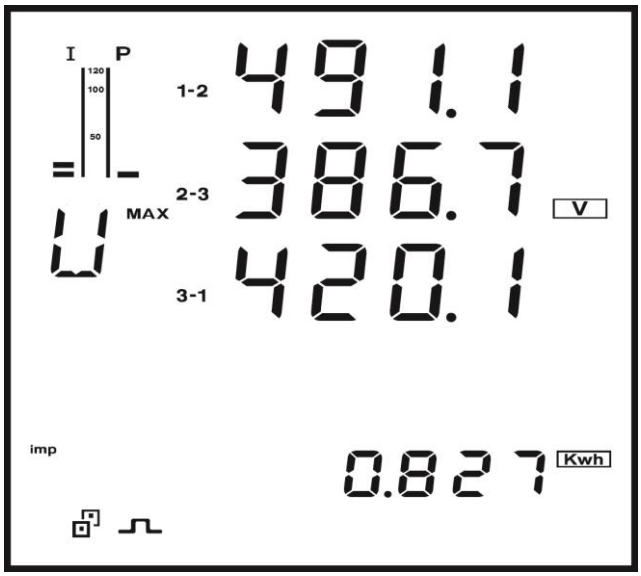
Press VA again, access 9th screen.

9th screen: Display every min phase voltage. See figure below:



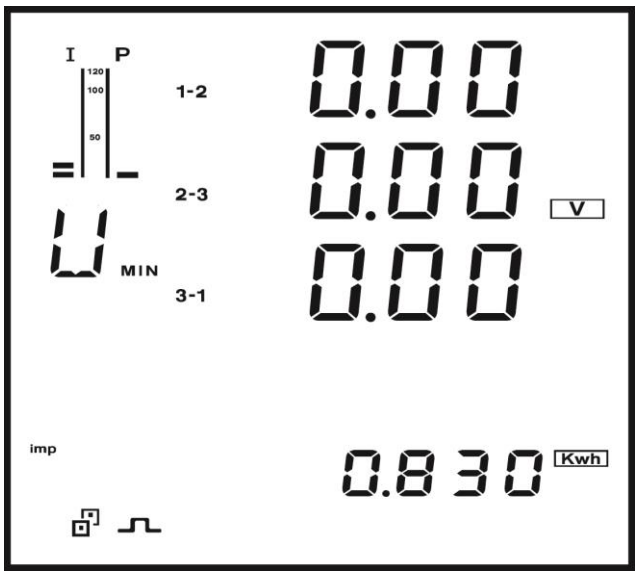
Press VA again, access 10th screen.

10th screen: Display every max line voltage. See figure below:



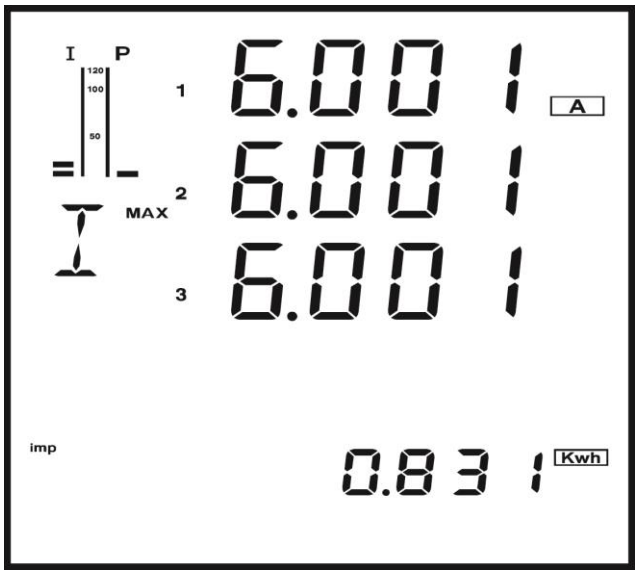
Press VA again, access 11th screen.

11th screen: Display every min line voltage. See figure below:



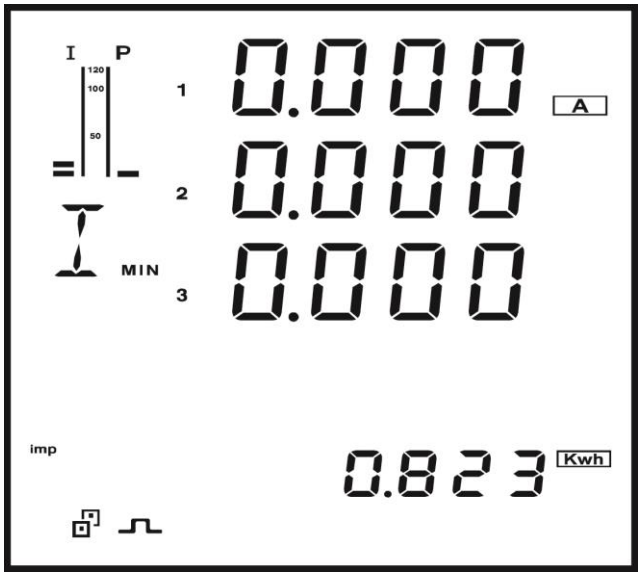
Press VA again, access 12th screen.

12th screen: Display every max phase current. See figure below:



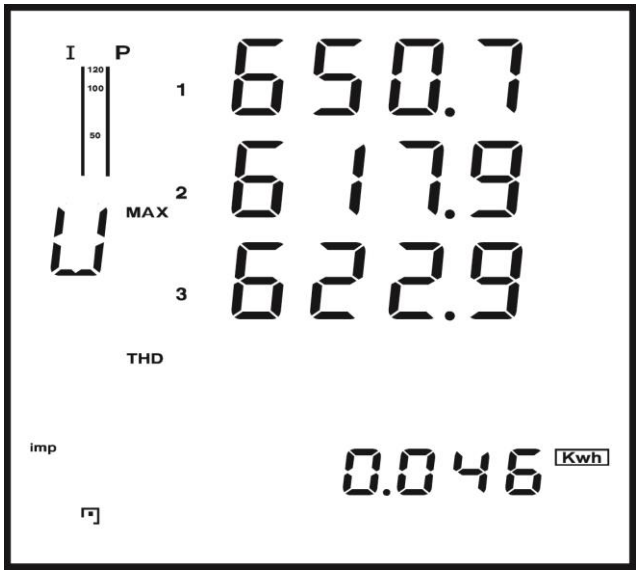
Press VA again, access 13th screen.

13th screen: Display every min phase current. See figure below:

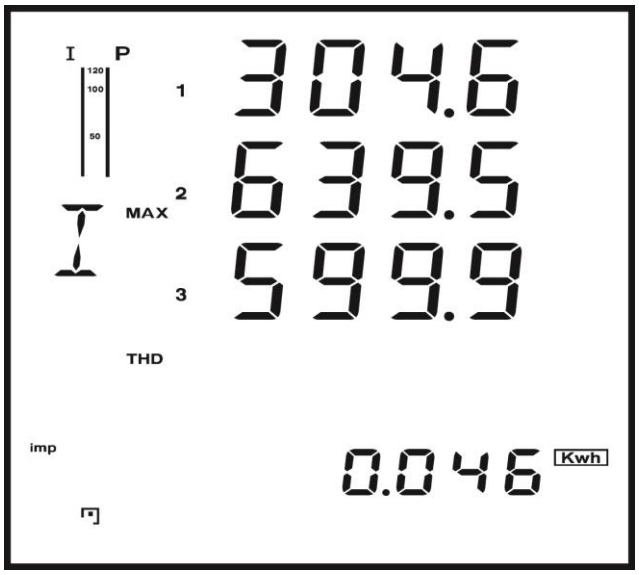


Press VA again, access 14th screen.

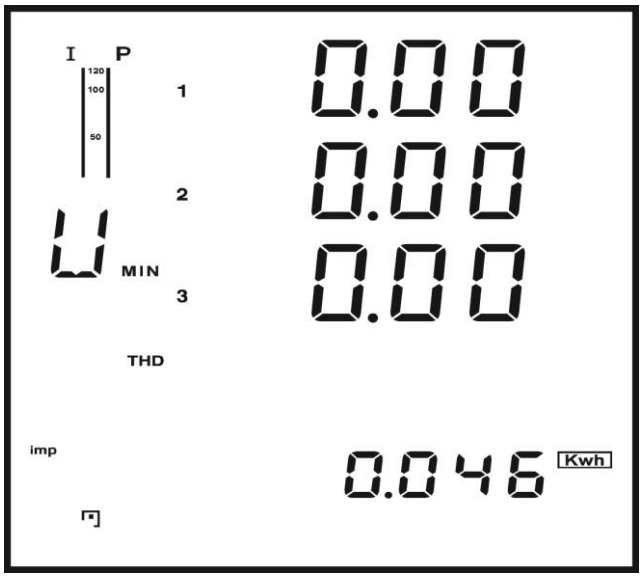
14th screen: Display every phase voltage max THD. See figure below:



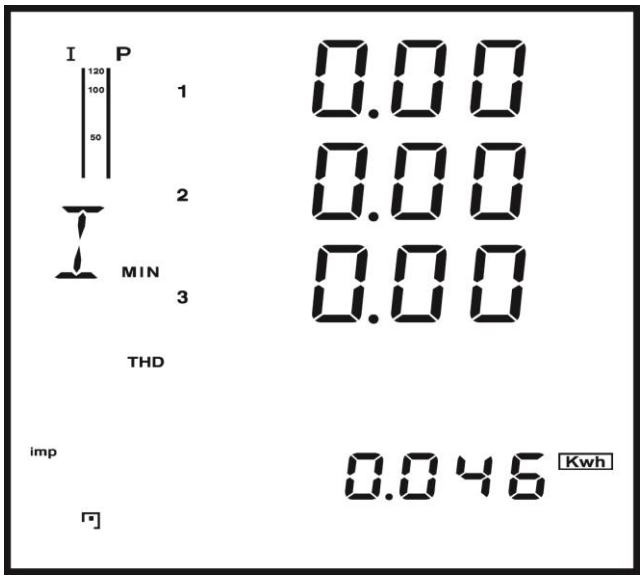
Press VA again, access 15th screen.
15th screen: Display every phase current max THD.
See figure below:



Press VA again, access 16th screen.
16th screen: Display every phase current min THD.
See figure below:



Press VA again, access 17th screen.
17th screen: Display every phase current min THD.
See figure below:

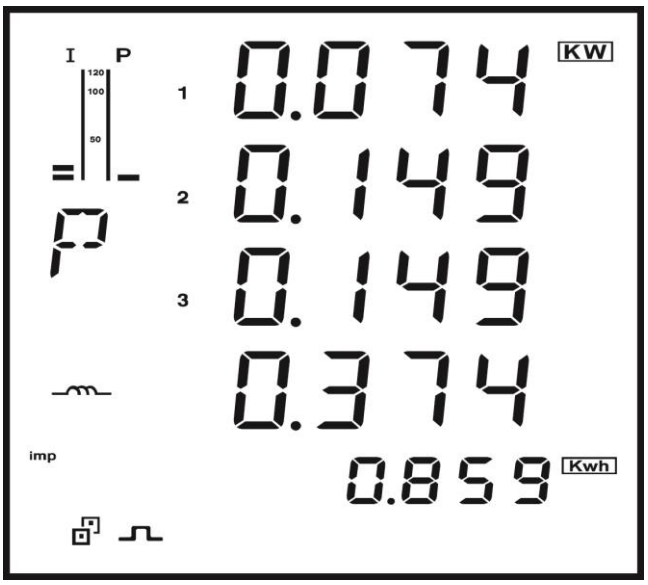


Press VA again, return to1st screen displaying phase voltage

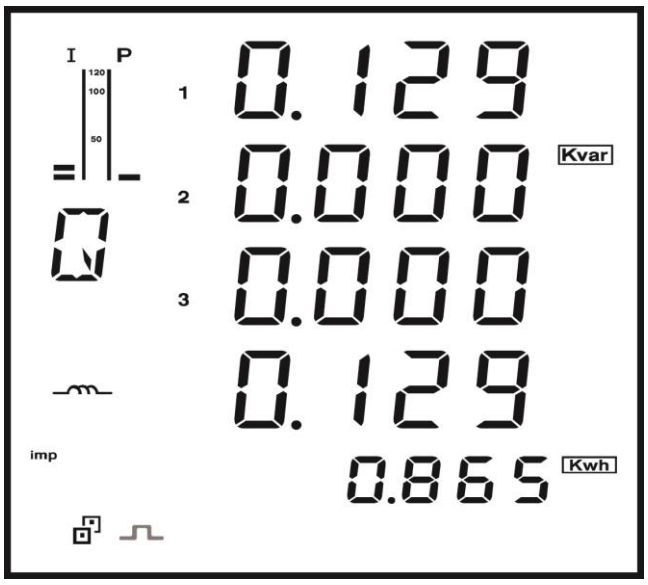
Press P

Display the power related parameters in the measuring data display area. Screen turns to next one when press P every time.

1st screen: Display every phase active power P1, P2, P3, system active power Psum.
Display as follow: P1=0.074KW; P2=0.149KW; P3=0.149KW; Psum=0.374KW; Load is inductive; imp active energy 0.859Kwh; communication in good condition; DO active pulse output.



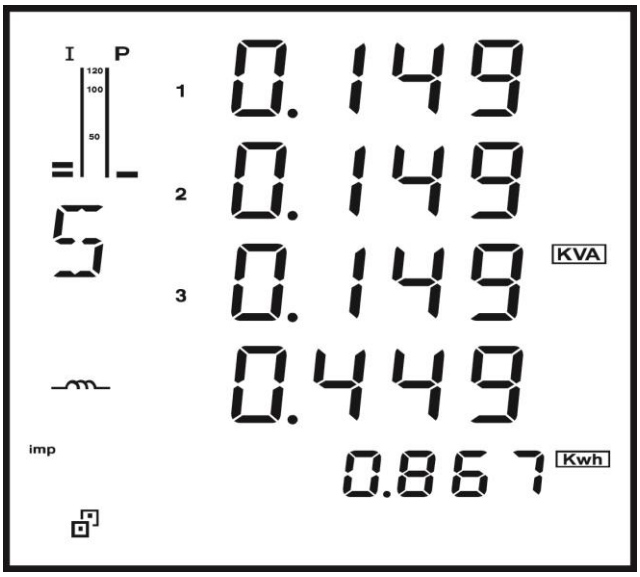
Press P again, access 2nd screen
2nd screen: Display every phase reactive power Q1, Q2, Q3 and total reactive power Qsum. See figure below:
Q1=0.129Kvar; Q2=0.000Kvar; Q3=0.000Kvar; Qsum=0.129Kvar.



Press P again, access 3rd screen.

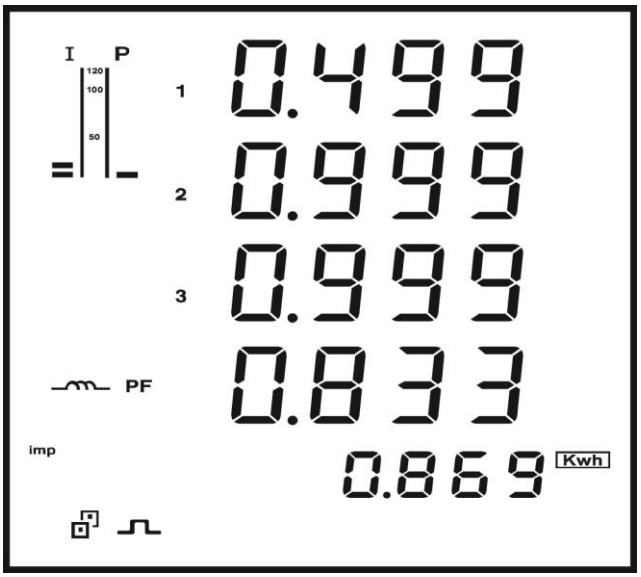
3rd screen: Display every phase apparent power S1, S2, S3 and total apparent power Ssum.

See figure below: S1=0.149KVA; S2=0.149KVA; S3=0.149KVA; Ssum=0.449KVA.



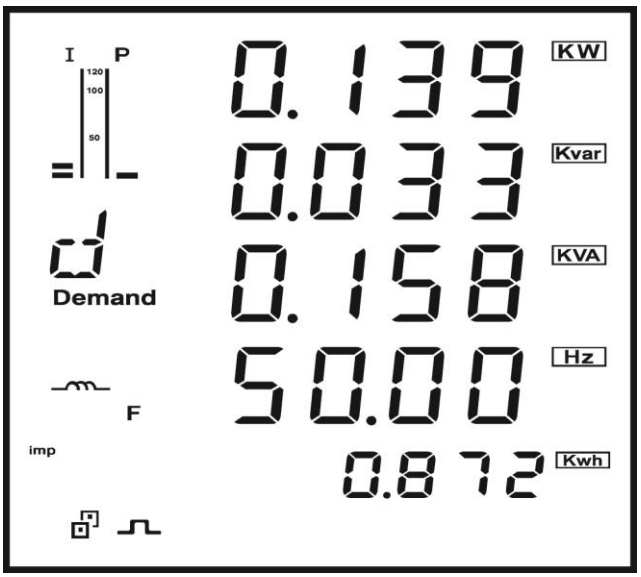
Press P again, access 4th screen

4th screen: Display every phase power factor PF1, PF2, PF3 and total power factor PF. See figure below PF1=0.499; PF2=0.999; PF3=0.999; PF=0.833.



Press P again, access 5th screen.

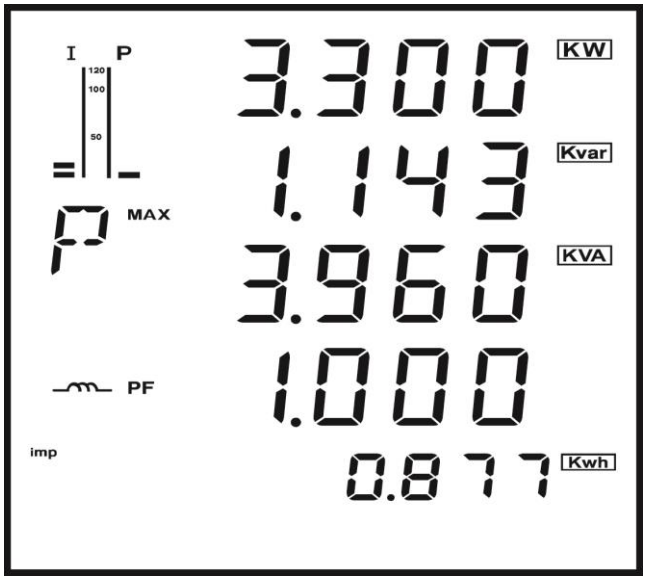
5th screen: Total active power demand 0.139KW, total reactive power demand 0.033Kvar, total apparent power demand 0.158KVA, total frequency 50HZ.



Press P again, access 6th screen.

6th screen: Max total active power Pmax, max total reactive power Qmax, max total apparent power Smax, total power factor PF.

See figure below: Pmax= 3.300KW; Qmax=1.143Kvar; Smax=3.960KVA; PF=1.000.



Press P again, access 7th screen.

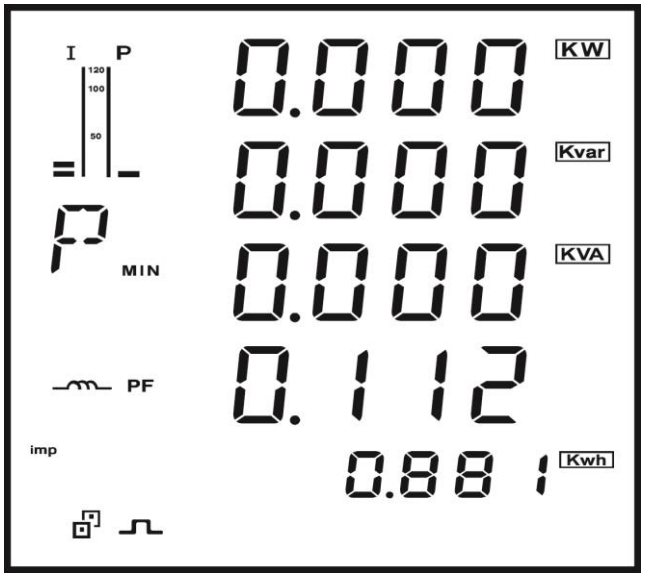
7th screen: Min total active power Pmin, min total reactive power Qmin, min total apparent power Smin, total power factor PF.

See figure below:

Pmin=0.000KW;

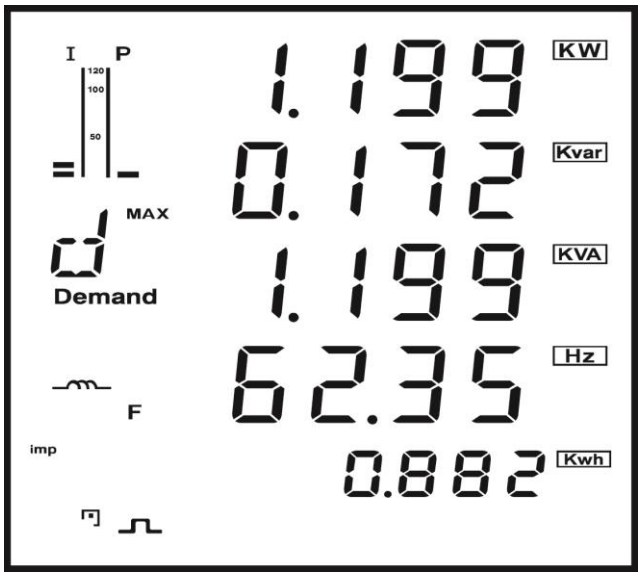
Qmin=0.000Kvar;

Smin=0.000KVA; PF=0.112.



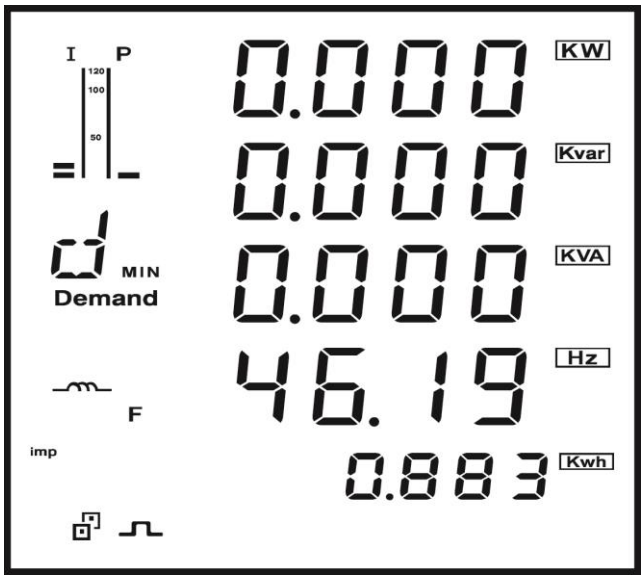
Press P again, access 8th screen.

8th screen: Max total active power demand 1.199KW, max total reactive power demand 0.172Kvar, max total apparent power demand 1.199KVA, max total frequency 62.35HZ.



Press P again, access 9th screen.

9th screen: Min total active power demand 0.000KW, min total reactive power demand 0.000Kvar, min total apparent power demand 0.000KVA, min total frequency 46.19HZ.

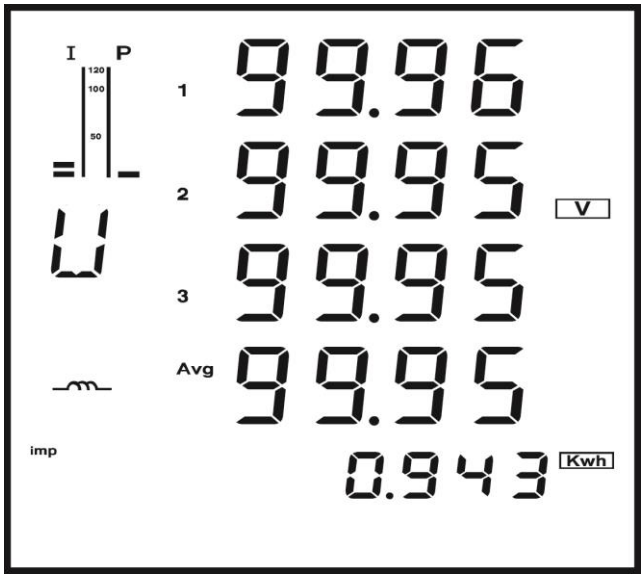


Press P again, return to 1st screen.

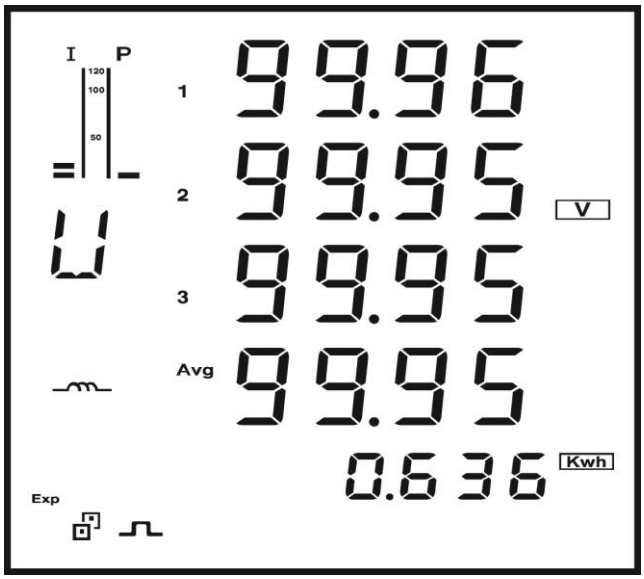
Press E

Display energy, date, time, power meter address, baud rate and energy pulse output in energy display area. Screen turns to next one when press E every time.

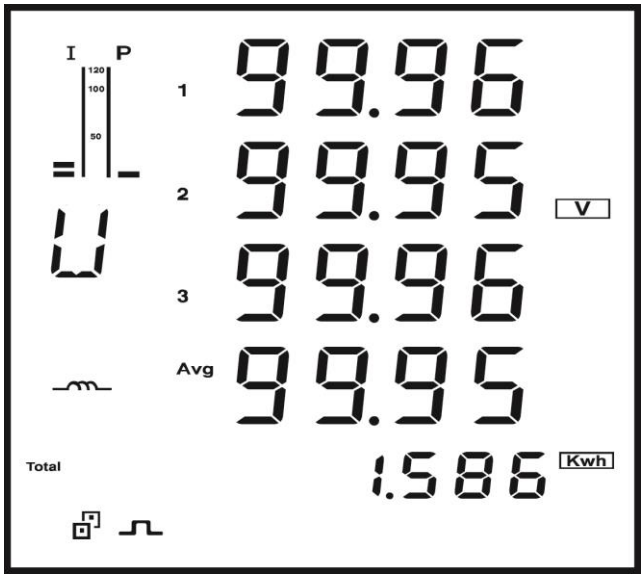
1st screen: Display forward active energy Ep_imp. See figure below: Ep_imp=0.943Kwh.



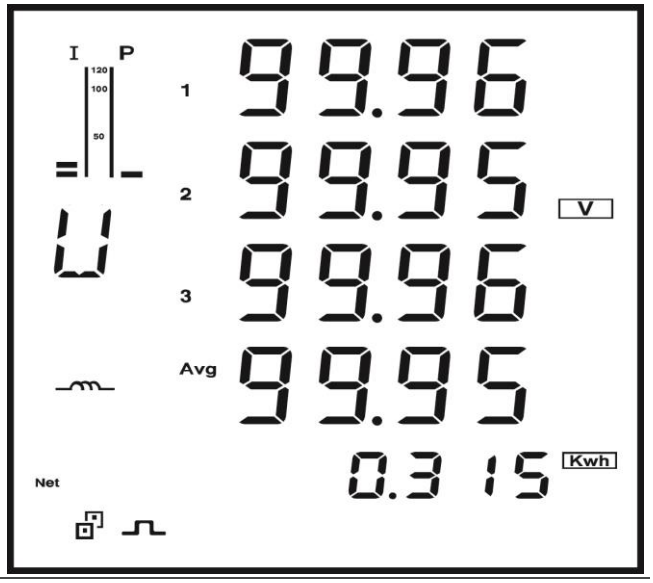
Press E again, access 2th screen.
2th screen: Display reverse active energy Ep_exp.
See figure below: Ep_exp=0.636Kwh.



Press E again, access 3rd screen.
3rd screen: Display total active energy Ep_total.
See figure below: Ep_total=1.586Kwh.



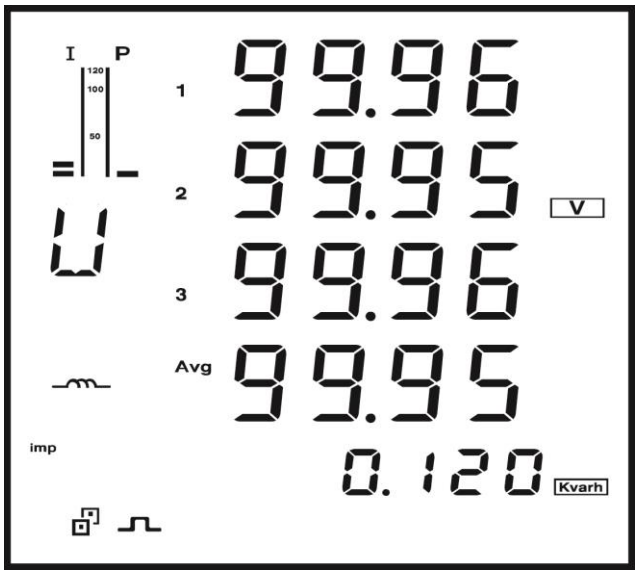
Press E again, access 4th screen.
4th screen: Net active energy Ep_net.
See figure below: Ep_net=0.315Kwh.



Press E again, access 5th screen.

5th screen: Display forward reactive energy Eq_imp.

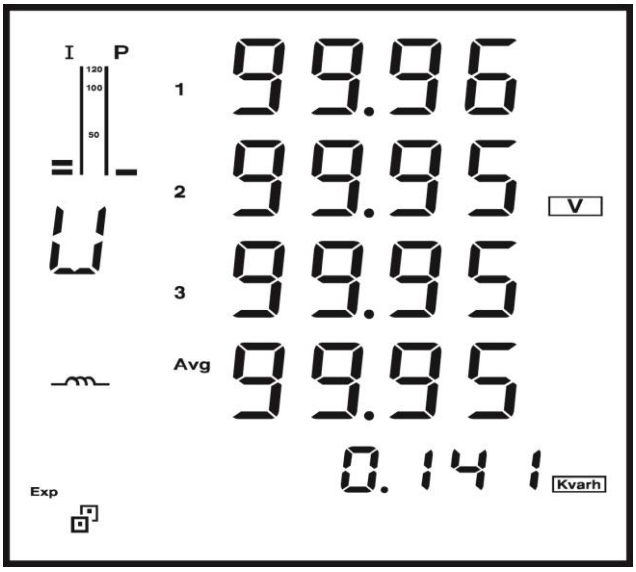
See figure below: Eq_imp=0.120Kvarh.



Press E again, access 6th screen.

6th screen: Display reverse reactive energy Eq_exp.

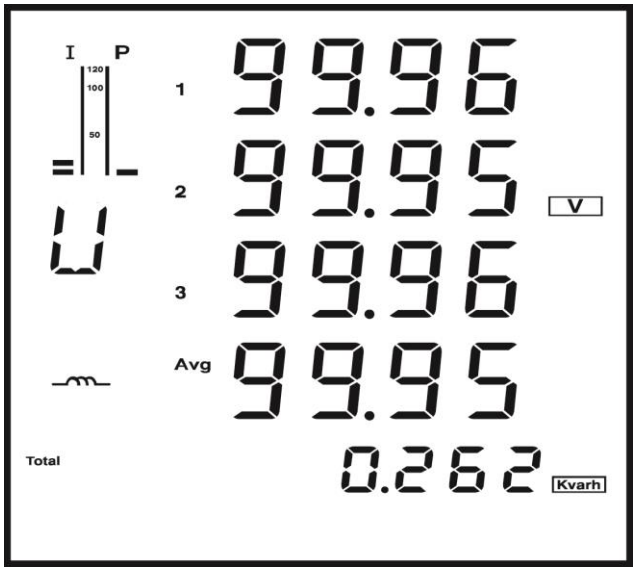
See figure below: Eq_exp=0.141Kvarh.



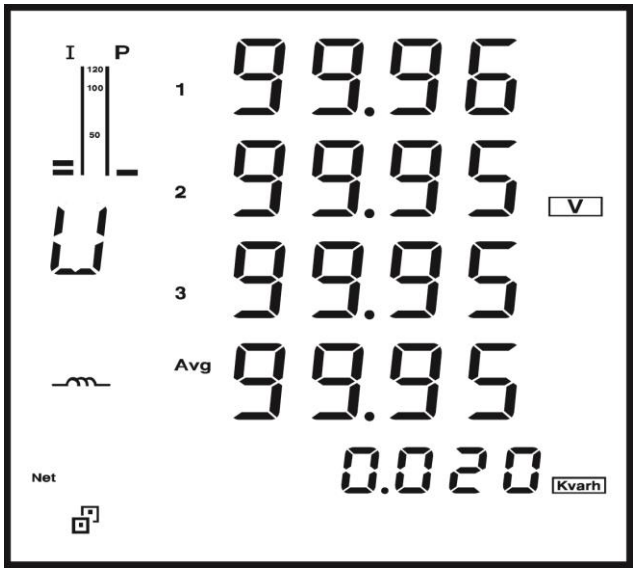
Press E again, access 7th screen.

7th screen: Display absolute value of reactive energy Eq_total.

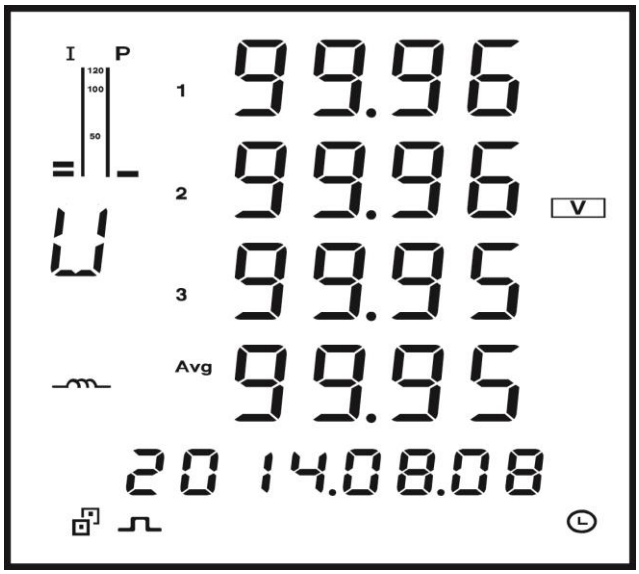
See figure below: Eq_total=0.262Kvarh.



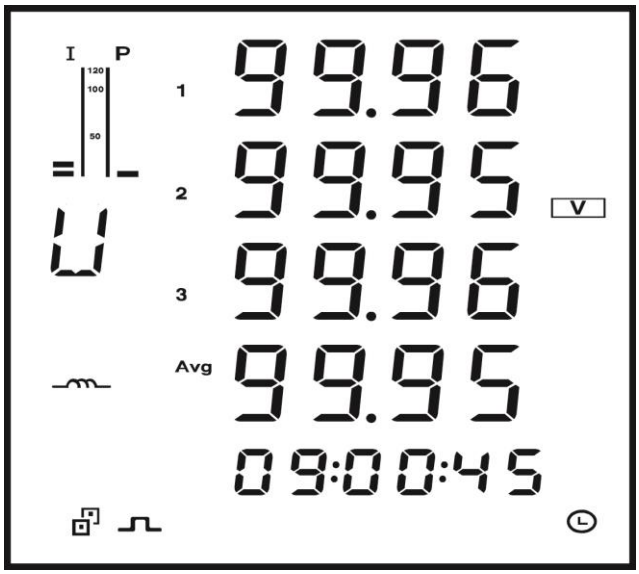
Press E again, access 8th screen.
8th screen: Display net reactive energy Eq_net.
See figure below: Eq_net=0.020Kvarh.



Press E again, access 9th screen.
9th screen: Display date, format: yyyy.mm.dd
See figure below: date is August 8th 2014

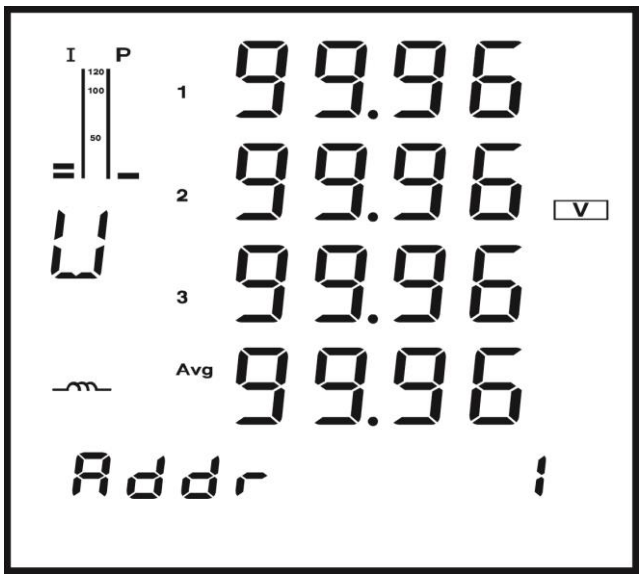


Press E again, access 10th screen.
10th screen: Display time, format: hh:mm:ss
See figure below: time is 09 hour 00 minute 45 second



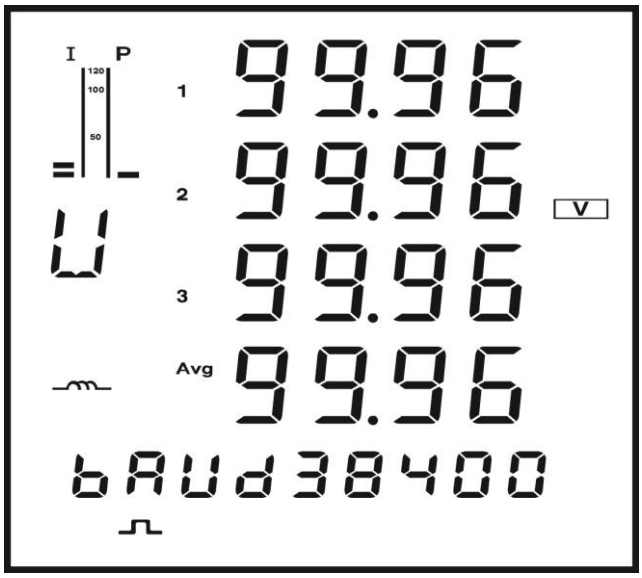
Press E again, access 11th screen.

11th screen: Display power meter address. See figure below: address is 1.



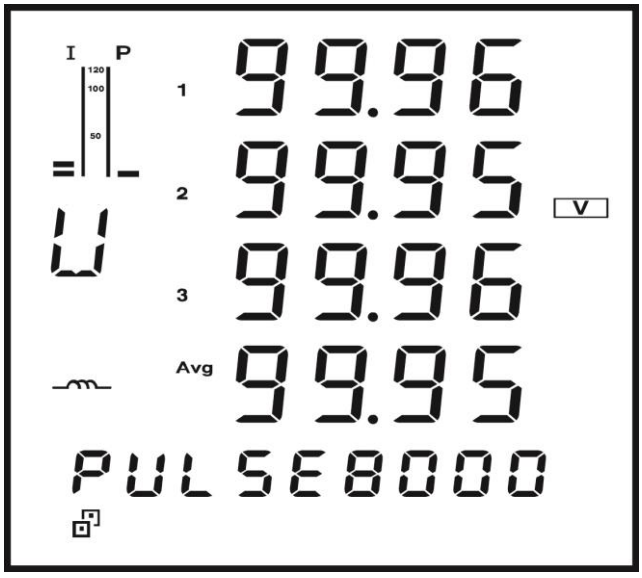
Press E again, access 12th screen.

12th screen: Display baud rate- baud. See figure below: baud is 38400.



Press E again, access 13th screen.

13th screen: Display pulse constant-pulse. See figure below: pulse is 8000.



Press E again, return to 1st screen displaying forward active energy.

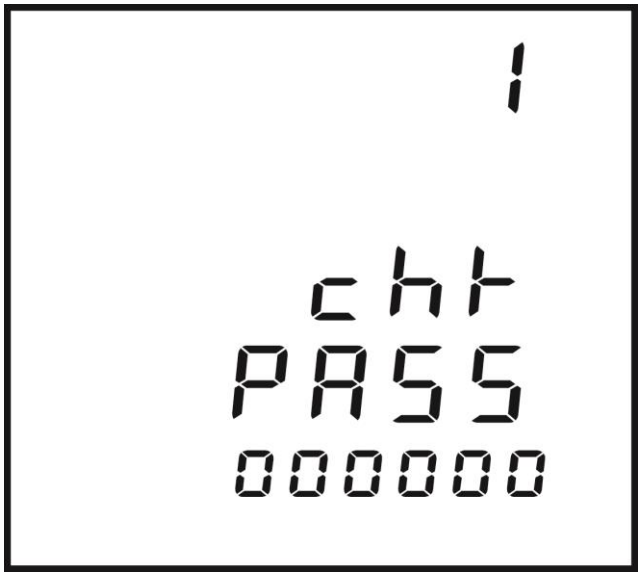
Set up parameters

FU2200A in working condition, press **S** can access parameters setup mode.
E moves cursor. Cursor moves to right selection when press E every time. At the same time, cursor located digit flash display.
P is add 1 button, as Cursor located digit performs plus one operation when press **P**, when count to 10 back to zero.
VA confirms and saves changed parameters and access next setup screen
In any setup screen, press **S** return measuring screen from parameters setup mode.
In any setup screen, press **VA**, then press **S**, the former setup takes effect.

The initial screen to access setup mode is protection password inquiry screen. **PASS** is parameters setup password, as only enter correct password can process the parameters setup. The password can be against falsify parameter by non- administrator or false operation.

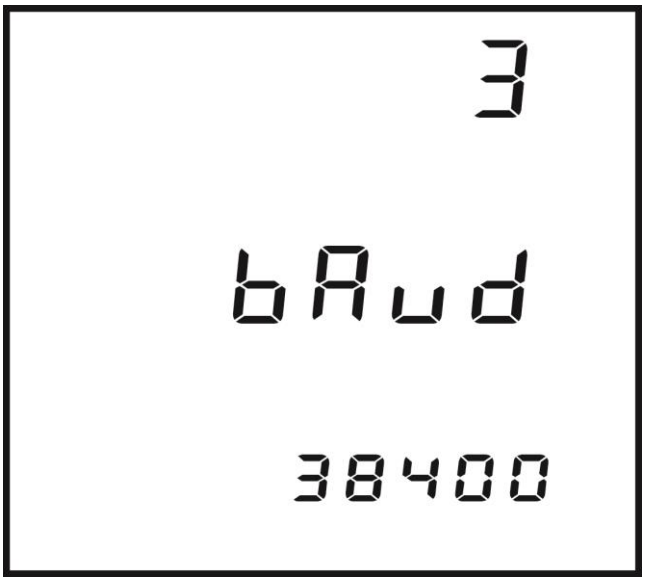
PASS has 6 digits. Range is 000000 to 999999 any integral numbers.
Default password: 000000
Once access setup mode, protection password inquiry shows 000000, user enter password then press **VA**. With correct password, user can access 2nd setup screen, or meter will refuse to access setup operation and return to measuring screen.

Protection password inquiry screen figure as follows

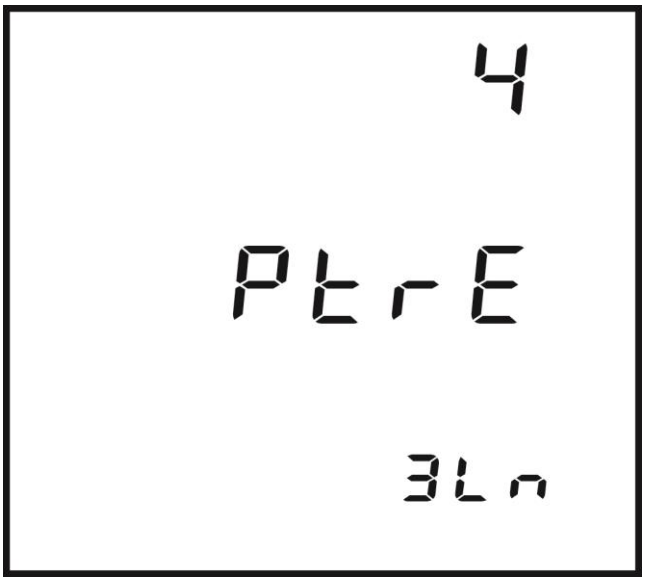


2nd screen: Communication address setup screen can setup communication address. Range is 0 to 255 any integral numbers (exceed 255, unpredictable).
See figure below, address 001, change method:
Press **E** to move cursor to the digit which you want to modify.
Press **P** to +1 until intended value.
Follow the directions to change other digits.
Finally press **VA** to save and access next setup screen.
If no need to change address, press **VA** to next setup screen.
Note: Modbus-RTU communication protocol regulates instruments in same line should have different address.

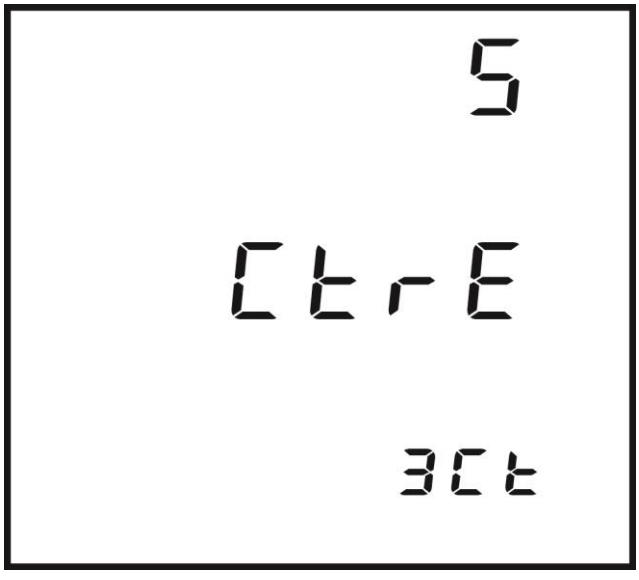
3rd screen: Communication baud rate setup screen is settable according to user requests. Normally can seven sets: 600, 1200, 2400, 4800, 9600, 19200, 38400bps
See figure below baud rate is 38400bps.
Press **E** to choose digit.
Press **P** to +1, 9 add 1 is 0.
Press **VA** is to save and access to next setup screen.
Note: instruments in same communication line should use same baud rate.



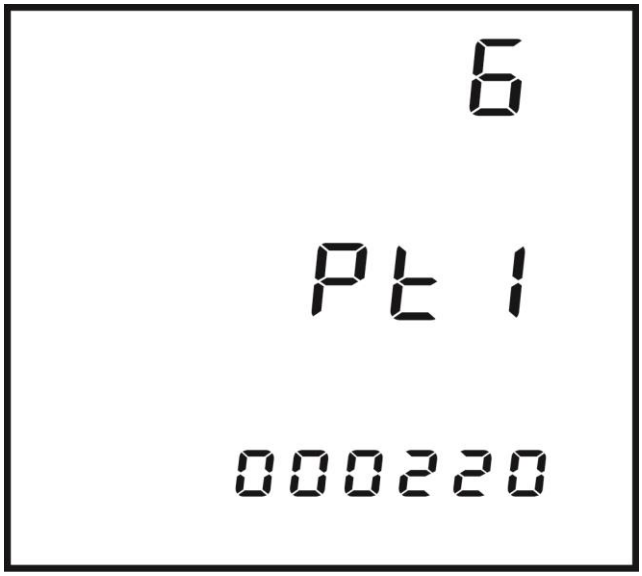
4th screen: Display voltage wiring setup screen. Voltage wiring can set as 3LN, 2LN, 2LL, See figure below: voltage wiring set as 3LN.
Press **P** or **E** can choose one from 3LN, 2LN, 2LL.
Press **VA** save and access to next setup screen.



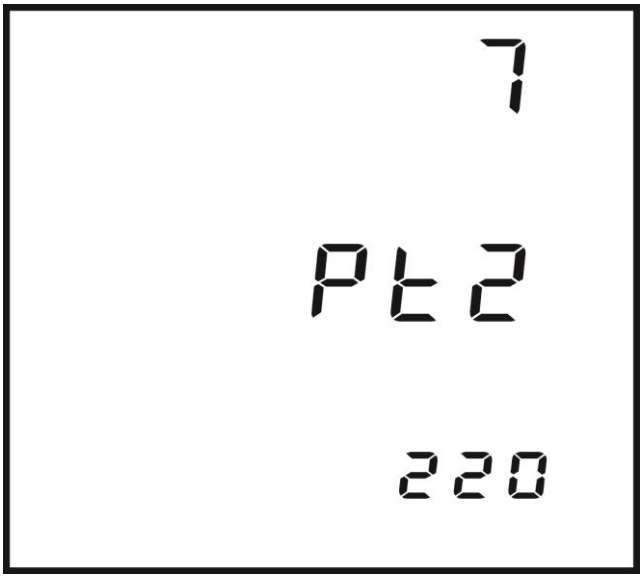
5th screen: Display current wiring setup screen. Current wiring can set as 3CT, 2CT, 1CT.
See figure below: current wiring set as 3CT.
Press **P** or **E** can choose one from 3CT, 2CT, 1CT.
Press **VA** save and access to next setup screen.



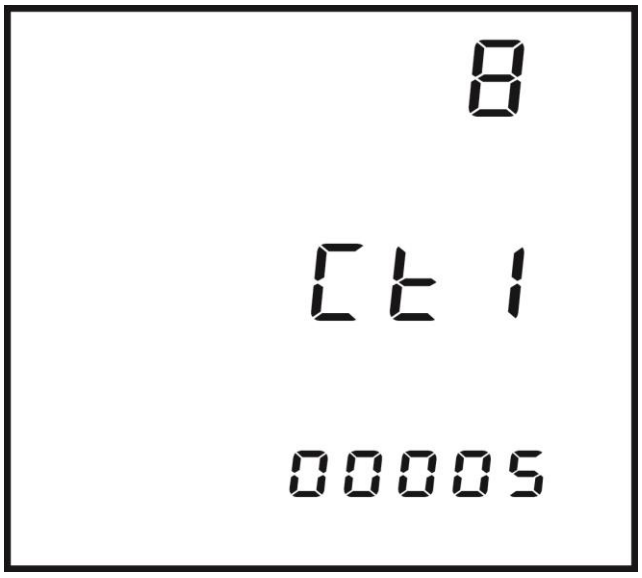
6th screen: Display PT primary rated voltage PT1 setup screen.
PT1 set range 100 to 500,000 integral number, unit Volt.
See figure below: PT1=220V
Press **P** or **E** to change PT1 value.
Press **VA** save and access to next setup screen.



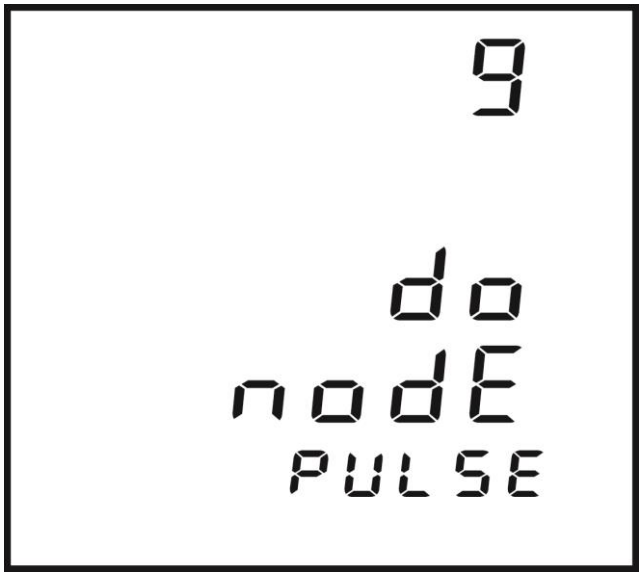
7th screen: Display PT secondary rated voltage PT2 setup screen.
PT2 set range 100 to 400 integral number, unit Volt.
See figure below: PT2=220V
Press **P** or **E** to change PT2 value.
Press **VA** save and access to next setup screen.



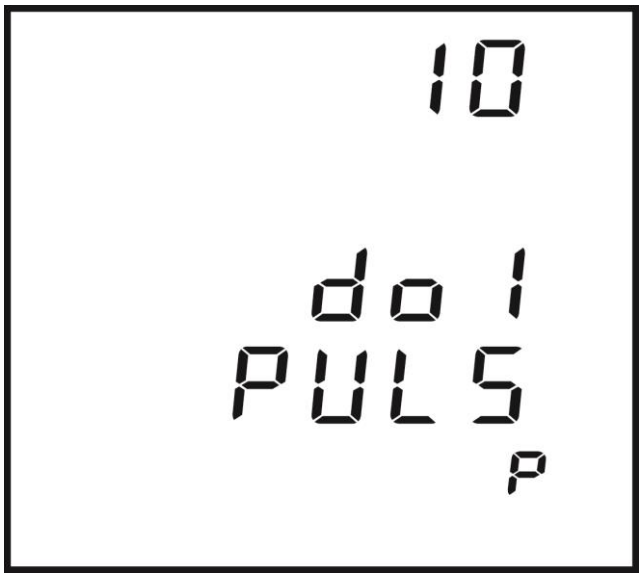
8th screen: Display CT primary rated current CT1 setup screen.
CT1 set range 5 to 10000 integral number, unit Amp.
CT secondary rated current usually is 5Amp.
Default CT2: 5Amp
See figure below: CT1=5A
Press **P** or **E** to change CT1 value.
Press **VA** save and access to next setup screen.



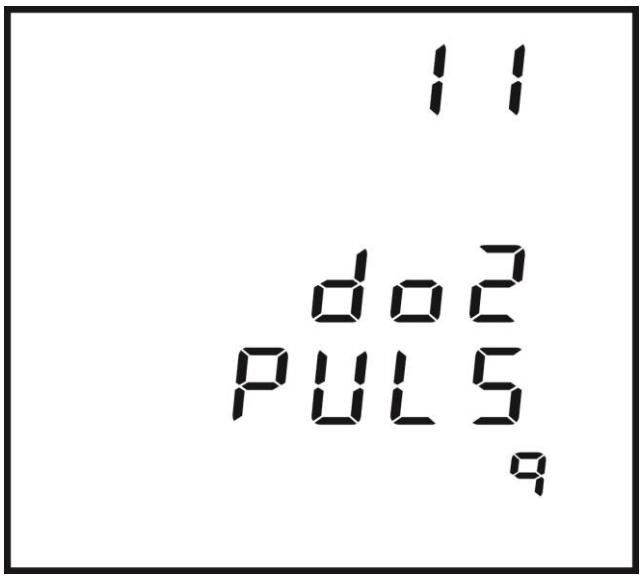
9th screen: DO operating mode selection setup screen.
This meter has 2 DO which can operate in alarm output mode or pulse energy output mode. DO1, DO2 both is settable in this screen.
ALArn indicate alarm output mode.
PULSE indicate pulse energy output mode.
After selection, press **VA** save and access to next setup screen.



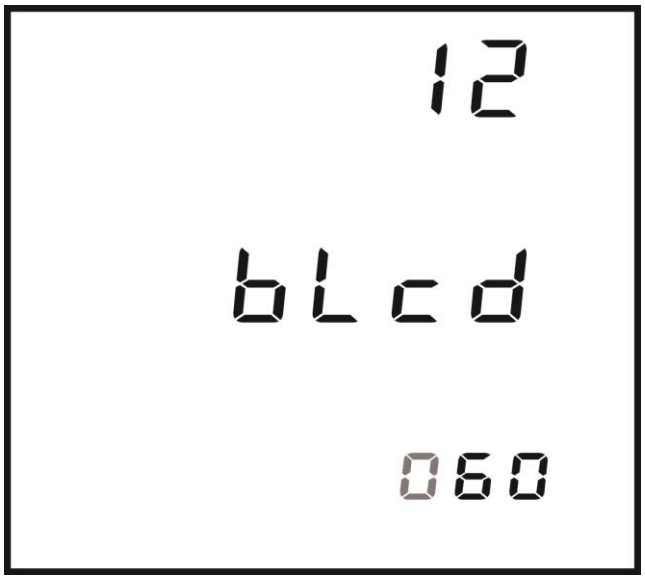
10th screen: DO1 pulse energy output selection.
Choose different energy values output from DO1
Press **P** or **E** to select active power P, reactive power Q, apparent power S and invalid-.



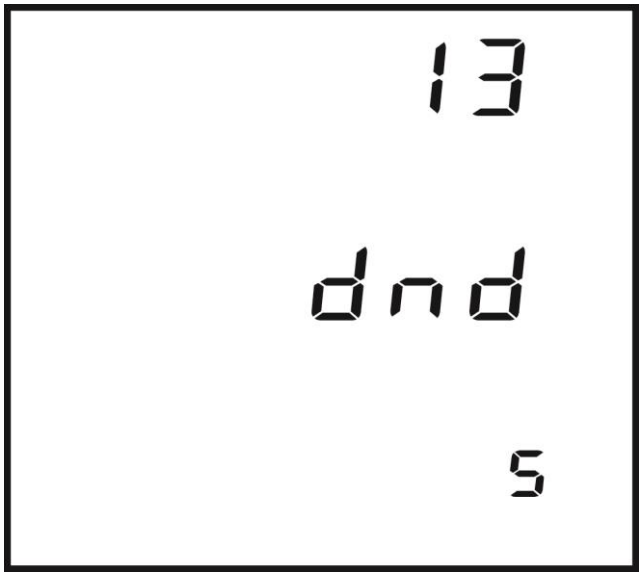
11th screen: DO2 pulse energy output selection.
Choose different energy values output from DO2
Press **P** or **E** to select active power P, reactive power Q, apparent power S and invalid-.



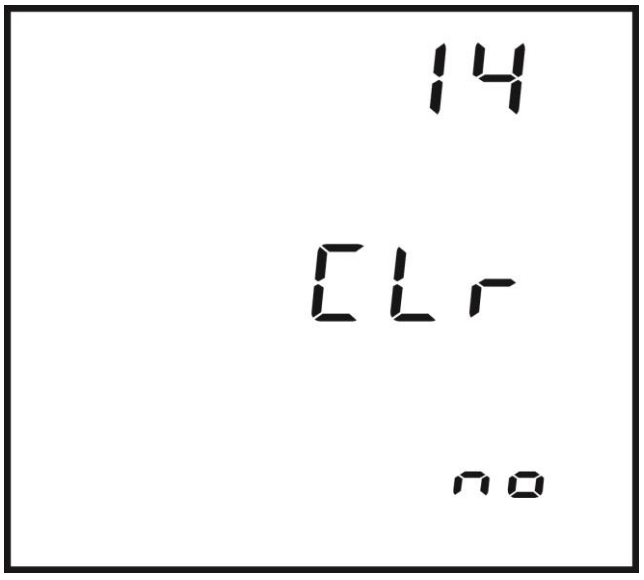
12th screen: Display backlight duration setup.
In order to low down power consumption and increase the components service life, after a time without press button, the backlight will automatically off. When press button the backlight will on. The lighting interval is user settable.
Set 0, backlight is in light.
See the figure below
Set backlight interval as 60 seconds as no button operation within 60 seconds, backlight will automatically off.



13th screen: Demand period setup
Press **P** to set demand period.
See figure below, demand period set as 5min.

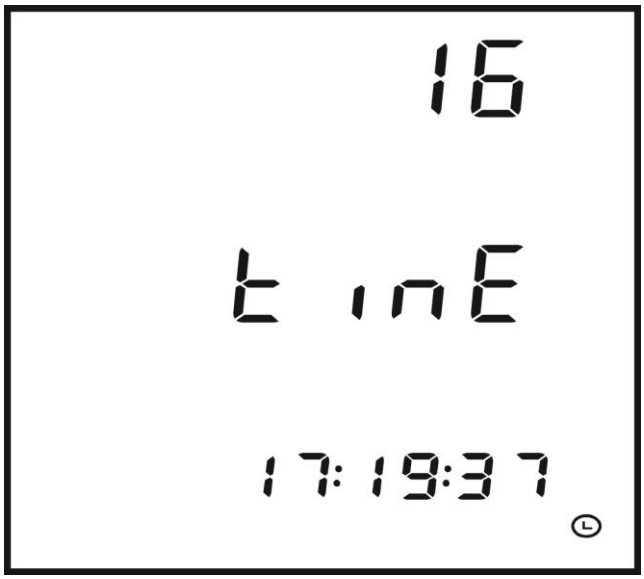


14th screen: Display Max/Min value clear selection.
Max, Min, Demand can be cleared through panel.
Clear is not reset, but clear to start new logging.
See figure below:
Screen display NO.
Press **P** or **E** can select between **NO** and **YES**.
If select **YES**, press **VA** to start max/min value clearance.
If select **NO**, press **VA** to access next setup screen.

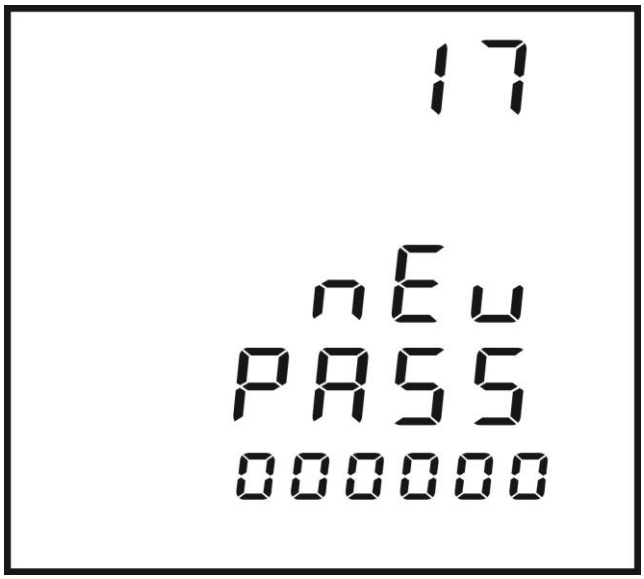


15th screen: Date setup screen
Display format: yyyy.mm.dd
Year range is 2000 to 2099
Month range is 1 to 12
Day range is 1 to 31
Press **P** or **E** to set.
Here the date is August 8th 2014.
Press **VA** to next setup screen.

16th screen: Time setup screen
Format hh:mm:ss
Hour range 0-23
Minute range 0-59
Second range 0-59
See figure below: System time is 17hour19min37sec
Press **VA** to next setup screen.



17th screen: Protection password setup screen. This is the last screen on setup. It can set a new password, please remember the new set password.
See figure below:
Set password 000000
Press **VA** to save and return to 1st screen on address setup.



CHAPTER 5 —MEASURING PARAMETERS AND FUNCTIONS

FU2200A has multiple measuring functions. Almost all the common electrical parameters can be measured. Here only explain some basic concepts which maybe unfamiliar parameters according to FU2200A features.

Voltage (U)

FU2200A use true RMS method to measure every phase voltage, line voltage and average in three phase system

Current (I)

FU2200A use true RMS method to measure every phase current, average and neutral current.

Active power (P)

FU2200A can measure every phase active power and total active power.

Reactive power (Q)

FU2200A can measure every phase reactive power and total reactive power.

Apparent power (S)

FU2200A can measure every phase apparent power and total apparent power.

Power factor (PF)

FU2200A can measure every phase power factory and total average power factor.

Frequency (F)

FU2200A initially select V1 phase voltage frequency as total frequency, V1 no-volt adopt V2, V1 and V2 both no-volt adopts V3

Active energy (Kwh)

Active energy is the time integral of active power. Unit: Kwh.

Because power has direction, when positive consume energy, negative release energy. So active energy has the forward active energy (import) and reverse active energy (export), at the same time, we define the sum of absolute import active energy and absolute export active energy is **total active energy**. And absolute import active energy minus absolute export active energy is **net active energy**. FU2200A can accumulate above four items respectively.

Reactive energy (Kvarh)

Similar with active energy, reactive energy is the time integral of reactive power. Unit: Kvarh.

Because reactive power has direction, when positive, reactive power is from power to load (inductance), negative is from load (capacitance) to power. So reactive energy has positive and negative direction, and the reactive power can have inductive reactive energy and capacitive reactive energy. At the same time, we define the sum of each absolute value as **total reactive energy**. And the difference between the two absolute values is **net reactive energy**. FU2200A can accumulate above four items respectively.

Demand: There is many demand statistic methods, FU2200A adopts sliding window demand. This can measure active demand, reactive demand, and apparent power demand. Sliding window wide range can set 1-60min, window every slide interval is fix as 1min, eg. Set sliding window width as 3min, if the first 1min average power is 12,

the second 1min average power is 14, the third 1min average power is 10, then after these 3mins, the power demand is (12+14+10)÷3=12, if one more minute later, this minute average power is 8, then after these 4mins, the power demand is (14+10+8)÷3=10.

Three-phase unbalance

FU2200A can measure voltage unbalance and current unbalance, the unbalance usually sign as percentage.

$$\text{Voltage unbalance} = \frac{\text{Three phase voltage max difference}}{\text{Three phase voltage average}} \text{x } 100\%$$

Three phase max difference is max difference of every valid phase voltage (triangle wiring is line voltage), three phase average is three phase valid voltage average.

$$\text{Current unbalance} = \frac{\text{Three phase current max difference}}{\text{Three phase current average}} \text{x } 100\%$$

Three phase max difference is max difference of every valid phase current (line current), three phase average is three phase valid voltage average.

Maxi/Min value (Max/Min)

FU2200A can measuring real time concerned max/min parameters (every phase/line voltage, every line current, active power, reactive power, apparent power, power factor, frequency, demand) and occur time, these logging data save in non-volatile EEPROM, even power off, data remains. All loggers can read and clear through panel, or operation through communication.

Real time clock

FU2200A has high precision calendar, real time clock. Year, month, day, hour, minute, second data can read and set through communication or panel.

Phase error (Phase offset)

It indicates phase connection between every phase voltage and current. Angle range is 0-360°, this function is to help user confirm the connection of input signals against false wiring. When voltage wiring set 2LL, indicate phase error of u23, i1, i2, i3 compare u12. When voltage wiring set 2LN or 3LN, indicate phase error of u2, u3, i1, i2, i3 compare u1.

Over value event alarm (option)

FU2200A has over value event alarm function, as a value exceeds the pre-defined setpoint (upper limit and lower limit) and duration exceeds pre-defined time setpoint, alarm will active. When alarm active, over value and time will be logged as event. Meanwhile, DO can be set as output interface to alarm for over value event and to output alarm signals.

Pulse energy output

Two digital outputs can be used as pulse energy output. But DO1, DO2 cannot as alarm output. All energy values (various different active energy and reactive energy), which need to output can be selected. Pulse constant and pulse width is settable. Pulse constant is every pulse which indicating meter energy. Pulse width indicates duration of logic 1 for every pulse. When output energy accumulated to pulse constant setpointed energy value, DO port will output a pulse to set pulse width.