User Manual

MarMonix®

MPQ400 Pro
POWER QUALITY ANALYZER

⚠ Warning ⚠

Thank you for purchasing our **MPQ400 PRO Power Quality Analyzer**, in order to better use this product, be sure to:
----Read this user manual in detail.
----Comply with the safe regulations and operating cautions strictly in this manual.

◆ **Failure to comply with follow precautions may cause in electric shock, explosion, or fire.**
★ Under any circumstance, shall pay special attention on safely in using this device.
★ Pay attention to words and symbols stick on the panel and back cover of the device.
★ This device is only to be used, disassembly and repair this device must be performed by authorized personnel.
★ Due to the reason of this instrument, if it is dangerous to continue using, should stopped and sealed immediately ,and handled by an authorized institution.
★ For danger symbol in manual "⚠", users must perform safely operation in compliance with the manual instructions.
★ For extremely danger symbol in manual " users must perform safely operation strictly in compliance with the manual instructions.
★ When removing and replacing the battery or the SD-Card, make sure that the device is disconnected tested line, current sensor,power adaptor and power off.
★ Current clamp must be corresponding connected with the device, or the test error may increase.
★ Please do not use the device if the battery or SD card slot is missing, damaged or improperly installed.
★ Any system security problems unrelated to this instrument should responsible by the founder and operator of the system.
★ For safety, please use only the wires and accessories attached to the instrument (in accordance with the standard of IEC61010-031(2002)). When a low voltage class sensor or acessories are connected to the device, which must be applicable to the system of this device.
★ Before using, please always check test leads, current clamps and accessories are in optimum condition. Any wire, current clamp or accessory is insulation damaged (or even partially damaged) must be repaired or scrapped.
★ Comply with the environmental conditions(refer to 15.3.1)
★ If required of the environment, please use personal safety protection equipment.
★ The instrument should be used in to the ground AC/DC voltage which not greater than CAT IV 600V class devices (IEC61010-1 standard), or use in the voltage is not greater than CAT III 1000V class devices. Forbid use on higher voltage networks or category.
★ Use only the power adapter or battery pack supplied by the manufacturer, which have the specific safety level.
★ Comply with the security level limits of accessories or current clamp, avoid to connection with unused terminal.
★ Some current clamps cannot be installed or removed from exposed conductors under the dangerous voltage.

◆ **Usage & Connection Step:**
★ Start up the instrument.
★ Set the relate parameters of the instrument according to the requested results and the power network type.
★ Connect the voltage test leads and current sensors to the instrument.
★ Connect the ground line and/or neutral line of the voltage test leads to the ground line and/or neutral line of the power network.
★ Connect the neutral line of current sensor to the neutral line of power network.
★ Connect the L1 phase lead to the power network L1 phase and the corresponding current sensor clamp to the power network phase L1.
★ Repeat the above connection steps for phases L2, L3.
Note: complying with this operation procedure reduces connection errors to minimum, and avoids to wast time.

◆ **Disconnection Steps:**
★ Reverse order to disconnect the wiring connection (disconnect the ground line or neutral line at last in general).

★ Pull out all the leads of the instrument and shutdown.
★ Charging the battery and upload the test data when necessary.
USB is used as the data transmission, battery can be charged by the special adapter.

◆Homonymous Ends Of The Current Clamp

★ The side with current clamp marks (L1, L2, L3, N/D or has red dot) is the current noninverting input end, that is homonymous end.
★ The side of 008B current clamp has red dot is the current noninverting input end, that is homonymous end.
★ The side of 040B, 068B current clamp without screws is the current noninverting input end, that is homonymous end.
★ The side with the lock symbol " " of the 300F flexiable coil current sensor as the current noninverting input end, that is homonymous end.

Contents

Marmonix

MPQ400 Pro

POWER QUALITY ANALYZER

1. SUMMARY

2. Accessories

2.1. Standard Configuration

No.	Designation	Quantity
1	Instrument host.	1 unit
2	Instrument Bag	1 pcs
3	Current sensors 008B	4 pcs (optional)
4	Current sensors 040B	4 pcs (optional)
5	Current sensors 068B	4 pcs (optional)
6	300F flexible coil current sensors (with Integrator)	4 pcs (optional)
7	Testing wires.	5 pcs (yellow, green, red, blue, black)
8	Crocodile clips.	5 pcs
9	Test probe.	5 pcs
10	Power adapter.	1 pcs
11	USB communication cable	1 pcs
12	Software CD.	1 copy
13	Lithium battery pack.	1 (Built into the instrument)
14	2GB memory card	1 pcs(Plug in the instrument)
15	Manual, warranty card, certification.	1 set

2.2. Instrument Weight

No.	Designation	Weight
1	Instrument host.	1.6Kg (with battery).
2	008B small sharp current clamp sensor.	170gX4.
3	040B current clamp sensor.	190gX4.
4	068B current clamp sensor.	510gX4.
5	300F flexible coil current sensor (with Integrator)	330gX4.
6	Test wires and power adapter.	900g.
7	Total weight.	9.2kg (with packaging).

Figure 2-1: All Accessories

3. Instrument Introduce

3.1. Overall View

Figure 3-1: Instrument appearance

3.2. Power On/Off Key

Press the key(red) to starts the instrument.
The device can be power supplied by the battery alone (if it is adequately charged) or by the specific power adapter.
Press the key again to shutdown the instrument. Confirmation is required to turn it off if the device is in recording modes or is transients capturing, alarm detecting.

3.3. Display Screen

3.3.1. Introduce

The instrument equip with backlight liquid crystal screen(640×480) can displays measurement value and curves diagram, the device parameters, the selection curves, the instantaneous values of the signals, and the measurement mode.
When the device powered up, automatically displays the waveform mode screen. More information about this screen refer to section §8.

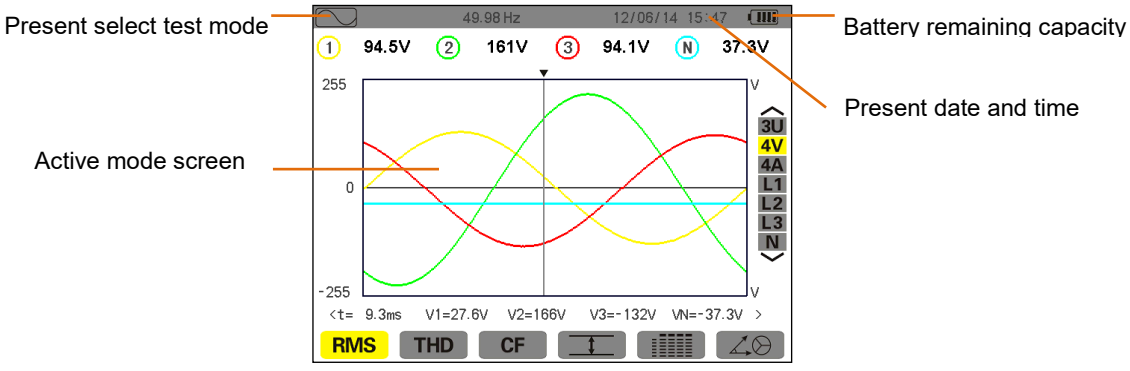


Figure 3-2: Screen display figure

Automatic shutdown: When the instrument is not in any state of trend chart recording, transient capture,

starting current detection or alarm detection (waiting or in progressing), the instrument will automatically shutdown if there is no keystroke operation within 15 minutes.

3.3.2. Symbol

The screen display symbol as follow:

Symbol	Designation	Symbol	Designation
V	Phase voltage		Display voltage and current RMS values and extrema.
U	Line voltage		Simultaneous display all voltage and current measurement
A	Current		Display voltage and current vector diagram
VA	Apparent power		Energies consumed
	Zoom in		Energies generated
	Zoom out		The 1st page of Help
	The waveform of X axis cursor indicator		The 2nd page of Help
PF…	Display value of PF, DPF, Tanφ.		The 3rd page of Help
W…	Display value of powers and energies		The 1st group monitoring parameter of trend mode
	Start Recording		The 2nd group monitoring parameter of trend mode
	Recording list		The 3rd group monitoring parameter of trend mode
OK	Confirm		The 4th group monitoring parameter of trend mode
	Stop		Page up
	Delete		Page down

3.4. Instrument Keys

3.4.1. Function keys(yellow keys)

F1 , F2 , F3 , F4 F5 F6 6 yellow function keys,corresponding function displayed on the LCD screen above the keys.

3.4.2. Navigation keys

Four arrow keys, one confirm key and one return key constitute the menu of navigation module.

Key	Function
	Up direction or increase
	Down direction or reduce
	Right direction(page down)
	Left direction(page up)
	Confirm
	Return

3.4.3. Test Mode Keys (6 keys)

Press the mode key enter into the corresponding test mode:

Key	Corresponding Test Mode	Detail Chapter
	Waveform mode: display of voltage and current waveform, max and min value, extreme value, summary tables of each parameter meeasurement value, voltage and current vector diagrams.	§ 8
	Harmonic mode: display of voltage, current, and apparent power harmonic ratios (displayed in a graph), harmonic RMS value, phase shift with respect to the fundamental.	§ 7
	Power and energy mode: displays the active power, the reactive power, the apparent power, power factor, phase shift of power factor, etc.	§11
	Trend mode: recording of the parameters selected in the *Configuration* menu.	§10

	Alarm mode: listing of recorded alarms exceeding the thresholds programmed in the configuration; recording of network blackouts with half-cycle resolution (Vrms, Arms, Urms), determination of energy consumption overshoots, monitoring of compliance with a power supply quality contract.	§9
	Capture mode: monitoring instantaneous change of power grid voltage current parameters, including the voltage current fluctuations, voltage current surge, sag and short supply interruption, temporary overvoltage, impact current and current voltage instantaneous distortion.	§ 6

3.4.4. Other keys

The other keys with following functions:

Item	Function	Detail Chapter
	Setting key: instrument setting and capture mode parameter setting, can setting date and time, display, type of connection to the network, voltage ratio, current sensor select, choice of thresholds to be detected, definition of alarms to be detected, choice of parameters to be detected.	§5
	Snapshot mode: snapshot of current screen and retrieval of screens already stored.	§12
	Help key: provides information about the functions and the symbols used for the current display mode.	§13

3.5. Wiring Connection

3.5.1. Measurement connectors

The wire connector located on the top of the instrument, these connectors are distributed as follows:

Figure 3-3: The connection port on the top

3.5.2. Charge interface & USB interface

Must be used with the special power adapter and USB communication cable.

3.6. Power Supply

3.6.1. Battery level indication

The battery symbol is in the top right corner of the screen, can shows the battery level. The number of bars indicate the present battery level.

Symbol	Charge State
	Battery fully charged
	Low battery
	Moving bars: battery charging
	The instrument is powered from an external power supply (the battery is fully charged)

When the battery level is too low, the following message is displayed:"Low battery, Instrument will soon turn

OFF". If not reconnect the instrument with the special power adaptor to charging in time, the instrument will shutdown after one minute.

3.6.2. Battery working time

Battery working time is 8 hours when the battery is fully charged.

3.6.3. Recharge the battery

The battery is charged by the special power adapter which attach with instrument. The power charging connector is shown in Figure 3-3. Please use the attch special adaptor that meets the safety standard for charging. Please keep charging the empty battery for about 5 hours. After charging is completed, the instrument will use the external power supply first and not consume the rechargeable battery power. The charger indicator light is on to indicate that the battery is charging, and the charger indicator light is off when the battery is fully charged.

3.6.4. The battery

Special lithium battery (9.6V), 4,500 mAh. The battery built-in battery compartment.

3.6.5. Power supply by special power adapter

When the instrument is running from the dedicated power adapter, the battery is optional. However, there is a risk of data loss if the main power supply is cut off during recording (when no battery is available).

3.7. The Bracket

A retractable bracket (Figure 3-4) on the back of the instrument keeps the device place at an angle of 60° .

Figure 3-4: Battery cover and bracket(the instrument back side structure)

3.8. Functions Summary

3.8.1. Measurement functions

- The AC voltage value between the devices(up to 1000V).
- The AC current value value (include neutral wire, up to 1000A).
- Sustaining voltage and current value (include neutral wire).
- Minimum and maximum half-cycle RMS value of voltage and current.
- Peak of voltage and current (include neutral wire).
- Power network of 50 Hz or 60 Hz.
- The peak factor of voltage and current (excluding neutral).
- Calculation of the K factor (KF) (apply to calculate the harmonics current of transformers).
- Current and voltage distortion factor (DF) (excluding neutral).
- Current and voltage total harmonic distortion (excluding neutral).
- Active power, reactive power (capacitive and inductive), apparent power of each phase (excluding neutral).
- Power factors (PF) and phase different power factors (DPF) (excluding neutral).
- Short-term voltage flicker (PST) (excluding neutral).
- Active, reactive (capacitive and inductive), and apparent energy (excluding neutral).
- Current and voltage harmonics (excluding neutral) up to order 50: harmonic ratio, RMS value, minimum and maximum, and sequence harmonics.
- Apparent power harmonic(50 times): harmonic ratio, RMS value, minimum and maximum.

- The motor starting current and surge current.

3.8.2. Main functions

- Display waveform (voltage and current).

■ “Starting Current” function: displays the parameters used to studying the motor starting.
★Instantaneous current value of designated by the cursor.
★Maximum instantaneous current value (the whole starting time).

★The semiperiod current TRMS value of the cursor point.
★Maximum semiperiod current TRMS value (the whole starting time).
★The motor starting time.
■ Screen shot (60 groups maximum).
■ Transients function. Detect and record power network parameters transient event records in a period of time (set the start and end times of the detection schedule)(up to 150 groups), store 4 complete period (one period before transient triggering, 3 period after triggering).
■ Trend diagram record function (2GB memory card which with the time, date, the start and end time of setting record--- max can record 100 groups). with histogram or curve shows the recorded parameters values and averages in chronological order.
■ Alarm function. Alarm record log (up to 12,800 groups)(triggered according to the setting threshold value); Set the start and end times of alarm monitoring; Displays the trigger channel of the alarm, the maximum and minimum value after the trigger, and the duration.

3.8.3. Setting function
■ Date and time setting.
■ Screen brightness and contrast setting.
■ Choice of curve colors.
■ Choice of reactive power and reactive energy calculation mode (with or without harmonics).
■ Choice of power network wiring connection (single-phase, split-phase, 3-phase 3 wires or 3-phase 4-wires, 3-phase 5-wire).
■ Choice of voltage measurement ratio and current clamp sensors.
■ Transient monitoring of voltage and current trigger threshold setting.
■ Monitoring parameters of trend diagram setting.
■ Choice of alarm monitoring parameters, trigger threshold setting.
■ Data delete (total or partial).
■ Display the instrument software and hardware version numbers.
■ Choice of language (Chinese/English).

3.9. Abbreviations
Meanings of the symbols and abbreviations used:

Symbol	Designation	Symbol	Designation
≃	AC and DC components	**MAX**	Maximum true RMS
~	AC component only	**MIN**	Minimum true RMS
⎓	DC component only	**ms**	Millisecond (unit)
φ	Phase angle	**PEAK**	Voltage & current maximum (+) or minimum(-) peak
⫗	Inductive phase shift	**PF**	Power factor
⫠	Capacitive phase shift	**PST**	Short-term voltage flicker
°	Degree	**RMS**	True RMS value (current or voltage)
∑	Sum of each phase values	**t**	Time
L	Phase (line)	**Tan**	Tangent
%	Percentage	**THD**	Total harmonic distortion
A	Ampere	**Ucf**	Line voltage peak factor

Acf	Current peak factor	**Uh**	Line voltage harmonic
Ah	Current harmonic	**Urms**	Line voltage true RMS
Akf	K Factor (for transformers)	**Uthd**	Line voltage total harmonic distortion
Arms	Current true RMS	**Uunb**	Line voltage unbalance (3φ)
Athd	Total harmonic distortion of current	**V**	Phase voltage
Aunb	Current unbalance (3φ)	**VA**	Apparent power
AVG	Average value.	**Vah**	Apparent energy
CF	Peak factor (current or voltage).	**VAR**	Reactive power
DC	DC component (current or voltage).	**VARh**	Reactive energy
DPF	Displacement power factor	**Vcf**	Voltage peak factor
Hz	Power network frequency	**Vrms**	Phase voltage true RMS
KF	Refer to Akf	**Vthd**	Voltage to neutral total harmonic distortion
W	Active power	**Vunb**	Phase voltage unbalance (3φ)
Wh	Active energy		

4. USE

The instrument must be set up before it can be used. Please refer to Chapter 5 of this manual for setting content.
The following precautions for use must be complied with:

- Do not measure to earth voltage exceeding 1,000V RMS.
- Before installing or removing the rechargeable battery, ensure that the instrument is not connected to any test wires and shut down.

4.1. Start-Up

Press the key to start up the instrument.
After about 3 seconds, the Waveform screen is displayed.

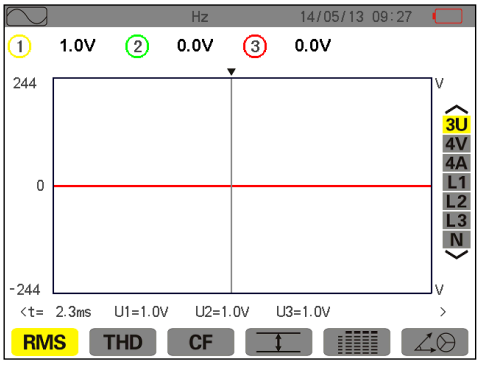


Figure 4-1: Waveform screen

When the battery power is full, the instrument power suppiled by battery. If not, the instrument will display alarm message “Low battery, Instrument will soon turn OFF” (refer to § 3.6). The instrument can be power supplied by special external power source(figure 3-3), the battery will not consume this time.

4.2. Setting

To setting the configure parameters and test parameter of the instrument, proceed as follows:
★ Press key, the instrument display setting interface.
★Press or key to select the parameter need to be modified. Press to enter the selected sub-menu.

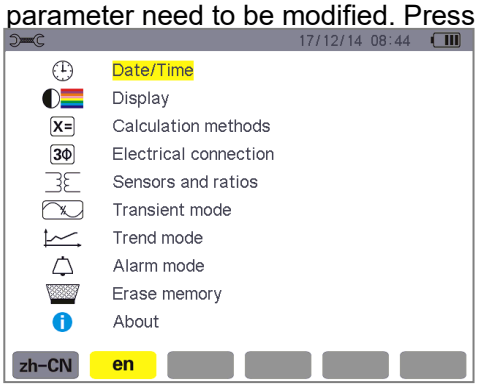


Figure 4-2: Setting screen

Press or and or to browse and press key to confirm in the displayed sub-menu. The detail operation refer to §5.3–§ 5.10.

Note: The following points must be checked or adjusted for each measurement:

Function	Reference
Define the parameters calculation methods.(reactive power/ reactive energy)	§5.5
Select the type of wiring connection (single- phase ~ three-phase, five-wire)	§5.6
Select voltage ratios and current clamp sensor type	§5.7
Transient triggering threshold (transients mode)	§5.8
Parameters need to be recorded (trend mode)	§5.9
Definition of alarm thresholds	§5.10

Press to return to the configuration menu screen.

4.3. Wire Connection

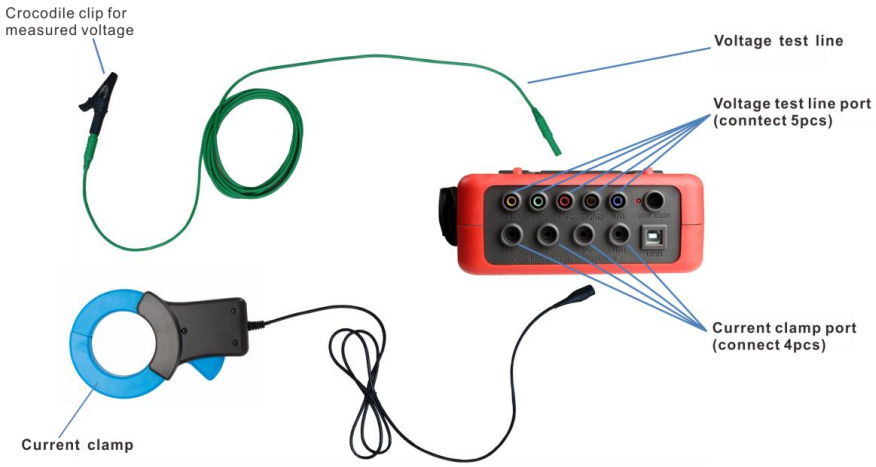


Figure 4-3 test connection on the top of device

Connect the measurement lines to the device as follows:

- Current measurement: 4 current clamp corresponding connect to 4 channels current interfaces of L1/A, L2/B, L3/C, N/D. Current clamp must corresponding connection can ensure the accuracy measurement. Select the apply current clamp before measurement (see § 5.7).
- Voltage measurement: The 5 voltage test wires according to the color corresponding connect to 5 voltage input interfaces of L1/A, L2/B, L3/C, E/GND, N/D. Set the voltage ratio before measurement.(see § 5.7).

The measurement line should be connected to the tested circuit as shown following diagrams.

4.3.1. Single-phase power network

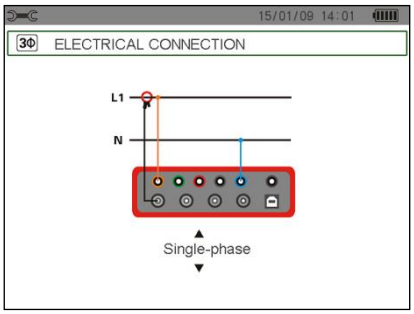


Figure 4-4: Single-phase connection

4.3.2. Three phase 3-wire power network

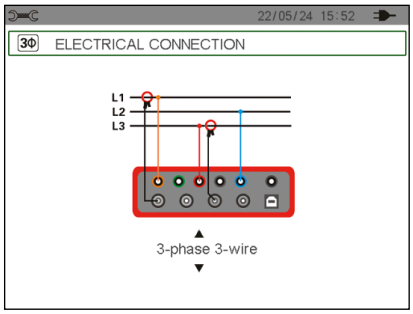


Figure 4-5: 3-phase 3-wire connection

4.3.3. Three phase 4-wire power network

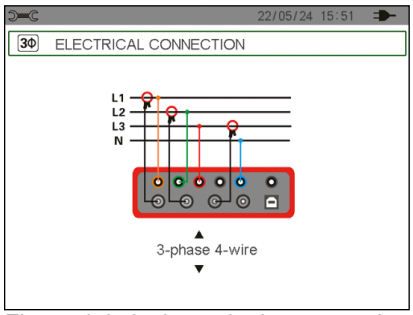


Figure 4-6: 3-phase 4-wire connection

4.3.4. Three phase 5-wire power network

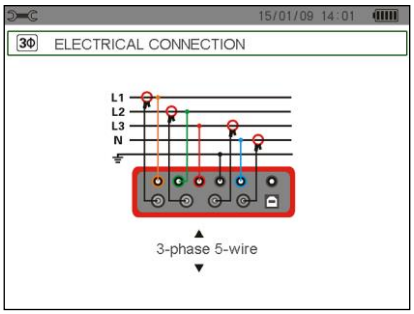


Figure 4-7: 3-phase 5-wire connection

4.3.5. Connection steps

★Power on the instrument.
★Configure the voltage ratio, select current sensor and the type of network concerned.
★Connect the leads and current sensors to the unit.
★Connect the earth and/or neutral lead to the network earth and/or neutral (when distributed) and connect the corresponding current sensor.
★Connect the L1 phase lead to the network L1 phase and connect the corresponding current sensor.
★If applicable, repeat the procedure for phases L2, L3.

Note: complying with this procedure reduces connection errors to a minimum and avoids wasting time.

4.4. Waveform Capture

Reminder: All screen interface can be saved (screenshot) by pressing the key ,the relate refer to § 12).
When the device start up and connected to the power network (connect weill with the voltage test line and current sensor), press key to waveform capture.

4.4.1. Display of the transients mode

Refer to §6.2.

4.4.2. Display of the inrush current mode

Refer to §6.3.

4.5. Display Harmonics

Reminder: All screen interface can be saved (screenshot) by pressing the key (referto § 12).
When the device start up and connected to the power network (connect well with the voltage test line and current sensor), press key to display harmonic.

4.5.1. Voltage harmonics display

Refer to §7.2.

4.5.2. Current harmonics display

Refer to §7.3.

4.6. Waveform Measurement

Reminder: All screen interface can be saved (screenshot) by press the key (referto § 12).
When the device start up and connected to the power network (connect well with the voltage test line and current sensor), press key to waveform measurement.

4.6.1. Display true RMS value

Refer to §8.2.

4.6.2. Display measurement value of total harmonic distortion

Refer to §8.3.

4.6.3. Display PEAK factor measurement

Refer to §8.4.

4.6.4. Display Min and Max RMS value, extreme value (voltage and current)

Refer to §8.5.

4.6.5. Simultaneous display all measurement parameter

Refer to §8.6.

4.6.6. Display vector diagram

Refer to §8.7.

4.7. Alarm Detection

Reminder: All screen interface can be saved (screenshot) by pressing the key (referto § 12).
When the device start up and connected to the power network (connect well with the voltage test line and current sensor), press key to waveform measurement.

4.7.1. Parameter setting of alarm mode detection

Refer to §9.2. to set the alarm detection parameters and threshold value.

4.7.2. Alarm schedule setting

Refer to §9.3 to set the start and stop time.

4.7.3. Automatic stop

After reaching the stop date and time set by the operator, the alarm recording operation will automatic stop.

4.7.4. Manual stop
Refer to §9.3.3. Do not reach preset stop date or time, the operator actively manual stops the detection.
4.7.5. Viewing the alarm log
Refer to §9.4.
4.7.6. Deleting the alarm log
Refer to §9.5.

4.8 Trend Chart Record Setting

Reminder: All screen interface can be saved (screenshot) by pressing the key (referto § 12).
When the device start up and connected to the power network (connect well with the voltage test line and current sensor), press key to waveform measurement.
4.8.1. Trend chart monitoring parameters setting
Refer to § 10.3.
4.8.2 Trend chart schedule setting
Refer to § 10.2.

4.9. Energy Measurement W

Reminder: All screen interface can be saved (screenshot) by pressing the key (referto § 12).
When the device start up and connected to the power network (connect well with the voltage test line and current sensor), press W key to waveform measurement.
4.9.1. Power consumption measurement
Refer to §11.2.
4.9.2. Energy generated measurement
Refer to §11.6.

4.10. Data Communication With PC

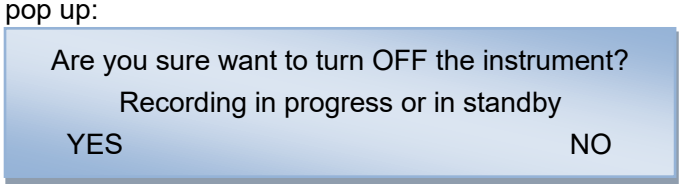
The PC software can communicate with the instrument through the USB interface to upload and store the measured data, which can be easily reviewed for future reference.
Note: The record data in the instrument will not deleted after transfer to the PC, but only copy to the PC, and the PC cannot read the instrument measurement data when the instrument is in any of the detection states of trend chart logging, transient capture, start current detection or alarm detection (waiting or in progress).

4.11. Delete Data

Stored data can be deleted before a new test campaign to free memory. Refer to §5.11.

4.12. Shut Down

Press the key to shut down the instrument.
If the instrument is in any of the detection states of trend chart recording, transient capture, start current detection, or alarm detection (pending or in progress), the instrument will not shut down without confirmation, and the following dialog box will pop up:



Select **Yes** or **No** via press the or key and will display with red word, press key to confirm.
★ If **No** is selected, recording will continue.
★ If **Yes** is selected, the data recorded until that point are saved and the device is turned off.

4.13. Power Supply

4.13.1. Recharge battery
Refer to §3.6.3.
4.13.2. Power supply operation
Refer to §3.6.5.

5. SETTING

Press key enter into device`s setting main menu. Before using the instrument, must set up the instrument and confirm the parameters. In addition, the settings can be modified if necessary. The instrument setting information is saved in the instrument after shutdown.

5.1. Setting Select Menus

Press key to select the sub-menu, press key to confirm, and press key to return to the main screen.

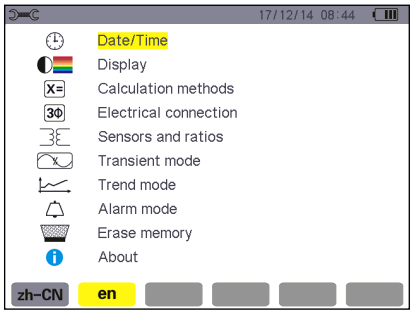


Figure 5-1: The sub-menu display interface

Name	Sub-menu	Refer
Date/Time	Date and time setting.	§5.3
Contrast/ brightness	Screen contrast and brightness setting.	§5.4.1
	Voltage curve and current curve colours setting	§5.4.2
Calculation Method	Reactive parameters calculation selection (with or without harmonics).	§5.5
Electric Wiring Connection	Select the type of electric connection to the power network (attention: calculations depend upon the type of connection type).	§5.6
Sensor & Ratio	Select the current sensors (008B current clamp, 040B current clamp, 068B current clamp, flexible coil current clamp).	§5.7.1
	Voltage ratio setting	§5.7.2
Transient Mode	Current threshold setting	§5.8.1
	Voltage threshold setting	§5.8.2
Trend Mode	Setting the request montoring parameters of the trend record	§5.9
Alarm Mode	Setting the request parameters, threshold of the alarm	§5.10
Delete Data	Delete some or all user data .	§5.11
About	Serial number, software and hardware version numbers, and capacity of on-board memory card.	§5.12

5.2. Display Language

To select the display language, press the yellow key under the corresponding icon on the screen (Figure 5-1). Select **zh-CN** is Chinese, choose **en** is English. Yellow background icon indicates the present use language.

5.3. Date/Time

This menu defines the system date and time. The display is as follows:

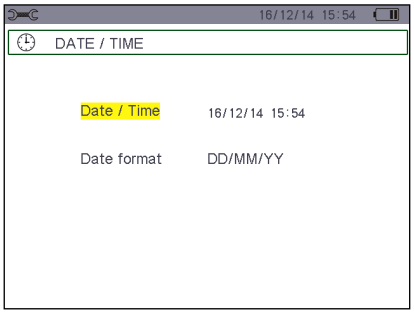


Figure 5-2: Date/Time menu

The Date/Time area is highlighted in yellow.

- Press key to change the date/time setting,.The arrows▲▼indicate the present value can be changed, press or key to increase or reduce the value.

  Press or key to select the require change value, press key to confirm.
- Change the date setting. press or key select the date/time item and dispay as yellow highlighted, and press key to confirm. The arrows▲▼ indicate the present value can be changed.
  Press or key to select DD/MM/YY or MM/DD/YY or YY/MM/DD, press key to confirm.
- Press key to return the setting main menu.

5.4. Display

5.4.1. Contrast/Brightness setting

Set the display contrast and brightness. shown as follows:

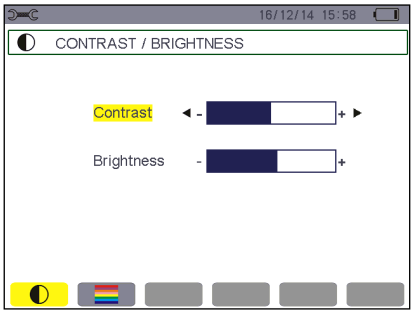


Figure 5-3: The Contrast/Brightness menu

The selected field is highlighted in yellow.

- Press or key to modify the contrast
- Press or key move to the next item.
- Press or key to change the brightness.
- Pess key return to the main menu.

5.4.2. Colour setting

The menu will display the colours of the voltage and current curves. The colours available are: yellow, orange,

red , pink , brown, green, dark green, wathet blue, sky blue, dark blue, light grey, grey.
The display screen shown as follows:

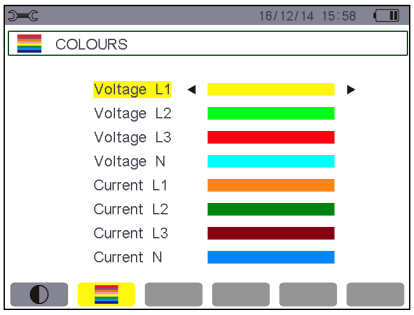


Figure 5-4: The Colours menu

The selected field will highlighted display in yellow.

- Press ◄ or ► key to select the colour of the voltage and current curves
- Press ▲ or ▼ key move to next item.
- Press ↩ key return to the main menu.

5.5. Calculation Methods

X= Menu set the calculation of reactive parameters (power and energy) with harmonics or not.

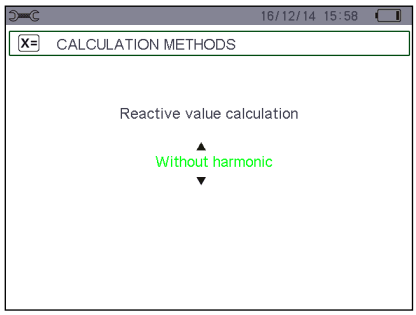


Figure 5-5: The Calculation methods menu

- Press ▲ or ▼ key to select wiht the harmonic or not.
  ★With harmonics: when calculating reactive quantities include harmonic.
  ★Without harmonics: when calculating reactive quantities not include harmonic.
- Press ↩ key return to main menu.

5.6. Electrical Wiring Connection Selection

The 3Φ menu is used to select the correct electrical wiring connection mode, shown as figure5-6:

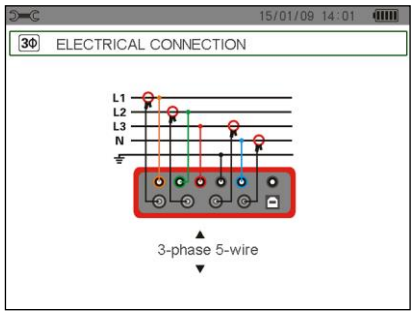


Figure 5-6: The Connection menu

Several electrical diagrams can be selected as follow:

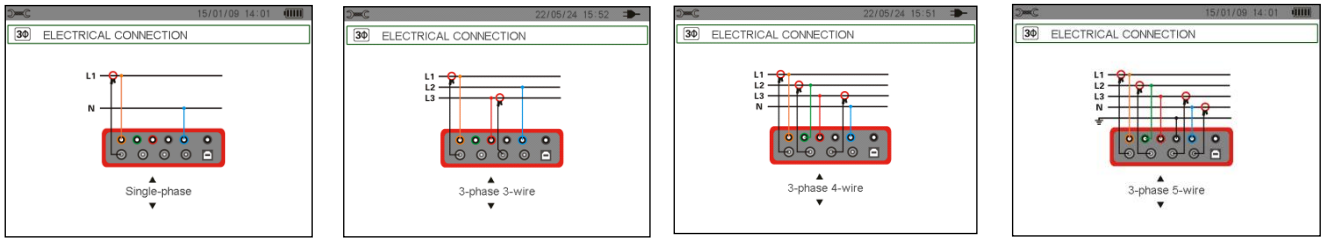


Figure 5-7: Four type can be selected

Set up the wiring connection as follow steps:

- Pressing ▲ or ▼ key to select Single-Phase, Two-Phase, 3-phse 3-wire or 3-phase 4-wire or 3-phase 5-wire connection.
- Press ↩ key return to main menu.

5.7. Sensors & Ratio Selection

5.7.1. Current sensors

In ⋮⋮ menu press and select yellow key **A** icon to choose the current clamp sensors and ratios. The device can select 4types current clamp sensors, and also can choose optional current clamp sensor, and set the turns ratio according require.

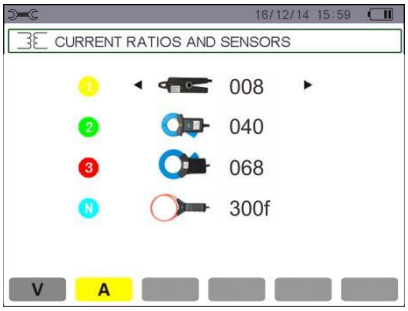


Figure 5-8: Current clamp and ratios screen in the Sensors and ratios menu

The current sensor can optional:

	008B current clamp: 10mA~ 10A
	040B current clamp: 0.10A~ 100A
	068B current clamp: 1.0A~ 1000A
	300F Flexible Coil Current Sensor (with Integrator) : 10A ~ 6000A

300F flexible coil current sensor, integrator mounted in handle, 2-in-1 mode::

- 4pcs 300F flexible coil current sensor corresponding to L1,L2,L3,N:

Insert the 300F audio plug into the current clamp input port of the power quality analyzer.

- Toggle the switch to the right to turn on the power of the flexible coil current sensor, the "POWER" indicator will be on, then toggle the switch to the left to turn off the power of the flexible coil current sensor.

Note:the flexible coil current sensor power supply by the 6F22 9V dry battery, when the right side “BAT LOW” indicator light on indicate that the battery voltage low, please replace the battery.

5.7.2. Voltage ratio

In ⋮⋮ menu, press and select the yellow **V** icon, to set the voltage ratios.

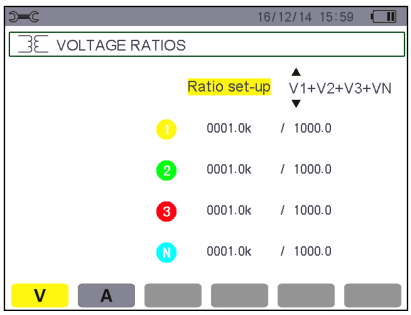


Figure 5-9: Voltage ratios setting menu

All the channels ratio can be set as the following:

■ (4V, 1/1) 4 channels are 1:1 ratio.
■ (4V) 4 channels are the same ratio.
■ (3V+VN)L1\L2\L3 is the same ratio, N line set the ratio independent .
■ (V1+V2+V3+VN)4 channels set the ratio respectively.

★Press key and the ratio setting appare the▲or▼ arrow key to select the 4types ratio combined mode as above, press key again to confirm.

★Press or key to select the corresponding ratio value, which select value will display highlighted in yellow.
★ Press key into ration setting, arrows key▲▼ appear.
★Press or key to select the position which require to change, press or key to increase or reduce the value, then press key to confirm.
★Press key return to setting main menu.

5.8. Transient Capature Setting

The menu can set current and voltage capture trigger thresholds of transient capture.

5.8.1. Current thresholds

In interface press the yellow **A** icon to select the current thresholds of transient capture.

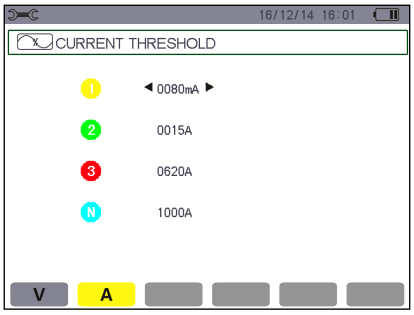


Figure 5-10: Current thresholds setting menu

★The arrow◄ ► indicate the channel of cursor.
★Press or key to select the channel, press key will appear ▲▼ arrow key, then start to change.
★Press or to select the change position and threshold current unit(mA/A), press or key to increase or reduce the value.
★Press key to confirm.

5.8.2. Voltage thresholds

In interface press the **V** icon to select the voltage thresholds of transient capture.

All the voltage threshold can be set 3 combined modes as following:

■ (4V)--4 channels are the same threshold.
■ (3V+VN) --L1\L2\L3 are the same threshold, N line set the threshold independent .
■ (V1+V2+V3+VN)-- 4 channelsset the threshold respectively.

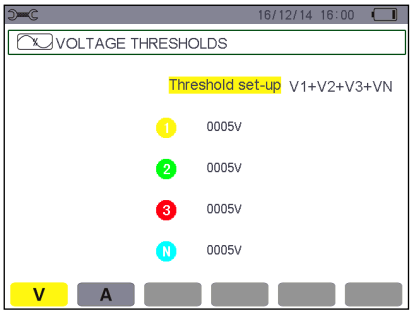


Figure 5-11: Voltage thresholds seetting menu

★Press key and the ratio setting appear the arrows▲▼key. Press or to select the above 3 different threshold combination modes, press to confirm.
★Press or key to select the corresponding require thresholds, which the selected value will display highlighted in yellow.
★Press key enter to threshold setting, The arrows▲▼ appear and start to change.
★Press or select the required change position and threshold unit(V/kV), press or key to increase or reduce the value.
★Press key return to the main menu.

5.9. Trend Monitoring Parameter Setting

The instrument has a trend chart recording function (refer to § 10), which records the measured or calculated values (e.g. Urms, Vrms, Arms, etc.). The menu is used to set the parameters to be monitored in the trend graph recording.
Press the corresponding function icon , , , to select the require monitoring parameters groups. The selected parameters groups identified by the icon with a yellow background.
The configuration example is shown below:

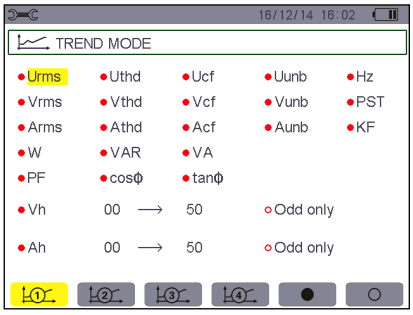


Figure 5-12: Trends chart record parameter selection

★Press the icon function key to set the monitoring parameters group 1. The selected icon display with yellow background.
★Press or and or key to move the cursor.
★Press to select/cancel, red solid dot indicate is selected, red hollow dot indicate is unselected.

Optional monitoring parameters are available:

Unit	Description
Urms	True RMS phase-to-phase voltage.
Uthd	harmonic distortion of the phase-to-phase voltage(2φ, 3φ).
Ucf	Crest (peak) factor of phase-to-phase voltage(2φ, 3φ).
Uunb	Phase-to- phase voltage unbalance(2φ, 3φ).
Hz	Network frequency.

Vrms	True RMS phase-to- neutral voltage.
Vthd	Total harmonic distortion of the phase-to-neutral voltage.
Vcf	Crest factor of phase-to-neutral voltage.
Vunb	Phase-to-neutral voltage unbalance(2φ, 3φ).
PST	Short-term flicker.
Arms	True RMS current.
Athd	Total harmonic distortion of the current.
Acf	Crest factor of current.
Aunb	Current unbalance (2φ, 3φ).
KF	K factor.
W	Active power.
VAR	Reactive power.
VA	Apparent power.
PF	Power factor.
DPF	Displacement power factor.
Tan	Tangent.
?	See comment below(relate to the harmonic).

The last two line need special settings, show as follow:

Figure 5-13: These two lines involve harmonics

These two lines relate to the monitoring values of harmonics VAH, Ah, Vh and Uh. The user can independently select the measured harmonics times (0 to 50 times) to record the corresponding times of harmonic ratio, and can also choose to record only the odd harmonics. Specific operations are as follows:

- **Select the monitoring harmonic parameters**: the selected ? highlighted display in yellow, press key and appear the arrows key▲▼, press or key to select the require parameters (VAh, Ah, Vh, and Uh), "?"indicate is unselected. press key to confirm, the selected values field is highlighted in yellow.
- Press to go to the next pption.
- **Select the starting harmonic times**: the relate option highlighted in yellow. Press key and appear the arrows▲▼ key. Press or key to increase or decrease the starting harmonic times, then pressing key to confirm . Press key to go to the next option.
- **Select the finishing harmonic times**: (the finishing harmonic times must higher than or equal to the starting harmonic times) highlighted in yellow. Pres key and appear arrows▲▼ key. Press or key to increase or decrease the finishing harmonic orders , then press key to confirm.
- Press to go to the next option.
- **Record odd harmonics only**: press key to select or cancel to record the odd harmonic only, the solid red dot mean slected:
  Selected: Record only the odd harmonic of the two harmonic times.
  Not selected: Record all harmonics time(include the odd harmonic).

Figure 5-14: Record harmonic times setting

- Press key return to setting main menu.

Set up another group of trend chart recording & monitoring parameter settings in the same way.

5.10. Alarm Monitoring Parameter Setting

The menu is used to set the parameters and thresholds to be monitored in alarm mode (refer to § 9). User can set 40 groups of alarm monitoring parameters

.

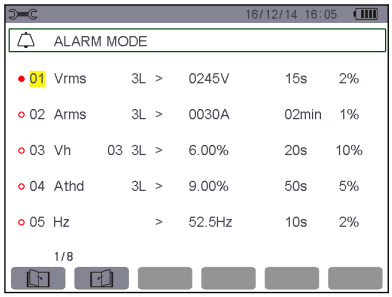


Figure 5-15: The alarm mode menu

- Use the or key to select different setting alarm parameter group.
- Press key to select present position parameter and then appera arrows▲▼key.
- press or key to select the setting parameters (Vah, Ah, Uh, etc., refer table in § 5.9), then press key to confirm. The selected parameter is display highlighted in yellow.
- Press or keys horizontally select each parameter, press key to confirm and then appear the arrows▲ ▼ key. Press or key to select the require setting value, press key to confirm.

Set the other values of each parameter in the same way.

Define each alarms, optionally:

★The alarm types (Vah, Ah, Uh, Vh, Tan, PF, DPF, VA, VAR, W, Athd, Uthd, Vthd, KF, Hz, Aunb, Vunb, Vrms, Acf, Ucf, Vcf, PST, Arms, Urms and Vrms) (refer the abbreviations in § 3.9).

★The harmonics time range (between 0 and 50, for Vah, Ah, Uh and Vh value).

★The alarm trigger channel (3L: 3-phases, L1, L2, L3 can be triggered individually ; N: neutral can be triggered).

★The alarm judgement direction (> or < can be selected for Arms, Urms, Vrms, Hz only; otherwise only one direction).

★The alarm triggering threshold (can set the the threshold unit of W, VAR, VA, Arms, Urms, Vrms).

★Exceed threshold trigger min.time(can set 0s - 99 minutes).

★The alarm hystersis value (The percentage increase or decrease from the corresponding alarm threshold, optional values can be selected with 1%, 2%, 5% or 10%. If exceed the selected percentage will stop alarm, refer §17.2).

- Press key to select or cancel the alarm parameter groups, red solid dot indicate is selected, red hollow dot indicate is unselected.
- Press or icons of the yellow background function key to disply the alarm monitoring parameter groups next page or up page.
- Press key return to setting main menu.

5.11. Delete Data

The menu is used to delete partial or all of the data stored in the instrument (trend chart records, transient records, starting currents, alarms, screenshots, instrument settings and monitoring parameter settings, etc.).

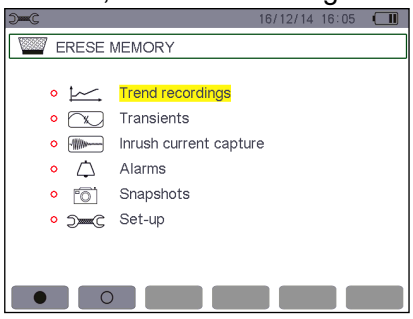


Figure 5-16: Delete data menu

■ **Partial delete:**

★Press or key to select the delete options. The selected option will display highlighted in yellow.
★Press to select/unselect, red solid dot indicate is selected, red hollow dot indicate is unselected.
Note: If select to delete the setting parameters, the instrument screen will display message “after the configuration is deleted, the device will be turned off”.
★Press icon function key and the icon will display highlighted in yellow background and indicate is ready and in delete state, Press the icon again to cancel the delete state.
★In the state of ready to delete, press key confirm to delete the selection parameters .
★Press key return to setting main menu.

■ **All delete:**

★Press●icon function key to select all the stored data, red solid dot indicate is selected and the secrren will display message ”after the configuration is deleted, the device will be turned off”.
Note: Since selected delete the setting parameters, the message “after the configuration is deleted, the device will be turned off” will display on the screen.
★ Press○ icon function key to cancel all the selection, red hollow dot indicate is unselected.
★Press key return to seeting main menu.

5.12. About

The screen will displays the serial number of the device, the firmware version, the DSP software version, the icon version, and the SD card capacity.

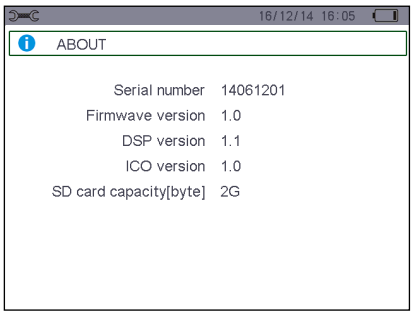


Figure 5-17: The about menu

Press key return to seeting main menu.

6. WAVEFORM CAPTURE MODE

6.1. Sub-Mode Selection

The waveform capture sub-modes are listed in the screen below, and the follow section will introduce individually .

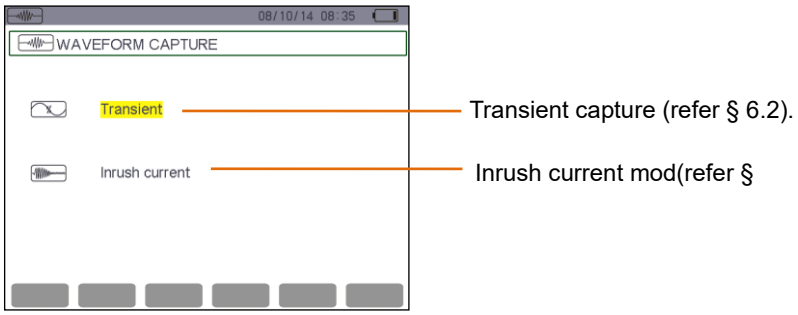


Figure 6-1: The waveform capture mode

Enter the sub-modes as follows steps:

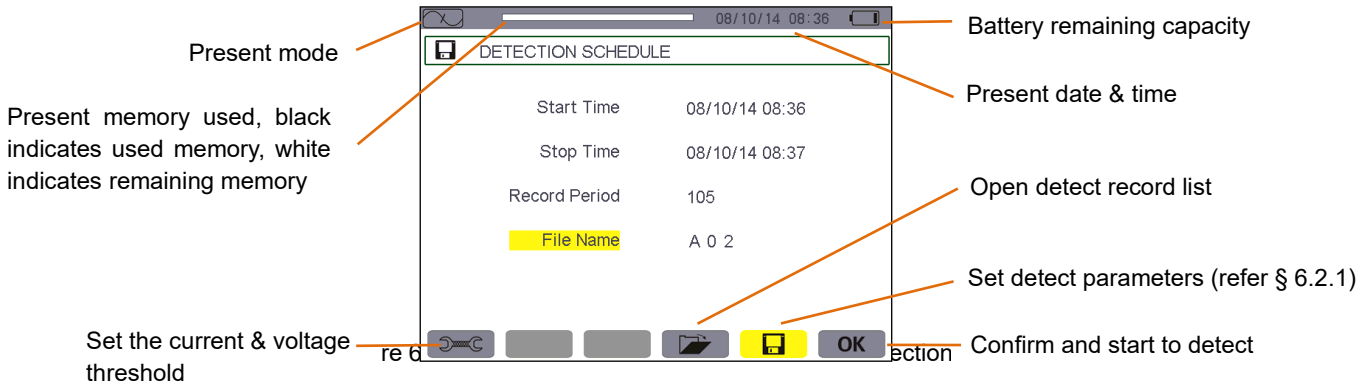
★ Press or key to select, the selected mode will display highlighted in yellow.

★ Press key to confirm.

★Press key return to waveform capture main meun.

6.2. Transient Measurement Mode

Transient measurement mode can detect transient event records, browse transient records, and select to delete transient records. 150 groups of transient measurement records can be saved.



6.2.1. Setting & starting detection

Press icon function key and display the detection schedule screen.

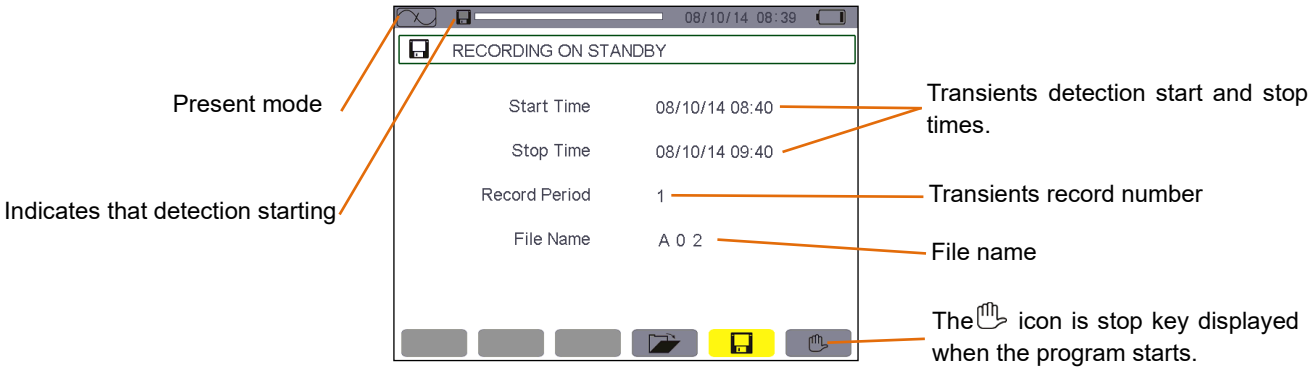


Figure 6-3: The transients mode schedule detecting

6.2.1.1. Step 1: Parameters setting

★Press ▲ or ▼ key to select the start time(the selected field is highlighted display in yellow). Press ↵ key enter to setting values, and the start date & time optional item value appear the arrows▲▼key.
★Press ▲ or ▼ to increase or decrease the value, press ◄ or ► key move to next item.
Note: The start time must be later than the present time.
★Press ↵ key to confirm the detection start date and time.
★Press ▲ or ▼ key to select the stop time(the selected field is highlighted display in yellow), Press ↵ key enter to setting values, and the stop date & time optional item value appear the arrows▲▼key.
★Press ▲ or ▼ to increase or decrease the value, press ◄ or ► key move to next item.
Note: The stop date and time must be later than the start date and time.
★Press ↵ key to confirm the stop date and time.
★By setting the number of records in the same way, the maximum total number of transient records that can be saved by the instrument 150 groups.
★Set the file name in the same way, the file name can be composed of numbers 0-9, letters A-Z, the length of the file name up to 8 characters.
★Press icon function key enter to setting **voltage** and **current thresold** interface, finish the seting press ↩ key return to waveform capture mode directly.

6.2.1.2. Step2: Start detection

Press **OK** icon function key to start detection at the preset start and stop times.
★The **OK** icon disappears and the icon appears instead.
★Before the real time reach the preset start time will display "**Detection on standby**", and the icon will flashes on the top display bar.
★When the real time reach the preset start time will display "**Detection in progress**".
★After the real time reach the preset stop time and finish the detection, will display the detection schedule and the **OK** icon (bottom right-hand corner of the screen) again. At this time,can set the next detection schedule.
Note: The transient capture is related to voltage and/or current and is consistent with the setting trigger thresh-old. If triggered by an event, the instrument will save the current waveform and voltage waveform.
Press ↩ key return to waveform capture main menu.

6.2.1.3. Active stop detection

Before the real time reaches the preset stop time, can press the corresponding yellow function key to actively stop the transient detection, and the **OK** icon will appear again at this time.

6.2.2. Display transient measurement record

Follow the steps below to display the saved transient detection records:
★Press icon function key display the transient detection record list, shown as follow:

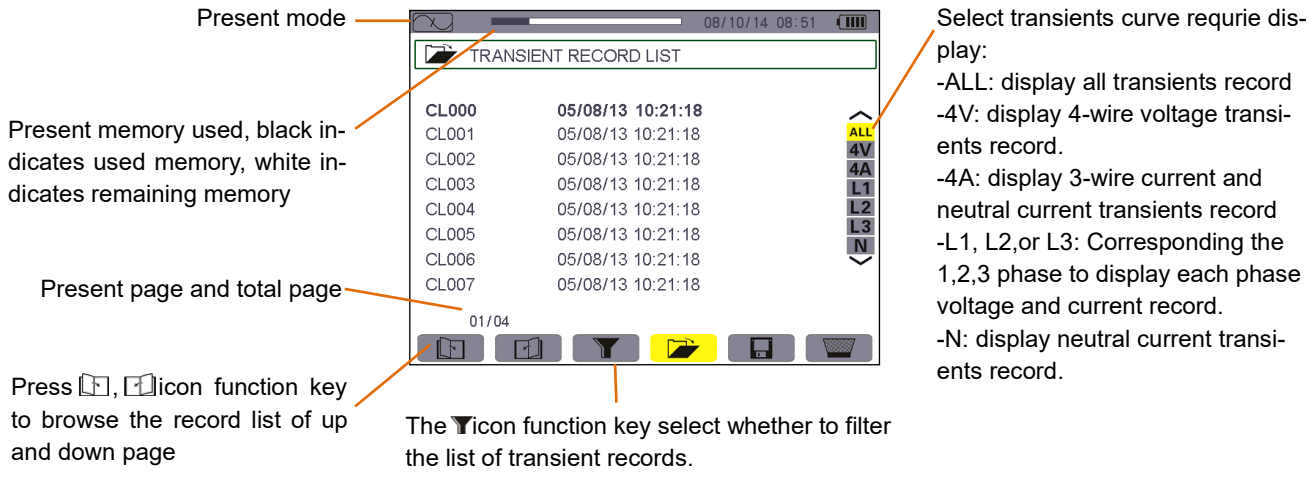


Figure 6-4: the Transient list screen

★Press ▲ or ▼ key to select the require display transient detection record, the selected line will display with bold word, and press ↵ key to confirm. The relate transient detection record will display as curves.

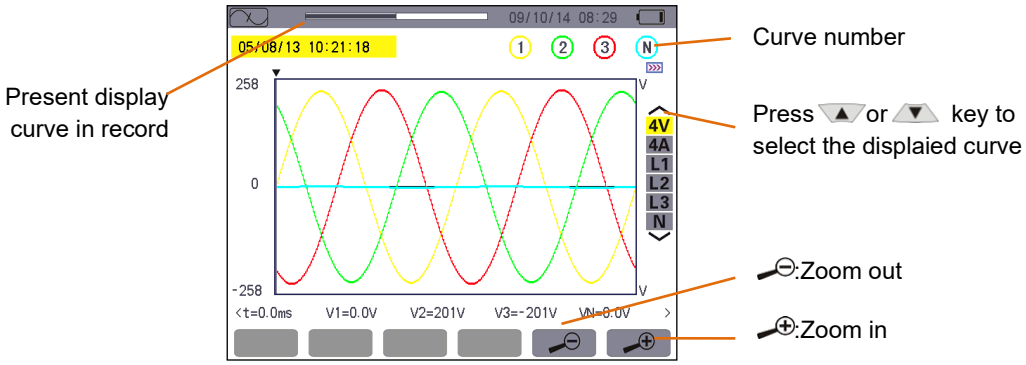


Figure 6-5: Transients waveform curves

★Press ▲ or ▼ key to select the request displaied curve, Press ◄ or ► key to move the cursor left and right, long press can move quickly.

★Press ↩ key return to transient detection record list.

6.2.3. Delete transient measurement record

The delete icon will displayed only when in transient record list . delete steps as follows:

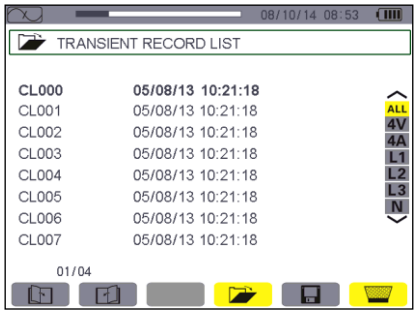


Figure 6-6: Delete transient measurement record

★Press ▲ or ▼ key to select the reqeust delete tranient record. The selected record will display as black bold word.

★Press icon function key to preare to delete. The icon displayed in yell background indicate selected and ready to delete, press icon function key or ↩ key to cancel the delete state.

★In the state of ready to delete, press ↵ key to confirm delete the record.

6.3. Inrush Current Mode

Inrush current mode can monitor the current waveform and voltage waveform when the electrical equipment starts up, and there are two submenus of **RMS** and **PEAK** in the capture record (refer to 6.3.2).

The instrument can store only one group of inrush current waveform capture chart.

6.3.1. Capture Schedule

Inrush current capture schedule as follows:

Press key enter to relate menu and display capture schedule interface.

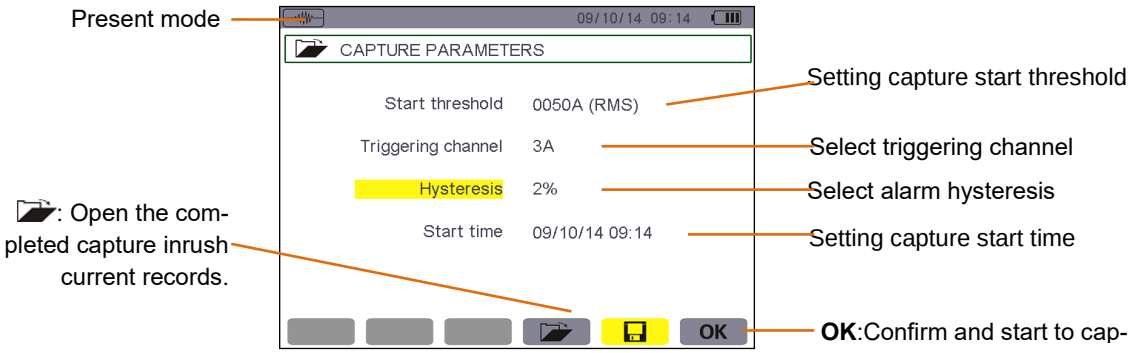


Figure 6-7: Inrush current capture schedule setting

6.3.1.1. Step 1: Parameter setting
Specific operations as follow:
★Press or key to select the start threshold setting(the selected item will highlighted display in yellow), Press key to enter and set relate values, at this time the arrows▲▼ key appear on various start threshold value.
★Press or to increase or decrease the value and press or to move to the next item and setting.
★Press key to confirm.
Operate as the same way to setting the **triggering channel**, **Hysteresis** and **Start time**.
Note: More information about the hysteresis, refer to § 17.2.
6.3.1.2. Step 2: Start capture
Press **OK** icon function key to start capture with the preseted date and time.
★The **OK** icon disappears and the icon appears instead.
★Before reaching the preset start time, the screen will dispaly "**capture pending**"m and the icon flashes in the screen's upper display bar.
★After reaching the preset start time and meet the activate condition, the screent will display **"Capture in progress"**, and the memory occupation indicator bar will display at the top of the screen . (The black bar is memory used; the white bar is memory available), the memory card occupancy indicator bar is only displayed during the capture process and disappears after finish capture.
★If the stop conditions are met (refer to 17.5) or if the instrument memory is full, the capture will stop automatically and the "**Capture Schedule**" and **OK** icons will appear again.
Note: The instrument can only store one group of inrush current capture waveform, the user need to delete the previous capture before the next capture can be made.
Press key return to waveform capture menu.
6.3.1.3. User active stop waveform capture
Use press icon (bottom right corner of the screen) function key to stop waveform cature, and the **OK** icon will appear in the same place.

6.3.2. Inrush Current Capture Parameter Display

Display the inrush current capture record parameters as follows:

- Press icon function key to open the completed inrush current record, shown as follow:

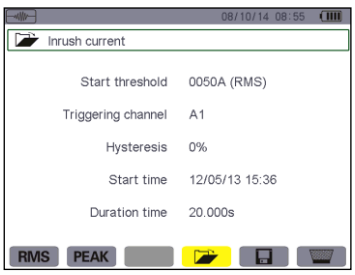


Figure 6-8: the Capture parameters interface

No.	Function	Refer
(1)	**RMS** mode	§ 6.3.3
(2)	**PEAK** mode	§ 6.3.4

■ Press the RMS or PEAK icon function key to select the capture parameter to be displayed in **RMS** mode or **PEAK** mode. The instrument displays the corresponding current waveform and voltage, and the user can move the cursor along the waveform curve to zoom in or zoom out to observe the waveform. Related Information:

★ The cursor points on the curve are instantaneous current or voltage values.
★ The maximum instantaneous current (whole inrush cycle).
★ Half-cycle current **RMS** value of the cursor mark point.
★ The maximum half-cycle RMS current (whole inrush cycle).
★ Maximum instantaneous value in inrush cycle(PEAK).
★ The starting time and the motor starting period.

Caution: Voltage must be available before the motor can be started at a stable and correctly servo-controlled frequency.

6.3.3. True RMS Current

RMS mode displays the half-cycle true RMS trend curve chart of the start-up process.

6.3.3.1. RMS mode display 3A

The relate information as follow:

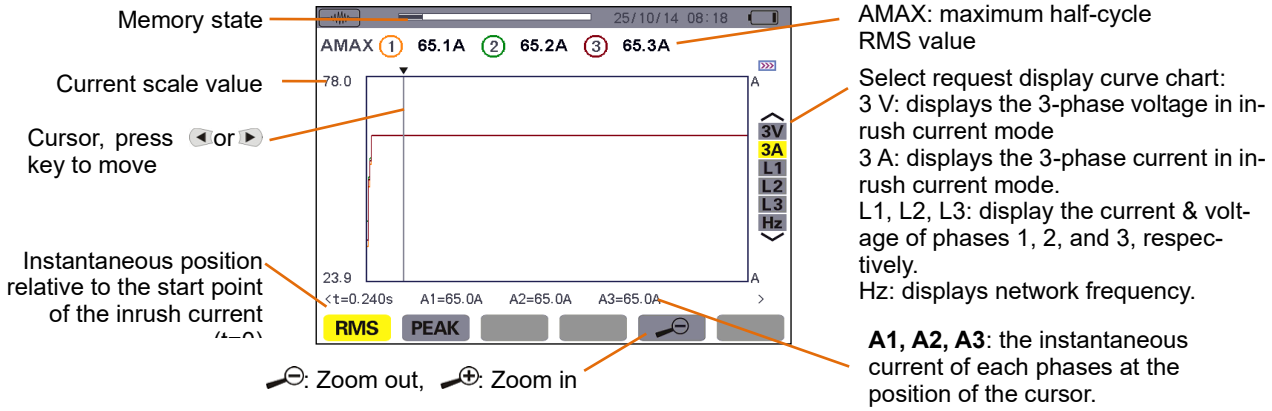


Figure 6-9: RMS mode display 3A scre

6.3.3.2. RMS mode display L1

The relate information as follow:

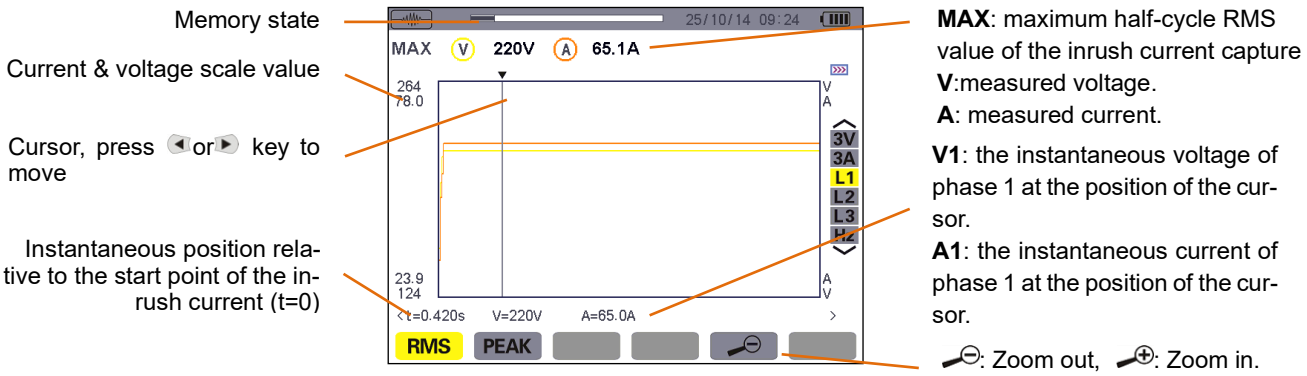


Figure 6-10: the L1 RMS display screen

Note: L2 and L3 can display the true RMS trend curves of phase 2 and phase 3 half-cycle current and voltage

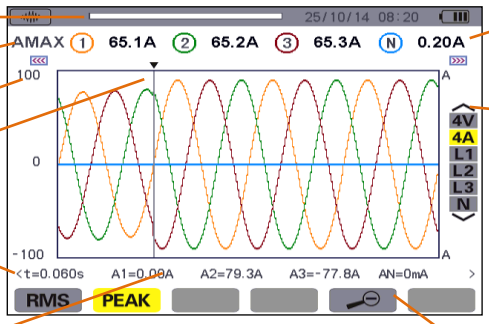
starting process, same as L1 display screen.

6.3.4. Inrush Current Instantaneous Value PEAK

The PEAK mode displays envelope curve and inrush current capture waveform.

6.3.4.1. PEAK mode display 4A

The relate information as follow:



Memory state

Peak absolute value

Current scale value

Cursor, press ◄or► key to move

Instantaneous position relative to the start point of the inrush current (t=0)

A1, A2, A3: the instantaneous current of each phase at the position of the cursor

AMAX:maximum half-cycle RMS value of the inrush current capture

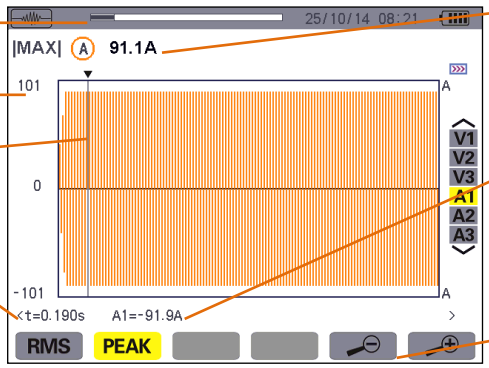
Select request display curve chart:
4 V: display 3-phase and neutral voltages
4 A: display 3-phase and neutral current.
L1, L2, L3: display the current & voltage of phases 1, 2, and 3, respectively.
N: display the neutral current and voltage

⊖: Zoom out, ⊕: Zoom in.

Figure 6-11: the 4A PEAK value display scree

6.3.4.2. The A1 PEAK value display

The relate information as follow:



Memory state

Current scale value

Cursor, press ◄or► key to move

Instantaneous position relative to the start point of the inrush current (t=0)

MAX: maximum half-cycle RMS value.

A1: the instantaneous current of phase 1 at the position of the cursor

⊖: Zoom out, ⊕: Zoom in.

Figure 6-12: the A1 PEAK value display screen

Note: A2 and A3 can display the current envelope curve record of phase 2 and phase 3, the above is the display screen of A1. V1, V2, V3 display the voltage envelope curve chart of phase 1, phase 2, and phase 3, similar to the display screen of A1.

7. HARMONICS MODE

Harmonic mode can displays each harmonic ratio of voltage, current and apparent power, can measures harmonic currents generated by nonlinear loads, and analyzes the problems caused by harmonics (heating case of neutral wires, conductors and motors, etc.).

7.1. Select Sub-Menu

The harmonic mode submenus are listed in the following screens and will introduce separately in the following sections.

Select the measurement type with the ellow function keys at the bottom of the screen.

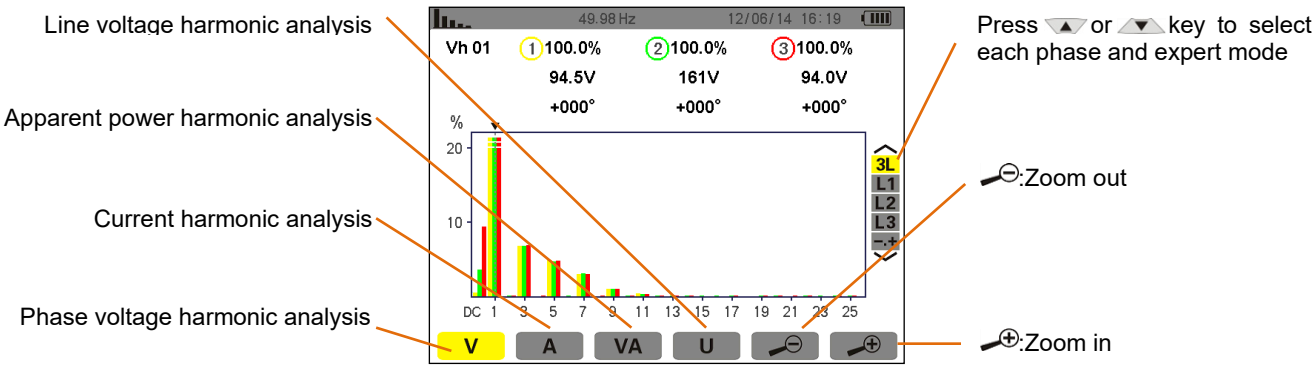


Figure 7-1: Harmonic mode screen

7.2. Phase Voltage V

This sub-menu displays the phase voltage harmonic.
Note: The display curve is determined by the wiring connection type (refer to §5.6):
★Single-phase: no choice (L1 only).
★2-phase: 2L, L1, L2.
★3-phase 4wire or 5-wire: 3L, L1, L2, L3, -,+ (expert mode).
The figure shows as the 3-phase wiring connection, which is also valid for the other submenus.

7.2.1. Phase voltage harmonics 3L display screen

Shown as follow information:

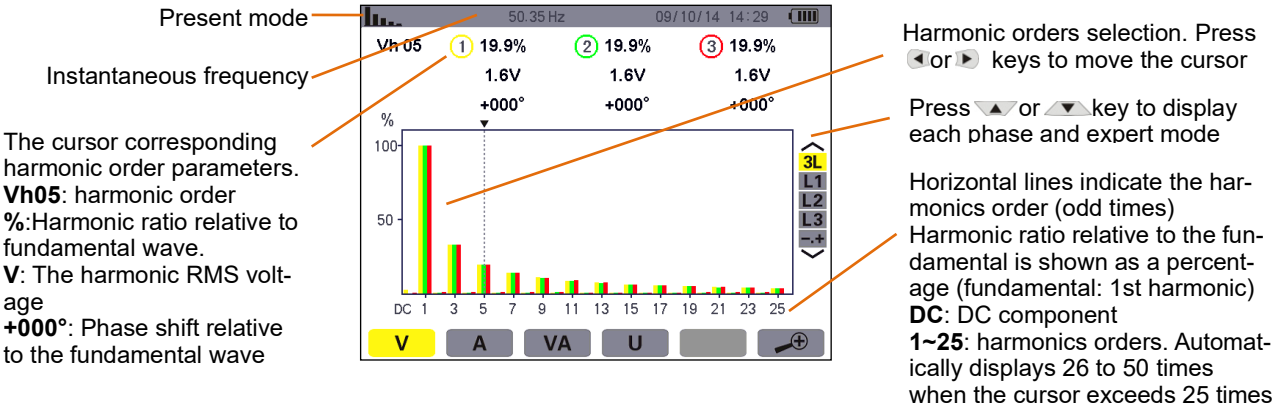


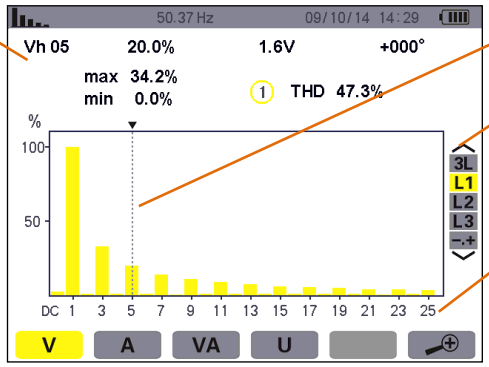
Figure 7-2: Phse voltage harmonic 3L display

Expert mode displayed in 3 x 3L or L1, L2 and L3(*) (3-phase wiring connection only - refer to §7.6)

7.2.2. Phase voltage harmonic L1 display

Shown as follow information:

The cursor corresponding harmonic order parameters.
Vh05: harmonic order
%:Harmonic ratio relative to fundamental wave.
V: The harmonic RMS voltage
+000°: Phase shift relative to the fundamental wave
Max, min: harmonic ratio of maximum and minimum (press ▷ keyto reset).
THD: total harmonic distortion.



Harmonic orders selection, Press ◁or▷ keys to move the cursor

Press △or▽key to display each phase and expert mode

Horizontal lines indicate the harmonics order (odd times)
Harmonic ratio relative to the fundamental is shown as a percentage (fundamental: 1st harmonic)
DC: DC component
1~25: harmonics orders. Automatically displays 26 to 50 times when the cursor exceeds 25 times

Figure 7-3: Phase votlage harmonic L1 display screen

Note: L2 and L3 display the phase voltage harmonics of phase 2 and phase 3 respectively, same as the L1 screen display. A

7.3.Current

The sub-menu displays the current harmonics.

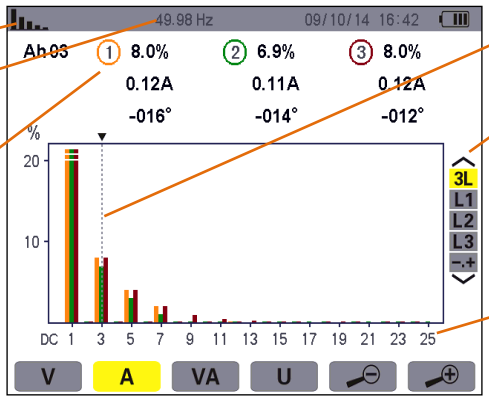
7.3.1. Current harmonics 3L display

Show as follow information:

Present mode

Instantaneous frequency

The cursor corresponding harmonic order parameters
Ah03: harmonic orders
%:Harmonic ratio relative to fundamental wave
A: Harmonic RMS current
+000°: Phase shift relative to the fundamental wave



Harmonic orders selection, Press ◁or▷ keys to move the cursor

Press △or▽key to display each phase and expert mode

Horizontal lines indicate the harmonics order (odd times)
Harmonic ratio relative to the fundamental is shown as a percentage (fundamental: 1st harmonic)
1~25: harmonics orders. Automatically displays 26 to 50 times when the cursor exceeds 25 times

Figure 7-4: Current Harmonic 3L display

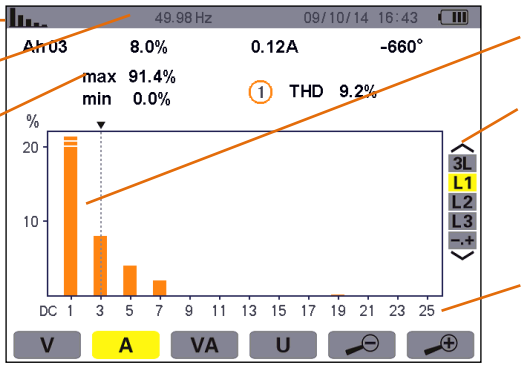
7.3.2. Current harmonics L1 display

Shown as follow information :

Present mode

Instantaneous frequency

The cursor corresponding harmonic order parameters
Ah03: harmonic orders
%:Harmonic ratio relative to fundamental wave
A: Harmonic RMS current
+000°: Phase shift relative to the fundamental wave



Harmonic orders selection, Press ◁or▷ keys to move the cursor

Press △or▽key to display each phase and expert mode

Horizontal lines indicate the harmonics order (odd times)
Harmonic ratio relative to the fundamental is shown as a percentage (fundamental: 1st harmonic)
1~25: harmonics orders. Automatically displays 26 to 50 times when the cursor exceeds 25 times

Figure 7-5: Current harmonic L1 display screen

Note: L2 and L3 display the current harmonics of phase 2 and phase 3 respectively, same as the L1 screen display.

7.4. Apparent Power VA

The sub-menu displays the apparent power harmonic.

7.4.1. Apparent power harmonic 3L display

Show as follow information:

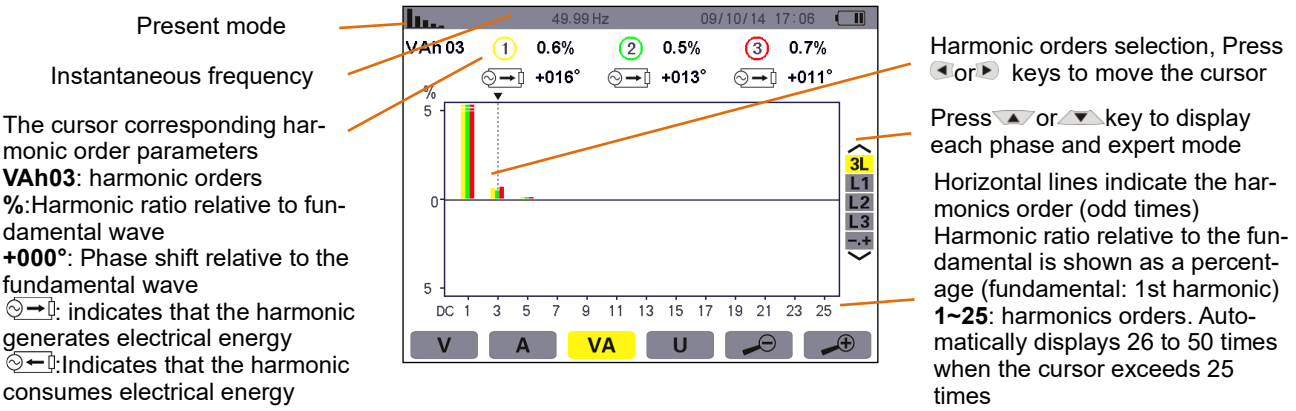


Figure 7-6: Apparent power harmonic 3L display screen

7.4.2. Apparent power harmonic L1 display

Shown as follow information:

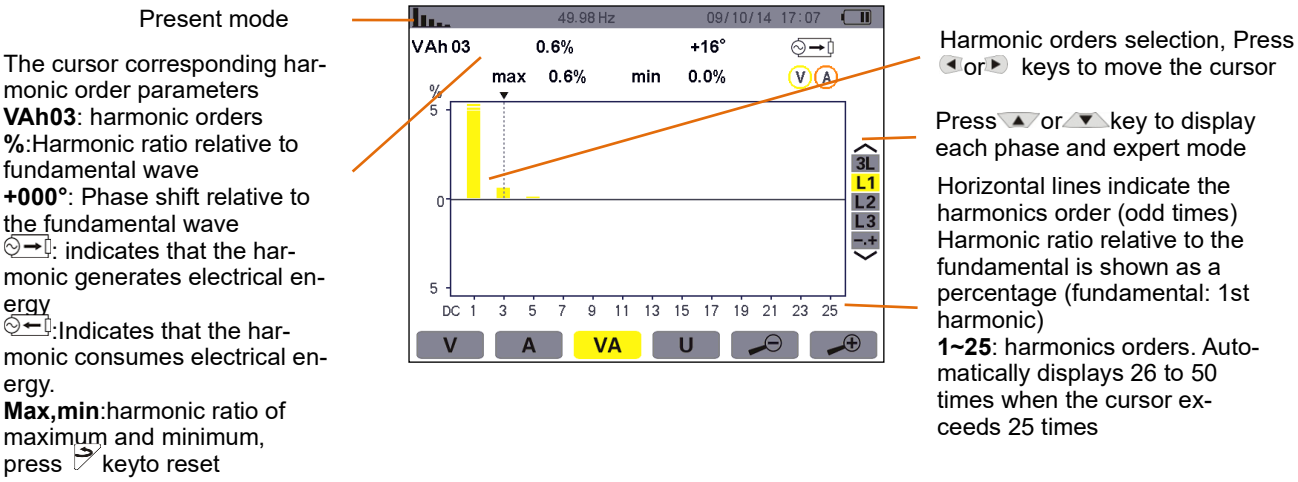


Figure 7-7: Apparent power harmonic L1 display screen

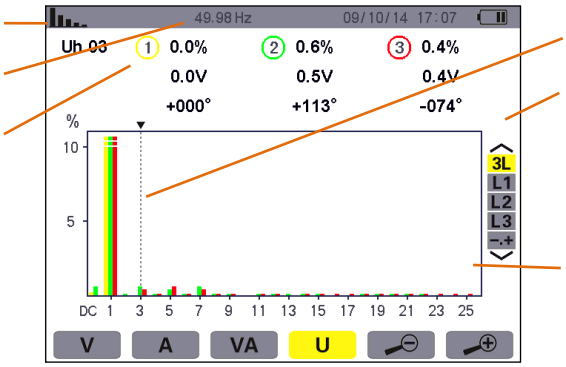
Note: L2 and L3 display the apparent power harmonics of phase 2 and phase 3 respectively, same as the L1 screen display. U

7.5. Line Voltage

Corresponding submenu display line voltage harmonics and only for 2-phase and 3-phase wiring connection.

7.5.1. L voltage harmonic 3L display

Shown as follow information:



Present mode

Instantaneous frequency

The cursor corresponding harmonic order parameters
Uh03: harmonic orders
%:Harmonic ratio relative to fundamental wave
V: Harmonic RMS voltage.
+000°: Phase shift relative to the fundamental wave

Harmonic orders selection, Press ◄or► kevs to move the cursor

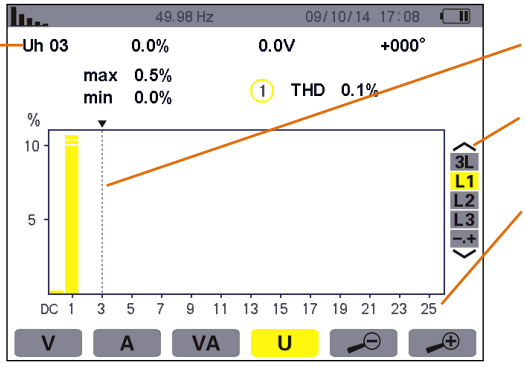
Press ▲or▼key to display each phase and expert mode

Horizontal lines indicate the harmonics order (odd times)
Harmonic ratio relative to the fundamental is shown as a percentage (fundamental: 1st harmonic)
DC: DC component
1~25: harmonics orders. Automatically displays 26 to 50 times when the cursor exceeds 25 times

Figure 7-8: Line voltage harmonic 3L display screen

7.5.2. Line voltage harmonic L1 display

Shown as follow information:



The cursor corresponding harmonic order parameters
Uh03: harmonic orders
%:Harmonic ratio relative to fundamental wave
V: Harmonic RMS voltage.
+000°: Phase shift relative to the fundamental wave
Max,min:harmonic ratio of maximum and minimum, press keyto reset
THD: total harmonic distortion.

Harmonic orders selection, Press ◄or► keys to move the cursor

Press ▲or▼key to display each phase and expert mode

Horizontal lines indicate the harmonics order (odd times)
Harmonic ratio relative to the fundamental is shown as a percentage (fundamental: 1st harmonic)
DC: DC component
1~25: harmonics orders. Automatically displays 26 to 50 times when the cursor exceeds 25 times

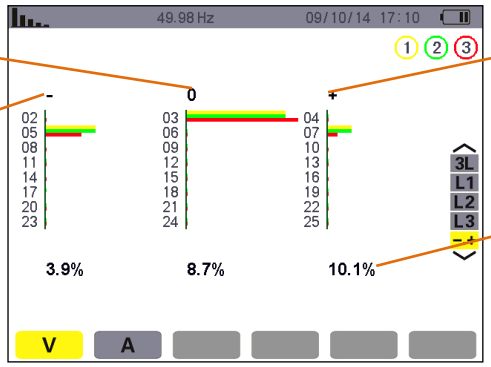
Figure 7-9: Linee voltage harmonic L1 display screen -.+

7.6. Expert Mode

The expert mode is only available for 3-phase connections. This mode is used to show the harmonic effects of the neutral line heating or the rotating motors. press the ▲ or ▼ keys to select the expert mode. The selected item −.+ **will** highlighted display in yellow and displays the expert mode at the screen.
In the expert mode screen have two sub-menus of V and A can be select (refer to next page).

7.6.1. Expert mode display phase voltage V

Submenu showing the effect of phase voltage harmonics in neutral heating or in rotating motors.
Shown as follow information:



Include a zero sequence harmonic

Include a negative sequence harmonic

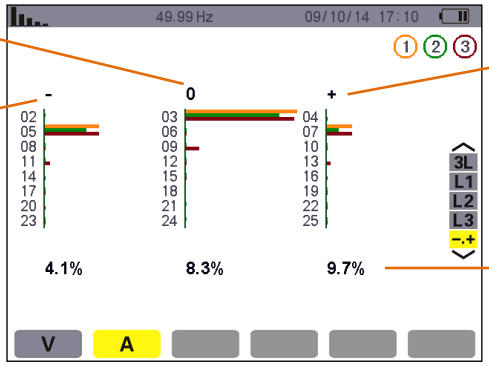
Include a positive sequence harmonic

%: Harmonic ratio relative to fundamental wave

Figure 7-10: Phase voltage expert mode display

7.6.2. Expert mode display current A

Submenu showing the effect of current harmonics in neutral heating or in rotating motors.
Shown as follow information.



Include a zero sequence harmonic

Include a negative sequence harmonic

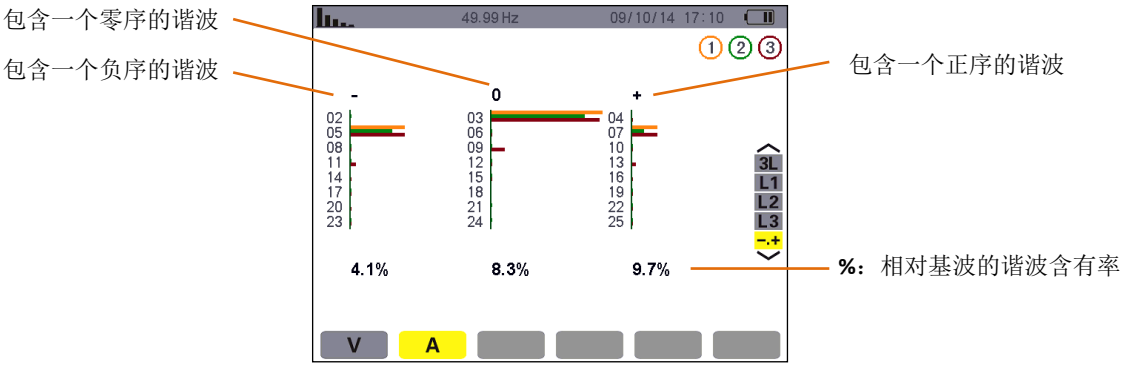
Include a positive sequence harmonic

%: Harmonic ratio relative to fundamental wave

Figure 7-11: Current expert mode display

8. WAVEFORM MODE

Waveform mode displays voltage and current curve chart, measured values and, calculated values (excluding power, energy and harmonics).



8.1. Select Sub-menus

The sub-menus are listed on the screen below and described individually in the paragraphs that follow. Users can select the type of measurement by pressing the yellow function key at the bottom of the screen.

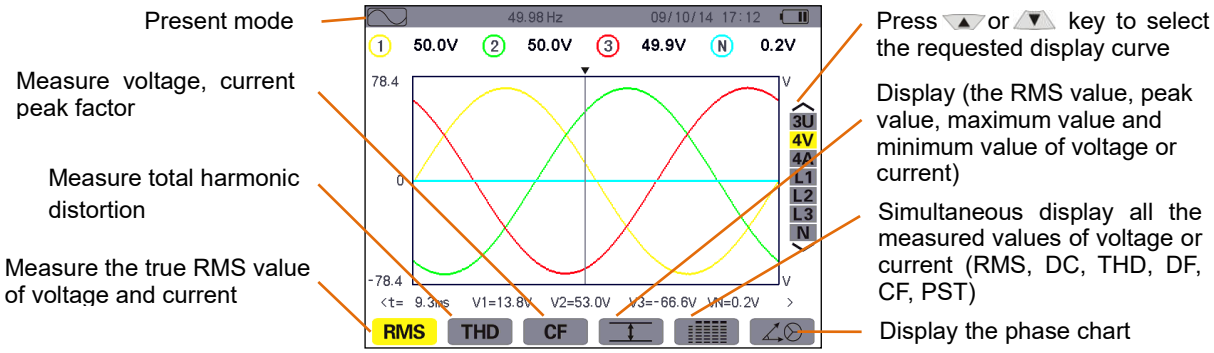


Figure 8-1: Waveform mode screen

8.2. True RMS RMS

The submenu can display the waveform of the measured signal and the true RMS value of voltage and current within a certain period of time.

Note: Which curve is displayed depends on the type of external wiring connection (refer to § 5.6):

- Single-phase: no choice (L1)
- 2-phase: 2V, 2A, L1, L2
- 3-phase, 3- or 4-wire: 3U, 3V, 3A, L1, L2, L3
- 3-phase 5-wire:

★For THD, CF and : 3U, 3V, 3A, L1, L2 and L3
★For RMS, and : 3U, 4V, 4A, L1, L2, L3 and N

The screen example shown as 3-phase 5-wire wiring connection type.

8.2.1. 3U RMS display screen

This screen shows as the 3-phase line voltages of the 3-phase system.
Shown as follow information:

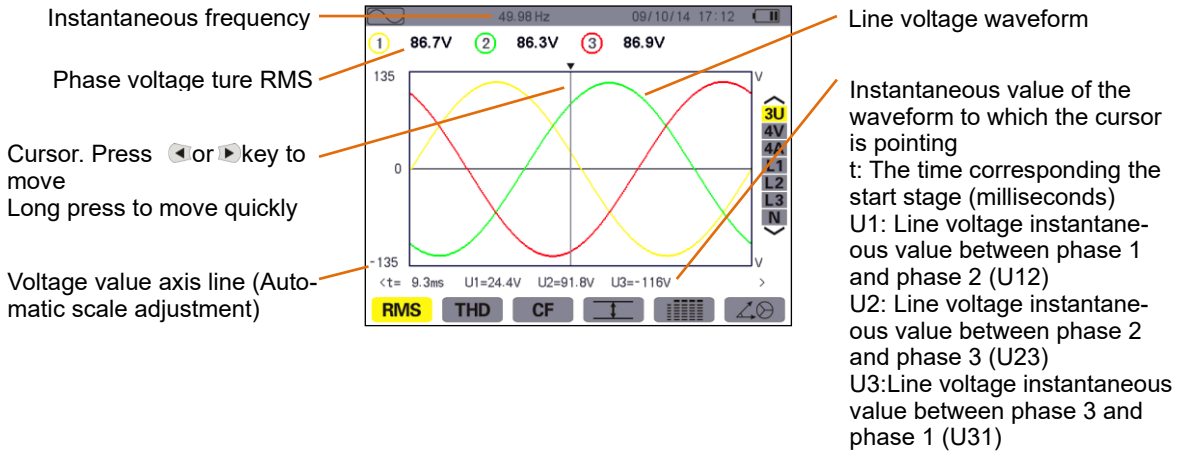


Figure 8-2: 3U RMS display screen

8.2.2. 4V RMS display screen

This screen shows as the 3-phase phase voltage and neutral line to earth voltage of the 3-phase system.
Shown as follow information:

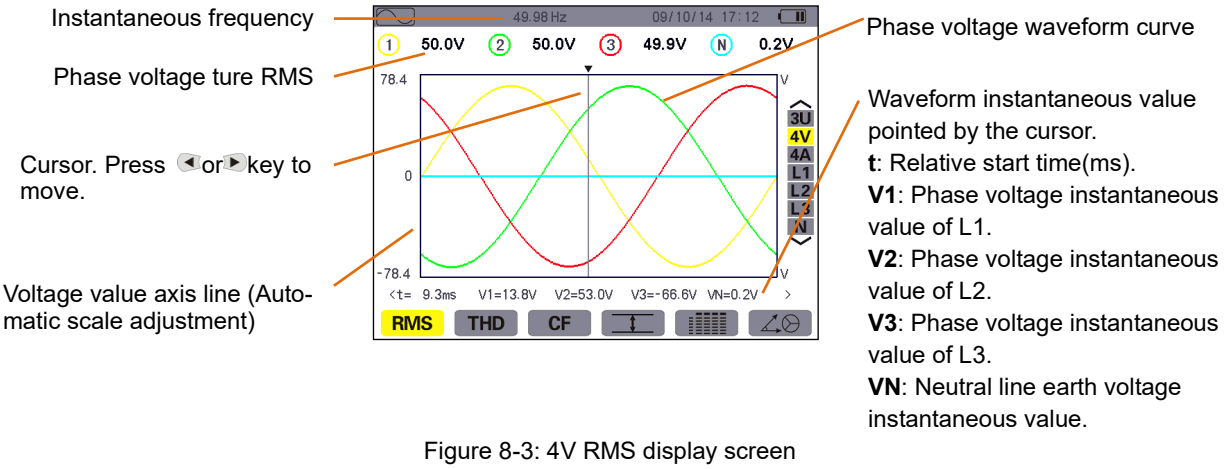
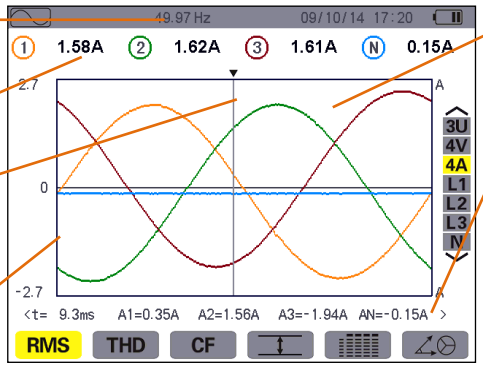


Figure 8-3: 4V RMS display screen

8.2.3. 4A RMS display Screen

This screen displays the three phase currents and the neutral current of three-phase system.
Shown as follow information:



Instantaneous frequency of network.

RMS currents

Cursor. Press ◄ or ► key to move
Long press to move quickly.

Current value axis line (Automatic scale adjustment)

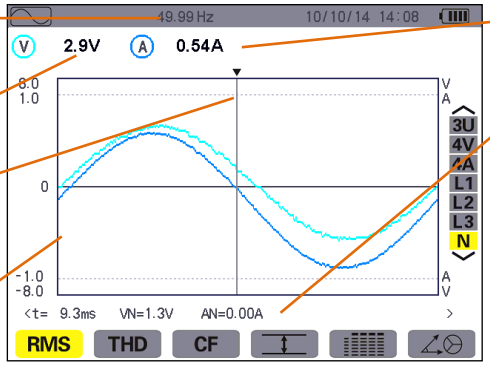
Current waveform curve

Waveform instantaneous value pointed by the cursor.
t: Relative start time(ms).
A1: Curent instantaneous value of L1.
A2:Curent instantaneous value of L2.
A3: Curent instantaneous value of L3.
AN: Neutral line current instantaneous value.

Figure 8-4: 4A RMS display screen

8.2.4 Neutral lineRMS display screen

This screen displays current and earth voltage of neutral line.
Shown as follow information:



Instantaneous frequency of network.

RMS voltage

Cursor. Press ◄ or ► key to move

Current and voltage value axis line
(Automatic scale adjustment)

RMS currents

Waveform instantaneous value pointed by the cursor.
t: Relative start time(ms).
VN: Earth voltage instantaneous value of neutral line.
AN: Current instantaneous value of neutral line

Figure 8-5: Neutral line RMS display screen

Note: L1, L2, and L3 display the current and voltage in phases 1, 2, and 3, respectively. The screen is identical to the one displayed for the neutral. THD

8.3. Total Harmonics Distortion

The THD submenu can display the measured signal waveform within a certain period of time and the total harmonic distortion rate of voltage and current.

8.3.1. 3U THD display screen

This screen displays the phase voltage waveforms and harmonic distortion rate within a certain period.
Shown as follow information:

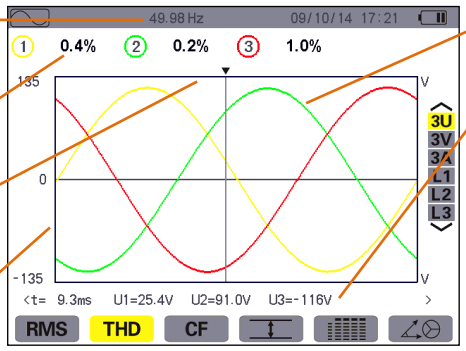


Figure 8-6: 3U THD display screen

8.3.2. 3V THD display screen

This screen displays the phase voltage waveforms and harmonic distortion rate within a certain period of time. Shown as follow information:

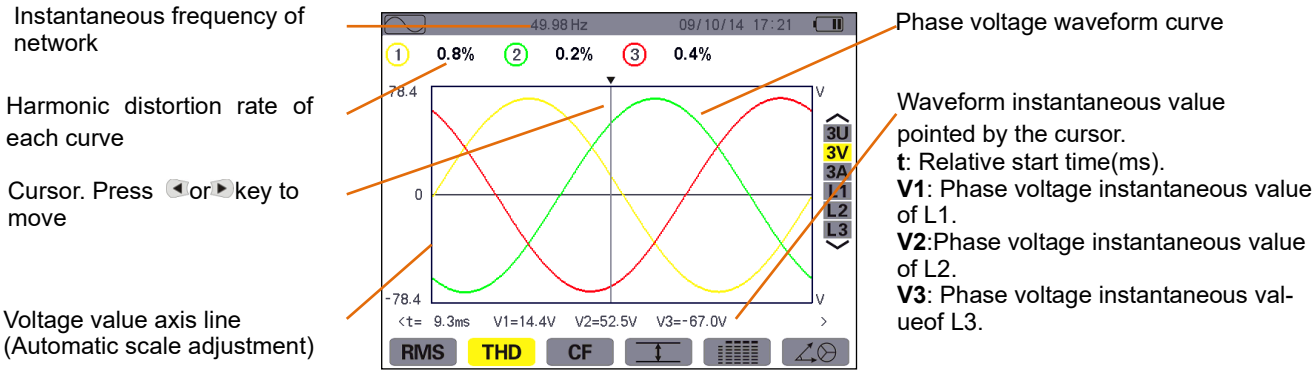


Figure 8-7: 3V THD display screen

8.3.3. 3A THD display screen

This screen displays the current waveforms and harmonic distortion rate within a certain period. Shown as follow information:

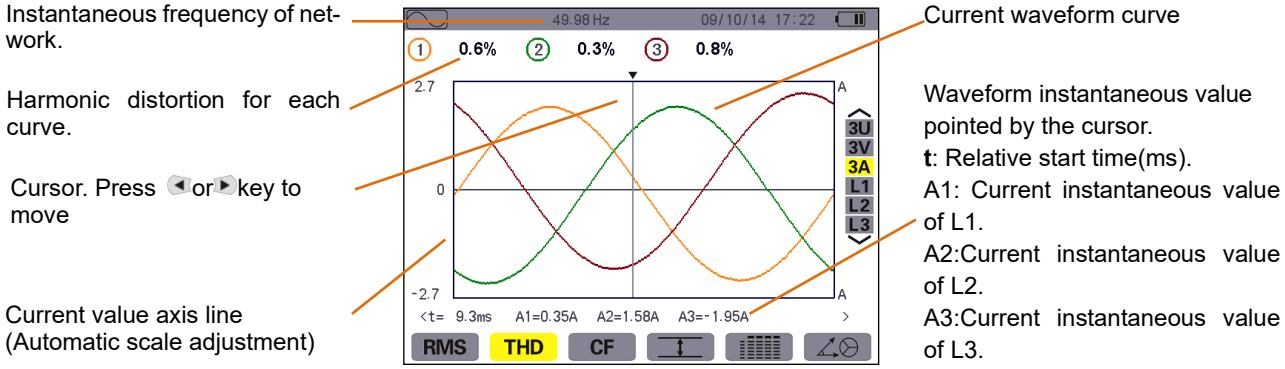


Figure 8-8: 3A THD display scree

Note: L1, L2, and L3 display the total harmonic distortion rate of voltage and current for phases 1, 2and 3 respectively.

8.4. PEAK Factor CF

The CF submenu can display the measured signal waveform within a certain period of time and the peak factor of voltage and current.

8.4.1. 3U CF display screen

This screen displays the phase voltage waveforms and peak factor within a certain period.
Shown as follow information:

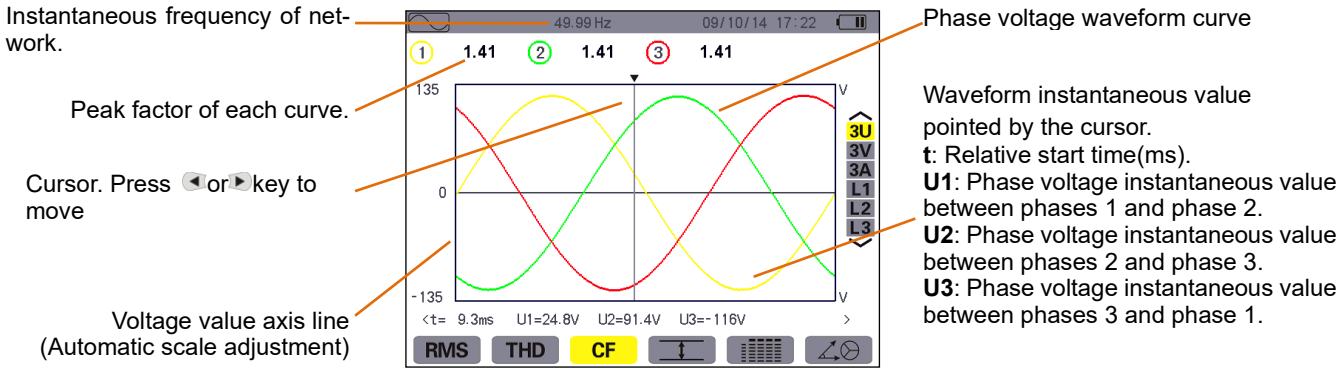


Figure 8-9: 3U CF display screen

8.4.2. 3V CF display screen

This screen displays the phase voltage waveforms and peak factor within a certain period.
Shown as follow information:

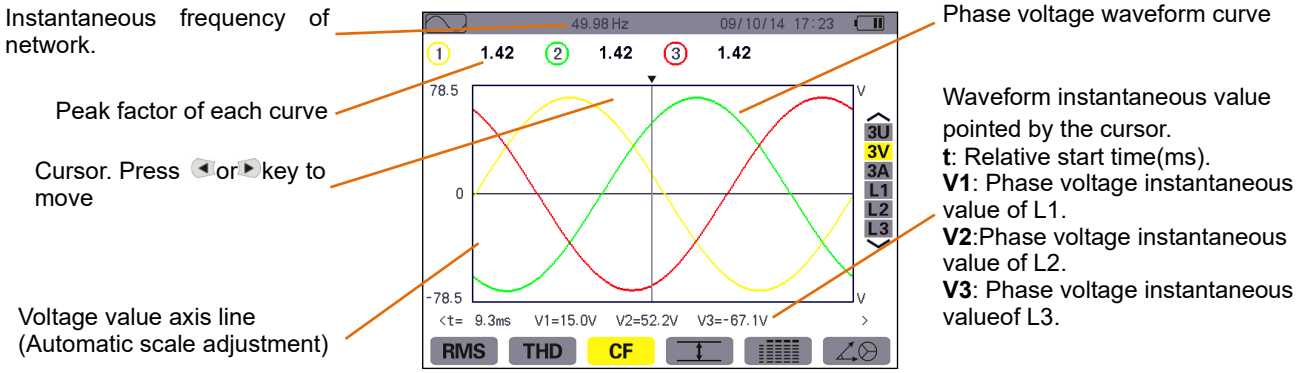


Figure 8-10:3V CF display screen

8.4.3. 3A CF display screen

This screen displays the current waveforms and peak factor within a certain period.
Shown as follow information:

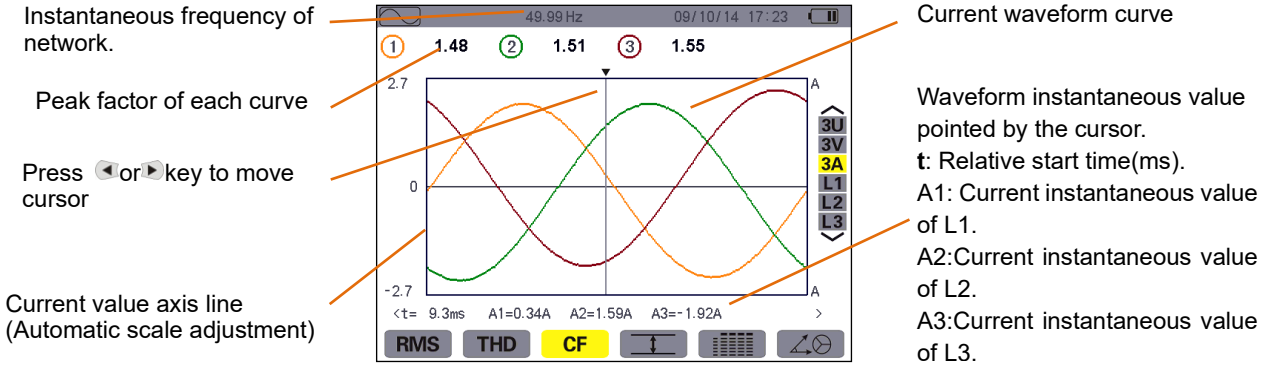


Figure 8-11: 3A CF display screen

Note: L1, L2, and L3 display the peak factor of voltage and current for phases 1, 2and 3 respectively.

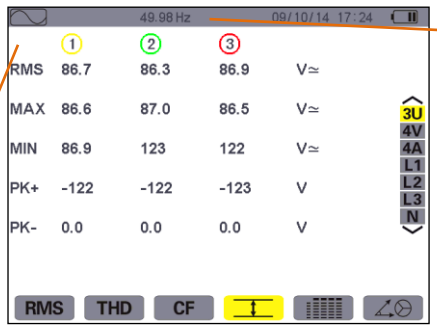
8.5. Extreme & Average Values Of Voltage & Current

The Submenu can display the RMS value, maximum value, minimum value, positive peak maximum value, negative peak minimum value of voltage and currentt.

8.5.1. 3U Max&Min value display screen

This screen displays the RMS value, maximum value, minimum value, positive peak maximum value, negative peak minimum value of line voltage.
Shown as follow information:

The various values of the column correspond to phases 1, 2 and 3 respectively.
RMS: Line voltage ture RMS Value
MAX: Line voltage RMS maximum value (The maximum value accumulated since power on or since the last press or key)
MIN: Line voltage RMS maximum value (same as above).
PK+: Line voltage postive peak maximum value (same as above).
PK-: Line voltage negative peak maximum value (same as above).



Instantaneous frequency of network.

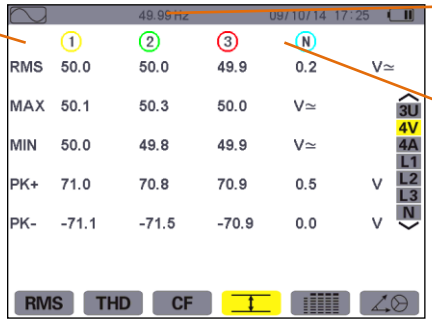
Figure 8-12: 3U Max&Min value display screen

Note: The instrument calculates the maximum and minimum values every half cycle (e.g. 10ms at 50Hz) and refreshes the measurement results every 300ms.

8.5.2. 4V Max&Min value display screen

This screen displays the RMS value, maximum value, minimum value, positive peak maximum value, negative peak minimum value of phase voltage and neutral line voltage.
Shown as follow information:

The various values of the column correspond to phases 1, 2 and 3 respectively.
RMS: Phase voltage ture RMS Value
MAX: Phase voltage RMS maximum value (The maximum value accumulated since power on or since the last press or key)
MIN: Phase voltage RMS maximum value (same as above).
PK+: Phase voltage postive peak maximum value (same as above).
PK-: Phase voltage negative peak maximum value (same as above).



Instantaneous frequency of network.

The Column varous values of neutral line: **RMS, PK+, PK-.**

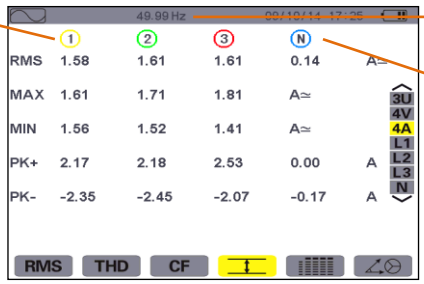
Figure 8-13: 4V Max&Min. value display screen

Note: The instrument calculates the maximum and minimum values every half cycle (e.g. 10ms at 50Hz) and refreshes the measurement results every 300ms.

8.5.3. 4A Max&Min value display screen

This screen displays the RMS value, maximum value, minimum value, positive peak maximum value, negative peak minimum value of current and neutral line current.
Shown as follow information:

The various values of the column correspond to phases 1, 2 and 3 respectively.
RMS: Current ture RMS Value
MAX: Current RMS maximum value (The maximum value accumulated since power on or since the last press or key)
MIN: Current RMS maximum value (same as above)



Instantaneous frequency of network

The Column varous values

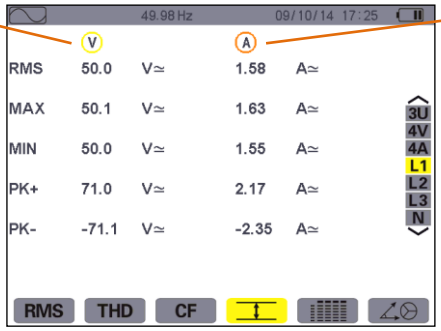
Figure 8-14: 4A Max&Min value display screen

Note: The instrument calculates the maximum and minimum values every half cycle (e.g. 10ms at 50Hz) and refreshes the measurement results every 300ms.

8.5.4. L1 Max&Min value display screen

This screen displays the RMS value, maximum value, minimum value, positive peak maximum value, negative peak minimum value of phase voltage and current.
Shown as follow information:

Voltage values column.
RMS: Phase voltage ture RMS Value
MAX: Phase voltage RMS maximum value (The maximum value accumulated since power on or since the last press or key)
MIN: Phase voltage RMS maximum value (same as above).
PK+: Phase voltage postive peak maximum value (same as above).
PK-: Phase voltage negative peak maximum value (same as above).



Current value clumn: Same as voltage value for each parameter information

Figure 8-15: L1 Max&Min. value display scrrent

Note: The instrument calculates the maximum and minimum values every half cycle (e.g. 10ms at 50Hz) and refreshes the measurement results every 300ms.
L2, L3, and N respectively display the earth voltage and current RMS value, maximum value, minimum value, positive peak value, and negative peak value of phase 2, phase 3, neutral line, and the relevant information display is same as L1.

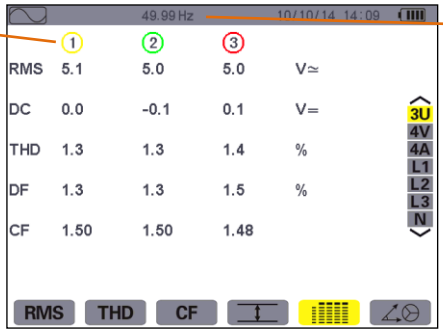
8.6. Various Test Value Displayed Simultaneously

The submenu displays all of the voltage and current measurement value (RMS, DC, THD, DF, CF, PST, KF).

8.6.1. Various value simultaneous display screen of 3U

This screen displays the RMS, DC, THD, DF, and CF values of the line voltages.
Shown as follow information:

The various values of the column correspond to phases 1, 2 and 3 respectively.
RMS: True RMS value of 1s
DC: DC component.
THD: Total harmonic distortion.
DF: Distortion factor.
CF: peak factor of 1s



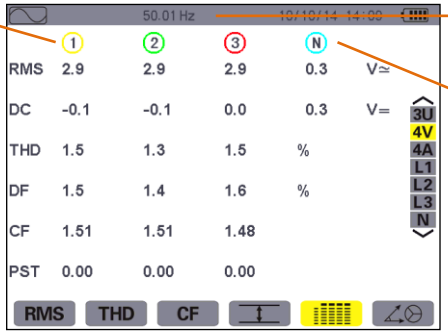
Instantaneous frequency of network

Figure 8-16: various value simultaneous display screen of 3U

8.6.2. Various value simultaneous display screen of 4V

This screen displays the RMS, DC, THD, DF, CF and PST values of the phase voltages and neutral line voltage. Shown as follow information:

The various values of the column correspond to phases 1, 2 and 3 respectively.
RMS: True RMS value of 1s
DC: DC component.
THD: Total harmonic distortion.
DF: Distortion factor.
CF: peak factor of 1s
PST: short-time voltage flicker(10 minutes).



Instantaneous frequency of network.

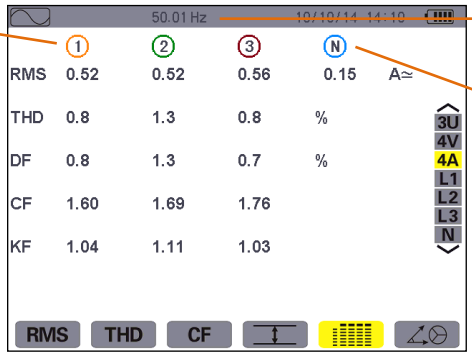
The Column varous values of neutral line: **RMS, DC**

Figure 8-17: various value simultaneous display screen of 4V

8.6.3. Various value simultaneous display screen of 4A

This screen displays the RMS, DC, THD, DF, CF, and KF values of the phase current and neutral line currents. Shown as follow information:

The various values of the column correspond to phases 1, 2 and 3 respectively.
RMS: True RMS value of 1s
DC: DC component.
THD: Total harmonic distortion.
DF: Distortion factor.
CF: peak factor of 1s
KF: transformer K factor



Instantaneous frequency of network.

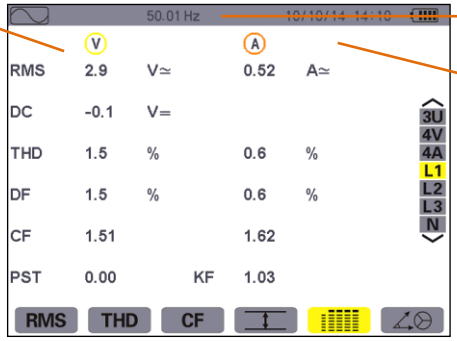
Neutral values: **RMS.**

Figure 8-18: various value simultaneous display screen of 4A

8.6.4. Various value simultaneous display screen of L1

This screen displays the RMS, DC, THD, DF, CF of phase 1 voltage, and DC,PSTparameters of voltage, KF value of current.
Shown as follow information:

The various values of the column correspond to phases 1, 2 and 3 respectively.
RMS: True RMS value of 1s
DC: DC component.
THD: Total harmonic distortion.
DF: Distortion factor.
CF: peak factor of 1s
PST: short-time voltage flicker(10 minutes).



Instantaneous frequency of network.

Current values.
RMS: true RMS value for 1s
THD: total harmonic distortion.
DF: distortion factor.
CF:peak factor of 1s
KF: transformer K factor.

Figure 8-19: L1 simultaneous display screen

Note: L2 and L3 display the voltage and current various values of phase 2 and phase 3 respectively, and the relevant information display is same as L1.

8.6.5. Neutral line various value simultaneous display screen

This screen displays the voltage RMS, DC value and the current RMS vlaue of neutral line.

8.7. Phasor Diagram Display

The submenu shows the absolute value, phase and unbalance of the voltage or current at the basic frequency.

8.7.1. Phasor diagram display screen of 3V

This screen displays the absolute value of the phase voltage, the phase angle of the phase voltage relative to the current and the unbalance of the phase voltage at the basic frequency.

Shown as follow information:

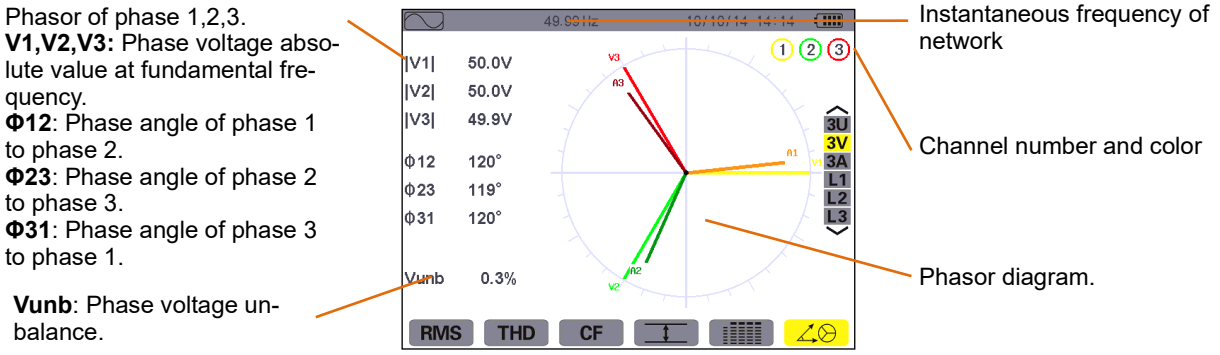


Figure 8-20: Phasor diagram display screen of 3V

8.7.2. Phasor diagram display screen of 3U

This screen displays the absolute value, the phase angle between the line voltages and the unbalance of the line voltage at the base frequency.

The information displayed on this screen is same as the information described in Section 8.7.1, the only difference is that the displayed values are related to the line voltage of 3U.

8.7.3. Phasor diagram display screen of 3A

This screen displays the absolute value, the phase angle between each pahse current and the unbalance of the current at the base frequency.

The information displayed on this screen is same as the information described in Section 8.7.1, the only difference is that the displayed values are related to the line voltage of current.

8.7.4. Phasor diagram display screen of L1

This screen displays the absolute value of the phase 1 voltage and current , and the phase angle of the phase 1 voltage relative to the current at the basic frequency.

Shown as follow information:

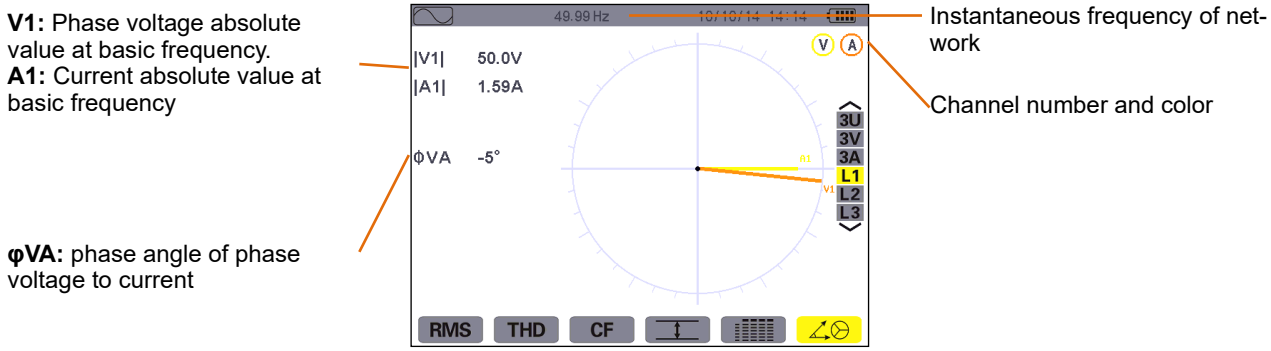


Figure 8-21: phasor diagram display screent of L1

Note: L2 and L3 respectively display the absolute value of the voltage and current of phase 2 and phase 3 and the phase angle of the corresponding phase voltage to current at the fundamental frequency, and the relevant information display is same as L1.

9. ALARM MODE

In the alarm mode, the instrument can monitor whether each measured value exceeds the threshold and generate alarm log. The values that can be monitored are: Vrms, Urms, Arms, PST, Vcf, Ucf, Acf, Vunb, Aunb, Hz, KF, Vthd, Uthd, Vdf, W, VAR, VA, DPF, PF, Vh, Uh, Ah, Vah, etc.
The user should set an alarm threshold (hysteresis) first and then can start the alarm monitoring .The monitored values:
★Defined in the Set/Alarm Mode screen (Section 5.10)..
★Select the setting parameter group (solid red dot means selected, hollow red circle means unselected).
The instrument can record up to 12800 alarm logs: the user can upload the stored alarm records to the PC and save them for later retrieval and viewing.

9.1. Submenus

All submenus of alarm mode are listed on the screen as shown in the figure below, and the following chapters will introduce respectively.
The user can press each yellow function key on the keyboard below the screen to select the corresponding submenu.

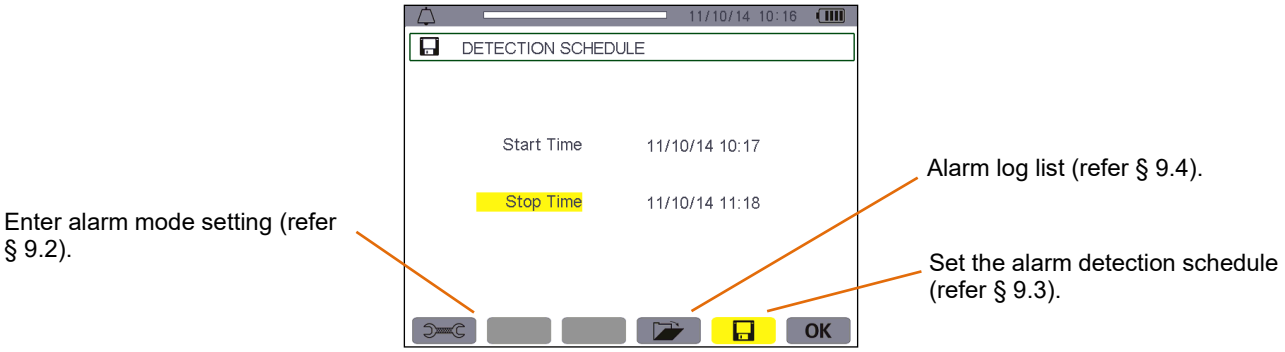


Figure 9-1: Alarm mode screen

OK and ✋ symbol have the following functions:
★**OK**: Confirm alarm detection settings and start alarm detection (fefer § 9.3.2).
★✋: Actively stop alarm detection (refer § 9.3.3).

9.2. Alarm Mode Setting

The submenu displays the list of alarm settings (refer 5.10). Press this key to define or modify the alarm settings.
Shown as follow information:

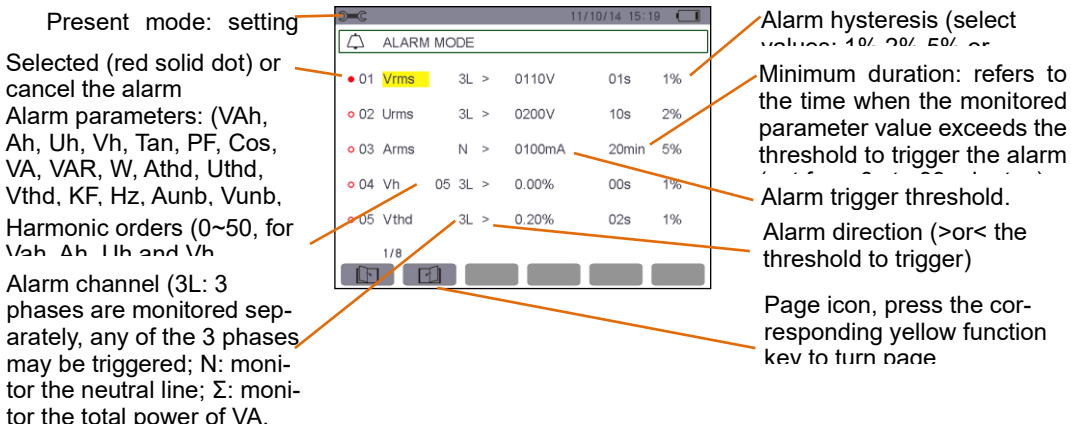


Figure 9-2: Alarm mode setting

Reminder: Use the keys to view variour values.
Set the alarm step as follows:
★ Press to selsect field value. And appear▲▼ arrow

★ Press or to input value(Vah, Ah, Uh,etc.),press key to confirm.
Set others value as same operation.
★ Move yellow cursor to the first column, press key to select the setted alarm. Red solid dot indicates selected. When the condition is met the setting alarm can be triggered, and generate the alarm log.
Note: Repeat step 3 can cancel the selected alarm.
★Press key return to the alarm detecion schedual screen.

9.3. Alarm Detection Schedual

The submenu set the start time and end time of the alarm schedule.

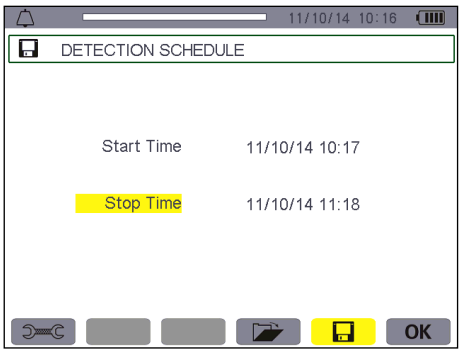


Figure 9-3: Alarm detection schdeual screen

9.3.1. Step1: Set the alarm schedual

Detail operation as follows:
■ Press or key to select the start time(yellow highlight display), Press to start setting time. The corresponding time and date area will diaply arrows▲▼.
Press or to increaset or decrease each value, press or key to select the reqeust modify value.
Note: The alarm start time must after present time.
■ Press to confirm the alarm start time setting.
■ Press or key to select the stop time setting(highlighted display). Press to set the stop time. The corresponding time and date area will diaply arrows▲▼.
Press or to increaset or decrease each value, press or key to select the reqeust modify value.
Note: The alarm start time must after present time.
■ Press to confirm the alarm stop time setting.

9.3.2. Step2: Start alarm detection

Press the **OK** icon funiction key and The instrument starts alarm detection with the set start and stop time.

- The **OK** icon disappears and the icon appears at same place.
- When waiting to start detection, the instrument screen displays "detection standby..." and the icon flash dispaly on top of screen.
- When the alarm detection start will display" detecting....".
- When alarm detection finish will display "detection schedual" again, **OK** icon is displayed. User can set the new alarm detection.

9.3.3. Voluntary stoppage of alarm campaign

Before the alarm setting stop time is reached, the user can press the icon yellow function key (lower right of the screen) to actively stop the alarm detection, and the OK icon will be displayed again at the same position after stopping.

9.4. View Alarm Log

The submenu displays the alarm log. The instrument can store up to 12,800 alarm logs. Press the icon yellow function key to view the alarm log.

Note: In mode, the selected wiring connection type will not influence each phase selection and parameters monitoring of alarm, users decide the selection.

Each data information shown as follow:

Figure 9-4: Alarm log screen

Reminder: The default units of the monitored parameters and corresponding trigger thresholds and trigger amplitudes in the alarm log are as follows:

Table 9-1

Monitored parameters	Default units	Units with the suffix	Example
Arms	A	m: mean mA k: mean kA	2.5: mean 2.5A 423m: mean 423mA
Vrms/Urms	V	k: mean kV	326: mean 326V 1.2k: mean 1.2kV
W/VAR/VA	W/Var/VA	K: mean kW/kVar/kVA M: mean MW/MVar/MVA	W parameter: 315 mean 315W W parameter: 5.8k mean 5.8kW
Hz	Hz		50.00: mean 50.00Hz

9.5. Delete Alarm Log

The submenu can delete all the alarm log. Detail operate steps as follows:

Press yellow function key select the submenu. The icon displayed in yellow indicate ready to delete, then press the yellow function key cancel the delete state. The icon displayed gray indicate not delete.

In the state of ready to delete, press key to confirm delete and all the alarm log will be to delete and cleared.

Figure 9-5: Alarm log screen in delete mode

10. TREND MODE

Trend mode can record the measured parameters selected in Set/Trend mode. (refer § 5.9).

10.1. Select Submenus

The submenus are shown in the below screen, and described in the follow sections.
Users can use the yellow function keys at the bottom of the screen to select the corresponding submenu.

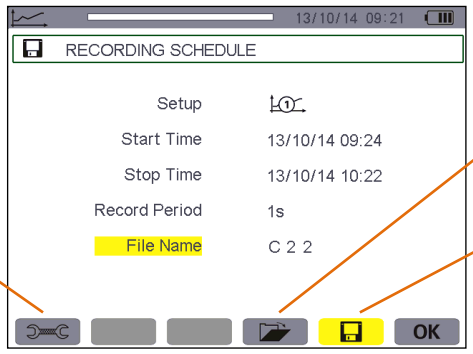


Figure 10-1 Trend mode screen

Press **OK** icon yellow function key start trend record monitoring (refer § 10.2).

10.2. Presets&Starts Record Trend Charts

The submenu specifies the parameters of the new record detection schedule.

Figure 10-2: Preset record screen

10.2.1. Stage 1: Set the measurement parameters of requesting record

Operate as follows:

■ Press ▲ or ▼ keys select the reqeusted setting parameters area. The selected area is highlighted display in yellow. Press ↵ to enter the setting, and appear arrows ▲▼.

■ Press ▲ or ▼ keys select the parameters setting group form ① to ④. Press ↵ to confirm.

Reminder: Parameter setting groups from ① to ④ are all set in the C setting/trend mode (refer §5.9). Users can also refer to §10.3 about the parameters selection and setting steps instruduction of trend chart.

■ Press ▲ or ▼ keys to select the "**Start Time**", and the selected field highlighted display in yellow. Press ↵ to enter and appear arrows ▲▼ when setting the start date and time. Press ▲ or ▼ to increase or decrese the value, press ◄ or ► to switch year, month, day, hour, minute etc.

Note: The start date and time must be later than the present date and time.

■ Press ↵ to confirm the "**Start Time**" of record.

■ Press ▲ or ▼ keys to select "**Stop Time**",nd the selected field highlighted display in yellow. Press ↵ to enter and appear arrows ▲▼ when setting the stop date and time. Press ▲ or ▼ to increase or decrese the value, press ◄ or ► to switch year, month, day, hour, minute etc.

Note: The stop date and time must be later than the start date and time. The longest recording time refer to § 10.6.4.

■ Press ↵ to comfirm the "**Stop Time**" of record.
■ Press ▲ or ▼ keys to select "**Record Period**", press ↵ key to enter and appear arrows ▲▼.
■ Press ▲ or ▼ to increase or decrease the values (optional value:1 s, 5 s, 20 s, 1 min, 2 min, 5 min, 10 min, or 15 min).
■ Press ↵ to confirm the "**Record Period**" setting.
Note: The record interval period is the average interval cumulative time for measuring each recorded value (that is, how long record data at intervals).
■ Press ▲ or ▼ to select the "File Name" and highlight display in yellow, press ↵ to enter the edit mode to enter the file name (The length should not exceed 8 characters, the records should use different names, and there should be no spaces in the middle of the file name).
The available characters are the letters from A to Z and the digits from 0 to 9. Use the ▲ or ▼ keys to display a character and ◄ or ► key move to the next character.
■ Press ↵ key to confirm the "File Name".

10.2.2. Stage 2: Start recording

■ Press **OK** icon yellow function key (the bottom right corner of the screen),the instrument starts recording with the start and stop times set by the user.
The **OK** icon disappears and the ✋ icon appears instead in this time.
■ The instrument display "Recording stand by..." before reach the start time and the 💾 icon continue flashing in the screen's top display bar.
■ The instrument will display "Recording..." after reach the start time.

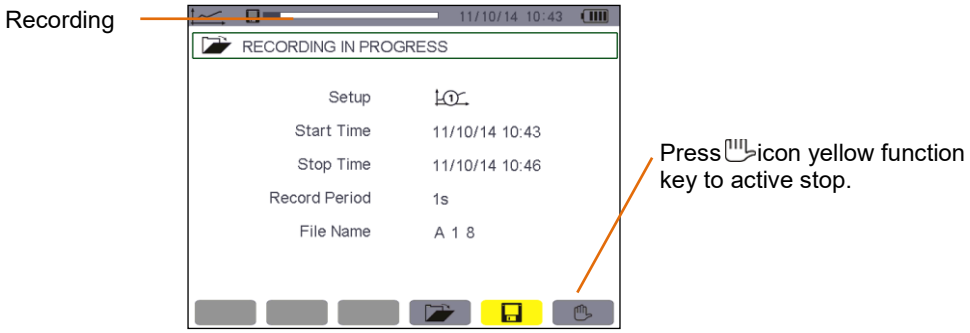


Figure 10-3: A trend chart monitoring display screen

■ The "Recording Schedule" screen and **OK** icon will appear again(bottom right corner of the screen) after reach stop time, and the record will active stop. The **OK** icon reappears at corresponding position.

10.2.3. Active stop present record

Before reach the setting stop time, press ✋ icon yellow function key (the bottom right corner of the screen), the record will active stop, and the **OK** icon will reappear.

10.3. Trend Chart Monitoring Parameter Setting

This submenu displays the selection list of trend chart monitoring parameters (refer to §5.9), and the user can set and change the monitoring parameter selection by using this shortcut key.
The information shown as follow:

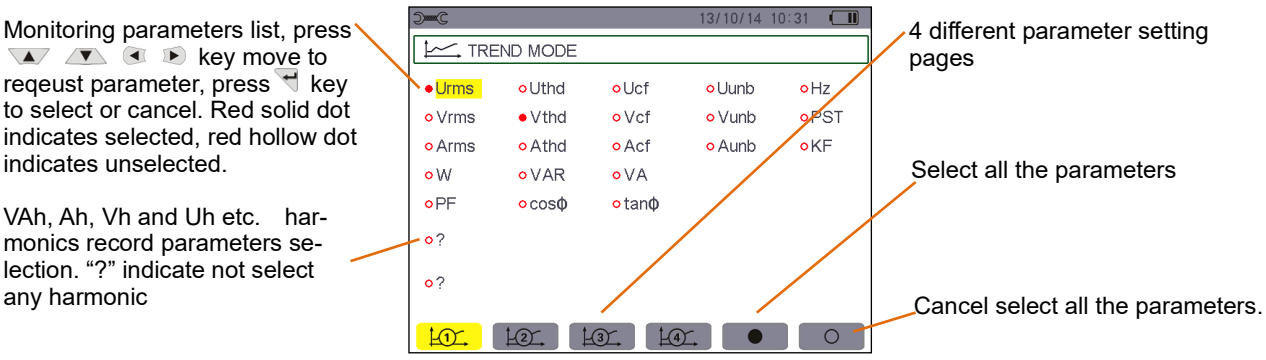


Figure 10-4: Trend chart monitoring parameter setting screen

Set a record operation as follow:
Example for parameter setting group 1:

■ Press icon yellow function key and highlighted display in yellow.
■ Press or and or keys move to select parameters, then press to confirm.and display with red solid dot
Reminder: User can select follow parameters:

Unit	Designation
Urms	RMS phase-to-phase voltage(2φ, 3φ).
Uthd	Total harmonic distortion of the phase-to-phase voltage(2φ, 3φ).
Ucf	Crest (peak) factor of phase-to-phase voltage(2φ, 3φ).
Uunb	Phase-to-Phase voltage unbalance(2φ, 3φ).
Hz	Network frequency.
Vrms	RMS phase-to-neutral voltage.
Vthd	Total harmonic distortion of the phase-to-neutral voltage.
Vcf	Crest factor of phase-to-neutral voltage.
Vunb	Phase-to-neutral voltage unbalance(2φ, 3φ).
PST	Short-term flicker.
Arms	RMS current.
Athd	Total harmonic distortion of the current.
Acf	Crest factor of current.
Aunb	Current unbalance(2φ, 3φ).
KF	K factor.
W	Active power.
VAR	Reactive power.
VA	Apparent power.
PF	Power factor.
Cosφ	Phase shift of power factor.
Tanφ	Tangent.
?	See comment below.

Specific function of the last two lines.
The position as follow:

○?

○?

Figure 10-5: These two lines involve harmonics

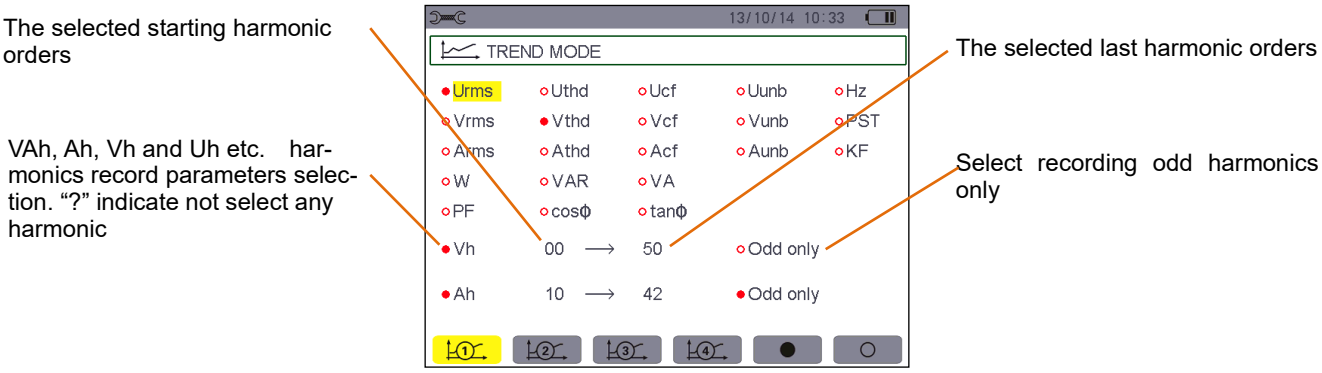


Figure 10-6: Trend mode record harmovic parameter setting

These two lines involve the recording of 4 different harmonics, as Vah, Ah, Vh, and Uh. For each harmonic, the user can select the reqeust recording harmonics orders (0-50), or only record odd harmonics. The operation is as follows:

■ Enter the request record parameters: the cursor highlighted display in yellow, press . The arrows ▲▼ appear. Select the value (Vah, Ah, Vh, and Uh) for which harmonics are to be recorded by pressing or . The red solid dot identifies your selection.

Confirm by pressing . The values field is highlighted in yellow.

■ To select the starting harmonic order: with the field highlighted in yellow, press . The arrows▲▼ appear. Select the order from which the harmonics are to be recorded by pressing or , then validate by pressing .

Press or to go to the next field.

■ To select the last harmonic: with the second field (greater than or equal to the starting harmonic order) highlighted in yellow, press . Select the highest harmonic order to be recorded by pressing or , then validate by pressing .

Press or to go to the next field.

■ For the odd harmonics only:

To select or deselect this function, press . The red solid dot identifies your selection:

★ selected, only odd harmonics between the two orders of harmonics specified in the previous points are recorded.

★ not selected, all harmonics (even and odd) between the two orders of harmonics specified in the previous points are recorded.

10.4. View Record List

The submenu displays recordings already made. Press the yellow key corresponding to the icon to view the list.

The data shown as follow:

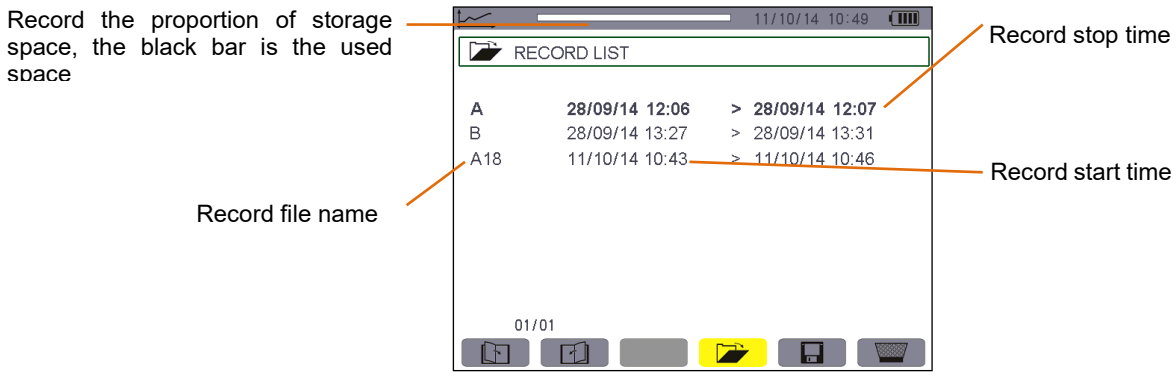


Figure 10-7: Record list display screen

10.5. Delete Record

The submenu is used to delete the records. operate as follows:

- Press or key to select the reqeust delete record. The selected record is bolded.
- Press key to select the submenu. The icon displayed yellow indicate ready to delete, and press the function key to cancel the delete state. The icon displayed gray indicate not delete.
- In the state of ready to delete, press key to delete the selected record.
-

Figure 10-8: Record list screen in delete mode.

10.6. Display Records

10.6.1. Record information

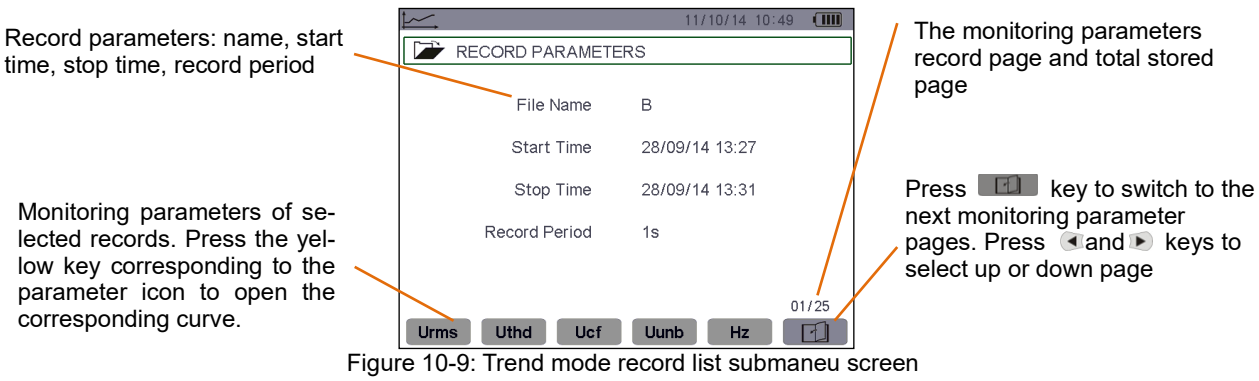


Figure 10-9: Trend mode record list submaneu screen

10.6.2. Trend curves record

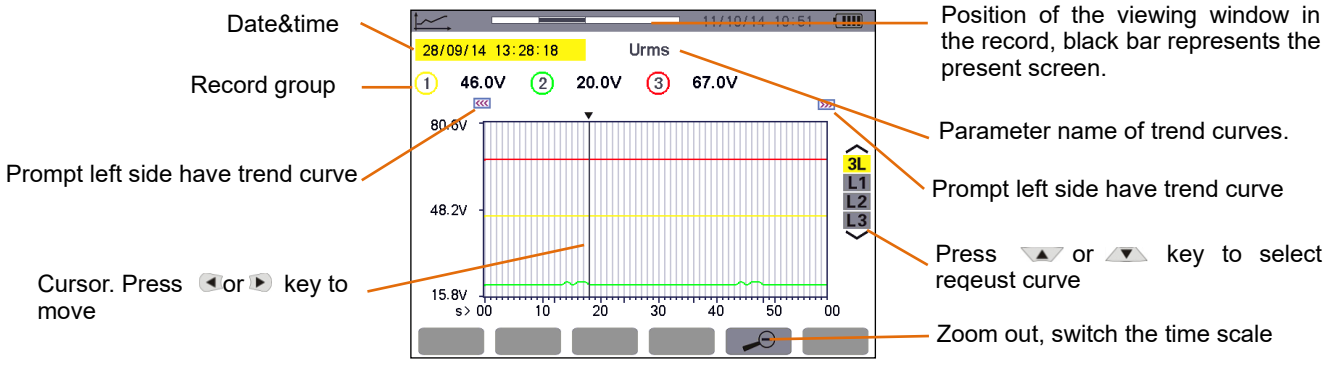


Figure 10-10: Trend curve record screen

Remark: If th cursor position is "----"indicate errors or missing values in the record.
When the curve display period is 20 seconds. Since the period of the record is one second, each point of this curve corresponds to a value recorded in a one-second window once 20 seconds. There is therefore a substantial loss of information (19 values out of 20), but the display is rapid.
With the increase of the display period, the loss values will be more. This case the user can select to activate the MIN-AVG-MAX mode. After the MIN-AVG-MAX mode activated, each point of the curve represents the mean of the total sampling points every period(such as the display period is 20 seconds, sampling period is 1 second, each display point of the curve represents the mean of 20 values recorded every second.).

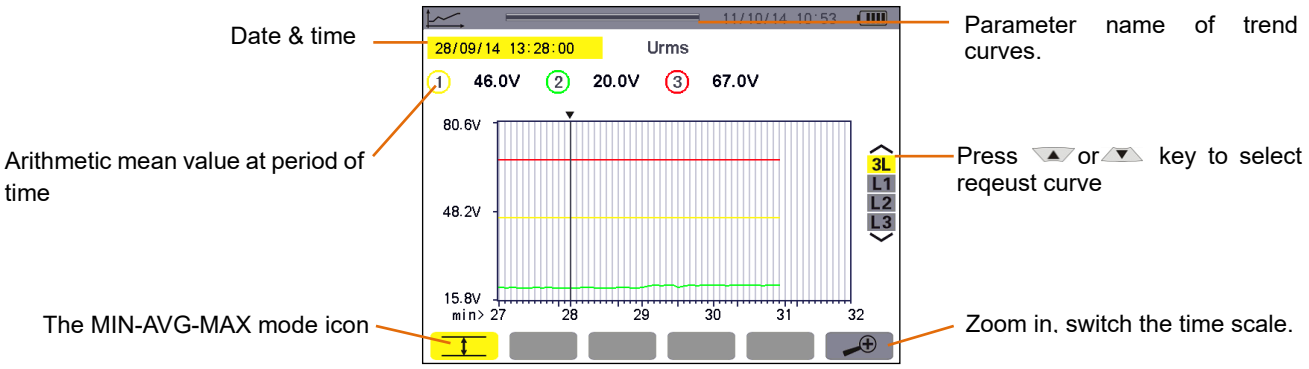


Figure 10-11: Vrms with MIN-AVG-MAX

Since the MIN-AVG-MAX mode is enabled, each point on the curve represents the arithmetic mean value within the display period, so the display is more accurate and there is no data loss, but the display speed is relatively slow(display time refer §10.6.3).

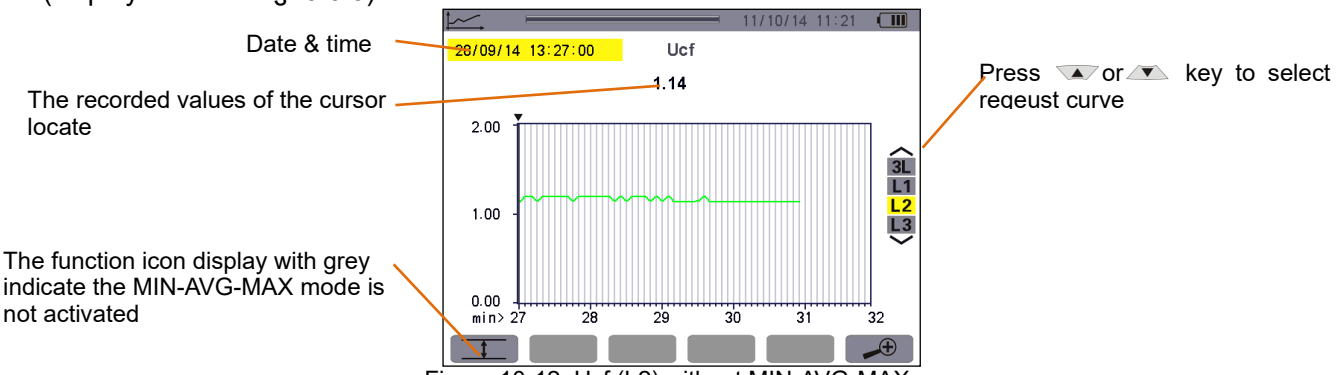


Figure 10-12: Ucf (L2) without MIN-AVG-MAX

When the MIN-AVG-MAX mode is not activated, display the curve of 60 values recorded of the cursor, the display is rapid.

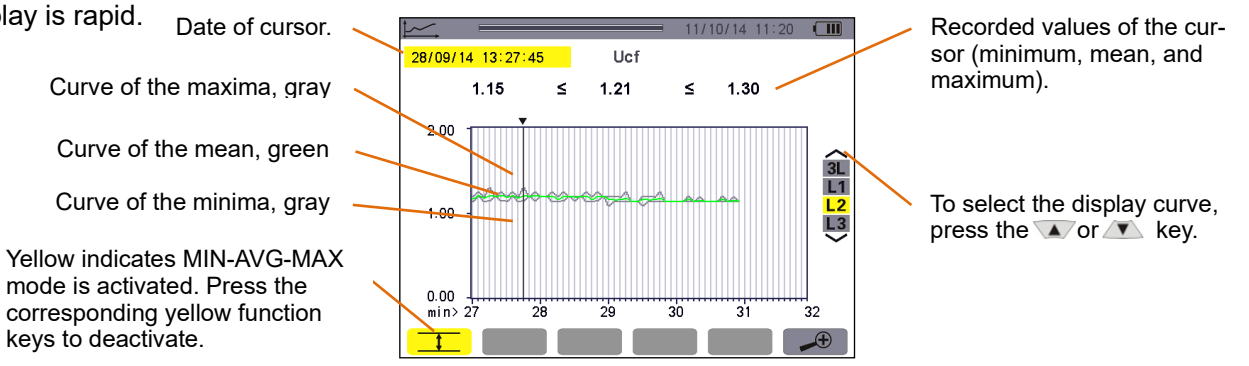


Figure 10-13: Ucf (L2) with MIN-AVG-MAX

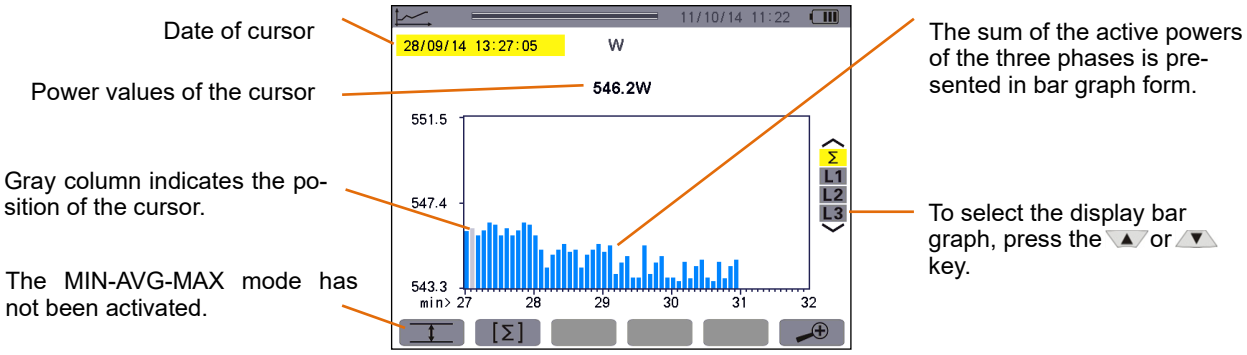


Figure 10-14: total active power without MIN-AVG-MAX

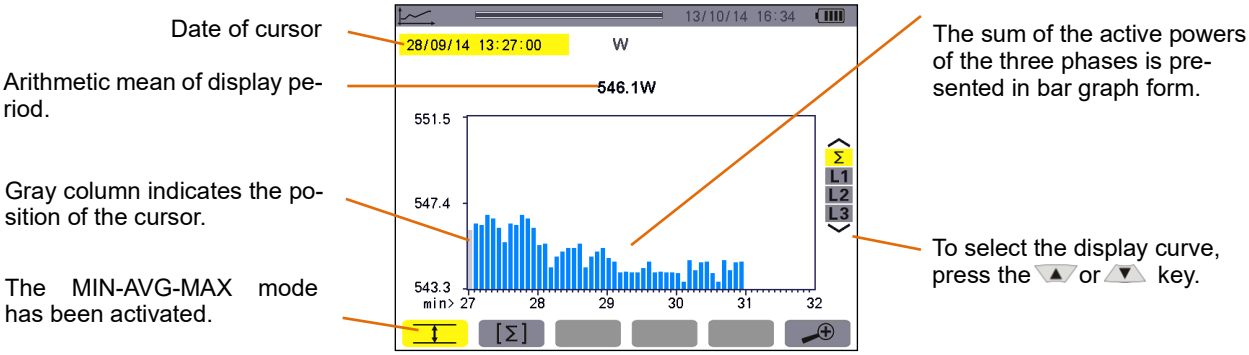


Figure 10-15: total active power with MIN-AVG-MAX

This curve differs slightly from the previous one because, with the MIN-AVG-MAX mode, there is no loss of information.

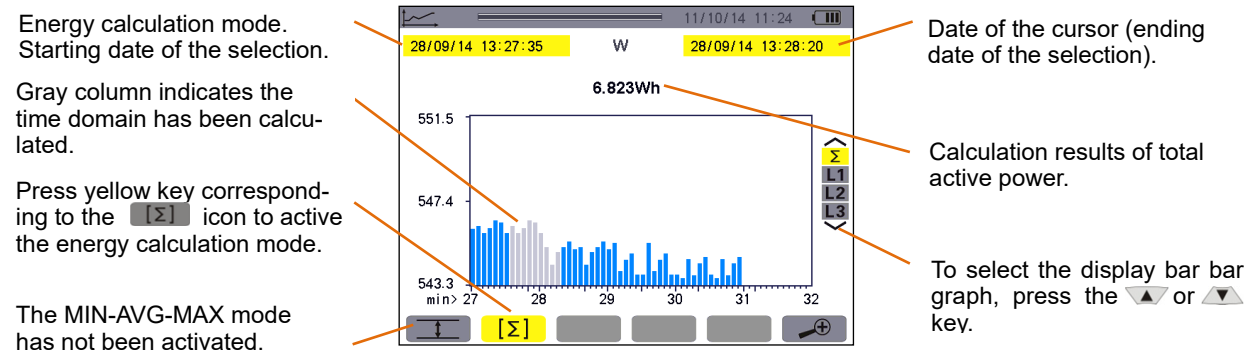


Figure 10-16: total active energy without MIN-AVG-MAX

Energy calculation steps:

■ Press yellow key corresponding to the [Σ] icon to active the energy summation mode. The current

cursor time is the starting time of the energy calculation.
■ Press the ◄ or ► to move the cursor. The stopping time of the energy calculation pointing the cursor time, the device calculates the energy between the start time and stop time automatically.

Note: the cursor moves left cannot exceed the location of the starting time.

10.6.3. The needing time for display the curve in the different scale

The following table indicates the time needed to display the curve on screen as a function of the width of the display window for a recording period of one second:

Time Span	Grid Unit Time	Waiting time
5 days	2 hours	30 seconds
2.5 days	1 hour	15 seconds
15 hours	15 minutes	4 seconds
10 hours	10 minutes	2 seconds
5 hours	5 minutes	1 second
1 hour	1 minutes	1 second
20 minutes	10 seconds	1 second
5 minutes	5 seconds	1 second
1 minute	1 second	1 second

■ to press the ⊕ or ⊖ key to change the scale of the display
■ to press the ◄ or ► key to move the cursor
■ to press the ▲ or ▼ key to change the display phase curve.
■ Above operation may restart the loading/calculation of the values from the beginning.

10.6.4. The longest recording time can be programmed

The longest time is base on the number of the recording parameters selection and the sampling period, the typical condition as follows:

Parameter of selected	Sampling period	Typical longest time can be programmed
All parameters (total 123)	1 second	10 days
1~20 parameters	1 second	62 days
All parameters (total 123)	5 seconds	50 days
1~20 parameters	5 seconds	300 days
All parameters (total 123)	1 minutes	600 days
1~20 parameters	1 minutes	3600 days

The above table indicates that the selected parameters is less, the sampling period is greater, the longest recording time is longer.

11. POWER AND ENERGY MODE W

The W key displays power and energy measurements.

11.1. Sub-menus

The sub-menus are listed in the screen below and described individually in the paragraphs that follow.
The sub-menus are selected using the yellow keys on the keypad below the screen.

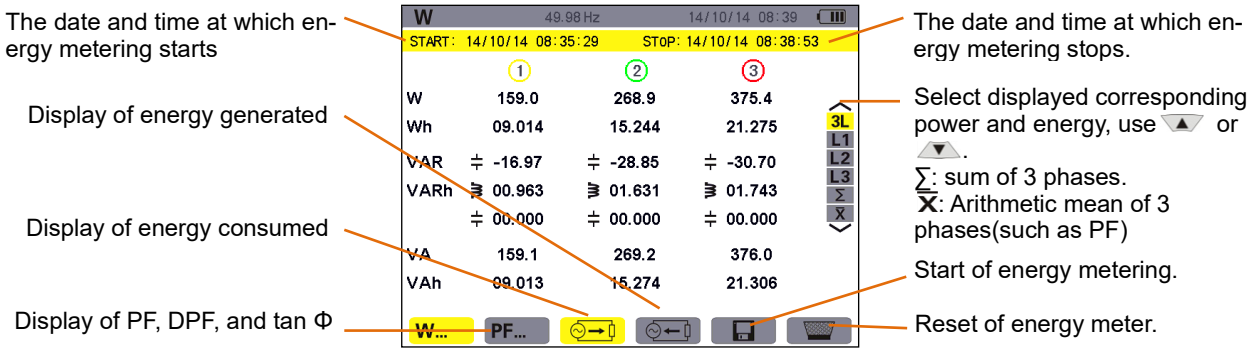


Figure 11-1: the Power and energy mode screen

11.2. Energy Consumed

The sub-menu displays the active power, the reactive powers (capacitive and inductive), the apparent power.

11.2.1. The energies consumed screen for the 3 phases (3L)

This screen displays the following information:

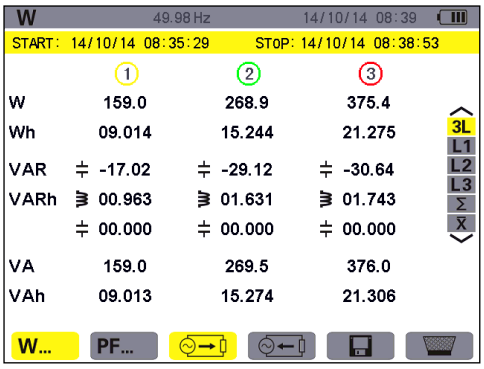


Figure 11-2: the energies consumed screen for the 3 phases (3L)

Unit	Designation
W	Active power.
Wh	Active energy consumed.
VAR	Reactive power(inductive ≋ or capacitive ≒).
VARh	Reactive energies consumed(inductive ≋ or capacitive ≒).
VA	Apparent power.
VAh	Apparent energy consumed.

11.2.2. The energies consumed screen for phase L1

This screen displays the following information:

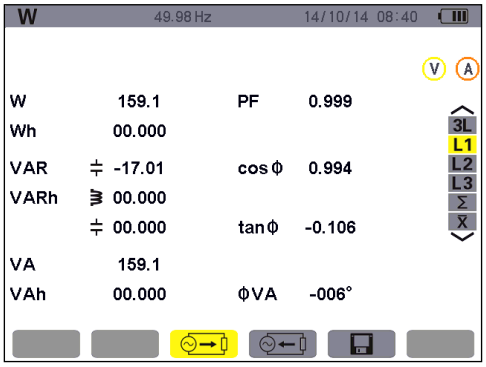


Figure 11-3: the energies consumed screen for phase L1

Unit	Designation
W	Active power.
Wh	Active energy consumed.
VAR	Reactive power(inductive ≋ or capacitive ∓).
VARh	Reactive energies consumed(inductive ≋ or capacitive ∓).
VA	Apparent power. (∑: sum of 3 phases)
VAh	Apparent energy consumed.
PF	Power factor.
Cosφ	Phase shift of power factor
Tanφ	Tangent factor
φVA	Phase shift of phase-to-neutral voltage with respect to current.

Note: Filters L2 and L3 display the same information for phases 2 and 3. ∑ screen display total power and energy consumed values for the 3 phases.

11.3. Power Factor Display Screen PF...

This screen page is available only with the 3L filter. To display the information, press the yellow key on the keypad corresponding to the PF... icon.
The following data is displayed:

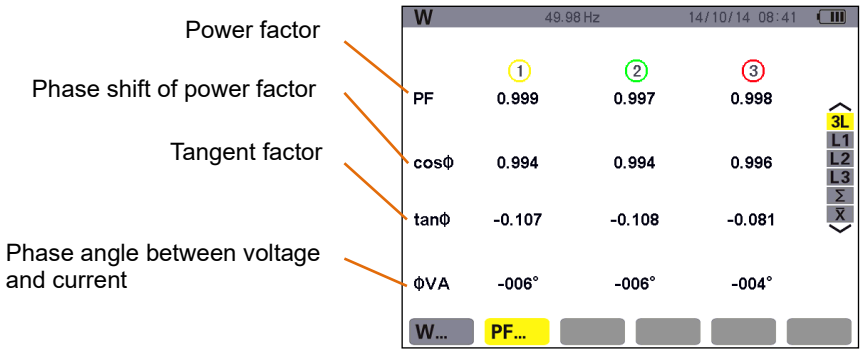


Figure 11-4: the Power factor screen for the 3 phases (3L)

11.4. The Sums Of Energies Consumed Display Screen

To display the information, select the ∑ icon of the right-hand filter. This screen displays the following information:

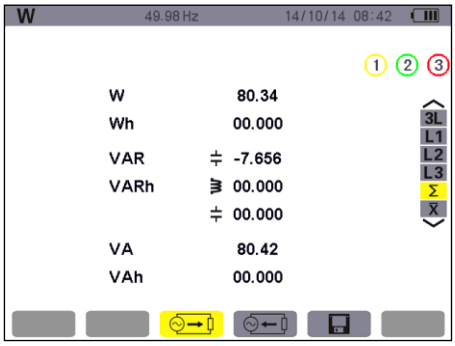


Figure 11-5: the sums of energies consumed display screen

Unit	Designation
W	Total active power.
Wh	Total active energy consumed.
VAR	Total reactive power, inductive ∋ or capacitive ∓.
VARh	Total reactive energies consumed, inductive ∋ or capacitive ∓.
VA	Total apparent power.
VAh	Total apparent energy consumed.

11.5. The Arithmetic Mean Values Of Power Factor Display Screen

To display the arithmetic mean values for the 3 phases (for power factor, phase shift of power factor and tangent), select the $\bar{X}$ icon of the right-hand button.
This screen displays the following information:

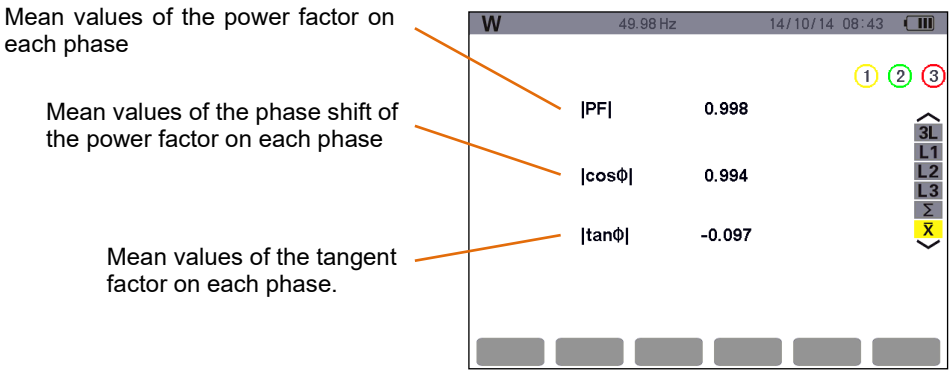


Figure 11-6: the Arithmetic mean values screen for the 3 phases

11.6. Energy generate

The sub-menu displays the active power, the reactive powers (capacitive and inductive), the apparent power, and all associated energies generated.

11.6.1. The energies generated screen for the 3 phases (3L)

This screen displays the following information:

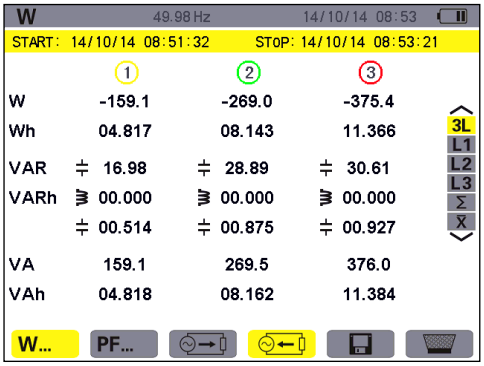


Figure 11-7: the Energies generated screen for the 3 phases (3L)

Unit	Designation
W	Active power.
Wh	Active energies generated.
VAR	Total reactive power, inductive ⫢ or capacitive ⫩.
VARh	Total reactive energies generated, inductive ⫢ or capacitive ⫩.
VA	Total apparent power.
VAh	Total apparent energy generated.

11.6.2. The energies generated display for phase L1

This screen displays the following information:

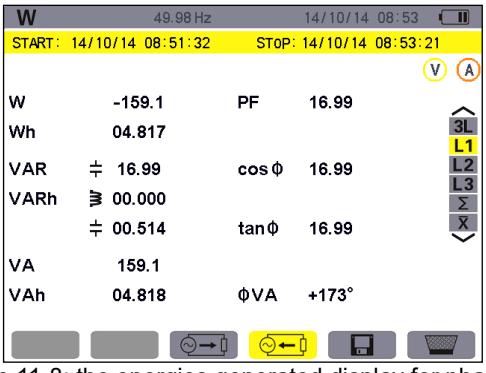


Figure 11-8: the energies generated display for phase L1

Unit	Designation
W	Active power
Wh	Active energies generated
VAR	Total reactive power, inductive ⫢ or capacitive ⫩

VARh	Total reactive energies generated, inductive ⋹ or capacitive ∓
VA	Total apparent power.
VAh	Total apparent energy generated.
PF	Power factor
Cosφ	Phase shift of power factor.
Tanφ	Tangent factor
φVA	Phase angle between voltage and current

Note: Filters L2 and L3 display the same information for phases 2 & 3. ∑ screen display total power and energy generated values for the 3 phases.

11.6.3. The sums of energies generated display screen

To display the information, select the ∑ icon.
This page displays:
★The total active power,
★The total active energy generated,
★The total reactive power, inductive ⋹ or capacitive ∓,
★The total reactive energies generated (inductive ⋹ and capacitive ∓),
★The total apparent power,
★The total apparent energy generated.

11.7. Starting Energy Metering

To start metering, press the yellow key on the keypad corresponding to the icon:

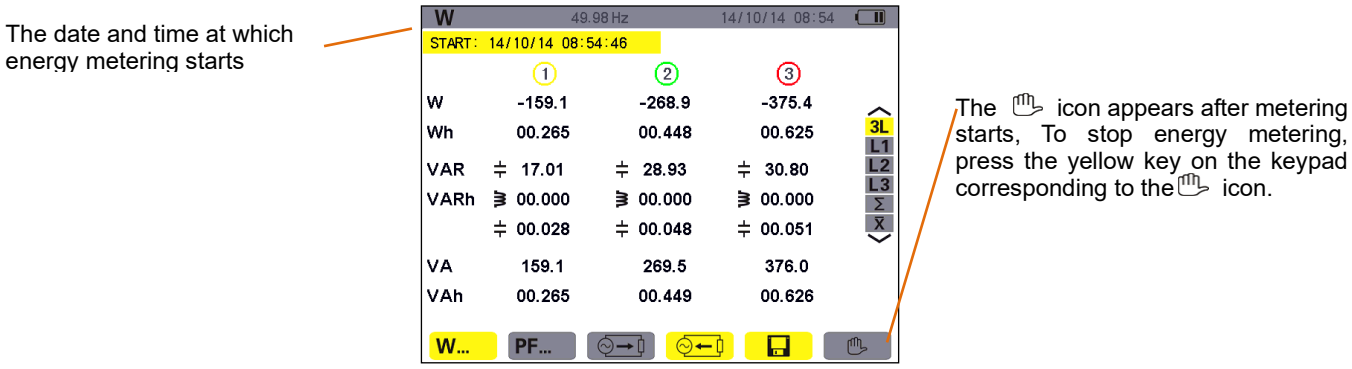


Figure 11-9: the Power and energies mode screen when energy metering is started

11.8. Stopping Energy Metering

To stop energy metering, press the yellow key on the keypad corresponding to the icon.

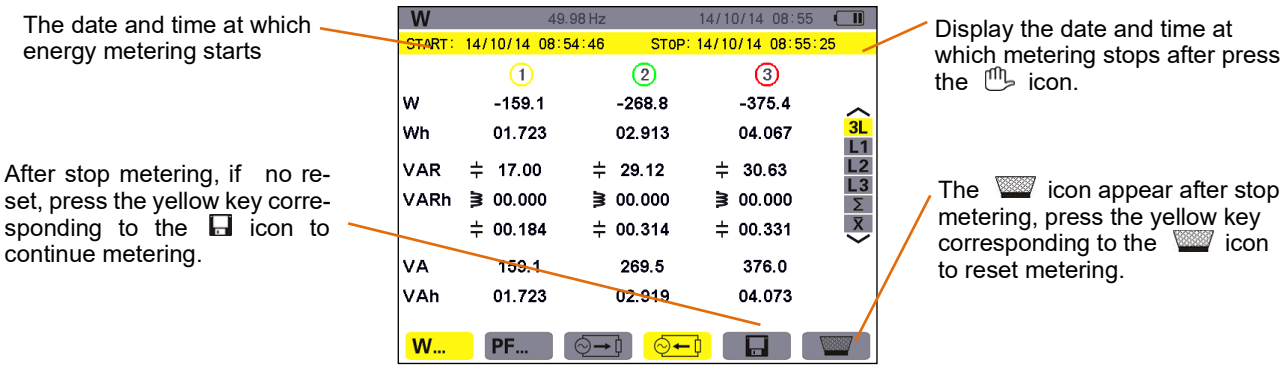


Figure 11-10: the Power and energies mode screen when energy metering is stop

11.9. Reset Of Energy Metering

To reset metering, press the yellow key on the keypad corresponding to the icon, The icon displayed yellow indicate ready to delete, then press the yellow key corresponding to the icon to cancel the delete state.
In the state of ready to delete, press the key to confirm. All energy values (consumed and generated) are

reset.
Note: refer to the 4-quadrant power diagram in § 17.3.

12. SCREEN SHOT MODE

The key can be used to:
★Capture a maximum of 60 screens for future reference (see § 12.1).
★display previously saved screen snapshots (see § 12.2).
Saved screens may then be transferred to a PC using the USB.

12.1. Screen Snapshots

Press for approx. 3 seconds to shoot any screen (including the , , , , , , and mode screens).
During the capture, the icon appears in the top left corner of the screen instead of the icon for the active mode (, , , , , ,). The active mode icon reappears when you release the key: the device has saved the image.
Reminder: the device can save a maximum of 60 screen snapshots. If the user attempt to take a 61st screen snapshot, first, upload the pictures you need to the computer through USB, then delete the device's snapshots before capture new pictures.

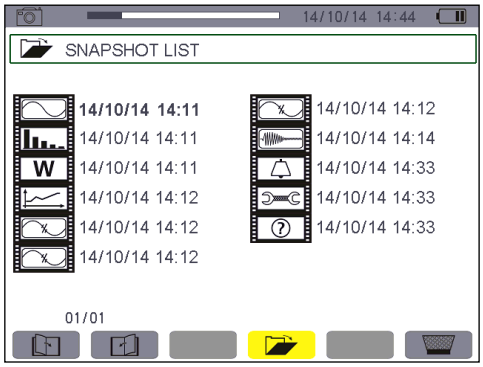


Figure 12-1: the snapshot list display screen

12.2. Handling Of Screen Snapshots

This handling concerns stored screen snapshots, i.e.:
★Display of the list of screen snapshots (see § 12.2.2).
★Viewing of one of the screen snapshots (see § 12.2.3).
★Deletion of one or more of the screen snapshots (see § 12.2.4).

12.2.1. Available functions

To enter screen snapshot mode, briefly press the key.

Reminder: holding the key down for approximately 3 seconds triggers the screen snapshot function (See § 12.1).

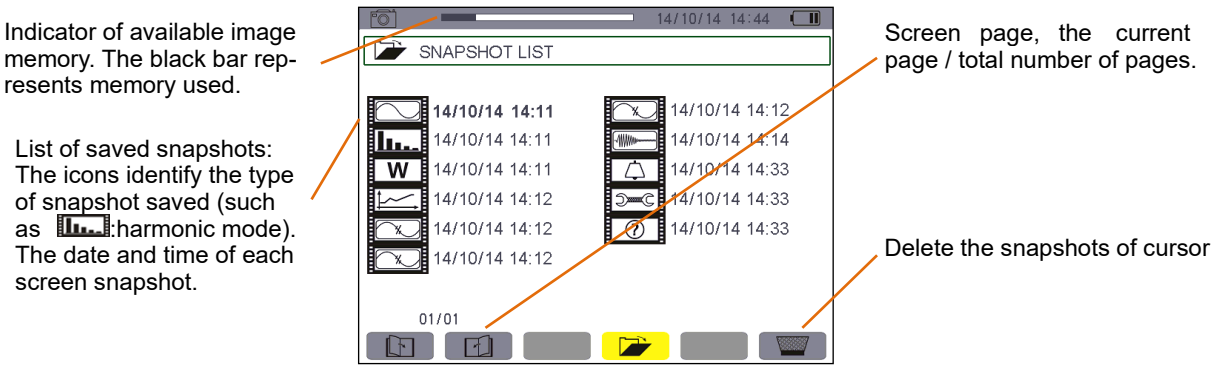


Figure 12-2: example of the snapshot list display screen

12.2.2. Viewing the list of snapshots

Press briefly to display this list. The screen presents the list of snapshots (see figure 12-2).

12.2.3. Viewing a snapshot from the list

To view a snapshot, proceed as follows:

★ Press . The icon is active and the snapshot list screen is displayed (see figure 12-2).
★ Select the snapshot to be viewed using the or and or keys. The date and time of the selected snapshot are bolded.
★ Press to display the selected snapshot. The top left corner of the screen displays the icon, alternating with the icon corresponding to the active mode (such as :harmonic mode).
★ Press to return to the list of screen snapshots.

12.2.4. Deleting a snapshot from the list

To delete a snapshot, proceed as follows:
From the list of snapshots (see Figure 12-2 for example).
★ Select the snapshot to be deleted using the or and or keys. The date and time of the selected snapshot are bolded.
★ Press the yellow key on the keypad corresponding to the icon, The icon displayed yellow indicate ready to delete, then press the yellow key corresponding to the icon to cancel the delete state.
★ In the state of ready to delete, press the key to confirm.
Press to delete the selected snapshot. The snapshot is deleted from the list.

13. HELP

The key provides information about the functions and symbols used in the current display mode.
The following information is displayed:

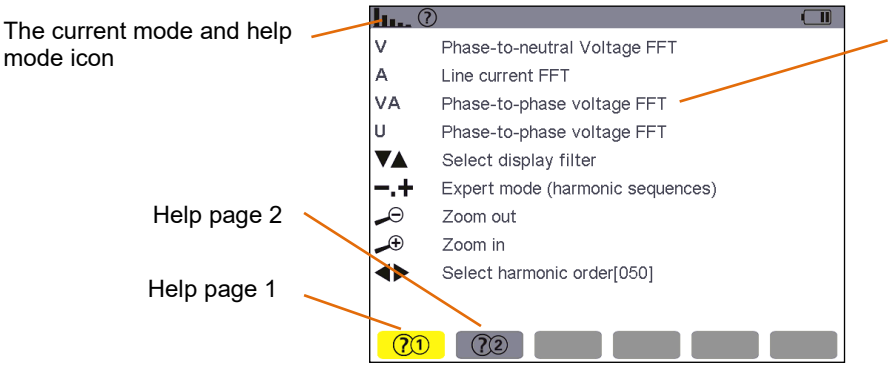


Figure 13-1: example of the help page for the powers and energies mode, page 1

14. DATA UPLOADED TO THE COMPUTER

To install a program, use the CD, then follow the on-screen instructions. Then connect the device to the PC using the USB cord supplied with the device, start the device, then open the data software to click on the computer's Power Quality Analyzer.exe. Wait for software to automatically search and connect the device. For directions for using the data export software, refer to its user manual.
Note: Note: The transfer does not delete the data, just copy to the PC. At alarm/trend chart record/transient capture mode (pending or ongoing), PC cannot read the data.

15. GENERAL SPECIFICATIONS

15.1. Housing

Housing	Rigid shell overmoulded with a red thermo-adhesive elastomer.
Connectors	5 voltage measurement sockets.
	4 special current connectors.
	One connector for the specific mains power unit.
	One connector for the USB link.
	One connector for the SD memory card. This connector is located in the battery compartment on the back of the device.
Keys	Function, navigation, and mode. Can be used with gloves on.
Hand strap	Located on the side of the device, use to operation more convenient.
Stand	To hold the device in an inclined position.
Battery cover	To access the battery, on the back of the instrument.
Dimensions	Overall: 240×170×68mm Screen: 640×480 pixels W×H: 118mm×90mm; Diagonal: 148mm
Weight	Host: 1600 g (with battery).

15.2. Power Supply

15.2.1. External mains power supply

Range for use	Input AC100V-240V, 50Hz/60Hz, Output DC12V, Maximum output current 3A.
Maximum input power	36VA

15.2.2. Battery supply

The device can be used without a connection to mains power. The battery also makes it possible to use the device during power outages.

Battery	Rechargeable lithium-ion battery pack 9.6V
Capacity	4500 mAh
Life	at least 500 charge-discharge cycles.
Charging current	approx. 0.6A
Charging time	approx. 8 hours
Service T°	[0 °C ; 50 °C].

Charging T°	[10 °C ; 35 °C].
Storage T°	Storage ≤30 days:[-20 °C ; 50 °C]
	storage for 30 to 90 days:[-20 °C ; 40 °C].
	storage for 90 days to 1 year: [-20 °C ; 30 °C].

15.2.3. Consumption

At 10% luminosity	410 mA
At 50% luminosity	490 mA
At 100% luminosity	590 mA

15.3. Range for use

15.3.1. Environmental conditions

15.3.1.1. Climatic conditions

The following table shows the conditions regarding ambient temperature and humidity:

	Temperature Range	Humidity Rnage
Reference environmental conditions	20℃~26℃	45%RH~75%RH
Application condition	0℃~50℃	10%RH~85%RH
Store condition（With battery）	-20℃~50℃	0%RH~90%RH
Store condition（Without battery）	-20℃~75℃	0%RH~90%RH

Caution: at temperatures above 40°C, the device must be powered by the battery alone OR by the mains power unit alone; use of the device with both the battery **AND** the mains power unit is **prohibited**.

15.3.1.2. Altitude

Use: [0 m; 2 000 m]

Storage: [0 m; 10 000 m]

15.3.2. Mechanical conditions

Under IEC 61010-1, the device is regarded as a **PORTABLE DEVICE (HAND-CARRIED).**

- Operating position: any position.
- Reference position in operation: on a horizontal plane, resting on its stand or lying flat.
- Rigidity (IEC 61010-1): force of 30 N applied to any part of the housing, the device being supported (at 40°C).

- Fall (IEC 61010-1): 1 m in presumed worst-case position; the requirement is no permanent mechanical damage andno functional degradation.

- Tightness: IP 50 as per NF EN 60529 A1 (IP2X electrical protection for the terminals).

15.3.3. EMC electromagnetic compatibility

15.3.3.1. Immunity as per IEC 61326:1-2006

- Immunity to electrostatic discharges (as per IEC 61000-4-2)

Level 1: Severity: 4 kV in contact

standard: Standard A

Level 2: Severity: 8 kV in air

standard: Standard A

- Immunity to radiated fields (as per IEC 61000-4-3 and IEC 61000-4-8)

Severity: 10V.m-1

Standard: standard B

- Immunity to rapid transients (IEC 61000-4-4)

Severity: 2 kV on voltage inputs and power supply
1 kV on current input
Standard: standard A
■ Immunity to electric shocks (as per IEC 61000-4-5)
Severity: 2 kV on voltage inputs in differential mode
1 kV on voltage inputs in common mode
Standard: standard A
■ Conducted RF interference (as per IEC 61000-4-6)
Severity: 3 V on voltage inputs and power supply
Standard: standard A
■ Voltage interruption (as per IEC 61000-4-11)
Severity: 100% loss over one period of the power supply
Standard: standard A
15.3.3.2. Emissions as per IEC 61326:1-2006
■ Class A equipment.

15.4. User safety

■ Application of safety rules as per IEC standard 61010-1 (protective impedances on voltage inputs).
■ Pollution type 2.
■ Double insulation on I/O with respect to earth (⧈ symbol).
■ Double insulation between the voltage inputs and power supply and the other I/O (⧈ symbol).
■ Indoor use.

16. FUNCTIONAL CHARACTERISTICS

16.1. Reference conditions

This table indicates the reference conditions of the quantities to be used by default in the characteristics.

Ambient temperature	(23±2)°C
Humidity (relative humidity	40%~ 60%
Atmospheric pressure	[860hPa~ 1060hPa]
Phase-to-neutral voltage	[(50±1%) Vrms; (500±1%) Vrms] without DC (< 0.5 %)
Frequency of electrical network	50Hz±0.1Hz, 60Hz±0.1Hz
Phase shift	0° (active power), 90° (reactive power)
Harmonics	<0.1%
Voltage unbalance	<10%
Voltage ratio	1
Current ratio	1
Power supply	Battery only
Electric field	<1V/m
Magnetic field	<40A/m

16.2. Electrical characteristics

16.2.1. Voltage input characteristics

0 Vrms to 1000 Vrms AC+DC phase-to-neutral and neutral-to-earth.
0 Vrms to 2000 Vrms AC+DC phase-to-phase. (on condition of compliance with 1000 Vrms with respect to earth in CAT III).

16.2.2. Current input range

008B current clamp: 10mA~ 10A.
040B current clamp: 0.10A~ 100A.
068B current clamp: 1.0A~ 1000A.
Optional current transformer**:** device input current 1mA~ 500mA.

16.2.3. Characteristics of the device alone (excluding the current sensor)

Respectively introduce the following data (on the basic of base conditions and the ideal current sensors, perfectly linear, no phase shift).

Measurement	Range	Display resolution	The maximum error in the range of the reference
Frequency	40Hz~ 70Hz	0.01Hz	±(0.03)Hz
True RMS phase-to-neutral voltage	1.0V~ 1000V	Min resolution 0.1V	±(0.5%+5dgt)
True RMS phase-to phase voltage	1.0V~ 2000V	Min resolution 0.1V	±(0.5%+5dgt)
DC voltage	1.0V~ 1000V	Min resolution 0.1V	±(1.0%+5dgt)
True RMS current	10mA~ 1000A	Min resolution 1mA	±(0.5%+5dgt)
Peak of phase-to-neutral voltage	1.0V~ 1414V	Min resolution 0.1V	±(1.0%+5dgt)
Peak of phase-to-phase voltage	1.0V~ 2828V	Min resolution 0.1V	±(1.0%+5dgt)
Current peak	10mA~ 1414A	Min resolution 1mA	±(1.0%+5dgt)
Peak factor	1.00~ 3.99	0.01	±(1%+2dgt)
	4.00~ 9.99	0.01	±(5%+2dgt)
Active power	0.000W~ 9999.9kW	Min resolution 0.001W	±(1%+3dgt) Cosφ≥0.8
			±(1.5%+10dgt) 0.2≤Cosφ<0.8
Reactive power, inductive or capacitive	0.000VAR~ 9999.9kVAR	Min resolution 0.001VAR	±(1%+3dgt) Sinφ≥0.5
			±(1.5%+10dgt) 0.2≤Sinφ<0.5
Apparent power	0.000VA~ 9999.9kVA	Min resolution 0.001VA	±(1%+3dgt)
Power factor	-1.000~ 1.000	0.001	±(1.5%+3dgt) Cosφ≥0.5
			±(1.5%+10dgt) 0.2≤Cosφ<0.5
Active energy	0.000Wh~ 9999.9MWh	Min resolution 0.001Wh	±(1%+3dgt) Cosφ≥0.8
			±(1.5%+10dgt) 0.2≤Cosφ<0.8
Reactive energy, inductive or capacitive	0.000VARh~ 9999.9MVARh	Min resolution 0.001VARh	±(1%+3dgt) Sinφ≥0.5
			±(1.5%+10dgt) 0.2≤Sinφ<0.5
Papparent energy	0.000VAh~ 9999.9MVAh	Min resolution 0.001VAh	±(1%+3dgt)
Phase angle	-179°~ 180°	1°	±(2°)
Tanφ (VA≥50VA)	-32.76~ 32.76	Min resolution 0.001	φ:±(1°)

Phase shift of power factor (DPF)	-1.000~ 1.000	0.001	φ:±(1°)
Harmonic ratio (order 1 to 50) (Vrms>50V)	0.0%~ 99.9%	0.1%	±(1%+5dgt)
Harmonic angle (Vrms>50V)	-179°~ 180°	1°	±(3°) harmonics of order 1 to 25
			±(10°) harmonics of order 26 to 50
Total harmonic ratio (THD or THD-F)≤50	0.0%~ 99.9%	0.1%	±(1%+5dgt)
Distortion factor (DF or THD-R)≤50	0.0%~ 99.9%	0.1%	±(1%+10dgt)
Transformer K factor	1.00~ 99.99	0.01	±(5%)
3 phases unbalance	0.0%~ 100%	0.1%	±(1%)

16.2.4. Current sensor characteristics (after linearization)

Sensor errors are offset by a typical correction inside the device. This typical correction, applied to the phase and amplitude, depends on the type of sensor connected (detected automatically) and the gain in the current acquisition channel used.

Type of current sensor	True RMS current	Max error of true RMS current	Max error of phase angleφ
008B current clamp	10mA~ 99mA	±(1%+3dgt)	±(1.5°),Arms≥20mA
	100mA~ 10.0A	±(1%+3dgt)	±(1°)
040B current clamp	0.10A~ 0.99A	±(1%+3dgt)	±(1.5°)
	1.00A~ 100A	±(1%+3dgt)	±(1°)
068B current clamp	1.0A~ 9.9A	±(2%+3dgt)	±(3°)
	10.0A~ 1000A	±(2%+3dgt)	±(2°)
300F flexible coil current sensor	10A～99A	±(1%+3dgt)	±(3°)
	100A～6000A	±(1%+3dgt)	±(2°)

17. APPENDICES

17.1. Mathematic Formulae

17.1.1. Network frequency and sampling

Sampling is controlled by (locked to) the network frequency so as to deliver 256 samples per cycle from 40 Hz to 70 Hz. This locking is essential for the calculations of reactive power, unbalance, and harmonic ratio and angles.

The frequency is measured by analysing ten consecutive positive-going zero crossings in the first voltage channel (V1) or first current channel (I1) after digital low-pass filtering and digital suppression of the DC component. The time of the zero crossing is determined precisely by linear interpolation between two samples to achieve resolution better than 0.002%.

The signals are acquired using a 16-bit converter and (for current acquisition) dynamic gain switches.

17.2. Hysteresis

Hysteresis is a screening principle that is often used after detection of a threshold stage in Alarm mode (See § 5.10) and in Inrush current mode (see § 6.3). A correct hysteresis setting avoids repeated changes of state when the measurement oscillates about the threshold.

17.2.1. Surge detection

With a hysteresis of 2%, for example, the return level for surge detection is equal to (100% - 2%) or 98% of the reference voltage threshold.

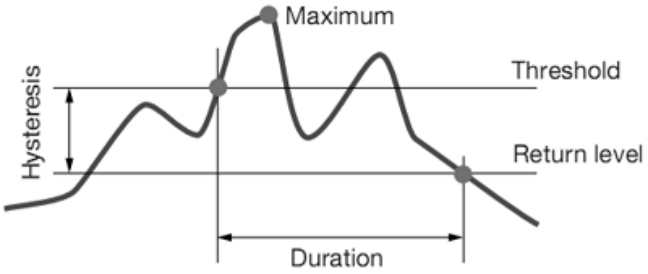


Figure 17-1: an example of return level for surge detection

17.2.2. Undervoltage or blackout detection

With a hysteresis of 2%, for example, the return level for undervoltage detection is equal to (100% + 2%) or 102% of the Uref voltage threshold.

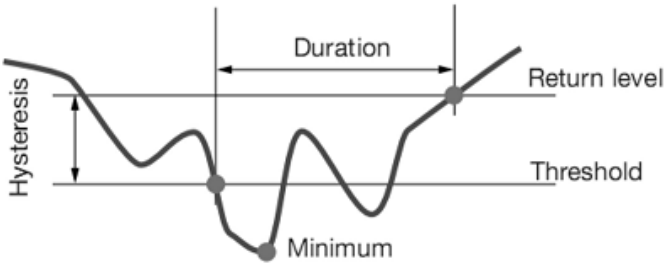


Figure 17-2: an example of return level for undervoltage detection

17.3. Four-quadrant Diagram

This diagram is used for power and energy measurements W.

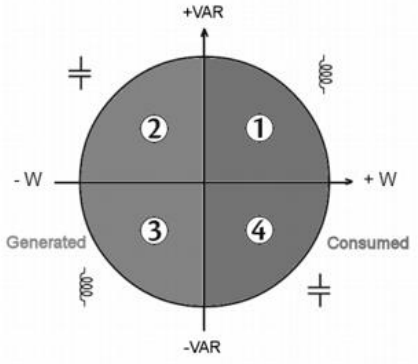


Figure 17-3: Four-quadrant diagram for power and energy

17.4. Mechanism For Triggering Transient Captures

The sampling rate is a constant 256 samples per cycle. When a transient capture is started, each sample is compared to the sample from the preceding cycle. The preceding cycle defines the mid-point of the trigger envelope and is used as reference. As soon as a sample is outside the envelope, the triggering event occurs; the representation of the transient is then captured by the device. The cycle preceding the event and the three following cycles are saved to memory.

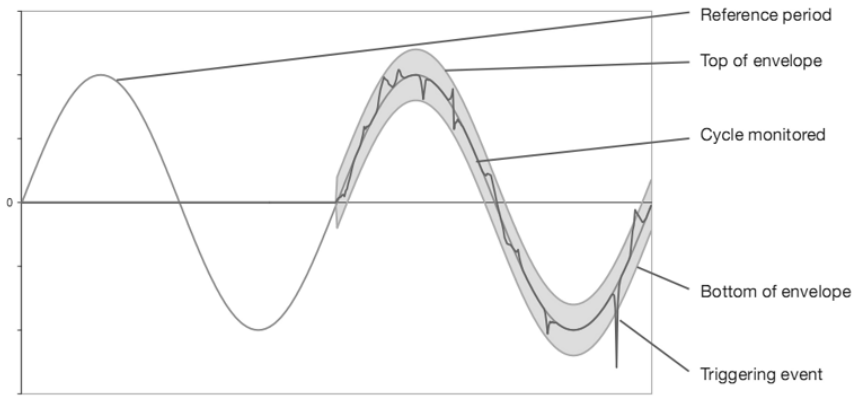


Figure 17-4: a graphic representation of the transient capture triggering mechanism

17.5. Capture Conditions In Inrush Current Mode

Reminder: The capture depends on a triggering (start) event and a stop event. If a capture ends with a stop event or if the recording memory of the device is full, the capture stops automatically.
The capture stop threshold is calculated as follows:
[Stop threshold [A]] = [Start threshold [A]] × (100 – [stop hysteresis [%]]) ÷ 100

Here are the conditions for triggering and stopping captures:

Triggering channel	Triggering and stop conditions
A1	Triggering condition ⇔ [A1 half-cycle RMS value] > [Triggering threshold] Stop condition ⇔ [A1 half-cycle RMS value] < [Stop threshold]
A2	Triggering condition ⇔ [A2 half-cycle RMS value] > [Triggering threshold] Stop condition ⇔ [A2 half-cycle RMS value] < [Stop threshold]
A3	Triggering condition ⇔ [A3 half-cycle RMS value] > [Triggering threshold] Stop condition ⇔ [A3 half-cycle RMS value] < [Stop threshold]
3A	Triggering condition ⇔ [[the half-cycle RMS value of one current channel]> [Triggering threshold] Stop condition ⇔ [the half-cycle RMS values of all current channels] < [Stop threshold]

18. MAINTENANCE

18.1. Important Recommendation

For maintenance, use only the spare parts specified. The manufacturer cannot be held liable for any accident that occurs following a repair not performed by its customer service department or by an approved repairer.

18.2. Recharging The Battery

The battery charge is managed by the device when connected to the AC network via the mains power unit supplied.

★ For safety reasons and to ensure the correct operation of the charger, the storage battery must be replaced with the power off.
★ Do not throw the battery into a fire.
★ Do not expose the battery to a temperature in excess of 75°C.
★ Do not short-circuit the terminals of the battery.
★ When the battery fully recharged, please remove the power adapter(if do not use external power supply).

18.3. Replacing The Battery

⚠For safety reasons, advice that replace the battery only with the original model
To replace the battery, proceed as follows:
★ To eliminate all risk of electric shock, disconnect the power supply cord and connected devices.
★ Turn the device over.
★ Use a cross screwdriver to unscrew the two quarter-turn screws on the back of the housing. Then open the battery cover.
★ Gently remove the old battery, replace a new original battery (To avoid damage the battery connection, do not pull on the wires).
★ Put the battery compartment cover back in place and screw the 2 quarter-turn screws back in.
★ Reboot the device to confirm.
Note: If the battery is disconnected, it must then be fully recharged, even if it is not replaced, so that the device will know the battery charge condition (this information is lost when the battery is disconnected).

Data Analysis Software

User Manual

CONTENTS

1. SUMMARY

Power Analyser Transfer Data View, this software is base on Windows system and match with the device. This Data analysis software use for view waveforms, harmonics, power energies, and can be exported to the type of real-time test data file. Real-time test data file is saved to your computer, so when you need to re-import into the analysis software to view; the device can be used to save the trend recording, alarm recording, transient recording, the inrush current recording, snapshots uploaded to the computer and display, and can be stored in the form of long-term data files to retain power for when you need to re-import into the analysis software to view .

Note: When an alarm campaign is initiated or a search for transients, an inrush current capture, or a trend recording is pending or in progress, the device will not respond to the data analysis software. You can upload the data after the capture completed. When the software connect with the device success, the device's mode should be through the data software to switch instead of press the keys of device directly.

The functions as follows:

- Real-time monitoring the test data and waveforms, monitor waveforms, harmonics and power energies.
- Upload and view the historical monitoring data.
- To zoom in, zoom out, move left and right, sifting sort the data and waveforms.
- Export the data files (*.pqaf).
- Export the excel data report.
- Save the pictures on the current screen.
- Import the previously saved data files(*.pqaf).

2. INSTALLATION

2.1.Software Installation

2.1.1.Directly open

According to the computer's system, if allow that you can click the *Power Quality Analyser.exe* to open the Data Analysis Software directly without installation.

2.1.2.Software installation

If directly open failed in § 2.1.1. it must be installed. Find the setup folder in the CD contents, click the setup.exe to install. After installed, the software will appear In the Start\Program\Power Quality Analyser\ Power Quality Analyser, the user also can create a desktop shortcut for Power Quality Analyser.exe.

2.2.Drive installation

2.2.1.Directly installation

In the CD contents, find the drive folder, double click the ftdi_ft232_drive.exe to install, then connect the device and wait for your computer to detect it automatically.

2.2.2.inf file installation

If the installation failed in § 2.2.1, you can do as the follows:

- Connect the device, executive the search driver installation wizard, select the inf drive folder.
- Continuous installation two times.

3. SOFTWARE START-UP

3.1.Start-up steps

Connect the device to the computer using the USB cord, then switch the device on, click the desktop shortcut: Power Quality Analyser.exe. to start-up the software. After the software start-up, it will detect automatically the computer and connect with the computer. In general, it need about 5 seconds to upload all the test data, and then enter the Waveform mode acquiescently

.
The following information is displayed:

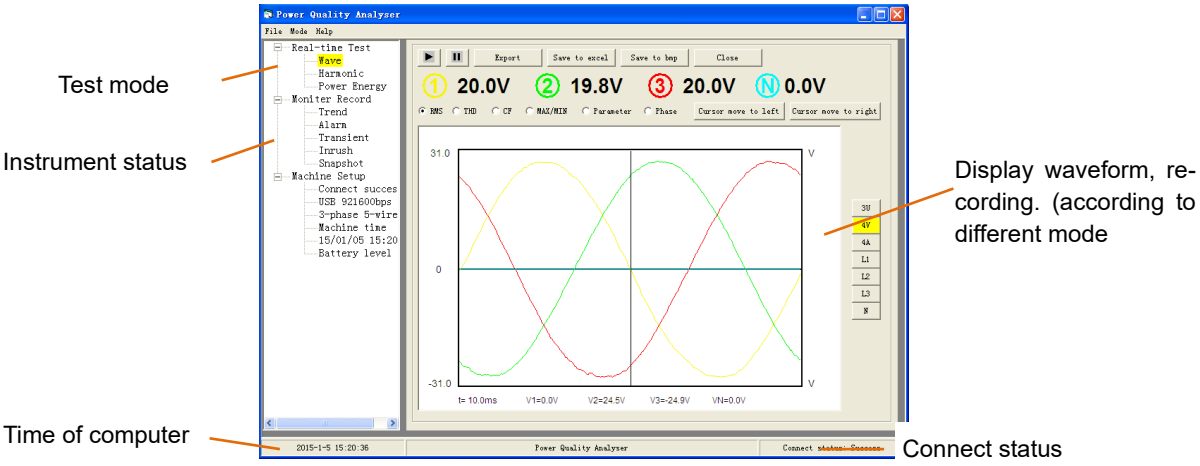


Figure 3-1: the software normal start-up and connect display screen

As shown in figure 3-1, the test mode have two parts: real-time test and monitor record. The real-time mode can be selected waveform mode, harmonic mode and power energy mode. The monitor record can be selected trend recordings, alarms, transient recordings, inrush currents, snapshots. Yellow highlight indicates the current mode.

4. REAL-TIME DATA

Real-time data is used to real-time display the device's test data and waveforms, including waveform, harmonic, and power energy mode. The software reads the real data from the device every 1 second, and refresh the display. The user can click the  icon to suspend update to observe the waveform, click the  icon to continue refresh the waveforms.

4.1. Waveform mode

Click the Real-time Test/Wave to into the Waveform mode, display the test waveforms and data.
The following information is displayed:

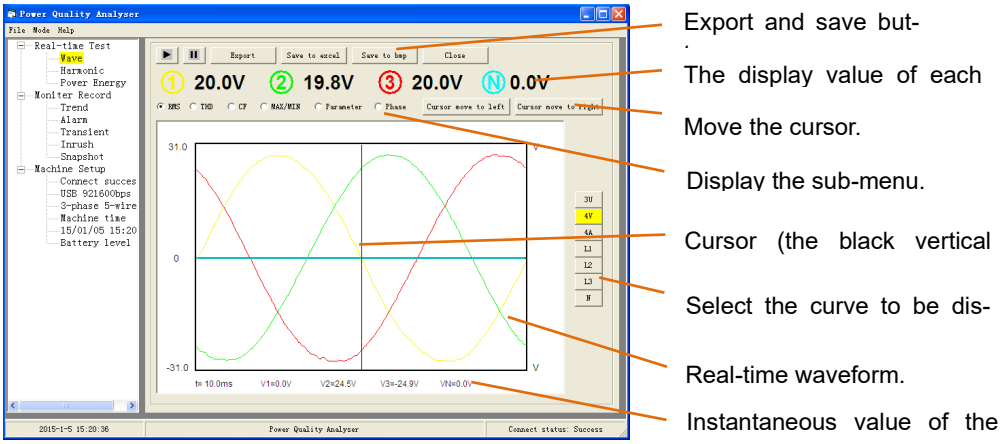
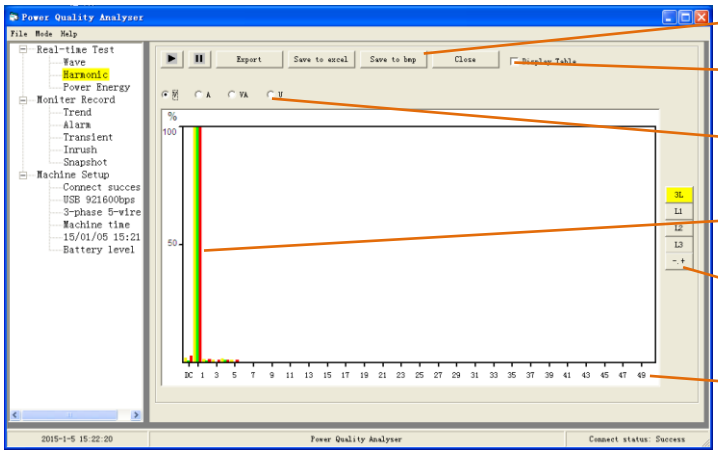


Figure 4-1: display the waveform in Real-time Test Mode

■ Export the data files: export the waveform data, the current curve waveform and the current status of the device information, and saved as the extension ***.pqaf***. You can re-import when need, and the display as the real-time monitoring, cannot be switch only in the import mode. (see § 6).
■ Save to excel: export the waveform data, the current curve waveform and the current status of the device information, and saved in the form of excel list.
■ Save to bmp: saved the current display screen in the form of bmp.
■ Display sub-menu: select to display RMS, THD, CF, maximum, minimum, parameter list and phasor diagram.
■ Select the curve to be displayed.: click the buttons (3U, 4V, 4A, L1, L2, L3, N) to select the displayed curve.
Note: in these three modes, the test mode of device will vary with the test mode of software to switch, that is, the software and the device in the same mode.

4.2. Harmonic Mode

Click the Real-time Test/Harmonic to into the Harmonic mode, display of the harmonic bar charts and the relevant data.
The following information is displayed:



Export and save buttons
Display by list
Display the sub-menu
Harmonic bar chart
Select the bar chart to be displayed
Harmonic order

Real-time Test

■ Display list: check: display of the list of harmonic data each phase in the form of table;
Uncheck: display of the the list of harmonic data each phase in the form of bar chart.
■ Display sum-menu: to select display of the harmonic bar chart of V, A, VA, U.
■ Select the bar chart to be displayed: click the buttons (3L, L1, L2, L3, -,+ expert mode) to switch the diagrams to be displayed.

4.3. Power Energy Mode

Click the Real-time Test/Power Energy to into the Power Energy mode, display of the power and the metering energy.
The following information is displayed:
■ Start calculate: press the *Start calculate* button, the energy start to calculate, and displayed the start time in the lower left corner of the window.
■ Stop calculate: after start calculate, press the *Stop calculate* button to stop calculate the energy, and displayed the stop time in the lower right of the window.

■ Reset of energy metering: after stop calculate, press the *Clear* button to reset the energy values in the tables.

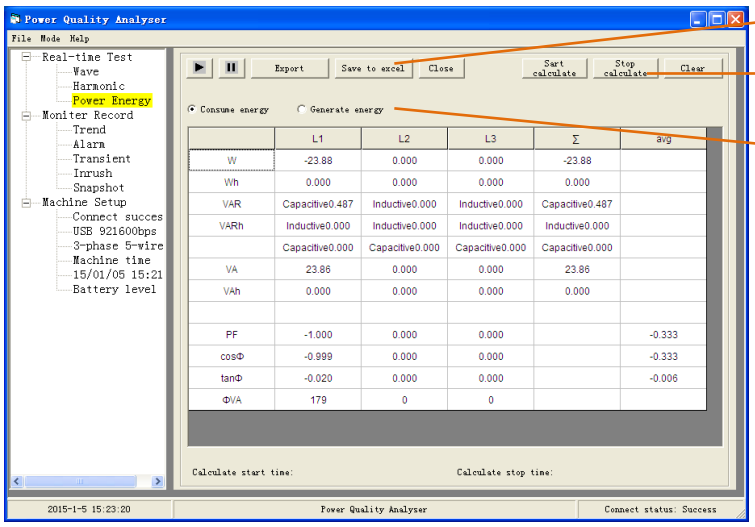


Figure 4-3: display the power energy in Real-time Test

5. MONITER RECORD

Moniter record including trend recordings, alarms, transient recordings, inrush currents, snapshots. It is used to upload the data which saved in the device to the computer for view and export.

5.1. Trend Recording

Click the *Moniter Record/Trend* to upload the recording and the number of the records, and displays in tables. The following information is displayed:

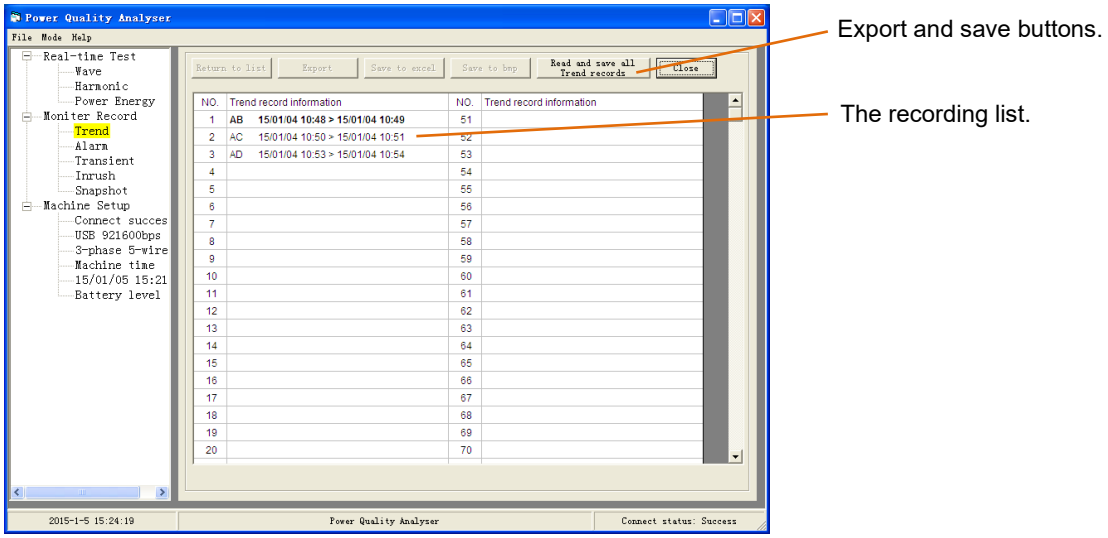
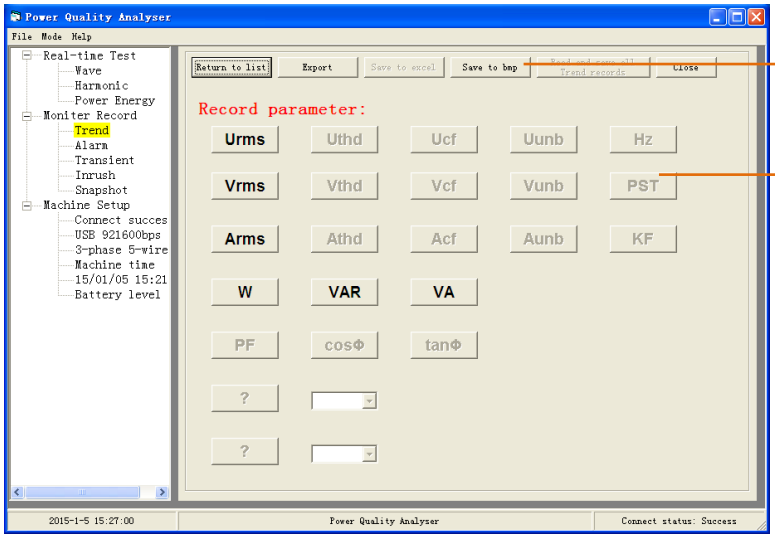


Figure 5-1: list of trend recording

■ Read and save all the trend charts: readout all the trend recording of the device and save to the default address: C:\PowerQuality\trend.

In the list of trend recording, the field where the mouse is bolded, click the left mouse button, upload and display the selected trend recordings.
The following information is displayed:

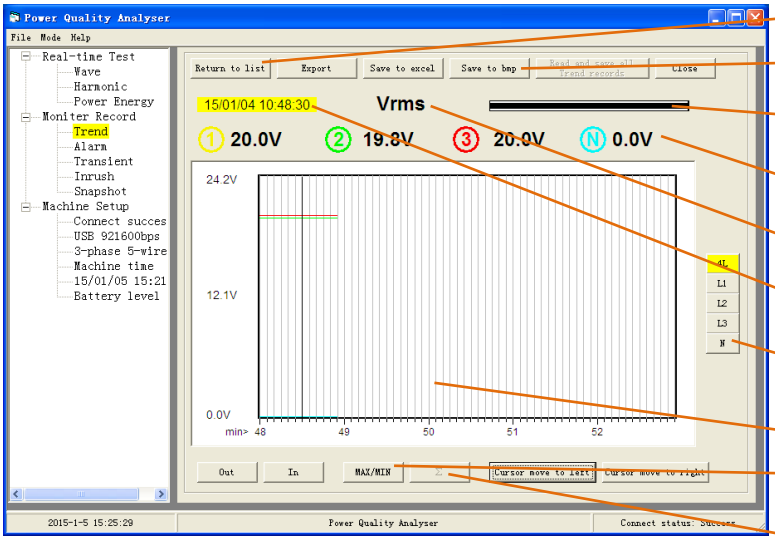


Export and save buttons.

Parameter list of the trend recording.

Figure 5-2: parameter list of the trend recording

The parameter list if the parameters that selected recorded in the trend mode. All parameters displayed in the figure. Black buttons indicate the selected parameters, gray buttons indicate the unselected parameters. Click the corresponding button to enter the trend curve waveform.
The following information is displayed:



Return to the trend recording list.

Export and save buttons.

Location of the zone displayed in the record.

Value of the cursor.

Current parameter name.

Date and time of the cursor.

Select the curve to be displayed.

Trend curve chart.

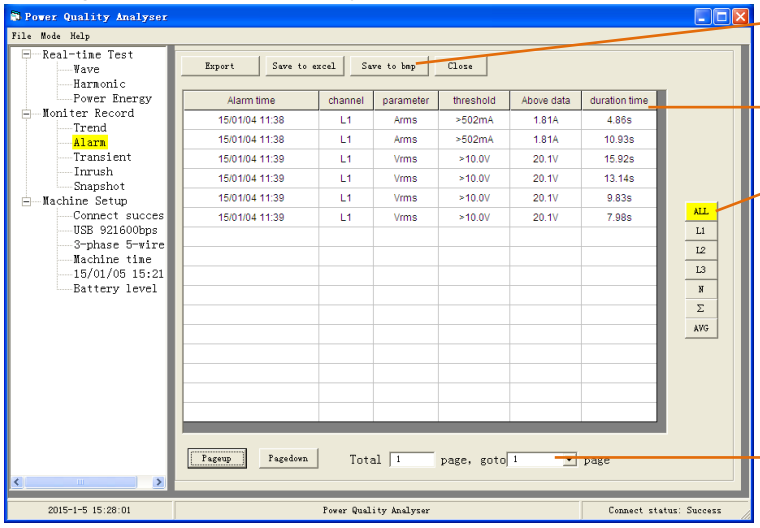
The activated MAX-AVG-MIN mode.

The button of start metering energy (when the selected parameter is W, VAR, VA).

Figure 5-3: curve of the trend recording

5.2. Alarm Recordings

Click the Moniter Record/Alarm to upload the alarm log and the number of the records, and displays in table.
The following information is displayed:



Export and save buttons.

The list of alarm log.

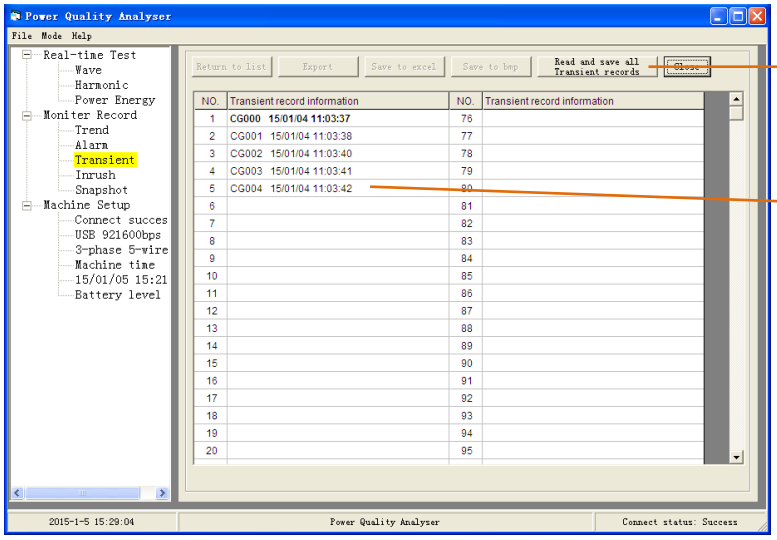
Press the trigger alarm channel to display the alarm log by classification.

Turn the page

Figure 5-4: Alarm list screen

5.3. Transient capture recording

Click the Moniter Record/Transient to upload the recorded transients and the number of the records, and displays in table.
The following information is displayed:



Read all the records and save to the default address.

The recording list.

Figure 5-5: instantaneous recordings

■ Read and save all the transient recordings: readout all the transient recordings of the device and save to the default address: C:\PowerQuality\ tran.
In the list of transient recording, the field where the mouse is bolded, click the left mouse button, upload and display the selected transient recordings.The following information is displayed:

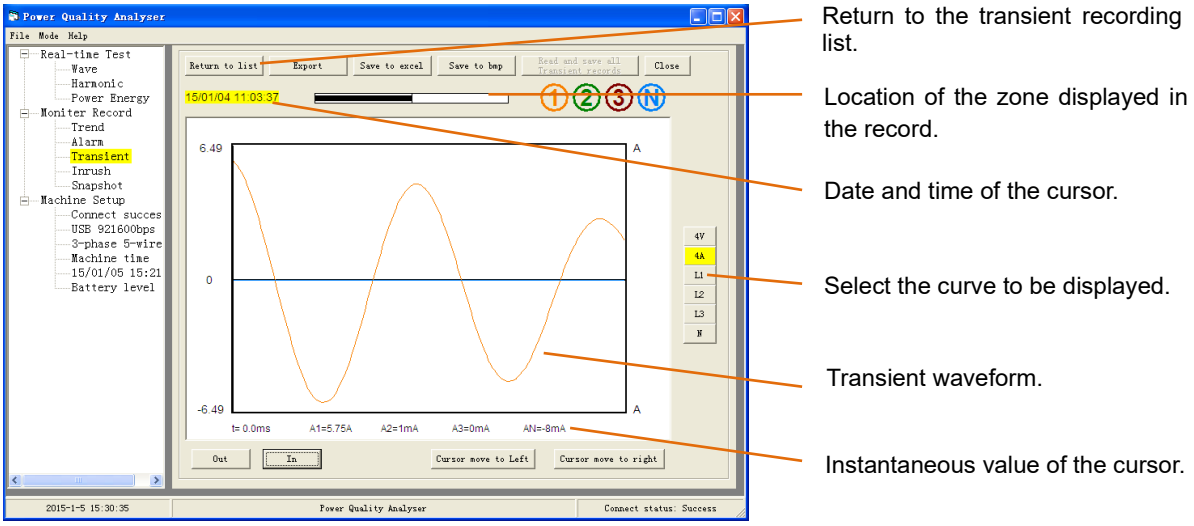
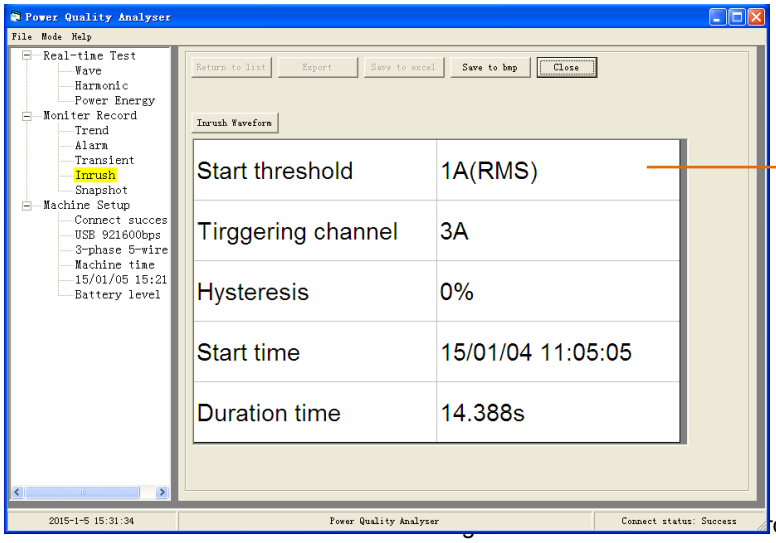


Figure 5-6 transient waveform display

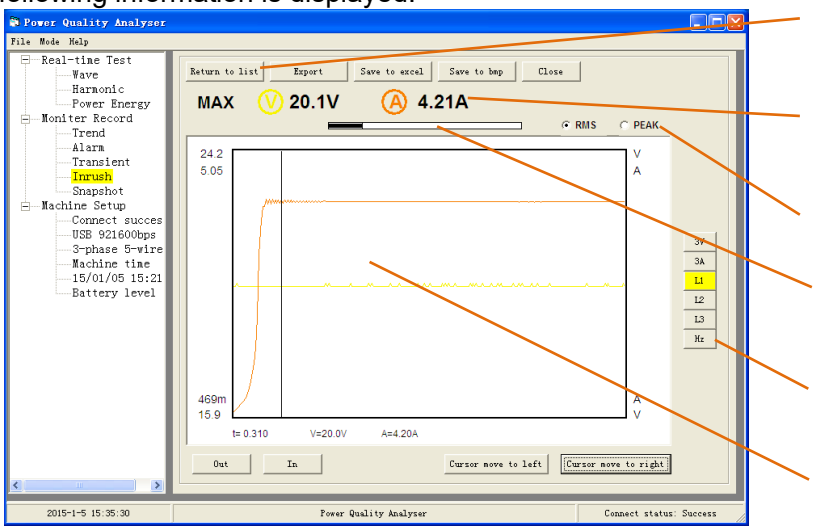
5.4. Inrush Current Capture Recording

Click the Moniter Record/Inrush to upload the inrush current recording, and displays in table.
The following information is displayed:



Start threshold	1A(RMS)
Tirggering channel	3A
Hysteresis	0%
Start time	15/01/04 11:05:05
Duration time	14.388s

In the inrush current recording list, click the *Inrush Waveform* button to upload the inrush current recordings, when the upload is complete will display the inrush current waveform.
The following information is displayed:



Return to the inrush current recording list.

The maximum RMS value (over the entire capture).

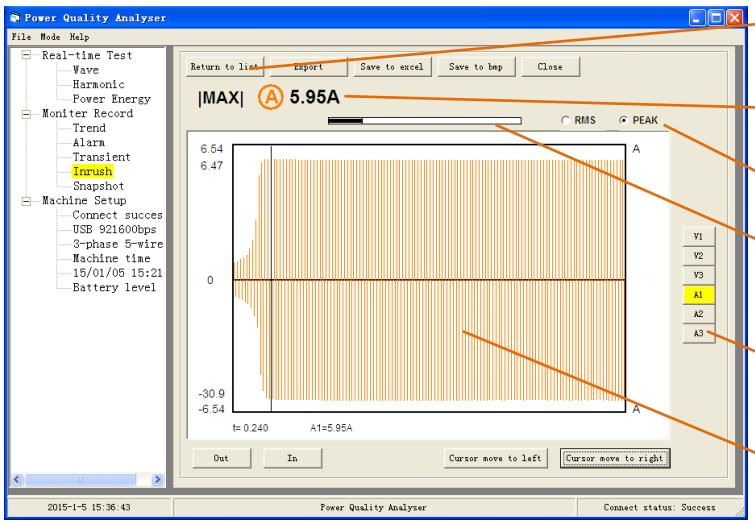
Switch RMS and PEAK.

Location of the zone displayed in the record.

Select the curve to be displayed

RMS curve in the half-cycle.

Figure 5-8: RMS of inrush current



Return to the inrush current recording list.

The maximum PEAK value (over the entire capture).

Switch RMS and PEAK.

Location of the zone displayed in the record.

Select the curve to be displayed.

PEAK envelope.

Figure 5-9: PEAK of inrush current

When display the PEAK envelope of the inrush current, click the *In* button to display the recorded waveform curves of the inrush current.
The following information is displayed:

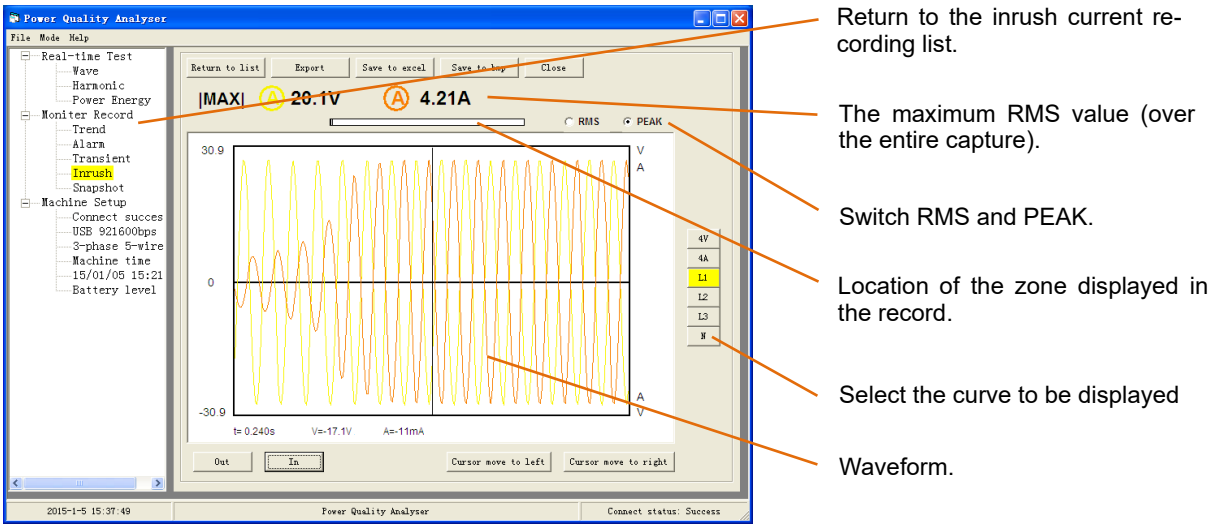


Figure 5-10: waveform of inrush current

5.5. Snapshots

Click the Moniter Record/Snapshot to upload the snapshots and the number of the snapshots, and displays in table.
The following information is displayed:

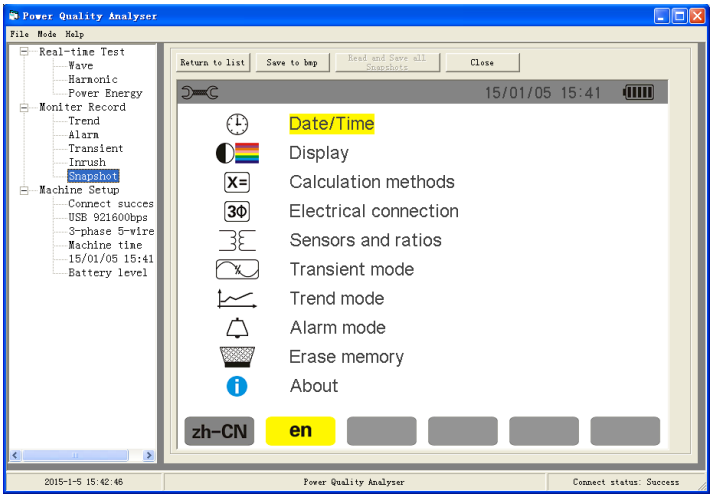
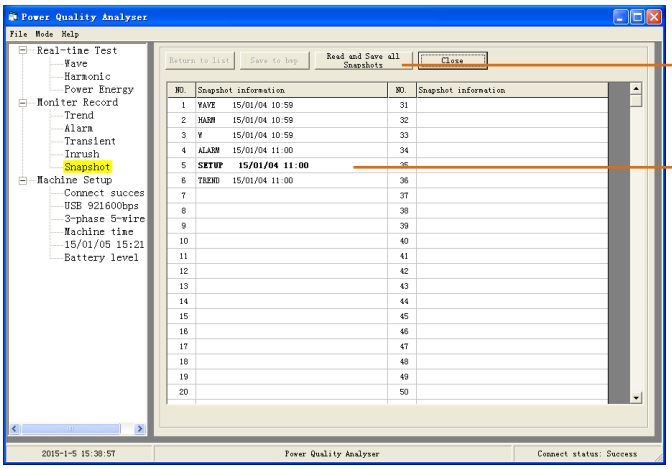


Figure 5-11: snapshots table

■ Read and save all the snapshots: readout all the snapshots of the device and save to the default address: C:\PowerQuality\ photo.

In the list of snapshot, the field where the mouse is bolded, click the left mouse button, upload and display the selected snapshots.

The following information is displayed:



Read all the records and save to the default address.

The recording list.

Figure 5-12: uploaded snapshots displayed screen

6. IMPORT DATA FILE

In the screen of Real-time Test and Moniter Record, to export the file which extension is **.pqaf**, press the Export button. The file saved the current real-time data or monitor records. The data can be re-imported to the software to display in need. Proceed as follows:
Disconnect the USB cord or turn the device off, then close the data analysis software, then click the Power Quality Analyser.exe to restart the software.
The following information is displayed:

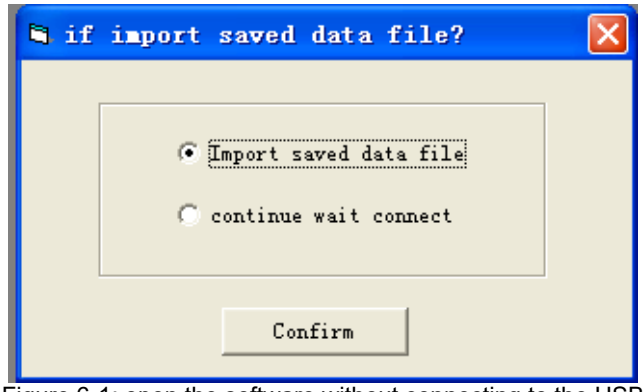
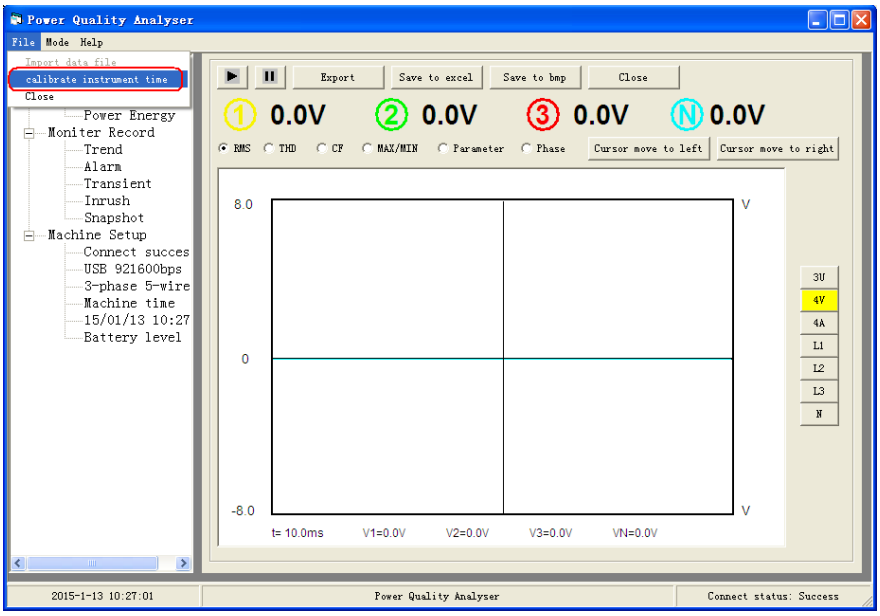


Figure 6-1: open the software without connecting to the USB

Select *Import saved data file,* press *Confirm* to enter the *Import data file* mode. In this status, It is display neither real-time data waveform nor device's status.
Import method: click the menu bar: *File\Import*, select the corresponding file which extension is ***.pqaf***, then the real-time data and monitor records displayed as §4 and §5. In this status, the display screen according to the import data mode, and the mode cannot be switched.

7. INSTRUMENT CALIBRATION TIME

In the normal, the device and computer connect success with the USB, if there have deviation between the device time and computer time, you can calibrate the device time to consistent with the computer time. Click the menu: *File\ calibrate instrument time*. Displayed as the following figure (the red block):



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The contents of this user manual cannot be used as a reason to use the product for special purposes.
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