EUROTEC
TECNOLOGIE IMPIANTISTICHE - AUTOMAZIONE - TELECONTROLLO

LUMEL
EVERYTHING COUNTS

POWER QUALITY ANALYZER
NP40



USER'S MANUAL

CE

Introduction

With dual DSP processor architecture, large-scale integrated circuits (FPGA), and embedded system (uClinux), the NP40 Power Quality Analyzer can calculate a large number of electrical parameters and process all data quickly. The Analyzer is designed specially for power inspection and maintenance department, offering extensive and powerful measurements to check power distribution system, detecting quality and electrical characteristics of power grid rapidly and conveniently. The analyzer has large-screen color LCD display interface, and easy-to-use keyboard.

Main features:

- Waveform real-time display(4 voltages/4 currents)
- Half cycle RMS measurement (voltage and current)
- intuitive operation
- variety of optional current clamps
- Measure DC component
- Measurement, calculation and display of harmonics and interharmonics can be up to 50 times.
- Transient capture
- Vector, Trend, Bar Graph and events table display
- Active power, reactive power, apparent power and energy, shift power factor and true power factor
- Three-phase unbalance (voltage and current)
- Flicker
- Inrush current
- Detection and record of Dips& Swells, Voltage Rapid Change, Interruption.
- Detect according to EN50160 or grid with user-defined limit.
- data storage and screenshots (can be replayed or output to a PC)
- Through the LAN interface PC can keep real-time remote communication with the Analyzer, operate the Analyzer and read back measurement data.
- Built-in 8G memory card.

The Analyzer and its accessories

- NP40 Power Quality Analyzer 1
- Program software for PC (CD) 1
- 2-meter-long voltage cable (with 4mm caliber banana plug) 5
- Crocodile clip 5
- Power adapter 1
- Power cord 1
- Bag 1
- Hang strap 1

Additional equipment

- current clamps KLC8C-5A(5A)
- current clamps CTC0080(50A)
- current clamps CTC0130(100A)
- current clamps CTC1535(1000A)
- Rogowski coils PY-3000A
- Rogowski coils PY-5000A(5000A)

General Safety Information

The Analyzer is designed and produced according to IEC61010-1 strictly, and complies with CAT III 1000V, CAT IV 600V and pollution degree II. Learn about below safety precautions to avoid personal injury, and damage to the Analyzer or any other products connected to it.

To avoid electrical shock or fire:

- Review the manual before use of the Analyzer and its accessories.
- Read all instructions carefully.
- Avoid working alone.
- Do not operate the Analyzer around explosive gas, vapor or moist environment.
- Use the Analyzer as specified, or the protection provided by the Analyzer might be impaired.
- Use only insulated current probes, test leads and adaptors as supplied with the Analyzer, or indicated as suitable for the Analyzer.
- Keep your fingers behind the finger guard on the probes.
- Before use, inspect the Analyzer, voltage probes, test leads and accessories for mechanical damage and replace when damaged. Look for cracks or missing plastic. Pay special attention to the insulation surrounding the connectors.
- Verify operation of the Analyzer by measuring known voltage.
- Remove all probes, test leads and accessories that are not in use.
- Always connect the power adapter first to the AC outlet before connecting it to the Analyzer.
- Do not touch high voltage: voltage>AC RMS 30V, or DC 60V.
- Use the ground input only to ground the Analyzer and do not apply any voltage.
- Do not apply input voltage above the rating of the Analyzer.
- Do not apply voltages in excess of the marked ratings of the voltage probes or current clamps.
- Pay special attention when connecting or removing flexible current probes: power down the device being tested or put on suitable protection suit.
- Do not insert metal objects into connectors.
- Use only power adapter provided by the Analyzer.

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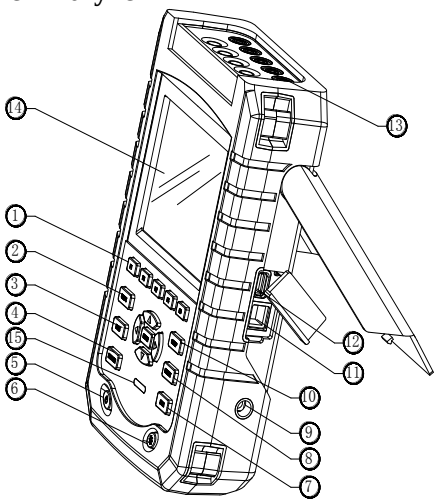
Chapter 1 Getting started

If this is your first time to use the Analyzer, or there is no time for you to read this manual carefully, browsing the content of this chapter is a rapid method for you to learn about the simple and practical functions of the Analyzer. For using more complex functions, please continue to read chapter 2 "Basic Operations", and chapter 3 "Application Example" if you have difficulties during use.

1.1 Overview of The Analyzer



1. Menu keys
2. Scope mode
3. Measurement menus
4. Power Quality Monitoring
5. Power On/Off
6. Display brightness
7. Save
8. Storage information
9. Power adapter
10. Setup
11. LAN
12. USB Host
13. Input
14. Display screen
15. Charging indicator

1.2 Charge the Battery and Prepare for Use

At delivery, the built in chargeable battery may be empty and it is recommend to charge it before use. A full charge for the first time takes at least 6 hours, it means the battery is fully charged when the charging indicator change from red to off. No damage will occur if the adapter is connected with the Analyzer for long periods. The Analyzer automatically cuts off charging when the battery is fully charged. Before use, check that the adapter voltage and

frequency range match the local line power range. To prevent decrease of batter capacity, charge it at least twice a year.

Before measurements, set the Analyzer according to the line voltage, frequency and wiring configuration of power system you want to measure, read section "Set the Analyzer" for more information.

1.3 Input Connections

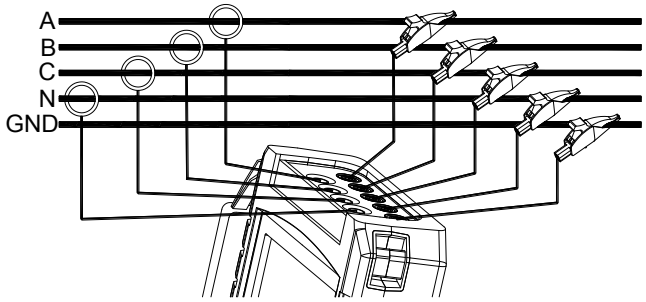


Fig.1-3-1 Connection of Analyzer to 3-phase distribution system

The Analyzer has 4 BNC-inputs for current clamps and 5 banana-inputs for voltages. For a 3-phase system, make the connections as shown in Figure 1.
First put the current clamps around the conductors of phase A (L1), B (L2), C (L3) and N (neutral). The clamps are marked with an arrow indicating the correct signal polarity.
Next make the voltage connections: start with Ground and then succession N, A (L1), B (L2), C (L3). For correct measuring results, always connect the Ground input.
For single phase measurements, use voltage input A (L1) or current input A (L1) or voltage inputs Ground.

1.4 Rapid Overview of Measuring Modes

This section provides an overview of all measuring modes. The screen information and the use of function keys of the Analyzer will be explained in detail in the following sections.

- ✧ **SCOPE mode**

Scope mode shows voltage/current by means of waveforms and numerical values, with cursor and zoom functions.

Measuring mode	Screen type	Form of measuring results
Scope	Waveforms	Scope shows waveforms of voltage or current

✧ **MENU**

Below measurements are available with MENU key:

Measurement mode	Screen type	Form of measuring results
Voltage/Current/Frequency	Table screen	Numerical values: voltage, current, frequency and waveform factor
	Trend	Trends of voltage, current, frequency and waveform factor over time
Dips & Swells	Trend	Trends of voltage and current rapid update over time
	Events table	Record events violate limit
Harmonics	Bar graph	Voltage, current harmonic, interharmonic, THD, DC component
	Table screen	Voltage, current harmonic, interharmonic,THD, DC component
Power and Energy	Table screen	Numerical values: active power, reactive power, apparent power, power factor, shift power factor, voltage, current, energy usage
	Trend	Trends of the numerical values in Table screen over time
Flicker	Table screen	Numerical values: short time flicker Pst (1 minute), Pst (10 minutes), long time flicker Plt
	Trend	Trends of the instantaneous flicker sensation level over time
Unbalance	Table screen	Numerical values: voltage, current negative unbalance percentage and zero unbalance percentage, fundamental voltage, current component and phase angle
	Vector	Phase relation and numerical values of voltage and current

Transient	Waveforms	Voltage, current waveforms and values Record events violate limit
Inrush current	Trend	Record events exceed limit
Logger	Table screen	Numerical value: all selected readings

✧ **MONITOR**

Below functions are available:

Measurement mode	**Screen type**	**Form of measuring results**
Monitor	Bar graph	Display specifications like voltage, harmonics, flicker, swells, dips, voltage rapid change, interruption, unbalance, frequency etc. of power quality parameters
	Bar graph	Detailed bar graph of harmonics
	Trend	Trends of selected data set over time
	Events table	Record events violate limit

1.5 Screen and Function Keys

The Analyzer uses five different screen types to present measuring results in the most effective way.

✧ **Table screen**



Fig. 1-5-1 Table screen

This screen gives an instantaneous overview of important numerical measuring values. Such as Table screen under VOLTS/AMPS/HERTZ mode.

Screen information:

① The screen header shows current measurement mode.

② Status indicator and status line.

③ Measurement parameters and values. The content depends on the measurement mode, phase number and wiring configuration.

Function keys:

F1: For 3-phase Y type wiring configuration, switch between phase voltage and line voltage.

F4: Access to the Trend screen.

F5: Switch between RUN and HOLD.

✧ **Trend screen**



Fig. 1-5-2 Trend screen

Trend shows the course over time of measuring values from the table. Such as dips&swells, time is horizontally displayed, the Trend is built up gradually from the right of the screen.

Screen information:

① Shows latest value of the Trend. If the Cursor is on, the Trend value at the cursor is displayed.

② Display area of Trend.

Function keys:

F1: Switch parameters to display

F4: Return to table screen

F5: Switch between RUN and HOLD

✧ **Waveform screen**

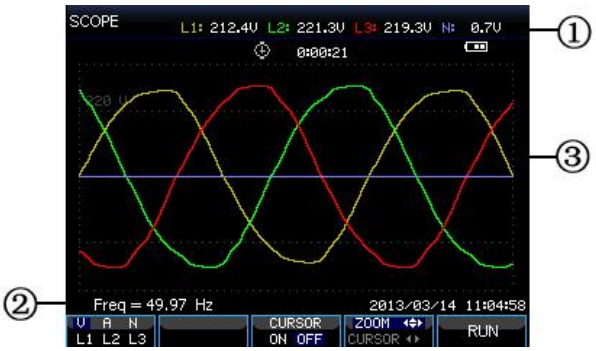


Fig. 1-5-3 Waveform screen

Screen information:

① The screen header shows the RMS value of waveforms.

② Show measured frequency

③ Display area of voltage/current waveforms

Function keys:

F1: Select waveform set to display: V displays all voltages; A displays all currents. L1, L2, L3 and N display voltage and current of selected phase synchronously.

F3: Access to Cursor

F4: Switch between Cursor and Zoom.

F5: Switch between RUN and HOLD.

✧ Phasor screen

The phase relation between voltages and currents are shown in a vector diagram. Phasor screen is available under Unbalance mode. Below figure explains this:

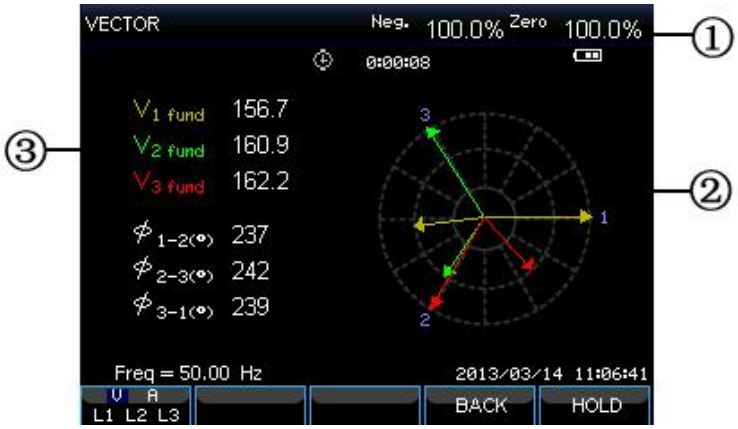


Fig. 1-5-4 Phasor screen

Screen information:

① The screen header shows the Unbalance value.

② Vector diagram, The vector of reference phase A(L1) points to the positive of X axis

③ Other data. Such as fundamental voltage, phase angle.

Function keys:

F1: Select waveform set to display: V displays all voltages; A displays all currents. L1, L2, L3 display voltage and current of selected phase synchronously.

F4: Return to table screen

F5: Switch between RUN and HOLD.

✧ **Bar graph screen**

Bar graph screen contains harmonic bar graph and power quality monitoring bar graph, the bar height indicates the percentage of represented parameter. Related parameter value will be shown in the screen header when moving cursor to specified bar.

For instance power quality monitoring bar graph screen contains: Voltage RMS, harmonics, flicker, rapid voltage change, dips, swells, interruption, unbalance and frequency. The related bar length will increase if a parameter exceeds its nominal value. .

Below figure explains this:

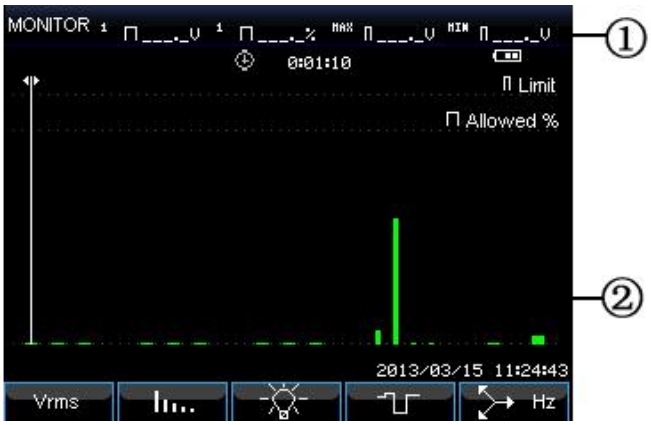


Fig. 1-5-4 Bar graph screen

Screen information:

① Limits value of bar graph under Cursor. Use left/right arrow keys to move cursor to another bar graph.

② Power quality monitoring screen, shows parameter time within high and low tolerance by a bar.

Function keys:

F1: Access to Voltage RMS submenu.

F2: Access to Harmonics submenu.

F3: Access to Flikcer submenu.

F4: Access to Dips&Swells submenu.

F5: Aceess to Unbalance and Frequency submenu.

Chapter 2 Basic Operations

2.1 Tilt Stand and Hang Strap

The Analyzer has a tilt stand that allows viewing the screen at an angle when placed on a flat surface. With the tilt stand folded out, the USB Host port and LAN interfaces can be accessed as shown in the figure.

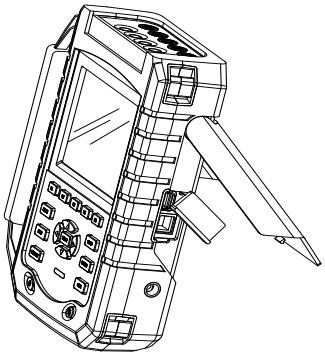


Fig. 2-1-1 Tilt stand and locations of interfaces

A hang strap shown as below figure is supplied with the Analyzer.

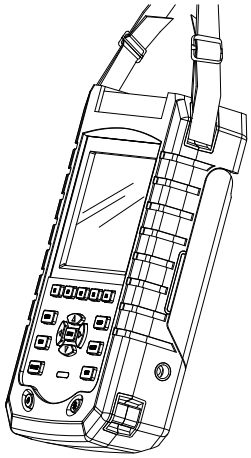


Fig.2-1-2 Fixing the hang strap

2.2 Power on/off

Press the Power key and a single beep can be heard, then the screen shows initial interface. Press the Power key to cut off the power of the Analyzer under power on state.

2.3 Display Brightness

The Analyzer provides 4 degrees of brightness, which is adjustable by pressing the brightness adjustment key. Low brightness is suggested to save the battery power when powered by the battery.

2.4 Update Firmware

If any defective was found during the use of the Analyzer, please contact the customer service representative to get the update pack.

Place the update pack under the root directory of U disk before making connection to the Analyzer. Press the Power key, then press F3 to start update on seeing prompt information at the bottom of the screen, do not operate the Analyzer during update process, or the Analyzer may be damaged and could not work normally. The Analyzer will start properly if updated successfully.

If the update was failed, check the reason with the help of the prompt information on the screen. Cancel the update by powering off the Analyzer if update was failed.

2.5 Input Connections

Check that the Analyzer setup meets the characteristics of the system under test. This concerns: wiring configuration, nominal frequency, nominal voltage, current clamp ratio and range.

The Analyzer has 4 BNC inputs for current clamps and 5 banana-inputs for voltages. De-energize power systems before making connections whenever possible, always use proper personal safety equipment.

For a 3-phase system, make the connections as shown in Fig. 2-5-1.

First put the current clamps around the conductors of phase A (L1), B (L2), C (L3) and N (neutral). The clamps are marked with an arrow indicating the correct signal polarity.

Next make the voltage connections: start with Ground (GND) and then in succession N, A (L1), B (L2) and C (L3). For correct measuring results, always connect the Ground (GND) input. Always double-check the connections.

For single phase measurements, use current input A (L1) and the voltage inputs Ground, N (neutral) and phase A (L1). The voltage inputs A (L1) is the reference phase for all measurements.

Before making any measurements, set the Analyzer up for the line voltage, frequency, and wiring configuration of the power system you want to measure.

Scope Waveform and Phasor display are useful to check if voltage leads and current clamps are connected correctly. In the vector diagram, the phase voltages and currents A (L1), B (L2) and C (L3) should appear in sequence when observing them in clockwise direction as shown in below figure:

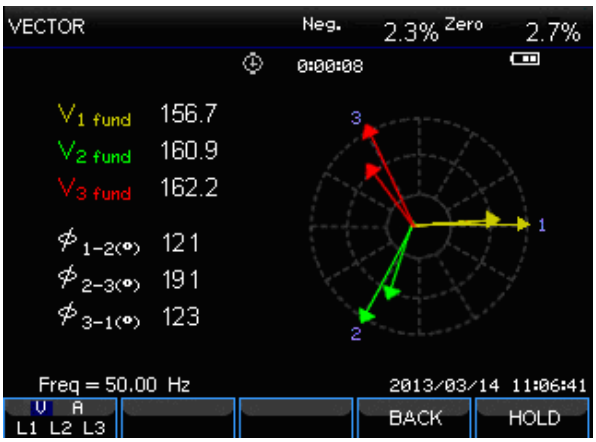


Fig. 2-5-1 Vector diagram for correctly connected Analyzer

2.6 Display Information

The Analyzer uses five different screen types to present measuring results in the most effective way.

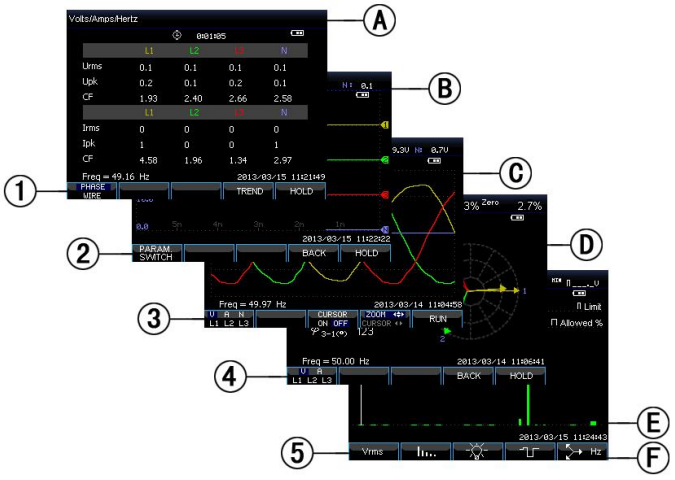


Fig. 2-6-1 Survey of Display types

✧ **Phase colors**

Measuring results belonging to different phases are presented with individual colors. The default colors are yellow for phase A (L1), green for phase B (L2), red for C (L3), and gray for N (neutral).

✧ **Screen types**

① Table screen: gives an instantaneous overview of important numerical measuring values.

② Trend screen: this type of screen is related to a table screen. Trend screen shows the course over time of measuring values from the table.

③ Waveform screen: shows voltage and current waveforms as displayed on an oscilloscope. Channel A (L1) is reference channel.

④ Phasor screen: shows the phase relation between voltages and currents in a vector diagram. The vector of reference channel A (L1) points to the positive horizontal direction.

⑤ Bar Graph screen: shows the density of each measuring parameters as a percentage by means of a Bar Graph.

✧ **Screen information common for all screen types**

A Measuring mode: the active measuring mode is shown in the screen header.

B Measuring values: main numerical measuring values. If cursor is off, the newest values are shown; otherwise, the values at the cursor are shown.

C Status indicators: Display working states of battery or adapter, and time that a measurement has been going on.

D Main area with measuring data.

E Status line: shows present date and time.

F Softkey text area: softkey functions that can be selected with F1 … F5 are indicated in white. Functions currently not available are indicated in gray. Active function key selections are highlighted with a blue background.

2.7 Set Up the Analyzer

At power-on, a welcome screen is displayed that shows settings currently in use. Check if the Date and Time of the system clock are correct. Also the wiring configuration must match the configuration of the power system to be checked. The 【SETUP】 key accesses menus to view and change Analyzer settings.

The settings are grouped in four functional sections which are explained respectively as below:

- General settings: wiring configuration, nominal frequency, nominal voltage, current clamps, current range and language.
- User preference: date and time, LAN interface.

- Limits settings: For recall, save and definition of the limits for power quality monitoring.

✧ **Setup interface**

Press 【SETUP】 key to access to setup interface, use up/down arrow keys to select options to be adjusted, then press left/right arrow keys to adjust. Settable options:

- Wiring configuration: after selecting wiring configuration, press 【ENTER】 key to access to wiring configuration interface. Press【F4】to confirm selection.
- Nominal frequency: adjust nominal frequency, after selecting nominal frequency, switch between preset 50Hz and 60Hz with left/right arrow keys.
- Nominal voltage: adjust nominal voltage, after selecting nominal voltage, press 【ENTER】key to access to voltage configuration interface and press 【F5】 key to confirm your selected nominal voltage.
- Language: select language then press left/right arrow keys to switch between Polish and English.
- Zooming: select the zooming setup and press 【ENTER】key to access to set up interface. Current clamp type and zoom of voltage/current are selectable. Press 【F5】to confirm the setting.

Available function keys:

F2 User preference: access to user preference interface, configure data, time, LAN interface etc.

F3 Calibration: access to calibration interface, calibrate the Analyzer.

F4 Monitor limits: configure limits value parameters for power quality monitoring.

F5 Confirm, access to menu interface.

✧ **User preference**

User preference allows you to customize time and LAN interface, press 【F4】 to access selected parameter preference menu, and 【F5】 to return to SETUP entry menu.

- Date and time: chose Date and time, then press 【F4】to select and access the time setting interface, use the up/down arrow keys to chose parameters, and the left/right arrow keys to set up each parameter, press 【F5】 to confirm the selection and make the setting active.

- LAN interface configuration: Press up/down arrow keys to select LAN SETUP, then press 【F4】 to access to setting interface of LAN interface, 【F1】 Tab keys to switch configuration parameters. When DHCP or fixed IP is highlighted, press 【ENTER】 key radio button to select this option. Access to IP address with 【F1】 Tab key, then press up/down keys to change figure, and left/right keys to move the cursor. Make the change active by pressing 【F4】confirmation key, press 【F5】to cancel the change and return to previous menu.

✧ Calibration interface

Press 【F3】 to access calibration interface which shows current firmware version, correct password is requested for processing calibration, do not calibrate the Analyzer arbitrarily but have it calibrated by specified institution or the manufacturer. Press 【F5】to return to setting interface.

✧ Monitor limits

The Analyzer presets a set of limits according to EN50160 standard, and reserves two user-defined options, which the users can modify under EN50160 standard set of limits and save as user-defined set of limits.

Use the up/down arrow keys to move the highlighted row, then press 【ENTER】 key radio button to select highlighted row. Selected by the radio button means this set of limits is currently active.

Press 【F4】to access to limits edition interface and edit current highlighted set of limits, a survey of monitor limits adjustments:

Limits	**Adjustments**
Voltage	2 probability percentages (100% and adjustable): each with adjustable upper and lower limits.
Harmonics	For 2-25 harmonics and THD 2 probability percentages (100% and adjustable): each with adjustable upper limit.
Flicker (*)	Weighing curve (lamp type). 2 probability percentages (100% and adjustable): adjustable percentage with adjustable upper limit.
Dips (*)	Threshold, hysteresis, allowed number of week.
Swells (*)	Threshold, hysteresis, allowed number of week.
Interruption (*)	Threshold, hysteresis, allowed number of week.

Rapid Voltage Change (*)	Voltage tolerance, steady time, minimum step, minimum rate, allowed number of week.
Unbalance	2 probability percentages (100% and adjustable): adjustable percentage with adjustable upper limit.
Frequency	2 probability percentages (100% and adjustable): each with adjustable upper and lower limits.

(*): Setups are also valid for measuring mode.

2.8 Using Memory and PC

The Analyzer can save screens and data into its memory, and the users can view, delete and copy them. The Analyzer can also be connected with a PC, through which the remote control of the Analyzer is available.

✧ Using memory

The Analyzer has a built-in 8G TF card to store data the users saved. The Analyzer can save screenshot of current screen, and data set of current measurement too.

✧ SAVE interface

The 【SAVE】 key accesses save interface, select screenshot or data set as save type, the name of the file to be saved is editable.

Press 【F1】 to switch save type. Use left/right arrow keys to move the cursor, and up/down keys to change name, press【F4】SPACE to erase current selected character, the cursor moves to its next position. Press 【F5】to save the setting and return to previous interface.

✧ MEMORY interface

The MEMORY button accesses to the save list interface, which shows the save time, name and type of saved files. Use up/down arrow keys to select specified row to save to. After accessing to the save interface, insert a U disk and wait for a few seconds, then press F2 to copy selected file to the U disk when "TO USB" characters become lighted, press ENTER to confirm when a copy finished window is popped up before pulling out the U disk.

Insert the U disk to a PC and use upper computer software to view the copied file.

Available function keys:

F2 Copy file to U disk after inserting a U disk and the characters of the key become lighted.

F3 View selected saved file.

F4 Delete selected saved file.

F5 Return to previous interface.

✧ **Using PC**

The Analyzer is equipped with a LAN interface for communication with a PC. With supplied upper computer software you can do remote control of the Analyzer on a PC. In addition, you can also view the data and screenshot copied from a U disk with the upper computer software.

On USER Preference interface, set the LAN interface of the Analyzer correctly before connecting the Analyzer to the internet with a network cable. Run the upper computer software, input the IP address of the Analyzer to make the connection, an operation interface analoging the Analyzer will be displayed for a successful connection. The saved file also can be downloaded from analyzer.

Chapter 3 Application examples

3.1 Scope

Scope mode shows voltages and currents in the power system under test by means of waveforms. Also numerical values are shown such as phase voltages, phase currents and frequency etc. The Scope waveform screen offers an oscilloscope style of display of voltage and current waveforms with a fast update rate. The screen header shows the related rms voltage/current values. Channel A (L1) is the reference channel, starting at 0V are displayed.

Available function keys:

F1 Selection of waveform set to be displayed: V displays all voltages; A displays all currents. A (L1), B (L2), C (L3), N (neutral) give simultaneous display of phase voltage and current for the selected phase.

F3 Access to cursor, when the Cursor is on, the waveform values at the Cursor are displayed in the screen header.

F4 Selection of Zoom function and Cursor move function. When the Cursor is selected, press left/right arrow keys to move the cursor; when the Zoom function is selected, press direction keys to expand or shrink waveforms.

F5 Switch between HOLD and RUN

3.2 Voltage/Current/Frequency

This function is used for measuring steady voltage, current, frequency and crest factors. The Crest Factor (CF) indicates the amount of distortion: a CF of 1.41 means no distortion and higher than 1.8 means high distortion. Use this screen to get a first impression of power system performance before examining the system in detail with other measuring modes.

✧ **Table screen**

The number of columns in the Table screen depends on the power system configuration. The figures in the Table screen are present values that may update constantly. Changes in these values over time are recorded as soon as the measurement is turned on. The recording is visible in the Trend screen.

Available function keys:

F1 Under 3-phase Y type wiring configuration, switch between voltage readings of each phase (A/L1, B/L2, C/L3,N)or phase-phase (AB, BC, CA).

F4 Access to the Trend screen.

F5 Switch between HOLD and RUN.

✧ **Trend**

All values in the Table screen are recorded, but the Trends from each row in the table are displayed one at a time. Press function key F1 to switch between parameters.

The traces build up from the right side. Readings in the header correspond to the most recent values plotted on the right.

Available function keys:

F1 Switch parameters that the current Trend screen displays, the header shows content being displayed.

F4 Return to the Table screen.

F5 Switch between RUN and HOLD.

✧ **Tips and Hints**

Voltage and frequency should be close to the nominal values of for example 120V, 230V, 480V, 60Hz or 50Hz.

The voltages and currents in the table can be e.g. used to check if power applied to a 3-phase induction motor is in balance. Voltage unbalance causes high unbalanced currents in stator windings resulting in overheating and reduced motor life. Each of the phase voltages should not differ more than 1% from the average of the three. Current unbalance should not exceed 10%. In case of too high unbalance, use other measuring modes to further analyze the power system.

A Crest Factor close to 2.0 indicates high distortion. CF=2.0 can e.g. be found if you measure the current drawn by rectifiers that only conduct at the sine wave top.

3.3 Dips and Swells

Dips and Swells records Swells, Dips, Interruptions, and Rapid Voltage Changes.

Dips and Swells are fast deviations from the normal voltage. Magnitude may be ten up to one hundred of volts. Duration may vary from a half cycle to a few seconds as defined in IEC61000-4-30. The Analyzer allows you to choose nominal or sliding reference voltage.

During a dip the voltage drops, during a swell the voltage rises. In 3-phase systems, a dip begins when the voltage on one or more phases drops below the dip threshold and ends when all phases are equal to or above the dip threshold plus hysteresis. A swell begins when the voltage on one or more phases rises up to the swell threshold and ends when all phases are equal to or below the swell threshold minus hysteresis. The trigger conditions for dips and swells are threshold and hysteresis. Dips and Swells are characterized by duration, magnitude and time of occurrence. Figure 3-3-1and 3-3-2 explains this.

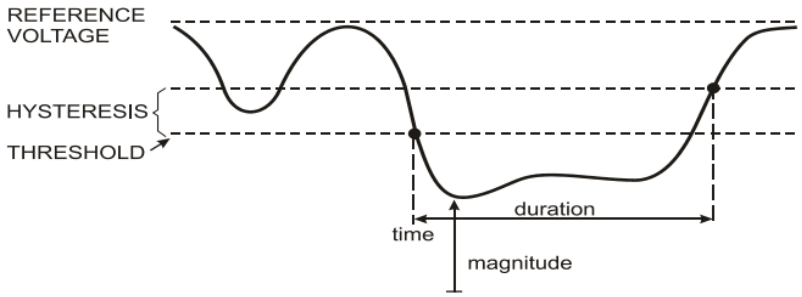


Fig.3-3-1 Characteristics of a voltage dip

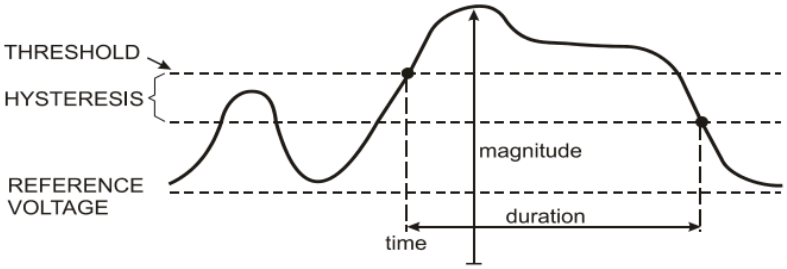


Fig. 3-3-2 Characteristics of a voltage swell

During an Interruption the voltage sinks well below its nominal value. In 3-phase systems, an Interruption begins when the voltages on all phases are below threshold and ends when one phase is equal to or above the interruption threshold plus hysteresis. The trigger conditions for interruptions are threshold and hysteresis. Interruptions are characterized by duration, magnitude and time of occurrence. Figure 3-3-3 explains this.

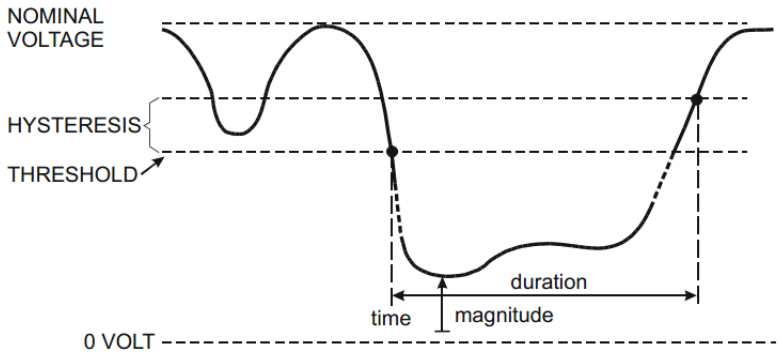


Fig. 3-3-3 Characteristics of a voltage interruption

Rapid voltage changes are quick transitions of the RMS voltage between two steady-states. Rapid voltage changes are captured based on steady voltage tolerance, steady time, minimum compensation and minimum rate detected. When voltage change exceeds dip or swell threshold,

it is considered as Dip or Swell instead of Rapid Voltage Change. The events list shows voltage step change and transient time. The detailed events list shows maximum voltage change over nominal voltage. Voltage change trend is shown in Fig. 3-3-4.

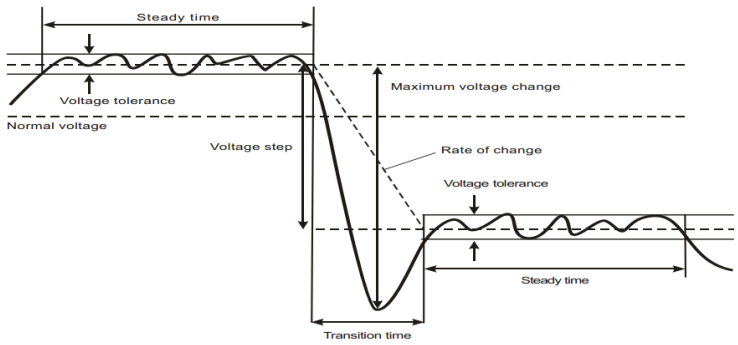


Fig. 3-3-4 Characteristics of a rapid voltage change

In addition to the voltage, current is also recorded. This allows you to see cause and effect of deviations. Function key 【F2】 accesses event tables where voltage events are listed in sequence.

✧ **Trend**

Available function keys:

F1 Switch between voltage and current trends, the header shows parameters being displayed.

F2 Access to Events tables

F3 Access to Cursor

F4 Selection of Cursor move or Zoom

F5 Switch between RUN and HOLD.

Event criteria such as threshold, hysteresis and others are preset, but they may be adjusted. The adjustment menu is reached via the 【SETUP】 key and limits setup.

✧ **Events tables**

The Events table lists all threshold crossings of phase voltages. Thresholds according to international standards or user –definable thresholds can be used. The Events table records major event characteristics: start time, duration, voltage magnitude, event type, and occurrence phase etc.

The below abbreviation is used in the events tables,

CHG changing of fast voltage

DIP voltage dip

INT voltage interrupt

SWL voltage swell

✧ **Tips and Hints**

The occurrence of Dips and Swells may indicate a weak power distribution system. In such a system voltage will change considerably when a big motor or a welding machine is witched on or off. This may cause lights to flicker or even show visible dimming. It may cause reset and loss of data in computer systems and process controllers.

By monitoring the voltage and current trend at the power service entrance, you can find out of the cause of the voltage dip is inside or outside the building. The cause is inside the building (downstream) when voltage drops while current rises; it is outside (upstream) when both voltage and current drop.

3.4 Harmonics

Harmonics measure and record harmonics and interharmonics up to the 50th. Related data such as DC components, (THD) Total Harmonic Distortion, and K-factor are measured. Harmonics are periodic distortions of voltage, current or power sinewave. A voltage or waveform can be considered as a combination of various sinewaves with different frequencies and magnitudes. The contribution of each of these components to the fundamental signal is measured. Readings can be given as a percentage of the fundamental (%f), or as a percentage of full signal RMS (%r).Results may be viewed in a Bar Graph display. Harmonics are often caused by non-linear loads such as DC power supplies in computers, TV's and adjustable speed motor drives. Harmonics can cause transformers, conductors, and motors to overheat.

✧ **Bar Graph Screen**

The Bar Graph display shows the percentage contribution of each of the components related to the fundamental or full signal. A signal without distortion should show a 1st harmonic at 100% while the others are at 0: in practice this will not occur because there always is a certain amount of harmonics resulting in distortion.

A sinewave becomes distorted when harmonics components are added to it. Distortion is represented by the Total Harmonic Distortion (THD) percentage. The display can also show the percentage of the DC component and each harmonic ratio.

The left/right arrow keys are used to position the Cursor on particular bar. The screen header will show for that bar phase identifier, harmonic component ratio, frequency and phase angle. If not all bars are shown on the screen, you can bring the next set within the viewing area by moving the Cursor off the left or right end of the screen.

Available function keys:

F1 Selection of harmonics type: voltage, current.

F2 Selection of bar set to be displayed: L1, L2, L3, N or all

F3 Interharmonics display on/off

F4 Open the table screen

F5 Switch between RUN and HOLD.

✧ **Table Screen**

The table screen lists all the harmonic parameters, including Harmonic Voltage, Harmonic Current, Interharmonic Voltage and Interharmonic Current. Select next page with up/down keys.

Available function keys:

F3 Take fundamental voltage as percentage reference (%f) or total harmonic voltage as percentage reference (%r)

F4 Open the bar graph screen of harmonic

F5 Switch between RUN and HOLD.

✧ **Tips and Hints**

The harmonic number indicates the harmonic frequency: the first harmonic is the fundamental frequency (60 or 50Hz); the second harmonic is the component with two times the fundamental frequency (120 or 100Hz), and so on. The harmonics sequence can be positive (1, 4, 7…), zero (3, 6, 9…) or negative (2, 5, 8…). Positive sequence harmonics try to make a motor run faster than the fundamental, negative sequence harmonics try to make a motor run slower than the fundamental. In both cases the motor looses torque and heats up. Harmonics can also cause transformers to overheat. Even harmonics disappear if waveforms are symmetrical, i.e. as equally positive and negative.

Zero sequence current harmonics add in Neutral conductors. This can cause overheating of these conductors, and make ground potential rising..

3.5 Power and Energy

Power and Energy displays a table with all important power parameters. The related Trend screen shows the changes over time of all measuring values in the table.

✧ Table

The table displays power data for each phase and in total: real or active power (kW), apparent power (kVA, the product of rms voltage and current), reactive power (kVAR, the reactive component of apparent power caused by phase shift between AC current and voltage in inductors and capacitors), power factor (TPF, the ratio of real power to apparent power for the total rms including harmonics), displacement power factor (DPF, the ratio of real power to apparent power for fundamental), and the rms values of voltage and current.

A popup table with energy usage by phase and in total can be activated by pressing 【F3 】– Energy function key. The table shows real energy (kWh), apparent energy (kVAh) and reactive energy (kVARh). The energy measurement starts when Power&Energy is started. The readout can be reset with function key F5.

Available function keys:

F3 Access the Energy popup screen.

F4 Access the Trend screen.

F5 Switch between RUN and HOLD.

✧ Energy popup screen

F3 Close Energy

F4 Access the Trend

F5 Reset, the time clock starts all over again

✧ Trend

The figures in the table are instantaneous values that update constantly. While changes in these values over time are recorded in the Trend. The traces build up from the right side. The readings in the header correspond to the most recent measurements plotted on the right.

Available function keys:

F1 Switch parameter being displayed.

F4 Return to the Table screen.

F5 Switch between RUN and HOLD.

✧ **Tips and Hints**

Power mode can be used to record apparent power of a transformer over several hours. Look at the Trend and find out if the transformer is overloaded.

Interpretation of Power Factor when measured at a device:

- PF = 0~1: not all supplied power is consumed by the device, a certain amount of reactive power is present. Current leads (capacitive load) or lags(inductive load).
- PF = 1: all supplied power is consumed by the device. Voltage and current are in phase.
- PF = -1: device generates power. Current leads or lags.

Reactive power (VAR)is most often due to inductive loads such as asynchronous motor, induction furnace, and transformers, etc. Installation of correction capacitors can correct for inductive VAR's.

3.6 Flicker

Flicker quantifies the luminance fluctuation of lamps caused by supply voltage variations. The Analyzer design strictly meets the IEC61000-4-15 Flicker Meter model. The Analyzer converts duration and magnitude of voltage variations into an 'annoyance factor' caused by the resulting flicker of a 60W lamp. A high flicker reading means that most people would find the luminance changes irritating. The voltage variation can be relatively small. The measurement is optimized to lamps powered by 120V/60Hz or 230V/50Hz. Flicker is characterized per phase by the parameters shown in a table. The Trend screen shows changes of instantaneous flicker sensation level over time.

✧ **Table**

Flicker is characterized by: short term severity Pst (measured over 10 minutes) and a long term severity Plt (measured over 2 hours). The Analyzer records severity measured over 1 minute too for fast feedback. Pst and Plt are parameters showing flicker severity over a certain period of time. Momentary flicker is shown in the PF5 submenu and is reached via function key 【F4】. Flicker PF5 is displayed as a fast Trend plot.

Available function keys:

F4 Access PF5 Trend screen.

F5 Switch between RUN and HOLD.

3.7 Unbalance

Unbalance displays phase relations between voltages and currents. Measuring results are based upon the fundamental frequency component (50 or 60Hz, use symmetrical components). In a 3-phase power system, the phase shift between voltages and between currents should be close to 120°. Unbalance mode offers a measurement table and a Phasor display.

✧ Table

The table screen shows all relevant numerical values: negative voltage unbalance percentage, zero sequence voltage unbalance percentage, negative current unbalance percentage, zero sequence current unbalance percentage, fundamental phase voltage, frequency, fundamental phase current, angle between voltage and current for each phase relative to the reference phase (A/L1)and angles between voltage and current for each phase.

Available function keys:

F4 Access Phasor screen.

F5 Switch between RUN and HOLD.

✧ Phasor

Shows the phase relation between voltages and currents in a vector diagram divided in 30 degree sections. The vector of the reference channel A (L1) points to the horizontal direction. Additional numerical values are given: negative voltage and current unbalance percentage, zero sequence voltage and current unbalance percentage, fundamental phase voltage and current, frequency, phase angles. With function key 【F1】, you can choose readings of all phase voltages, phase currents or voltage and current in one phase.

Available function keys:

F1 Selection of signals to be displayed: V displays all voltages; A displays all currents. L1, L2, L3 give simultaneous display of phase voltage and current.

F4 Return to unbalance table screen.

F5 Switch between RUN and HOLD.

✧ Tips and Hints

The voltages and currents in the table can e.g. be used to check if power applied to a 3-phase induction motor is in balance. Voltage unbalance causes high unbalanced currents in stator windings resulting in overheating and reduced motor life. Negative voltage component Vneg

should not exceed 2%, current unbalance should not exceed 10%. In case of too high unbalance, use other measuring modes to further analyze the power system.

Each phase voltage or current can be split-up into three components: positive sequence, negative sequence, and zero sequence.

The positive sequence component is the normal component such as present in balanced 3-phase systems. The negative sequence component results from unbalanced phase-to-phase currents and voltages. This component for instance causes a 'braking' effect in 3-phase motors, which will result in overheating and life reduction. Zero sequence components may appear in an unbalanced load in 4-wire power systems and represent the current in the neutral wire. Unbalance exceeding 2% is considered as too high.

3.8 Transients

The Analyzer can capture waveforms at high-resolution during a variety of disturbances. The Analyzer will give a snapshot of the voltage and current waveforms at the precise time of the disturbance. This allows you to see the waveforms during transients.

Transients are fast spikes on the voltages waveform. Transients can have so much energy that sensitive electronic equipment can be affected or even damaged. A waveform is captured each time that the voltage exceeds adjustable limits. A maximum of 100 events can be captured. The sample rate is 20kS/s.

✧ Waveform display

Cursor and Zoom can be used to investigate details of captured waveforms.

Available function keys:

F2 Playback captured Transients waveforms.

F3 Access to Cursor.

F4 Selection of Zoom or Cursor.

F5 Switch between RUN and HOLD.

✧ Tips and Hints

Disturbances such as transients in a power distribution system can cause malfunctions in many types of equipments. For example, computers may reset and equipment subjected to repeated transients can eventually fail. Events occur intermittently, making it necessary to monitor the system for a period of time to find them. Look for voltage transients when electronic power supplies are failing repeatedly or if computers reset spontaneously.

3.9 Inrush currents

Inrush currents can be captured by the Analyzer. Inrush currents are surge currents that occur when a large, or low-impedance load comes on line. Normally the current will stabilize after some time when the load has reached normal working condition. For example the start-up current in induction motors can be ten times the normal working current. Inrush is a 'single shot' mode that records current and voltage Trends after a current event has occurred. An Inrush occurs when the current waveform exceeds adjustable limits. The Trends builds up from the right of the screen. Pretrigger information allows you to see what occurred in advance of the inrush.

✧ Trend display

Use the arrow keys in the Start menu to adjust the trigger limits: expected inrush time, nominal current, threshold and hysteresis. The maximum current determines the vertical height of the current display windows. Threshold is the current level that triggers the trend capture. The inrush time is the time between trigger and the time that the current falls to the value indicated by Hysteresis and is indicated on the trend display between two vertical markers. The screen header displays the rms of all phases during the inrush time. If the Cursor is on, the rms measuring values at the Cursor are displayed.

Available function keys:

F1 Switch parameters to be displayed.

F3 Access to Cursor.

F4 Selection of Zoom or Cursor.

F5 Switch between RUN and HOLD.

✧ Tips and Hints

Check the inrush currents and their duration, use the Cursor for readout of momentary values. Check if fuses, circuit breakers, and conductors in the power distribution system can withstand the inrush current during this period. Check also if phase voltage stay stable enough.

High peak currents can cause circuit breakers to trip unexpectedly. Measuring Inrush current can help in setting trip levels. Since the Analyzer simultaneously captures Inrush current and voltage Trends, you can use this measurement to check voltage stability as large loads come on line.

3.10 Power Quality Monitoring

Power Quality Monitoring displays a Bar graph screen. This screen show whether important Power Quality parameters meet requirements. Parameters include: RMS voltages, Harmonics, Flicker, Dips&Swells/Interruptions/Rapid Voltage Changes, Unbalance, and Frequency.

The length of a bar increases if the related parameter is further away from its nominal value. The bar turns from green to red if an allowed tolerance requirement is violated.

Use the direction keys to position the cursor on a particular bar and measuring data belonging to that bar is displayed in the screen header.

Power Quality Monitoring is usually done during a long observation period. The function is entered via the【MONITOR】key and start menu to define immediate or timed start of the measurement. Minimum duration of the measurement is 2 hours, and maximum is 1 week.

The Power Quality parameters RMS voltages, Harmonics, and Flicker have a bar for each phase. From left to right these bars are related to the phase A (L1), B (L2) and C (L3).

The parameters Dips/Interruptions/Voltage Changes/Swells, Unbalance and Frequency have a single bar for each parameter representing performance across three phases.

Most of the Bar Graphs have a wide base indicating adjustable time related limits (for instance 95% of time within limit) and a narrow top indicating a fixed 100% limit. If one of both limits is violated, the related bar changes from green to red. Dotted horizontal lines on the display indicate the positions of 100% limit and the adjustable limit.

The meaning of the bar graphs with a wide base and a narrow top is explained below by way of example this is done for the RMS voltage. This voltage for instance has a nominal value of 220V with a tolerance of ±15% (tolerance range between 187 … 253V). The momentary RMS voltage is constantly monitored by the Analyzer, it calculates an average from these measuring values across 10 minutes observation periods, and these averages are compared against the tolerance range.

The 100% limit means that the 10-minute averages must always (i.e. 100% of time or with 100% probability)be within range. The bar graph will turn to red if a 10-minute average crosses the tolerance range.

The adjustable limit of for instance 95% (i.e. 95% probability) means that 95% of the 10-minute averages must be within tolerance. The 95% limit is less stringent than the 100% limit. Therefore the related tolerance range usually is tighter. For 220V this for instance can be ±10% (tolerance range between 198V … 242V).

The bars for Dips/Interruptions/Rapid Voltage Changes/Swells are narrow and indicate the number of limits violations that occurred during the observation period. The allowed number is adjustable (for instance to 20 Dips/week). The bar turns to red if the adjusted limit is violated.
You can use a pre-defined set of limits or define your own. An example of a pre-defined set is that according to the EN50160 standard.
The table below gives a survey of the aspects of Power Quality Monitoring:

Parameter	Available Bar Graphs	Limits	Averaging Interval
V rms	3, one for each phase	Probability 100%: upper & lower limits Probability x %: upper & lower limits	10 minutes
Harmonics	3, one for each phase	Probability 100%: upper limit Probability x %: upper limit	10 minutes
Flicker	3, one for each phase	Probability 100%: upper limit Probability x %: upper limit	2 hours
Dips/Interruptions/Rapid Voltage Changes/Swells	4, one for each parameter covering all 3 phases	Allowed number of events	1/2 cycle rms based
Unbalance	1, covering all 3 phases	Probability 100%: upper limit Probability x %: upper limit	10 minutes
Frequency	1, measured on Reference Voltage Input A/L1	Probability 100%: upper & lower limits Probability x %: upper & lower limits	10 seconds

✧ **Power Quality main screen**

Power Quality Monitoring is reached via the 【MONITOR】 key, and Immediate or Timed start is settable. With the direction keys you can position the Cursor on a particular Bar Graph. Measuring data belonging to the bar is shown in the screen header.

Detailed measurement data is available under the Function keys:

F1 RMS voltage: events table, trends.

F2 Harmonics: bar graphs, events table, trends.

F3 Flicker: events table, trends.

F4 Dips/Interruption/Rapid Voltage Change/Swells: events table, trends.

F5 Unbalance, frequency: events table, trends.

The measuring data available under the Function keys is explained in the following sections. Data is presented in the formats Events Table, Trend Display and Bar Graph Screen.

✧ **Events table**

The events table shows the events that occurred during the measurement with time of start, phase and duration. Events recording situation:

- V rms events: an event is recorded each time that a 10 minute aggregated RMS value violates its limits.
- Harmonics events: an event is recorded each time a 10 minute aggregated harmonic or THD violates its limit.
- Dips/Interruption/Rapid Voltage Change/Swells events: an event is recorded each time one of the items violates its limit.
- Unbalance and Frequency events: an event is recorded each time that a 10 minute aggregated RMS value violates its limit.

Available function keys:

F3 Access Trend Screen

F4 Switch between selected and all events.

F5 Return to previous menu.

The below abbreviation is used in the events table,

CHG changing of fast voltage

DIP voltage dip

INT voltage interrupt

SWL voltage swell

Hx the harmonic order of beyond limit value

Hz Frequency

✧ **Trend**

Press【F3】 in Events Table to access Trend Screen. Press left/right arrow keys to access horizontal time base zoom.

Available function keys:

F5 Return to previous menu.

✧ **Bar Graph Screen**

The main system monitor display shows the worst harmonic for each of the three phases. Function key【F2】 brings up a screen with Bar Graphs showing the percentage of time each phase spent within limits for 25 harmonics and Total Harmonic Distortion (THD). Each Bar Graph has a wide base (representing an adjustable limit of e.g. 95%) and a narrow top (representing the limit of 100%). A Bar Graph changes from green to red if the limits for that harmonic are violated.

With the left/right arrow keys you can position the Cursor on a particular Bar Graph and measuring data belonging to that bar is shown in the screen header.

Available function keys:

F1 Selection of Bar Graphs belonging to phase A (L1), B (L2) or C (L3).

F4 Access to events table.

F5 Return to main menu.

The below signs used in the title bar

 : the setting x% limit value

 : 100% limit value

Item	The parameter meaning of title bar			
voltage deviation	x% limiting voltage	* the transfinite percentage of x% limit value	The max voltage of 100% limit value	The mini voltage of 100% limit value
Harmonic	the transfinite percentage of x% limit value harmonic	* the transfinite percentage of 100% limit value harmonic		
Flicker	the transfinite percentage of x% limit value flicker	the transfinite percentage of 100% limit value flicker		
Dips & Swell	Transfinite event			

	number			
CHG	L1 event number	L2 event number	L3 event number	
Unbalance	the transfinite percentage of x% limit value unbalance	the transfinite percentage of 100% limit value unbalance		
frequency deviation	x% limiting frequency	the transfinite percentage of x% limit value	The max Fre. of 100% limit value	The mini Fre. of 100% limit value

*the transfinite percentage of x% limit value: the percentage between x% measured value and setting limit value

* the transfinite percentage of 100% limit value: the percentage between 100% measured value and setting limit value

3.11 Logger

Logger function is used to record a group of measurement data as your selected parameter, the interval selected from 1s to 1hour. When each interval ends, the maximum, minimum and average of selected parameters are recorded to memory and then start next interval recording. The whole process lasts as you selected duration time and the record parameter are all selectable for users.

Press 【MENU】key and select Logger Menu. Press 【ENTER】key to access to logger setting interface. User can view the spare memory, set logger parameter, interval, duration time and name of saved file. When finished the setting, press 【F5】to start the logging by timing or immediately.

The record file is saved in SD card as CSV format, which can be opened as EXCEL table by Office 2007 or advanced version in PC. User can make the record data into the graph as demand. For example, select first line of logger time and three lines of maximum, minimum, average of L1 Vrms, then insert the scatter lots with smooth line, it will generates the graph as below picture 3-11-1.

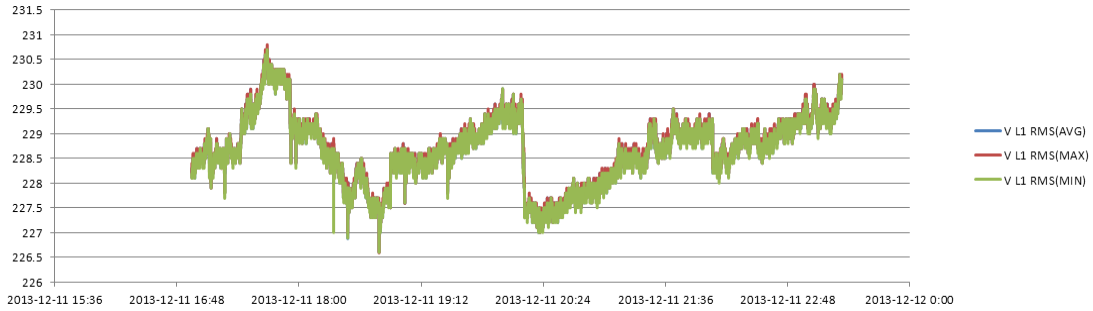


Fig. 3-11-1

✧ **Table Screen**

The table screen displays all the real time measurement data as selected parameters. With left/right key to refer to next page for view of the data.

Available function:

F5 Switch between RUN and Hold.

F4 Save records. The prompt of success saved will pop up after pressing this key. Press 【ENTER】to confirm and the record will automatically stop.

Chapter 4 Service and support

4.1 Warranty

The supplier will give one year's warranty to maintaining or replacing since consignment for the verified quality problem of the product.

Except for this explanation and the description in the warranty card, the company has no other warranty, in proclamation or in implication. Under no circumstances, the company will responsible for the direct, indirect or other secondary loss.

Chapter 5 Specifications

5.1 Frequency Measurement

Nominal frequency	Measurement range	Resolution	Accuracy
50Hz	42.50~57.50 Hz	0.01Hz	±0.01Hz
60Hz	51.00~69.00 Hz	0.01Hz	±0.01Hz

Note: measured on Reference Voltage Input A/L1.

5.2 Voltage Input

Numbers of input	4 (3 phase + neutral) DC coupling
Max continuous input voltage	1000Vrms
Range of nominal voltage	50 to 500V
Max pulse peak voltage	6kV
Input impedance	4MΩ/5pF

5.3 Current Input

Numbers of input	4 (3 phase + neutral) DC coupling
Type	Clamp Current Sensor, with mV output
Nominal input range	0~±5.625Vpeak, 0~3.97Vrms sinewave
Input range	1 to 3000Arms with supplied current clamp
Input impedance	50kΩ

5.4 Sampling System

Resolution	8 channels 16 bits AD
Sampling rate	20kS/s for each channel, 8 channels sample synchronously
RMS sampling	5000 points for 10/12 cycles (according to IEC 61000-4-30)
PLL sync	4096 points for 10/12 cycles (according to IEC61000-4-7)

5.5 Display Mode

Waveform display	4 voltages and 4 currents signal waveforms can be displayed synchronously, displayable under Scope and Transient modes.
Phasor Display	Intuitively view voltage and current phases of each phase (Displayable under Unbalance)

Table Display	Displayable under voltage/current/frequency, harmonic, power and energy, flicker, unbalance modes.
Trend Display	Display Trend record of measurement parameters changes over time (Displayable under voltage/current/frequency, power and energy, dips and swells, inrush current, flicker, monitoring modes)
Events Table Display	Display information of events exceeding limits value (Displayable under Dips&Swells, Transient, Inrush current, Monitoring modes.)
Bar Graph Display	Harmonic and interharmonic bar graph display mode is more intuitive (Displayable under harmonics and monitoring modes)

5.6 Measuring Modes and Parameters

Measurement mode	Measured parameters
Oscilloscope	Vrms, Arms, Vcursor, Acursor, Hz
Voltage/current/frequency	Vrms, Vpk, Vcf, Arms, Apk, Acf, Hz
Dips&Swells	Vrms1/2, Arms1/2, capture up to 1000 events, include date, time, duration, magnitude and phase mark, and threshold is programmable settable.
Harmonic	1-50, harmonic voltage, THD voltage, harmonic current, THD current, interharmonic voltage, interharmonic current
Power and energy	W, VA, VAR, power factor, shift power factor, Arms, Vrms, kWh, kVah, kVARh
Flicker	Pst (1 minute), Pst, Plt, PF5
Unbalance	Vneg, Vzero, Aneg, Azero, Vfund, Afund, Hz, V phase angle, A phase angle
Transient	Vrms, Vcursor
Inrush current	Inrush current, Inrush duration, Arms1/2, Vrms1/2
System monitoring	Vrms, Arms, Harmonic voltage, Total harmonic distortion voltage, Plt, Vrms1/2, Arms1/2, Vneg, Hz, Swells, Dips, Interruption, Rapid Voltage Change. All parameters are measured simultaneously according to EN50160 standard. Specify unreliable readings according to IEC61000-4-30 standard.
Logger	User-defined to select more parameter, and record of setting time interval

5.7 Measurement Range, Resolution, Accuracy

Voltage/Current/Frequency	Measurement range	Resolution	Accuracy
Vrms (AC+DC)	1~1000Vrms	0.1Vrms	±0.5% of nominal voltage
Vpk	1~1400Vpk	0.1Vpk	±0.5% of nominal voltage
V(CF)	1.0~>2.8	0.01	±5%
Arms (AC) 1000/3000A current sensor <100A current clamp	 1~1000/3000A 1~100A	 1A 0.1A	 ±1%±2A ±1%±0.2A
Apk	1~4000Apk	1A	±1%±5 characters
A(CF)	1~10	0.01	±5%
Frequency 50Hz nominal Frequency 60Hz nominal	42.5~57.5 51~69	0.01Hz 0.01Hz	±0.01Hz ±0.01Hz

Dips&Swells	Measurement range	Resolution	Accuracy
Vrms1/2	0~200% nominal voltage	0.1Vrms	±1%
Arms1/2	1~3000A	1A	±1%±2A
Threshold value	Threshold is settable according to nominal voltage percentage Detectable events type: Dips, Swells, Interruption, Voltage Rapid Change.		
Duration	hour-minute-second-microsecond	0.5 cycle	1 period

Harmonic	Measurement range	Resolution	Accuracy
Harmonic number	1~50		
Interharmonic	1~49		
Harmonic voltage	0.0~100.0%	0.1%	±0.1%±n×0.1%
Harmonic current	0.0~100.0%	0.1%	±0.1%±n×0.1%
THD	0.0~100.0%	0.1%	±2.5%
DC relative	0.0~100.0%	0.1%	±0.2%
Frequency	0~3500Hz	1Hz	1Hz
Phase	-360°~ 0°	1°	±n×1.5°

Power and energy	Measurement range	Resolution	Accuracy
Active power P(kW), apparent power S(kVA), reactive power Q(kvar),	1.0~20.00MW	0.1kW	±1.5±10 characters
Kilowatt-hour	0.00kWh~200GWh	10Wh	±1.5±10 characters
Power factor (TPF)	0~1	0.01	±0.03
Cosφ (DPF)	0~1	0.01	±0.03
Tgφ (tanØ)	-10...10	0.01	±3%

Flicker	Measurement range	Resolution	Accuracy
Flicker severity (Pst, Plt) and the instantaneous flicker sensation level	0.00~20.00	0.01	Within ±5% of table value according to IEC61000-4-15

Unbalance	Measurement range	Resolution	Accuracy
Voltage unbalance	0.0~5.0%	0.1%	±0.5%
Current unbalance	0.0~20.0%	0.1%	±1%
Voltage phase	-360°~ 0°	1°	±2 characters
Current phase	-360°~ 0°	1°	±5 characters

Rapid range of voltage	Measurement range	Resolution	Accuracy
Voltage			
Vpk	±6000Vpk	1V	±15%
Vrms	10~1000Vrms	1V	±2.5%
Minimum test time	50μs		
Sampling rate	20kS/s		

Inrush current	Measurement range	Resolution	Accuracy
Arms	0~3000Arms	0.1	±1%±5 characters
Inrush evaluation time	6s~32min settable	10ms	±20ms

5.8 Wiring Combinations

1Ø+NEUTRAL	Single phase with neutral
1Ø SPLIT PHASE	Split phase
1Ø IT NO NEUTRAL	Single phase system with two phase voltages without neutral
3Ø WYE	3-phase 4-wire system, Y type
3Ø DELTA	3-phase 3-wire system delta (Delta)
3Ø IT	3-phase Y type without neutral
3Ø HIGH LEG	4-wire 3-phase delta system (Delta) with center tapped high leg
3Ø OPEN LEG	Open-delta (Delta) 3-wire system with two transformer windings
2-ELEMENT	3-phase 3-wire system without current sensor on phase L2/B (2 Watt meter method)
2 ½ -ELEMENT	3-phase 4-wire system without voltage sensor on phase L2/B

5.9 General Characteristics

Interface	
Isolated USB Host interface	Copy saved file to PC from a U disk, then analyze it with upper computer software.
Isolated LAN interface	For remote control of the Analyzer and measurement data transmission.

Screen	Color TFT LCD
Size	5.6 inch
Resolution	320×240
Brightness	Adjustable

Memory	
Flash memory	128M
TF card	Standard 8G

Standard	
Measurement method	IEC61000-4-30 S degree
Measurement performance	IEC61000-4-30 S degree
Power quality monitoring	EN50160
Flicker	IEC61000-4-15
Harmonic	IEC61000-4-7

Environment	
Working temperature	0°~ 40°
Storage temperature	-20°~ 60°
Humidity	90% relative humidity

Safety	
Complied with	IEC61010-1 Safety Degree: 600V CAT IV 1000V CAT III Pollution Degree: 2
Maximum voltage at voltage input	600V CAT IV 1000V CAT III
Maximum voltage at current input	42Vpk

Mechanical	
Dimension	262× 173 × 66
Weight	1.6 kg

Power	
Adapter input	90~264V
Adapter output	9V 2.2A
Battery	Rechargeable lithium ion 7.4V 4.4Ah
Battery operating time	>7 hours
Battery charge time	6 hours

5.10 The specification of additional equipment

Model	**Range**	**Turns ratio**	**Accuracy**	**Size** mm
KLC8C-5A (clamps)	5A	10mV/A	0.2%	Φ8
CTC0080 (clamps)	50A	10 mV/A	0.2%	Φ8
CTC0130(clamps)	100A	10 mV/A	0.2%	Φ13
CTC1535(clamps)	1000A	1 mV/A	1.0%	Φ52
PY-3000A (Rogowski coils)	3000A	65 mV/1000A	1.0% (+2% position error)	Φ162
PY-5000A (Rogowski coils)	5000A	50 mV/1000A	1.0% (+2% position error)	Φ143

Appendix 1: The instruction of PC software

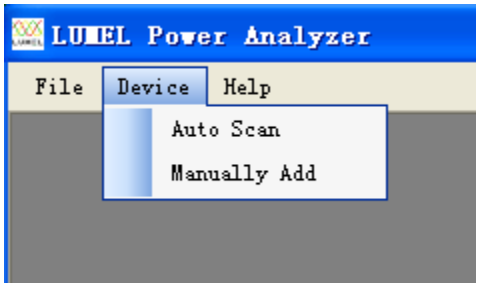
This software has two functions, separately to be remote control instrument and download and open the saved file from instrument

1. Remote control through LAN interface

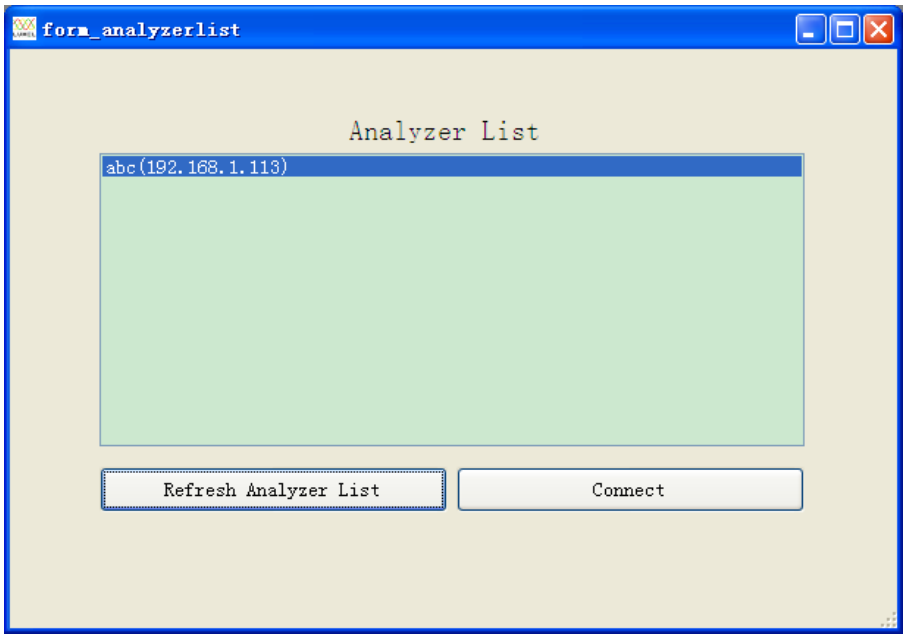
(1) Connect the device and PC using network cable and set both IP address of PC and device to be in the same network segment.

For example, if IP address of PC is 192.168.1.xxx, then the IP address of device should also be set to be 192.168.1.xxx.

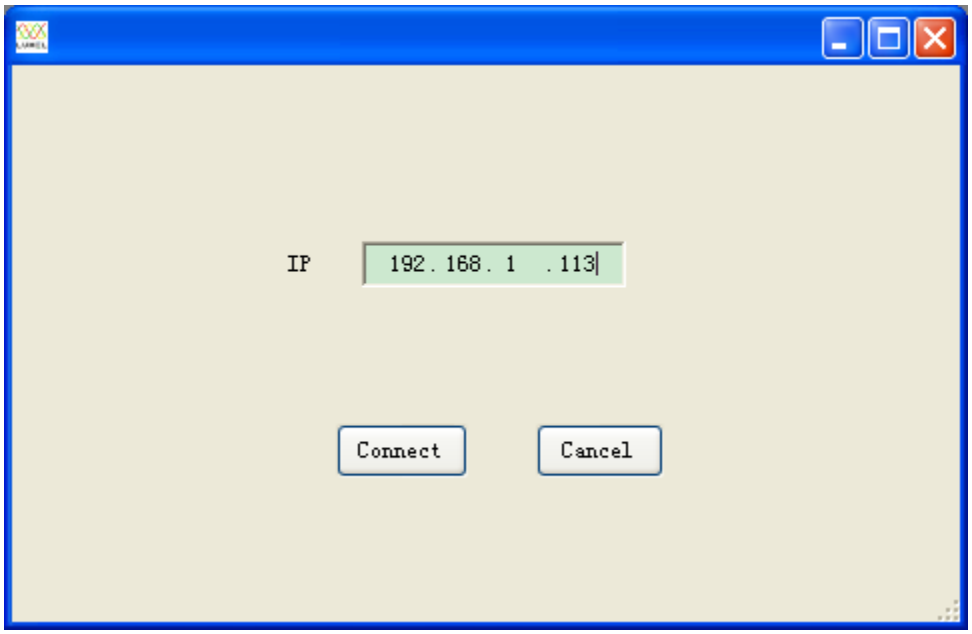
(2) Open the software and click '**Device**' like below picture shown, pull-down menu includes 'Auto Scan' and 'Manually Add', which separately means automatically scan device and manually add IP address of device.



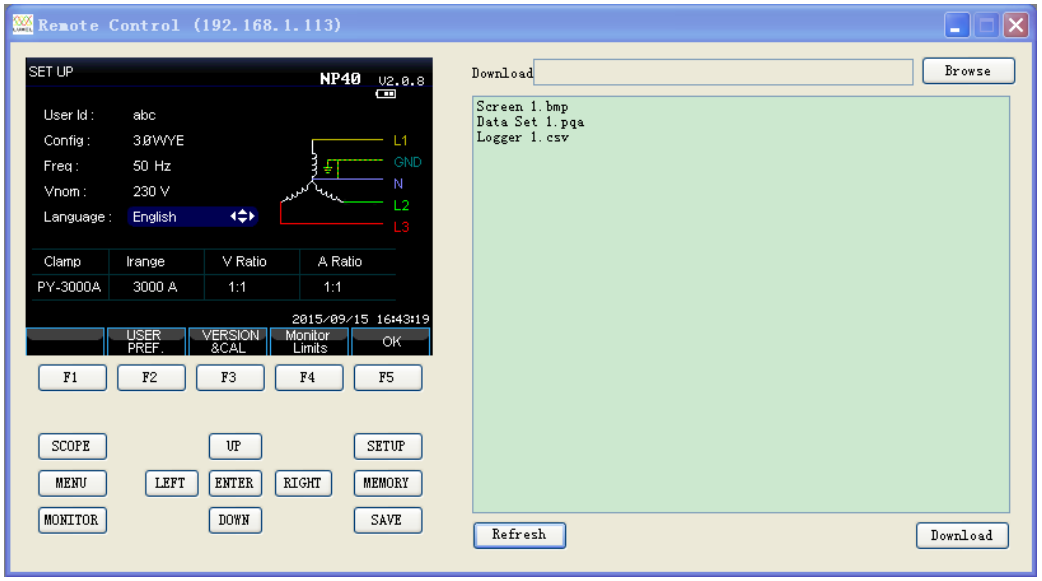
Click '**Auto Scan**'



Or click '**Manually Add**',



Both of ways can make the connection available. After clicking '**Connect**', the below interface will appear,



Remote control the device through pressing buttons in left area of above interface, the right area is the stored list files, user can click '**Download**' button to download selected files to the computer.

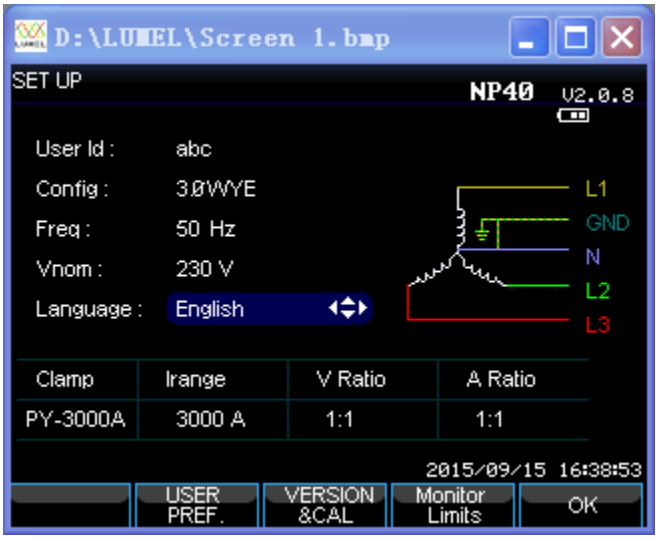
2. Check stored file

The device can store below three format file:

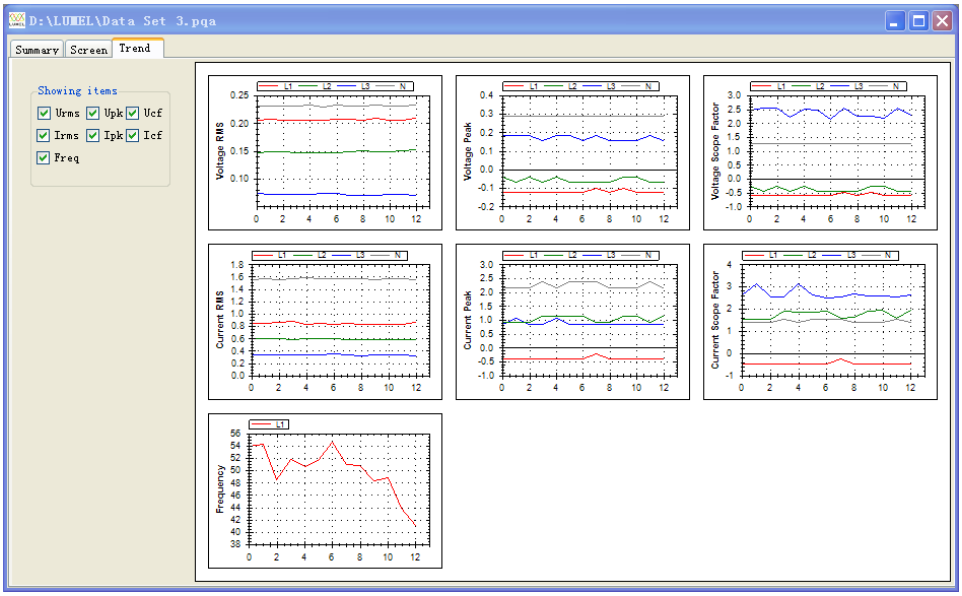
.bmp picture file
.pqa data file

.csv log file

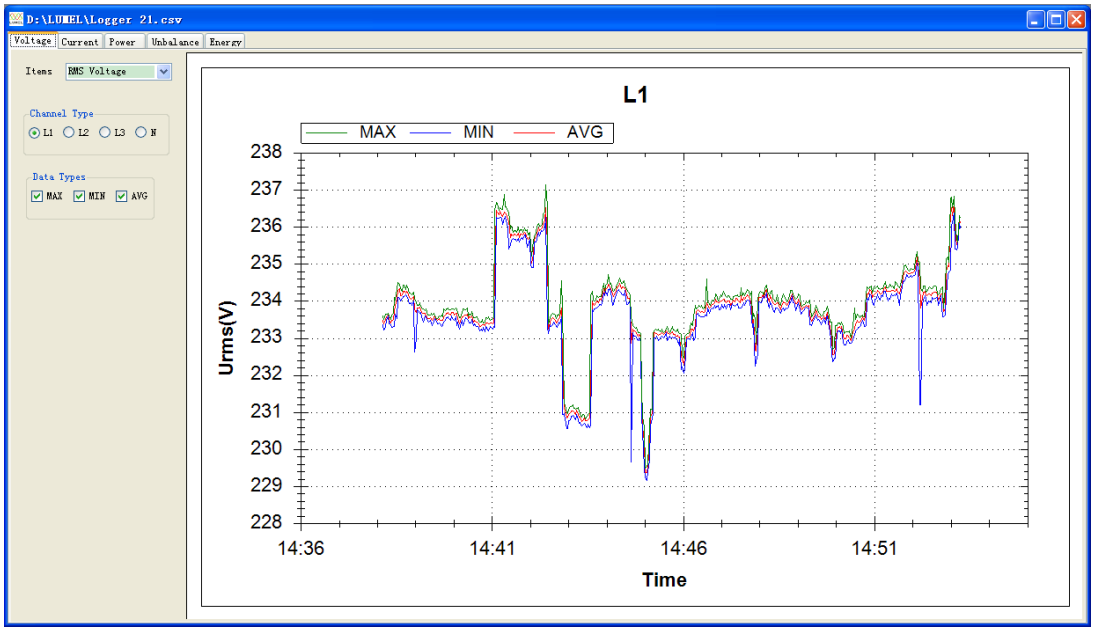
(1) Open the picture file and take the below screenshot for example



(2) Open the date file, and take the below picture saved under voltage/current measurement for example



(3) Open log file with .csv format, user can directly open EXCEL file under windows or open it using this software.


D:\LUMEL\Logger 21.csv
Voltage
Current
Power
Unbalance
Energy
Items
RMS Voltage
Channel Type
L1
L2
L3
N
Data Types
MAX
MIN
AVG
L1
MAX
MIN
AVG
Urms(V)
238
237
236
235
234
233
232
231
230
229
228
14:36
14:41
14:46
14:51
Time

Ordering code

Analyzer NP40-	X	XX	X	X
Additional equipment:				
lack	0			
4 pcs. Rogowski coils PY 3000 A	1			
4 pcs. Rogowski coils PY 5000 A	2			
4 pcs. current clamps KLC8C 5 A	3			
4 pcs. current clamps CTC0080 50 A	4			
4 pcs. current clamps CTC0130 100 A	5			
4 pcs. current clamps CTC1535 1000 A	6			
Version:				
standard		00		
Custom-made*		XX		
Language:				
Multilanguage (Polish/ English)			M	
other*			X	
Acceptance tests:				
Without extra quality requirements				0
With an extra quality inspection certificate				1
Acc. to customer's requirements*				X

* after agreeing with the manufacturer

LUMEL
EVERYTHING COUNTS

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