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sisco

UT285A SERIES Operating Manual

Three Phase Energy and Power Quality Analyzer

Table of Contents

Standard Shipment Overview

	Description
1	The Analyzer UT285A with Side Strap, Battery Pack and 32 GB SD Memory Card Installed
3	Hang Strap
4	Alligator Clips. Set of 5
5	Test Leads, 2.5 m + Color Coding Clips. Set of 5
6	Power Adapter
7	CD-ROM with PC Software
8	USB Interface Cable for PC Connection (USB-A to mini-USB-B)
9	3000 A AC Flexible Current Probe. Set of 4
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Conventions Used in this Manual

The following conventions are used throughout the UT285A Users Manual:

"**Graphical user interface elements**": All names of graphical user interface elements both on the screen and on the front panel, such as dialog boxes, softkeys, menus, options, buttons etc., are enclosed by quotation marks.

"**KEY ICONS**": Key Icons are drawn directly.
"**INPUT**": Input to be entered by the user is displayed in italics.
"**File names' , commands, program code**": File names, commands, coding samples and screen output are distinguished by their font.

1. Basic Operations of the Analyzer

The UT285A Three Phase Energy and Power Quality Analyzer (hereafter referred to as Analyzer) is a powerful instrument to investigate the power systems. This chapter provides information about basic functionality and about the user interface of the Analyzer.

1.1 Overview of the Analyzer

Figure1-1 is an overview of the Analyzer.

Analyzer Overview	
1	Measurement Inputs
2	Display Screen
3	Keyboard
4	USB connector
5	Battery Charger Input

Figure1-1. Overview of the Analyzer

1.2 Screen Layout and Elements

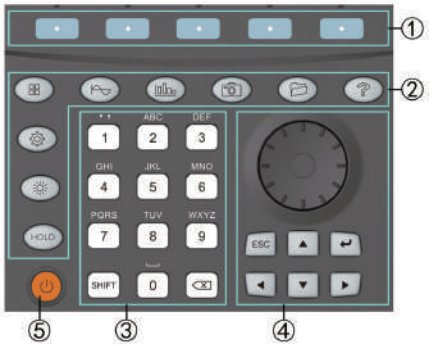
Figure1-2 shows a sample screen layout of the Analyzer. It shows all elements that are common for all measurement modes of the Analyzer. Screen layouts that are specific for different measurement modes are provided in the corresponding chapters of this manual.

Screen Description		
1	Screen Title	
2	Date and Time	
3	Instrument Status	
		Battery Capacity Indicator
		SD Card Capacity Indicator
		Hold/Run Switching Indicator
		Keypad Lock/unlock Indicator
		Alphanumeric Keypad Switching Indicator
		USB Connection Indicator
4	Measurement Status Bar	
5	Display Window	
6	Soft Key Labels	

Figure1-2. A sample screen layout of the Analyzer

1.3 Keypad Layout and Elements

The keypad of the Analyzer provides an easy and efficient way to manipulate the Analyzer, as shown in Figure1-3.



Keypad Description	
1	Soft Keys
2	Shortcut Keys
3	Alphanumeric Keys
4	Navigation Keys and Rotary Knob
5	Power Button

Figure1-3. Keypad of the Analyzer

1.3.1 Soft Keys

Soft keys are representatives of their soft key label counterparts appearing at the bottom of a screen. Soft keys are screen sensitive, meaning that they may represent different functions for different screens.

1.3.2 Shortcut Keys

Shortcut keys are used to perform a function with a single finger strike. These functions

Explanation of shortcut keys	
	Menu
	Scope Mode
	Power Quality Profile Mode
	Screenshot
	File Management
	Online Help
	Setup
	Adjust Screen backlight
	Hold/Run

Figure1-4. Explanation of shortcut keys

1.3.3 Alphanumeric Keys

Alphanumeric keys are used to enter numeric values or characters. The selections between numbers and characters are made by pressing the SHIFT key. Entries can be corrected with the Back key. The Back key

moves the cursor one position backwards and deletes the number or character that was in that place.

1.3.4 Navigation Keys and Rotary Knob

Navigation keys include UP, DOWN, LEFT and RIGHT keys, and their supplementary ENTER and ESCAPE keys. Navigation Keys' primary functions are to navigate through dialog boxes and soft-key submenus. These keys are also screen sensitive, and their usages are detailed in the corresponding screens in chapters that follow.

The rotary knob with ENTER functions similar to navigation keys in many situations. The rotary knob is screen sensitive and is described in detail in the corresponding screens in chapters that follow.

1.3.5 Power Button

Press the power button to switch on or off the Analyzer. Hard shutdown method: press the power button for more than five seconds than release the instrument will be completely powered off.

1.4 Powering the Analyzer

The Analyzer may be powered by the built-in rechargeable battery or the AC adapter both included in the delivery.

1.4.1 Powering with the AC Adapter

Connect the AC adapter to the DC port on the right side of the Analyzer. Make sure to fully insert the plug into the port. Then connect the plug to an AC power outlet. The voltage range of the AC power supply is 100V to 240V AC. After the Analyzer is supplied with power, turn it on with the power button on the front panel. Press power button again to turn off the Analyzer after work.

Risk of damage to the Analyzer

- Use only the supplied power supply.
- AC supply voltage must be compatible to the voltage specified on the power supply unit.

1.4.2 Powering with the Battery

The Analyzer has a built-in rechargeable Li-ion battery that can power it for more than eight hours when fully

charged. A full charge takes at least four hours with the Analyzer turned off. When turned-on, charging takes much longer because the charging current is reduced by the power drain of the Analyzer. At delivery the battery may be empty and it is recommended to charge it before use. To charge the battery, connect the AC power adapter included in the delivery. After the battery is fully charged, turn on the Analyzer with the power button on the front panel. Press power button again to turn off the Analyzer after work.

1.5 Performing Measurements

This section gives an overview on how to perform different measurements to investigate the power system.

1.5.1 Setting up the Analyzer

Before preparing for a measurement, it is recommended to setup the Analyzer first. Detailed descriptions of setting up the Analyzer are presented in Chapter 2. By default, the Analyzer will use the factory presettings for measurement.

1.5.2 Check for correct input connections

Use Scope mode to determine whether voltage leads and current clamps are connected correctly. The current clamps are marked with an arrow to indicate proper signal polarity.

1.5.3 General Impression of a Power System

Use VAH mode to measure voltages, currents, frequency and crest factor values. Its Realtime Value screen displays current values of all phases, while its Trend screen displays the process over time of these realtime values.

Use Power Quality Profile mode to get a general impression of the power quality of a power system. This mode displays a screen with Bar Graphs that show common power quality aspects of all phase voltages. A Bar Graph changes from green to red when the related aspect exceeds the power quality limit setup.

1.5.4 Different measurement modes to study for power system details

Besides, each measurement mode may be used to

inspect and investigate certain aspects of power systems in detail. For example, Dips & Swells mode could be used to record sudden voltage changes. Inrush Current mode could be used to record sudden current increases. Harmonics mode could be used to check for voltage and current harmonics. Flicker mode could be used to check short and long term voltage flick. Unbalance mode could be used to investigate system voltage unbalances. And Power and Energy mode could be used to determine the amount of power and energy consumed by different electrical loads. The different measurement modes are described in detail in Chapter 3 to 15. Each measurement mode is explained in a separate chapter.

1.5.5 Two Ways of Using the Analyzer

Generally there are two ways to use the analyzer. One way is to use it for manual field test, and the other way is to use it for automatic online test. For the manual field test, the user manually operates the analyzer to use its different measurement modes, and only current measurement mode screens can be logged. This is suitable for short-time manual field test, which is flexible and convenient. For the automatic online test, the measurements are performed automatically by using tasks. Tasks may perform up to all measurements and log up to all measurement data simultaneously. This is suitable for long-time automatic online test. Task operation is described in detail in Chapter 16.

2. Setting up the Analyzer

Before preparing for a measurement, it is recommended to setup the Analyzer first. By default, the Analyzer will use the factory preset values for all measurements. There are four kinds of settings for the Analyzer, namely, Instrument Setup, Measurement Setup, Limits Setup, and Recording Setup. Press the “ ” shortcut key, the Setup screen appears as shown in Figure 2-1. The following sections describe in detail these four kinds of setups.

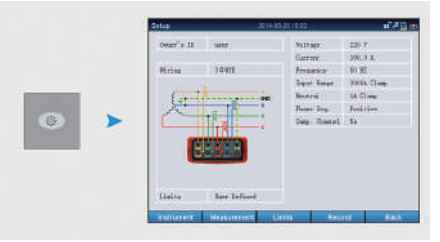


Figure 2-1. Setup screen

2.1 Instrument Setup

In the Setup screen shown in Figure 2-1, press the " Instrument" soft key, The Instrument Setup screen appears as shown in Figure 2-2. The Instrument Setup screen is a collection of setup information about instrument, and allows a user to customize the information according to his preferences. These selectable preferences are listed below in table 2-1.

Figure 2-2. Instrument Setup screen

Group Title	Item	Description
Instrument Owner	Owner's ID	Key in an owner's identification.
Language	Language	Choose a preferred display language.
Date and Time	Date Format	Choose the date format.
	Time Zone	Choose the time zone.
	Date	Key in date.
	Time	Key in time.
Display	Effective Digits	Choose digits of displayed numbers.
	Phase ID	Choose a phase identification set used in different countries.
	Phase Colors	Choose phase colors used in different countries.
	Highlighted Bar Color	Choose the color of the highlighted bar.
	Backlight Brightness(%)	Key in percentage of LCD backlight brightness.
	Backlight Timeout(s)	Key in seconds for LCD backlight timeout.
RS-232 Port	Baud Rate	Choose baud rate for the RS-232 port communication.

Table 2-1. Instrument SetupItems

Different customizable items may be selected with the rotary knob or navigation keys. For items with selectable options, also use rotary knob or navigation keys to choose an option, as shown in Figure 2-3. For items with key-in options, use alphanumeric keys to input contents, as shown in Figure 2-4.

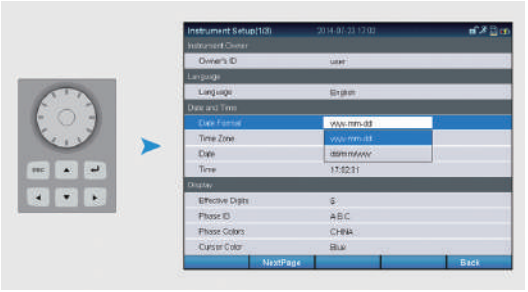


Figure 2-3. An instrument setup item with a selectable option

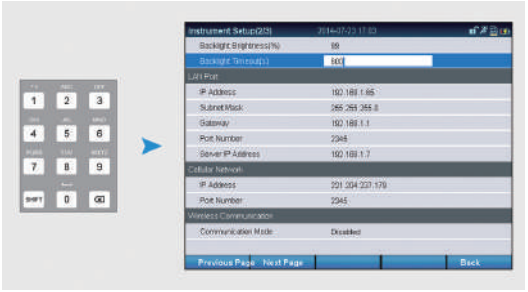


Figure 2-4. An instrument setup item with a key-in option

2.2 Measurement Setup

In the Setup screen shown in Figure 2-1, press the “ Measurement” soft key, The Measurement Setup screen appears as shown in Figure 2-5. The Measurement Setup screen is a collection of setup information about measurement, and allows a user to select these measurement setup items according to his measurement needs. These items are listed below in table 2-2.

Figure 2-5. Measurement Setup screen

Group Title	Item	Description
Input Setup	Wiring	Choose one of the nine wiring configurations.
	Nominal Voltage	Choose or key in a nominal voltage.
	Nominal Current	Key in a nominal current.

	Nominal Frequency	Choose 50Hz or 60Hz as the nominal frequency.
	Current Input Range	Choose a current input range.
	Phase Sequence	Choose positive or negative phase sequence.
	Sampling Channel	Choose a sampling channel for the internal A/D. Usually choose Va as the sampling channel. If Va is unavailable, then Vb, then Vc, etc.
Information of Facility under Test	Facility Name	Key in the name of facility under test.
	Facility Address	Key in the address of facility under test.
	Line Name	Key in the line name of facility under test.
	Line Number	Key in the line number of facility under test.
Energy Pulse Output	Pulse Frequency	Choose the frequency of th output energy pulse.
	Pulse of Channel 1	Choose the kind of power that channel 1 pulse represents.
	Pulse of Channel 2	Choose the kind of power that channel 2 pulse represents.

Table 2-2. Measurement Setup Items

Different items may be selected with the rotary knob or navigation keys. For items with selectable options, also use rotary knob or navigation keys to choose an option, as shown in Figure 2-6. For items with key-in options, use alphanumeric keys to input content, as shown in Figure 2-7.

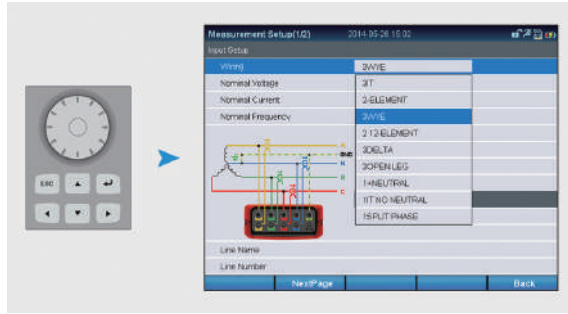


Figure 2-6. A measurement setup item with a selectable option

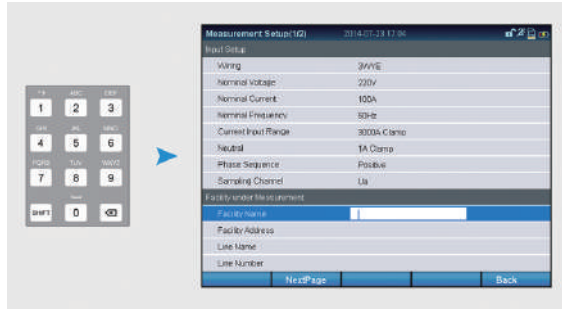


Figure 2-7. A measurement setup item with a key-in option

2.3 Limits Setup

In the Setup screen shown in Figure 2-1, press the " Limits" soft key, The Limits Setup screen appears as shown in Figure 2-8. The Limits Setup screen is a collection of setup information about limits, and allows a user to select these limits setup items according to his measurement needs. These items are listed below in table 2-3.

Figure 2-8. Limits Setup screen

Group Title	Item	Description
Limits Sets	Limits Set	Choose one of the Chinese GB Series, EN50160, or User Defined limits set. For the first two limits sets, the limit values that follow are only for display, but not changeable. For the last one, users may key in user defined limit values.
Voltage Deviation	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	100% Probability Lower Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Lower Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Frequency Deviation	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	100% Probability Lower Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.

	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Lower Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Unbalance	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Short Term Flicker	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.

Long Term Flicker	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Total Harmonic Distortion	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Odd Harmonics	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.

Even Harmonics	100% Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Secondary Probability Upper Limit	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Swells	Reference Voltage	Choose reference voltage from nominal voltage or gliding.
	Threshold	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Hysteresis	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Allowed Number of Swells per Week	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Dips	Reference Voltage	Choose reference voltage from nominal voltage or gliding.
	Threshold	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Hysteresis	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Allowed Number of Dips per Week	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Interruptions	Threshold	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Hysteresis	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Allowed Number of Dips per Week	Displays the default value. A user may key in a user defined value for the User Defined limits set.
Inrush	Reference Current	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Threshold	Displays the default value. A user may key in a user defined value for the User Defined limits set.
	Hysteresis	Displays the default value. A user may key in a user defined value for the User Defined limits set.

Table 2-3. Limits SetupItems

Different items may be selected with the rotary knob or navigation keys. For items with selectable options, also use rotary knob or navigation keys to choose an option, as shown in Figure 2-9. For items with key-in options, use alphanumeric keys to input content, as shown in Figure 2-10.

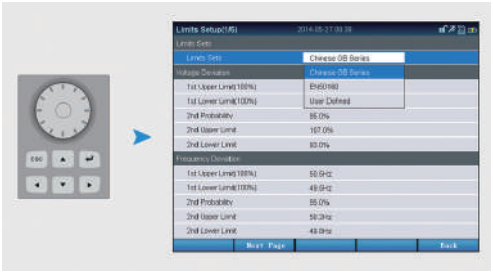


Figure 2-9. A limits setup item with a selectable option

Figure 2-10. A limits setup item with a key-in option

2.4 Recording Setup

In the Setup screen shown in Figure 2-1, press the “ Recording” soft key, The Recording Setup screen appears as shown in Figure 2-11.

Figure 2-11. Recording Setup screen

The Recording Setup screen is a collection of setup information about recording, and allows a user to select these recording setup items according to his measurement needs. These items are listed below in table 2-4.

Group Title	Item	Description
Disturbance Trigger Waveform Recording	Pre-trigger Recording Cycles	Key in a pre-trigger recording cycles number.
	Post-trigger Recording Cycles	Key in a post-trigger recording cycles number.
	Voltage Sudden-Change Trigger	Choose yes or no to enable or disable voltage sudden-change trigger.
	Voltage Sudden-Change Threshold	Key in the voltage sudden-change threshold.
	Current Sudden-Change Trigger	Choose yes or no to enable or disable current sudden-change trigger.
	Current Sudden-Change Threshold	Key in the current sudden-change threshold.
	Negative Sequence Voltage Trigger	Choose yes or no to enable or disable negative voltage sequence trigger.
	Negative Sequence Voltage Threshold	Key in the negative voltage sequence threshold.
	Zero Sequence Voltage Trigger	Choose yes or no to enable or disable zero voltage sequence trigger.
	Zero Sequence Voltage Threshold	Key in the zero voltage sequence threshold.
	Voltage THD Trigger	Choose yes or no to enable or disable voltage THD trigger.
	Voltage THD Threshold	Key in the voltage THD threshold.
	Current THD Trigger	Choose yes or no to enable or disable current THD trigger.
	Current THD Threshold	Key in the current THD threshold.
	Frequency Upper Deviation Trigger	Choose yes or no to enable or disable frequency upper deviation trigger.
	Frequency Upper Threshold	Key in the frequency upper threshold.

	Frequency Lower Deviation Trigger	Choose yes or no to enable or disable frequency lower deviation trigger.
	Frequency lower Threshold	Key in the frequency lower threshold.
Steady State Logger	Steady State Logging	Choose yes or no to enable or disable steady state logging.
	Logging Interval	Key in the logging interval.
Transient Recording	Transient Voltage Limit	Key in the transient voltage limit.

Table 2-4. Recording Setup Items

Different items may be selected with the rotary knob or navigation keys. For items with selectable options, also use rotary knob or navigation keys to choose an option, as shown in Figure 2-12. For items with key-in options, use alphanumeric keys to input content, as shown in Figure 2-13.

Figure 2-12. A recording setup item with a selectable option

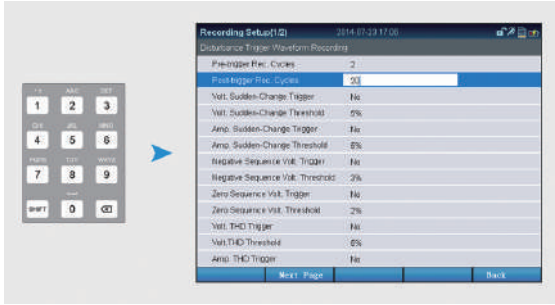


Figure 2-13. A recording setup item with a key-in option

2.5 Managing Setup Data by Using Setup Files

Besides setting up the Analyzer as described in the previous sections, it is also possible to set up the Analyzer by using setup files. Current active setup data may be saved as setup files for later use, and setup files may be recalled to be current active setup data. This section describes setup files management by using instrument setup files as an example, a general

description of file management could be found in Chapter 15.

In the Instrument Setupscreen shown in Figure 2-2, press“ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 2-14.

Figure 2-14. Instrument Setupscreen after “ ” shortcut key being pressed

If “Save Setup” soft key is pressed in screen shown in Figure 2-14, the Instrument Setup screen changes to the picture shown in Figure 2-15. Type in file name and a file description, then press “Yes” soft key to confirm the operation, the current active instrument setup data is saved to the above named instrument setup file. An instrument setup file has an ‘INS’ extension name.

Figure 2-15. Instrument Setup screen after “Save Setup” soft key being pressed

If “View File” soft key is pressed in screen shown in Figure 2-14, the Instrument Setup screen changes to the picture shown in Figure 2-16. Select an instrument setup file, press “Operate” soft key to choose an operation. If “Load as Current Setup” menu item is chosen, data stored in the selected setup file is recalled as current active setup data. One can also choose “View Description” or “View File” menu item to view a setup file’s detailed information before deciding to load the file data as current setup. Figure 2-17 shows a sample screen after the “View File” menu item is chosen. Note

that the title bar's color now turns to black-and-white to indicate that it is now in recall mode.

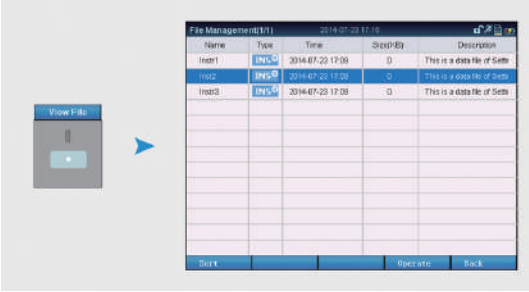


Figure 2-16. Instrument Setup screen after "View File" soft key being pressed

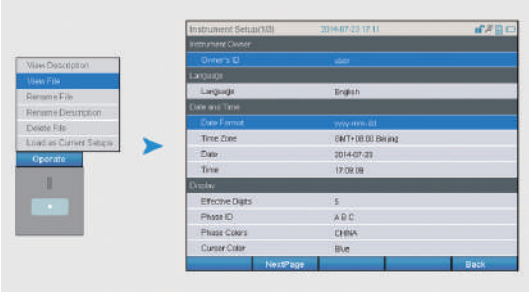


Figure 2-17. Instrument Setup screen after "View File" operation being chosen

Operations of other kind of setup files, namely, measurement setup file, limits setup file, recording setup file, and total setup file which is a collection of all the above four kinds of setup files, are exactly the same as operations of the instrument setup file.

2.6 Screenshot of Setup Screens

In a current setup screen, press the "" shortcut key, a screenshot screen appears as shown in Figure 2-18. Type in screenshot file name and a file description, then press "Yes" soft key to confirm the operation, the current setup screen's screenshot is saved to the above screenshot file. A screenshot file has a 'SCR' extension name.

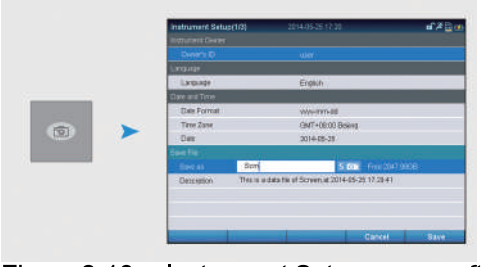


Figure 2-18. Instrument Setup screen after "" shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

2.7 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ” shortcut key. Figure 2-19 is a sample online help screen for an Instrument Setup screen.

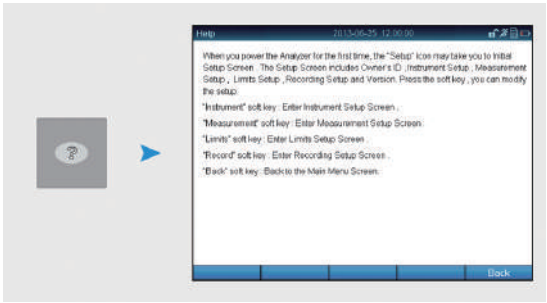


Figure 2-19. A sample online help screen for an Instrument Setup screen

3. Scope Mode

The Scope mode of the Analyzer provides the functionality to perform basic measurements of voltages and currents in the forms of waveforms, phasors with realtime values, and trends.

3.1 Waveform

Press the“ ” shortcut key, or select the “Scope” icon in the main menu, or press the “Waveform” soft key in the Phasor screen or in the Trend screen, the Waveform screen in the Scope mode appears as shown in Figure 3-1. The screen displays up to three phase voltage and current waveforms for four periods in two separated windows. “ Display” soft key may be used to customize which waveforms to be displayed. Realtime RMS values of the displayed waveforms are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 3-1.

Figure 3-1. Waveform screen in the Scope mode

Key	Description
Display	Choose which ones of voltage and current waveforms to be displayed.
Phasors	Switch to the Phasor screen.
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Scope mode measurement data. See section 3.5 for a detailed description.
	Zoom in and zoom out the waveforms vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 3-1. Keys in the Waveform screen of the Scope mode

By default, the waveforms are adjusted automatically to fit into the display window vertically. Nevertheless, “Up” and “Down” arrow keys may be used to zoom in and zoom out the waveforms vertically to view the details. Waveforms are usually changing constantly over time. To investigate the waveforms in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window shown in Figure 3-2, which can be moved left and right by rolling the rotary knob. The measurement values at the top of the screen are the ones of the voltages and currents at the cursor’s position.

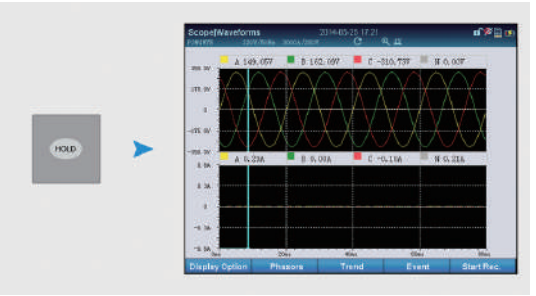


Figure 3-2. Cursor appearing when the Waveform screen being in hold state

3.2 Phasor

Press the “Phasors” soft key in the Waveform screen or in the Trend screen, the Phasor screen in the Scope mode appears as shown in Figure 3-3. The screen displays up to three phase voltage and current phasors with Ua(V-L1) as the reference phasor, together with realtime voltage, current, frequency, power factor, active power, and reactive power values. Soft keys in this screen are listed in Table 3-2.

Figure 3-3. Phasor screen in the Scope mode

Key	Description
Waveforms	Switch to the Waveform screen.
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Scope mode measurement data. See section 3.5 for a detailed description.

Table 3-2. Keys in the Phasor screen of the Scope mode

3.3 Trend

Press the “Trends” soft key in the Waveform screen or in the Phasor screen, the Trend screen in the Scope mode appears as shown in Figure 3-4. The screen displays the first four measurement data trend charts of all measurement data in the display window, and “Next Page” soft key may be pressed repeatedly to view the remaining measurement data trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen.

Soft keys and other keys that have specific functions assigned to this screen are listed in Table 3-3.

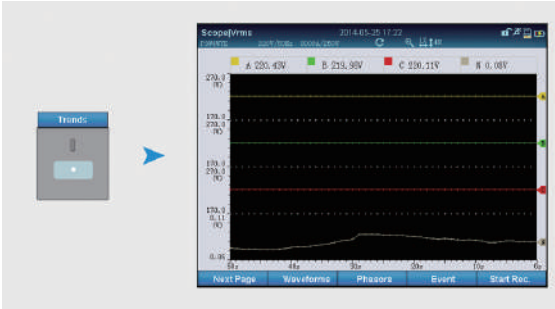


Figure 3-4. Trend screen in the Scope mode

Key	Description
Next Page	View other measurement data trend charts.
Waveforms	Switch to the Waveform screen.
Phasors	Switch to the Phasor screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Scope mode measurement data. See section 3.5 for a detailed description.
◄ ►	Zoom in and zoom out the trend charts horizontally. See description in this section.
▲ ▼	Zoom in and zoom out the trend charts vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 3-3. Keys in the Trend screen of the Scope mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “ Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 3-5, which can be moved left and right by rolling the rotary knob. The measurement values at the top of the screen are the ones at the cursor’s position.

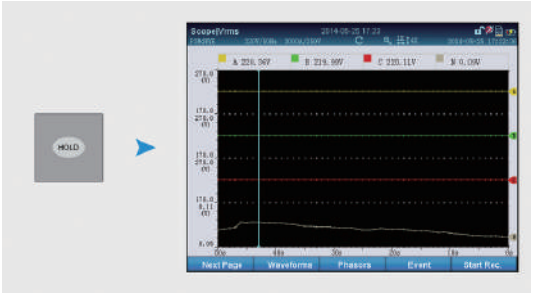


Figure 3-5. Cursor appearing when the Trend screen being in hold state

3.4 Events

Press the“Events” soft key in the Waveform, Phasor, or Trend screen, the Events screen in the Scope mode appears as shown in Figure 3-6. The screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 3-4.The event type and symbol descriptions are listed in Table 3-5.

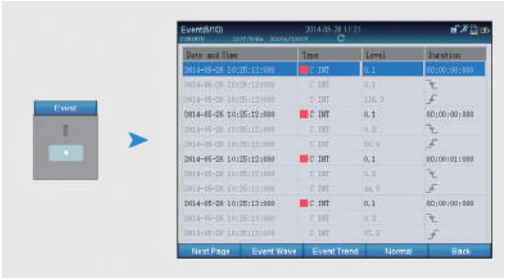


Figure 3-6. Events screen in the Scope mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Sketch Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Waveform, Phasor, or Trend screen.
◄ ►	View the previous page or next page.

Table 3-4. Keys in the Events screen of the Scope mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 3-5. Event type and symbol descriptions in the Scope mode

3.5 File Management in the Scope Mode

In the Waveform, Phasor, or Trend screen of the Scope mode, one can press the “Start Rec./Stop Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 3-7. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure 3-8.

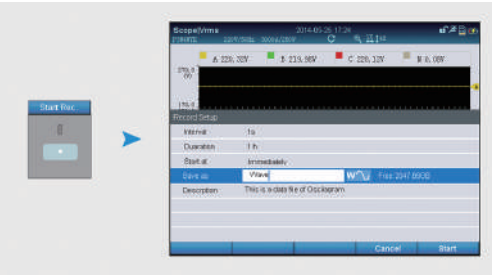


Figure 3-7. Recording the measurement data to a file in the Scope mode

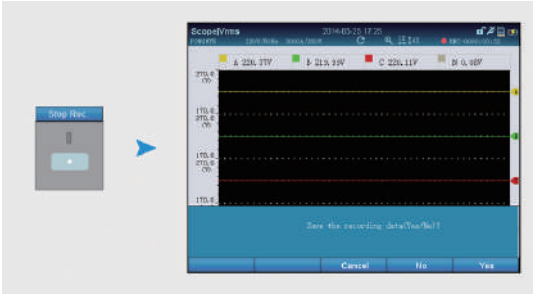


Figure 3-8. Stop recording data to a file in the Scope mode

In any screen of the Scope mode, press“ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 3-9.

Figure 3-9. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 3-9, the screen changes to the picture as shown in Figure 3-10. The screen lists all the saved scope files with the ‘PWV’ extension name. Select a file, press “ Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a scope file’s detailed information. Figure 3-11 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected scope file.

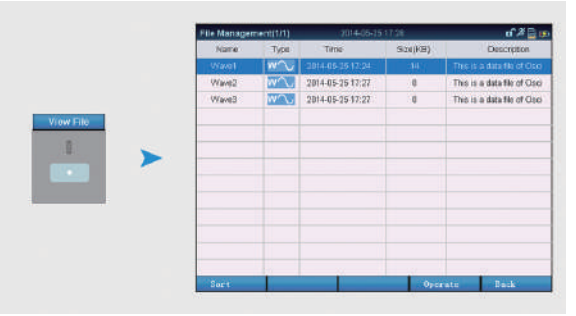


Figure 3-10. A sample screen after “View File” soft key being pressed

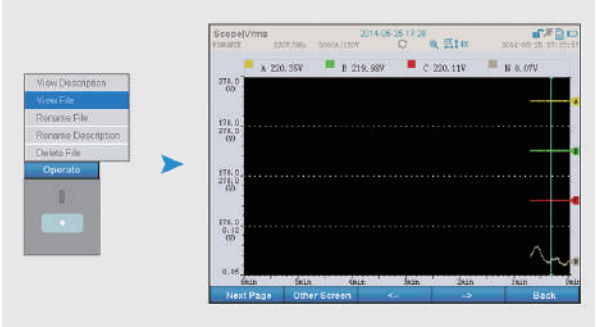


Figure 3-11. A sample screen after “View File” operation being chosen

In any screen of the Scope mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 3-12. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

Figure3-12. A Scope screen after “ ” shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.
A general description of file management could be found in Chapter 15.

3.6 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have

different online help contents. Online help is activated in any screen by pressing the “ ” shortcut key. Figure 3-13 is a sample online help screen for a Scope screen.

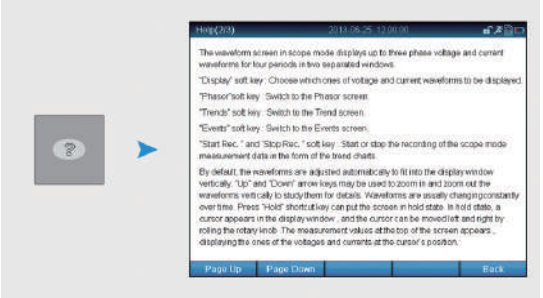


Figure 3-13. A sample online help screen for a Scope screen

3.7 Applications

Phasor screen may help users to determine whether voltage leads and current clamps are correctly connected. The voltage phasors should be balance stretched with a 120 degree spacing. A current phasor should be close the voltage phasor of the same phase, usually with less than a 30 degree phase shift. Each phase voltage value should not exceed 1 % of the average of the three phase voltage values, and current not exceed 10 %. Unbalanced currents are usually caused by unbalanced voltages, and may reduce the lifespan of certain loads, such as motors.

Waveform screen provides a direct view of voltage and current waveform shapes. If voltages have smooth sinusoidal waveform shapes, it means that they are free from distortion. The voltage and frequency measurement values should be close to their nominal ones. Big voltage and frequency changes mean a weak power system.

The high resolution recording of measurement data in the form of the trend charts may help to investigate the influence of sudden load changes on voltage and current waveforms, like switching on and off of big loads such as motors, pumps, welding machines, and invertors.

4. VAH Mode

The VAH mode of the Analyzer provides detailed measurement information of voltages(V), currents(A), and frequency(H) in the forms of realtime numerical values and trends.

4.1 Realtime Numerical Values

In the main menu, select the“VAH” icon, or press the “ Realtime Value” soft key in the Trend screen, the Realtime Numerical Values screen in the VAH mode appears as shown in Figure 4-1. The screen displays RMS values, peak values, and crest factors of the measured voltages and currents. The frequency of the power system under test is also displayed.

Figure 4-1. Realtime Numerical Values screen in the VAH mode

“Phase Volt/Line Volt” ping-pong soft key may be used to select the display of line-to-neutral or line-to-line voltages. Soft keys in this screen are listed in Table 4-1.

Key	Description
Phase Volt. Line Volt.	Switch between the display of line-to-neutral or line-to-line voltages.
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the VAH mode measurement data. See section 4.4 for a detailed description.

Table 4-1. Keys in the Realtime Numerical Values screen of the VAH mode

4.2 Trend

Press the“Trends” soft key in the Realtime Numerical Values screen, the Trend screen in the VAH mode appears as shown in Figure 4-2. The screen displays the first four measurement data trend charts of all measurement data in the display window, and “Page Down” soft key may be

pressed repeatedly to view the remaining measurement data trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 4-2.

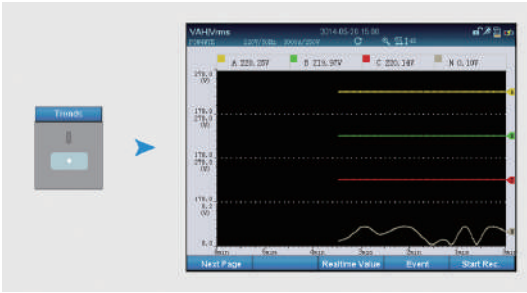


Figure 4-2. Trend screen in the VAH mode

Key	Description
Page Down	View other measurement data trend charts.
Realtime Value	Switch to the Realtime Numerical Values screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the VAH mode measurement data. See section 4.4 for a detailed description.
	Zoom in and zoom out the trend charts horizontally. See description in this section..
	Zoom in and zoom out the trend charts vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 4-2. Keys in the Trend screen of the VAH mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 4-3, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

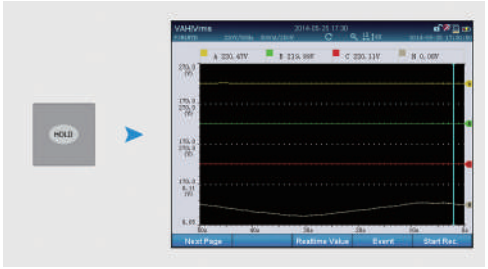


Figure 4-3. Cursor appearing when the Trend screen being in hold state

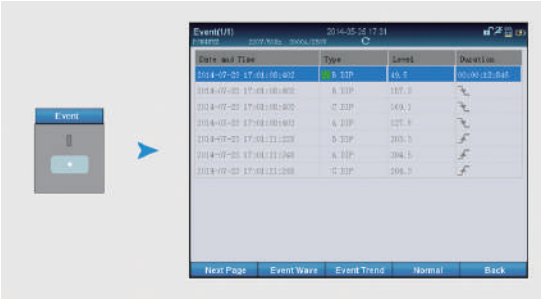


Figure 4-4. Events screen in the VAH mode

4.3 Events

Press the“Events” soft key in the Realtime Values screen, or Trends screen, the Events screen in the VAH mode appears as shown in Figure 4-4. The screen lists all over-limit events of measured values. Soft keys in this screen are listed in Table 4-3.The event type and symbol descriptions are listed in Table 4-4.

Key	Description
Next Page	View other over-limit events.
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Numerical Values, or Trends screen.

Table 4-3. Keys in the Events screen of the VAH mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 4-4. Event type and symbol descriptions in the VAH mode

4.4 File Management in the VAH Mode

In the Realtime Numerical Values screen, or Trends screen of the VAH mode, one can press the “Start Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 4-5. Fill in all the necessary recording setup information and press the “ Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure 4-6.

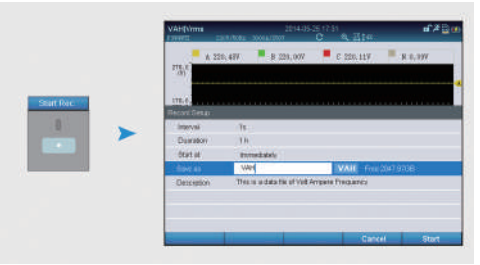


Figure 4-5. Recording the measurement data to a file in the VAH mode

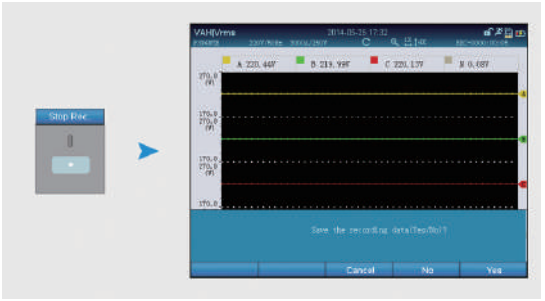


Figure 4-6. Stop recording data to a file in the VAH mode

In any screen of the VAH mode,press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 4-7.

Figure 4-7. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 4-7, the screen changes to the picture as shown in Figure 4-8. The screen lists all the saved VAH files with the ‘VAH’ extension name. Select a file, press “Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a VAH file’s detailed information. Figure 4-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected VAH file.

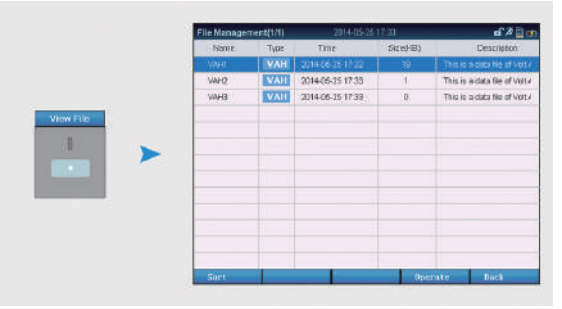


Figure 4-8. A sample screen after “View File” soft key being pressed

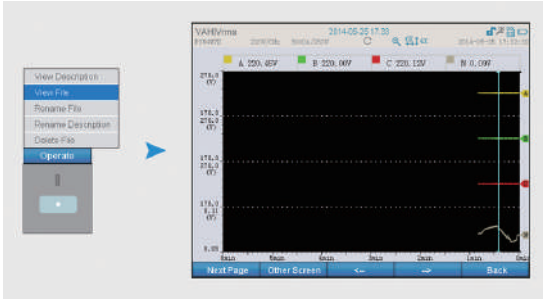


Figure 4-9. A sample screen after “View File” operation being chosen

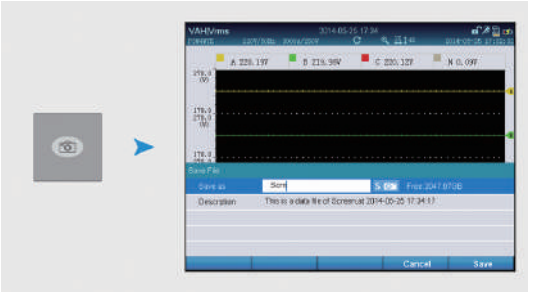


Figure 4-10. A VAH screen after “ ” shortcut key being pressed

In any screen of the VAH mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 4-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.
A general description of file management could be found in Chapter 15.

4.5 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online

help contents. Online help is activated in any screen by pressing the "?" shortcut key.
Figure 4-11 is a sample online help screen for a VAH screen.

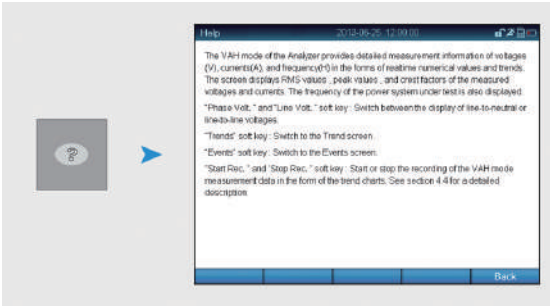


Figure 4-11. A sample online help screen for a VAH screen

4.6 Applications

VAH mode provides a first general impression of the power system under test. The voltage and frequency measurement values should be close to their nominal ones. Big voltage and frequency changes mean a weak power system. Each phase voltage value should not exceed 1 % of the average of the three phase voltage values, and current not exceed 10 %. Unbalanced currents are usually caused by unbalanced voltages, and may reduce the lifespan of certain loads, such as motors. The crest factor CF is a measurement of the distortion of the measured voltages and currents. A Crest Factor of 1.41 means no distortion, and a crest factor of greater than 1.8 means high distortion.

5. Dips and Swells Mode

The Dips and Swells mode of the Analyzer provides a means of capturing sudden voltage changes, that is, dips, interruptions, and swells of the measured voltages.

5.1 Trends

Select the "Dips and Swells" icon in the main menu, the Trends screen in the Dips and Swells mode appears as shown in Figure 5-1. The screen displays the four voltage rms value trend charts of all measurement data in the display window, and "Next Page" soft key may be pressed to view the four current rms value trend charts. Realtime measurement values of the displayed channels at the

tips of the drawing pens on the right side of the screen are also shown at the top of the screen. “Start Rec./Stop Rec.” ping-pong soft key may be used to record the sudden voltage changes. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 5-1.

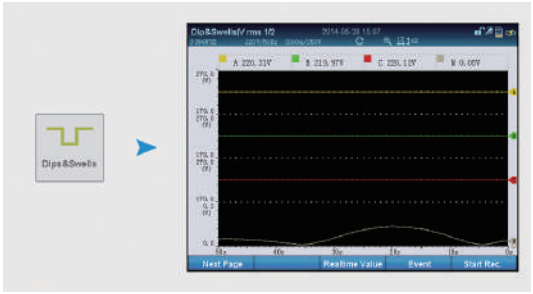


Figure 5-1. Trends screen in the Dips and Swells mode

Key	Description
Next Page	View other measurement data trend charts.
Realtime Value	Switch to the Realtime Value screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Dips and Swells mode measurement data. See section 5.4 for a detailed description.
	Zoom in and zoom out the trend charts horizontally. See description in this section.
	Zoom in and zoom out the trend charts vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 5-1. Keys in the Trends screen of the Dips and Swells mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 5-2, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

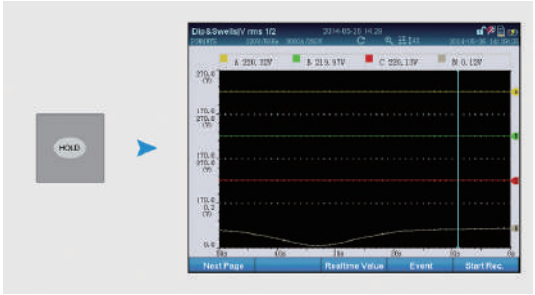


Figure 5-2. Cursor appearing when the Trends screen being in hold state

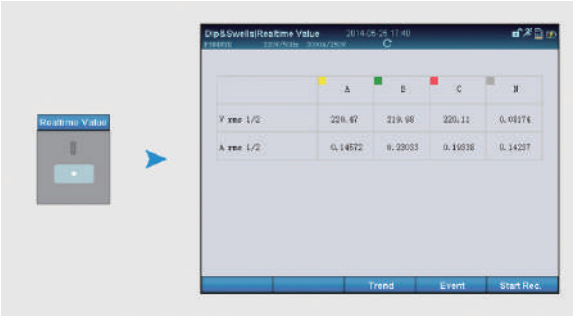


Figure 5-3. Realtime Numerical Values screen in the Dips and Swells mode

5.2 Realtime Numerical Values

Press the“Realtime Values” soft key in the Trends screen, the Realtime Numerical Values screen in the Dips and Swells mode appears as shown in Figure 5-3. The screen displays voltage half cycle rms values and current half cycle rms values, The frequency of the power system under test is also displayed. Soft keys in this screen are listed in Table 5-2.

Key	Description
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Dips and Swells mode measurement data. See section 5.4 for a detailed description.

Table 5-2. Keys in the Realtime Numerical Values screen of the Dips and Swells mode

5.3 Events

Press the“Events” soft key in the Trends or Realtime Values screen, the Events screen in the Dips and Swells mode appears as shown in Figure 5-4. The screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 5-3.The event type and symbol descriptions are listed in Table 5-4.

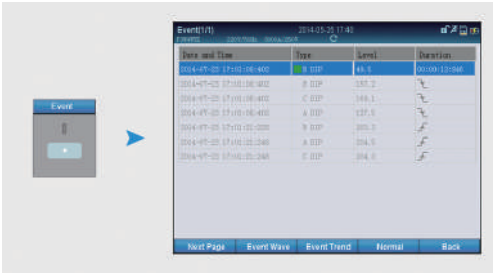


Figure 5-4. Events screen in the Dips and Swells mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Values, or Trend screen.
◄ ►	View the previous page or next page

Table 5-3. Keys in the Events screen of the Dips and Swells mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded

	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 5-4. Event type and symbol descriptions in the Dips and Swells mode

5.4 File Management in the Dips and Swells Mode

In the Realtime Numerical Values screen, or Trend screen of the Dips and Swells mode, one can press the “Start Rec./Stop Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 5-5. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure 5-6.

Figure 5-5. Recording the measurement data to a file in the Dips and Swells mode

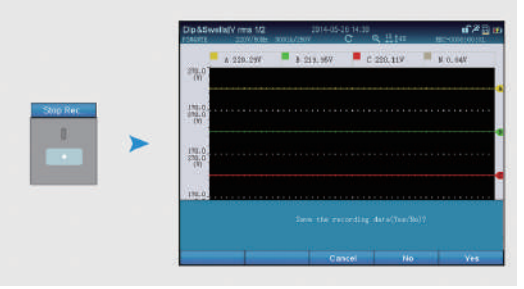


Figure 5-6. Stop recording data to a file in the Dips and Swells mode

In any screen of the Dips and Swells mode, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 5-7.

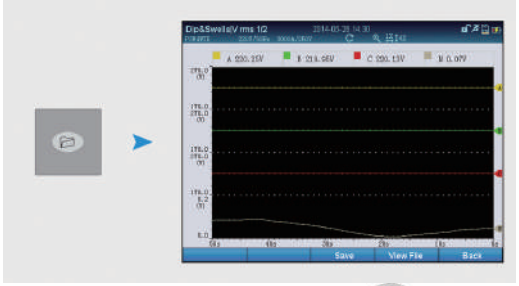


Figure 5-7. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 5-7, the screen changes to the picture as shown in Figure 5-8. The screen lists all the saved Dips and Swells files with the ‘DSW’ extension name. Select a file, press “Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a Dips and Swells file’s detailed information. Figure 5-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected Dips and Swells file.

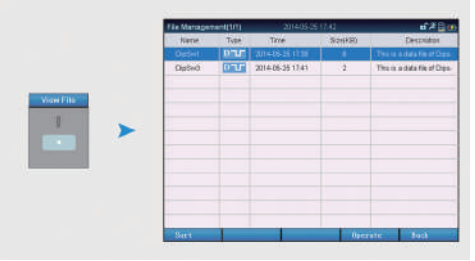


Figure 5-8. A sample screen after “View File” soft key being pressed

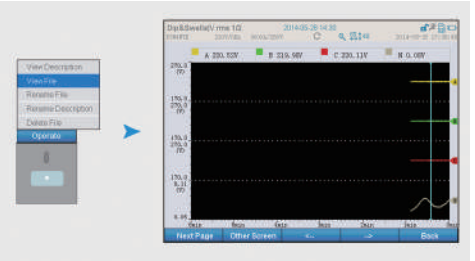


Figure 5-9. A sample screen after “View File” operation being chosen

In any screen of the Dips and Swells mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 5-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

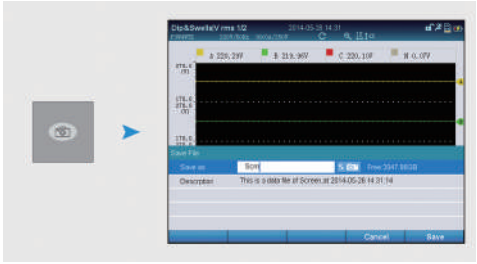


Figure 5-10. A Dips and Swells screen after “ ” shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

5.5 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ”shortcut key. Figure 5-11 is a sample online help screen for a Dips and Swells screen.

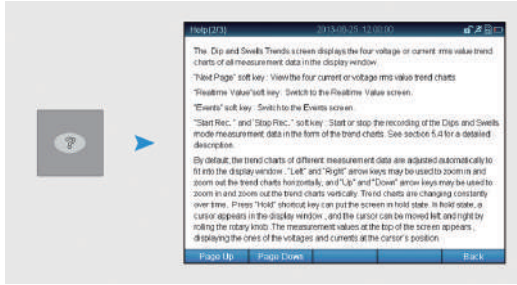


Figure 5-11. A sample online help screen for a Dips and Swells screen

5.6 Applications

Usually the voltage measurement values should be close to their nominal ones. Big voltage changes mean a weak

power system. The Dips and Swells mode of the Analyzer may help to capture the occurrences of such voltage changes. Sudden switching on and off of big loads such as motors, pumps, welding machines, and invertors may be the cause of such dips and swells. Big voltage changes caused by Dips and Swells may lead to flicker of lighting and loss of data in information and control systems.

6. Harmonics Mode

The Harmonics mode of the Analyzer provides detailed measurement information of harmonics of voltage, current, and power in the forms of bar graph, realtime numerical values and trends.

6.1 Bar Graph

Select the“Harmonics” icon in the main menu, the Bar Graph screen in the Harmonics mode appears as shown in Figure 6-1.

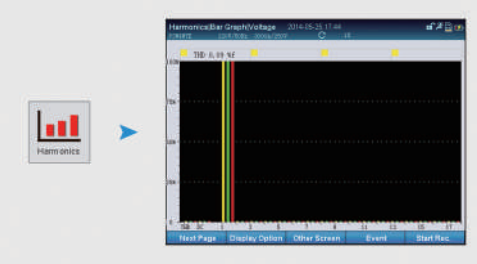


Figure 6-1. Bar Graph screen in the Harmonics mode

By pressing the “Display Option” soft key and selecting different display options as shown in Figure 6-2, the Bar Graph screen may display harmonic components of voltage, current, or power of the selected phases in desired units, along with DC components and total harmonic

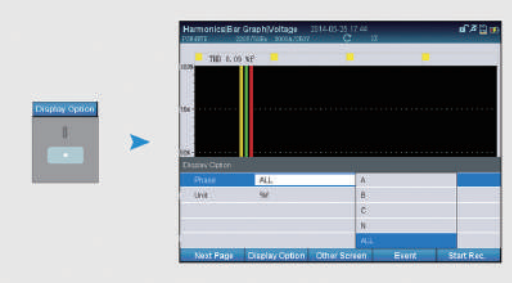


Figure 6-2. Display options in the Bar Graph screen

distortions(THD). The amplitude in the forms of real value and percentage, frequency, and phase angle of the harmonic component at the cursor position are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 6-1.

Key	Description
Next Page	Switch among harmonic components of voltage, current, and power.
Display Option	Select different display options. See description in this section.
Other Screen	Switch to the Realtime Value screen, or the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Harmonics mode measurement data. See section 6.5 for a detailed description.
	Zoom in and zoom out the bars vertically. See description in this section.
	Move the cursor left and right. See description in this section.

Table 6-1. Keys in the Bar Graph screen of the Harmonics mode

By default, the harmonic bars are adjusted automatically to fit into the display window vertically. Nevertheless, “Up” and “Down” arrow keys may be used to zoom in and zoom out the harmonic bars vertically to study them for details. To view the amplitude, frequency, and phase angle of a certain harmonic component, move the cursor to that harmonic bar by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones of the harmonic bar at the cursor’s position. When the cursor is moved to the leftmost or rightmost position of the display window, the display will be switched to show other harmonic component bars if not all bars are shown in the display window.

6.2 Realtime Numerical Values

Press the“Other Screen” soft key in the Bar Graph screen or in the Trend screen, and select “Realtime Value”, the Realtime Numerical Values screen in the Harmonics mode appears as shown in Figure 6-3.

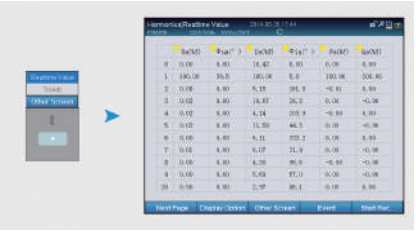


Figure 6-3. Realtime Numerical Values screen in the Harmonics mode

By pressing the “Display Option” soft key and selecting different display options as shown in Figure 6-4, the Realtime Numerical Values screen may show the realtime measurement values of harmonic components of voltage, current, or power of the selected phases in desired units in various display combinations.

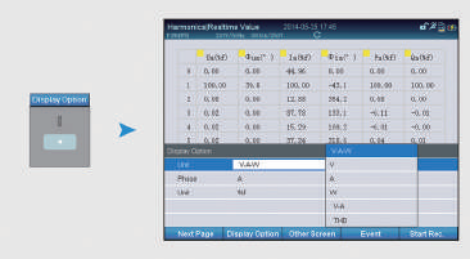


Figure 6-4. Display options in the Realtime Numerical Values screen

Soft keys in this screen are listed in Table 6-2.

Key	Description
Next Page	View other harmonic components if not all values are shown in the window.
Display Option	Select different display options. See description in this section.
Other Screen	Switch to the Bar Graph screen, or the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Harmonics mode measurement data. See section 6.5 for a detailed description.

Table 6-2. Keys in the Realtime Numerical Values screen of the Harmonics mode

6.3 Trend

Press the “Other Screen” soft key in the Bar Graph screen or in the Realtime Numerical Values screen, and select “Trend”, the Trend screen in the Harmonics mode appears as shown in Figure 6-5.

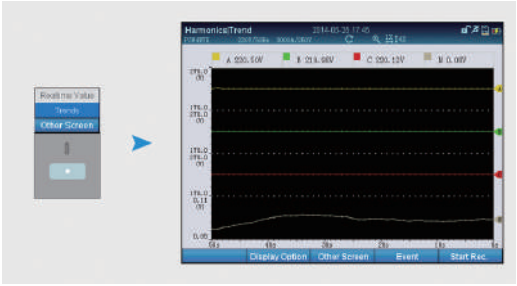


Figure 6-5. Trend screen in the Harmonics mode

By pressing the “Display Option” soft key and selecting different display options as shown in Figure 6-6, the Trend screen may display four measurement data trend charts of selected items in the display window. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 6-3.

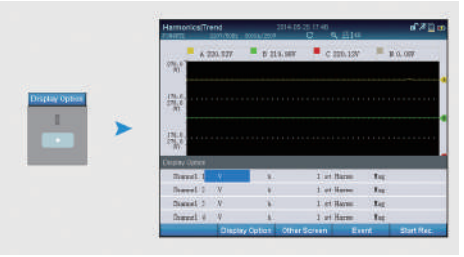


Figure 6-6. Display options in the Trend screen

Key	Description
Display Option	Select different display options. See description in this section.
Other Screen	Switch to the Realtime Value screen, or the Bar Graph screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Harmonics mode measurement data. See section 6.5 for a detailed description.
◄ ►	Zoom in and zoom out the trend charts horizontally. See description in this section.
▲ ▼	Zoom in and zoom out the trend charts vertically. See description in this section.
	Move the cursor left and right. See description in this section.

Table 6-3. Keys in the Trend screen of the Harmonics mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “ Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 6-7, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

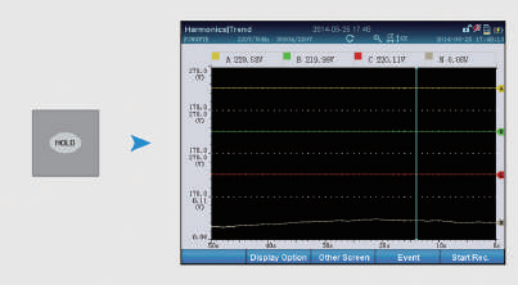


Figure 6-7. Cursor appearing when the Trend screen being in hold state

6.4 Events

Press the “Events” soft key in the Bar Graph, Realtime Numerical Values, or Trend screen, the Events screen in the Harmonics mode appears as shown in Figure 6-8. The screen lists all over-limit events of measured values. Soft keys in this screen are listed in Table 6-4.The event type and symbol descriptions are listed in Table 6-5.

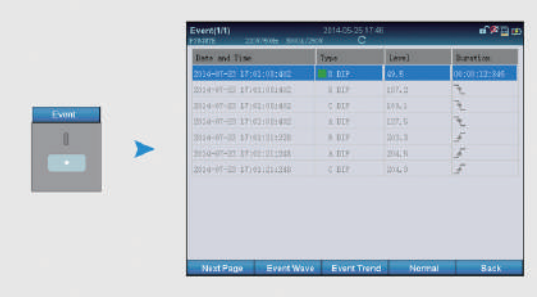


Figure 6-8. Events screen in the Harmonics mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.

Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Bar Graph, Realtime Numerical Values, or Trendscreen.
◂ ▸	View the previous page or next page.

Table 6-4. Keys in the Events screen of the Harmonics mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded

	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 6-5. Event type and symbol descriptionsin the Harmonics mode

6.5 File Management in the Harmonics Mode

In the Bar Graph, Realtime Numerical Values, or Trend screen of the Harmonics mode, measurement data to a file as shown in Figure 6-9. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the preset time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to

stop the recording of data before the preset time is up, or just to discard the recording file, as shown in Figure 6-10.

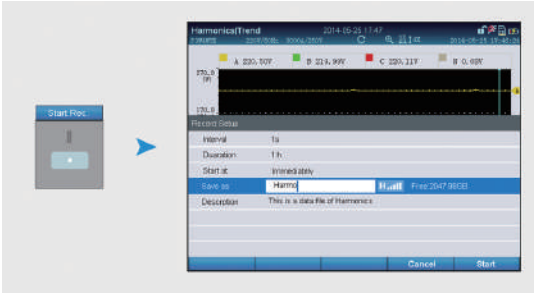


Figure 6-9. Recording the measurement data to a file in the Harmonics mode

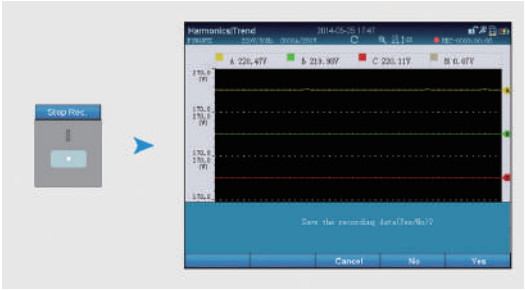


Figure 6-10. Stop recording data to a file in the Harmonics mode

In any screen of the Harmonics mode, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 6-11.

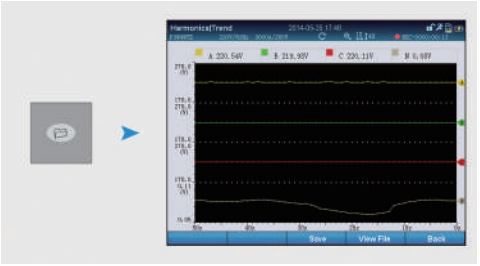


Figure 6-11. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 6-11, the screen changes to the picture as shown in Figure 6-12. The screen lists all the saved harmonic files with the ‘HAR’ extension name. Select a file, press “Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a harmonic file’s detailed information. Figure 6-13 shows a sample screen after the “View File” menu item is chosen. Note that the title

bar's color now turns to black-and-white to indicate that it is now in recall mode. Press "View Setups" soft key, or "" shortcut key now to view the setup files saved together with this selected harmonic file.

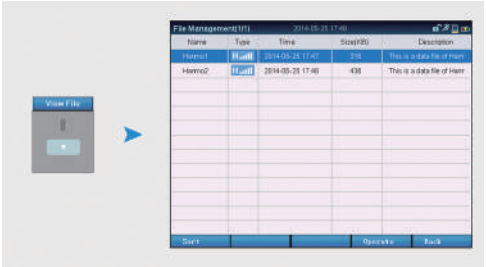


Figure 6-12. A sample screen after "View File" soft key being pressed

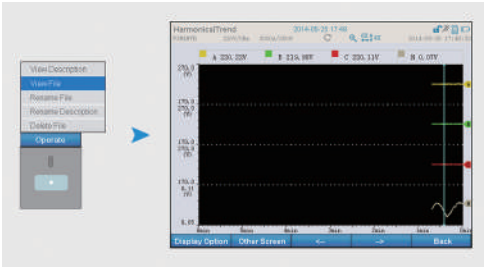


Figure 6-13. A sample screen after "View File" operation being chosen

In any screen of the Harmonics mode, press the "" shortcut key, a screenshot screen appears as shown in Figure 6-14. Type in screenshot file name and a file description, then press "Yes" soft key to confirm the operation, the current screen's screenshot is saved to the above screenshot file. A screenshot file has a 'SCR' extension name.

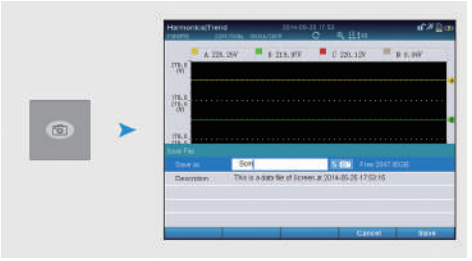


Figure 6-14. A Harmonics screen after "" shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the "" shortcut key. See Chapter 15 for detailed descriptions. A general description of file management could be found in Chapter 15.

6.6 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the "?" shortcut key. Figure 6-15 is a sample online help screen for a Harmonics screen.

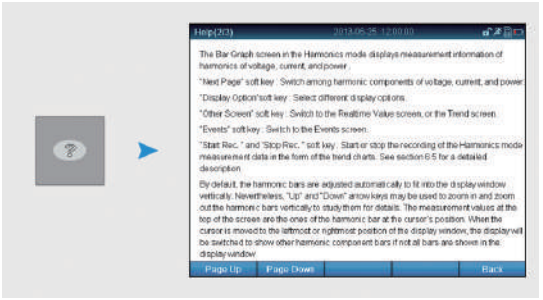


Figure 6-15. A sample online help screen for a Harmonics screen

6.7 Applications

Harmonics may adversely affect a lot of equipments used in a power system. For example, harmonics may cause transforms and motors to heat up; may cause capacitor banks to resonate; may interfere with telecommunications; and may impact the accuracy of watt hour meters. Harmonics may be produced by commercial and industrial loads that containing power electronics, such as fluorescent lighting, air conditioners, elevator drivers, power converters, arc devices, and so on. Harmonic currents usually flow from the harmonic-producing loads to the power system source. Thus, we can use the Analyzer to measure harmonic currents in each branch starting at the beginning of the circuit and trace the harmonics to the source.

7. Interharmonics Mode

The Interharmonics mode of the Analyzer provides detailed measurement information of interharmonics of voltage and current in the forms of bar graph, realtime numerical values and trends.

7.1 Bar Graph

Select the “Interharmonics” icon in the main menu, the Bar Graph screen in the Interharmonics mode appears as shown in Figure 7-1.

Figure 7-1. Bar Graph screen in the Interharmonics mode

By pressing the “Display Option” soft key and selecting different display options as shown in Figure 7-2, the Bar Graph screen may display interharmonic components of voltage and current of the selected phases in desired units.

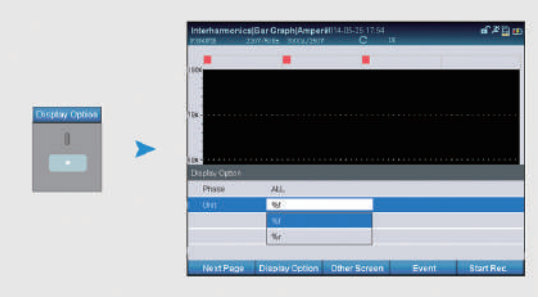


Figure 7-2. Display options in the Bar Graph screen

The amplitude in the forms of real value and percentage, and frequency of the interharmonic component at the cursor position are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 7-1.

Key	Description
Next Page	Switch between harmonic components of voltage and current.
Display Option	Select different display options. See description in this section.
Other Screen	Switch to the Realtime Value screen, or the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Interharmonics mode measurement data. See section 7.5 for a detailed description.
	Zoom in and zoom out the bars vertically. See description in this section.
	Move the cursor left and right. See description in this section.

Table 7-1. Keys in the Bar Graph screen of the Interharmonics mode

By default, the interharmonic bars are adjusted automatically to fit into the display window vertically. Nevertheless, “Up” and “Down” arrow keys may be used to zoom in and zoom out the harmonic bars vertically to study them for details. To view the amplitude and frequency of a certain interharmonic component, move the cursor to that interharmonic bar by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones of the interharmonic bar at the cursor’s position. When the cursor is moved to the leftmost or rightmost position of the display window, the display will be switched to show other interharmonic component bars if not all bars are shown in the display window.

7.2 Realtime Numerical Values

Press the“Other Screen” soft key in the Bar Graph screen or in the Trend screen, and select “Realtime Value”, the Realtime Numerical Values screen in the Interharmonics mode appears as shown in Figure 7-3.

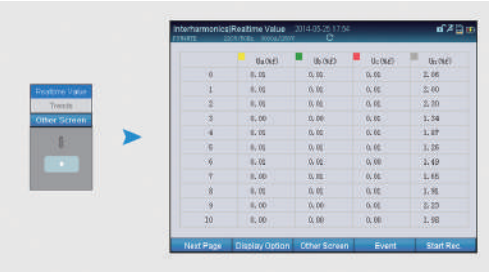


Figure 7-3. Realtime Numerical Values screen in the Interharmonics mode

By pressing the “Display Option” soft key and selecting different display options as shown in Figure 7-4, the Realtime Numerical Values screen may show the realtime measurement values of interharmonic components of voltage and current of the selected phases in desired units in various display combinations.

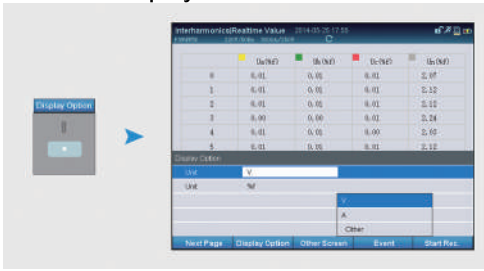


Figure7-4. Display options in the Realtime Numerical Values screen

Soft keys in this screen are listed in Table 7-2.

Key	Description
Next Page	View other interharmonic components if not all values are shown in the window.
Display Option	Select different display options. See description in this section.
Other Screen	Switch to the Bar Graph screen, or the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Interharmonics mode measurement data. See section 7.5 for a detailed description.

Table 7-2. Keys in the Realtime Numerical Values screen of the Interharmonics mode

7.3 Trend

Press the “Other Screen” soft key in the Bar Graph screen or in the Realtime Numerical Values screen, and select “Trend”, the Trend screen in the Harmonics mode appears as shown in Figure 7-5.

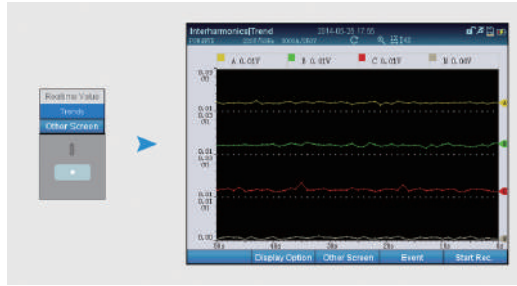


Figure 7-5. Trend screen in the Interharmonics mode

By pressing the“Display Option” soft key and selecting different display options as shown in Figure 7-6, the Trend screen may display four measurement data trend charts of selected items in the display window. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are listed in Table 7-3.

Figure 7-6. Display options in the Trend screen

Key	Description
Display Option	Select different display options. See description in this section.
Other Screen	Switch to the Realtime Value screen, or the Bar Graph screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Interharmonics mode measurement data. See section 7.5 for a detailed description.
	Zoom in and zoom out the trend charts horizontally. See description in this section.
	Zoom in and zoom out the trend charts vertically. See description in this section.
	Move the cursor left and right. See description in this section.

Table 7 -3. Keys in the Trend screen of the Harmonics mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 7-7, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

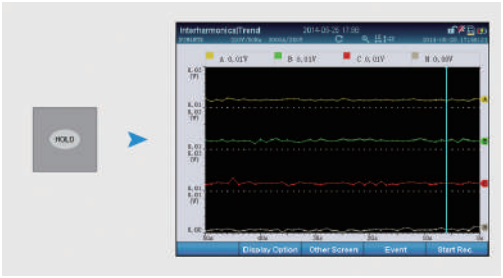


Figure 7-7. Cursor appearing when the Trend screen being in hold state

7.4 Events

Press the “Events” soft key in the Bar Graph, Realtime Numerical Values, or Trend screen, the Events screen in the Interharmonics mode appears as shown in Figure 7-8. The screen lists all over-limit events of measured values. Soft keys in this screen are listed in Table 7-4.The event type and symbol descriptions are listed in Table 7-5.

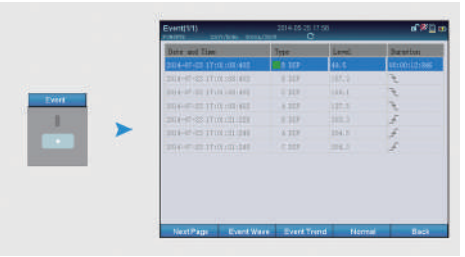


Figure 7-8. Events screen in the Interharmonics mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Bar Graph, Realtime Numerical Values, or Trend screen.
◄ ►	View the previous page or next page.

Table 7 -4. Keys in the Events screen of the Interharmonics mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption

SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 7-5. Event type and symbol descriptions in the Interharmonics mode

7.5 File Managementin the Interharmonics Mode

In the Bar Graph, Realtime Numerical Values, or Trend screen of the Interharmonics mode, one can press the “Start Rec./Stop Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 7-9. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the preset time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording of data before the preset time is up, or just to discard the recording file, as shown in Figure 7-10.

Figure 7-9. Recording the measurement data to a file in the Interharmonics mode

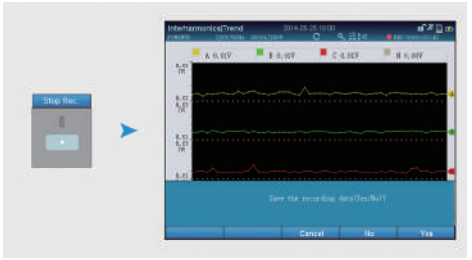


Figure 7-10. Stop recording data to a file in the Interharmonics mode

In any screen of the Interharmonics mode, press " " shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 7-11.

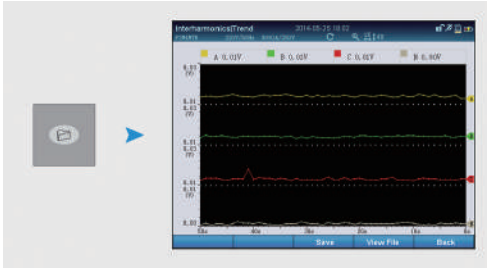


Figure 7-11. A sample screen after " " shortcut key being pressed

If "View File" soft key is pressed in the screen shown in Figure 7-11, the screen changes to the picture as shown in Figure 7-12. The screen lists all the saved interharmonic files with the 'IHM' extension name. Select a file, press " Operate" soft key to choose an operation. Among other choices, one can choose "View Description" or "View File" menu item to view an interharmonic file's detailed information. Figure 7-13 shows a sample screen after the "View File" menu item is chosen. Note that the title bar's color now turns to black-and-white to indicate that it is now in recall mode. Press "View Setups" soft key, or " " shortcut key now to view the setup files saved together with this selected interharmonic file.

Figure 7-12. A sample screen after "View File" soft key being pressed

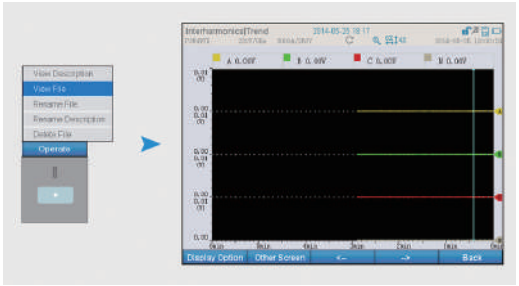


Figure 7-13. A sample screen after “View File” operation being chosen

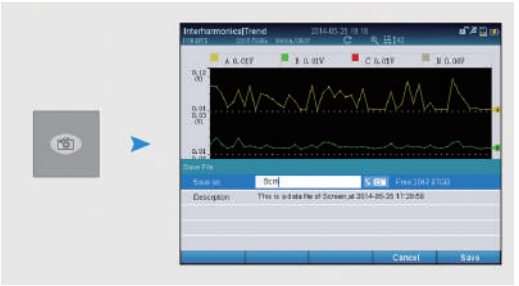


Figure 7-14. An Interharmonics screen after “ ” shortcut key being pressed

In any screen of the Interharmonics mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 7-14. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

7.6 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the " ? " shortcut key. Figure 7-15 is a sample online help screen for an Interharmonics screen.

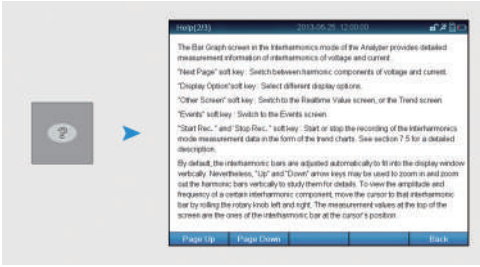


Figure 7-15. A sample online help screen for an Interharmonics screen

7.7 Applications

Adverse impacts of interharmonics are similar to those of harmonics, such as overloading, overheating and interference. Two main interharmonic sources are electronic power converters which may produce current distortion over a whole range of frequencies, and rapid current-changing loads such as induction furnaces and cycloconverters.

8. Power and Energy Mode

The Power and Energy mode of the Analyzer provides detailed measurement information of power and energy of facilities under test in the forms of realtime numerical values and trends.

8.1 Realtime Numerical Values

In the main menu, select the "Power & Energy" icon, or press the "Realtime Value" soft key in the Trend screen, the Realtime Numerical Values screen in the Power and Energy mode appears as shown in Figure 8-1. The screen displays all the important power and energy measurement parameters as listed in Table 8-1. The first page of this screen displays the power parameters, and second page

displays the energy parameters.

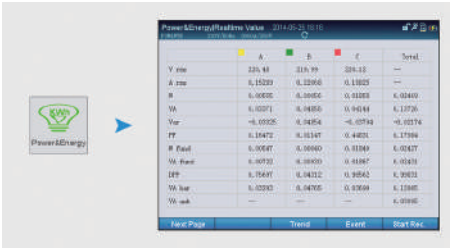


Figure 8-1. Realtime Numerical Values screen in the Power and Energy mode

Measurement Parameter	Description
V rms	Voltage RMS value
A rms	Current RMS value
W	Real power
VA	Apparent power
var	Reactive power
PF	Power factor
W fund	Fundamental real power
VA fund	Fundamental apparent power
DPF	Displacement power factor
VA har	Harmonic power
VA unb	Unbalance power
Wh fund	Fundamental active energy

Table 8-1. Measurement parameters in the Realtime Numerical Values screen

Note that the energy measurement will not begin until " Start Rec." soft key is pressed, and the corresponding items are set. This means that the "Start Rec./Stop Rec." ping-pong soft key controls both the start/stop recording of the measurement values, and the start/stop of the energy measurement. Soft keys in this screen are listed in Table 8-2.

Key	Description
Next Page	Switch between the first page of the power parameters, and second page of the energy parameters.
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Power and Energy mode measurement data, and at the same time start or stop the energy measurement. See section 8.4 for a detailed description.

Table 8-2. Keys in the Realtime Numerical Values screen of the Power and Energy mode

8.2 Trend

Press the "Trends" soft key in the Realtime Numerical Values screen, the Trend screen in the Power and Energy mode appears as shown in Figure 8-2. The screen displays the first four measurement data trend charts of all the power measurement data in the display window, but the energy

measurement data will not be displayed in the trend mode. “Page Up” and “Page Down” soft keys may be used to view other power measurement data trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 8-3.

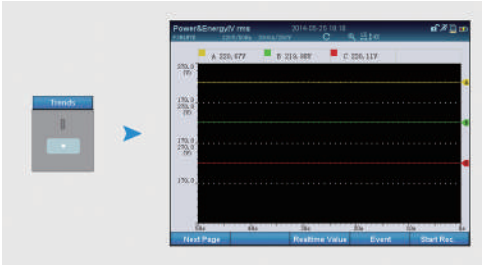


Figure 8-2. Trend screen in the Power and Energy mode

Key	Description
Page Up	View other measurement data trend charts.
Page Down	View other measurement data trend charts.
Realtime Value	Switch to the Realtime Numerical Values screen.
Event	Switch to the Events screen.

Start Rec. Stop Rec.	Start or stop the recording of the Power and Energy mode measurement data, and at the same time start or stop the energy measurement. See section 8.4 for a detailed description.
	Zoom in and zoom out the trend charts horizontally. See description in this section..
	Zoom in and zoom out the waveforms vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 8-3. Keys in the Trend screen of the Power and Energy mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “HOLD” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 8-3, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

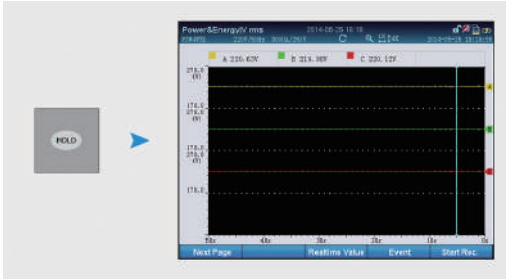


Figure 8-3. Cursor appearing when the Trend screen being in hold state

8.3 Events

Press the “Events” soft key in the Realtime Numerical Values, or Trends screen, the Events screen in the Power and Energy mode appears as shown in Figure 8-4. The screen lists all over-limit events of measured values. Soft keys in this screen are listed in Table 8-4.The event type and symbol descriptions are listed in Table 8-5.

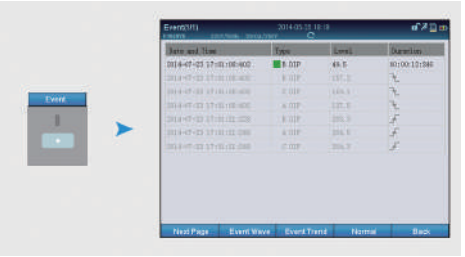


Figure 8-4. Events screen in the Power and Energy mode

Key	Description
Next Page	View other over-limit events.
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Numerical Values, or Trends screen.

Table 8-4. Keys in the Events screen of the Power and Energy mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 8-5. Event type and symbol descriptions in the Power and Energy mode

8.4 File Management in the Power and Energy Mode

In the Realtime Numerical Values screen, or Trends screen of the Power and Energy mode, one can press the “Start Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 8-5. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure 8-6. Note that the “ Start Rec./Stop Rec.” ping-pong soft key also controls the start/stop of the energy measurement at the same time.

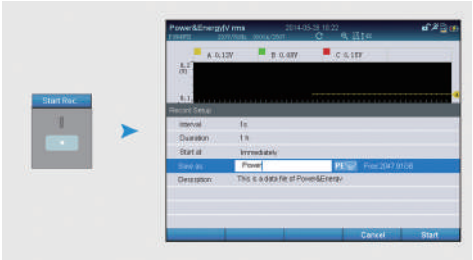


Figure 8-5. Recording the measurement data to a file in the Power and Energy mode

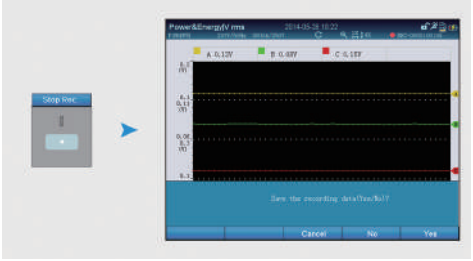


Figure 8-6. Stop recording data to a file in the Power and Energy mode

In any screen of the Power and Energy mode, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 8-7.

Figure 8-7. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 8-7, the screen changes to the picture as shown in Figure 8-8. The screen lists all the saved Power and Energy files with the ‘PEM’ extension name. Select a file, press “Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “ View File” menu item to view a Power and Energy file’s detailed information. Figure 8-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files

saved together with this selected Power and Energy file.

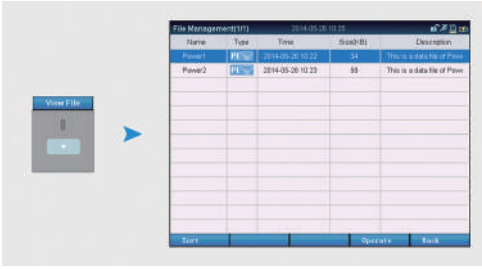


Figure 8-8. A sample screen after “View File” soft key being pressed

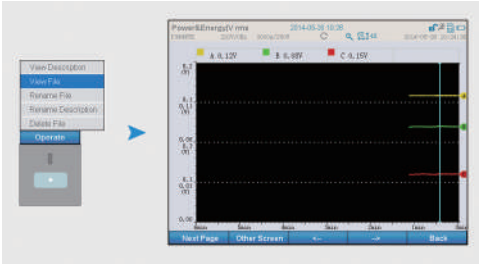


Figure 8-9. A sample screen after “View File” operation being chosen

In any screen of the Power and Energy mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 8-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

Figure 8-10. A Power and Energy screen after “ ” shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

8.5 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the "?" shortcut key. Figure 8-11 is a sample online help screen for a Power and Energy screen.

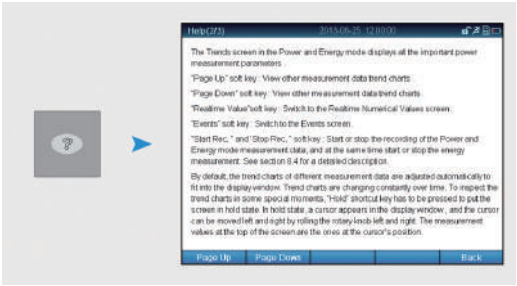


Figure 8-11. A sample online help screen for a Power and Energy screen

8.6 Applications

The Power and Energy mode of the analyzer may be used to study load characteristics, and survey power and energy usages. Load studies may help to discover how much energy an equipment is consuming when it is operating at a specific capacity. Load studies can also identify situations where the load may be exceeding the allowable capacity of the circuit. Power and energy surveys may help the user to manage energy costs and identify savings opportunities. By logging power usage at the main service entrance and then at large loads and secondary supplies, the user can find how much power is being used when, by what, and at what hourly cost, and adjust power usage modes accordingly. Power and energy surveys may help the user to check for the accuracy of electrical bills. By comparing the energy readings of the Analyzer and the installed watt hour meter, the user can find what is being billed versus what is actually used. A significant deviation between the amount charged for electricity usage and the Analyzer data would signal the need to investigate the watt hour meter setup.

9. Unbalance Mode

The Unbalance mode of the Analyzer provides the information of phase relations of measured voltages and currents in the forms of phasors, realtime measurement values, and trends.

9.1 Phasors

Select the “Unbalance” icon in the main menu, the Phasors screen in the Unbalance mode appears as shown in Figure 9-1. The screen displays up to three phase voltage and current phasors with Ua(V-L1) as the reference phasor, together with realtime voltage, current, frequency, power factor, active power, and reactive power values. Soft keys in this screen are listed in Table 9-1.

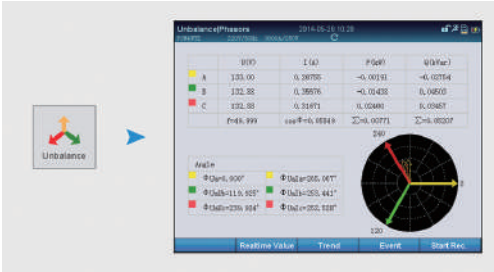


Figure 9-1. Phasors screen in the Unbalance mode

Key	Description
Realtime Value	Switch to the Realtime Numerical Values screen.
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Scope mode measurementdata. See section 9.5 for a detailed description.

Table 9-1. Keys in the Phasor screen of the Unbalance mode

9.2 Realtime Numerical Values

Press the “Realtime Value” soft key in the Phasors screen or in the Trends screen, the Realtime Numerical Values screen in the Unbalance mode appears as shown in Figure 9-2. The screen displays fundamental phase voltages, fundamental phase currents, phase angles, and positive, negative and zero sequence components of measured voltages and currents. The frequency of the power system under test is also displayed. Soft keys in this screen are listed in Table 9-2.

Figure 9-2. Realtime Numerical Values screen in the Unbalance mode

Key	Description
Phasors	Switch to the Phasors screen.
Trends	Switch to the Trend$_S$ screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Unbalance mode measurement data. See section 9.5 for a detailed description.

Table 9-2. Keys in the Realtime Numerical Values screen of the VAH mode

9.3 Trends

Press the “Trends” soft key in the Phasors screen or in the Realtime Numerical Values screen, the Trend screen in the Unbalance mode appears as shown in Figure 9-3. The screen displays the first four measurement data trend charts of all measurement data in the display window, and “Next Page” soft key may be pressed repeatedly to view the remaining measurement data trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 9-3.

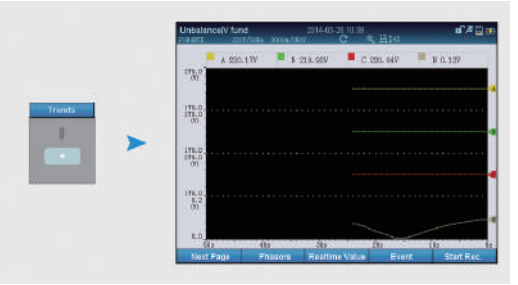


Figure 9-3. Trend screen in the Unbalance mode

Key	Description
Next Page	View other measurement data trend charts.
Phasors	Switch to the Phasors screen.
Realtime Value	Switch to the Realtime Numerical Values screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Unbalance mode measurement data. See section 9.5 for a detailed description.
◄ ►	Zoom in and zoom out the trend charts horizontally. See description in this section.
▲ ▼	Zoom in and zoom out the trend charts vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 9-3. Keys in the Trend screen of the Unbalance mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “ Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “HOLD” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 9-4, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

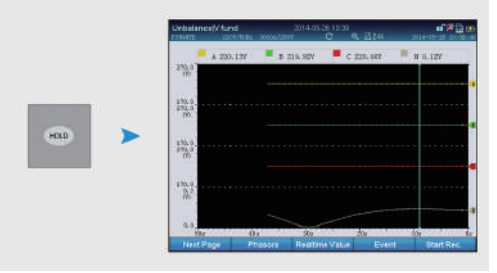


Figure 9-4. Cursor appearing when the Trend screen being in hold state

9.4 Events

Press the “Events” soft key in the Realtime Numerical Values, Phasors, or Trends screen, the Events screen in the Unbalance mode appears as shown in Figure 9-5. The

screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 9-4. The event type and symbol descriptions are listed in Table 9-5.

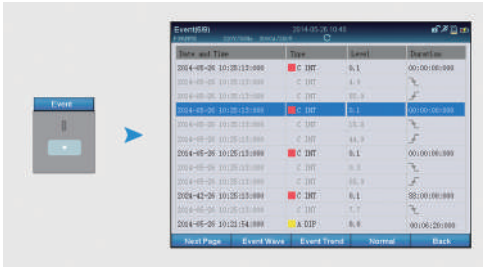


Figure 9-5. Events screen in the Unbalance mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Numerical Values, Phasors, or Trends screen.
◂ ▸	View the previous page or next page.

Table 9-4. Keys in the Events screen of the Unbalance mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards

	Change downwards

Table 9-5. Event type and symbol descriptions in the Unbalance mode

9.5 File Management in the Unbalance Mode

In the Realtime Numerical Values, Phasors, or Trends screen of the Unbalance mode, one can press the “Start Rec./Stop Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 9-6. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure 9-7.

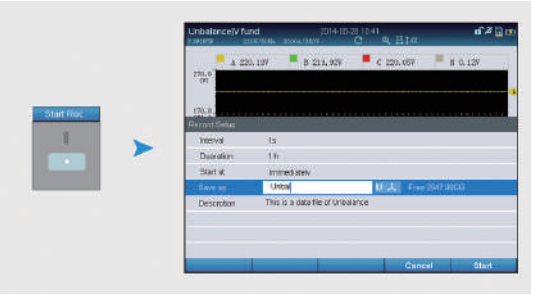


Figure 9-6. Recording the measurement data to a file in the Unbalance mode

Figure 9-7. Stop recording data to a file in the Unbalance mode

In any screen of the Unbalance mode, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 9-8.

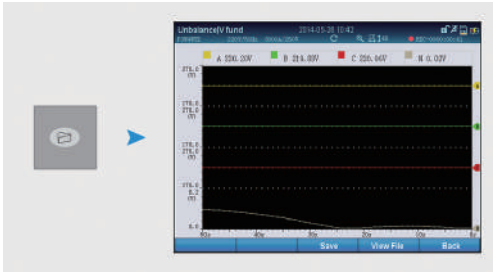


Figure 9-8. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 9-8, the screen changes to the picture as shown in Figure 9-9. The screen lists all the saved Unbalance files with the ‘UBL’ extension name. Select a file, press “ Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view an Unbalance file’s detailed information. Figure 9-10 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected Unbalance file.

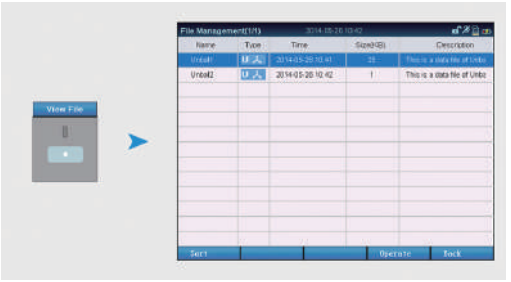


Figure 9-9. A sample screen after “View File” soft key being pressed

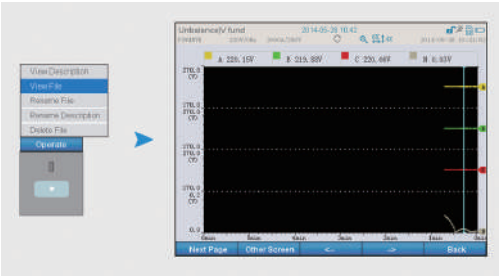


Figure 9-10. A sample screen after “View File” operation being chosen

In any screen of the Unbalance mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 9-11. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

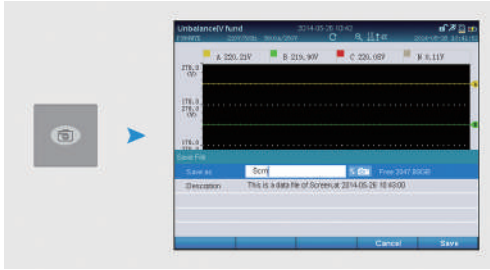


Figure 9-11. An Unbalance screen after “ ” shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

9.6 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ” shortcut key. Figure 9-12 is a sample online help screen for an Unbalance screen.

Figure 9-12. A sample online help screen for an Unbalance screen

9.7 Applications

An unbalance is a condition in a three-phase system in which rms values or phase angles of voltages or currents are not equal. The degree of unbalance is expressed by the ratios of the negative and zero sequence components

to the positive sequence component of the voltage or current. The primary source of voltage unbalances of less than 2 percent is single-phase loads on a three-phase circuit. Voltage unbalance can also be the result of blown fuses in one phase of a three-phase capacitor bank. Severe voltage unbalance of greater than five percent can result from single-phasing conditions. A voltage unbalance can cause a reverse-rotating airgap field in induction machines, and thus increasing heat loss and temperature rise. If the voltage or current unbalance is too high, the user should try other measurement modes of the Analyzer to further investigate the power system under test.

10. Flicker Mode

Flicker is the visual effect produced by the variation in the electrical voltage. The Flicker mode of the Analyzer provides the flicker measurement parameters in the forms of realtime measurement values, and trends.

10.1 Realtime Numerical Values

Select the “Flicker” icon in the main menu, the Realtime Numerical Values screen in the Flicker mode appears as shown in Figure 10-1. The screen displays instantaneous flicker Pinst, short term severity Pst(1min) measured over 1 min, short term severity Pst measured over 10 min, and a long term severity Plt measured over 2 hours. The voltages, currents, and frequency of the power system under test are also displayed. Soft keys in this screen are listed in Table 10-1.

Figure 10-1. Realtime Numerical Values screen in the Flicker mode

Key	Description
Trends	Switch to the Trends screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Flicker mode measurement data. See section 10.4 for a detailed description.

Table 10-1. Keys in the Realtime Numerical Values screen of the Flicker mode

10.2 Trends

Press the “Trends” soft key in the Realtime Numerical Values screen, the Trend screen in the Flicker mode appears as shown in Figure 10-2. The screen displays the first four measurement data trend charts of all measurement data in the display window, and “Next Page” soft key may be pressed repeatedly to view the remaining measurement data trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 10-2.

Figure 10-2. Trends screen in the Flicker mode

Key	Description
Page Up	View other measurement data trend charts.
Page Down	View other measurement data trend charts.
Realtime Value	Switch to the Realtime Numerical Values screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Flicker mode measurement data. See section 10.4 for a detailed description
	Zoom in and zoom out the trend charts horizontally. See description in this section.
	Zoom in and zoom out the trend charts vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 10-2. Keys in the Trend screen of the Flicker mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 10-3, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

Figure 10-3. Cursor appearing when the Trends screen being in hold state

10.3 Events

Press the “Events” soft key in the Realtime Numerical Values, or Trends screen, the Events screen in the Flicker mode appears as shown in Figure 10-4. The screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 10-3.The event type and symbol descriptions are listed in Table 10-4.

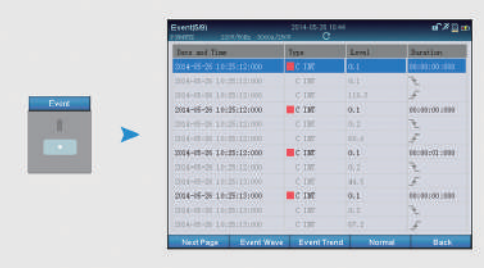


Figure 10-4. Events screen in the Flicker mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal Detail	Switch between normal and detailed view of the over-limit events.

Back	Back to the Realtime Numerical Values, or Trends screen.
◄ ►	View the previous page or next page.

Table 10-3. Keys in the Events screen of the Fliker mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 10-4. Event type and symbol descriptions in the Fliker mode

10.4 File Management in the Flicker Mode

In the Realtime Numerical Values, or Trends screen of the Flicker mode, one can press the “Start Rec./Stop Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 10-5. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording

of data before the predefined time is up, or just to discard the recording file, as shown in Figure 10-6.

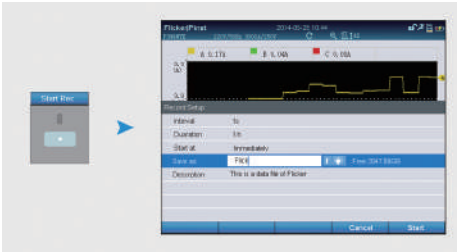


Figure 10-5. Recording the measurement data to a file in the Flicker mode

Figure 10-6. Stop recording data to a file in the Flicker mode

In any screen of the Flicker mode, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 10-7.

Figure 10-7. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 10-7, the screen changes to the picture as shown in Figure 10-8. The screen lists all the saved Flicker files with the ‘FLK’ extension name. Select a file, press “ Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a Flicker file’s detailed information. Figure 10-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected Flicker file.

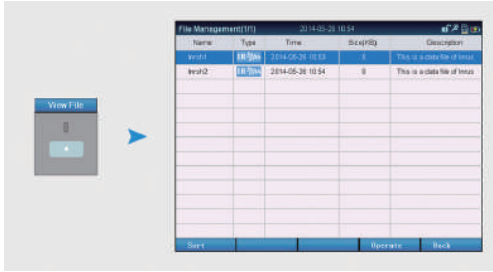


Figure 10-8. A sample screen after “View File” soft key being pressed

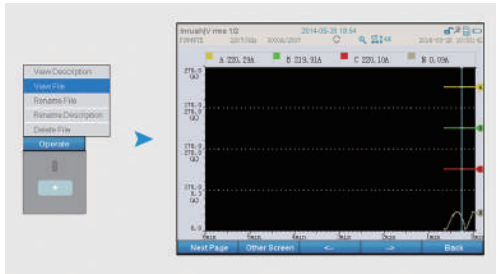


Figure 10-9. A sample screen after “View File” operation being chosen

In any screen of the Flicker mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 10-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

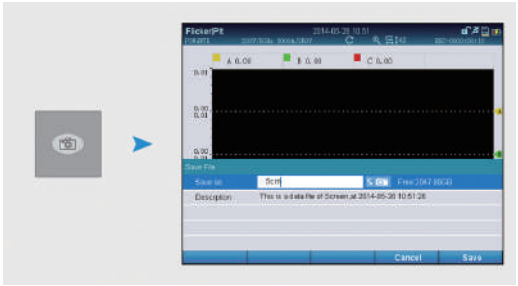


Figure 10-10. A Flicker screen after “ ” shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

10.5 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ? ” shortcut key. Figure 10-11 is a sample online help screen for a Flicker screen.

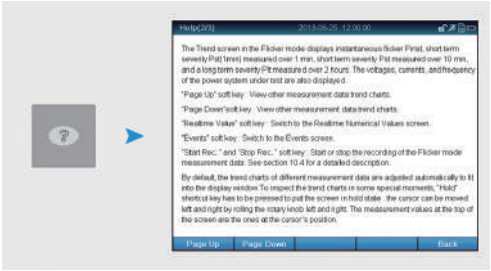


Figure 10-11. A sample online help screen for a Flicker screen

10.6 Applications

The root cause of the flicker is that the power system is too weak to support the loads. A common load that can often cause flicker is an electric arc furnace, which is nonlinear, time-varying load that often cause large voltage fluctuations. Large induction machines under going start -up, or widely varying load torque change are also known causes of flicker. If there are interferences when investigating flicker, the user should use longer measurement periods such as Pst and Plt to eliminate these random voltage changes.

11. Inrush Mode

The Inrush mode of the Analyzer provides a means to capture sudden big current changes, that is, inrush currents.

11.1 Trends

Select the “Inrush” icon in the main menu, the Trends screen in the Inrush mode appears as shown in Figure 11-1. The screen displays the four current rms value trend charts in the display window, and “Next Page” soft key may be pressed to view the four voltage rms value trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the

screen are also shown at the top of the screen. “Start Rec./Stop Rec.”ping-pong soft key may be used to record the inrush currents. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 11-1.

Figure 11-1. Trends screen in the Inrush mode

Key	Description
Next Page	View other measurement data trend charts.
Realtime Value	Switch to the Realtime Value screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Irush mode measurement data. See section 11.4 for a detailed description.
	Zoom in and zoom out the trend charts vertically. See description in this section.
	When in hold state, move the cursor left and right. See description in this section.

Table 11-1. Keys in the Trends screen of the Irush mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “HOLD” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 11-2, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

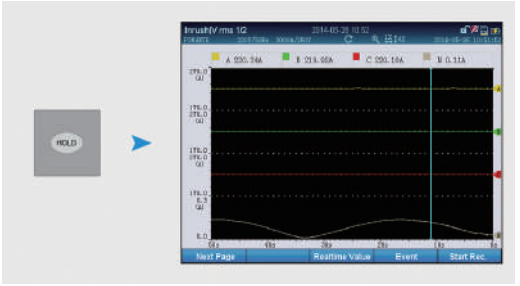


Figure 11-2. Cursor appearing when the Trends screen being in hold state

11.2 Realtime Numerical Values

Press the “Realtime Values” soft key in the Trends screen, the Realtime Numerical Values screen in the Inrush mode appears as shown in Figure 11-3. The screen displays current half cycle rms values and voltage half cycle rms values, The frequency of the power system under test is also displayed. Soft keys in this screen are listed in Table 11-2.

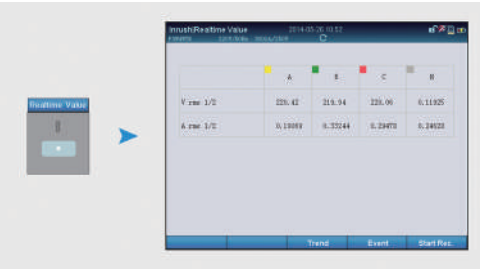


Figure 11-3. Realtime Numerical Values screen in the Inrush mode

Key	Description
Trends	Switch to the Trends screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Inrush mode measurement data. See section 11.4 for a detailed description.

Table 11-2. Keys in the Realtime Numerical Values screen of the Inrush mode

11.3 Events

Press the “Events” soft key in the Trends or Realtime Values screen, the Events screen in the Inrush mode

appears as shown in Figure 11-4. The screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 11-3.The event type and symbol descriptions are listed in Table 11-4.

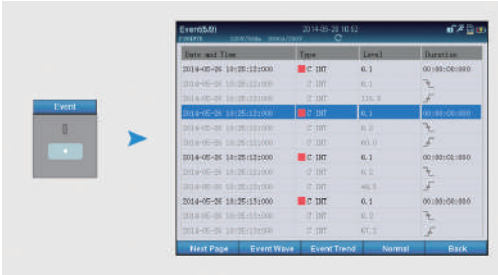


Figure 11-4. Events screen in the Inrush mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Values, or Trend screen.
◂ ▸	View the previous page or next page

Table 11-3. Keys in the Events screen of the Inrush mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards

	Change downwards

Table 11-4. Event type and symbol descriptionsin the Inrush mode

11.4 File Management in the Inrush Mode

In the Realtime Numerical Values screen, or Trend screen of the Inrush mode, one can press the “Start Rec./Stop Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 11-5. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press the “Stop Rec.” soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure11-6.

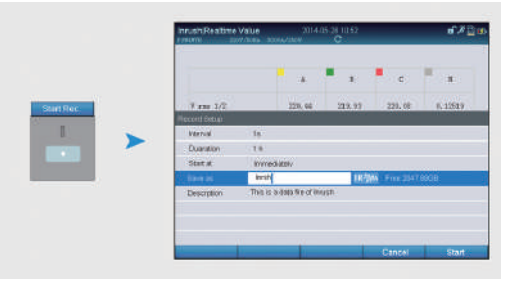


Figure 11-5. Recording the measurement data to a file in the Inrush mode

Figure 11-6. Stop recording data to a file in the Inrush mode

In any screen of the Inrush mode, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 11-7.

Figure 11-7. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 11-7, the screen changes to the picture as shown in Figure 11-8. The screen lists all the saved Inrush files with the ‘IRS’ extension name. Select a file, press “ Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view an Inrush file’s detailed information. Figure 11-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected Dips and Swells file.

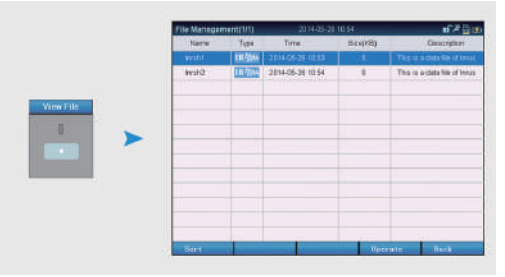


Figure 11-8. A sample screen after “View File” soft key being pressed

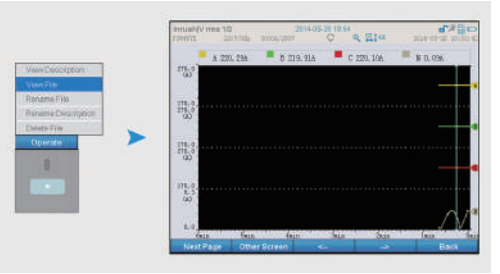


Figure 11-9. A sample screen after “View File” operation being chosen

In any screen of the Inrush mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 11-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘ SCR’ extension name.

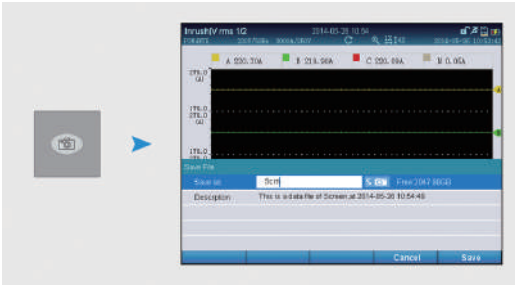


Figure 11-10. An Inrush screen after “ ” shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

11.5 Online Help

To better help users to operate the Analyzer, online help is prov ided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ” shortcut key. Figure 11-11 is a sample online help screen for an Inrush screen.

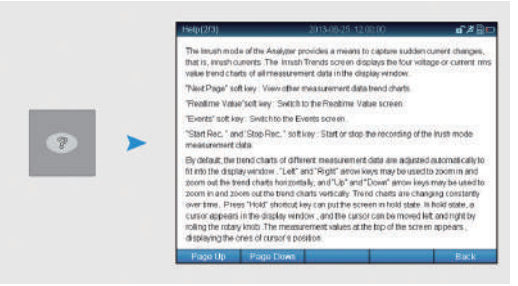


Figure 11-11. A sample online help screen for an Inrush screen

11.6 Applications

Inrush current is the maximum, instantaneous input current drawn by an electrical device when first turned on. For example, incandescent light bulbs have high inrush currents until their filaments warm up and their

resistance increases. Alternating current electric motors and transformers may draw several times their normal full-load current when first energized, for a few cycles of the input waveform. Power converters also often have inrush currents much higher than their steady state currents, due to the charging current of the input capacitance.
The selection of over-current protection devices such as fuses and circuit breakers is made more complicated when high inrush currents must be tolerated. The over-current protection must react quickly to overload or short circuit but must not interrupt the circuit when the inrush current, which is usually harmless, flows. Therefore, it is helpful to use the Analyzer to measure the inrush currents to verify if the over-current protection devices could withstand the inrush currents to prevent incorrect operations of protection, such as unexpected circuit breaker trips and blown fuses.
Inrush currents may also cause voltage instabilities. So use the Analyzer to monitor the system voltages the same time when inrush currents occur.

12. Power Quality Profile Mode

The measurement modes of the Analyzer described in the previous chapters provide detailed information of a certain power quality aspect of the power system under test. Yet, sometimes we want to see the overall power quality aspects of the system. The Power Quality Profile mode of the Analyzer provides this kind of information.

12.1 Overview Screen

Press the “  ” shortcut key, or select the “Power Quality Profile” icon in the main menu, the Overview screen in the Power Quality mode appears as shown in Figure 12-1. Unlike in other measurement modes, one needs to fill in all the necessary recording setup information and press the “Start” soft key to start the Power Quality Profile measurement and recording as shown in Figure 12-2.

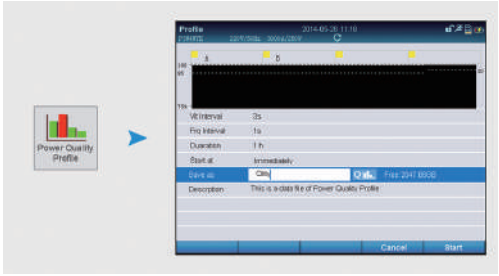


Figure 12-1. Overview screen in the Power Quality Profile mode

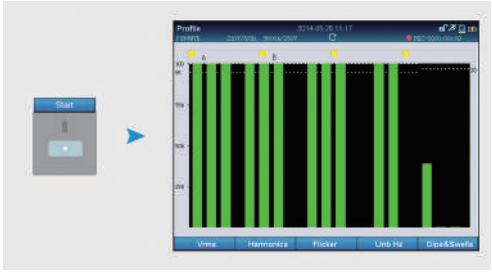


Figure 12-2. Overview screen after measurement start

There are five groups of measurement parameters shown in bar graphs, namely, three phase RMS voltages, three phase Harmonics, three phase Flicker, Dips/Interruptions/ Swells, and Unbalance/Frequency. The cursor can be moved left and right to a particular bar by the ones at the cursor's position. The length of a bar decreases when the related parameter is further away from its nominal value, and a bar turns from green to red when a predefined limit is violated. The bars representing three phase RMS voltages, three phase Harmonics, three phase Flicker, and Unbalance/Frequency have a wide base indicating adjustable limits and a narrow top indicating a fixed 100% limit. The bars representing Dips/Interruptions/Swells are only narrow ones and indicate the number of limit violations that occurred during the observation period.

12.2 Detailed Measurement Information

Detailed measurement information is available for each measurement parameter group by pressing the corresponding soft key below the group bars. The soft keys are listed in Table 12-1.

Key	Description
Vrms	Detailed measurement information is available in the form of realtime measurement values, trends and events.
Harmonics	Detailed measurement information is available in the form of bar graph, realtime measurement values, trends and events table.
Flicker	Detailed measurement information is available in the form of realtime measurement values, trends and events.
Unb Hz	Detailed measurement information is available in the form of realtime measurement values, trends and events.
Dips&Swells	Detailed measurement information is available in the form of realtime measurement values, trends and events.

Table 12-1. Soft keys in the overview screen of the Power Quality Profile mode

The follow parts of this section describe the detailed measurement information of three phase RMS voltages as an example.

12.2.1 Trends

Press the “Vrms” soft keys in the overview screen, the Three Phase RMS Voltage Trends screen in the Power Quality Profile mode appears as shown in Figure 12-3. The screen displays the four voltage RMS value trend charts in the display window. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 12-2.

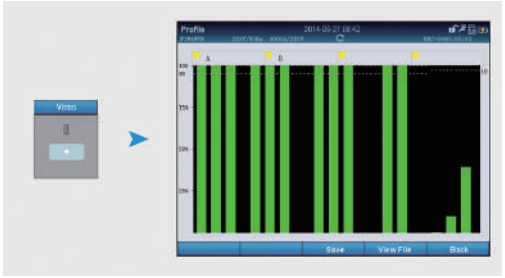


Figure 12-3. Three Phase RMS Voltage Trends screen in the Power Quality Profile mode

Key	Description
Realtime Value	Switch to the Realtime Value screen.
Event	Switch to the Events screen.
Back	Back to the Overview screen
◄ ►	Zoom in and zoom out the trend charts horizontally. See description in this section.
▲ ▼	Zoom in and zoom out the trend charts vertically. See description in this section.

	When in hold state, move the cursor left and right. See description in this section.

Table 12-2. Keys in the Three Phase RMS Voltage Trends screen

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 12-4, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

Figure 12-4. Cursor appearing when the Trends screen being in hold state

12.2.2 Realtime Numerical Values

Press the “Realtime Values” soft key in the Three Phase RMS Voltage Trends screen, the Realtime Numerical Values screen in the Power Quality Profile mode appears as shown in Figure 12-5. The screen displays voltage RMS values, and their deviations from nominal values. Soft keys in this screen are listed in Table 12-3.

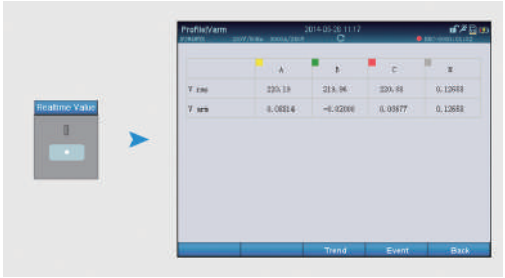


Figure 12-5. Three Phase RMS Voltage Realtime Numerical Values screen

Key	Description
Trends	Switch to the Trends screen.
Event	Switch to the Events screen.
Back	Back to the Overview screen

Table 12-3. Keys in the Three Phase RMS Voltage Realtime Numerical Values screen

12.2.3 Events

Press the “Events” soft key in the Three Phase RMS Voltage Trends or Realtime Values screen, the Three Phase RMS Voltage Events screen in the Power Quality Profile mode appears as shown in Figure 12-6. The screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 12-4.The event type and symbol descriptions are listed in Table 12-5.

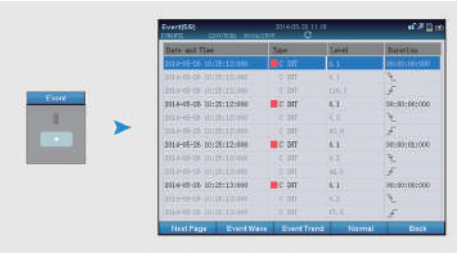


Figure 12-6. Three Phase RMS Voltage Events screen

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Values, or Trends screen.
◂ ▸	View the previous page or next page

Table12-4. Keys in the Three Phase RMS Voltage Events screen

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 12-5. Three Phase RMS Voltage Event type and symbol descriptions

12.3 File Management in the Power Quality Profile Mode

As described in section 12.1 of this chapter, one needs to first fill in all the necessary recording setup information and press the “Start” soft key to start the Power Quality Profile measurement and recording. After measurement and recording started, one may stop the recording of data before the preset time is up, or just to discard the recording file by powering off the Analyzer.

In any screen of the Power Quality Profile mode, press “  ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 12-7.

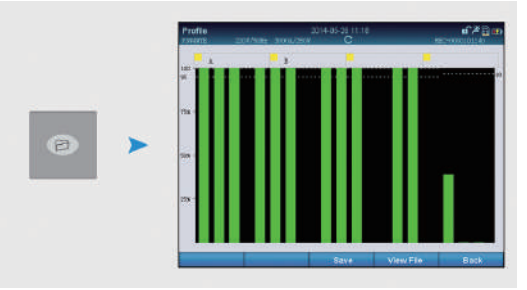


Figure 12-7. A sample screen after ‘ ’ shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 12-7, the screen changes to the picture as shown in Figure 12-8. The screen lists all the saved Power Quality Profile files with the ‘QLT’ extension name. Select a file, press “Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a Power Quality Profile file’s detailed information. Figure 12-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected Power Quality Profile file.

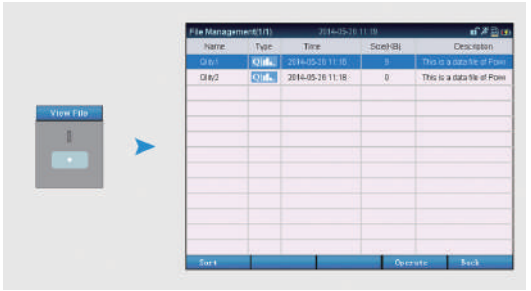


Figure 12-8. A sample screen after “View File” soft key being pressed

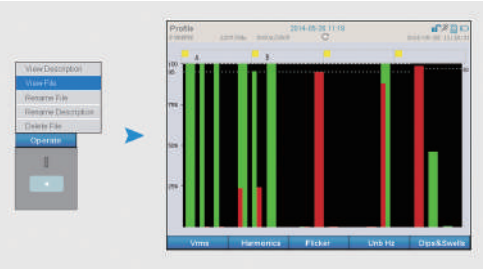


Figure 12-9. A sample screen after “View File” operation being chosen

In any screen of the Power Quality Profile mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 12-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

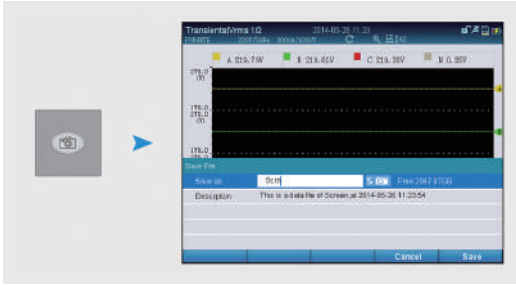


Figure 12-10. A Power Quality Profile screen after “ ” shortcut key pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

12.4 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ” shortcut key. Figure 12-11 is a sample online help screen for a Power Quality Profile screen.

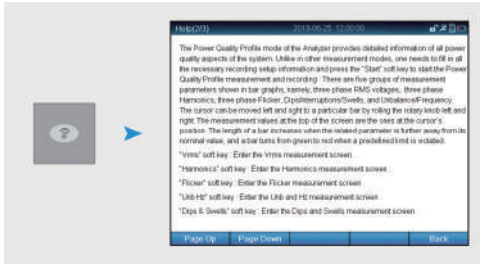


Figure 12-11. A sample online help screen for a Power Quality Profile screen

12.5 Applications

Power Quality Profile is usually done during a long observation period. Minimum duration of the measurement is two hours, and a usual measurement period is one week. The main overview screen of the Power Quality Profile mode may provide the user an overall impression of power quality aspects of the power system under test. Detailed measurement information is available for each measurement parameter group by pressing the

corresponding soft key below the group bars in the main overview screen. Or the user may switch to other measurement modes of the Analyzer described in the previous chapters to obtain even more detailed information of a certain power quality aspect for troubleshooting.

13. Transients Mode

Transients are very fast voltage changes. The Transients mode of the Analyzer may help to capture these kinds of sudden voltage changes.

13.1 Trends

Select the “Transients” icon in the main menu, the Trends screen in the Transients mode appears as shown in Figure 13-1. The screen displays the four voltage rms value trend charts of all measurement data in the display window, and “ Next Page” soft key may be pressed to view the four current rms value trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. “Start Rec./Stop Rec.” ping-pong sof key may be used to record the sudden voltage changes. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 13-1.

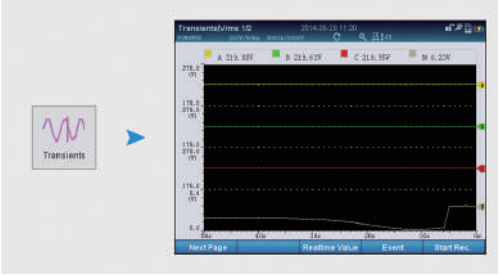


Figure 13-1. Trends screen in the Transients mode

Key	Description
Next Page	View other measurement data trend charts.
Realtime Value	Switch to the Realtime Value screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Transients mode measurement data. See section 13.4 for a detailed description.
◂ ▸	Zoom in and zoom out the trend charts horizontally. See description in this section.
▴ ▾	Zoom in and zoom out the trend charts vertically. See description in this section.

	When in hold state, move the cursor left and right. See description in this section.

Table 13-1. Keys in the Trends screen of the Transients mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “ HOLD ” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 13-2, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

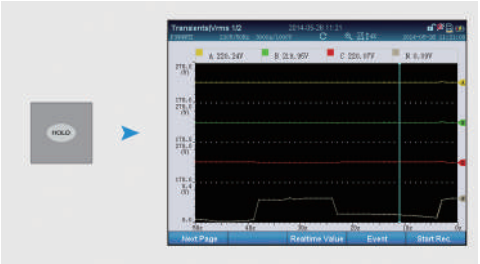


Figure 13-2. Cursor appearing when the Trends screen being in hold state

13.2 Realtime Numerical Values

Press the “Realtime Values” soft key in the Trends screen, the Realtime Numerical Values screen in the Transients mode appears as shown in Figure 13-3. The screen displays voltage half cycle rms values and current half cycle rms values, The frequency of the power system under test is also displayed. Soft keys in this screen are listed in Table 13-2.

Figure 13-3. Realtime Numerical Values screen in the Transients mode

Key	Description
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Dips and Swells mode measurement data. See section 13.4 for a detailed description.

Table 13-2. Keys in the Realtime Numerical Values screen of the Transients mode

13.3 Events

Press the “Events” soft key in the Trends or Realtime Values screen, the Events screen in the Transients mode appears as shown in Figure 13-4. The screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 13-3.The event type and symbol descriptions are listed in Table 13-4.

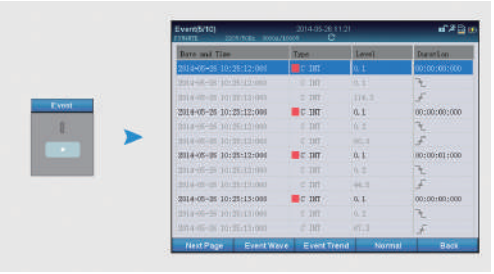


Figure 13-4. Events screen in the Transients mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.

Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Values, or Trend screen.
◄ ►	View the previous page or next page

Table 13-3. Keys in the Events screen of the Transients mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded

	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards
	Change downwards

Table 13-4. Event type and symbol descriptions in the Transients mode

13.4 File Managementin the Transients Mode

In the Realtime Numerical Values screen, or Trend screen of the Transients mode, one can press the “Start Rec./Stop Rec.” ping-pong soft key to start recording the measurement data to a file as shown in Figure 13-5. Fill in all the necessary recording setup information and press the “Start” soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the “Start Rec.” soft key becomes the “Stop Rec.” soft key. Press

the “Stop Rec.” soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure 13-6.

Figure 13-5. Recording the measurement data to a file in the Transients mode

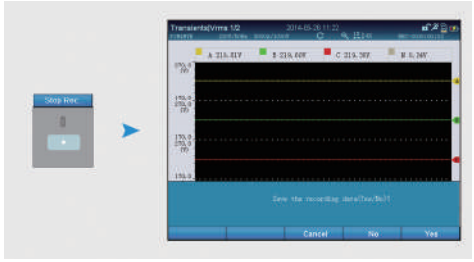


Figure 13-6. Stop recording data to a file in the Transients mode

In any screen of the Transients mode, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 13-7.

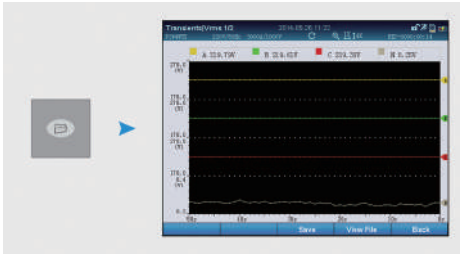


Figure 13-7. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 13-7, the screen changes to the picture as shown in Figure 13-8. The screen lists all the saved Transients files with the ‘TRA’ extension name. Select a file, press “Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a Transients file’s detailed information. Figure 13-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that

it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected Transients file.

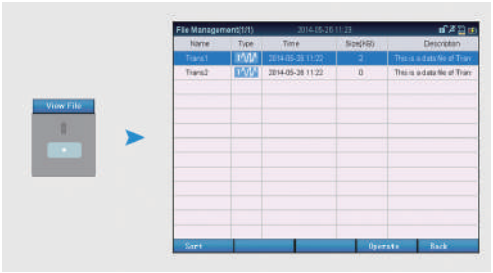


Figure 13-8. A sample screen after “View File” soft key being pressed

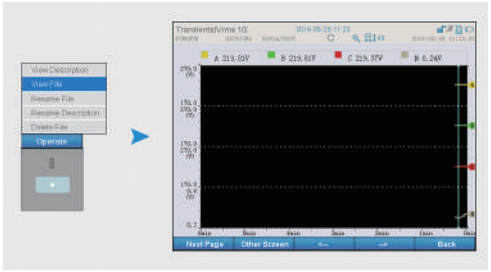


Figure 13-9. A sample screen after “View File” operation being chosen

In any screen of the Transients mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 13-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

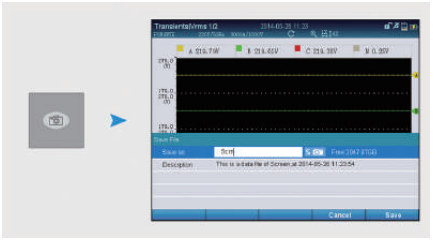


Figure 13-10. A Transients screen after “ ” shortcut key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

13.5 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ” shortcut key. Figure 13-11 is a sample online help screen for a Transients screen.

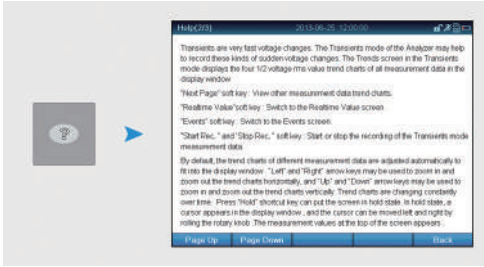


Figure 13-11. A sample online help screen for a Transients screen

13.6 Applications

Electrical transients are the results of a sudden and rapid change in the electrical system. Capacitor switching and lightning are two main causes of transient over-voltages on utility systems. Transients in the power system may affect adversely on many kinds of equipments. Electronic devices may operate erratically. They could lock up, reset repeatedly, produce garbled results, or even suffer from early failures. These types of disruptions may be difficult to diagnose, so it is often necessary to use the Analyzer to monitor the system for some time to find them.

14. Trigger Parameter View Mode

The Trigger Parameter View mode of the Analyzer displays trigger parameters in the forms of realtime measurement values, and trends.

14.1 Trends

Select the “Trigger Parameters” icon in the main menu, the Trends screen in the Trigger Parameter View mode appears as shown in Figure 14-1. The screen displays the first four measurement data trend charts of all measurement data in the display window, and “Next Page” soft key may be pressed repeatedly to view the remaining measurement

data trend charts. Realtime measurement values of the displayed channels at the tips of the drawing pens on the right side of the screen are also shown at the top of the screen. Soft keys and other keys that have specific functions assigned to this screen are listed in Table 14-1.

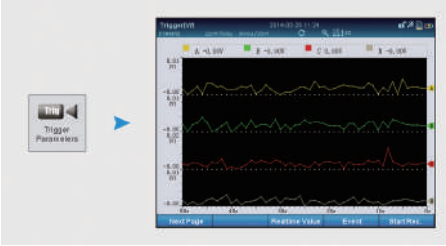


Figure 14-1. Trends screen in the Trigger Parameter View mode

Key	Description
Next Page	View other measurement data trend charts.
Realtime Value	Switch to the Realtime Value screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Trigger Parameter View mode measurement data. See section 14.4 for a detailed description.
◂ ▸	Zoom in and zoom out the trend charts horizontally. See description in this section.
▴ ▾	Zoom in and zoom out the trend charts vertically. See description in this section.
◯	When in hold state, move the cursor left and right. See description in this section.

Table 14-1. Keys in the Trends screen of the Trigger Parameter View mode

By default, the trend charts of different measurement data are adjusted automatically to fit into the display window. Nevertheless, to investigate for details, “Left” and “Right” arrow keys may be used to zoom in and zoom out the trend charts horizontally, and “Up” and “Down” arrow keys may be used to zoom in and zoom out the trend charts vertically. Trend charts are changing constantly over time. To inspect the trend charts in some special moments, “HOLD” shortcut key has to be pressed to put the screen in hold state. In hold state, a cursor appears in the display window as shown in Figure 14-2, and the cursor can be moved left and right by rolling the rotary knob left and right. The measurement values at the top of the screen are the ones at the cursor’s position.

Figure 14-2. Cursor appearing when the Trends screen being in hold state

14.2 Realtime Numerical Values

Press the “Realtime Values” soft key in the Trends screen, the Realtime Numerical Values screen in the Trigger Parameter View mode appears as shown in Figure 14-3. The screen displays all the trigger parameters in the window. Soft keys in this screen are listed in Table 14-2.

Figure 14-3. Realtime Numerical Values screen in the Trigger Parameter View mode

Key	Description
Trends	Switch to the Trend screen.
Event	Switch to the Events screen.
Start Rec. Stop Rec.	Start or stop the recording of the Dips and Swells mode measurement data. See section 13.4 for a detailed description.

Table 14-2. Keys in the Realtime Values screen of the Trigger Parameter View mode

14.3 Events

Press the “Events” soft key in the Trends or Realtime Values screen, the Events screen in the Trigger Parameter View mode appears as shown in Figure 14-4. The screen lists all over-limit events of measured voltages and currents. Soft keys in this screen are listed in Table 14-3.The event type and symbol descriptions are listed in Table 14-4.

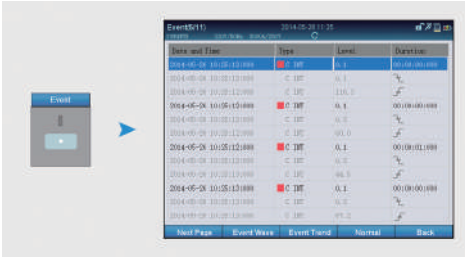


Figure 14-4. Events screen in the Trigger Parameter View mode

Key	Description
Next Page	View other over-limit events..
Event Wave	Switch to the waveform view of the chosen event.
Event Trend	Switch to the trend view of the chosen event.
Normal / Detail	Switch between normal and detailed view of the over-limit events.
Back	Back to the Realtime Values, or Trend screen.
◂ ▸	View the previous page or next page

Table14-3. Keys in the Events screen of the Trigger Parameter View mode

Event Type or Symbol	Description
DIP	Voltage Dip
INT	Voltage Interruption
SWL	Voltage Swell
TRA	Transient
AMP	Amp value exceeded
VDEV	Voltage Deviation
FRQ	Frequency Deviation
UNB	Unbalance event
FLK	Flick Value exceeded
Hx	Harmonic number of that exceeds defined limits
VCHG	Rapid Voltage Change
ICHG	Rapid Current Change
VTHD	Voltage THD exceeded
ITHD	Current THD exceeded
VNEG	Voltage negative sequence exceeded
VZERO	Voltage zero sequence exceeded
	High value of 100 % limit exceeded
	Low value of 100 % limit exceeded
	High value of x % limit exceeded
	Low value of x % limit exceeded
	Change upwards

	Change downwards

Table 14-4. Event type and symbol descriptions in the Trigger Parameter View mode

14.4 File Managementin the Trigger Parameter View Mode

In the Realtime Numerical Values screen, or Trend screen of the Trigger Parameter View mode, one can press the " Start Rec./Stop Rec." ping-pong soft key to start recording the measurement data to a file as shown in Figure 14-5. Fill in all the necessary recording setup information and press the "Start" soft key, the recording starts. Recording of the data to the file will finish automatically when the predefined time is up. After recording started, the "Start Rec." soft key becomes the "Stop Rec." soft key. Press the "Stop Rec." soft key to stop the recording of data before the predefined time is up, or just to discard the recording file, as shown in Figure 14-6.

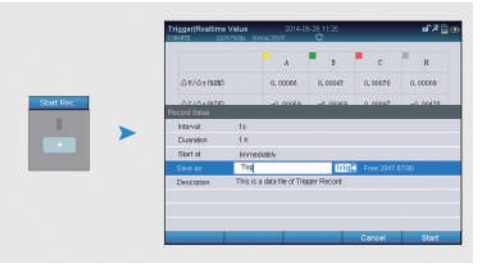


Figure 14-5. Recording the measurement data to a file in the Trigger Parameter mode

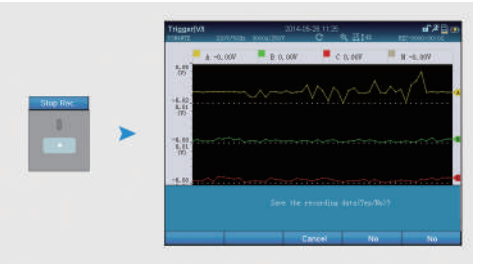


Figure 14-6. Stop recording data to a file in the Trigger Parameter View mode

In any screen of the Trigger Parameter View mode, press " " shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 14-7.

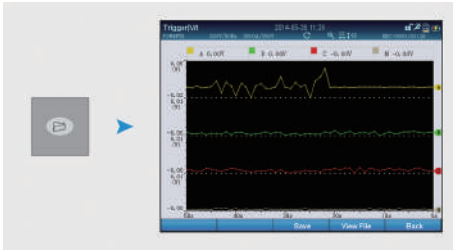


Figure 14-7. A sample screen after “ ” shortcut key being pressed

If “View File” soft key is pressed in the screen shown in Figure 14-7, the screen changes to the picture as shown in Figure 14-8. The screen lists all the saved Trigger Parameter View files with the ‘TRG’ extension name. Select a file, press “Operate” soft key to choose an operation. Among other choices, one can choose “View Description” or “View File” menu item to view a Transients file’s detailed information. Figure 14-9 shows a sample screen after the “View File” menu item is chosen. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode. Press “View Setups” soft key, or “ ” shortcut key now to view the setup files saved together with this selected Trigger Parameter View file.

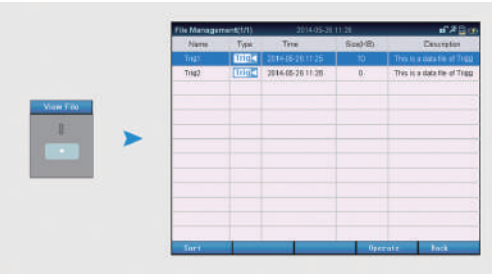


Figure 14-8. A sample screen after “View File” soft key being pressed

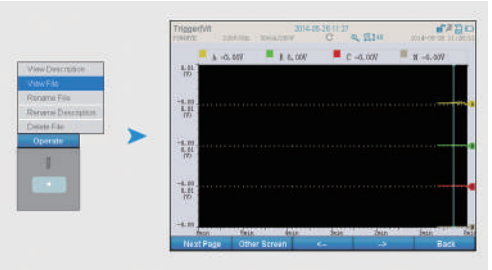


Figure 14-9. A sample screen after “View File” operation being chosen

In any screen of the Trigger Parameter View mode, press the “ ” shortcut key, a screenshot screen appears as shown in Figure 14-10. Type in screenshot file name and a file description, then press “Yes” soft key to confirm the operation, the current screen’s screenshot is saved to the above screenshot file. A screenshot file has a ‘SCR’ extension name.

Figure 14-10. A Trigger Parameter screen after “ ” key being pressed

Screenshot files may be recalled and reviewed in the Main Menu screen by pressing the “ ” shortcut key. See Chapter 15 for detailed descriptions.

A general description of file management could be found in Chapter 15.

14.5 Online Help

To better help users to operate the Analyzer, online help is provided in the Analyzer. Online help is screen sensitive, meaning that different screens may have different online help contents. Online help is activated in any screen by pressing the “ ” shortcut key. Figure 14-11 is a sample online help screen for a Trigger Parameter View screen.

Figure 14-11. A sample online help screen for a Trigger Parameter View screen

14.6 Applications

The trigger parameters described in this chapter are mainly used for detecting events that may cause faults in the electrical power systems. Fault events usually begin

and end with an abrupt change of measured quantities. The measured quantities are the four voltages and currents from input channels of the Analyzer. These trigger parameters serve as the indicators of these abrupt changes. By analyzing these fault event recordings, the user may optimize the functionality of the equipments monitored by the Analyzer, such as compensation equipments, protection equipments and power circuit-breakers.

15. File Management

Datasets, i.e., measurement data and setups etc., are stored in the Analyzer as files. The concept of a file in the Analyzer is similar to that in a conventional computer system. The properties of a file in the Analyzer include name, type, time modified, size, and a description of the file. The file names follow the 8.3 filename convention, that is, have at most eight English or number characters, and an extension of at most three English characters. The description of a file may have at most 200 characters. The types and the default names of the files in the Analyzer are listed in Table15-1.

File Type	Default Name	Ext. Name	Illustrative Icon
Instrument Setup	Instr	INS	INS
Measurement Setup	Meas	MEA	MEA
Limits Setup	Limit	LIM	LIM
Recording Setup	Rec	REC	REC
Combination of the above four Kinds of Setups	Sets	SET	SETS
Scope Measurement	Wave	PWV	W
VAH Measurement	VAH	VAH	VAH
Dips & Swells Measurement	DipSw	DSW	D
Harmonics Measurement	Harmo	HAR	H
Inter-harmonics Measurement	Inhar	IHM	IH
Power and Energy Measurement	Power	PEM	PE
Unbalance Measurement	Unbal	UBL	U
Flicker Measurement	Flick	FLK	F
Inrush Measurement	Inrsh	IRS	IR
Power Quality Profile	Qlity	QLT	Q

Transients Measurement	Trans	TRA	
Trig Recording	Trig	TRG	
Screen Shot	Scrn	SCR	
Task (See descriptions in the next chapter)	Task	TSK	

Table15-1. Types and default names of files in the Analyzer

The operations of files in the Analyzer are screen sensitive, meaning that file operations in different kinds of screens may leads to the operations of different kinds of files. Different setup file operations and measurement file operations can be finished in their corresponding screens as described in the chapters from two to fifteen. This chapter describes file operations in the main menu, which allows the user to operate any kinds of saved files.

In the main menu, press “ ” shortcut key, the soft keys at the bottom of the screen change to contents shown in Figure 15-1.

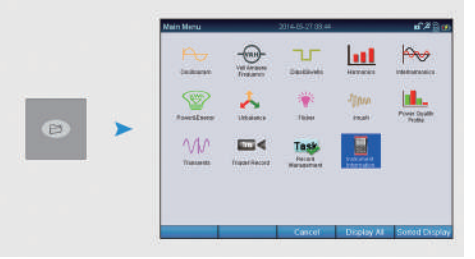


Figure 15-1. Main Menu screen after “ ” shortcut key being pressed

Press the “Display All” soft key, the File Management screen appears as in Figure 15-2,

Figure 15-2. File Management screen - Display All

which lists all the available saved files. To view only a certain kind of files, one can press the “Sorted Display” soft key in the screen shown in Figure 15-1, and the sorted display screen appears as shown in Figure 15-3. Press “Sort” soft key in Figure 15-2 or Figure 15-3 to sort the files according to their names, types(only for Figure 15-2), time modified, or sizes. After selection of a file by using arrow keys, the rotary knob, and “Page Up” and “ Page Down” soft keys, one can operate the selected file by pressing the “Operate” soft key.

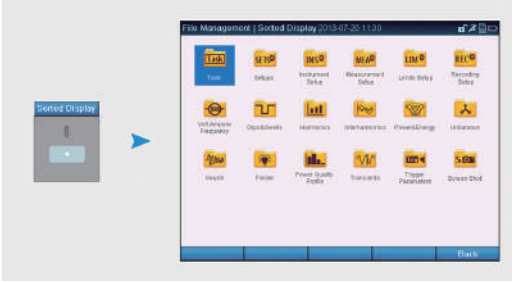


Figure 15-3. File Management screen - Sorted Display

15.1 Operating a Measurement File or a Screen Shot File

If the selected file is a Measurement Data file, a screen will appear as shown in Figure 15-4 after pressing the “operate” soft key. Choose “View Description” in Figure 15-4, the screen.
changes to the picture shown in Figure 15-5. The file description appears in the window; Choose “View File” in Figure 15-4, the screen changes to the picture shown in Figure 15-6. Note that the title bar’s color now turns to black-and-white to indicate that it is now in recall mode; Choose “Rename File” in Figure 15-4, the screen changes

Figure 15-4. File Management screen after “Operate” soft key pressed - Measurement Data

to the picture shown in Figure 15-7. Now one may type in a new name for the file; Choose “Rename Description” in Figure 15-4, the screen changes to the picture shown in Figure 15-8. Now one may type in a new description for the file; Choose “Delete File” in Figure 15-4, the screen changes to the picture shown in Figure 15-9. Press “Yes” to confirm the operation.

Figure 15-5. File Management screen - Measurement Data - View Description

Figure 15-6. File Management screen - Measurement Data - View File

Figure 15-7. File Management screen - Measurement Data - Rename File

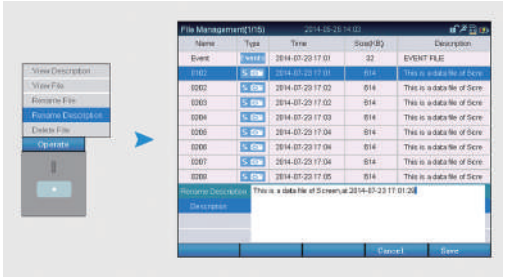


Figure 15-8. File Management screen - Measurement Data - Rename Description

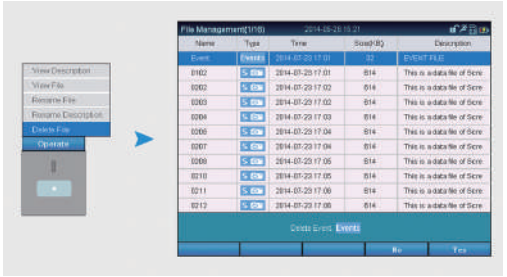


Figure 15-9. File Management screen - Measurement Data – Delete File

The operation of a Screen Shot file is exactly the same as the operation of a Measurement Data file.

15.2 Operating a Setup File

If the selected file is a Setup file, a screen will appear as shown in Figure 15-10 after pressing the “operate” soft key. The operation of a Setup file is very similar to the operation of a Measurement Data file. The only difference is that it has an additional option of “Load as Current Setup”. Choose “ Load as Current Setup” in Figure 15-10, the screen changes to the picture shown in Figure 15-11. The screen reminds the user to save current Setup data first before load the saved file as current Setup. If the user selects to save the current Setup data, the screen changes to the picture as shown in Figure 15-12. After filling in the necessary information to save the current Setup data, the screen changes to the picture shown in Figure 15-13 to ask the user to confirm the operation. Press “Yes” to finish the operation.

Figure 15-10. File Management screen after “Operate” soft key pressed – Setup file

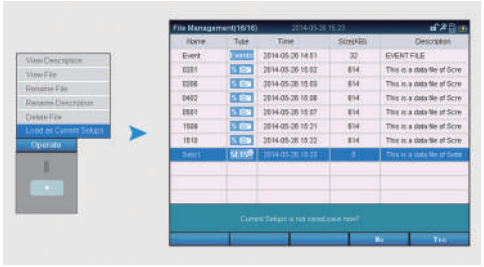


Figure 15-11. File Management screen – Setup File –Load as Current Setup

Figure 15-12. File Management screen – Setup File –Load as Current Setup – Save File

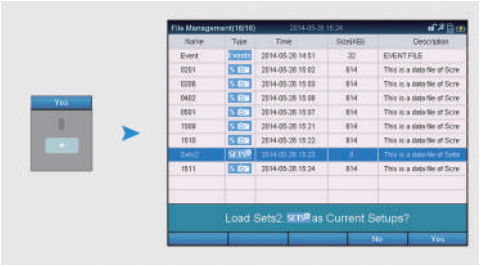


Figure 15-13. File Management screen – Setup File –Load as Current Setup – Confirmation

16. Task Management

A task in the Analyzer is a special kind of file, or more precisely, a group of setup and measurement files. Tasks may be used to perform long-time automatic online tests. A task usually consists of a Sets file, and one or more measurement files. The properties of a task in the Analyzer include name, origin, status, time modified, size, and a description of the task. Task names also follow the 8.3 filename convention with “Task” as its default name and “TSK” as its extension name. The origin of a task

indicates where the task was created, i.e., created in a PC and then downloaded to the Analyzer, or created locally in the Analyzer. The status of a task indicates if the task has finished and been uploaded to a PC. The description of a task may have at most 200 characters.
Select “Task Management” icon in the main menu, or select a task in the File Management screen in Figure 15-2, the Task Management screen appears as shown in Figure 16-1, which lists all the available saved tasks.

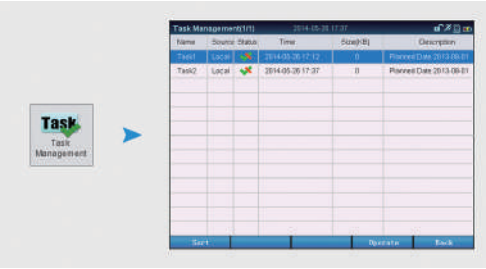
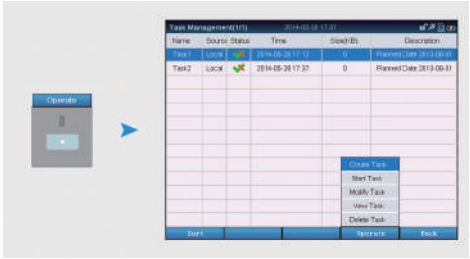


Figure 16-1. Task Management screen

Press “Sort” soft key in Figure 16-1 to sort the tasks according to their names, origins, status, planned dates, time modified, or sizes. After selection of a task by using arrow keys, the rotary knob, and “Page Up” and “Page Down” soft keys, one can operate the selected task by pressing the “Operate” soft key as shown in Figure 16-2.



16-2. Task Management screen after “Operate” soft key pressed

16.1 Creating, Modifying, Running, and Deleting a Task

There are two ways of creating a task. The first one is to create a task on a PC and then download it to the Analyzer, which will be described in the next chapter. The second one is to create a task locally in the Analyzer. This section describes the second way of creating a task. Choose “ Create Task” in Figure 16-2, the screen changes to the picture shown in Figure 16-3. Fill in all the necessary information one by one to create a task. When the

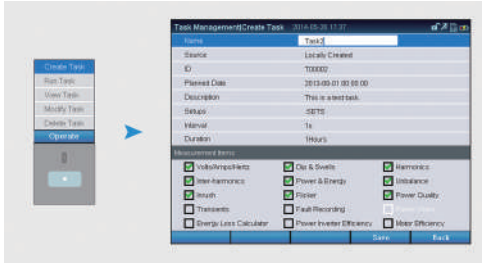


Figure 16-3. Task Creation screen

bar moves to the Setups Item and the “Enter” key is pressed, a screen will appear as shown in Figure 16-4, which lists all the available Setups files for the user to choose from. When the bar moves to the Measurement Item in Figure 16-3, the user may select multiple measurement items simultaneously as shown in Figure 16-5. But note that certain measurement items are mutual exclusive. For example, waveform recording may not be selected with other measurement items at the same time. After all items are filled in, save the task and press “Back” soft key to go back to the Task Management screen.

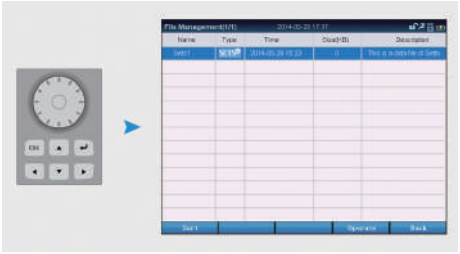


Figure 16-4. Task Creation screen – Setups Item selected

Modifying a task is very similar to creating a task. The only different is that the items are usually blank or with default values for the user to fill in when creating a task, while the items are full for the user to rewrite new information when modifying a task.

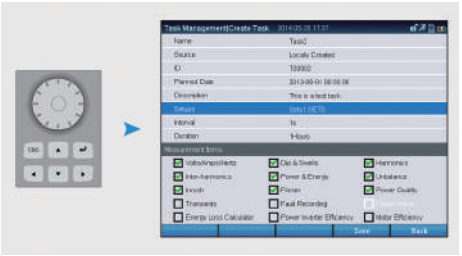


Figure 16-5. Task Creation screen–Measurement Items selection

Select “Run Task” in Figure 16-2, the screen changes to the picture shown in Figure 16-6. Choose immediately start or timed start, and then press “Start” soft key to run the task. After the task is running, the screen changes back to the main menu. The user may select to enter any measurement mode which is not mutual exclusive with the measurements in the current task.

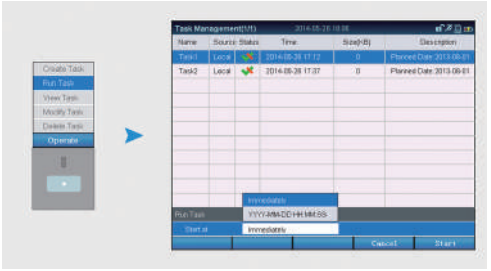


Figure 16-6. Running a Task

Select “Delete Task” in Figure 16-2, the screen changes to the picture shown in Figure 16-7. Press “Yes” to confirm the operation.

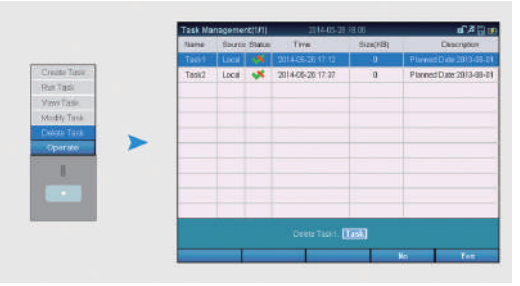


Figure 16-7. Deleting a Task

16.2 Viewing the Contents of a Task

Choose “View Task” in Figure 16-2, the screen changes to the picture shown in Figure 16-8. The soft keys at the bottom of the window provide available viewing options. Press “View Descrip.” soft key in Figure 16-8, the screen changes to the picture shown in Figure 16-9, which shows the description of the selected task. Press “View Setups.” soft key in Figure 16-8, the screen changes to the picture shown in Figure 16-10. The user may press the soft keys at the bottom of the window to further view detailed setup information of the selected task. Note that the title bar’s

color now turns to black-and-white to indicate that it is now in recall mode. Press “View Data” soft key in Figure 16-8, the screen changes to the picture shown in Figure 16-11. A bar appears for the user to select one of the measurement items. After selecting a measurement item by moving navigation keys and press “Enter” key, the detailed information of the selected measurement item appears. For example, select “Volts Amps Hertz” and press “Enter”, the detailed measurement information appears as shown in Figure 16-12. Also note that the title bar’s color is black-and-white to indicate that it is now in recall mode.

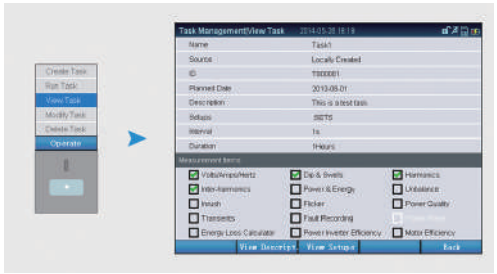


Figure 16-8. Viewing the Contents of a Task

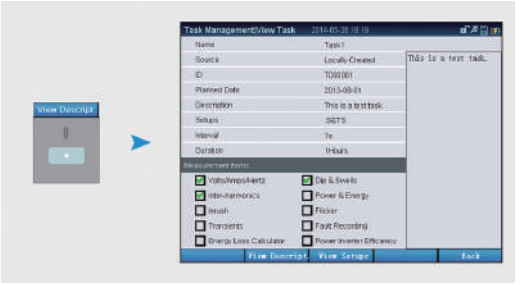


Figure 16-9. Viewing the Contents of a Task – View Description

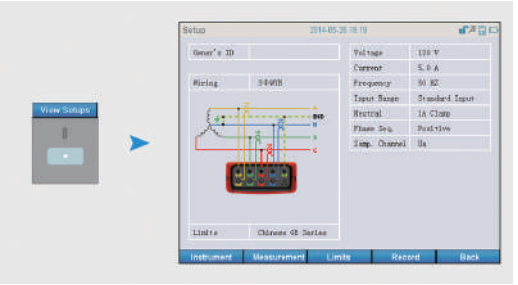


Figure 16-10. Viewing the Contents of a Task – View Setups

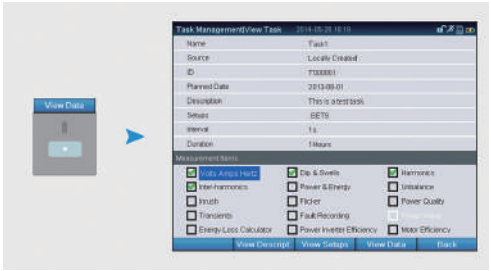


Figure 16-11. Viewing the Contents of a Task – View Data

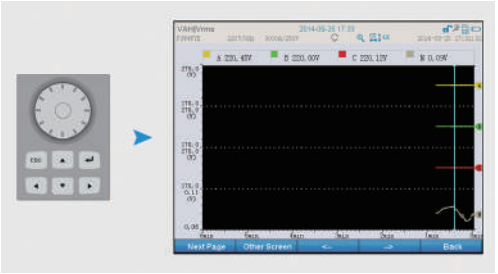


Figure 16-12. Viewing the Contents of a Task – View Data

17. Analyze Power Quality on PC

AccupoView software is the PC software for the UT285 series Analyzers. Features of the AccupoView include: Create tasks and setup files, and download them to the Analyzer for it to finish the tasks; Upload all kinds of recorded dataset files, including the finished tasks, in the Analyzer to the AccupoView on PC; Perform detailed analysis of the uploaded dataset files; And generate comprehensive and sophisticated reports based on the above analysis, and export the reports for use with other programs such as Microsoft Excel, Microsoft Word, Adobe PDF Reader, or AccupoView file format(.apv), or directly print out the generated reports. This chapter provides instructions for installing and using the AccupoView software.

17.1 Installing AccupoView, and Connecting PC to the Analyzer

Insert the included Analyzer CD into a PC, and the installation should start automatically. If not, run the launch.exe program on the CD. Follow on-screen instructions to

install the AccupoView in the desired language. The installed AccupoView will have a shortcut in the programs menu. An AccupoView quick-launch shortcut can also be added to the desktop during installation. After connecting the Analyzer with the PC installed with AccupoView by a USB cable, the user may start the AccupoView by selecting the AccupoView program icon, and a MDI start window with a blank pane will appear as shown in Figure 17-1. There are mainly two ways for the AccupoView to interact with the Analyzer, one way is for the AccupoView to communicate directly with the Analyzer's internal MCU, and to send and receive datasets through this MCU, which is usually slow; Another better way is to make the Analyzer act as a USB disk for the AccupoView to directly read and write files on it. The following sections use this second way.

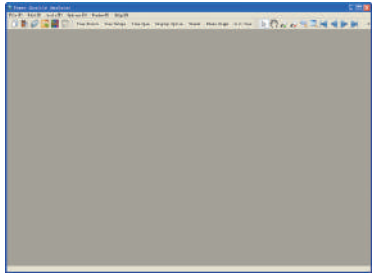


Figure 17-1. AccupoView Start Window

17.2 Creating and Downloading files in AccupoView

AccupoView may be used to create tasks and setup files, and then download them to the Analyzer for it to finish the tasks.

17.2.1 Creating Setup files

Creating Setup files in the AccupoView are very similar to that in the Analyzer, only easier and quicker. Select from the menu **File | New | Instrument Setup**, the Instrument Setup window appears as shown in Figure 17-2. The Instrument Setup window is a collection of

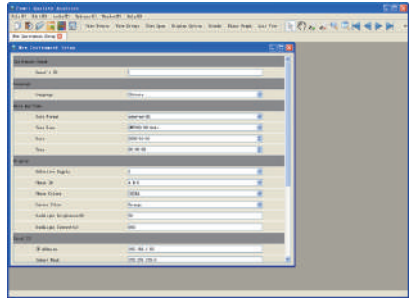


Figure 17-2. AccupoView – Instrument Setup Window

instrument related setup information, and allows a user to customize the information according to his preferences. Different customizable items may be selected with the mouse. For items with selectable options, also use the mouse to choose an option. For items with key-in options, use the PC keyboard to key in the option. When completed, mouse-click the “Save” icon, a dialog box will appear as shown in Figure 17-3. Type in a file name and a file description, then click “Save” to save the file.

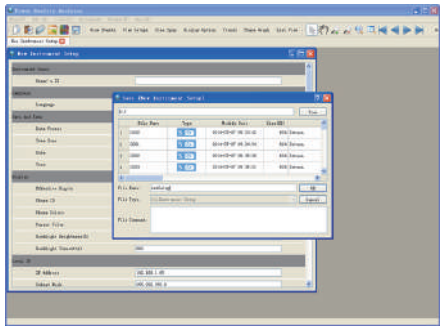


Figure 17-3. AccupoView – Instrument Setup – “Save” Dialog Box

Operations of other kind of setup files, namely, measurement setup file, limits setup file, record setup file, and total setup file which is a collection of all the above four kinds of setup files, are exactly the same as operations of the instrument setup file.

17.2.2 Creating a Task file

Creating a Task file in the AccupoView is also very similar to that in the Analyzer, only easier and quicker. Select from the menu **File | New | Task**, the Task creation window appears as shown in Figure 17-4. Fill in all the necessary information one by one to create a task. When

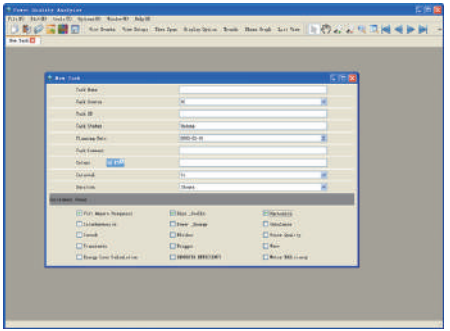


Figure 17-4. AccupoView – Task Creation Window

the bar moves to the Setups Item and the “Enter” key is pressed, or left click the mouse, a dialog box will appear

as shown in Figure 17-5, which lists all the available

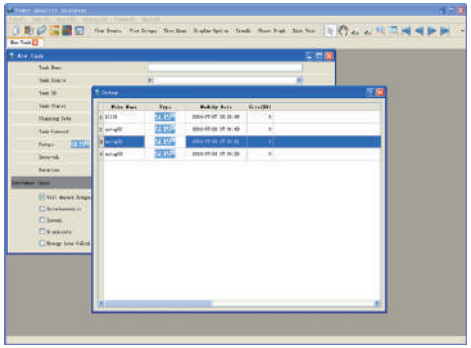


Figure 17-5. AccupoView – Task Creation – Setups Item selected

Setups files for the user to choose from. When the bar moves to the Measurement Item in Figure 17-4, the user may select multiple measurement items simultaneously. But note that certain measurement items are mutual exclusive. For example, waveform recording may not be selected with other measurement items at the same time. After all items are filled in, mouse-click the “Save” icon, a dialog box will appear as shown in Figure 17-6. Verify the task name and the task description, then click “ Save” to save the task.

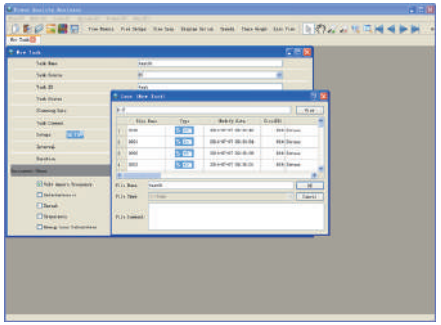


Figure 17-6. AccupoView –Task Creation – “Save” Dialog Box

17.2.3 Creating a Text file

AccupoView allows create text files for writing memos, such as summary of an output report. Select from the menu **File | New | Text File**, a text file window is created as shown in Figure 17-7.

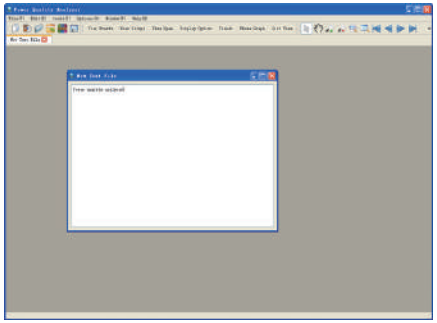


Figure 17-7. AccupoView – Text file Window

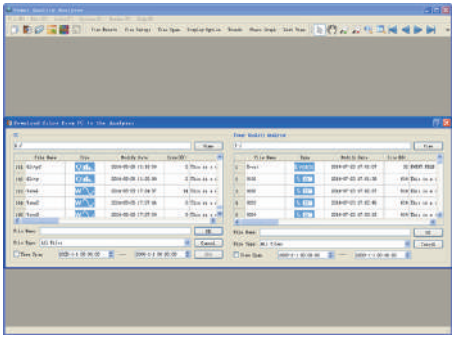


Figure 17-8. AccupoView – Download File Dialog Box

17.2.4 Downloading files to the Analyzer

Select from the menu **File | Download**, or mouse-click the "Download" icon on the General Operation toolbar, the Download File Box appears as shown in Figure 17-8. AccupoView allows download setup files tasks from PC to the Analyzer. The Analyzer will finish the downloaded tasks, and then upload the finished tasks back to PC at some later time for AccupoView to perform detailed analysis of the uploaded dataset files included in the uploaded tasks, and to create reports.

17.3 Perform Analysis in AccupoView

AccupoView may perform detailed analysis of stand-alone uploaded dataset files, or datasets included in the uploaded tasks, by providing different view modes of a certain dataset, namely, Trend View, Realtime Value View, Waveform View, Phasor View, Bar Graph View, and Event List View. Note that a certain dataset may only have some of these views.

17.3.1 Uploading files to AccupoView

Select from the menu **File | Upload**, or mouse-click the " Upload" icon on the General Operation toolbar, the Upload File Box appears as shown in Figure 17-9. AccupoView allows upload all kinds of dataset files, including tasks, from the Analyzer to PC. After uploading, AccupoView may open the specified file directly in the Upload File Dialog Box, or open a specified file later from the Open File Dialog Box as shown in Figure 17-10. Figure 17-11 shows a finished task being opened.

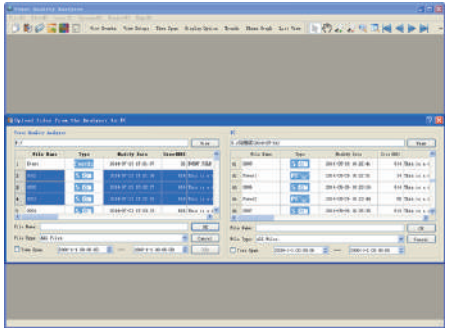


Figure 17-9. AccupoView – Upload File Dialog Box

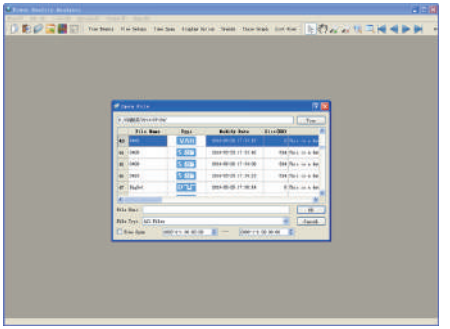


Figure 17-10. AccupoView – Open File Dialog Box

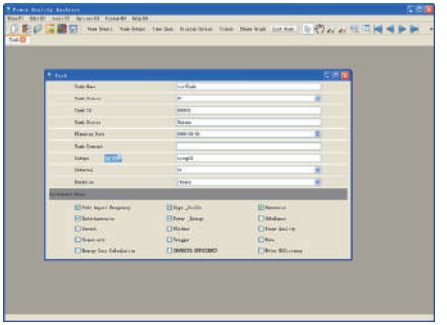


Figure 17-11. AccupoView – a Finished Task being opened

17.3.2 Trend View

Figure 17-12 shows the Trend View of a VAH dataset. By mouse-clicking the “Display Options” icon on the Analyzer Operation toolbar in Figure 17-12, the user may select the contents and order of the parameters displayed in the trend graph. The user may then investigate the trends in detail by using the Investigation tool bar to manipulate, such as to zoom in, zoom out, or bookmark, certain parts of the trend graph.

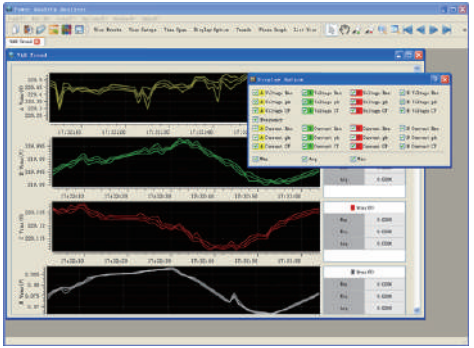


Figure 17-12. Trend View of a VAH dataset

17.3.3 Realtime Value View

Realtime Value View may further be expressed in two different views, i.e., List View and Table View. List View lists all the selected parameter values of a selected time span as

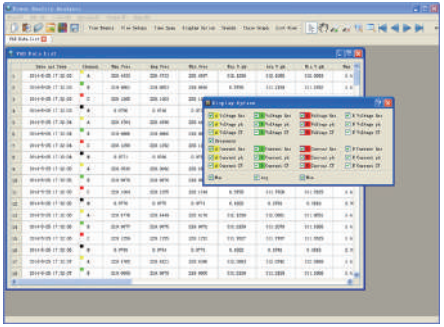


Figure 17-13. Realtime Value View of a VAH dataset – List View

shown in Figure 17-13, while table view displays only the parameter values at a specific time as shown in Figure 17-14.

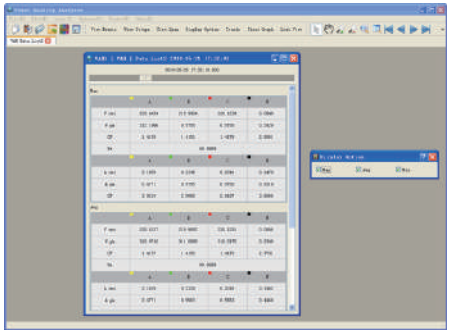


Figure 17-14. Realtime Value View of a VAH dataset – Table View

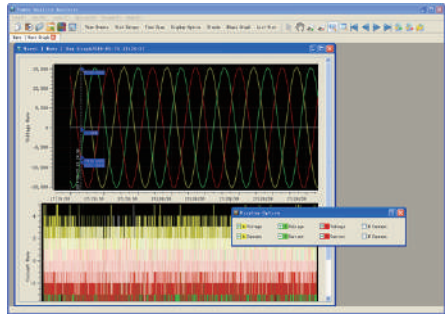


Figure 17-15. Waveform View of a Scope dataset

17.3.4 Waveform View

Figure 17-15 shows the Waveform View of a Scope dataset. By mouse-clicking the “Display Options” icon on the Analyzer Operation toolbar in Figure 17-15, the user may select the contents of the parameters displayed in the waveform picture. The user may then investigate the waveforms in detail by using the Investigation tool bar to manipulate, such as to zoom in, zoom out, or bookmark, certain parts of the waveforms.

17.3.5 Phasor View

Phasor View may further be expressed in two different views, i.e., List View and Table View. List View lists phasors with all the selected parameter values of a selected time span as shown in Figure 17-16, while table view displays phasors with the selected parameter values at a specific time as shown in Figure 17-17.

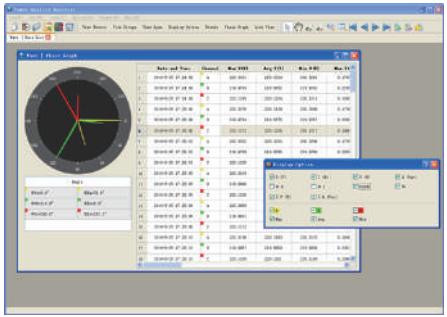


Figure 17-16. Phasor View of a Scope dataset – List View

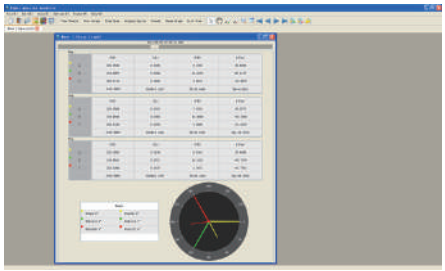


Figure 17-17. Phasor View of a Scope dataset – Table View

17.3.6 Bar Graph View of Harmonics

Figure 17-18 shows the Bar Graph View of a Harmonic dataset. By mouse-clicking the “Display Options” icon on the Analyzer Operation toolbar in Figure 17-18, the user may select the contents of the parameters displayed in the bar graph. The user may then investigate the bars in detail by using the Investigation tool bar to manipulate, such as to zoom in, zoom out, or bookmark, certain parts of the bar graph.

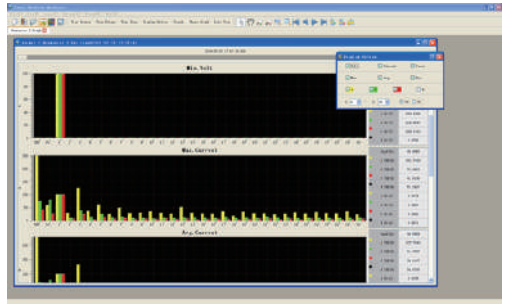


Figure 17-18. Bar Graph View of a Harmonic dataset

17.3.7 Bar Graph View of Power Quality Profile

Figure 17-19 shows the Bar Graph View of a Power Quality Profile dataset, which provides the user an overall impression of power quality aspects of the power system under test. Detailed measurement information is available for each measurement parameter group by mouse-clicking the “Vrms”, “Harmonics”, “Flicker”, “Unb”, “Hz”, or “Dips & Swells” icon on the Analyzer Operation toolbar in Figure 17-19. The user may also investigate the bars in detail by using the Investigation tool bar to manipulate, such as to zoom in, or zoom out certain parts of the bar graph.

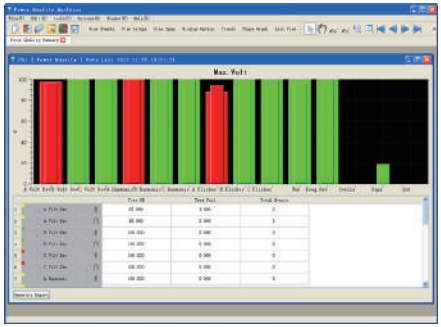


Figure 17-19. Bar Graph View of a Power Quality Profile dataset

17.3.8 Event List View

On the Analyzer Operation toolbar of any other view, there is an “Events” icon. Mouse-click the “Events” icon, a picture appears as shown in Figure 17-20. The Events window lists all over-limit events of measured voltages and currents. Double-click the index in the left of the chosen item, the Trend View and the Waveform View of the selected event both appear, by which the user may investigate the details when the selected event happened.

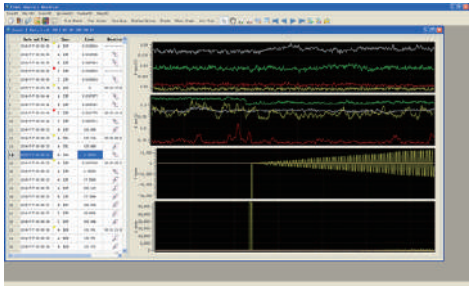


Figure 17-20. Event List View

17.4 Writing a Report in AccupoView

After dataset analysis, AccupoView may help the user to write a report. open "Power Quality Profile", mouse-click the "Report" icon and choose the saving route, then the power quality report file will be exported as excel file format.

Users can also make a self-defined report through "Graph-Text Report Assistant ". Open the dataset interface you want, select "Tools" | "Add as Graph-Text Element" (as shown in Figure 17-21). choose "Tools" | "Create Graph-Text"(as shown in Figure 17-22), drag the Gragh-Text elements already added in the left list into the right preview window, click "Save" button and choose the saving path, then the self-defined report will be exported as excel file format.

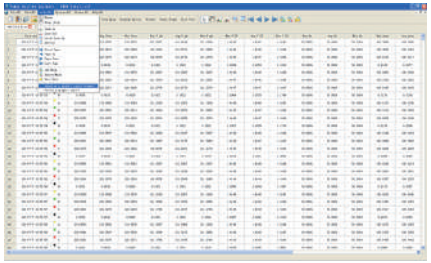


Figure 17-21. Add as Graph-Text Element

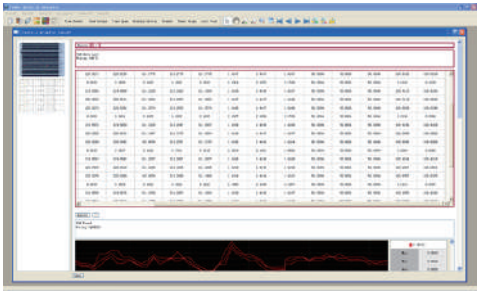


Figure 17-22. Create Graph-Text

18. Technical Specifications

The following technical specifications are valid for UT285 Series Three Phase Energy and Power Quality Analyzers unless otherwise specified.

18.1 Input Characteristics

Voltage Inputs	
Number of Inputs	4
Maximum Input Voltage	1000 Vrms
Nominal Voltage Range	500 V
Maximum Peak Voltage	6 kV

Current inputs	
Number of Inputs	4
Range	3000 Arms flexible current probe

18.2 Measurement Specifications

Volt/Amps/Hertz	Range	Resolution	Accuracy
Vrms	1~1000 V	0.01 V	±0.1% of nominal voltage
Vpk	1~1400 Vpk	1 V	±5% of nominal voltage
V Crest Factor	1.0~ 2.8	0.01	±5%
Arms	3000 A	0.1A	±1%
Apk	0 ~4200 Apk	1A	±5%
A Crest Factor	1 ~10	0.01	±5%

Dips and Swells	Range	Resolution	Accuracy
Vrms½	0~200% of nominal voltage	0.1V	±0.2% of nominal voltage
Arms½	3000A	0.1A	±1%
Duration	Hhh:mm:ss:mmm	Half cycle	One cycle

Harmonics	Range	Resolution	Accuracy
Vrms			
Relative (%f)	0~100.0%	0.1%	± 0.1% ± n x 0.1%
Relative (%r)	0~100.0%	0.1%	± 0.1% ± n x 0.4%
Absolute	0~1000V	0.1 V	± 5%
THD	0~100.0%	0.1%	± 2.5%

Arms Relative(%f) Relative (%r) Absolute THD	 0~100.0% 0~100.0% 40~3000A 0~100.0%	 0.1% 0.1% 0.1A 0.1%	 ± 0.1% ± n x 0.1% ± 0.1% ± n x 0.4% ± 5% ± 2.5%
Watts Relative(%f or %r) Absolute THD	 0.0~100.0% clamp scaling * V nominal 0~100.0%	 0.1% 0.1%	 ± n x 2% ± 5% ± n x 2% ± 5%
Hz	0 ~ 2500 Hz(1-50 order)	1 Hz	±1Hz
Phase Angle	0~360°	1°	±n × 1°

Note: n is the measured harmonic order.

Power and Energy	Range	Resolution	Accuracy
Watt	Max3000KW	1W	±1%
kWh	clamp scaling * V nominal		±1%
Power Factor	0~1	0.01	±0.1%

Flicker	Range	Resolution	Accuracy
Pst (1min), Pst, Plt	0.00~20.00	0.01	±5%

Unbalance	Range	Resolution	Accuracy
Volts	0.0~20.0%	0.1%	±0.1%
Current	0.0~20.0%	0.1%	±1%

Transient	Range	Resolution	Accuracy
Volts Peak Voltage RMS Voltage	 6000 Vpk 10~1000 V	 1V 1V	 ±15% ±2.5%
Minimum Detect Duration	19μs		

Inrush	Range	Resolution	Accuracy
Arms	0~3000A	1A	±1%
Inrush Duration	mm:ss:mmm	Half cycle	One cycle

Recording	Sampling Rate	Interval	Duration
Volts/Amps/Hertz	5 readings/sec or 1 reading/3 sec	0.2 s~2 hr	1 hr~1 year
Harmonics			
Power & Energy			
Unbalance			
Dips & Swells	100/120 readings/sec	0.2 s~2 hr	
Inrush			
Flicker	1reading/1 min. 1reading/10min. 1reading/2 hr		
Quality Profile	3 s/ 1min. /10 min for volts 1 s/3 s/10 s for frequency		

Events	100/120 readings/sec	22~260 waveform cycles,10s for ½ cycle rms trend	Trigger
Transients	19 µs	22~260 waveform cycles,10s for ½ cycle rms trend	Trigger

18.3 General Specifications

General Specifications	
Housing	Rigid cast housing
Display	Color LCD with VGA resolution
Line Power	85V~ 450V adapter with country specific plug
Battery Operating Time	Up to 8 hours
Battery Charging Time	4 hours
Operating Temperature	-10°C ~ +50°C
Storage temperature	-20 °C ~ +60 °C
Humidity	90% RH non condensing
Electrical Safety	IEC 61010, 1000V CAT III/600V CAT IV
EMC	EN-61326
Dimensions	256 x 169 x 64 mm
Weight	1.95kg