HZDZ-S3 Portable Three Phase Power Quality Analyzer

USER MANUAL

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Content

Preface

Power quality refers to the quality of the AC power supply via the utility grid to the user, which normally means the good or bad situation of the electric energy in transmission line. Power quality problems are mainly caused by the load side of the terminal. For example, impact reactive load will lead to serious fluctuates to power network voltage, and decrease the quality of power supply.

With the development of power electronics technology, on one hand, it brought positive side to the modern industrial energy efficiency and energy conversion. On the other hand, while the power electronic devices are widely used in all walks of life, it also has brought new and more serious damage to the power quality, and has become the main source of harmonic in grid.

The increasing use of rectifiers, frequency control devices, electric arc furnaces, electric railway and a variety of power electronic devices in each distribution system, impact the electricity network or called power pollution. It causes voltage instability, over-voltage, generates harmonics and so on. Harmonic makes efficiency of electricity production, transmission and utilization reduce, so that the electrical equipment will be overheat, vibration and making noise, and insulation aging, shortened life expectancy, and even failure or burned. Harmonics can also cause localized power system an occurrence or series resonant parallel resonance, so that the harmonic content is amplified, resulting in capacitors and other equipment destroyed.

Electrical properties of non-linear, impact resistance and unbalanced of these kind of load, causes serious pollution to the quality of power supply. Thus, eliminating the higher harmonic problem in supply and distribution system has a very positive meaning in improving the power quality issues and ensuring power system security, stability and economic operation.

On the other hand, electrical equipments in modern industrial, commercial and residential users are more sensitive to power quality, and have a higher requirement of quality of power supply. Currently, harmonics, electromagnetic interference, power factor reduction have been tied to the three hazard of the power system.

When it is interfered or contaminated, grid power quality can't reach the national standards, so it has to be targeted on the grid power quality improvement. To understand the actual situation of power quality, you must have the appropriate equipment to test and analysis the actual situation. Counter the domestic condition, our company developed the professional power quality analysis instrument, which is suitable for the country. The following will illustrate the specific performances, parameters, methods of use on the power quality analyzer in detail.

I Functions and Features

1. The instrument is designed as a high-precision test equipment to detect grid waveform distortion occurrence, the harmonic content , voltage fluctuations and flicker and phase imbalance of power quality problems; It also includes electrical parameters testing, vector analysis functions.

2. It can accurately measure a variety of electrical parameters, such as voltage, current, active power, reactive power, phase angle, power factor, frequency, etc.

3. It can display the vector diagram of the measured voltage and current , by analyzing which users can judge if the metering device wiring is correct or not.

4. Current is measured by using the clamp transformers. You can easily and securely do the measurement, because of the use of clamp current transformers, without connecting the current loop. Depending on the user's measurement range, you can be equipped with different range of clamps.

5. Measurement and analysis of the AC power quality from the utility grid to client can be done easily, its measurement and analysis: frequency deviation, voltage deviation, voltage fluctuations, flicker, three-phase voltage unbalance factor and harmonic.

6. It can display single-phase voltage, current waveform and can display three-phase voltage and current waveform at the same time.

7. All testing interface is functioned with a screen lock feature to facilitate reading and analysis of user data.

8. Load fluctuations monitoring: It can measure and analysis fluctuations on the utility grid

power quality caused by a variety of electrical equipment at different operating conditions. Record and store trend of electrical parameter, such as voltage, current, active power, reactive power, apparent power, frequency, and phase at a regular time.

9. It can do electrical equipment adjustment and dynamic monitoring during operation, and help users to solve the power adjustment and commission process problems.

10. It can measure and analysis the dynamic parameters of reactive power compensation and filtering devices in the power system, and make quantitative evaluation of its features and technical specifications.

11. Users can set different storage interval, and it will successively store data according to the set time interval;

12. High-capacity data storage is equipped inside. It can store 18 consecutive months or more according to one minute interval, which meets the needs of long-term monitoring testing points.

13. The instrument includes a USB connector, which can be easily used to copy the data directly to the backstage management computer.

14. It coordinates with powerful data management software, and can directly upload real-time sampling data to backstage management compute, which can do a more comprehensive and rapid treatment in the background.

15. It has a calendar, clock function, which can display date and time in real-time. You can detect at the scene while saving test data and results, and upload to a computer via serial connector, then realize computerized data management through the backstage management software (optional), with powerful reporting capabilities.

16. Large-screen imported color LCD is used as a display, and Chinese user interface is equipped with Chinese character prompt, multi-parameter display LCD interface, friendly interactive interface.

17. LCD will automatically enter power-saving mode when there are 3 minutes without operation in order to maximize the extending battery life.

18. It uses conductive silicone keypad, which feels good, long life, reasonable design, and

easy to operate.

19. High-capacity, high-performance lithium-ion rechargeable battery is equipped inside, which can continuously work for more than 10 hours if the battery is fully charged.

20. It has a small size, light weight, easy to carry. It can be used both as site testing measurement and as the standard measurement equipment in laboratory.

II Technical Specifications

1. Input characteristics

Voltage measuring range: 0～200V～800V, automatic cutting gear.

Current measurement range

Clamp transformers (three types): 5A / 25A (standard)

100A / 500A (optional)

400A / 2000A (optional)

Phase angle measuring range: 0 ~ 359.99 °.

Frequency measurement range: 45 ~ 55Hz.

Voltage channels: three-channel (U_A、U_B、U_C).

Current channels: three-channel (I_A、I_B、I_C).

Maximum harmonic analysis times: 63 times.

Maximum continuous storage period in 1 minute interval: 18 months.

2. Accuracy

Measurement of electrical parameters section:

Voltage: ± 0.2%

Frequency: ± 0.01Hz

Current, power: ± 0.5%

Phase: ± 0.2 °

Power quality section:

Fundamental voltage tolerance: ≤0.5% F.S.

Fundamental current tolerance: ≤1% F.S.

Phase between fundamental voltage and current measurement error: ≤0.2 °

Percentage of harmonic voltage measurement error: ≤0.1%

Percentage of harmonic current measurement error: ≤0.2%

Three phase voltage unbalance error: ≤0.2%

Voltage deviation error: ≤0.2%

Voltage fluctuation error: ≤0.2%

3. Working temperature: -10 ℃ ～+ 40 ℃

4. Charging Power: 220V AC, 45Hz-55Hz frequency

5. Host Power: ≤3VA

6. Battery maximum working time: ≤10 hours

7. Insulation:

1) The insulation resistance between the voltage, current input terminal and the housing ≤100MΩ.

2) Withstand 1.5KV (valid value) with power frequency on operating power input and the shell, which lasts one minute.

8. Size: 320mm × 240mm × 130mm

9. Weight: 2.0Kg

III Structural Appearance

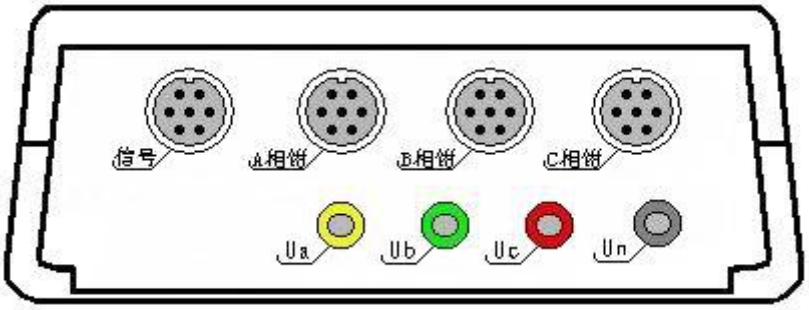
(I) Size of the shell structure and terminal arrangement

Front elevation of the instrument appearance as shown:

（电能质量测试仪：power quality analyzer　　参数设置：Parameter Setting　电气测试： Electrical Testing　　谐波测试： Harmonics Testing　频谱分析：Spectrum Analysis　　波形显示：Waveform Display 矢量分析：Vector Analysis　　电压闪变：Voltage Flicker　历史数据：Historical Data　国标查询：GB Query　移动存储：Removable Storage 磁盘查询：Disk Reading　　系统校准：System Calibration　　存储：storage　查询：query　退出：quit　设置：set　切换：shift　自检：self-checking　帮助：help　【测试】及【存储】相关参数输入：[Test]and [storage]related parameters input)

The front top of the instrument panel is a a liquid crystal display, and the below is key area, and the top part of the instrument is wiring area, and the right is other ports (communication, charging, USB) area.

Top wiring terminals district as shown:



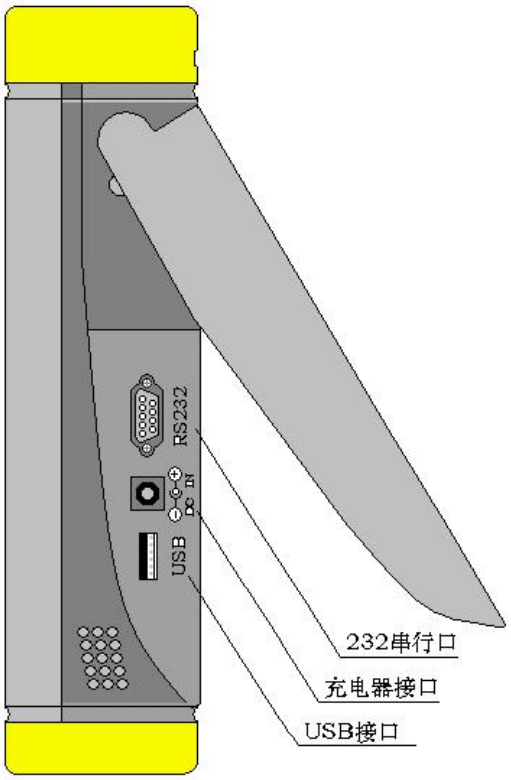
信号：Signal　A 相钳：phase-A clamp　B 相钳：phase-B clamp
C 相钳：phase-C clamp

Including: Voltage input terminals: UA、UB、UC、UN; Clamp current transformer ports (phase-A clamp, phase-B clamp, phase-C clamp); Signal port(reserved function).

A right side view of the instrument is shown at right, other parts of interface of the lower portion can be exposed when the rear holder is opened, which includes the following three parts: (232 串行口：232 serial port

充电器接口：Connector of the charger

USB 接口：USB connector)

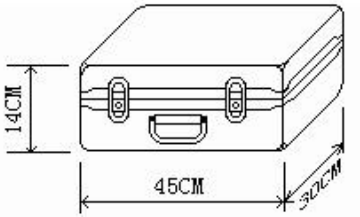


● 232 serial port (used to upload stored data to computer): It can also be used to update the program; Note: This connection to the computer must be equipped with special communication cable, which can be found in the box after you buy this instrument. Common serial cable is not suitable for this connection.

●Connector of the charger is for connecting with the charger. Please connect the charger to this connector for charging the instrument when power is low.

● USB connector can be connected to a computer via a dedicated data line. The storage card in the instrument will be used as high-capacity removable memory. The side view as shown at right:

● Size of the crates of the instruments as shown at right:



(II) Keyboard

There are 30 keys on the keyboard, namely: switch, storage, query, set, ↑, ↓, ←, → , quit, self-checking , help, figure 1, figure 2 (ABC), figure 3 (DEF), figure 4 (GHI), figure 5 (JKL), figure 6 (MNO), figure 7 (PQRS), figure 8 (TUV), figure 9 (WXYZ), figure 0, the decimal point, #, auxiliary functions button F1, F2, F3, F4, F5.

Each key function as follows:

Switching key: It is used to control power of the instrument on and off. Usage : On - press this button and then release; Off - press and hold this button for 2 seconds (the center of the screen will display "System Shutdown"), then release.

↑, ↓, ←, → keys: Moves the cursor; It is used to move the cursor in the main menu to point to a function menu, and press Enter key to enter the corresponding function; Up and down keys are used to switching current option, and left and right keys are to change the value in the parameter setting screen. In addition, ↓ can also be used to display the subdirectory menu.

↵Key: Enter key; Press this button to display the subdirectory menu in the main menu. Press this key to enter the selected function in the subdirectory menu. In addition, this button is to start and end input when you input certain parameters.

Exit key: Return key, press this key and it goes directly back to the main menu.

Storage key: It is used to store the results as records.

Query key: Pressing this key in the main menu will directly lead you to the <Disk Consult> function screen.

Setting key: Pressing this key in the main menu will directly lead you to the <Parameter Setting> function screen.

Toggle key: Reserved function, not available.

Self-test key: It is used for burning fonts during instrument debugging process, which is of no use for users.

Help key: Pressing this key in the main menu will directly lead you to the <Help File> function

screen.

Figure (character) key: It is used for inputting parameter settings (you can input figures or characters).

Decimal point key: It is used to input a decimal point when setting parameters.

Key: Reserved function, not available.

F1, F2, F3, F4, F5 keys: Auxiliary function keys (shortcuts). It is used to quickly access the auxiliary function interface or implement corresponding function as prompt message says.

When no key is pressed within five minutes the liquid crystal display will automatically enter power saving mode, press any key to restore the display.

IV LCD screen

1. Main menu:

When the power is on screen display will be shown as right. A total of twelve options are in main menu, which are: Parameter Setting, Electrical Testing, Harmonics Testing, Spectrum Analysis, Waveform Display, Vector Analysis,

（电能质量测试仪：power quality analyzer

参数设置：Parameter Setting　电气测试：Electrical Testing

谐波测试：Harmonics Testing　频谱分析：Spectrum Analysis

波形显示：Waveform Display 矢量分析：Vector Analysis 电压闪变：Voltage Flicker

历史数据：Historical Data　国标查询：GB Query　移动存储：Removable Storage 磁盘查询：Disk Reading　系统校准：System Calibration

【测试】及【存储】相关参数输入：[Test] and [storage] related parameters input)

Press ←, →, ↑, ↓ keys to change these options including Voltage Flicker, Historical Data, GB Query, Removable Storage, Disk Reading and System Calibration. It will be highlighted when the

name of the menu is selected. Related functions prompt will be shown in the blue bar at the bottom of the screen. Press Enter key to enter the corresponding functional testing and setting; Upper right corner of the screen shows the remaining power percentage of the built-in rechargeable battery, according to which users can determine whether you need to charge the instrument; Left side of the battery shows the current date and time; Left side of time shows the voltage and current measuring gear of the instrument. It is adaptive to change the voltage gear. If you need to change the current gear, you can enter the "Parameter Setting" option to manually set; Upper left corner of the screen displays the name of the instrument, the instrument number and software version.

2. "Parameter Setting" Interface:

"Parameter Setting" interface as shown at right, is used to adjust the data to be determined before trial, including: PT ratio, CT ratio, Connection Mode, Current Input, Rated Voltage, Short Circuit Capacity, Power Supply Capacity, Agreement Capacity, Setting Date, Setting Time, Substation Name, Line Name, File Name, Storage Rates, Start Storing.

（电能质量测试仪：power quality analyzer

PT 变比：PT ratio　CT 变比：CT ratio　接线方式：Connection Mode　三元件：three-element　三相四线：three-phase four-wire　电流输入：Current Input 小钳：small clamp　额定电压：Rated Voltage　一次：primary side　短路容量：Short Circuit Capacity　供电容量：Power Supply Capacity　协议容量：Agreement Capacity　设置日期：Setting Date　变电站名：Substation Name　线路名称：Line Name　文件名称：File Name 存储速率：Storage Rates　分钟：minute　帧：frame　开始存储：Start Storing 否：No 按【回车】修改，【退出】返回：Press [Enter] to modify,[Quit] to back)

●PT ratio: refers to the ratio value of voltage transformer used by the device under test. Input

method: Press Enter key to make the figures turn red, then press the corresponding figure keys to enter data, and then press Enter key to complete.

●CT ratio: refers to the ratio value of current transformer used by the device under test. Input method: Press Enter key to make the figures turn red, then press the corresponding figure keys to enter data, and then press Enter key to complete.

● Connection Mode: refers to the connection mode of the device under test, including: two-element delta connection, three-element delta connection, three-element star connection. By using ←, → key among several ways you can switch to the desired mode selected.

- Current Input: refers to the measurement method of current, including: 5A clamp measurement, 25A clamp measurement, 100A medium clamp measurement, 500A medium clamp measurement, 400A large clamp measurement (non-standard), 2000A large clamp measurement (non-standard), a total of six kinds of options. By using ←, → key among several ways you can switch to the desired mode selected.
- Rated Voltage: refers to the rated voltage on the primary side of the device under test. There are seven stalls as 0.38, 6, 10, 35, 66, 110, 220kV. Press ←, → key to switch options, and select the desired gear.
- Short Circuit Capacity: Short-circuit capacity refers to apparent power when three-phase short circuit happened on some certain point when the electric power system is in the specified run mode. It is a characteristic parameter which shows the ability of the power supply system, whose value is equal to the short-circuit current multiplied by rated voltage on the point of the three-phase short circuit.
- Power Supply Capacity: Load of power supply system, generally refers to capacity of the step-down transformer on the user side, kVAs for example.
- Agreement Capacity: Maximum active power or apparent power supply of electricity applied by users and authorized by supplier.
- Setting Date: Input method: Press Enter key to make the figures turn red, then press the corresponding figure keys to enter data, and then press Enter key to complete. For example:

January 12, 2013, enter 20130112 to confirm.

- Setting Time: Input method: Press Enter key to make the figures turn red, then press the corresponding figure keys to enter data, and then press Enter key to complete. For example: 11:45:07, enter 114507 to confirm.
- Substation Name: refers to the name of the substation where the tests are done, which is used to distinguish between the saved results. It is composed by figures and characters, which can be any combination. Enter corresponding figure / character keys directly. Input method: Press Enter key to make the contents turn red, then input the corresponding keys, and then press Enter key to complete.
- Line Name: refers to the number of circuit under test, which is used together with "Substation Name" to distinguish between the saved results. It is composed by figures and characters, which can be any combination. Enter corresponding figure / character keys directly. Input method: Press Enter key to make the contents turn red, then input the corresponding keys, and then press Enter key to complete.
- File Name: refers to the name of a file stored in recording. It is composed by figures and characters, which can be any combination. Enter corresponding figure / character keys directly. Do not enter the file extension. The program will automatically add.
- Storage Rates: refers to the time interval in storing the test data, whose minimum interval is one minute and maximum interval is five minutes. Press ←, → key to switch options, and select the desired time interval.
- Start Storing: refers to the switch of storage function setting. When you select "Yes", the storage function is on and will start storing data automatically. When you select "No", the storage function is off and will stop storing data.

Press Enter key to enter the corresponding setting, and press Escape key to return to the main menu.

3. "Electrical Testing" interface:

To display data from measured point of the transformer primary side and secondary side, Figure at right shows three-phase voltage, current amplitude from primary side, and phase angle between each phase voltage and current;

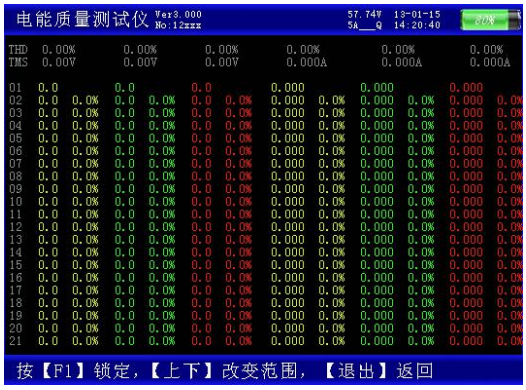
(电能质量测试仪： power quality analyzer

测试参数【一次】: measurement parameter[primary side] 测试功率【一次】: measurement power[primary side] 综合参数：comprehensive parameter

按【上下】移动，【左右】改变，【退出】返回：Press [up and down] to move,[left and right] to modify,[quit] to back)

It shows each phase active power, reactive power, apparent power, total active power P_h, total reactive power Q_h and total apparent power S_h; It also shows zero-sequence voltage U_o, zero-sequence current I_o; Positive sequence voltage U_1, positive sequence current I_1; Negative-sequence voltage U_2, negative-sequence current I_2; Voltage and current unbalance # U, # i; Measured frequency, and total power factor. Press F1 to lock the current screen for easy reading, and press F2 to continue to refresh, and press F3 to see the primary data, and press F4 to switch to the secondary side of the interface. Press Escape key to return to the main menu.

4. "Harmonics Test" Interface:



Voltage and current harmonics display as shown at right, displays each harmonic content of each phase voltage and current signal (from left to right, saying A, B, C phase voltage and A, B, C phase current), in which THD refers to voltage or current

waveform distortion of each phase (i.e. total harmonic distortion), and RMS refers to voltage or current effective value of each phase, and 01 times means a fundamental voltage or current (represented by the actual amplitude), and the following times means the values of the other

various harmonics, which is represented as valid value and percentage of the fundamental wave. It represents 1-63 harmonics in tabular. You can switch tabular of (01-21) times, (22-42) times and (43-63) of the harmonic content by ↑, ↓ keys.

Press F1 to lock the current screen for easy reading, and press F2 to continue to refresh. Press Escape key to return to the main menu.

5. "Spectrum Analysis" Interface:

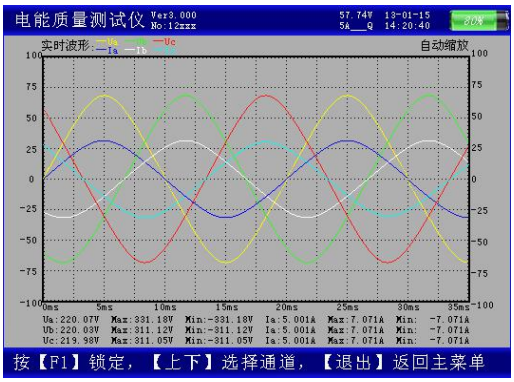
"Spectrum Analyzer" interface as shown at right, shows the harmonic content of phase-A voltage, phase-B voltage, phase-C voltage, phase-A current, phase-B current and phase-C current in histogram.

(电能质量测试仪：power quality analyzer 通道：channel 按【F1】锁定，【上下】改变范围，【左右】换通道：Press [F1] to lock, [up and down] to change range, [left and right]to change channel)

The column of adjacent times of the harmonic content can be distinguished by different colors. There are 10 colors for each group cycle. We just displayed in the histogram 32 times, for 32 or more times harmonic can hardly be used in general. UA-UB-UC-IA-IB-IC indicates the current measurement channel (available through ←, → keys to change the selected channel). The ordinate scale of 0% -10% represents the percentage of each harmonic component. The fundamental component always corresponds to 100% scale (It is amplified in display when the harmonic component are all less than 10%, i.e. as a full scale of 10%; It is on a normal scale display when there are more than one harmonic component greater than 10%, i.e. that is 100% as full scale). The abscissa indicates the times of harmonics. Numbers on the right shows the total harmonic distortion value THD, effective value and the value of 1-64 times of each harmonic (with ↑ , ↓ keys to flip). Signal with no distortion should display first harmonic (fundamental). It is tested with Ua, Ub, Uc of the three voltage channels and Ia, Ib, Ic of the three current measurement channels.

The bottom of the screen is an indicator, indicating that operations can be carried out. Press F1 to lock the current screen for easy reading, and press F2 to continue to refresh so that you can continue viewing from 1 to 64 harmonic phase voltage. Press Escape key to return to the main menu.

6. "Waveform Display" Interface:



"Waveform Display" interface is shown at right. Actual waveform of the measured analog can be displayed in this screen. The current waveform is in real-time to refresh, to visually show distortion of the measured signal (whether distortion or whether truncated). It is currently displayed as A, B, C three-phase with all of the voltage and current waveform, with ↑ , ↓ keys to switch between different phases; It can be switched to the phase-A voltage and current waveform, phase-B voltage and current waveform, phase-C voltage and current waveform, A, B, C three-phase voltage waveform ,A, B, C three-phase current waveform. It can be used as a simple oscilloscope to use.

(电能质量测试仪：power quality analyzer 实时波形：real-time waveform 自动缩放：Auto scale 按【F1】锁定，【上下】选择通道，【退出】返回主菜单：press[F1]to lock,[up and down] to select channel，[quit] to back to main menu)

The bottom of the screen is an indicator, indicating that operations can be carried out.

7. "Vector Analysis" interface:

"Vector Analysis" interface is shown at right. Measured vector hexagonal diagram of device under test is displayed in this screen. It also shows vector relationship of three-phase voltage (two-phase when two elements),

(电能质量测试仪：power quality analyzer

测试数据：measurement data　　接线分析：connection analysis　相序：phase sequence 更正系数：modifying coefficient 感性：susceptible 容性：tolerance 按【F1】锁定，【退出】返回：press[F1] to lock,[quit] to back) three-phase current (two-phase when two elements) and each phase angle reference to U_a (U_{ab} when two elements). You can visually determine whether the three-phase metering device is correct, and tolerance-susceptible relationship between loads of each phase through this screen. The above shows three-phase four-wire vector diagram when the wiring is all correct under standard resistive load. Press F1 to lock the current screen, and press F2 to continue to refresh. Press Escape key to return to the main menu.

8. "Voltage Flicker" Interface

Extension function: No function in this version.

9. "Historical Data" interface

Press F1 to view the electrical parameters from a historical moment, including: each phase voltage and current, zero-sequence voltage and current, positive sequence voltage and current,

(电能质量测试仪：power quality analyzer 电气参数：electrical parameter 记录总数：record total number 当前记录：current record 测试时间：Testing time 按【上下】浏览，【左右】快进，【退出】返回：press[up and down]to browse,[left and right]to fast forward, [quit] to back)

negative sequence voltage and current, unbalance of voltage and current, active power and reactive power of each phase, total active power, reactive power, frequency, total power factor, phase angle between each phase voltage and current, and power factor. Press F2 to view 1 up to 16 times distortion and harmonics of voltage and current. Press F3 to see 17 to 32 harmonics, F4 to see 33 to 48 harmonics, F5 to see 49 to 64 harmonics.

The bottom of the screen is an indicator. Press ↑, ↓ keys and you can browse history one by one, ←, → key to fast forward looking, Escape key to return to the main menu.

10. "GB Query" Interface

(电能质量测试仪：power quality analyzer 额定电压：rated voltage 短路容量：short circuit capacity 供电容量：Power Supply Capacity 协议容量：Agreement Capacity 次数：times 电流：current 电压：voltage 按【退出】返回主菜单：press[quit] back to main menu)

"GB Query" Interface as shown at right, shows international standard of 2 to 25 times voltage and current harmonic calculated based on the nominal voltage, short circuit capacity, power supply capacity, agreement capacity (setting in "Parameter Setting"). If the harmonics value is lower than the standard, then it's compliance with international standards.

11. "Removable Storage" Interface

This interface serves as a connection between a built-in large-capacity data storage card and a computer. The instrument can be directly used as a USB storage device.

(电能质量测试仪：power quality analyzer USB 和电脑接好线后，按【F5】键；按【退出】键返回主菜单：Be sure to connect the USB connector to a computer, press[F5]; press[quit] back to main menu)

Note: Be sure to connect the USB connector to a computer via a dedicated cable (not an ordinary USB cable) before you can press F5 to online operation, or it may cause a death phenomenon as long-awaiting, which must be shut down to end the crash.

12. "Disk Reading" Interface

"Disk Reading" interface is shown at right. This feature screen is used to view the

contents of the internal memory of the instrument, including name of the stored files, size, total disk capacity and remaining available storage space.

(电能质量测试仪：power quality analyzer 文件夹列表：folder list 无文件夹：No folders 记录文件夹列表：record folder list 按【退出】返回主菜单：press[quit]back to main menu)

13. "System Calibration" Interface

Not available for users, omit.

V Usage

The instrument is equipped with a four-core voltage testing line and three current test clamps (can be equipped to six as required). Voltage test lead is used to access to the measured voltage signal. When testing with current clamp in the field, each current clamp corresponds to a clamp connector, non interchangeable, otherwise it will affect test accuracy. There's a roundel sticker in the middle of each clamp, exhibiting phase and polarity of the clamp (The superscript N end is current outflow end. Pay attention to the polarity on use of wiring, because reversal would affect the test results).

Should be noted during the testing:

1. Intercalate the current test clamp before testing. Clip testing signal before intercalating the current test clamp is strictly prohibited. It's equivalent to open circuit on the secondary side of current test clamp, which is prone to a high-pressure of open circuit and damage the instrument. Take off all current test clamp and then unplug connected to the host after the test is completed.

2. To ensure the accuracy of each channel, the test clamp should be one-to-one correspondence, which means properly inserting each current clamp to the corresponding outlet. Exchanging different input socket will reduce accuracy of the test, but it generally does not exceed the measurement accuracy of ± 2% after crossing.

3. The test line must access to the voltage terminal of the instrument when accessing to the voltage signal, and then access to the voltage terminal of the device under test; You must

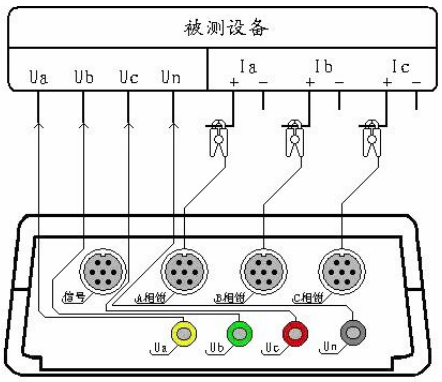
take off the voltage connector of the device under test after the test is completed, and then remove the voltage lines on instrument side. (This provision is particularly important, or it may cause a major accident)

Here's illustration about different test items.

(I) Measurement of parameters of three-phase four-wire connection mode devices

1 Purpose for testing

Detect Three-phase voltage and three-phase current signals of the device under test. Get to know real-time voltage magnitude, current amplitude, active power, reactive power, phase, frequency of the device under test, and real situation of vector relationship between the various parameters through the test data; Vector graphics of six parameters can be displayed on one screen, in order to determine the operation condition of the power supply system, and to facilitate analysis of failure causes and reasons for line losses.



三相四线制设备测试接线图

2 Testing method

(被测设备：tested equipment　信号：signal　A 相钳：phase-A clamp　B 相钳：phase-B clamp　C 相钳：phase-C clamp

三相四线制设备测试接线图：Wiring diagram for testing three-phase four-wire devices)

Specific wiring as shown:

Connect phase-A voltage terminal of the test equipment and phase-A voltage terminal of the instrument with a yellow wire when it's three-phase four-wire connection mode, and connect phase-B voltage terminal of the test equipment and phase-B voltage terminal of the instrument

with a green wire, and connect phase-C voltage terminal of the test equipment and phase-C voltage terminal of the instrument with a red wire; Three clamp current transformers are used to measure A, B, C three-phase current of the device. You can view measurement results in "Testing Parameters" screen after done with wiring.

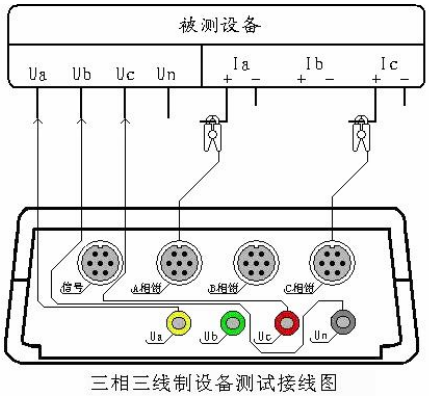
(II) Measurement of parameters of three-phase three-wire connection mode devices

1 Purpose for testing

Detect two-phase voltage and two-phase current signals of the device under test. Get to know real-time voltage magnitude, current amplitude, active power, reactive power, phase, frequency of the device under test, and real situation of vector relationship between the various parameters through the test data; Vector graphics of four parameters can be displayed on one screen, in order to determine the operation condition of the power supply system, and to facilitate analysis of failure causes and reasons for line losses.

2 Testing method

(被测设备：tested equipment　信号：signal A 相钳：phase-A clamp　B 相钳：phase-B clamp　C 相钳：phase-C clamp 三相三线制设备测试接线图：Wiring diagram for testing three-phase three-wire devices)



三相三线制设备测试接线图

Specific wiring as shown at right:

There are only three voltage lines used in three-phase three-wire connection mode, which are, yellow wire used to connect phase-A voltage terminal of the test equipment and phase-A voltage terminal of the instrument, and green wire used to connect phase-B voltage terminal of the test equipment and phase-N voltage terminal of the instrument(Note: not a phase-B), and red wire used to connect phase-C voltage terminal of the test

equipment and phase-C voltage terminal of the instrument. You can view the measurement results in the "Testing Parameters" screen after done with wiring.

(III) Measurement of waveform display section

1 Purpose for testing

You can view waveform of each parameter, understand the phase relationship between each parameter (lead or lag), observe distortion situation of waveform, analyze the causes for distortion generated, and whether the PT and CT are overload through this project.

2 Testing method

You should perform different wiring depending on varies wiring of the device under test:

Perform wiring in accordance with wiring diagram for testing three-phase four-wire devices if the device is a three-Phase four-wire connection mode one;

Perform wiring in accordance with wiring diagram for testing three-phase three-wire devices if the device is a three-Phase three-wire connection mode one.

Go to the "Waveform Display" interface for testing after wiring.

(IV) Measurement of spectrum analysis section

1 Purpose for testing

This function is used to display histogram of 1-50 times harmonic content of the parameters of each phase voltage, each phase current as well as the percentage of content of (1-64 times) harmonic in each parameter, and total harmonic distortion and other indicators. So that you can determine whether power quality of this phase voltage or current is good or bad.

2 Testing method

You should perform different wiring depending on varies wiring of the device under test:

Perform wiring in accordance with wiring diagram for testing three-phase four-wire devices if the device is a three-Phase four-wire connection mode one;

Perform wiring in accordance with wiring diagram for testing three-phase three-wire devices if the device is a three-Phase three-wire connection mode one.

Go to the "Spectrum Analysis Interface" for testing after wiring.

(V) Analysis of voltage harmonic section

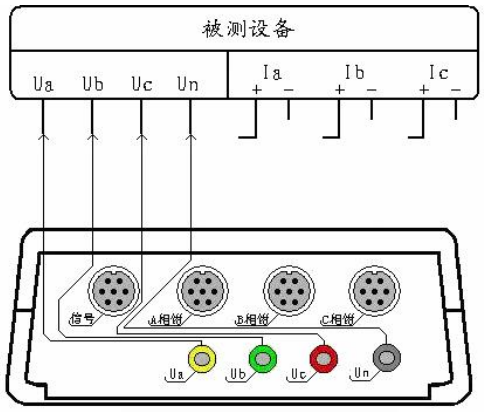
1 Purpose for testing

This function is used to display the numerical and percentage content of 2-64 harmonic content of the three-phase voltage parameters, in order to determine whether power quality of the measured voltage signal is good or bad.

2 Testing method

(被测设备：tested equipment 信号：signal A 相钳：phase-A clamp B 相钳：phase-B clamp C 相钳：phase-C clamp

电压谐波测试接线图：Voltage Harmonics Test Wiring Diagram)



电压谐波测试接线图

Specific wiring as shown at right:

In this project, three-phase voltage signal is simultaneously accessed. Make sure that four colors of yellow, green, red, black, the voltage test lines are respectively corresponding to A, B, C, N four-phase lines of measured signals (connect phase-B voltage of the test equipment to Un terminal of the instrument when PT secondary is three-wire, with only three voltage lines available). Go to the "Voltage Harmonics" interface for checking test results after wiring.

(VI) Analysis of current harmonic section

1 Purpose for testing

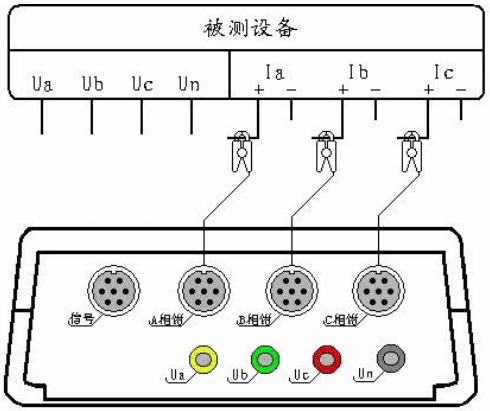
This function is used to display the numerical and percentage content of 2-64 harmonic

content of the three-phase current parameters, in order to determine whether power quality of the measured current signal is good or bad.

2 Testing method

(被测设备：tested equipment 信号：signal A 相钳：phase-A clamp B 相钳：phase-B clamp C 相钳：phase-C clamp

电流谐波测试接线图：Current Harmonics Test Wiring Diagram)



电流谐波测试接线图

Specific wiring as shown at right:

In this project, three-phase current signal is simultaneously accessed. Measure A, B, C three-phase current loop of the device under test using A, B, C three clamp current transformers respectively(Only use A, C two-phase clamps when the device under test is in three-phase three-wire connection mode). Go to the "Current Harmonics" interface for checking test results after wiring.

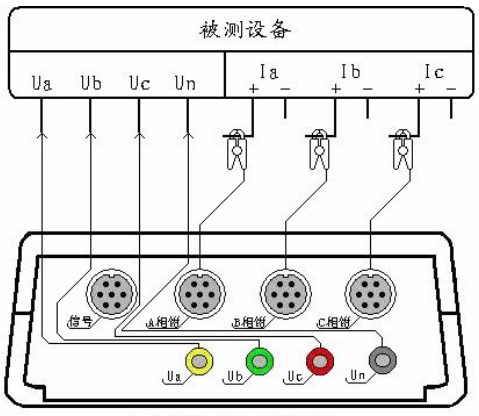
(VII) Unbalance measurement section

1 Purpose for testing

This function is used to display voltage amplitude of sub-phase, three times the zero-sequence voltage 3U0, zero-sequence voltage U0, positive sequence voltage U1, negative sequence voltage U2, voltage unbalance value #u; each sub-phase current amplitude and 3 times the zero sequence current 3I0, zero-sequence current I0, positive sequence current I1, negative sequence current I2, and current unbalance value #i. So you can assess the impact of voltage and current unbalance to power quality.

2 Testing method

Specific wiring as shown at right: (被测



不平衡度测试接线图

设备：tested equipment

信号：signal　A 相钳：phase-A clamp　B 相钳：phase-B clamp

C 相钳：phase-C clamp

不平衡度测试接线图：Unbalance Test Wiring Diagram)

Connect phase-A voltage terminal of the test equipment and phase-A voltage terminal of the instrument with a yellow wire, and connect phase-B voltage terminal of the test equipment and phase-B voltage terminal of the instrument with a green wire, and connect phase-C voltage terminal of the test equipment and phase-C voltage terminal of the instrument with a red wire; Three clamp current transformers are used to measure A, B, C three-phase current of the device. You can view the measurement results in the "Unbalance Interface" screen after done with wiring.

VI Battery Maintenance and Charging

The instrument uses a high-performance lithium-ion rechargeable battery as an internal power supply. Operator can not easily replace other types of batteries, in case causing damage to the instrument for electrical level is not compatible.

The instrument should be promptly charged, in case that deep discharge battery affects the battery life.

Charge it everyday if it’s possible under normal use (Better to charge it once a month if not used in the long-term), so as not to affect the use and battery life. Charging time should be at least six hours every time. The instrument can be continuous charging due to the internal charging protection function.

Each time when you remove the battery from the instrument, battery protection board inside the instrument will automatically enter protection status. Re-insert the battery, and the instrument can not work directly, you need to give power to the charger to rescind the protection state before working properly.

VII Notes

1. Do not touch the metal parts of the test line during measurement process to avoid electrical injury.

2. Measurement wiring must operate in strict accordance with the instructions to ensure personal safety.

3. Better use of power outlet with ground.

4. Do not work in the case of excess voltage and current limits.

5. Each clamp must be accordance with the corresponding socket on the panel, otherwise it will affect the test results.

6. You must follow the principles of accessing the instrument before the device under test when connecting to the instrument, and the principles of removing the device under test before the instrument when splitting the instrument for voltage line and clamp.

7. Pay attention that you must turn off the power supply switch whenever testing is finished, because sometimes the LCD backlight automatically goes into power-saving mode, but the LCD screen does not display while the instrument is still working as normal. That's why you must turn off the power switch.

8. When monitoring during a long time, be sure to connect to the power wire, otherwise the internal power supply will be so exhausted that it'll be unable to complete the monitoring.