KvTester
www.kvtester.com

ZC-203M

Transformer Ratio Tester

User Manual V2.0



❖KVTESTER ELECTRONICS TECHNOLOGY CO., LTD.❖

Foreword

1. Sincerely thank you for using the company's products, so you will receive the company's comprehensive technical support and service guarantee.

2. This instruction manual is applicable to the turns ratio tester.

3. Before you use this product, please read this instruction manual carefully and keep it properly for future reference.

4. Please operate strictly according to the steps required in the manual, improper use may endanger personal safety.

5. If you have any doubts during reading this manual or using the instrument, please feel free to consult our company.

Before using this instrument, please read the operation manual carefully, and it is the user's responsibility to ensure safety

This manual is subject to change without notice.

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Chapter 1 Product overview

Section 1 Application

In the production process of semi-finished and finished power transformers, before the newly installed transformers are put into operation and according to the preventive test procedures of the Ministry of Electric Power, the transformers are required to undergo turns ratio or voltage ratio tests. The operation of the traditional turns ratio bridge is cumbersome, the reading is not intuitive, and the necessary conversion is required,the test can only be carried out in a single phase, and the work efficiency is low. The turns ratio tester series overcomes the shortcomings of traditional turns ratio bridge testing. The screen adopts a large-screen color LCD screen, English menu prompt, simple and intuitive operation, complete the three-phase turns ratio test at one time, the test speed is fast, the accuracy is high, and the protection function is perfect. The instrument generates a highly stable test power supply to avoid the influence of the external power supply on the test data. The turns ratio tester series provides two power supply methods: AC 100-240V and internal lithium battery, which is convenient for users to use in different scenarios.

Section 2 Performance Characteristics

- The interface adopts intelligent touch mode, which is simple and convenient to operate.
- High stability sine wave power supply, the test voltage is automatically adjusted according to the load.
- The quality of the power supply in the field is poor and the test data is accurate when the generator is powered.
- The test speed is fast, and the three-phase transformation ratio test can be completed in one wiring, which only takes 10 seconds.
- CT, PT, CVT and Z-connection transformers can be tested.
- It is suitable for ratio measurement from distribution transformers to 1000KV transformers, current transformers (CT), voltage transformers (PT) and Z-type connection transformers.
- A variety of short circuit measurement methods are set inside, which is more convenient for

fault judgment.

- No power-off clock and date display, 200 sets of data can be saved in the machine, and the power-down data will not be lost.
- Large color LCD display, clear and easy to read data. RS485 communication interface and U disk storage interface.
- The instrument has the function of high and low voltage reverse connection protection, and has the function of transformer short circuit and inter-turn short circuit protection.

Chapter 2 Special Tips

Section 1 Power Supply Aspects

This instrument provides two power supply modes, AC model uses AC100~240V 50/60HZ, DC model has built-in lithium battery.

Section 2 Security Aspects

1) Be sure to read this manual carefully before using this instrument.

2) The operator of the instrument should have common sense of the use of electrical equipment or instruments.

3) **For the safety of the instrument and the operator, the instrument should be reliably grounded when used.** When testing equipment, the ground wire is connected first, and the grounding wire is removed at the end of the work.

4) The output voltage of the instrument is high, and safety should be paid attention to to prevent electric shock.

5) This instrument can be used both indoors and outdoors, but it should be avoided in harsh environments such as rain and corrosive gas.

6) The maintenance, care and adjustment of the instrument should be carried out by professionals.

7) The instrument should avoid violent vibration.

Section 3 Operational Aspects

1) The connection between the instrument panel and the test line should be tightened and there should be no loosening.

2) When wiring, the yellow, green, red and black of the test wire clamp correspond to the A, B, C, O of the transformer respectively, and the high and low voltage cables should not be reversed.

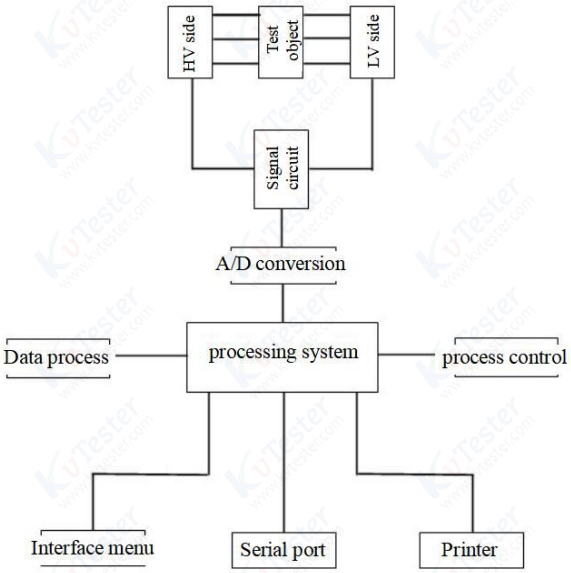
3) When measuring in single phase, use yellow and black wire clamps, don't use the wrong ones, and the unused test clips should be suspended.

4) After the wiring is completed, it should be checked again to see if there is any wiring error. During the test, if there is any abnormal phenomenon, the power should be turned off immediately and the wiring should be checked.

Chapter 3 Technical Datas

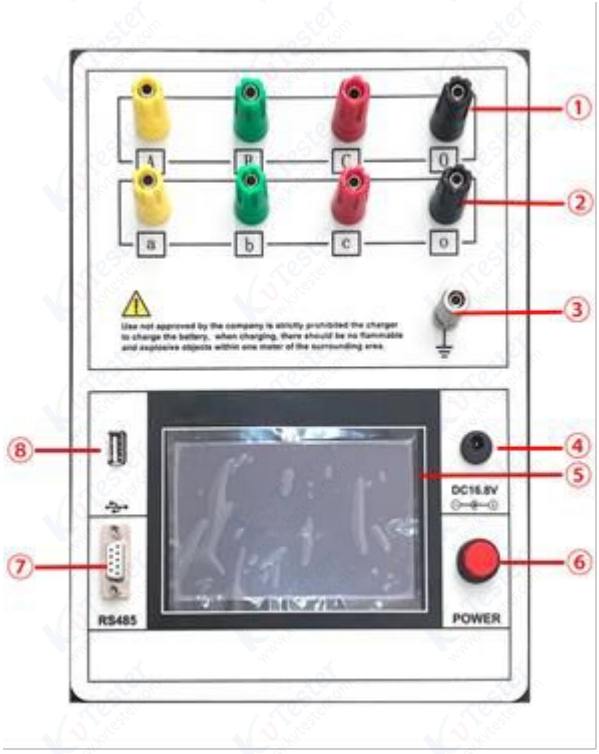
Display digits	5 bits	
Output voltage	≤160V	
Test Range	0.9-10000	
accuracy	<2000	±0.1%
	2000-10000	±0.3%
Minimum resolution	0.0001	
power supply	AC100-240V,50/60Hz,or lithium battery	
Test data storage	200 sets	
Operating temperature	－20℃～40℃	
relative humidity	≤ 80%, non-condensing	
volume	285 mm * 218 mm * 158 mm	
net weight	5kg	

Chapter 4 Working Principle

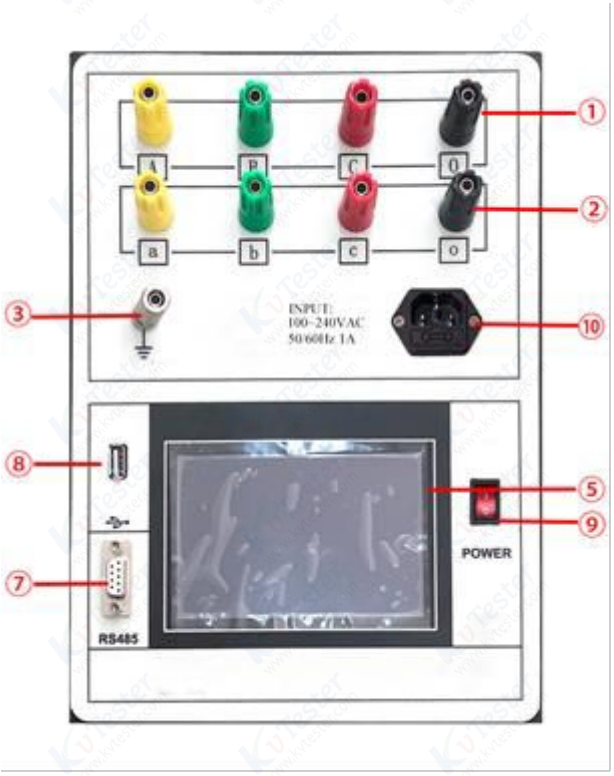


Chapter 5 Instrument Panel

Section 1 Panel Schematic:



Battery-powered instrument panel



AC-powered instrument panel

Section 2 Description of each part:

1) High-voltage output: yellow, green, red, black binding posts, respectively A, B, C, O three phases, connected to the corresponding color cable, the other end of the cable has yellow, green, red, black clamps, corresponding to the high voltage side of the transformer under test A, B, C, O three phases.

2) Low-voltage input terminal: yellow, green, red, black binding posts, respectively a, b, c, o three phases, connect the corresponding color cable, the other end of the cable has yellow, green, red, black clamps, corresponding to the low voltage side of the transformer under test a, b, c, o three phases.

3) ⏚ Protect the grounding post, in order to ensure the safety of the operator and the normal operation of the instrument, the terminal of the terminal should be reliably grounded before use.

4) Battery charger interface: used to charge the battery inside the tester.

5) LCD touch LCD display: used to operate the menu and display the test results.

6) Battery instrument switch.

7) RS485 communication interface: used to connect to PC, convenient for remote control through PC.

8) USB interface: used to export test records to USB devices.

9) AC instrument power switch.

10) Power socket: AC power input port, connected to 100-240V, 50/60Hz AC power supply, the socket contains a fuse, this instrument should be installed with a 1A fuse.

Chapter 6 Instructions

Section 1 Instrument boot interface

After turning on the power of the instrument, the 2-second boot screen is displayed, and the instrument is being initialized accordingly, as shown in Figure 1.



Figure 1

Section 2 Instrument self-test:

After the instrument-related initialization is complete, an internal self-test is performed, as shown in Figure 2.

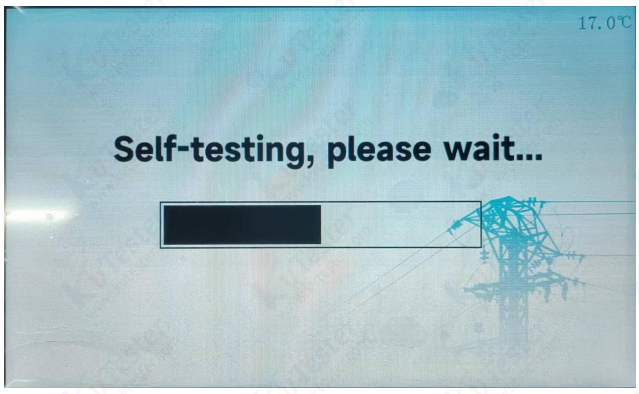


Figure 2

Section 3 Main menu

After the instrument self-test is completed, it will automatically enter the main menu, as shown in Figure 3.

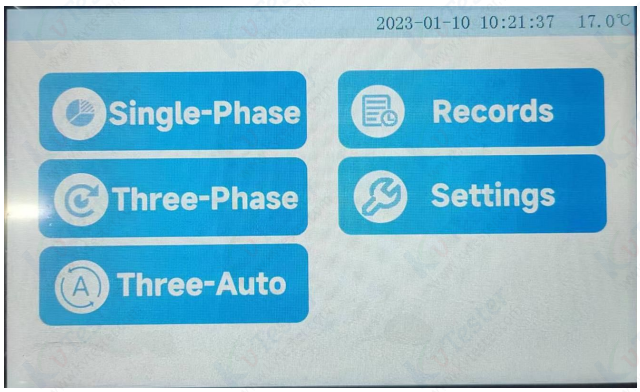


Figure 3

The main menu is mainly divided into **test operation buttons, time display area, system setting buttons, and access history buttons**。

A）**Test operation buttons：**

< Single-phase > : Single-phase transformation ratio test.

< Three-Auto > : The instrument automatically performs three-phase testing without entering parameters.

< three-phase >: with neutral point test method, it can test transformer turn ratio. The specific test methods are shown in Appendix I。

B）**Time display area：**

Displays the current perpetual calendar information in the format of: 2015-01-20 10:20:48.

C）**Settings button：**

Instrument system settings menu.

D）**Records botton:**

Click the record button to enter the record interface, which is convenient to view the relevant test records.

Section 4 Single-phase testing

Click the <Single-Phase test > button on the main menu panel, and the instrument will enter the < parameter setting > menu to set the relevant parameters, as shown in Figure 4.



Figure 4

Including:

Rated HV: The rated voltage on the high voltage side of the transformer.

Rated LV: The rated voltage on the low voltage side of the transformer.

Taps distance: transformer equal tap distance.

Rated Tap Side: Determines whether the tap changer position is on the high voltage or low voltage side of the tap.

Rated tap: Fill in the rated tap position of the transformer.

Plus taping: fill in the number of positive taps of the transformer (optional)

Asset ID: The number of the device under test.

Like Polarity: Select the copolarity display "-" or "+".

Note: After correctly entering the transformer's rated HV, rated LV, rated tap, and tap-distance, the test result will automatically display the number of positions and the error value of this tap.

After the parameter setting is completed, click the test button in the lower right corner to start the test, and the test result is shown in Figure 5.

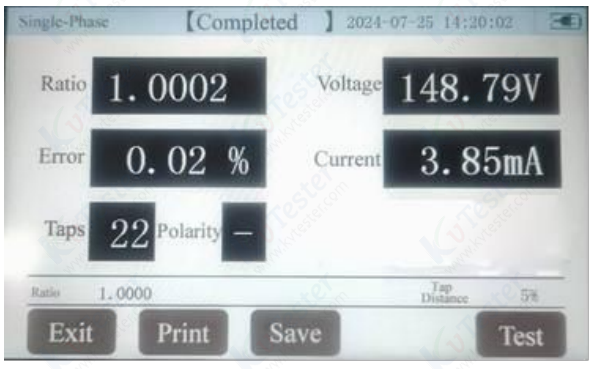
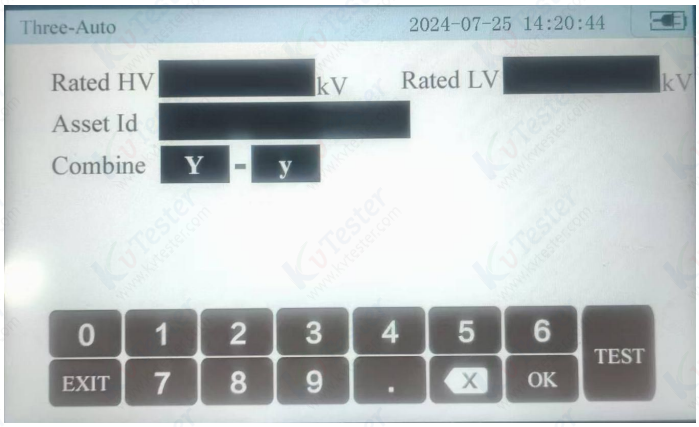


Figure 5

Section 5 Auto test:



The instrument performs three-phase automatic testing, and the ratio test can be completed without entering parameters. The three-phase automatic test interface is shown in Figure 6.

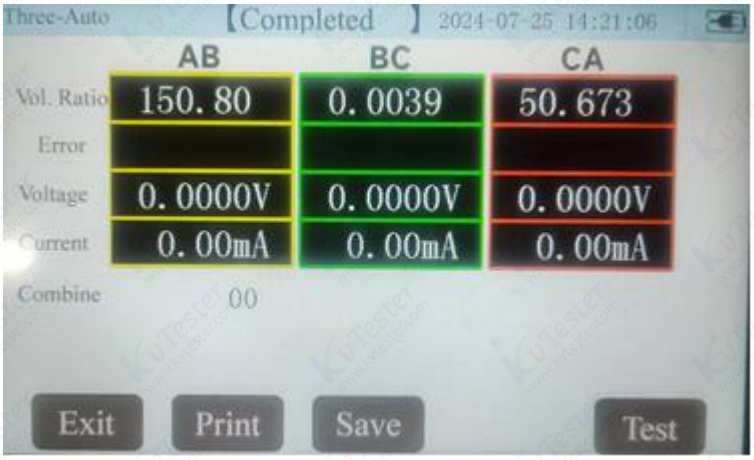


Figure 6

Section 6 Three phase test:

Click the <Three-phase Test> button on the main menu panel, and the instrument will enter the relevant parameter settings > <Three-phase Parameter Setting, as shown in Figure 7.

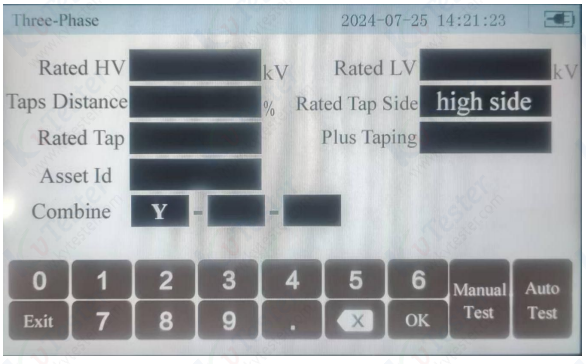


Figure 7

Including：

Rated HV: The rated voltage on the high voltage side of the transformer.

Rated LV: The rated voltage on the low voltage side of the transformer.

Taps distance: transformer equal tap distance.

Rated Tap Side: Determines whether the tap changer position is on the high voltage or low voltage side of the tap.

Rated tap: Fill in the rated tap position of the transformer.

Plus taping: fill in the number of positive taps of the transformer (optional)

Asset ID: The number of the device under test.

Combine: Select the connection mode of the transformer under test. When the input connection mode is inconsistent with the tested connection mode, the instrument will be alerted in red。

Note: After correctly entering the four data of the transformer's high voltage, low voltage, rated tap, and tap distance, the test result will automatically display the number of tap positions and the error value of this tap。

After the parameter setting is completed, click the Auto test button in the lower right corner to start the test, as shown in Figure 8.



Figure 8

Section 7 Records interface:

Select the <Records> key in the main menu to enter the record interface, as shown in Figure 9:

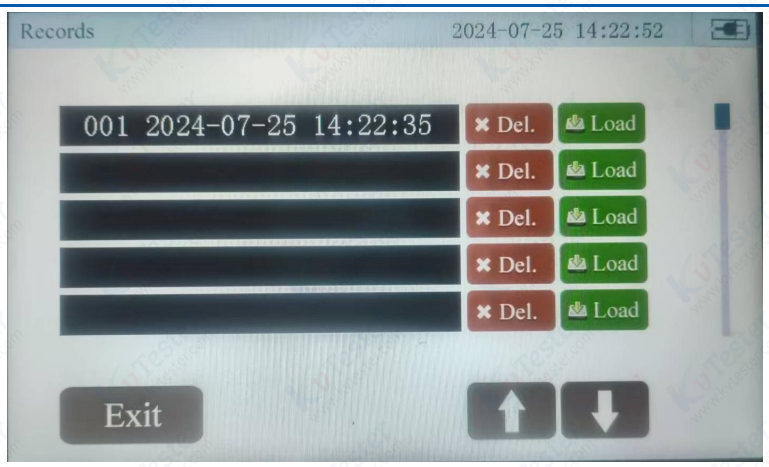


Figure 9

A total of 200 sets of data can be stored on the instrument. Users can flip the screen by "↑" and "↓", and the blue progress bar on the right indicates the current scrolling position. When 200 data sets are stored, the latest data overwrites the oldest data. Each set of data can be deleted and exported to a USB device separately.

The directory consists of the data type and the data test time, for example: S 2015-01-20 10:20:38, where S indicates that this set of test data is single-phase test data, if the test data is three-phase test data, it is T. The following time indicates the time when the data was tested. Click on the data in the directory to go to the specific data display page.

Section 8 System Settings interface

From the main menu, press < Settings> key. The instrument enters the instrument setting menu, as shown in Figure 10.

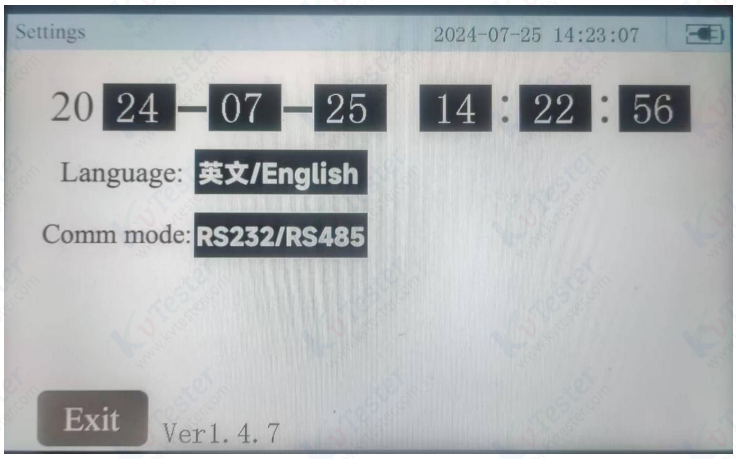


Figure 10

<Test Mode>: This option generally defaults to Auto mode, and when the transformer has a small a mount of leftover magnetic which affect test result, try using the “Manual” mode to test, where the

tester manually controls the test time and click the "Next" button to perform the next phase data tes t when the first phase of the data stabilizes. If accurate data is still not available, degaussing needed before performing the ratio test.

< Language >: Used to switch between Chinese and English in the instrument menu。

< Comm mode>: wireless communication (Bluetooth/WIFI) or wired (RS232/485) communication options.

Time setting: You can set the date and time by pressing the up and down keys of the time display location.

Section 9 Store Datas:

After testing, the instrument will automatically display the test results, press the "Save" key to store the data, and after completion, the upper right corner of the instrument will prompt [Save Completed]

Section 10 Review datas

The "Records" button on the main menu allows you to review the test records. For details, see 6.7 record page.

Section 11 Delete datas:

Enter the records interface through the "Record" key of the main menu, at this time the stored record directory is displayed, each record corresponds to a "Del" key, the user can delete the data through the "Del" key on the right, delete a group of data needs to click the "Del" key twice, the first time you click the "Del" key, the corresponding data directory will become red, and when you click the "Del" button again, the data will be deleted.

Section 12 Download datas to USB flash

The user can export the record data saved to a USB flash drive, and when the interface is in record interface, insert the USB flash drive, and the USB flash drive connection logo will be displayed in the upper right corner of the screen. After the USB flash drive is unplugged, the USB

flash drive connection symbol disappears automatically. After the USB flash drive is successfully connected, click the "Load" button corresponding to the data to be exported, and the data will be imported to the USB flash drive. When the data export is completed, the screen prompts [Export Completed], as shown in Figure 11.

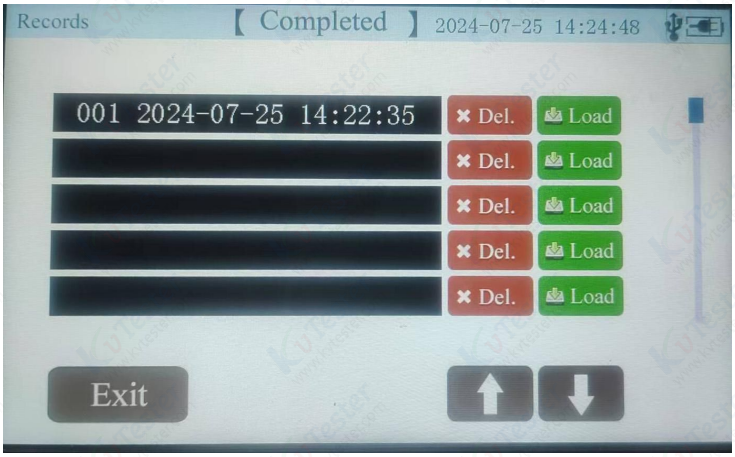


Figure 11

At this time, the instrument will automatically create a folder named "KV ******" in the root directory of the USB flash drive (the last six digits are the year, month and day of the data storage) and create a file named "KV ******.TXT" (the last six digits are the hours, minutes, and seconds of the data storage).

Section 13 Printing datas

The instrument can choose a Bluetooth printer for test data printing.

After testing, the instrument will prompt [Test Completed]. At this time.

(Note: During the test, the printing and storage operations are invalid, and the instrument will not execute the corresponding commands.)

Chapter 7 Test

Section 1 Wiring preparation

1）Clamp one end of the grounding wire to the ground grid, and one end is reliably attached to the grounding terminal of the panel. Note: The grounding point of the ground grid should have good electrical conductivity, otherwise the accuracy of the measurement will be affected.

2）Wiring in strict accordance with the wiring diagram, and ensure that the contact points are in good contact.

3）During the test, the test object should be disconnected from the external line.

Section 2 Test Steps

1）Turn on the power switch and wait for the instrument to enter the main menu.

2）Select "Auto Test", "Single-phase Test", "Three-Phase Test" according to the situation.

Section 3 Clean up the power switch

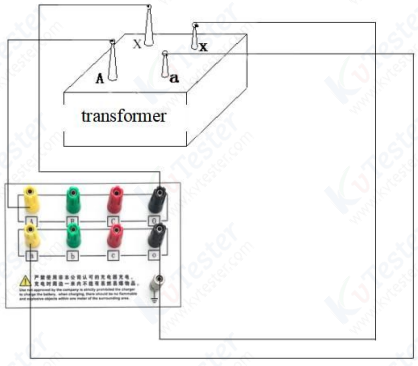
1) Turn off the power switch.

2) Dismantle and put away the two sets of dedicated test wires for easy use next time.

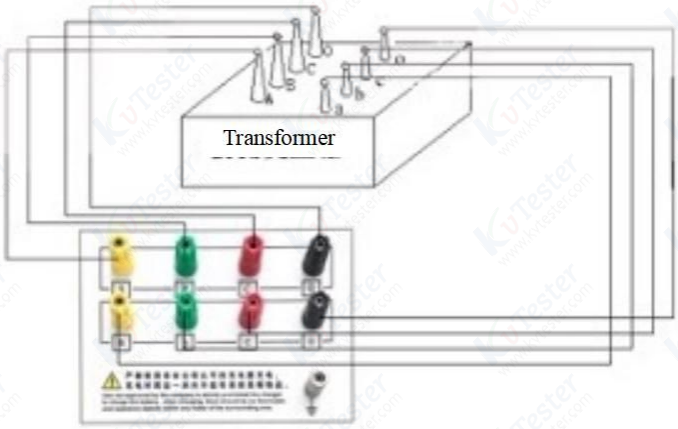
3) Remove the grounding wire and tidy it up.

Chapter 8 Wiring diagram

Section 1 Single-phase transformers



Section 2 Three-phase transformers



Chapter 9 Transportation & Maintenance

Section 1 Transportation

This product must be packed during transportation, and the packing box can be a carton or wooden box, and the packaging box should be padded with a foam shockproof layer. The packaged products should be able to be transported by road, rail and air. It shall not be placed in an open car during transportation. The warehouse should pay attention to rain, dust, and mechanical damage。

Section 2 Storage

When the instrument is not in use, it should be stored in an indoor room with ambient temperature of -20°C~60°C, relative humidity not exceeding 85%, ventilation and no corrosive gas. It should not be stored against walls and floors

Section 3 Protection from Moisture

In humid areas or humid seasons, if this instrument is not used for a long time, it is required to turn on the power once a month (about two hours) to dissipate moisture and protect components

Section 4 Protection from the sun

When the instrument is used outdoors, avoid or reduce direct exposure to sunlight on the LCD screen as much as possible.

Section 5 Maintenance

When the instrument is not used for a long time, the battery should be regularly maintained (at least once every 90 days for a full charge). In order to avoid battery failure affecting the use of the instrument.

Chapter 10 Precautions

1. The output voltage of the instrument is 160V, and safety should be paid attention to to prevent electric shock。

2. When testing a transformer with an on-load tap-changer in neutral, the correct number of positive tap-changers is entered to display the correct tap number.

Chapter 11 After-sales service

The instrument is granted with free repair and replacement for problems arising from product quality within one year from the date of purchase, and lifetime warranty and technical services. For any abnormality or fault of the instrument, please contact us in time for the most convenient solution.

Chapter 12 Packing List

Name	Quantity	Remarks
Host	1	
Test cable	1 set	It is 13 meters long, with yellow, green, red and black color each two pieces
Three-core power cord	1	250V/10A（For AC model）
Grounding wire	1	2 meters
Operator's manual	1	
User manual	1	
Fuse	2	2A
Test report	1	
Power adapter	1	16825 (battery model)

Chapter 13 Appendix 1

Turns Ratio Tester Winding Short Circuit and Measurement Method

Group	HV side UH	LV side UL	Turns ratio K
D—d—0 D—d—6	A—B	a—b	K=UH/UL
	B—C	b—c	
	C—A	c--a	
D—d—2 D—d—8	A—B	b—c	K=UH/UL
	B—C	c—a	
	C—A	a—b	
D—d—4 D—d—10	A—B	c—a	K=UH/UL
	B—C	a—b	
	C—A	b--c	
Y—y—0 Y—y—6	A-(B-C)	a-(b-c)	K=UH/UL
	B-(C-A)	b-(c-a)	
	C-(A-B)	c-(a-b)	
Y—y—2 Y—y—8	A-(B-C)	b-(c-a)	K=UH/UL
	B-(C-A)	c-(a-b)	
	C-(A-B)	a-(b-c)	
Y—y—4 Y—y—10	A-(B-C)	c-(a-b)	K=UH/UL
	B-(C-A)	a-(b-c)	
	C-(A-B)	b-(c-a)	
YN—yn—0 YN—yn—6	A—O	a—o	K=UH/UL
	B—O	b—o	
	C—O	c—o	
YN—yn—2 YN—yn—8	A—O	b—o	K=UH/UL
	B—O	c—o	
	C—O	a—o	
YN—yn—4 YN—yn—10	A—O	c—o	K=UH/UL
	B—O	a—o	
	C—O	b—o	
YN—y—0	A—O	a-(b-c)	

YN－y－6	B－O	b-(c-a)	K=(UH/UL)×1.5
	C－O	c-(a-b)	
YN－y－2 YN－y－8	A－O	b-(c-a)	K=(UH/UL)×1.5
	B－O	c-(a-b)	
	C－O	a-(b-c)	
YN－y－4 YN－y－10	A－O	c-(a-b)	K=(UH/UL)×1.5
	B－O	a-(b-c)	
	C－O	b-(c-a)	
Y－yn－0 Y－yn－6	A-(B-C)	a—o	K=(UH/UL)/1.5
	B-(C-A)	b—o	
	C-(A-B)	c—o	
Y－yn－2 Y－yn－8	A-(B-C)	b—o	K=(UH/UL)/1.5
	B-(C-A)	c—o	
	C-(A-B)	a—o	
Y－yn－4 Y－yn－10	A-(B-C)	c—o	K=(UH/UL)/1.5
	B-(C-A)	a—o	
	C-(A-B)	b—o	
YN－d－1 YN－d－7	A－O	a—b	K=(UH/UL)×√3
	B－O	b—c	
	C－O	c--a	
YN－d－3 YN－d－9	A－O	b—c	K=(UH/UL)×√3
	B－O	c—a	
	C－O	a—b	
YN－d－5 YN－d－11	A－O	c—a	K=(UH/UL)×√3
	B－O	a—b	
	C－O	b--c	
Y－d－1 Y－d－7	A-(B-C)	a—b	K=(UH/UL)×(2/√3)
	B-(C-A)	b—c	
	C-(A-B)	c--a	
Y－d－3 Y－d－9	A-(B-C)	b—c	K=(UH/UL)×(2/√3)
	B-(C-A)	c—a	

	C-(A-B)	a—b	
Y—d—5 Y—d—11	A-(B-C)	c—a	K=(UH/UL)×(2/√3)
	B-(C-A)	a—b	
	C-(A-B)	b--c	
D—yn—1 D—yn—7	A—B	b—o	K=(UH/UL)/√3
	B—C	c—o	
	C—A	a—o	
D—yn—3 D—yn—9	A—B	c—o	K=(UH/UL)/√3
	B—C	a—o	
	C—A	b—o	
D—yn—5 D—yn—11	A—B	a—o	K=(UH/UL)/√3
	B—C	b—o	
	C—A	c—o	
D—y—1 D—y—7	A—B	b-(c-a)	K=(UH/UL)/(2/√3)
	B—C	c-(a-b)	
	C—A	a-(b-c)	
D—y—3 D—y—9	A—B	c-(a-b)	K=(UH/UL)/(2/√3)
	B—C	a-(b-c)	
	C—A	b-(c-a)	
D—y—5 D—y—11	A—B	a-(b-c)	K=(UH/UL)/(2/√3)
	B—C	b-(c-a)	
	C—A	c-(a-b)	

Chapter 14 Appendix 2

Prompt Information and Handling

Prompt Message	Meaning	Required Actions
	The instrument is powered by the battery 100% battery capacity left.	

	The instrument is powered by the battery 75% battery capacity left.	
	The instrument is powered by the battery 50% battery capacity left.	
	The instrument is powered by the battery 20% battery capacity left.	Charge as soon as possible to not affect using..
	The instrument is powered by the battery Battery is out of power.	Charge as soon as possible to not affect using..
Under testing	The instrument is testing, please wait.	
Test completed.	The instrument finishes testing and is able to print and save data.	
Under printing.	The instrument is printing, please wait	
Print completed.	The instrument finishes printing	
Under saving	The instrument is saving test data to memory, please wait	
Save completed.	The instrument finishes saving of test data	

	USB has been correctly inserted into the instrument and data can be exported.	
Under exporting.	The data saved in the instrument is being imported into the USB flash drive, please wait	
Export completed.	The operation of exporting the recorded data has been completed. The USB flash drive can be pulled out or the next set of data can be exported after 2 seconds.	
Export falied.	An error occurred in the process of data exporting, and the export of records failed.	Export data again. If the export fails again, please replace the USB flash drive, restart the instrument and export again. In case of repeated export failures, please contact the manufacturer's technician for handling.
USB module error	The internal module of the instrument fails.	Please contact the manufacturer’s technician for handling
Input error	The input parameters have an error	Please check the input parameters to see if they meet the specifications.
Internal Error	Instrument internal error	Please restart the instrument and try again. If the fault is not eliminated, please contact the manufacturer's technician for

		handling.
Test error	An error occurred during the testing of the instrument	Please check if the test leads are correctly connected. If the fault is not eliminated, please contact the manufacturer's technician for handling.
! Current Protection	Overcurrent	Check if there's short circuits in the wiring and tested product.
! Voltage Protection	Overvoltage	Please check if high and low voltage test leads are reversed in connection
! Battery Protection	The part of inverter power source fails	Please restart the instrument and try again. If the fault is not eliminated, please contact the manufacturer's technician for handling.

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