Introduction

welcome to:

Sincerely thank you for choosing our products,As a result, you will receive comprehensive technical support and service guarantee from our company.

Please read this manual carefully before using this product and keep it properly for future reference.If you have any questions during use, please contact our company in time.

About this instrument:

The transformer on-load tap changer parameter tester is used for measuring and analyzing electrical performance indexes of power transformers and special transformers on-load tap changers in power systems.Through the precise measurement circuit, the parameters such as transition time, transition waveform, transition resistance and three-phase synchronism of the on-load tap-changer can be accurately measured.

The user can measure directly by the tap changer lead or take the transformer body together according to the needs and site conditions. The instrument has many functions such as displaying, analyzing, printing, storing, communicating, uploading and PC testing the measured data, which can diagnose the potential faults of on-load tap-changer in time in the preventive test of power equipment and transformer overhaul and improve the reliability of power system operation.

Main features:

1） **High accuracy measurement:**The instrument is designed as a high-voltage test equipment that fully meets the power industry standards of the People's Republic of China. The general technical conditions DL / T846 and 8 - 2004 are adopted. The high-speed ARM processor and the 6 - channel high-resolution synchronous A / D converter are adopted, and the four-wire resistance measurement method eliminates the lead resistance and achieves high-precision standard measurement.

2） Light wave function: The instrument can record A, B and C phases simultaneously in three channels. The instrument can automatically capture and display the transition resistance and time jump during the transition process. It can work normally in complex environment and is far better than light oscillograph in precision and intelligence.

3） Comprehensive test capability: All kinds of parameters of on-load tap-changer can be comprehensively measured in one instrument. Such as switch selection, whether there is a break point, transition waveform, transition time, transition resistance, and three-phase synchronism in the whole process of switching. The time and resistance of each time period in the waveform can also be analyzed in further detail.

4） Man - machine control is perfect: 320× 240 (QVGA) high-resolution display is selected and driven by a high-speed microprocessor to realize a perfect man-machine interface, full Chinese character prompt, high-speed printing and intuitive and fast output results. The built-in help menu basically enables the operator to operate without looking at the instructions.

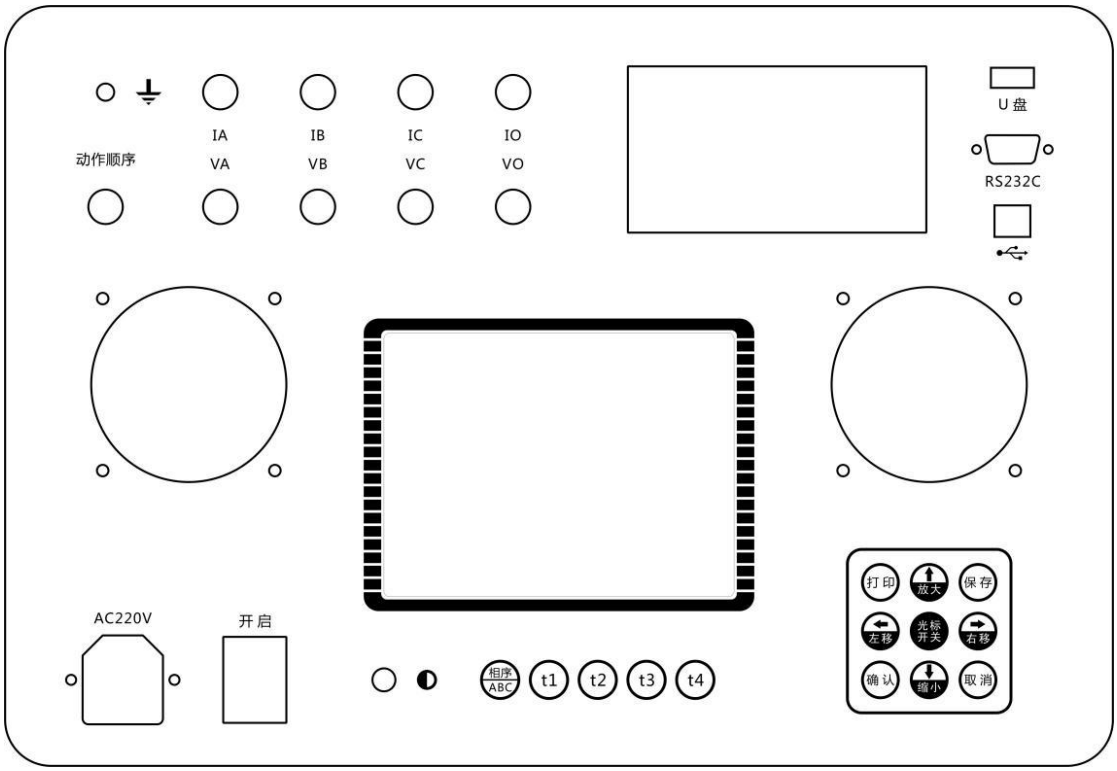
5） USB Storage Management: 100 test records can be stored inside the instrument. You can also connect U disk for data transfer, and the file system is fully compatible with the standard PC.

6） PC test function: PC can be connected to the instrument host through USB or RS232, and the instrument can be operated through special test software to analyze the test data in more detail.

7） PC test function: Anti - interference portable design: The instrument adopts an independent chassis structure with anti-seismic and anti-electromagnetic

interference characteristics. The power supply has a wide working range and is designed as a three-phase independent constant current source. Compact structure, easy carrying and field measurement.

I. panel



1. Printers: This instrument uses a miniature high-speed printer of the plate type to ensure fine, smooth and clear printing of data and waveforms.

2. Display: This instrument is equipped with a 320× 240 dot large screen dot matrix liquid crystal display, which is used to display the instrument's function menu, measurement results, parameter setting, fault indication, waveform curve, etc.

3. Keyboard: 1) Cursor Waveform Analysis Function Keys: 5 in phase sequence ABC, T1, T2, T3 and T4; Used in graphic analysis operations.

Press the cursor key and any of the above keys to automatically position the cursor. The ABC key in phase sequence is used to adjust phases A, B and C; T1, T2, T3 and T4 keys are used to adjust cursor line positions respectively.

2) Direction and control keys: cursor switch (switching), ↑ / zoom in, ↑ / zoom out, ← / move left, → / move right, confirm, cancel, print and save a total of 9. The keys ↑, ↓, ↓, → are valid by default. Press the cursor to open the key to (or exit from) the graphic operation state, then the zoom-in and zoom-out keys are valid, and the horizontal time axis can be zoomed in or zoomed out at this time. The move left and

move right keys are valid, and the entire screen can be moved left and right at this time.

4. Action sequence: Measure the number of turns in the action sequence

5. Grounding: grounding the instrument case

6. RS232 communication: communication

7. USB Communication: Communication, U Disk

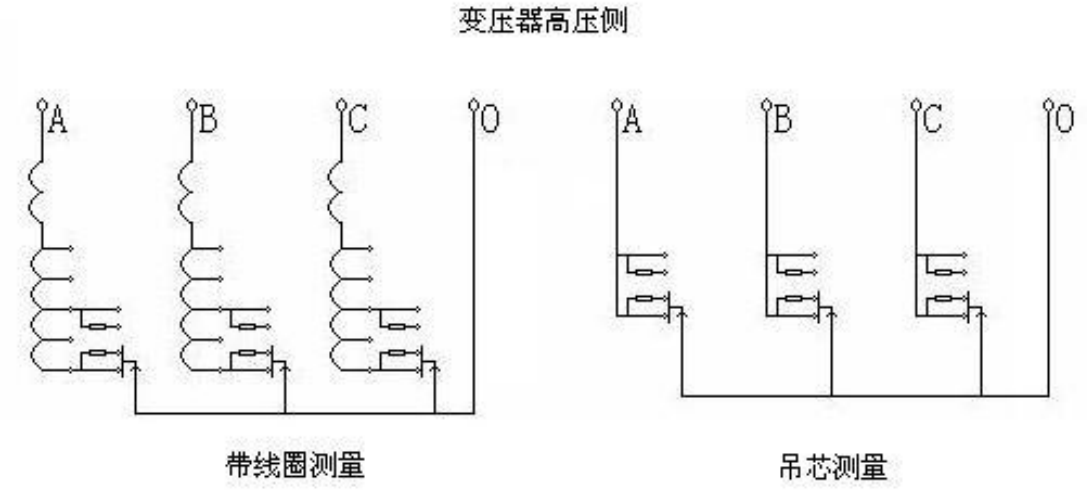
8. Current terminals: IA +, IB +, IC +, IO -

9. Voltage posts: VA +, VB +, VC +, VO -

10. Power outlet: AC 220 V

11. Power switch: the working power is turned on

II. Wiring:



Note:

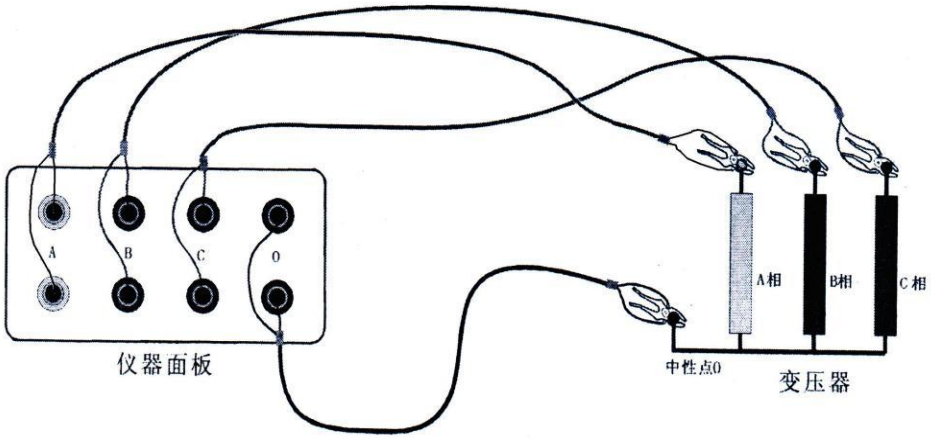
1.The other measuring windings of the transformer that are electrically independent must be short-circuited and grounded.

2. For problematic waveforms, such as a breakpoint somewhere, you can do it again in reverse. If there is also a breakpoint at the symmetry between the waveform measured in the reverse direction and the waveform measured in the forward direction, it is likely to be a problem. If there is no breakpoint, it should be done positively again to prevent misjudgment.

3. When the three-phase waveform is disordered, it may be one of the poor contacts, and the phase separation test shall be conducted at this time.

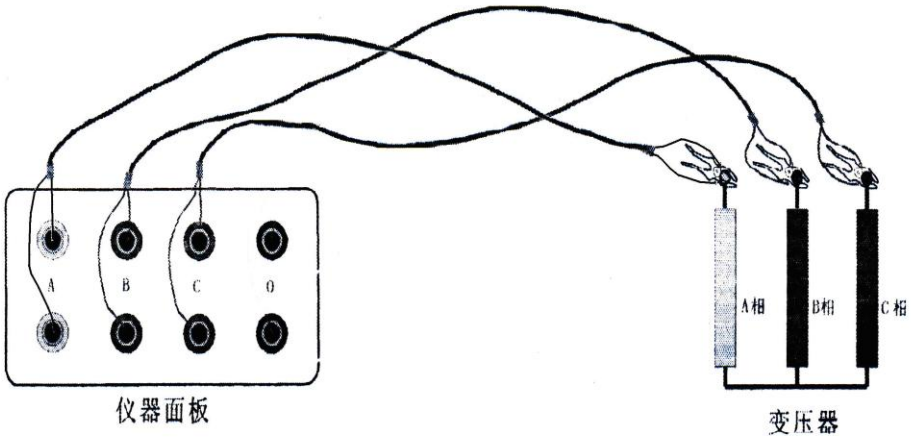
4. For the on-load switch that has not moved for a long time, it should be sucked in several times before the test to remove the oxide layer on the contact surface and impurities between the contacts.

(1) On - load voltage regulating winding Y - type wiring has neutral point measurement:



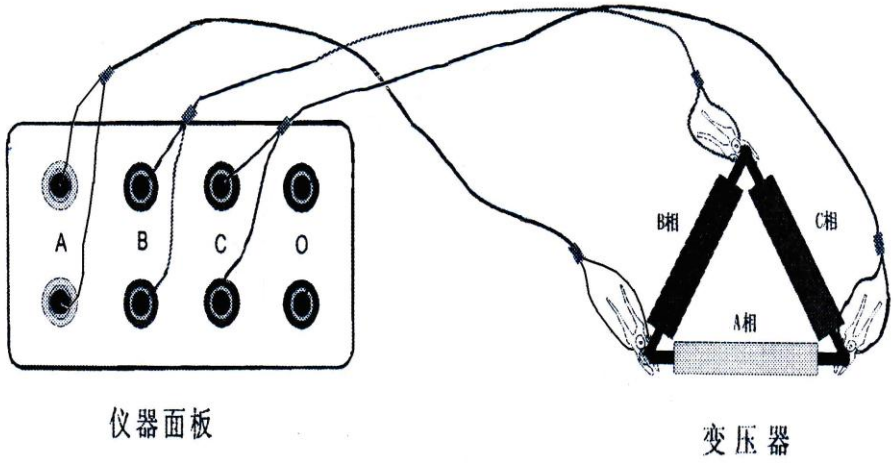
Yellow, green, red and black lines are sandwiched between A, B and C terminals of transformer high voltage and O terminals of neutral point. **Connection type:** " neutral point leading out", **current mode:** " (a. b. c) - > o".

(2) On - load voltage regulating winding Y - type wiring has no neutral point measurement



Each time two phases are measured, the other phase is used as neutral point (B or C). Take A and B phases as examples to explain as follows: **wiring type:** " neutral point does not lead out"; **Current mode:** " (a. b) - > c". Measure A and B phases and clamp the yellow, green and red clamps on A, B and C of the transformer respectively. The wiring of the instrument panel is that the yellow wire is connected to the A phase port, the green wire is connected to the B phase port and the red wire is connected to the C phase port.

(3) On - load voltage regulating winding △ type wiring measurement



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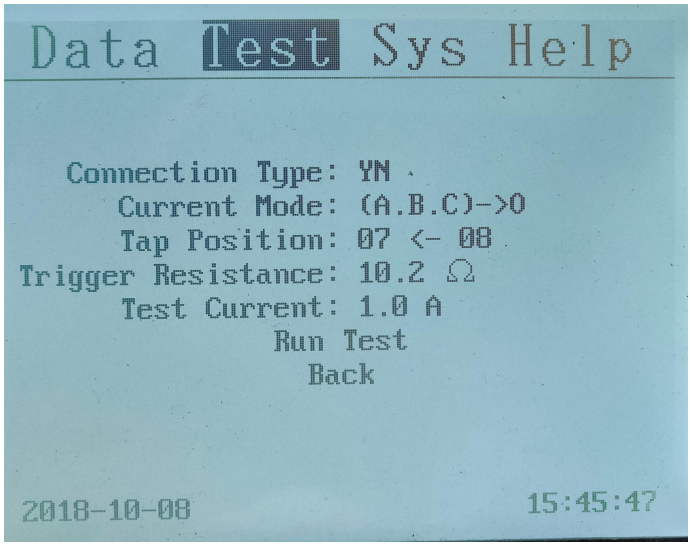
(4) measurement without coil

When the transformer is overhauled, the on-load tap-changer is hoisted out without coil connection. As shown in the hanging core wiring diagram in the previous figure, the contacts connected to the switches in each phase can be short-circuited and connected to the test line.

Ⅲ. menu operation:

(1) Setting: Turn on the power switch of the instrument after checking that the wiring is correct. The boot screen is shown in the following figure.



1. Wiring types: divided into " neutral point leading out" and " neutral point not leading out"

2. current mode: when neutral point leads out, it is " (a b c) - > o"; When the neutral point does not lead out, it is " (a. b) - > c" or " (a. c) - > b".

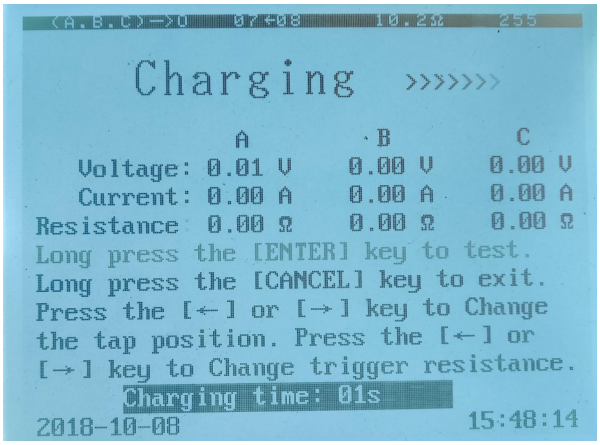
3. gear: expressed as " xx - > xx", press " ↑" key to raise and " ↓" key to lower. For example, if the gear is " 07 - > 08", pressing " write" will change to " 08 - > 09" and vice versa will change to " 07 < - 08". After each test, the gear will automatically increase or decrease.

4. Trigger Resistance: The resistance value should be greater than the charging interface resistance value and less than the sum of the transformer transition resistance value and the charging interface resistance value, and the most appropriate trigger value should be set during the actual setting.

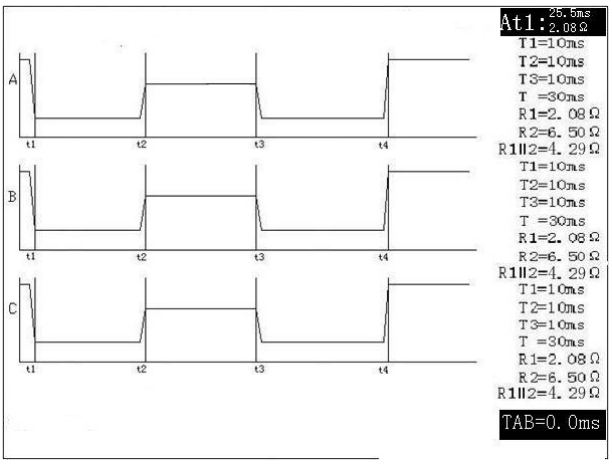
At this time, press the " Up" key or " Down" key to move the cursor, and press the " Confirm" key to enter the test menu to modify the settings and test.

(2) Testing

1. Press the " Test" key to display the charging status of each channel, as shown in the figure. After charging, you will be prompted to press OK to start the test.

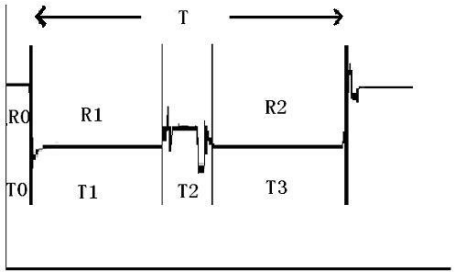


2. The screen display shows that sampling is in progress, waiting for the on-load switch to switch. The resistance value changes when the on-load switch is heard to switch the contacts. The instrument will automatically search for the transition waveform and display it on the screen as shown in the following figure. In this case, press the cursor " switch" key, and the screen will display the position of the action point and the calculated measurement parameter value of the automatic cursor search. Press the " left" and " right" keys in cursor - free mode to move the current waveform position; Press the " Up" and " Down" keys to change the proportion of waveform compression display. Press the " Left" and " Right" keys to move the cursor in cursor mode.



If you are not satisfied with the automatically measured parameters, you can manually move the four cursors to the obvious turning point of the series and parallel waveforms, and press the " phase sequence" key to change and adjust the three phases A, B and C; Press the " T1", " T2", " T3" and " T4" keys to change the selected cursor.

After the cursor is adjusted, the transition time and resistance value of each phase waveform will be directly displayed on the right side of the display screen. The meaning of each parameter is shown in the following figure. R1 and R2 are transition resistance values, R1 / / 2 is R1 and R2 are parallel transition resistance values, T1 is the transition time of resistor R1, T2 is the parallel transition time of resistor R1 and R2, T3 is the transition time of resistor R2, and T is the transition time of the entire loaded waveform.



After processing the parameters of the three phases, the TAC is automatically calculated at the bottom of the screen as the time difference of the three phases in the same period.

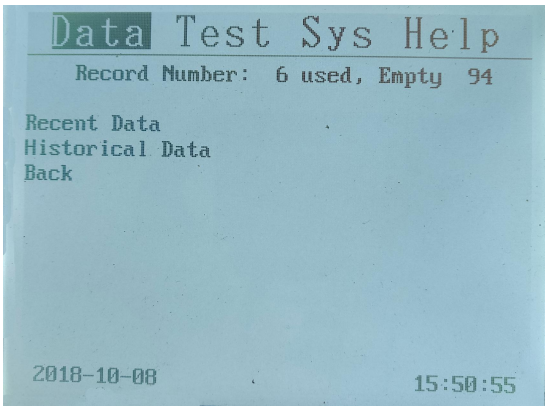
Press the " Print" key to start printing the measured waveform and data (the printed waveform is the same as that shown on the screen).

To store measured waveforms and parameters, press the " store" key to enter waveform storage.

To blank the cursor and return to the waveform moving interface, press the cursor " switch" key to return.

To exit the test data interface, press " Cancel" to exit.

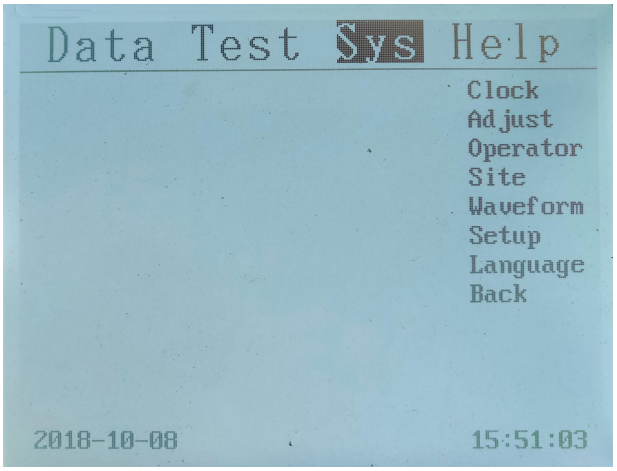
(3) Data: Select the " Data" key to enter the data interface. The display screen appears as shown in the following figure:



1. Current: Used to repeatedly display the last test data and waveform of the instrument.

2.History: used to display data and waveforms stored inside the instrument. The data index table shows the gear and storage time of each historical record, and can be searched and turned with the ↑ and ↑ keys. To delete this record, press the " Print" key and the system will delete it after confirmation. Press the " Confirm" key to display the waveforms and parameters to be consulted.

(4) System: Select the " System" key to enter the system interface. The display screen appears as shown in the following figure:



1. Date and Time: used to modify the system date and time.

2. Accuracy calibration: used to correct the accuracy of the instrument.

3. Tester: It is used to enter information of testers. You can enter 8 digits or English.

4. Test Location: used to enter test location information. You can enter 8 digits or English.

5. Waveform: used to modify test waveform display data and select " voltage" waveform for on-load switch band winding test; Select the " resistance" waveform without winding.

6. Setting: used to set trigger times, pre-production time, filter depth and printing options.

1) charging time: 5 - 95s optional (5s stepping), default is 10 seconds, mainly used to set the charging time for transformer windings. the larger the winding, the longer the setting time should be, or press the < confirm > key in the charging interface to enter the test interface manually according to the actual situation.

2) Trigger times: Set the trigger sensitivity when the instrument starts to save the sampling data when the on-load switch operates. During the test, if the switch has not yet operated the instrument, the waveform will be picked up, indicating that the sensitivity is too high. At this point, the trigger frequency should be increased. If the switch has been activated and the instrument has not picked up the waveform or half the waveform, the sensitivity is too low and the trigger frequency should be reduced.

3) Pre - production time: the value of 0 - 25.5 ms (0 - 255 points) can be set, which is used to set the steady-state data collected by the instrument before signal jump and to distinguish the transient jump process.

4) Filtering depth: used to filter the sampled waveform. The larger the winding value, the smoother the waveform.

5) Printing options: used to set printing contents, including data, waveform and all. For example, the selected waveform is that the printer only prints the header and waveform.

(5) Help: Provide simple online operation help for customers. See the contents of the display screen.

Ⅳ.test record waveform interpretation instructions:

(1) Measuring the ideal DC waveform and parameters in the recording process:

1) The switching order of the switch contacts shall specifically measure the waveform change of the switching process during the action time T4 of the whole switching process, and whether the three phases are synchronized or not shall be seen from the waveform diagram.

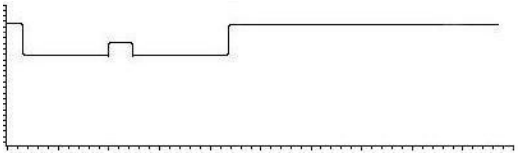
2) The excessive resistance of each contact connection, including the lead part. As shown in the following table, the reference indexes (different from manufacturer to manufacturer) and measurement reference values of a certain type of on-load switch are listed.

Switching sequence of switch contacts: (in ms)

直流示波图	测量值 / 相数	单		双		双		单	
		t1	T2	t3	T	t1	T2	t3	T
t1 T2 t3	A	20	6	18	44	20	5	18	43
	B	20	5	18	43	21	5	17	43
T	C	22	6	18	46	22	4	18	44
T_2=2～7 t_1≥15 t_3≈20ms T=35～50	三相不同步					$\triangle_t$=3		R=10%	

(2) Explanation of interpretation of DC current oscillograph:

1) measurement of hanging core:

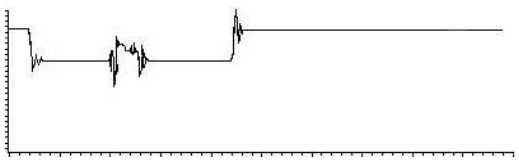


The ordinate scale shown in the waveform diagram indicates the resistance value, and the abscissa is the time scale. We can interpret the switching time from the diagram, such as phase A T1 ≈ 16.8 ms T2 ≈ 7.2 ms T3 ≈ 20 ms, and the whole switching time is about

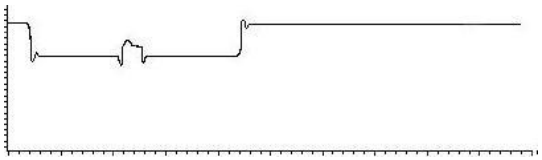
44 ms. The three synchronicity of waveforms is determined by the parameters of t0. The BC item is referenced to item A ..

Note: The waveform measured after hanging the core will be very smooth. No further smoothing treatment is required.

2) Non - hanging core test: (This method is generally adopted on site).



Compared with the waveform measured after hanging the core (i.e. measured by the traditional method), obvious burrs can be seen in the contact transformation process, which is mainly caused by the back potential caused by the current in the transformer coil when the contact bounces during the switch transformation process, which further truly reflects the state of the switch in the actual operation process of the transformer. This provides a qualitative judgment on the quality of the contacts, especially the obvious disconnection.

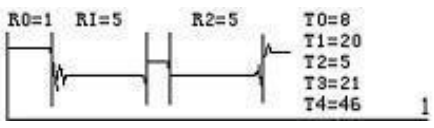


In order to facilitate the observation of the contact change waveform after switching the transformer coil. From the " System" menu, we can enter the column of " Setting Filter Parameters" and increase the filter ratio before entering the current screen from " Data" and the smoothed waveform will be displayed.

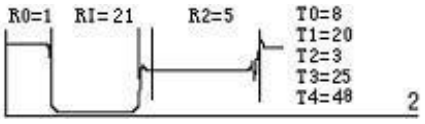
As shown in the figure, the larger the ratio of " filter parameters" is, the smoother it will be.

(3) according to the standard analysis test waveform, judge whether there is any fault in the switch

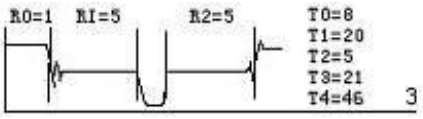
1) The waveform of the graph has no disconnection point, and the total excessive time t = 46 is within the standard 35 ~ 50ms. The resistance caused by the test line and the like before the switch action is about 01 Ω, and the resistance R1 = 5 Ω and R2 = 5 Ω connected by the switch action are very clear in the process of bridging the two resistors. The switch is normal.



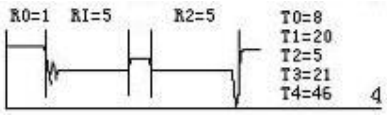
2) The waveform in the figure has obvious disconnection point and the total excessive time is within the standard. However, the resistance value of switch action access exceeds the range and has been disconnected, and the disconnection time reaches 20 ms, seriously exceeding the standard stipulation of occasional disconnection time within 2 ms. The switch has been damaged and should be repaired. Failure to repair the live operation will cause serious consequences.



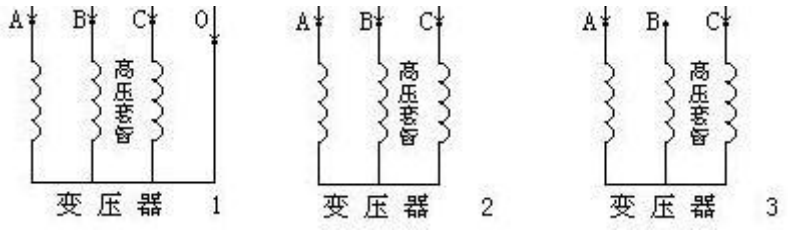
3) The waveform in the figure has obvious disconnection point and the total excessive time is within the standard. The resistance value switched in by the switch action is normal, but the process of bridging the two resistors has an off time of 5 ms. It is certain that the switch has an open circuit fault and must be repaired before it can be put into use.



4) The waveform in the figure has a disconnection point, and the total excessive time t = 46 is within the standard 35 ~ 50ms. The resistance values connected before and after the switch action are normal, and the process of bridging the two resistors is clear. However, the transition bridge from R2 to the packet has been broken to see if the breaking point has exceeded the standard limit of the occasional breaking time within 2 ms. If it does not exceed 2 ms or the maximum resistance does not exceed the range of effective values measured by this instrument. you can continue to use it. If they exceed the standard, repeat the test several times to see if they all exceed the standard. If they all exceed the standard, there is a problem.



(4) resistance algorithm of different wiring methods:



1. The transition resistance value obtained during the measurement of the first wiring method is R1 = R2 = R

2. The transition resistance value measured by the second wiring method is R1 / 3 ≈ R2 / 3 ≈ R.

3. The transition resistance value measured by the third wiring method is R1 / 2 ≈ R2 / 2 ≈ R.

In the data printed by the tester, T is the transition time, T2 is the bridging time, and T0 is the three-phase synchronism.

Ⅴ.the upper computer data management software

(1) Hardware connection: The computer connects the instrument through USB or serial port (modified in " **Communication Settings**"), and clicking " **Connect Equipment**" will automatically find the instrument and display it in the lower left corner of the software.

(2) Test parameter setting:

1. **Switch type:** divided into " neutral point leading out" and " neutral point not leading out"

2. current mode: when neutral point leads out, it is " (a b c) - > o"; When the neutral point does not lead out, it is " (a. b) - > c" or " (a. c) - > b".

3. gear: expressed as " xx - > xx", press " ↑" key to raise and " ↓" key to lower. For example, if the gear is " 07 - > 08", pressing " write" will change to " 08 - > 09" and vice versa will change to " 07 < - 08".

4. Trigger Resistance: Set trigger conditions for the instrument to start saving sampling data when the on-load switch is activated. The resistance value is the nominal resistance value of the on-load switch.

5. The upper computer menu has no **pre-acquisition time**; **Trigger times and filter depth,** using the setting parameters of the instrument's lower computer.

(3) the test results of graphic operation instructions

1. Zoom in: Click and hold the mouse in the area that needs to be zoomed in, and drag it from the top left to the bottom right to release it. It can be zoomed in many times.

2. Shrink: Click and hold the mouse and drag it from right to left to shrink and restore.

3. Drag: Right - click the mouse without dragging

4. Adjust the transition point settings for each phase: select the transition point cursor to be adjusted by clicking the combination of " phase sequence A", " phase sequence B", " phase sequence C" and " T1", " T2", " T3" and " T4", move the cursor to the desired position with the mouse, and click OK with the left key.

(4) uploading historical data stored by the lower computer: click " **upload data**" and the software will display the index of historical data of the lower computer; Double - click the historical data to upload. This data will be displayed on the upper computer.

VI. Technical Indicators: Meet DL / T 846.8 - 2004 Standard

1.Three independenty tested power supplies.Test voltage 24V. The test currents range from 0.1A to 5A and are available in a variety of models.

2. Instrument sampling rate 10kHz;

3. The maximum storage time of a single waveform is 268 milliseconds.

4. The test range,resolution,and accuracy of transition resistances are shown in the following table:

current	range	resolution	accuracy
0.1A	20~200Ω	0.1Ω	5.0%±0.1Ω
0.2A	20~100Ω	0.1Ω	2.0%±0.1Ω
0.5A	4~40.0Ω	0.01Ω	1.0%±0.1Ω
1A	1~20.0Ω	0.01Ω	1.0%±0.1Ω
3A	O.1~6.0Ω	0.01Ω	1.0%±0.1Ω
5A	O.1~4.0Ω	0.01Ω	1.0%±0.1Ω

5. Time measurement precision: the measurement range of action time is 0. LMS 268 ms, and the resolution is 0. LMS. The allowable deviation of action time in the range of 0. LMS - 100 ms is better than that of schlms. Action time is within 100 ms - 268 ms (excluding 100 ms), and the maximum allowable deviation is better than 1 % of soil.

6. Display: 320 * 240;

7. Processing part: high-speed 32 - bit microprocessor, the instrument can hold 100 pieces of data; `

8. High - speed 12 - bit 6 - channel synchronous A / D converter with a maximum sampling rate of 250 kHz;

9. Power supply: 220 V 10 %, power: 200 W.

10. Host size: 415× 320× 168 mm.

11. Weight: 6 kg

VII. Maintenance:

1. The operator of the instrument should have general knowledge of the use of electrical equipment or instruments;

2. The instrument can work normally at ambient temperature of - 5 ℃ ~ 40 ℃ and relative humidity of ≤ 80 %, but it should not be exposed to rain or direct sunlight when used outdoors.

3. There is a protective earth wire on the power socket. Please insert the plug into the three-eye socket with earth wire.

4. The instrument outputs a maximum voltage of 24V. Connect all leads before turning on the instrument power during field test.

5. The power supply must be turned off when the instrument changes the clamp. The instrument can take the coil for measurement, but it is strictly prohibited to take live measurement.

6. More than two groups of wires cannot be connected together as a single measurement. Unused wires should be opened.

7. After the test, close the instrument first and then remove all wiring.

Ⅷ、Simple fault analysis and elimination

Fault phenomenon	Cause analysis	Exclusion method	Remarks
There is no display when the machine is turned on	1) The power supply is not connected	switch on	The replacement fuse tube should be the same as the original model
	2) fuse tube is broken	Reinstall the fuse tube or update the fuse tube	
No output	1) Open circuit of equipment to be tested	Check the equipment for troubleshooting	
	2) the test circuit has an open circuit fault	Check the test circuit for an open circuit	
There is no display on the boot screen	There is a change in the contrast adjustment potentiometer	Adjust the range of the contrast potentiometer on the panel	
Unable to print	1) No printing paper	Replace printing paper	
	2) reverse direction of	Change direction of printing paper	

	printing paper		
If the above method still cannot be solved, please send the instrument back to the manufacturer for repair.			

This product will be guaranteed free of charge and maintained for life in case of quality problems within three years from the date of sale.

IX. Accessories

1. Test 1 set of clamping wires	1 set
2. 1 set of short wiring	1 set
3. One grounding wire	1 root
4. One power cord	1 root
5. 1 angle sensor (optional)	1
6. Printing paper 2 volumes	2 volumes
7. Two fuse tubes	2 branches