

Dear Client

Thank you for Purchasing our **HTGK-IV HV Switch Tester**.  
Please read the manual in detail prior to first use, which will help you use the equipment skillfully.



Our aim is to improve and perfect the company's products continually, so there may be slight differences between your purchase equipment and its instruction manual. You can find the changes in the appendix. Sorry for the inconvenience. If you have further questions, welcome to contact with our service department.



The input/output terminals and the test column may bring voltage, when you plug/draw the test wire or power outlet, they will cause electric spark. PLEASE

**CAUTION RISK OF ELECTRICAL SHOCK!**

**Company Address:**

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- ◆ Sales Hotline: 86-27- 87457960
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- ◆ Website: [www.hvtest.cc](http://www.hvtest.cc)

## ◆ **SERIOUS COMMITMENT**

All products of our company carry one year limited warranty from the date of shipment. If any such product proves defective during this warranty period we will maintain it for free. Meanwhile we implement lifetime service. Except otherwise agreed by contract.

## ◆ **SAFETY REQUIREMENTS**

Please read the following safety precautions carefully to avoid body injury and prevent the product or other relevant subassembly to damage. In order to avoid possible danger, this product can only be used within the prescribed scope.

*Only qualified technician can carry out maintenance or repair work.*

--To avoid fire and personal injury:

### **Use Proper Power Cord**

Only use the power wire supplied by the product or meet the specification of this produce.

### **Connect and Disconnect Correctly**

When the test wire is connected to the live terminal, please do not connect or disconnect the test wire.

### **Grounding**

The product is grounded through the power wire; besides, the

ground pole of the shell must be grounded. To prevent electric shock, the grounding conductor must be connected to the ground.

Make sure the product has been grounded correctly before connecting with the input/output port.

### **Pay Attention to the Ratings of All Terminals**

To prevent the fire hazard or electric shock, please be care of all ratings and labels/marks of this product. Before connecting, please read the instruction manual to acquire information about the ratings.

### **Do Not Operate without Covers**

Do not operate this product when covers or panels removed.

### **Use Proper Fuse**

Only use the fuse with type and rating specified for the product.

### **Avoid Touching Bare Circuit and Charged Metal**

Do not touch the bare connection points and parts of energized equipment.

### **Do Not Operate with Suspicious Failures**

If you encounter operating failure, do not continue. Please contact with our maintenance staff.

### **Do Not Operate in Wet/Damp Conditions.**

### **Do Not Operate in Explosive Atmospheres.**

### **Ensure Product Surfaces Clean and Dry.**

## — **Security Terms**

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Warning: indicates that death or severe personal injury may result if proper precautions are not taken

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Caution: indicates that property damage may result if proper precautions are not taken.

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# **I. Overview**

## **i.Product introduction**

With the development of society, people have higher and higher requirements for the safety and reliability of power consumption. High-voltage circuit breakers have the dual tasks of control and protection in the power system. The performance of the power circuit is directly related to the safe operation of the power system. The mechanical characteristic parameter is one of the important parameters for judging the performance of the circuit breaker.

The high-voltage switch dynamic characteristic tester is a special instrument developed by the company to meet the needs of various high-voltage switch action characteristics tests, and can accurately measure various oil grades such as less oil, more oil, vacuum, sulfur hexafluoride, etc. Mechanical dynamic characteristics of high voltage circuit breakers. For circuit breakers with closing resistors, the closing resistor and switching waveform can be accurately measured. The instrument adopts large-screen display, Chinese characters prompt man-machine dialogue

operation, Chinese characters display results and printout, with intelligent, multi-function, accurate data, strong anti-interference, simple operation, small size, light weight, beautiful appearance, etc. .o

## ii.Executive standard

<b>Serial</b>	<b>standard name</b>
1	DL/T 846.3-2004 General technical conditions for high voltage test equipment Part 3: High-voltage switch comprehensive tester

### **iii.Instrument characteristics**

1. It is applicable to SF6 switch, GIS combined electrical appliance, vacuum switch and oil switch of all models of metal contact produced at home and abroad.
2. Linear travel sensor and rotary sensor are easy to install.
3. Mainframe large screen, transparent, background light LCD, contrast electronic adjustment. Chinese menu prompt operation, switch action once, display all data and waveform map.
4. The host can store multiple groups of on-site opening and closing test results, and the real-time clock in the host is convenient for archiving and storing the test date and time.
5. Built in fast micro printer to print all data and atlas.
6. The instrument has powerful data analysis function, which can effectively analyze various index parameters of the mechanical characteristics of the circuit breaker.

### **iv.Performance introduction**

1. Time: inherent opening and closing time of 12 common fractures.  
In phase synchronization, in phase synchronization.

2. Reclosing: closing opening, opening closing, opening closing opening process time of each fracture: one opening time, one closing time, two opening time, golden short time, no current time value.

3. Bounce: closing bounce time, bounce times, bounce process and bounce waveform of each fracture; opening bounce amplitude of each fracture.

4. Speed: rigid opening and closing speed, maximum speed, time travel characteristic curve.

5. Current: opening and closing current value and current waveform of opening and closing coils.

6. Action voltage: dc30-250v / 20A digital adjustable circuit breaker action power supply is provided in the unit, which automatically completes the low voltage action test of the circuit breaker and measures the action voltage value of the circuit breaker.

## **v. Technical parameter**

### (1) Applicable environment

Input voltage: AC220V $\pm$ 10% 50Hz $\pm$ 10%

Atmospheric pressure: 86~106kPa

Temperature: -10~45°C

Humidity:  $\leq 80\%RH$

(2) Safety performance

Insulation resistance:  $> 2M\Omega$

Dielectric strength: the power supply can withstand 1 minutes of power frequency 1.5kV, no flashover and arcing.

(3) Basic parameters

① Time range: 16000.0ms Resolution: 0.1ms

Time error: Within 200 ms  $\pm 0.1ms+1d$

More than 200 ms  $\pm 2\%$

Period  $\pm 0.1ms$

② Velocity range: 20.00m/s Resolution: 0.01m/s

Velocity error: Within 0-2m/s  $\pm 0.1m/s$

More than 2m/s  $\pm 0.2m/s$

③ Travel:

	Range	Resolution	Error
Vacuum breaker	50.0mm	0.1mm	$\pm 0.5mm$
SF6 breaker	300.0mm	0.1mm	$\pm 2mm$
L-Oil breaker	600.0mm		

④ Current range: 20.00A Resolution: 0.01A

⑤ Closing resistance range: 0-2000  $\Omega$  Resolution: 1  $\Omega$

Closing resistance accuracy: 1%

⑥ Fracture type: 12 metal fracture

## 6 way closing resistor fracture

⑦Output voltage: DC30 ~ 250V digital adjustable / 20A  
(instantaneous work)

⑧Dimensions and quality:

Host: 360mm×290mm×280mm                      6kg

Enclosure: 370mm×280mm×220mm              9kg

### **vi. Definition of Terms**

1. Opening (closing) time: the time when the opening (closing) coil is powered on as the starting point of timing, and the time when the dynamic and static contacts just open (close).

2. In phase synchronization: in the same phase, the difference between the maximum and minimum opening (closing) gate time.

3. Phase to phase synchronization: the difference between the maximum and minimum opening (closing) time of three phases.

4. Average speed: during the opening (closing) process, 10% of the front and 80% of the middle of the total travel of the moving contact are removed respectively, and the ratio of the travel of the moving contact to the time is taken.

5. Maximum speed: during the opening (closing) process, after

the moving contact starts to move, the moving contact moves every 10ms as a speed unit until the moving contact stops moving, and several speed unit values are obtained, among which the maximum unit speed value is the opening (closing) maximum speed.

6. Rigid opening (closing) speed: according to the different manufacturers and switch models of the tested switch, each manufacturer has defined different rigid opening and closing speeds. This tester includes different definitions for users to choose.

#### Velocity definition

General 10ms	some oil breakers and some SF6 breakers.
General 5ms	some oil breakers
General 6ms	some 10kV vacuum breakers
General 10ms	some 35kV vacuum breakers
Average speed	some SF6 breakers
LW6	LW6 SF6 breakers
LW8	LW8-35 SF6 breakers
ABB-HPL550B2	ABB breakers
ABB-HPL245B1	ABB breakers
LW33-72.5/T	SF6 breakers
LW33-126	SF6 breakers
3AQ1E	SIEMENS breakers

## 3AT2

## SIEMENS breakers

Tip: If the above definitions are not adopted, users can define the speed sampling section of rigid point and rigid point on the curve according to the time travel characteristic curve measured by the tester (the travel direction), and the instrument can automatically calculate the user defined immediate opening point and immediate closing point velocity (the travel-time ratio in the sampling section).

## II. Product description

### I. Panel layout

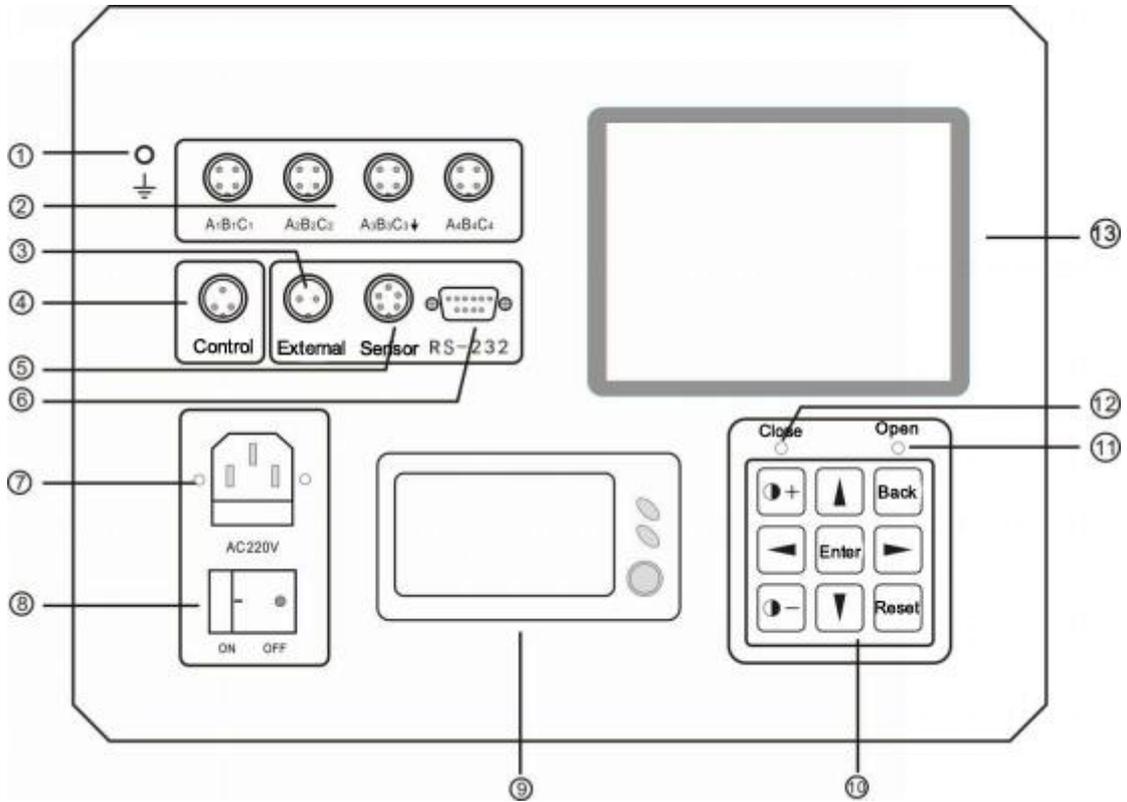


Figure 1 Panel Layout diagram

No	Panel indication	Function description
1	Protective grounding	Connect with the earth
2	A1 B1 C1 - A4 B4 C4	12-way break time measurement channel, ↓ is the last 6 channels of virtual land, not connected to the earth
3	External	External trigger

4	Control	Output voltage control
5	Sensor	Sensor signal input
6	RS-232	Connect with PC
7	Power socket	Power input $\sim 220V/50Hz$
8	Power switch	Input power control
9	Panel printer	Print test reports and curves
10	Function button block	 Contrast adjustment
		 Up and down move operations
		 Left and right move operations
		 Confirmation operation
		 Return or cancel operation
		 Instrument reset
11	Indicator lamp	Opening indicator lamp
12	Indicator lamp	Closing indicator lamp
13	LCD panel	Display all data and curves

## ii. Instructions

Turn on the power switch, press  or  , Electronic adjustment of display contrast until the best display. Press the "Enter" button to enter the menu operation interface. At the top of the screen is the main menu of the instrument operation, as shown in Figure 2, from left to right are "View", " Test", "Set", "File", "Help", five main menu.

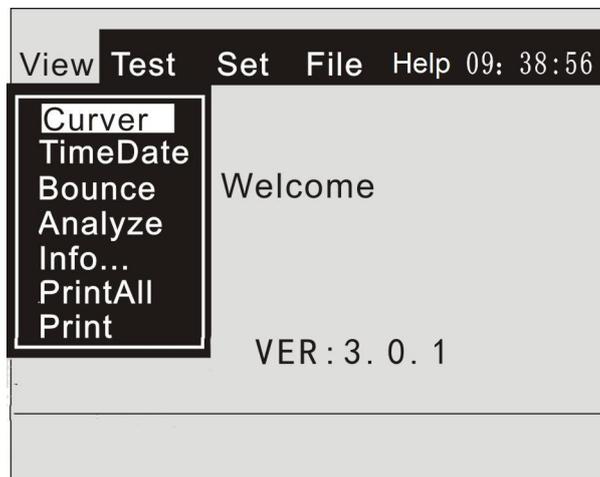


Figure 2. Main menu

### (1)Set

Before the test, the various operating conditions of the instrument are set. There are 'TestSet', 'VolSet', 'DateTime', 'Option', 'Status' under the settings menu. As shown in Figure 3

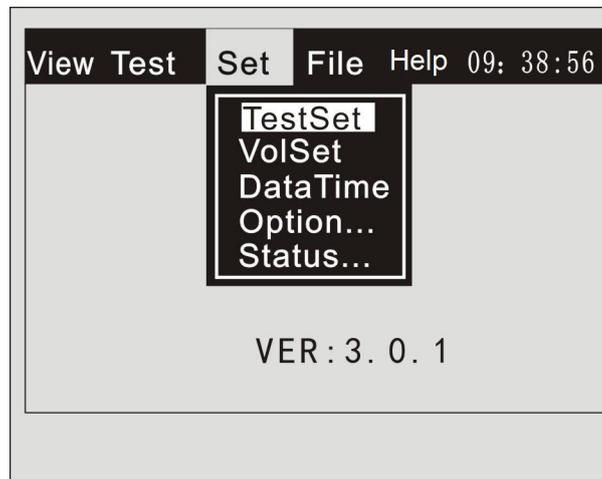


Figure 3. Settings menu

### ① TestSet

<Velocity> Fifteen speed definitions have been solidified for the instrument (Note: These 10 definitions can be redefined and solidified by PC according to the need). The corresponding definitions are selected according to the breaker type. If the corresponding definition can not be found, the time-travel characteristic curve can be measured by "10 ms before and after closing" and then the corresponding velocity value can be obtained by corresponding analysis on the curve.

<Trigger> Internal trigger: use the internal DC power supply to breaker closing and opening; external trigger: the internal DC power supply of the instrument does not work, and use the external power supply (both AC and DC) to operate the breaker action. When the instrument closing (opening) the "external trigger" connection of the instrument is directly connected to the closing

(opening) coil. When the breaker operates, the instrument takes the voltage signal from the coil as the starting point for timing.

<Time Scope> Refers to the time length of the operation voltage of the internal power supply.

250ms: Single opening and single closing test of breaker.

500ms: Normal breaker 'C-O', 'O-C' operation.

1000ms: The closing time of the old-fashioned generator outlet switch is usually greater than 500ms, so choose 1000ms;

2000ms: When the breaker is testing 'O-C-O', choose 2000ms;

4000ms: Calibrate the internal operation voltage of the instrument. Choose 4000ms.

8000ms, 16000ms: Special use.

<Sensor Pos> According to the different installation position of speed sensor, select different phase. If it is a three-phase linkage, it is usually selected in the "A" phase.

<Sensor> There are two options for rotary sensor and linear sensors, corresponding settings according to the sensors used.

<Contactor> the instrument has one type of Contact: metal.

<Enable V> When the linear sensor is used to measure the velocity, the breaker stroke can be measured by turning on the instrument, and when the rotary sensor is used to measure the velocity, turn it off.

<Travel Set> The total linear resistance value of the input breaker is measured when rotating sensor and universal sensor are used to measure velocity. When using linear resistance sensor to measure speed and stroke, input the stroke value of sensor.

<No.> Input line number.

Tip: After all options are completed, move the cursor to the

bottom of the screen and press the "Enter" button to complete all settings.

Internal power supply voltage calibration: Use multimeter measure "control power output" of the closing or opening, set the test time to 2000 ms or 4000ms, do single-closing or single-open operation, can be measured to the output power supply voltage.

Note: the power supply inside the instrument can't be used as the power source of the external power storage motor. After the calibration is completed, the test time must set back to 250ms. Otherwise, long time DC output will destroy the breaker and closing coil.

#### ②Voltage set

Test Voltage: After entering the voltage setting menu, according to the needs of the field, according to the text prompt below the instrument screen, set the operating voltage of the breaker.

Note: the power supply inside the instrument can't be used as the power source of the external power storage motor. After the calibration is completed, the test time set back to 250ms. Otherwise, long time DC output will destroy the breaker and closing coil.

#### ③DateTime

Screen display project options, set according to needs, date and time the instrument has been set up.

#### ④Option

Under this menu, there are time curve, current curve, stroke curve, velocity curve, key tone. The above functions are customized options. If you need to specify the function, when

you select the function, press the "Enter" key and change the status symbol to " [· ] ", this means that the function has been selected, otherwise it is not selected. Finally, confirm it.

### ⑤ Status

Enter the status detection menu and install the sensor according to the prompt at the bottom of the screen to check whether the sensor works properly and whether the installation is reasonable.

### (2) Test

After the instrument is set, then test. Under the test menu, there are Auto Test, Open, Close, O-C,C-O, O-C-O, LV Test as shown in Figure 4.

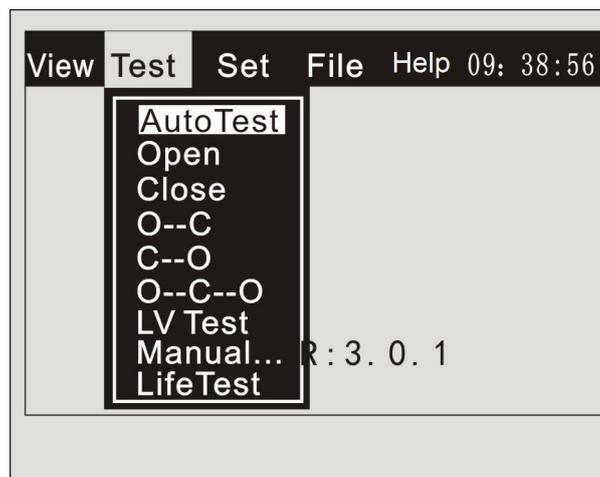


Figure 4 Test. menu

### ① Auto test

Automatic test, the instrument determines the type of test according to the state of channel A1. If it is closing, the breaker-close operation is carried out; otherwise, the breaker-open operation is carried out.

## ②Open

Single open test of breaker

## ③Close

Single close test of breaker

## ④O—C

The "O--C" test of the breaker, after setting the "open-t2-close" control time interval, can directly get the value of the breaker's single-open time, single-close time and O-C time.

## ⑤C—O

The "C--O" test of the breaker, after setting the "close-t2-open" control time interval, can directly get the value of the breaker's single-close time, single-open time and C-O time.

## ⑥O—C—O

After setting the time interval of "open-t2-close-t1-open" control, the "open-close-open" test of the breaker can directly get the value of single open time, single close time, twice open time, C-O time and O-C time of the breaker.

## ⑦LV Test

The automatic low voltage operation test of closing and opening can be operated according to the screen prompt of the instrument after entering the interface.

## ⑧Manual

Under a set voltage, the breaker is repeatedly open and close.

Such as:

Under 30% rated voltage, the breaker should be operated three times continuously, and the breaker should be reliable and not operate, the function is completed.

Before the breaker factory does the breaker test, under the rated voltage, the breaker needs to be open and close several times before the breaker is tested, and this function is also used.

### ⑨LifeTest

It is used by breaker manufacturers for testing.

### (3)View

Under the view menu, there are menus such as Curver, TimeDate, Resistance Curver, Resistance Data, Bounce, Analyze, Information, Print All, Print, etc., as shown in Figure 5.

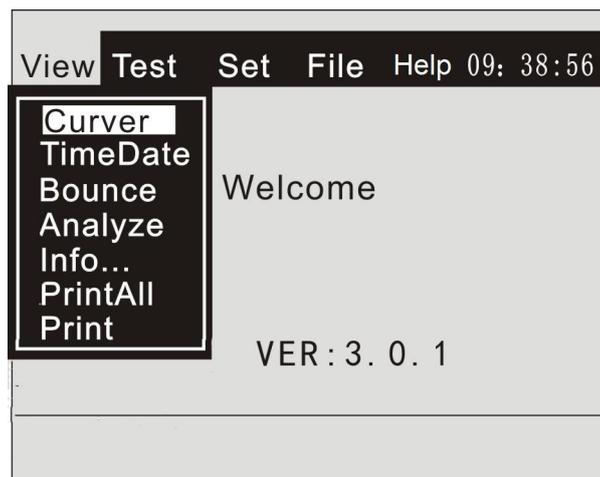


Figure 5. View menu

### ① Curver

The comprehensive curve Atlas of test results includes time waveform, bounce curve, time-stroke curve and coil current curve of each switch. These curves are all integrated atlas displayed on a coordinate chart with time as abscissa.

### ② TimeData

The measured results are shown in tabular form, including the open and close time, the one phase same period, the each phase same period, velocity, the maximum velocity, the coil current, the total switch stroke, the overrun or the rebound amplitude, etc.

### ③ Bounce

It shows the bouncing time and bouncing times of each contactor. If you want to see more detailed bouncing process of each contactor, you can see the first closing time, the first opening time, the second closing time and the second opening time of the corresponding contactor by pressing the "Enter" button under the 'Detailed'. A more detailed bounce process. If you want to print the bounce result, press  or  key under the "Detailed" cursor to eliminate the "Detailed", then call out the "View" menu and select "Print" to print.

### ④ Analyze

By analyzing the measured "time-stroke" curve, we can get the relevant data. Of course, the most important thing is to get the open

and close velocity data, as shown in Figure 6.

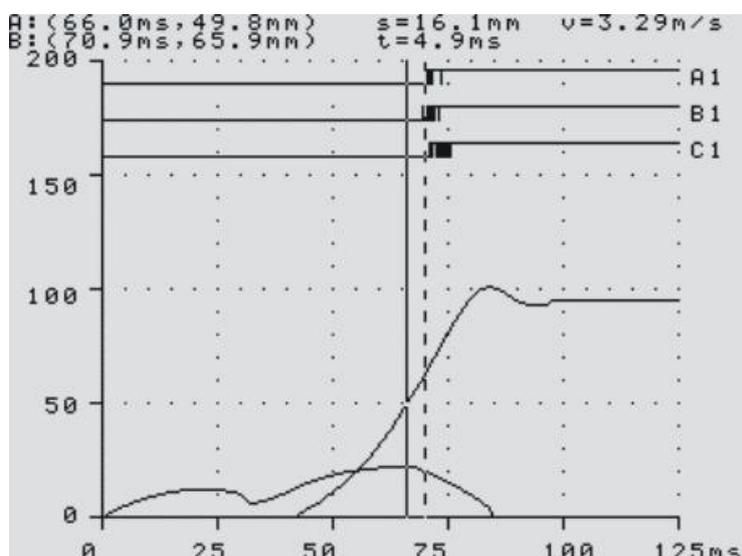


Figure 6. Time and travel curve

Operation hints:

Entering the interface of velocity analysis, there are two vertical coordinate lines on the "time-travel" curve: solid line and dotted line. The dotted line is at the opening and closing point of channel A, the solid line is the defining point of closing and opening velocity, and the upper left corner of the screen is the coordinate value of the intersection of two coordinate lines and the travel curve. The abscissa is time, and the ordinate is the travel position point of the breaker contact at this time. The solid line can move left and right. When moving, the coordinate point will change in real time, and the dashed line can not move. By pressing up or down keys, the solid line and the dotted line can be switched.

a).  $S = XX.X$  mm      the difference between the ordinate coordinates of the two coordinate points on the stroke curve.

b).  $t = XX.X$  ms      the difference of the abscissa of the two coordinate points on the stroke curve.

c).  $V = XX.XX$  m/s      It is the ratio of the difference between the ordinate and the abscissa of the two points. That is the average velocity between moving contacts. If we set these two points according to the definition of opening and closing velocity of breaker manufacturer, then  $V$  is the measured opening and closing velocity.

Of course, moving the two coordinate lines to the corresponding position and looking at the difference between the ordinate coordinates of the two coordinate points, we can see the data of the distance, the overrun, the Overshoot, the rebound amplitude and so on. On the curve, we can also see the data which are not shown in a series of "comprehensive data tables" such as the starting point of the moving contact for analysis.

#### ⑦ Information

Test information before instrument test

#### ⑧ Print All

Print test date, test content, test curve map and comprehensive data.

## ⑨Print

Print the contents currently displayed on the screen.

## (4)File

Under the File menu are Open File, Save File, Delete File and Delete Directory, as shown in Figure7

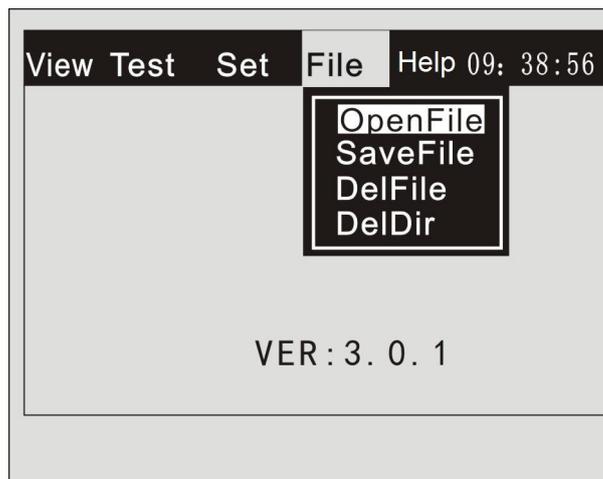


Figure 7. File menu

## ①Open File

Open the test results that have been saved in the instrument.

## ②Save File

The test results are stored in the instrument memory, and the test number is used as a folder. The test results on the same day are stored in the same folder according to the test time. If the result is not refreshed, it can be permanently saved.

## ③Delete File

Delete one of the data files stored in the instrument.

#### ④Delete Directory

Delete a data directory stored in the instrument.

#### (5)Help

After entering the copyright information menu, the copyright, software version and product serial number are displayed on the interface.

### **III. Operation wiring method**

#### **i. Wiring operation**

The general steps of instrument use are summarized as follows:  
wiring (sensor installation)→turn on the instrument→setting→  
testing→viewing (analysis) results→saving (printing) results→turn  
off the instrument→Disassembly line.

Special safety tips: after the instrument arrives at the scene, please connect the protective area of the instrument to the ground before other wiring and operation can be carried out; after the test, turn off the power supply of the instrument, then dismantle other wires, and finally dismantle the ground wire.

#### (1)switch wiring

① Three switches wiring of circuit breaker is shown in Fig 9

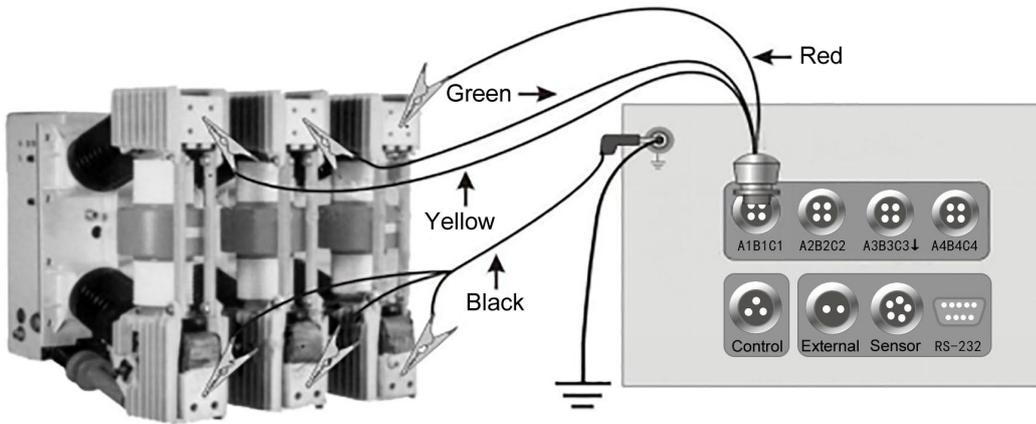


Figure 9. Three switches wiring

② six switches wiring of circuit breaker is shown in Fig 10:

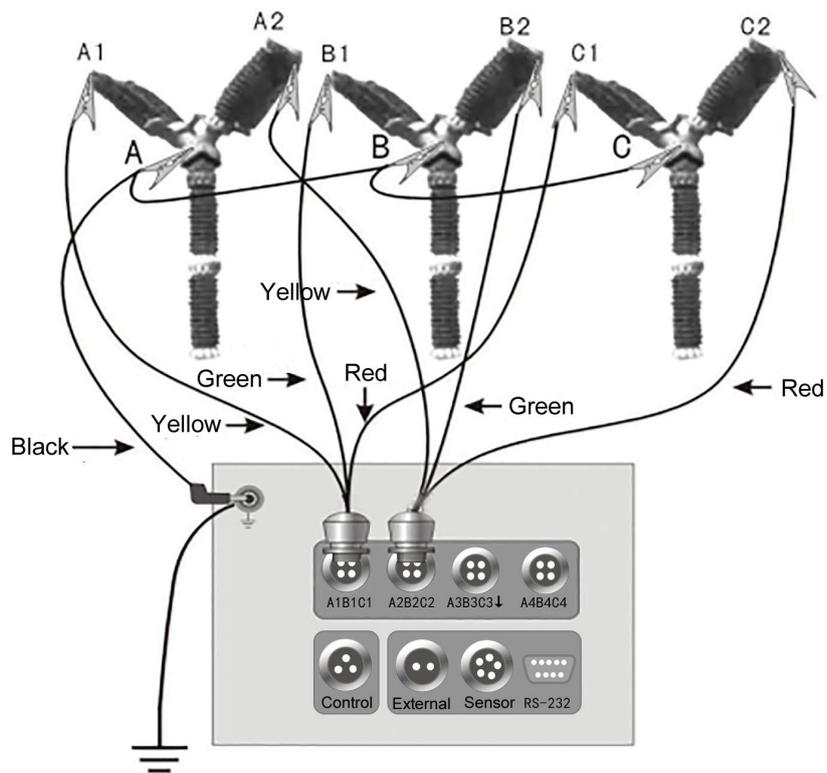


Figure 10. Six switches wiring

Note: The wiring method of the closing resistance test is the same as that of the metal disconnecting, but it must be connected to A1B1C1 and A2B2C2, and the [Test Setting] interrupt port type should be changed to [closing resistor].

## (2) Closing and opening control line

① When the closing and opening control power supply is provided by the instrument, disconnect the control power supply in the breaker control box under test (usually pull out the insurance connecting the control power supply in the control box with the control bus), but the energy storage power supply of the breaker mechanism can not be cut off, and Then follow the wiring shown in Figure 12.

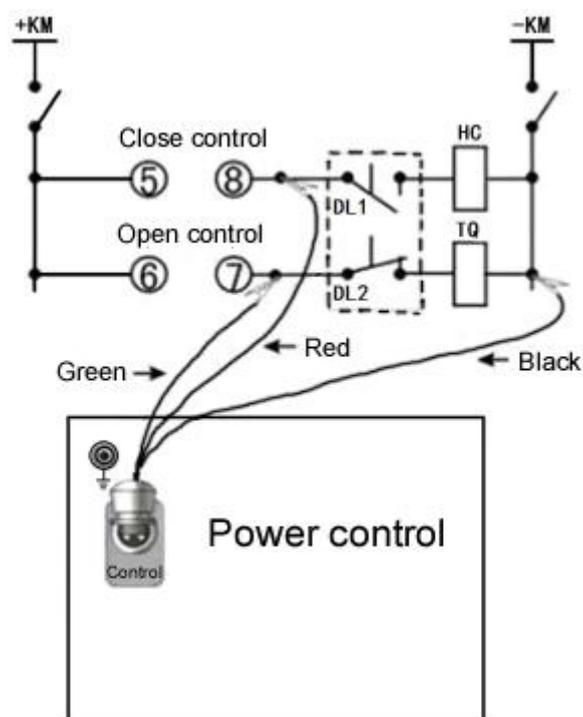


Figure 12. Control wiring diagram

Note: the instrument can only provide DC power inside, and the internal power use "Internal" trigger mode. If the breaker is an AC operation mechanism, please use the 'External' trigger mode.

②When the external operation power is used to open and close, the output of the control power disconnect. When the breaker is used for a single close test, the external trigger two lines is connected to the two ends of the closing coil in parallel.

③When the breaker is used for a single open test, the external trigger two lines is connected to the two ends of the opening coil in parallel.

Note: use external trigger when using external power. The external trigger mode can be tested regardless of whether the breaker mechanism is AC or DC. When external triggering is used, the instrument control power is disconnected.

## ii. Sensor installation

This instrument is equipped with two kinds of velocity sensors, which are used in different situations. All two sensors have a five-core sensor signal line, which is connected to the "Sensor" socket of the instrument.

### (1) Rotary sensor

For some breakers, especially imported and joint-venture breakers, the linear transmission part is enclosed in the breaker body. When the breaker manufacturer makes the velocity test, the breaker splitting indicator or the rotating shaft of the arm are tested. In this case, the rotary sensor is selected. The installation method is shown in Fig. 13

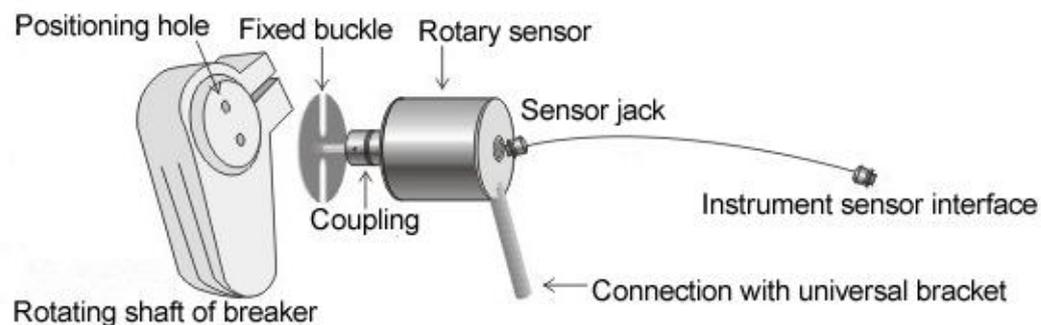


Figure 13. Schematic diagram of rotating sensor installation

Installation Note: The axis of the rotary sensor should be as concentric as possible with the breaker rotation axis, otherwise the rotation of the sensor will be hindered.

## (2) Linear sensor

If you need to accurately measure the action stroke of the switch, you need to use the stroke sensor. There are three kinds of stroke sensors, namely 50mm, 200mm, 300mm.

50mm stroke sensor for measuring the travel speed of vacuum breakers.

200mm and 300mm stroke sensors are used for SF6 breaker stroke and velocity measurement, these two sensors are

non-standard configurations.

Take a vacuum breaker as an example, when the linear sensor is installed, it is necessary to ensure that the motion axis of the sensor can move in a straight line and fix the sensor with a magnetic universal bracket. For the SF6 breaker and the oil breaker, the installation method is similar. The installation method is shown in Figure 14.。

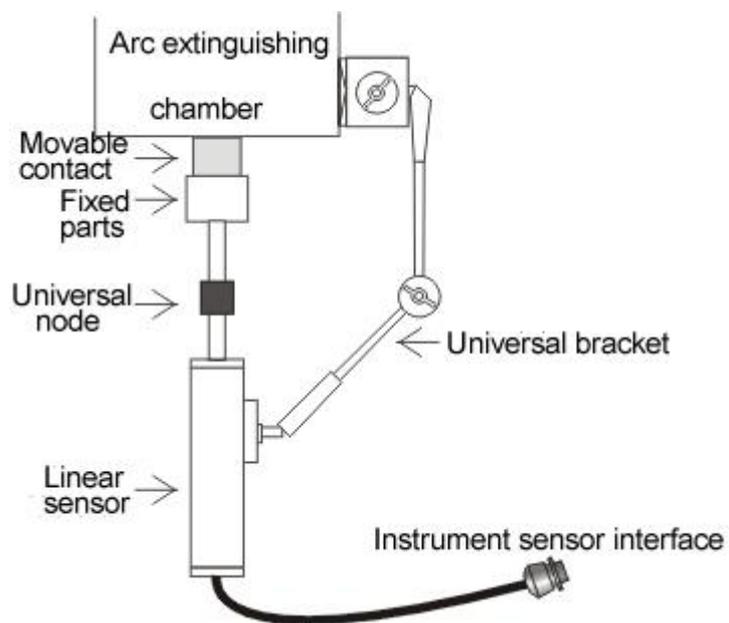


Figure 14. Schematic diagram of linear sensor installation

## IV Common problems and Solutions

i. When the instrument is used for controlling opening and closing operation, the breaker does not action.

(1) There are some problems in the wiring of the open and close of breaker control.

Solution: Find the control wiring diagram of the field control cabinet, ask the relevant protection professionals, and find out the auxiliary contact points of the closing and opening coils and breakers respectively. See the control wiring diagram in Figure 12 of this specification and explain the re-wiring. Check the control loop to ensure smooth circuit.

(2) The instrument indicates 'the output is short circuit or the load is too high. Please turn off the instrument to check the control wiring'.

① Control wiring error, resulting in short circuit of instrument output, resulting in the start of short circuit protection function and instrument's control power supply no output".

Solution: After shutting down, refer to the above figures 9 and 10 to re check the wiring.

② The coil load is too large for the instrument to drive normally.

Solution: a). For the breaker of the electromagnetic mechanism, the driving current required by the switch closing coil is very large (up to 100A or several hundred amperes), while the maximum carrying capacity of the instrument operating power supply is 20A. The load is too large for the instrument to drive normally.

Generally, the closing control wire is connected to the closing contactor coil of the front stage of the closing coil. The instrument controls the closing of the breaker contactor, and the contactor drives the closing coil of the breaker to make the breaker action. Or use the "External" trigger mode to operate the breaker.

b). For the breaker of hydraulic and spring mechanism, the default is "overload" when the output current of the instrument is greater than 6A. Please take a look or use a multimeter to measure the resistance value of the closing coil to confirm that the current of the closing coil is large. Then please check the wiring carefully and confirm that there is no short circuit in the closing output, then cancel the short circuit protection function of the instrument for testing. (Note: When the short circuit protection function of the instrument is cancelled, the output of "closing and opening control power supply" does not have the protection function. If the output of the control power supply is indeed in short circuit state at this time, it may cause damage to the control power supply of the instrument.

Please be careful.

The specific way: Instrument shutdown → Hold down the '▼' key button all the time → Instrument boot, Until the "release button" screen prompts appear → Release the '▼' button, Short circuit protection function cancelled.

Note: as long as the instrument is turned off or reset, the short-circuit protection function is restarted.

(3) Check whether the operation power of the instrument has DC output.

Use multimeter to check the operation power supply inside the instrument. If voltage output is normal, other inspections should be carried out:

① The operation of the fuse on the operation control line is destroyed or damaged.

Solution: The new fuse should be replaced or the control line should be reconnected.

② Internal power failure of instrument

Solution: Operate the power supply in the locale switchgear, and use the "external trigger" mode to operate.

(4) There are protective latches (such as SIEMENS and ABB breakers).

Solution: ① During the closing and opening test of the internal

power supply operation breaker provided by the instrument, the blockage must be released. Field technicians or breaker manufacturer personnel are requested to assist in releasing the blockade according to the control wiring diagram of the field control cabinet.

② Use field operation power supply and test with 'External' trigger mode.

ii. When the instrument was tested for single close and single open, the breaker acted, but there was no data display.

(1)The ground wire is not connected.

Solution: Carefully check the ground wire and re tighten the ground wire.

(2)The resistance value of the closing coil or the opening coil is too large to cause the load to be too small (when the coil current is less than 1A, it is easy to occur), which makes the instrument trigger ahead of time and no data are collected.

Solution: Cancel short circuit protection function and retest

(3)If the closing test is not out of data, the closing control circuit is damaged, If the opening test is not out of data, the opening control circuit is damaged

Solution: The temporary test of the power supply control channel used in the field, If the closing test is not out of data, then

the test closing is done by using the opening channel. The method is to connect the switch control line (green and black lines) to the closing coil and use the opening control to operate the breaker closing test process.

iii. When the instrument do the single close test, the breaker is closed and opened immediately.

(1)There are problems in the breaker control loop.

Solution: Check the breaker control circuit carefully and troubleshooting.

(2)Closing control channel damage

Solution: Remove the opening control line and use the closing control channel to do the test.

iv. Printers can carry paper out but not print words and graphics.

(1)The printing paper is reversed.

Solution: Correctly install thermal printing paper.

(2)The thermal printer's heating head is broken.

Solution: Back to factory maintenance thermal printer heating head.

v. When the velocity test was carried out, the test results appeared full screen vertical stripes.

(1)The sensor selection is incorrect (the linear sensor is selected in the test settings, the rotary sensor is installed).

Solution: Install the correct sensor.

vi. Technical question and answer

(1) When the instrument is grounded, why should the ground wire be first connected then connect the test line?

Answer: In the field test, there is often a high induction voltage between the breaks of the high voltage breaker (especially above 220kV), which is large and energy is small, but it is enough to threaten the safety of the instrument itself. Inside the instrument, a discharge circuit is connected between the switch signal input end and the ground. The earth wire is connected first, and the discharge circuit is connected first in practice. When connecting the signal line of the switch, even if the switch induced a high voltage, it can be released to the earth through the discharge circuit, so as to ensure the safety of the instrument's switch channel.

(2) How to determine whether the switch of the instrument is normal?

Answer: Choose [Test] - [Auto Test] to display the real-time status of 12 switch at the bottom of the LCD screen of the instrument. The screen display is shown in Figure 15:

Test	
0、 Voltage:	220V
1、 Velocity:	General 6mm
2、 Trigger:	Internal
3、 Time Scope:	250ms
4、 Sensor Pos:	Pole A
5、 Sensor:	Linear Sensor
6、 Contactor:	Metal
7、 Enable V:	Enable
8、 Travel Set:	50.0mm
9、 No.:	L0000000

A1	B1	C1	A2	B2	C2	A3	B3	C3	A4	B4	C4
○	○	○	○	○	○	○	○	○	○	○	○

Figure 15.Switches Status

In this interface, it can be detected whether the fracture channel of the instrument is intact. If the fracture input is floating, it should display “minute” . If it is short-circuited to ground, it should display “close” . Therefore, each fracture is short-circuited to the ground, and the change of the state display is observed to determine whether the instrument breakage time channel is normal.

3. What is the speed of the split? What is the difference between the time division and the distance segment defining the speed of the switch?

Answer: The so-called just-in-time (combined) speed refers to the average speed of a period of time (or a distance) after the high-voltage switch has just been divided (just before the minute). If time is used as the definition standard, the IEC standard and China's national standard are generally defined as the average speed of 10ms after the combination. For some countries or some switch manufacturer definitions, our company's instruments can be redefined by computer and matching speed definition. It can be defined as a time period or as a distance segment, providing flexible and convenient speed testing for high voltage switches. Taking the vacuum switch as an example, the opening distance of

the 10kV switch is generally about  $S=11\text{mm}$ , and the just-integrated (minute) speed is defined as the average speed of 6mm just before (just after). Some manufacturers are defined as the following:

(1) The closing average is taken as the whole process, and the average speed of 6 mm after the split is taken;

(2) The closing average is taken for the whole process, and the average speed of the whole trip is taken;

Tip: With the speed definition add program function, it is also convenient to perform speed test according to the specific vacuum switch. In addition, when the vacuum switch is tested for speed, the average speed of the entire opening process is very low due to the action of the buffer mechanism during the opening process. Generally, the average speed before the buffer mechanism is activated during the opening process of the vacuum switch is the average speed of the whole process, that is, the average speed of the closing is taken, and the average speed of the 6 mm after the opening is closer to the true value. Since the 35kV vacuum switch opening distance is generally about  $S=22\text{mm}$ , all the above values

6 for the 10kV vacuum switching speed definition can be changed to 10 or 11.



First step: press the round button to open the front cover of the printer and remove the remaining paper core, as shown in Figure 16.

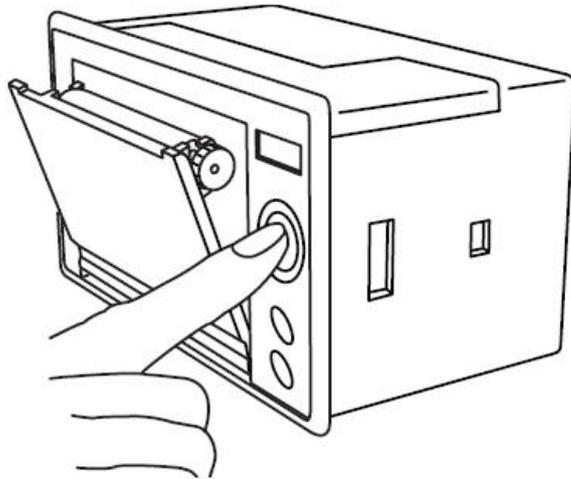


Figure 16. Schematic diagram of opening front lid operation

The second step: put the new paper roll as shown in Figure 17.

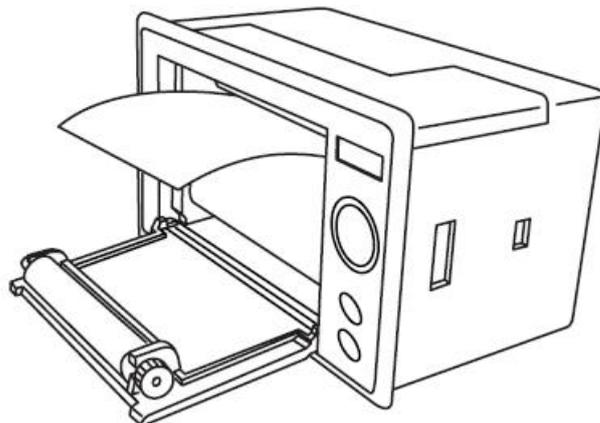


Figure 17. Sketch of operation in paper roll

The third step: pull out a piece of paper, place it in the middle position, and close the front cover, as shown in Figure 18.

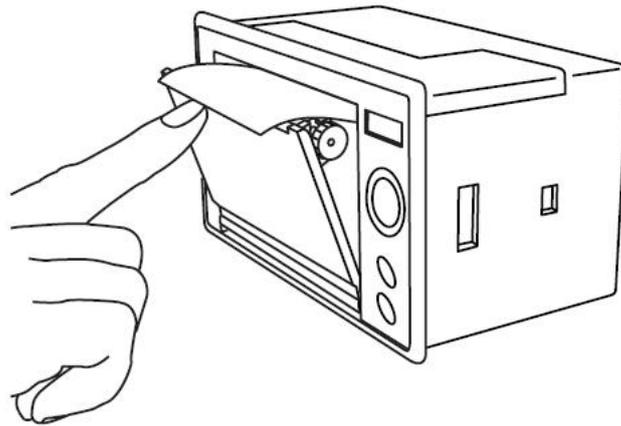


Figure 18. Operation diagram of closing front cover

Note: close cover to make a paper from the paper out of the mouth, let the glue shaft will fully roll down, otherwise unable to print. Thermal printer paper, thermal paper must confirm the thermal coating on the thermal paper in the printer position, if the thermal layer does not print on a handwriting. If the printing paper is out of alignment, you can reopen the front cover and adjust the position of the printing paper.

#### ii. Indicator and button operation

There are two transparent keys on the printer panel, which are marked with SEL (selection) and LF (aliasing). SEL transparent button can also display the red state, LF transparent button can also display the green state. The red light indicates the printer's online/offline status, and the green light often indicates that the printer is energized.

After the power is switched on, the green indicator light is

always bright. If there is no good printing paper, the red indicator will flash intermittently for two times. When the printing paper is good, the red indicator light is always on.

Online / offline status selection:

After power-on or out of self-detection mode, the printer enters the online working state and the red indicator lights up; after pressing the SEL key, the red indicator lights out and enters the offline working state; after pressing the SEL key again, the red indicator lights up and re-enters the online working state. When offline, the printer no longer receives data from the host.

Another function of the SEL key is to pause in the printing process, that is, when the SEL key is pressed during the printing process, the red indicator lights out, and the printer will pause after printing the current line of text, at this time it can walk on the paper operation. Press the SEL button again, the red indicator light is on, and the printer continues to print.

Paper operation:

In the offline state, press the LF key, the printer will not print empty paper; then press the LF key, the printer will stop moving paper. Under the way of paper, press the SEL key printer to enter the online mode directly.

## Annex IV Packing list

No.	Name	Quantity	Specifications
1	Host	1	
2	Accessory packing case	1	
3	C&O Control line	1	Three-core 6m
4	External trigger test line	1	Two-core 6m
5	Sensor signal line	1	Five-core 5m
6	Ground wire	1	4m
7	Test line	10	9m*4 4m*3 6m*3
8	Power line	1	
9	Switch test line	2	Three-core*1 Four-core*1
10	Shorting test line 40cm	2	
11	Shorting test line 80cm	2	
12	Rotary sensor	1	
13	Linear sensor	1	50mm
14	Magnetic base	1	
15	Rotating bracket	3	Ø60*1 、 Ø40*1 、 Ø25*1
16	Rotary bar	4	
17	Permanent magnet pedestal	1	
18	Screw	4	M5*35、 M5*45、 M8*25、 M8*35、
19	Screwdriver 6*38mm	1	
20	Screwdriver 3*75mm	1	
21	Clips	16	
22	Inner hexagon spanner	2	2mm
23	Thermal printing paper	2	
24	Inserting needle	3	
25	Fuse	3	25A
26	Certification	1	
27	Inspection report	1	
28	User manual	1	