

CT8009 Series Circuit Breaker Analyzer



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Forward

Thanks for choosing our company's instruments, and we will supply the technical support and the services of the instrument.

We make a promise that there are no materials shortcomings and defective workmanship of the instrument. We will give a quality guarantee of three years for this instrument. If there is something wrong with the instrument, please contact us, we will repair or change a new one according to the warranty. If the field repair and user guide is needed, please contact us or contact the local seller for further information.

Before using the instrument, please read through the user manual to prevent from the risks of human safety and instrument damage. The details may be different according to different types of instrument. For more details, please contact us by email or phone.

Notes

- ☆ It's only allowed to work with well trained personnel and with the power systems familiar personnel, please read the user manual carefully before operation.
- ☆ The connection of the test lines should be done before supply power to the instrument.
- ☆ When the instrument is powered on, the operator should not touch the testing circuit loop. and the ground should be well connected.
- ☆ Use the original connection lines as possible.
- ☆ Don't switch the instrument on or off with the power supply connected to the system, this is to prevent accidental operation.
- ☆ The instrument is powered with 220V, please don't supply with 380V.
- ☆ Operating temperature: - 10 °C to 50 °C; storage: - 20 °C to + 70 °C. relative humidity: 5 - 95%, without condensing.

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1. Characteristics

- ◆ the instrument can test the vacuum circuit breaker, sf6, oil circuit breaker, GIS and etc.
- ◆ there are discharge circuit on every main contact channel, so the instrument can be used in the 550kV environment.
- ◆ the instrument can test up to 12 main contacts. 6 aux contacts, 6 PIR contacts, 3 or 6 graphite contacts, 3 or 6 BSG are selectable.
- ◆ With one analog motion transducers and one digital transducers test interface. Three analog and digital transducers are selectable.
- ◆ Just one test, the user can get the close(open) , C-O, O-C and O-C-O's time , motion and speed results table and graph.
- ◆ Up to 50 different circuit breaker types are supported.
- ◆ With the built-in large power and isolation digital dc power, the MTC,MLC , charge motor and charge motor test are easily supported.
- ◆ With archive management, the pc software is available, the **envelope curves function is available.**
- ◆ With a 7 inch TFT LCD panel, keypad, a friendly HMI interface is supported.
- ◆ The **change** between the simple Chinese and English language is supported.

Type \ Test ability	AD	A	B	C	D	E	F	G	H
Normal contact	12	12	12	12	12	12	12	12	12
PIR	Select	/	6	6	6	6	6	6	6
BSG	Select	/	/	/	/	3	6	3	6
Graphite	Select	/	/	3	6	/	/	3	6
Auxiliary	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)

2. Technical Specification

2.1. Timing Part

(1) Main Contact, Aux Contact :

Recording length : 1ms~20s

Time resolution : 0.1ms~20ms(Depend on recording time length)

Time accuracy : $\pm 0.1\%$ reading ± 1 Lsb

(2) PIR Contact :

PIR resistance range : 50 Ω ~5000 Ω

PIR resistance resolution: 1 Ω

PIR resistance accuracy: $\pm 1\%$ reading $\pm 2\Omega$

(3) Graphite Contact :

Recording length : 1ms~2s

Time resolution : 0.1ms

Time accuracy : $\pm 0.2\%$ reading ± 1 Lsb

(4) BSG test method :

Recording length : 1ms~2s

Time resolution : 0.1ms

Time accuracy : $\pm 0.2\%$ reading ± 1 Lsb

2.2. Stroke Part

Stroke range : 0~1000mm

Stroke resolution : 0.1mm

Stroke accuracy : $\pm 0.5\%$ reading ± 1 Lsb

2.3. Velocity Part

Velocity range : 0~20.0m/s

Velocity resolution : 0.01m/s

2.4. Coil Current Part

Current range : 0~20A

Current resolution : 0.001A

2.5. Voltage Source Part

Voltage range : 15~255V

Max power : 5kW

2.6. Power Supply Part

Main unit supply : 220V±10% AC, 50Hz±10%

2.7.Environment Part

Operating temperature : -10°C ~ 55°C

Storage temperature : -30°C ~ 70°C

Relative humidity : 5~95%, non-condensing

Altitude : less than 2000m

2.8.Main unit Dimensions

Type A/B ABS : 456(W)*372(D)*185(H)mm

Type C to H ABS : 472(W)*365(D)*210(H)mm

Type AD(4U aluminum) : 483(W)*450(D)*178(H)mm

2.9.Weight

Type A/B ABS :

Type C to H ABS : 11.5 kg

Type AD(4U aluminum) :

3. Basic concepts

3.1. time

Closing time : interval of time between energizing the closing circuit, the circuit-breaker being in the open position, and the instant when the contacts touch in all poles.

Opening time: the interval of time between the instant of energizing the opening release, the circuit-breaker being in the closed position, and the instant when the arcing contacts have separated in all poles.

Bounce time: The time gap between the two contacts touch(separate)the first time and the two contacts touch(separate) stable.

Bounce cycles: The cycles in the progress of the time gap between the two contacts touch(separate) the first time and the two contacts touch(separate) stable.

close-open time: interval of time between the instant when the contacts touch in the first pole during a closing operation and the instant when the arcing contacts have separated in all poles during the subsequent opening operation.

3.2. Motion/Travel

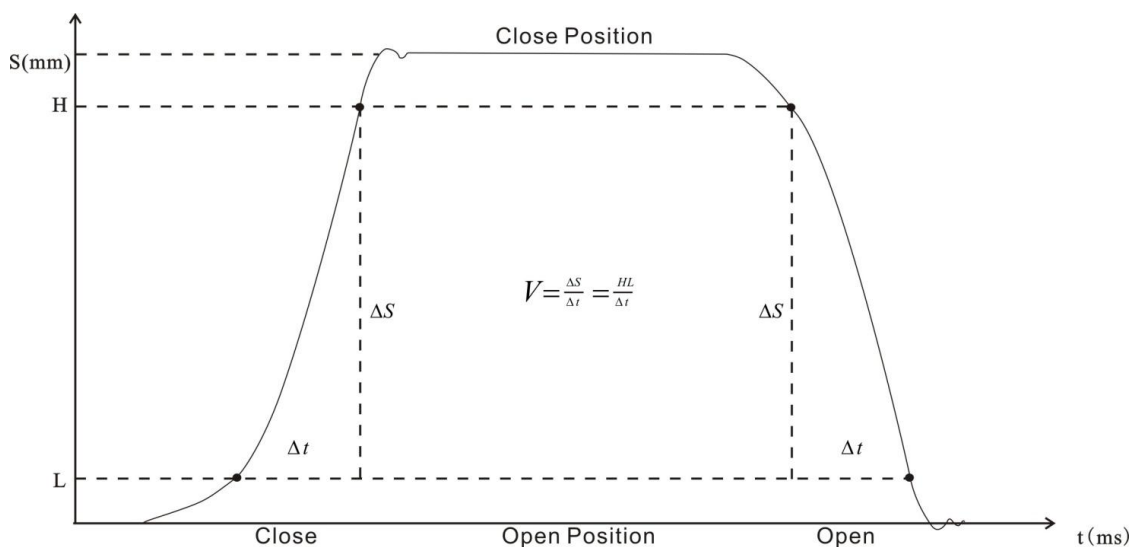
Stroke : stroke is the distance from the stable initial close(open) state to the stable final close(open) state.

3.3. Speed

Speed : the close or open speed is defined by the circuit breaker producer. It is also called just open/close speed, or average speed.

Max Speed: it means the maximum average speed based on the 10ms gap.

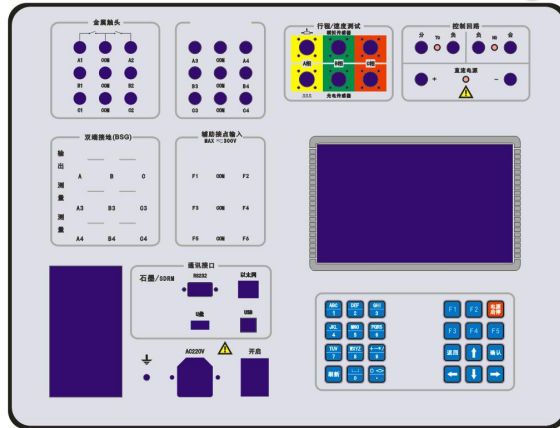
Speed definition: from the circuit breaker producer's speed definition or the country's standards, the average speed can be calculated from the S-t graph. $V = \frac{\Delta S}{\Delta t} = \frac{HL}{\Delta t}$, HL is the distance gap, Δt is the time gap.



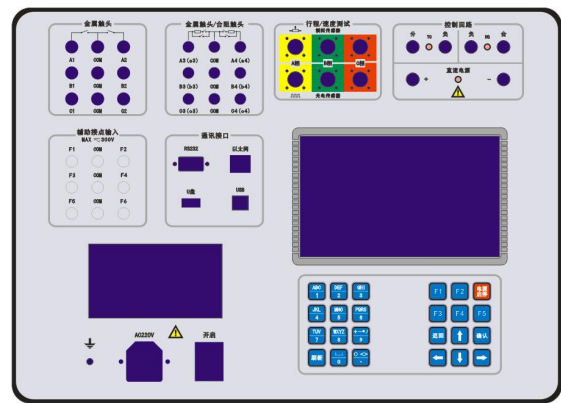
4. Instrument Panel

ABS package

Type C--H

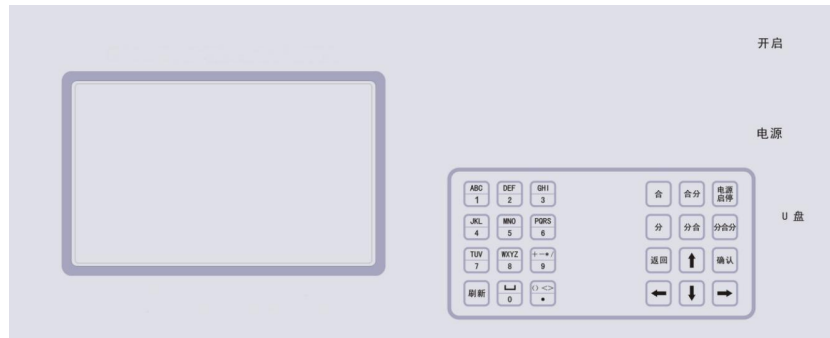


Type A/B



Type AD

Front panel



Rear panel



panel introduction

main: six main contacts interface.

main/PIR: six main contacts, combined with pir test function.

BSG: the dual ground test function interface.

GRAPHITE/SDRM: use one three wire signal connection line to connect with the graphite test unit.

AUX: six aux contacts interface .Combined with dry and wet aux contacts, select the contact type from the circuit breaker model creation menu.

Motion/velocity test: the velocity tests interface can connect analog transducers, digital encoder, accelerators (user selectable).

Input power connector: three pins with grounding pin, supply with AC 220V,50Hz .there are two spare fuses of 15A in the fuse box for spare use.

Power IO : The main power switch with a led as indicator.

Ground stud : the protective grounding stud is $\Phi 4$ with a hole in the center.

Printer: thermal printer with paper width 58mm .

Communication : include RS232C, USB communication ,USB flash disk .

Key Pad : keypad is divided into two parts, the left part is twelve keys of numeric plus alphabet.

The right part is twelve shortcut keys for dedicated functions.

LCD : 7 inch TFT LCD panel.

DC Power: + and – are the internal dc power output ,it is also used for the connection with external power, with a red led as indicator .

Control Circuit: the open , common, close port are the digital power's output . the open and close ports are the positive side, the common ports are the negative side. The pairs of close and common ,open and common can also be used as the external trigger, with LEDs as indicators .

AC power: L、 N are internal ac power's output ,with LED indication (user selectable for Type AD) .

AC control out circuit : the open , common, close port are the ac power's output . the open and close ports are the L side, the common ports are the N side. The pairs of close and common ,open and common can also be used as the external trigger, with LEDs as indicators .

Voltage regulator: connect with the external voltage regulator's power lines .

Control interface : connect the control signal lines of the voltage regulator .

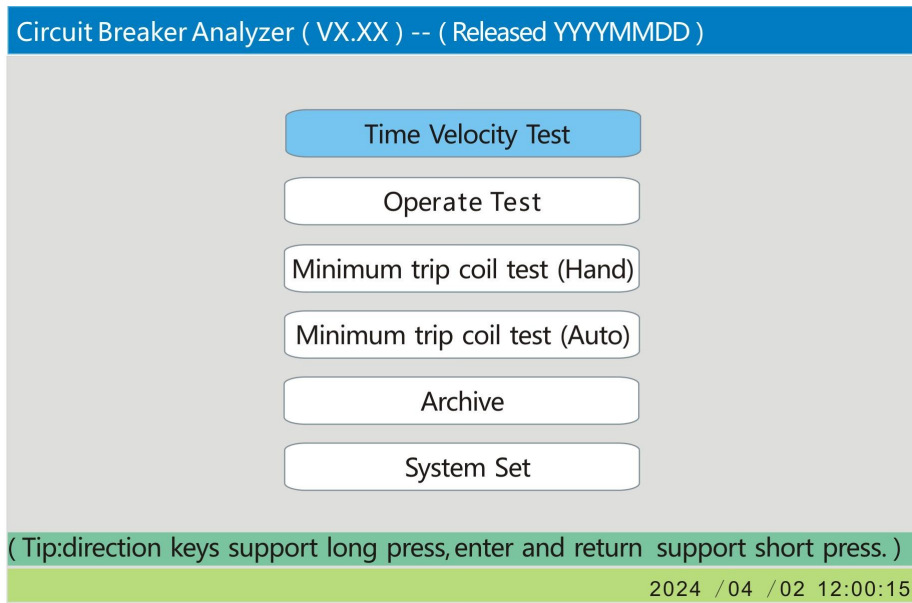
5. Menu

5.1 Create a circuit breaker model

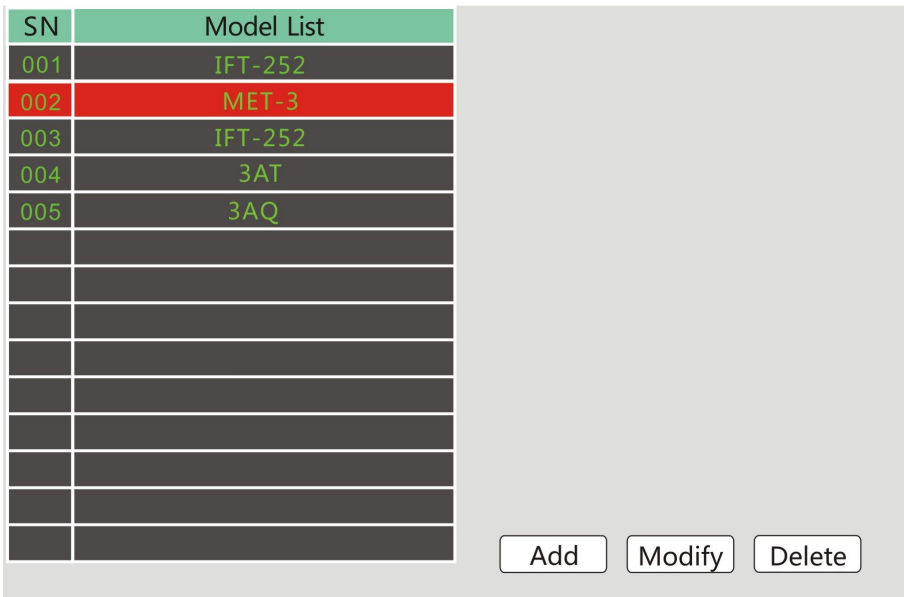
1st - Edit and store the circuit breaker model makes the test easier, once the model is created(with test set parameters), select one model and test immediately .

2nd - the instrument can store up to 50 circuit breaker types.

3rd - Power up the tester , the screen is as following.



4th - select the Time velocity Test, and press key Enter, the screen is as following.



5th - Press key → to select the Add button , then press key Enter . the screen is

as following .

CB Model	IFT-252		Open Set
Contact	Normal		Testtime 00100 (ms)
AuxType	Wet		Close Set
Transduce.	Digital	Pulses 02500	Testtime 00200 (ms)
S Type	Input		O-C Set
SetStroke	0230.00	(mm)	Testtime 00400 (ms)
Velocity	3		O-C Ctrl 00230 (ms)
C: before C	10.0	ms	C-O Set
O: after O	10.0	ms	Testtime 00400 (ms)
TimeStart	00.10	(A)	C-O Ctrl 00120 (ms)
MotorI	Not test		O-C-O Set
MchargePreC	10000	(ms)	Testtime 00500 (ms)
MchargePreO	10000	(ms)	O-C Ctrl 00230 (ms)
C Pulse	00100	(ms)	C-O Ctrl 00120 (ms)
O Pulse	00100	(ms)	
			Save&Return
			Save&ToTestPage

6th - short repeat press the keys to enter the alphabet.

7th - Contact: Normal、PIR parallel、PIR serial、Graphite、BSG(DC) and BSG(AC). If the DUT's contact type has no PIR function , select the normal . If the DUT's contact type has PIR function , select the PIR parallel or the PIR serial. If the DUT's contact type is Simens graphite , select the Graphite contact , and the CB Model should be entered 3AQ or 3AT(the correct circuit breaker model makes the software compensation available). BSG(DC) means that the circuit breaker's dual sides are grounded, use the direct constant current to test the close or open time . BSG(AC) means that the circuit breaker's dual sides are grounded, use the high frequency ac signal to test the close or open time .

8th - Aux contacts . Choose the dry or wet contacts based on the dut's auxiliary contact type.

The cooperation time calculation between the main contact and aux contact pairs are F1-A1, F2-A2, F3-B1, F4-B2, F5-C1, F6-C2 .

9th - Transducer :Select the transducer type, include analog and digital.

(1) select the analog transducer:

when the stroke type is Input type , the circuit breaker's stroke calculation use the set stroke data of the circuit breaker. This mode doesn't care the voltage drop between the circuit breaker's close position and open position.

when the stroke type is Measure type , the circuit breaker's stroke calculation use the setstroke data of the transducer. This mode can test the circuit breaker's close position and open position's true data ,i.e. the circuit breaker's stroke.

$$\Delta M = M \times \Delta V / V$$

ΔM : true stroke

M: transducer's stroke

$$V = | V1 - V2 |$$

V1: the voltage of the circuit breaker's open position

V2: the voltage of the circuit breaker's close position

V: the transducer's supply voltage (5.0 V)

(2) select the digital transducer, set the encoder's pulses.

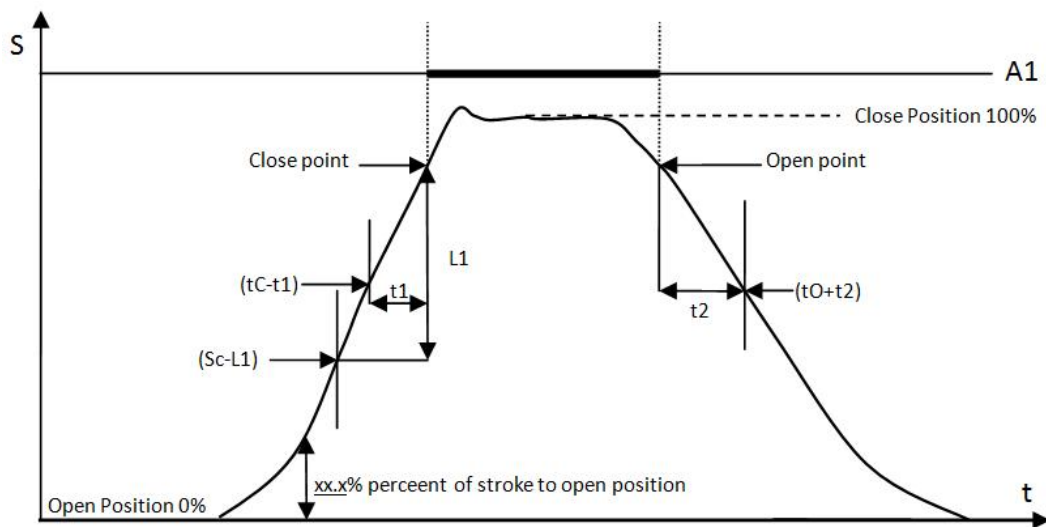
When select the digital transducer, the stroke type should be set as Input mode.

The circuit breaker's true stroke uses the set stroke to calculate the other stroke data and velocity data .

10th - Set the velocity definition of the close definition and open definition.

Assumption: the close operation stroke curve should be drawn from the bottom to top , the open operation stroke curve should be drawn from the top to the bottom .

Define the circuit breaker's moving contact's location as 0% or 0mm when the circuit breaker is opened . Define the circuit breaker's moving contact's location as 100% when the circuit breaker is closed.



This tester has eleven velocity definitions to select .

1、 C: S _____% to C point

0: 0 point to S _____%

2、 C: S _____%to_____%

0: S _____%to_____%

3、 C: before C _____ms

0: after 0 _____ms

4、 C: before C _____mm

0: after 0 _____mm

5、 C: S _____mm to C point

0: after 0 _____mm

6、 C: S _____mm to _____mm

0: S _____mm to _____mm

7、 C: before C _____mm to after C _____mm

0: before 0 _____mm to after 0 _____mm

8、 C: S _____% - _____ms

0: S _____% + _____ms

9、 C: S _____% to C point

0: S _____%to_____%

10、 C:open distance_____% to C point

0:open distance_____% to 0 point

11、 C: before C _____ms to after C _____ms

0: before 0 _____ms to after 0 _____ms

11th - The timestart current means the coil current reaches the value to trig.

1、 use to calculate the open coil or close coil 's current length.

2、 use to calculate the OCO's second open time .

3、 use to calculate the CO's open time .

4、 use to calculate the OC's close time .

12th - The motor current means to test the charge motor or not .

If the charge motor's current test is needed ,select the Test. The value set

in the 'MchargePreC ____ms' should be bigger than the sum of the closetime and motor charge time .And the value set in the 'MchargePre0 ____ms' should be bigger than the sum of the opentime and motor charge time .

13th - The close pulse and open pulse width set.

- 1、 C pulse ____ (ms) set the close operation's power width .
- 2、 0 pulse ____ (ms) set the open operation's power width .

14th - open and close record time set.

1、 Open Set

Open testtime means the open operation's record time.

2、 Close Set

Close testtime means the close operation's record time.

3、 0-C Set

0-C testtime means the open-close operation's record time.

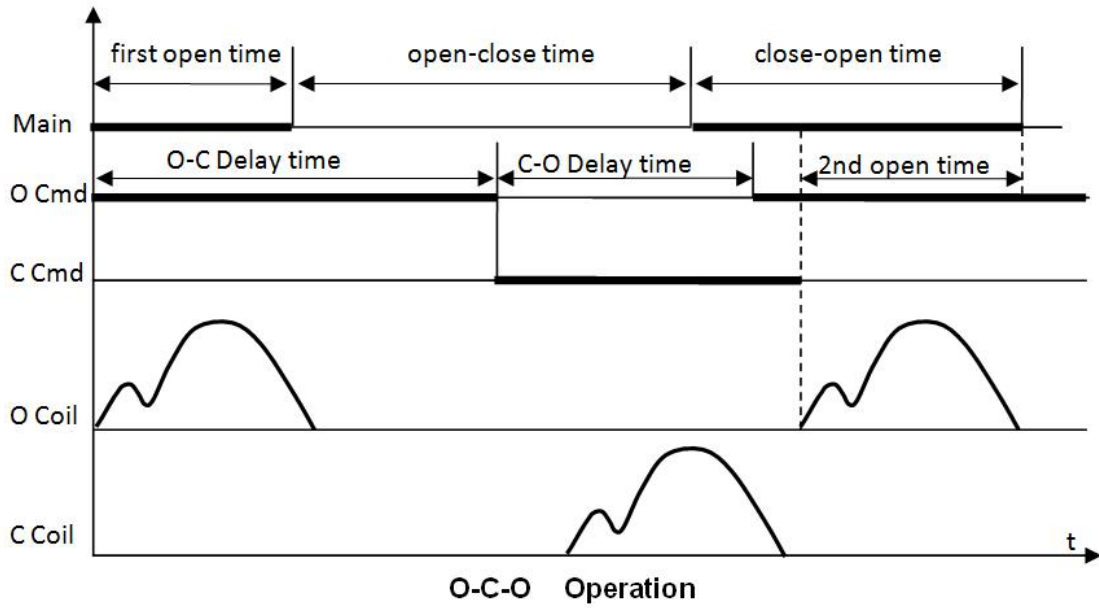
0-C Ctrl time means the delay time between the open command and the close command.

4、 C-0 Set

C-0 testtime means the close-open operation's record time.

C-0 Ctrl time means the delay time between the close command and the open command.

5、 0-C-0 Set

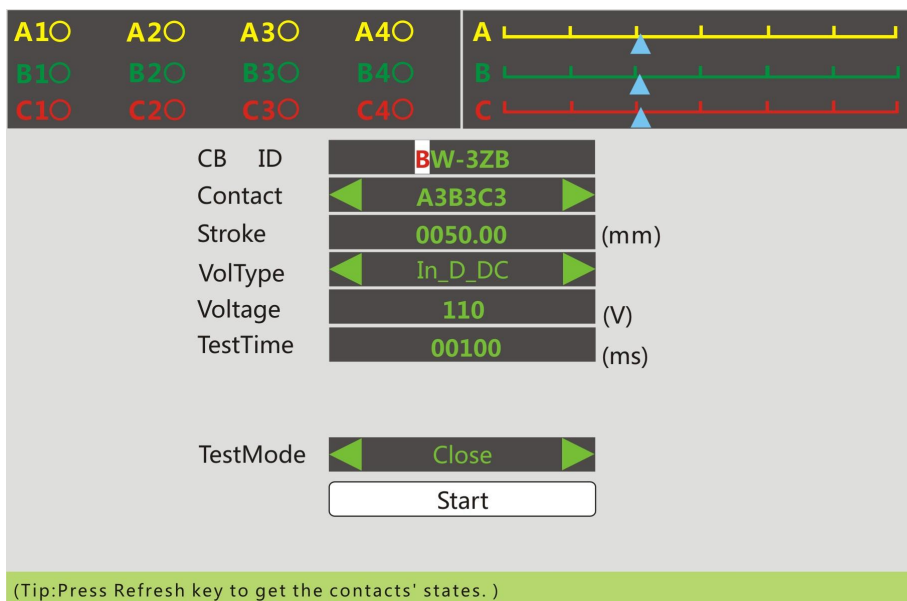


O-C-O testtime means the open-close operation's record time.

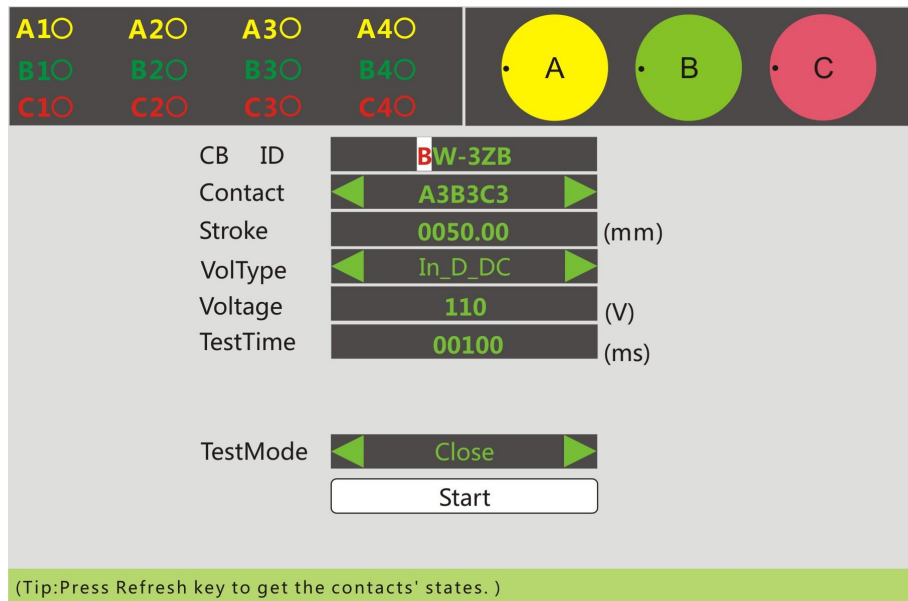
O-C Ctrl time means the delay time between the first open command and the first close command.

C-O Ctrl time means the delay time between the first close command and the second open command.

15th - After the parameters have been set, select the **Save&return** and press to add one circuit breaker model to the model list. Select **Save&ToTestPage** and press to jump to the test page screen. The screen is as follows.



(Analog transducer Test page)



(Digital transducer Test page)

16th - Contact selection . The contact varies from A1B1C1 to A4B4C4. The selected contact's close time and open time will be used to calculate the stroke parameters and velocity parameters .

5.2 Time Velocity Test

One、 Connect the test lines and install the transducer.

Two、 Create one circuit breaker model according to title 5.1 .

Three、 Select the circuit breaker model under test, press enter to load the very circuit breaker model.

Fourth、 the stroke set is easy use during modify the stroke of the transducer or the circuit breaker.

Fifth、 use key ← to clear the CB ID, enter the true CB ID of the D. U. T.. Enter the rated voltage of the circuit breaker.

Sixth、 The transducer indication is helpful when install the transducer . The ● means the contact is closed , the ○ means the contact is opened.

Specially , if the contact type is the BSG(AC) , press the refresh key to get the signal of the circuit breaker 's close loop or the signal of the circuit breaker's open loop . the values are useful for the analyse of the test . Press



key F1 to set the gain values of the signal sampling circuit , the gain changes

between X1 and X5 . The principal of set the gain value is to get a bigger gap between the close and open loop .

Seventh、The operation sequences include: Open ,Close,0-C, C-0 ,0-C-0 ,0_Ext_Trig, C_Ext_Trig, 0_Hand , C_Hand , CO_OneCoil, 0_OneCoil , C_OneCoil .

Eighth、Because one close-open test can't get the transducer's voltage of the close position ,and one open-close test can't get the transducer's voltage of the open position. So during every close or open operation , the analyzer system will record the transducer voltage of the close position and the open position .

Once the transducer installation has been changed or the analyzer is first powered on, one close and one open operation should be done before the multi-sequence operation.

Ninth、Select one operation

sequence, if there is no need to execute the motor charge test, press key Power to turn the power on ,and charge the circuit breaker. Then use the direction keys to set the focus on the Start button. press enter to start the test .Wait the record time, then the screen will display the tabula of the test ,as following .

Port	closetime(ms)	Tbounce(ms)	Nbounce	To.p.(ms)	Tdelta(ms)	
A1	00052.7	00000.5	1			
B1	00053.5	00001.6	2			
C1	00052.7	00000.4	1			
Pha.	S(mm)	O.D.(mm)	O.T.(mm)	O.S.(mm)	Rebo.(mm)	V(m/s)
A	0013.41	0010.62	0002.78	0000.75	0002.08	00.86
B	0013.40	0011.31	0002.10	0000.75	0002.08	00.88
C	0013.40	0010.62	0002.78	0000.75	0002.08	00.86
△A(ms)	△B(ms)	△C(ms)	△ABC(ms)	Icoil(A)	Rcoil(Ω)	
00000.0	00000.0	00000.0	00000.8	01.027	0	
电机电流(A)	电机电流时间(ms)					
00.164	04250.0					

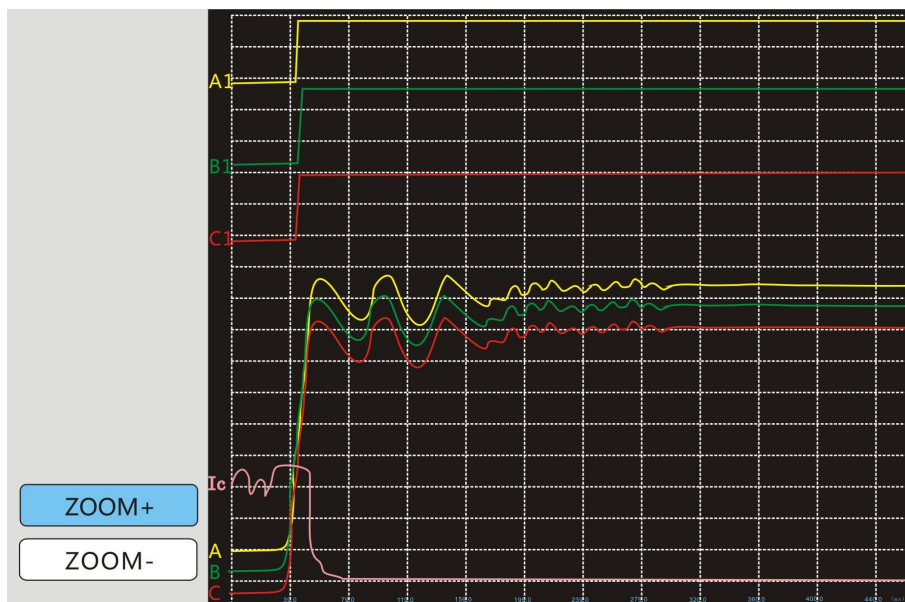
Save
Print
Graph
ReCalc.

On the tabula, use the → or ← direction key to move the focus .If the contacts are not displayed totally ,as A2 ,A3 and A4 ,Use key ↑ or ↓ to view the others.

Press enter during the Save button is focused ,the test results will store to the flash .The archive data can be loaded or exported to the USB flash disk for further analyze.

Press enter during the Print button is focused, the thermal printer will printout the tabula and graph.

Press enter during the Graph button is focused, the screen will display the graph.



On the graph, there are contacts curve, stroke curve, close coil current or open coil current displayed simultaneous.

Press key Return to return to the previous page.

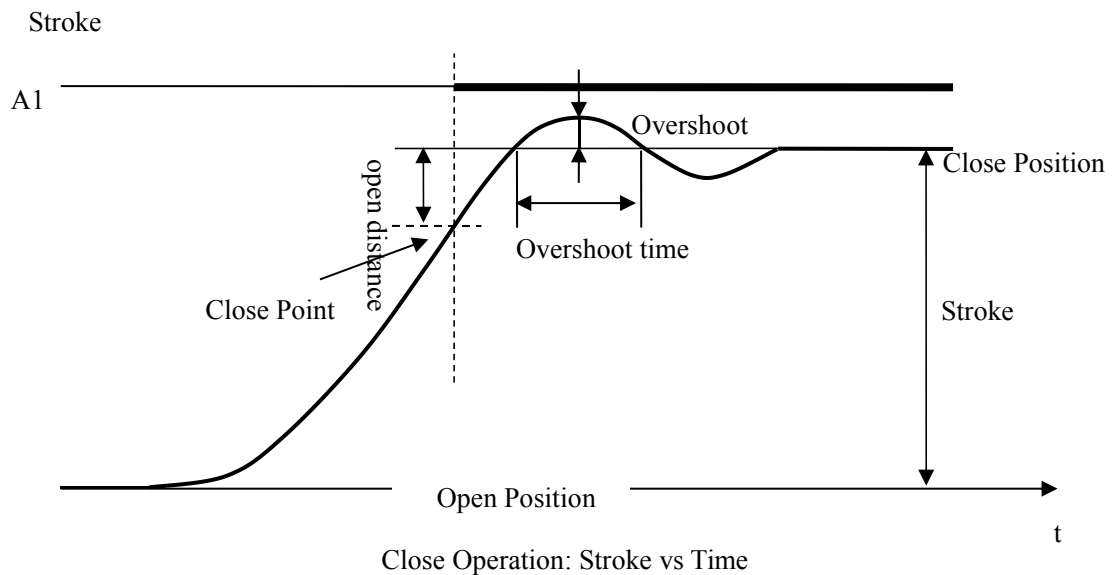
Tenth、 On the tabula, Press button ReCalc. to jump to the recalculate set screen.

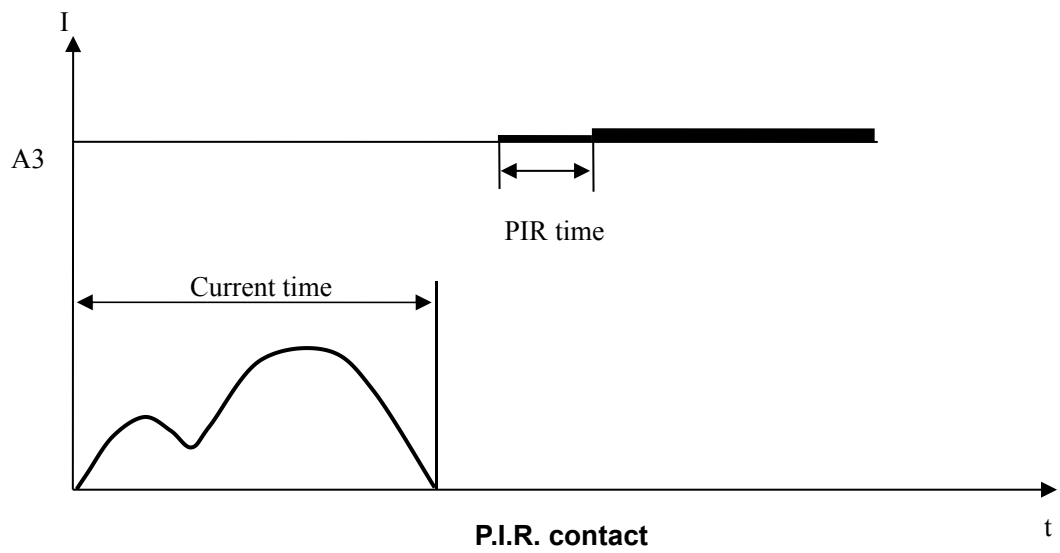
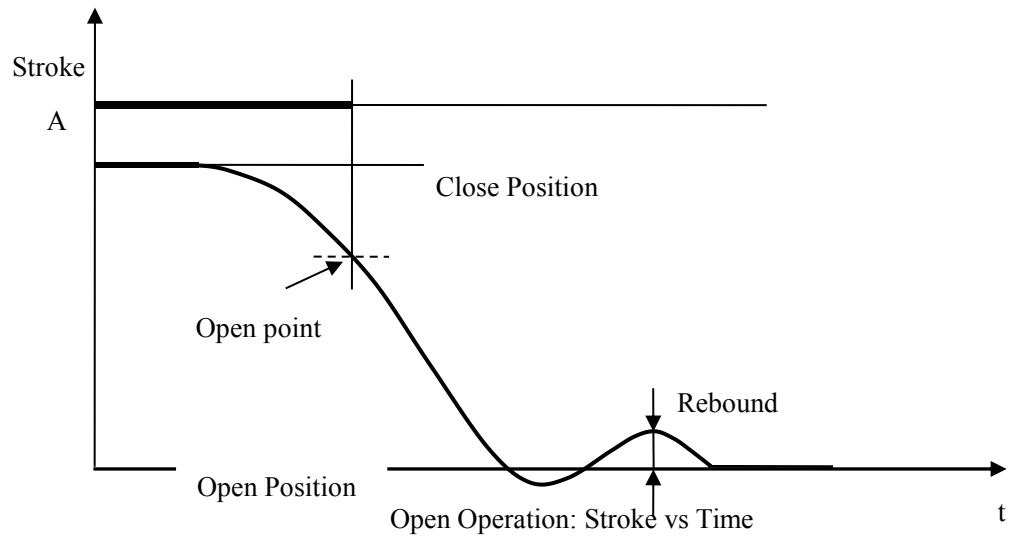
Re-Calculate Set

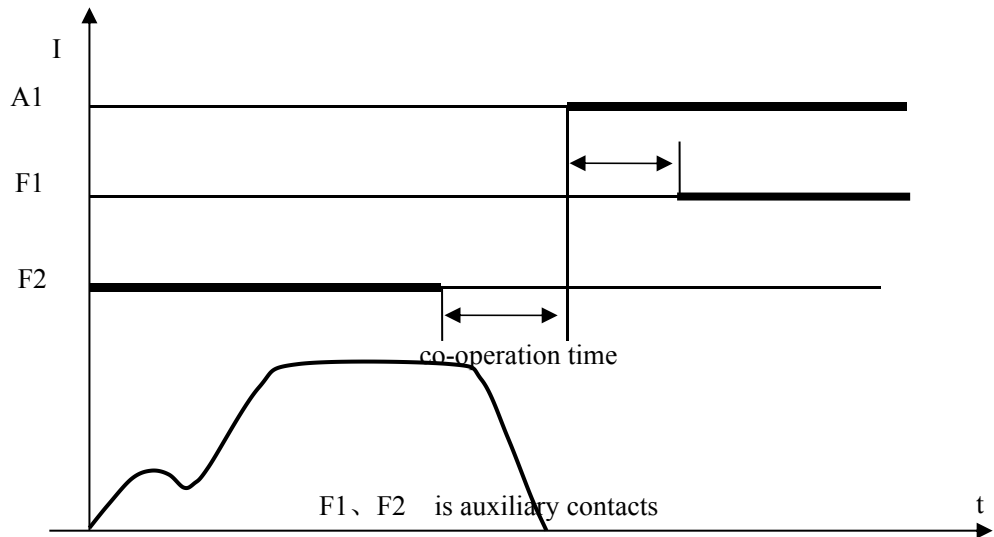
Contact	A1B1C1	
Velocity	7	
C:before C	050.0 mm	to after C 020.0 mm
O:before O	050.0 mm	to after O 050.0 mm
TimeStart	00.10 (A)	
Filter	3	

If the test set parameters are not suitable, modify the test parameters, especially the velocity definition. After set, then press the ReCalculate button. the screen will display the tabula. It is helpful during modify some test set parameters, for the reason there is no need to modify the test set parameters and test again.

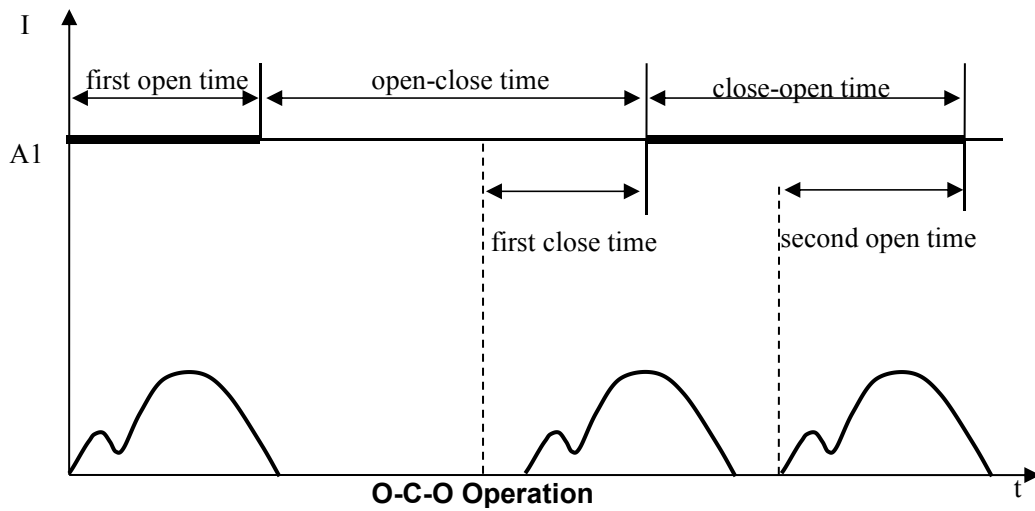
Circuit breaker's graph analyze







main contact vs auxiliary contact



Eleventh, This analyzer can store 50 test records.

5.3 Operate Test

This module is for the circuit breaker's operate test.

Operate Test	
Mode	OCO
Number	00100 (cycles)
Voltage	110 (V)
PulseWide	00100 (ms)
Executed	00000
0-T1-C-T2-0-T3-C-T4	
T1=	0001.2 (S)
T2=	0002.3 (S)
T3=	0003.4 (S)
T4=	0004.5 (S)
Start	
Save	
Clear	
Quit	

Mode: The operate test supplies two modes, include CO and OCO operate modes.

Number: Set the target operate cycles of the operate mode. use the key ← to clear the original number , then enter the target number .The max number is 10000 cycles.

Voltage: Set the D.U.T.'s operating mechanism rated voltage.

PulseWide: the pulse width is the voltage supply time length. Use the key ← to clear the original number, then enter the target number. The max pulse width is 15000 ms .

Executed: The executed number indicates the cycles have been finished.

T1 : T1 is the time gap between the previous operation's ending and the next operation's beginning. It ranges from 1s to 1000s .

T2 : T2 is the time gap between the previous operation's ending and the next operation's beginning. It ranges from 1s to 1000s .

T3 : T3 is the time gap between the previous operation's ending and the next operation's beginning. It ranges from 1s to 1000s .

T4 : T4 is the time gap between the previous operation's ending and the next operation's beginning. It ranges from 1s to 1000s .

Start: Press the start button during the button has the focus to start the operation. Then the start button will change to Cancel. Press this button will cancel the test and the

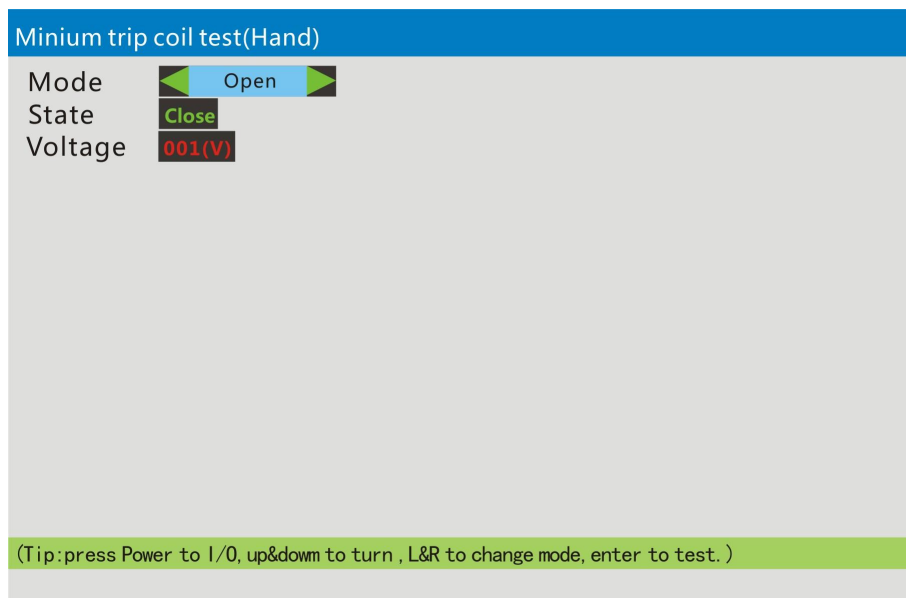
button will change to start again.

Save: When it needs to halt in the operation, and go with the current executed cycles next time .press the save button before leaving the page.

Clear: When it needs to clear the executed cycles, Press the clear button. Once the Clear button has been pressed, the executed cycles will return to zero.

Quit: Press this button to return to the analyzer's main page.

5.4 Minimum trip coil test(Hand)



Operation steps :

- 1、 Connect the analyzer's close or open output to the D.U.T.'s close coil or open coil (it is better to connect the coils via the auxiliary contact).
- 2、 Connect the analyzer's power out to the DUT's motor charge input.

3、 press key Power to turn on the internal power , the state will change from Close to Open ,the voltage starts from 30V .When the power is on state, press key Power again, the power will be shut down, the state will change from Open to Close.

4、 Turn ↑、 ↓ to turn the voltage to the target value.

5、 Press ←、 → to change the test sequence between close and open.

6、 Press enter to send the voltage pulse from the close or open output.

5.5 Minimum trip coil test(Auto)

This test mode is used to test the minimum trip voltage of the coils automatically .

Rated Voltage is the operating mechanism's rated voltage.

Vstart is the start voltage of the test.

Vend is the max voltage of the test.

Pulsewide is the voltage pulse's time length.

Vstep is the voltage gap between the two voltage pulses.

Tstep is the time gap between the two voltage pulses.

Mode is to set the operation sequence, there are two modes to select, open or close.

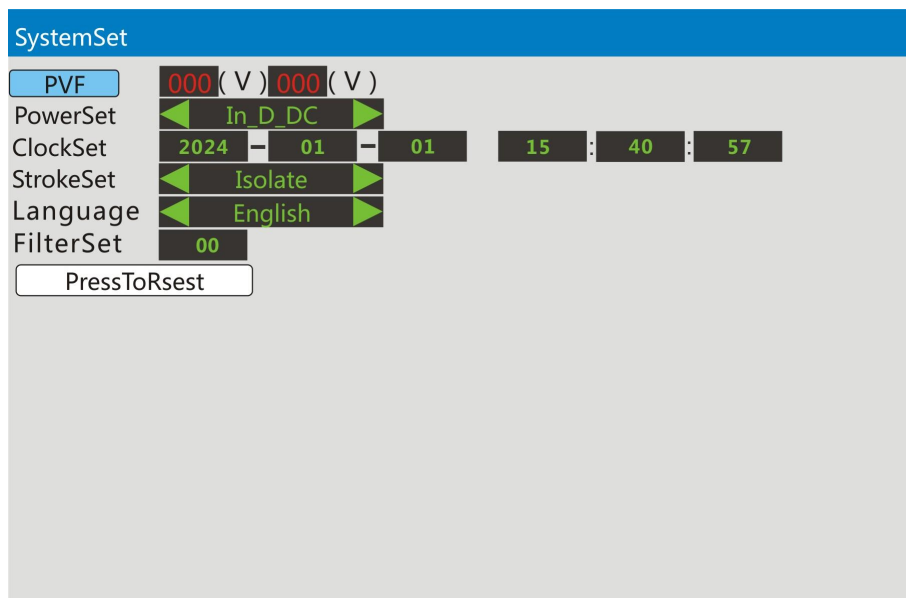
The screenshot displays the 'Minimum trip coil test(Auto)' interface. At the top, there are three status indicators: 'A1' (yellow), 'B1' (green), and 'C1' (red), each with a '000 V' reading. To the right, a '005 V' reading is shown. Below these are several adjustable parameters, each with a numerical value and a unit, and a 'Start' button at the bottom. A tip at the bottom of the screen reads: '(Tip:press Start after setting to test,press Cancel to stop.)'

Parameter	Value	Unit
Rated V	110	V
Vstart	05	(V)
Vend	121	(V)
Pulsewide	0300	(ms)
Vstep	5	(V)
Tstep	2	(s)
Mode	Close	

Operation steps :

- 1、 Connect the analyzer's close or open output to the D.U.T.'s close coil or open coil (it is better to connect the coils via the auxiliary contact).Connect the circuit breaker's contacts to the analyzer's normal contacts, this analyzer supports three contacts .
- 2、 Connect the analyzer's power out to the DUT's motor charge input.
- 3、 Set the test parameters based on the necessary .
- 4、 Press button Start when the button has focus .

5.6 System Set



PVF: Press the button PVF to verify the internal Digital Control DC power.

PowerSet: press key ←、 → to change the power mode ,include the internal digital controlled DC power(In_D_DC for short) and the external DC power(Ex_DC for short).

ClockSet: Set the analyzer system's internal RTC.

StrokeSet: Set the stroke curves as combined together or isolated.

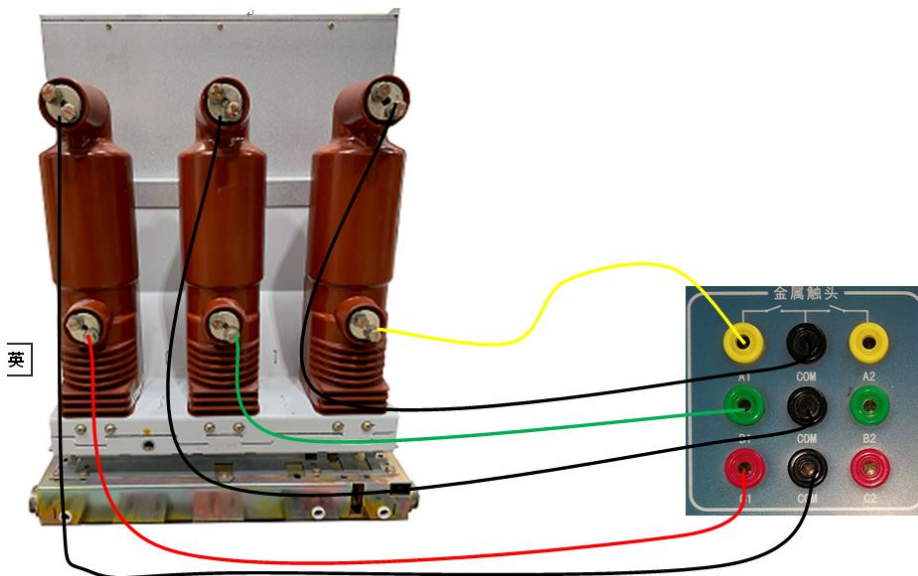
Language: set the analyzer's language between English and Chinese. Once the language has changed, the system will restart automatically to load the new characters.

FilterSet: This filter set the optical encoder's filter depth, it ranges from 0 to 15 .The filter is deeper when the value is bigger. The demo value is zero, means that there is no

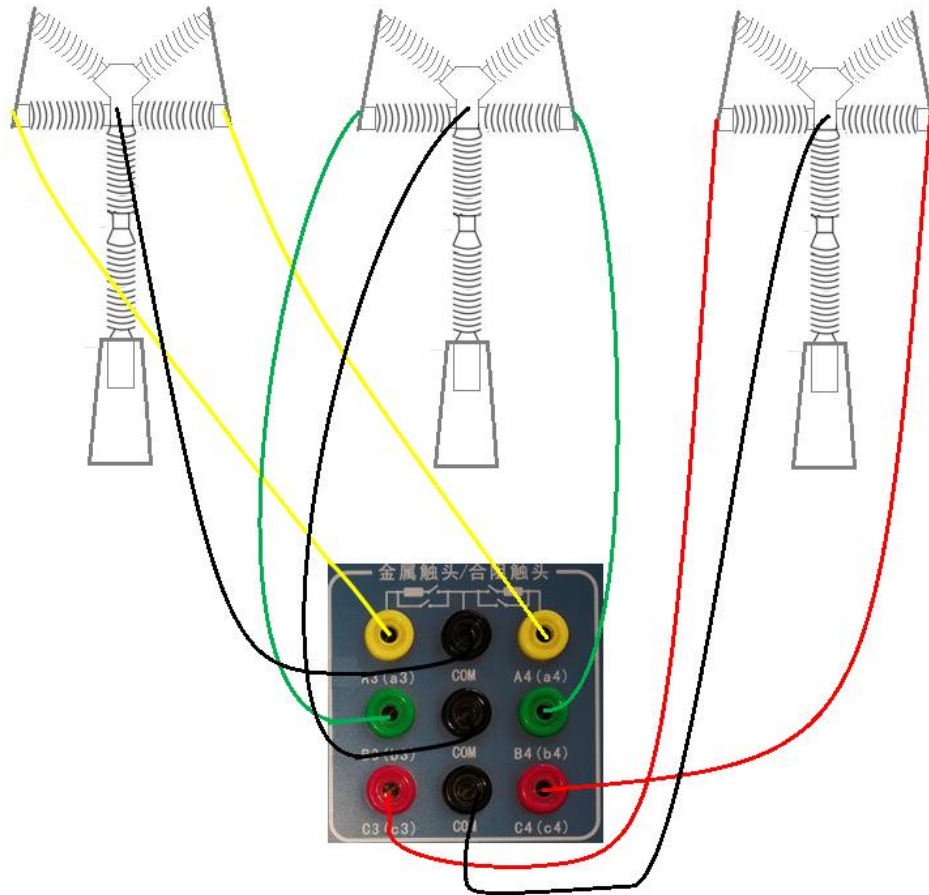
filter .

PressToReset: Press the ↑、↓ direction keys to move the focus of the widgets. When the button has the focus(the background color changes to light blue) ,press key Enter to reset the analyzer to the factory set state.

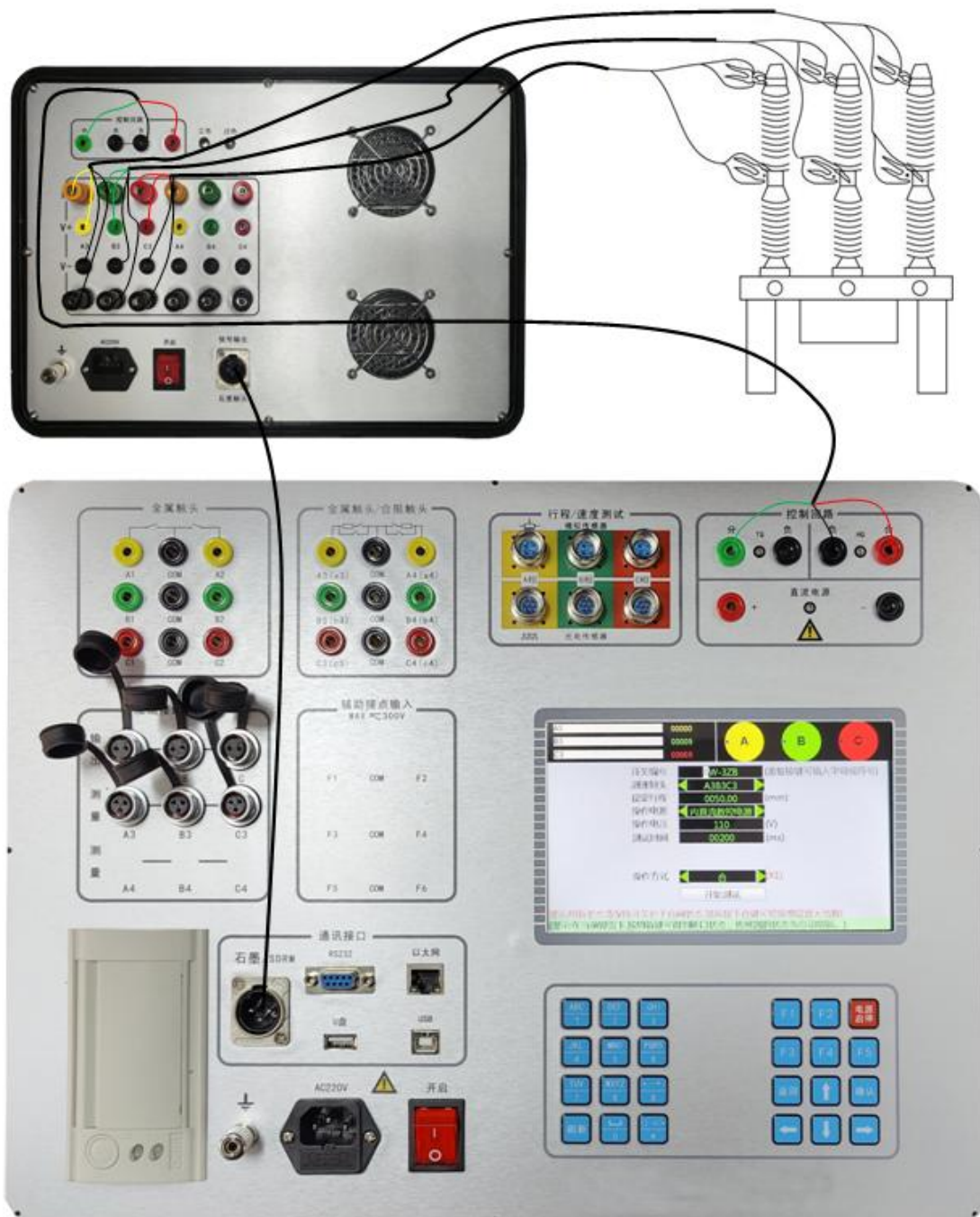
6. Test lines connection



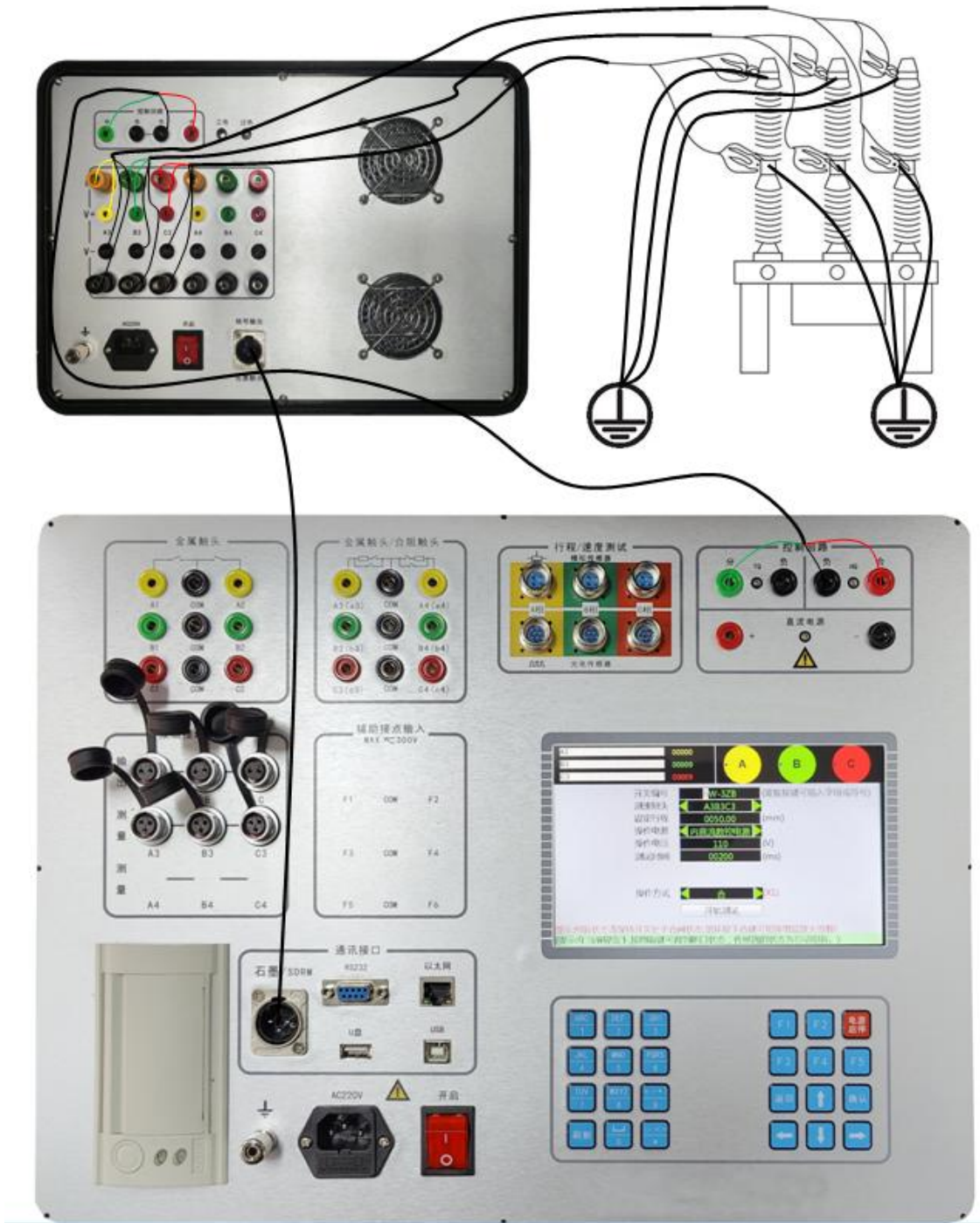
Normal contact connection (3 contacts for example)



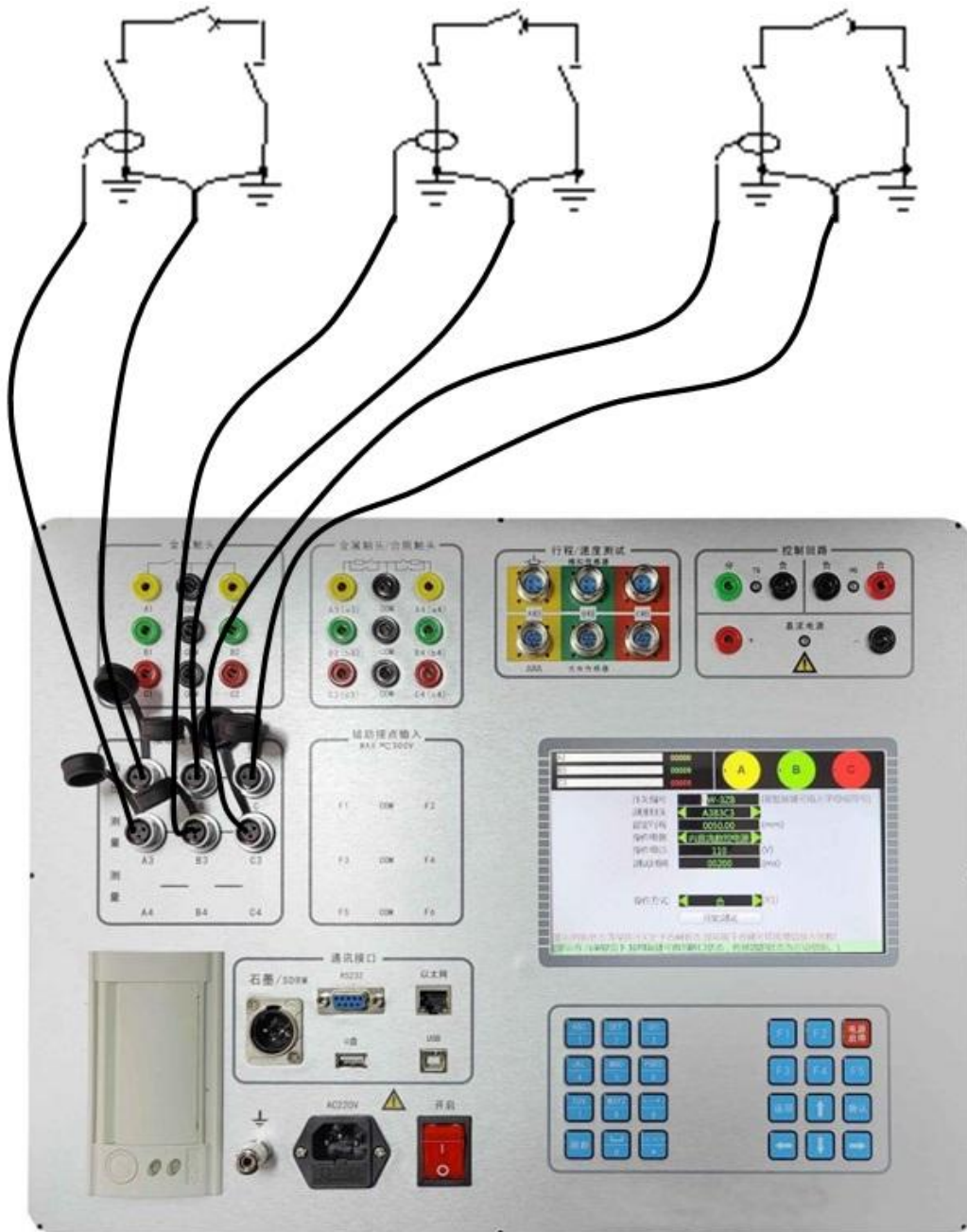
PIR contacts (6 contacts for example)



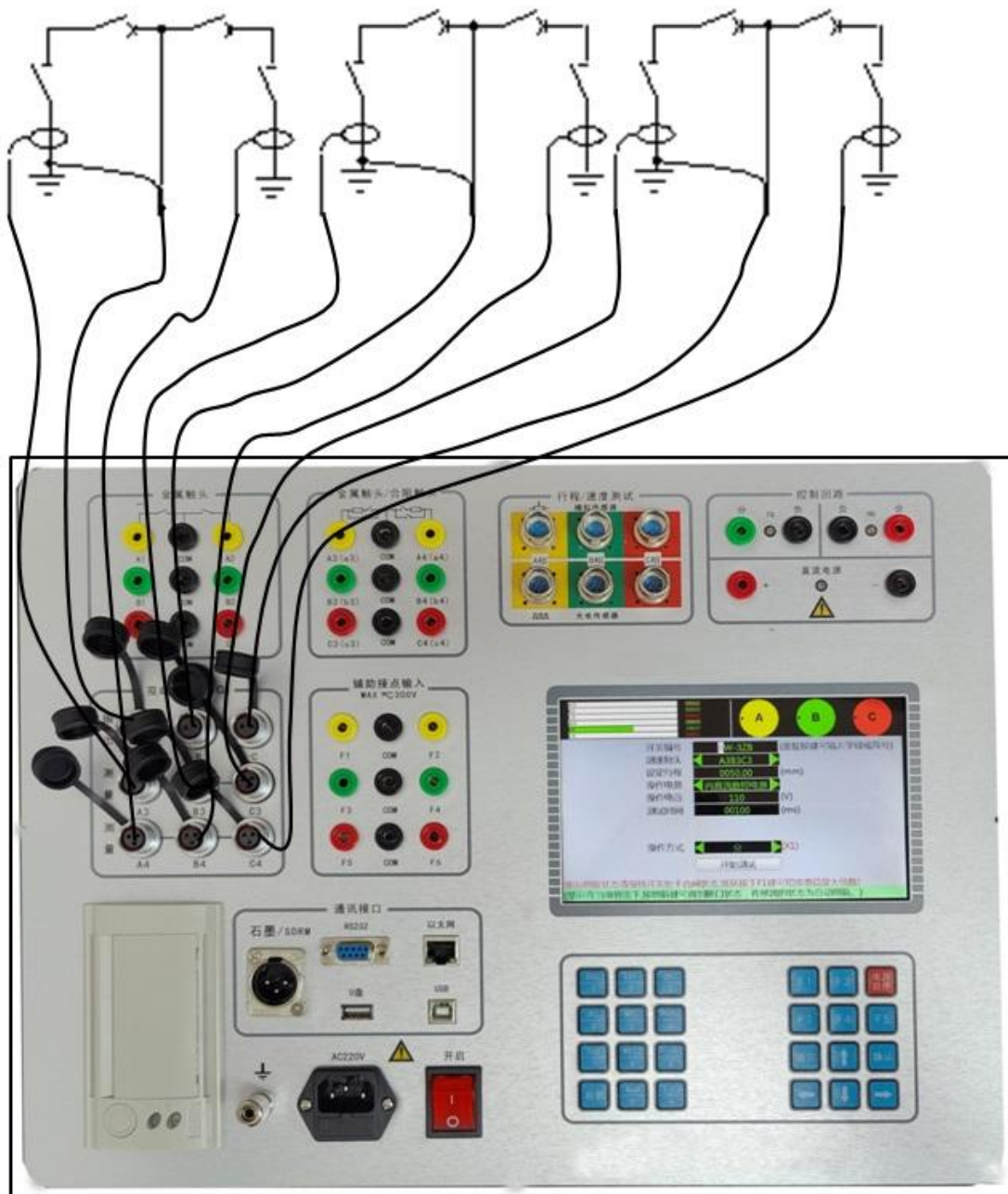
Graphite contacts (3 contacts for example)



BSG(DC)(3 contacts for example)



BSG(AC)(3 contacts for example)



BSG(AC)(6 contacts for example)

7. After-sales service

Our company will supply a quality guarantee of three years of the product.