ZXKC-H High Voltage Switch Dynamic Characteristics Tester

Contents

Precautions

1. Ensure wiring well before using instrument firstly, in order to confirm user & instrument's security.

2. Inspect whether the power voltage is AC 200V or not before using instrument firstly, otherwise it will damage the instrument.

3. Keep attention to safety on working instrument with internal DC220 V outlet.

4. Scrutinize the control wiring and strictly prohibit short out to avoid damaging the internal DC power or control contact, which is under circumstance of using the divide-shut brake of internal DC power control switch.

5. Confirm each part of fracture lines connecting well for fear that switch vibration influences test data.

6. Prohibit to open enclosure randomly while there has 220V voltage inside.

Ⅰ product description

With the development of society, people have higher and higher requirements for the safety and reliability of electricity. High-voltage circuit breakers are responsible for the dual tasks of control and protection in the power system. The performance of the high-voltage circuit breaker is directly related to the safe operation of the power system. The mechanical characteristic parameter is one of the important parameters to judge the performance of the circuit breaker. This instrument provides convenience for dynamic analysis of various circuit breakers, and can accurately measure the mechanical dynamic characteristics of low voltage, high oil, vacuum, sulfur hexafluoride and other high voltage circuit breakers of various voltage levels. The high-voltage circuit breaker is responsible for the dual tasks of control and protection in the power system, and its performance is directly related to the safe operation of the power system.

Ⅱ Performance characteristics

1. This instrument is an embedded industrial control computer. The motherboard is based on CortexTM-A8, with a main frequency of 1GHZ and a flash memory of 1GB. It takes only 16 seconds to boot up quickly.

2. 8.4-inch color large screen, windows operating system, user-friendly operation interface, intuitive interface, touch screen, support for Chinese and English input, easy for on-site operators to use.

3. High-speed thermal printer, convenient for printing test data on site.

4. The integrated operation power supply in the machine does not require on-site secondary power supply, and the on-site use is convenient and fast. DC30 ~ 260V adjustable power supply, current 20A. Arbitrarily set the operating voltage value of the opening and closing coils, and can be used to test the low voltage operation of the circuit breaker.

5. Equipped with linear sensor, rotation sensor, universal sensor and bracket, special fixed multi-function connector, installation is extremely convenient and simple.

6. Applicable to all types of SF6 switches, GIS combined appliances, vacuum switches, oil switches produced at home and abroad.

7. The switch acts once to get all the data and graphics.

8. The host can store 6000 sets of current test data (expandable memory card), real-time clock in the machine, easy to archive.

9. Equipped with U disk interface, can directly save data to U disk, upload to computer for analysis and storage.

10. At the same time, it can measure 12-channel metal contact fracture, 6-channel main fracture and 6-channel auxiliary fracture.

11. Contains the envelope line, through the value of a switch test, a standard envelope line is generated for analysis and comparison, and the vibration frequency of the switch can also be analyzed.

12. The internal anti-interference circuit can meet the reliable use in 500kV substation.

Ⅲ Main technic parameters

1. Time measurement：

   12 circuits fixed separating (closing) time

   separating (closing) inner-phase with asynchronism

   separating (closing) interphase with asynchronism

   closing (separating) bounce time (bounce times)

   testing range: 0.01ms～230s， resolution：0.01ms

2. velocity measurement : instant separating (instant closing) velocity

   Appointed time slot(stroke segment or angle segment) average velocity

3. velocity measurement range: 1mm sensor 0.01～25.00m/s，

   0.1mm sensor 0.001～2.50m/s

   0.5°angle sensor 1 cycle/ 0.5°

4. stroke measurement : moving contact stroke (stroke)

   contact stroke (separation)

overshoot stroke or retrace (over travel)

5. three way liner sensor :50mm, resolution: 0.1mm

   360 wire sensor : 360°， resolution:0.5°

   Matching sensor: 300mm, 1000mm, acceleration sensor, laser sensor.

6. current : maximum current output:20A

7. AC power supply ： AC：220 V ± 10%；50Hz ± 2%

8. DC power supply : voltage output:8~220V continuous adjustment, current

   output: ≤ 20A(short time)

9. disconnecting switch measurement range：

1) Voltage output: DC8～220V(adjustable)

2) Current output time: 0.01~20 s (settable)

3) Fracture signal maximum acquisition time: 200s

4) Measurable fracture closing, separation time, three-phase a synchronism , bounce time and frequency

10. mainframe volume : 380×280×170mm

11. operating environment: -20℃~+50℃

12. relative humidity: ≤80%

Ⅳ **Term Definition**

1) Three-phase synchronism: refers to the maximum & minimum differentials of on-off three-phase separation (closing) switch.

2) Same phase asynchronies : refers to 6 fractures or more switches, the time difference of separating (closing) brake to same phase fracture

3) Bounce time: refers to the accumulative time values, which is the interval from first contacting to completely contacting, of all contacts while in progress of closing, separating (bounce) brake when switch's moving & static contacts .

4) Opening time: refers to the interval from separating brake dropping out with electrification to every polar arc contact separating, where the breaker is in closed position.

5) Closing time: refers to the interval from closing circuit with electrification to every polar arc contact touching, where the breaker is in open position.

6) Reclosing time: in the cyclic process of reclosing, it's the interval from opening to each polar contacts closing together.

7) Instant separating (closing) velocity: refers to within some appointed time of opening/ closing moving contact and static contact, or average velocity of a certain appointed stroke. Take 10ms for instance, to separating brake ,it's average velocity to separate brake within 10ms after separating. To closing brake, it's average velocity to close brake within 10ms before closing.

8) Opening range: refers to the stroke of switch from divided state to instant touch of moving contact with static contact.

9) The maximum velocity of opening (closing)switch: refers to the maximum instantaneous speed of opening (closing) switch, generally speaking, this value shall appear in this stroke or point, which is analyzed from velocity and stroke curve, while switch just opening or closing.

10)Average velocity of opening (closing): refers to the ratio of stroke to time , where the switch moving contact exists in whole action.

Ⅴ Panel introduction
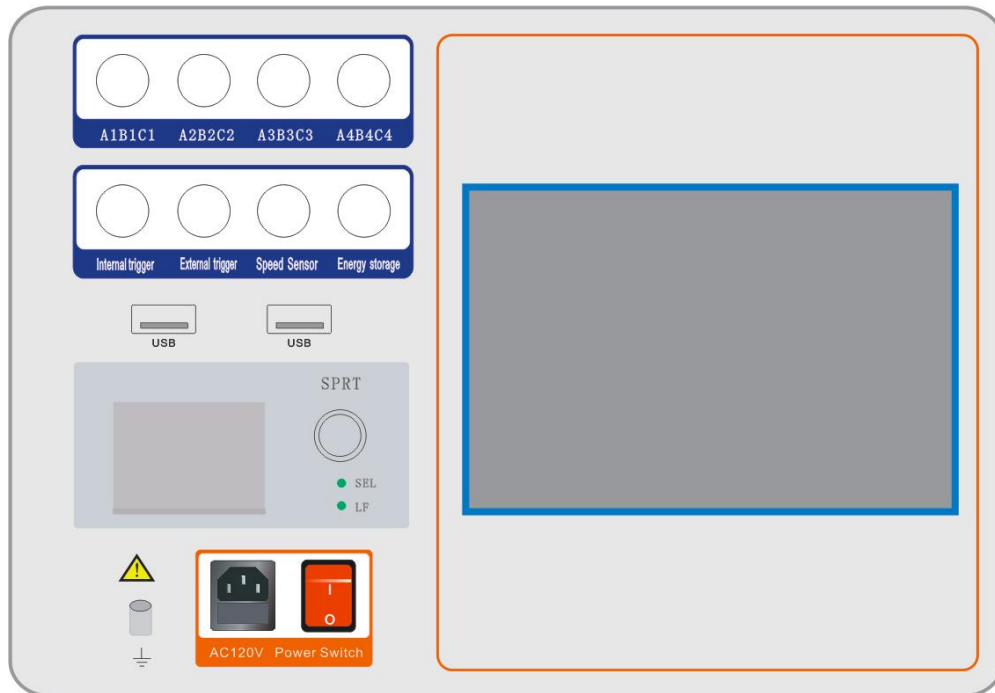
1. Metal contact testing port: can measure tome of 12 circuits ordinary breakers' closing, separating brake, bounce, synchronism, same phase, etc.

2. Internal trigger: refers to the operation in separating and closing with the output of DC30~265V adjustable power supply of instrument, which defaults as DC220V.

3. External trigger: refers to the operation in on-off action with on-site power supply (both AC and DC), while the DC power supply is in non-operative station inside of instrument.

4. Ground pole :confirm the ground wires connecting well before beginning the tests.

5. Velocity sensor port: the ports of connecting liner sensor with rotation sensor and universal sensor.

6. Printer: print the measure data on site.

7. LED screen : parameter design, measure, data display.

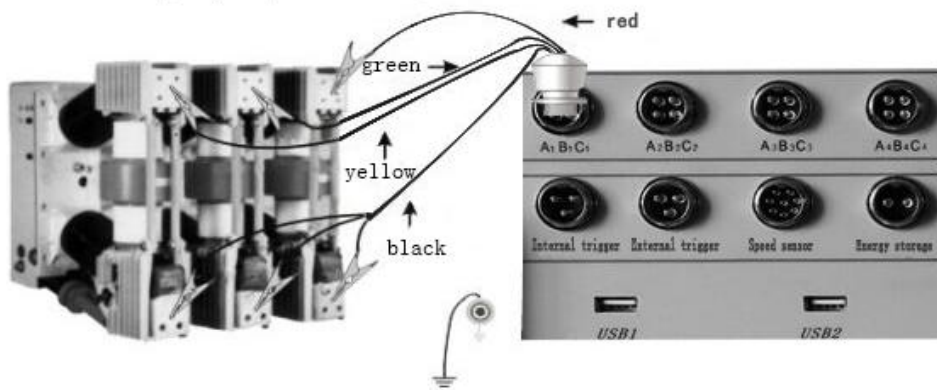# Ⅵ Fracture wire, closing/ opening brake control, sensor mounting methods

6.1 fracture wiring methods

This instrument has two fracture testing input ports, each facture with 4 wires, which are A1(yellow), B1(green) and C1(red) these three connect with three-phase moving contact port, GND(black), static contact(three-phase short circuit), could test and sample 6 fracture breakers (switch) in total.

The pictures below are exemplified as breakers' connection of 3 fractures and 6 fractures. Use these fracture testing input interfaces, and their connections are : A1 and A2 connect the yellow fracture input line, B1 and B2 connect with green fracture input line, C1 and C2 connect with red fracture input line. For three-phase 3 breakers, which only use the former fracture testing signal input port, A1 is the main fracture in it. (notation: 3 fracture, 6 facture breakers have one public GND).

12 connection of break signal wire
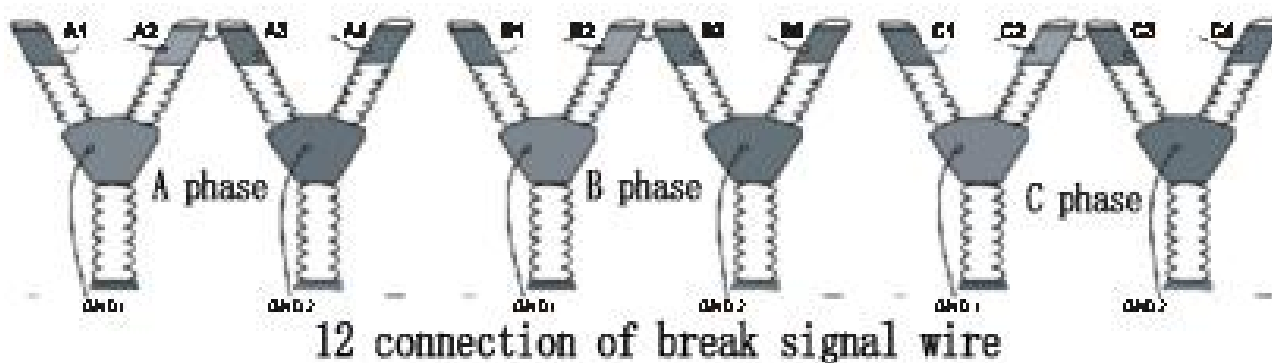
Fracture wiring diagram (three fractures)

Fracture wiring diagram (six fractures)
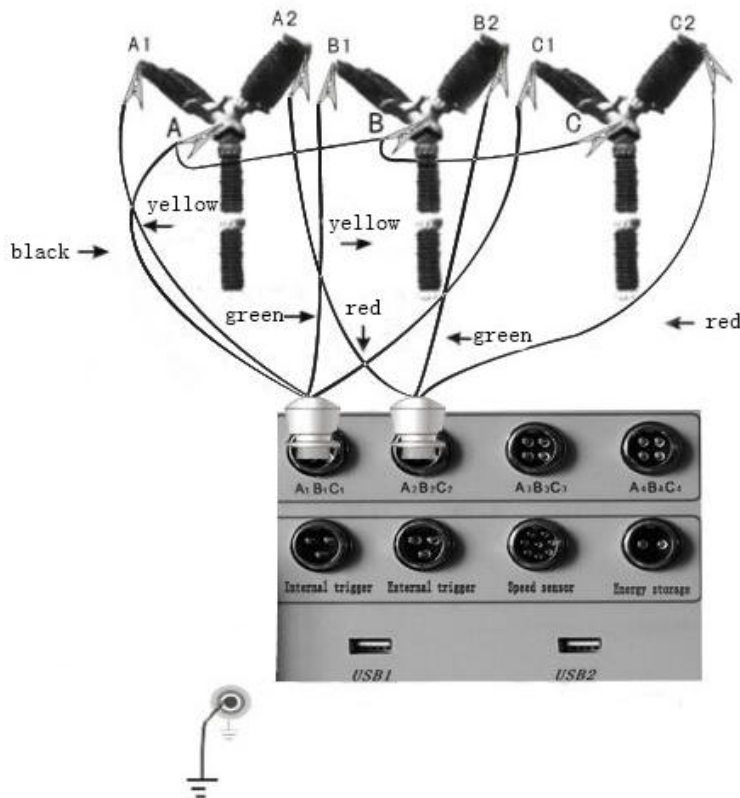
## 6.2 wiring methods for internal trigger separating/ closing brake control

In on-site test, if select interior power supply of instrument, three control wires of closing brake control wire(red), separating brake control wire(green), public wire(black), connect with "internal trigger" ports (aviation plug) of instrument panel. When instrument inputs separation+, close+, negative+, usually connect with contacts of pilot switch(effectively protect coil and instrument).

Auction: sever the included operational power (cut-off brake or pull up fuses) of high-voltage switch gear, that avoids conflicts between two powers to damage instrument.
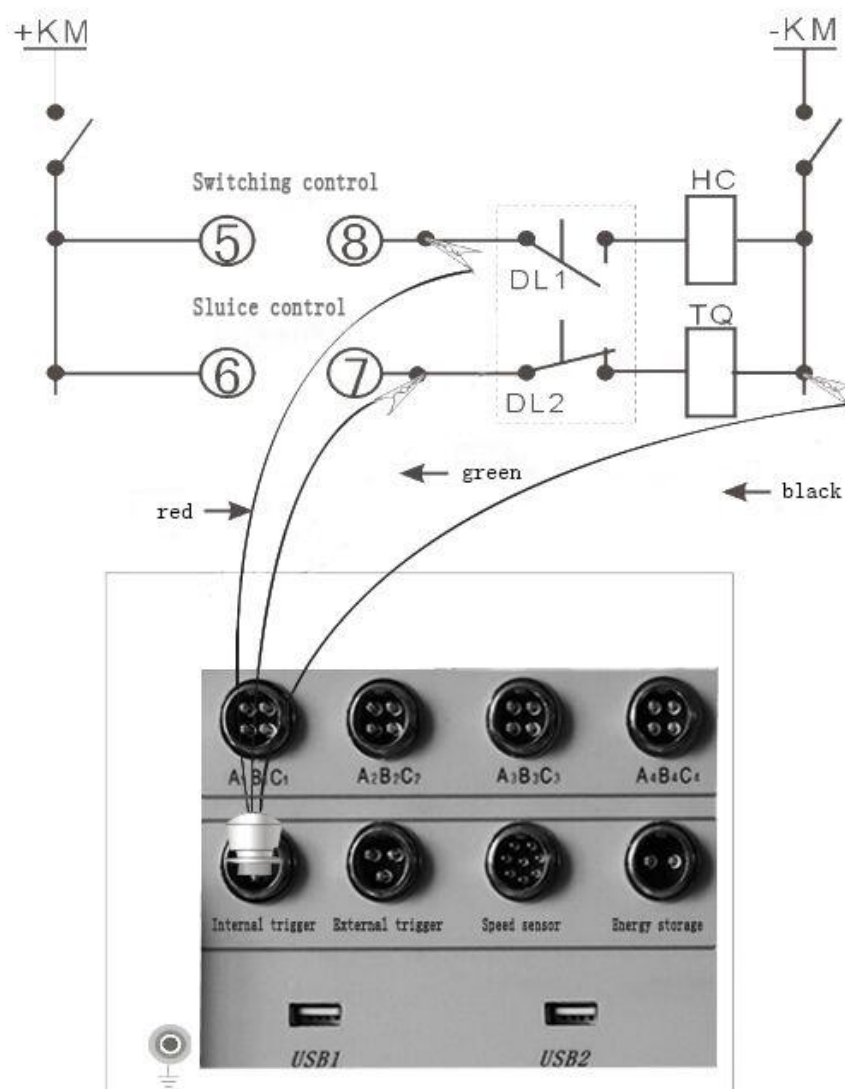

High-voltage switch control panel internal trigger control wiring sketch

VS1 vacuum switch on-off control wiring sketch as below: closing brake red wire connects (4), separating brake green wire connects (31), public contact(14) and (30) connect black wire after shorting circuit.
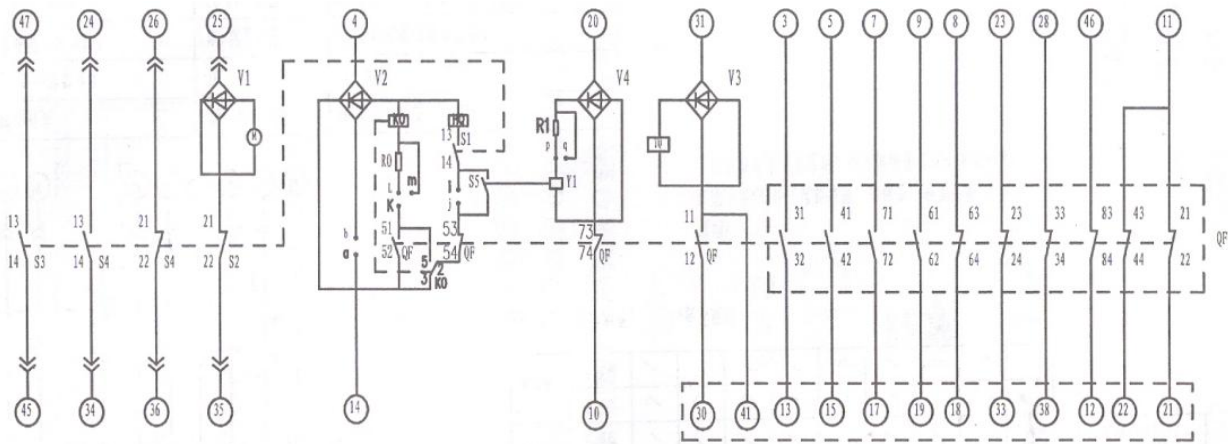
6.3external wiring (used in AC switch or permanent magnetic switch)

Connect control wire with "external trigger" port of panel before putting external power into use, then set the instrument parameters, transfer the trigger method to external trigger, whose wiring methods are same with internal trigger, meanwhile, another choice is connecting red wire with closing brake coil, green wire with separating brake coil, black wire with public port. When put into test, push the "enter" key to operate and test in the characteristic test menu firstly, then turn to operate on-off action of breaker and collect data. Before wiring , user should scrutinize and analyze the methods in wiring according to each wiring diagram of high-voltage switch control panel.
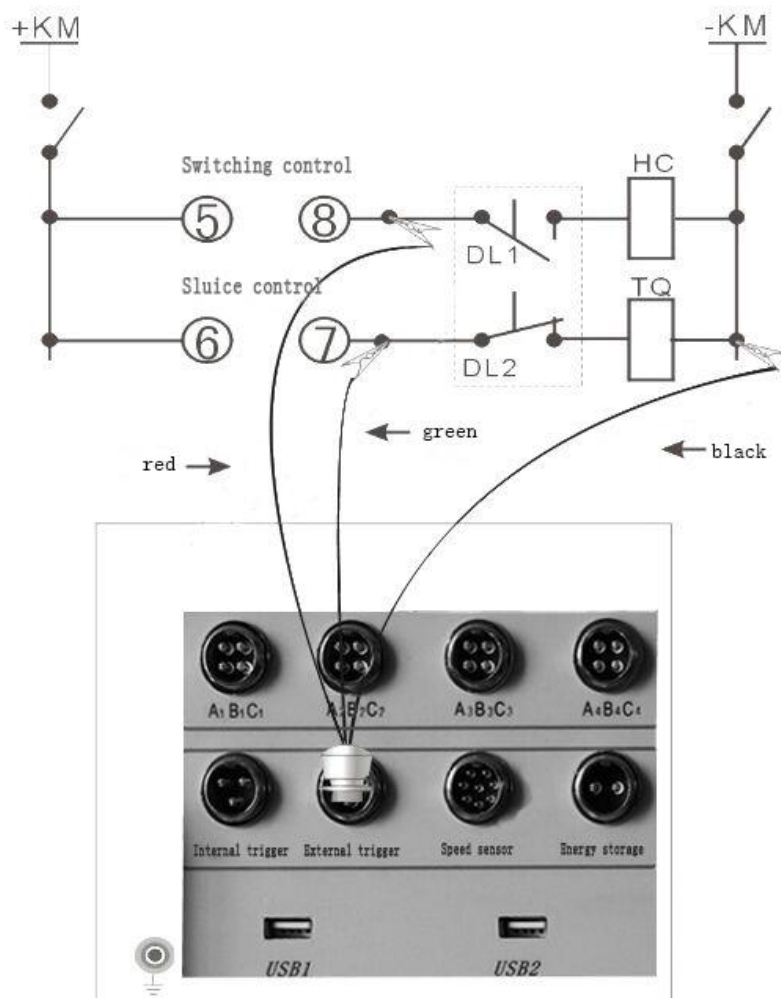
6.4 manual trigger needn't wiring control

Wait 8s before testing signal appearing, rapidly manually separate or close brake ASAP to get the signal, which action asks to be done in 8s, otherwise, no data appear on screen. Test data principally consult the evaluated values on bounce time, bounce frequency, synchronism, velocity, closing/ opening time.
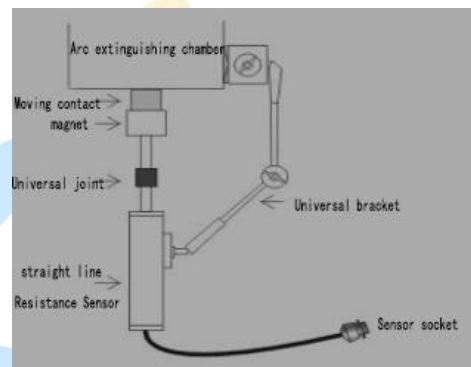
6.5 Installation methods of velocity sensor

When test switch velocity, install liner sensor on high-voltage contacts firstly. Choose the genre of switch to install, such as, oil, vacuum, SF6,etc.

6.5.1 0.1mm liner sensor(vacuum switch class)

The sensor's straight pull rod is attached on the switch's vertical conducting rod (moving contact), and sensor is fixed by gimbal, they are installed while in separating station. Keep electronic ruler vertical with moving contact, pull out around 15mm to ensure sensor couldn't be broken when closing/ separating brake has on-off actions. This installed method , mainly includes ZN28 switch or ZN63 with non-mounted chassis, is used on vacuum switches with moving bare contacts.

0.1mm electronic ruler and gimbal   installment sketch

6.5.2 360 wire rotation sensor installment

Like as sealed VS1, VD4 switches, which are assembled on two sides of connecting levels(main shaft), take away the white sealed cap, and then you can find the club shaped shaft, try to use dedicated contact to sleeve onto it. Keep horizontal level while installing, and use gimbal to fix it. Instructions as below.

If shaft is not club shaped, try to employ methods below to install

Installation of 110KV SF6 Switching Sensor

If cannot find out connecting lever, try to install at the place where is separating/ closing pointer. Take off the separating/ closing pointer firstly, then screw the sensor connector on.   Installment sketches below about outside vacuum switch and sulfur hexafluoride.
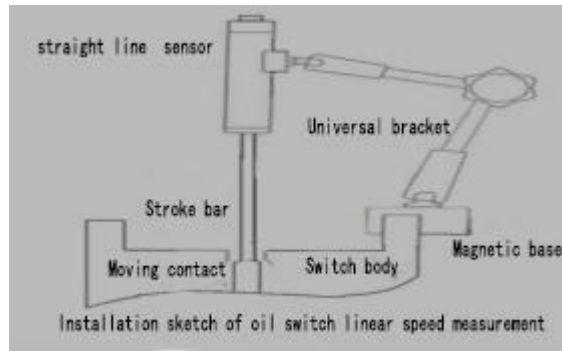

Installation of 35KV SF6 Switching Sensor

Employ adapting piece to install angle sensor onto spindle mechanism, then fixed it with gimbal. As below:


6.5.3 1mm liner sensor(oil switch)

Installation sketch of oil switch linear speed measurement

6.5.4 Installment methods of universal sensor

universal sensor, i.e. has another name of velocity sensor, should be attached on moving contact stroke rod and keep liner motion when install the measure stroke, but it's wrong to install on connecting lever to conduct rotation and operation measurement. If it is horizontal movement, fix sensor on the lever, keep the frontage of sensor toward ongoing direction.
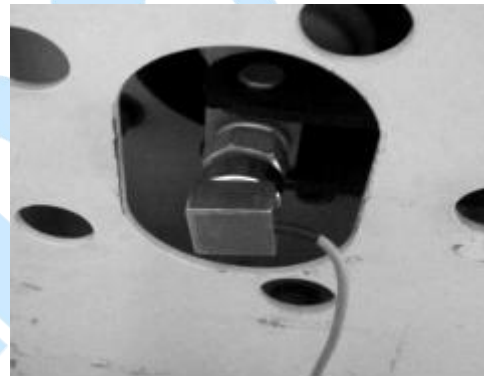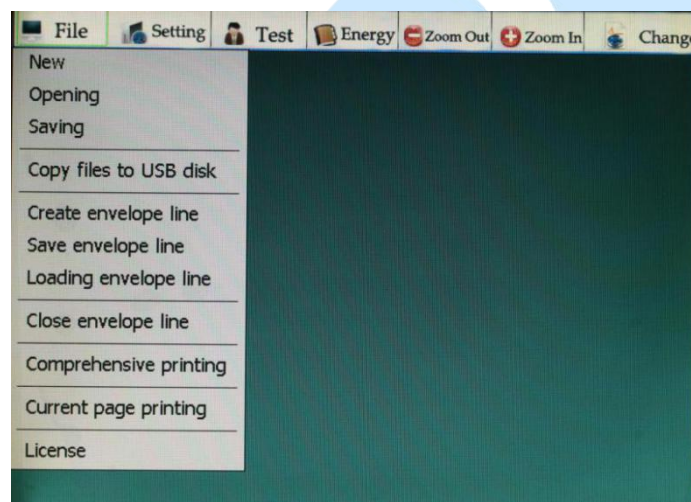

Ⅶ **Menu Instruction**

Enter main operation interface of instrument after boot
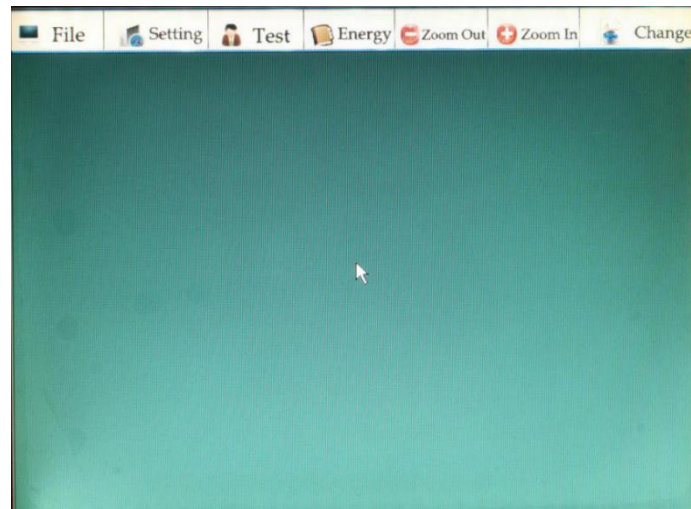
7.1 File menu

Click file menu, as below:

1) Build new : click this key to shuffle if the data are not on file in test.

2) Open: double clicks to open the stored file in folder.

3) Save: save the test data. As below:

4) create envelope line

5) Loading envelope line

Close envelope line: these three menus are designed to compare & analyze

same type of test data (same type of switch, and closing or separating data at

same time) of switch. If not, it will prompt file errors.

Click create envelope line, select relevant file.

6) Comprehensive print: click menu to print all test data out.

7) Language:Click on this menu ,select the Chinese and English operation interface,after the confimation of the instrument and then switch off automatically enter the Chinese or English language interface.
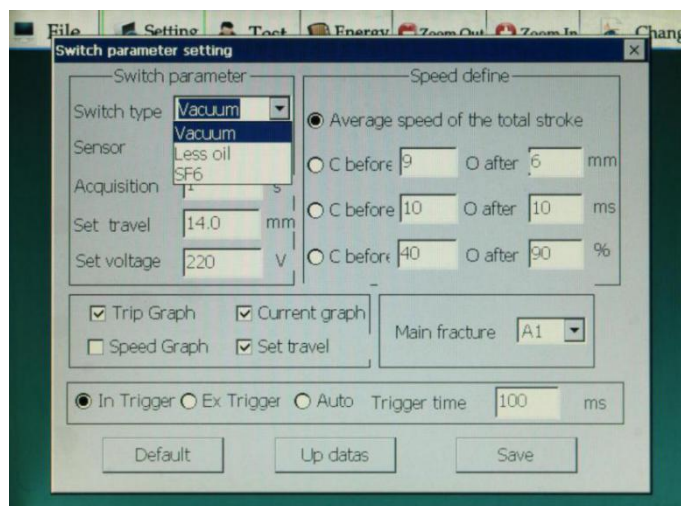
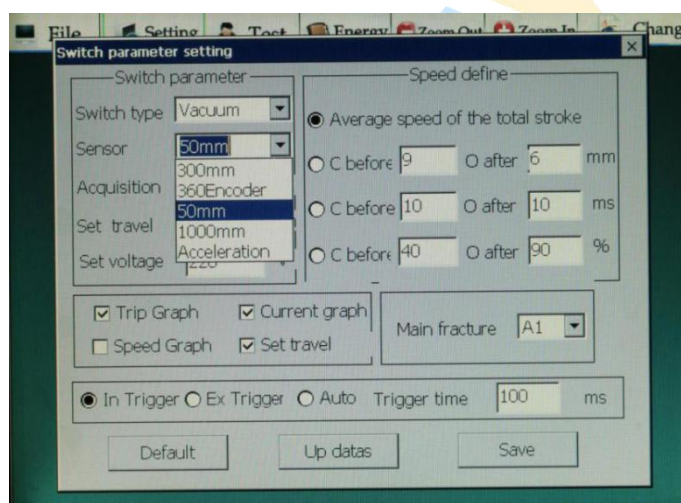**7.2 setting menu**
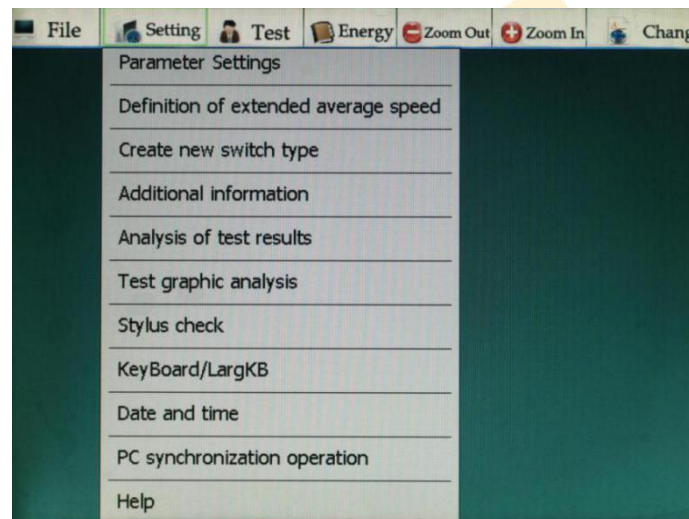
1) Click parameter setting, as below
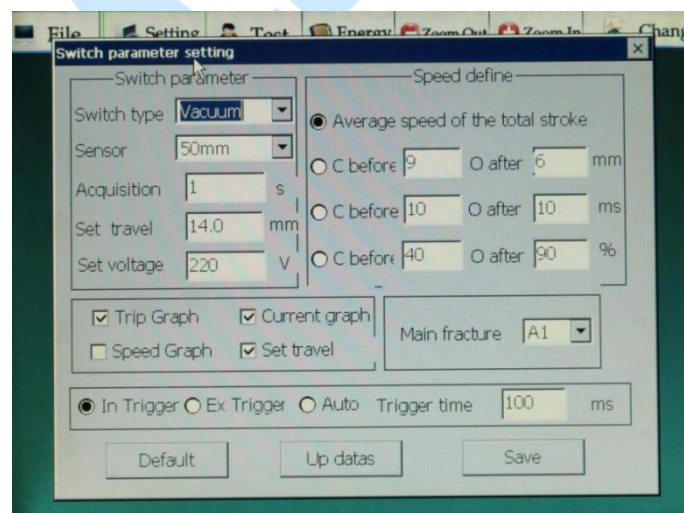
2) First step, set the type of switch, as below

3) Second step, set the sensor, as below

4) Acquisition time : length of test signal acquisition time, default as 500ms.

5) Preset stroke: total stroke (opening range + transgression)

6) Operation voltage: range from DC35 ~ 265V (adjustable)

7) Average velocity of total stroke: if have no clues on velocity definition, choose this item as usual, SF6 breaker choose the last item: the ratios of connecting lever to stroke are 90% before closing and 90% after separating.

**7.3** Click additional information menu

1) Use keyboard to input data. Set methods as below.

2) Click "shift + space" to shift input method of Chinese & English.

3) When type Chinese pinyin input method, if there are some other homophonous characters, click " Home", and come out many homophonous characters to choose relevant words. If wrongly input, click "BS" to delete. Click space key to confirm while input one word.

4) Production ID is only input English and figures without Chinese, click "OK" to next step.

7.4 Pen check: if there is something wrong with menu misplace while clicking touch screen, follow the method to collate character position. Method as below.
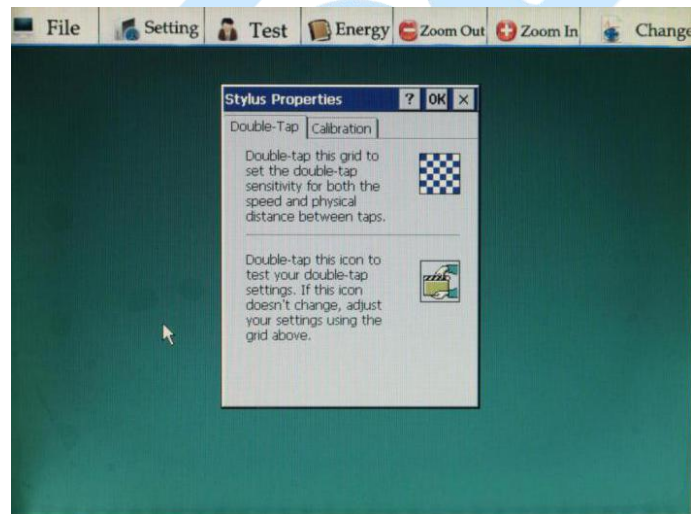

7.5 Keybd / largekb: click "option" to shift large or small keyboard, select to use the large keyboard under the requirement of Chinese input, the small one for other input. As below:
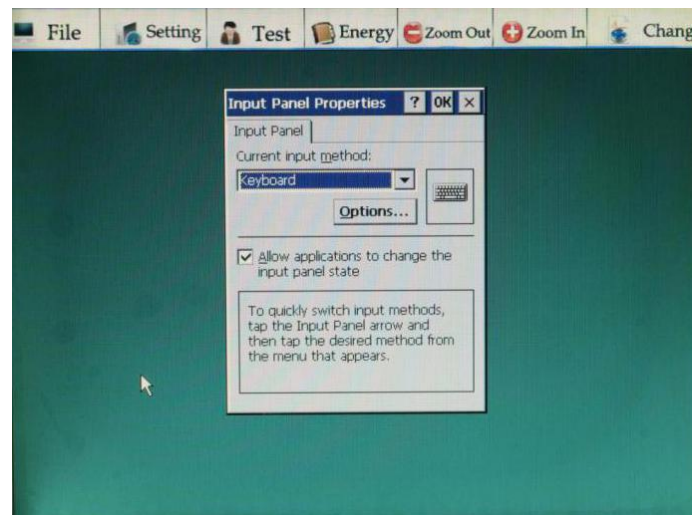
7.6 Day/time: set current data

1) Year set: click year box, then click the up arrow or down arrow to adjust to current year.

2) Month set: click month box, then click right arrow to choose current month.

3) Data set: click current data directly.

4) Time set: firstly set hour, click the hour character to change into dark black, then set the minute through up and down arrows as the same method with hour set. At last, click to save to finish whole sets.
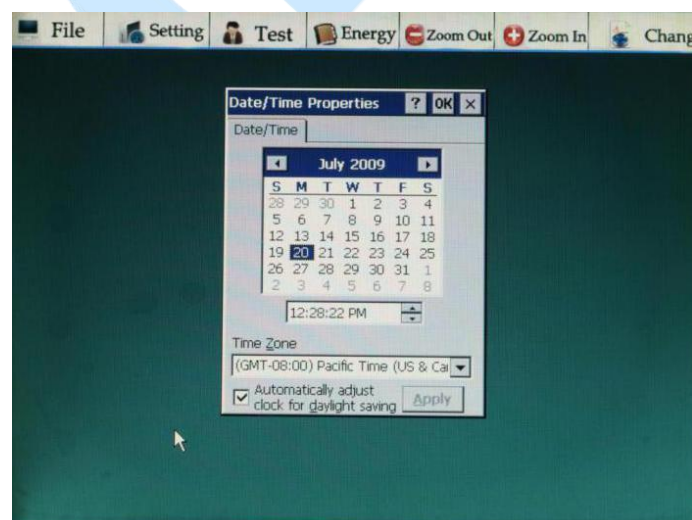

7.7 click test menu, interface as below:
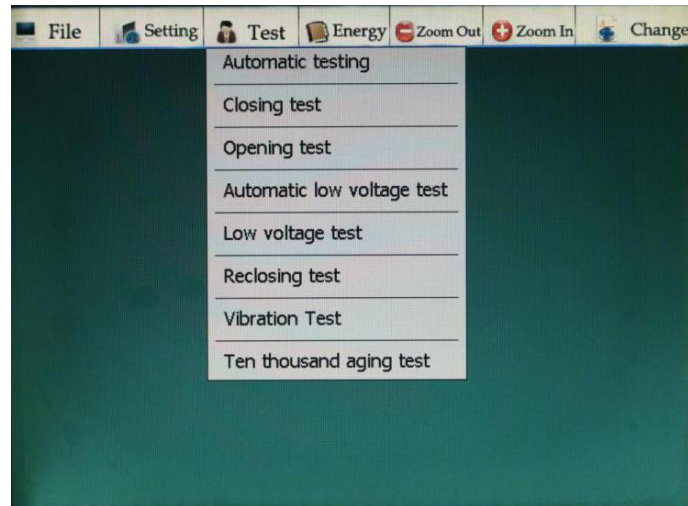
1) Click begin test: refers to measuring the parameters as the closing/
separating time of switch, bounce time , bounce frequency, three-phase
synchronism, opening range, transgression, average velocity of metal
contact. Interface as below:
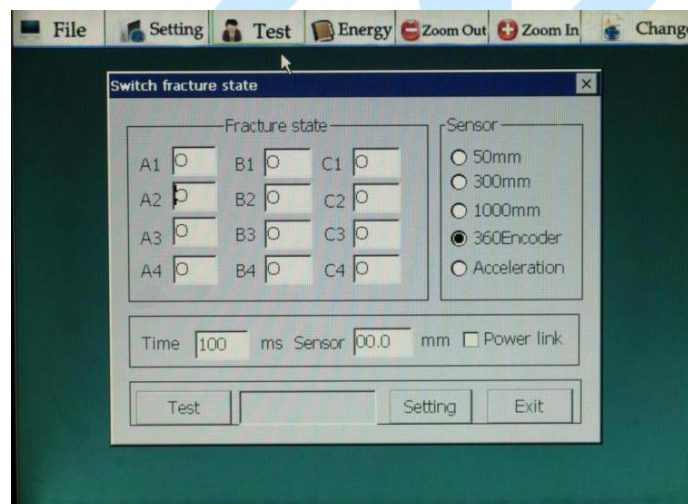
2) Existed-fracture low transition test. Operation interface as below.

Existed-fracture low transition test refers to existed fracture wires in test,

which is through   automatic identification on separating/ closing status,

controlling low voltage operation.
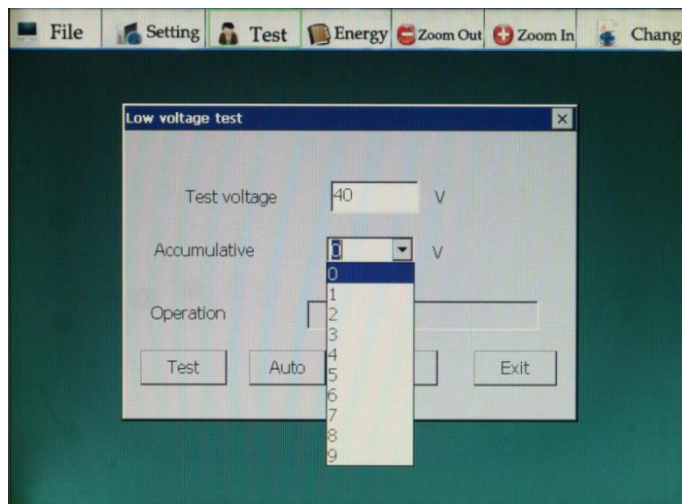
①   Manual surge: set test voltage and accumulation voltage (voltage amplitude) firstly, click "start" menu with hand, it output voltage once time by one manual click action. If no actions in closing/ separating, voltage will automatically accumulate voltage, then click "start test" menu till finishes closing/ separating.

②   Automatic surge: input relevant values of voltage and accumulation voltage, click "start test", then it will finish the action of closing and separating of minimum voltage .

③   Non-fracture low transition test: refers to operate on-off actions through internal trigger control wire transmitting voltage to coil with non-fracture testing wire.
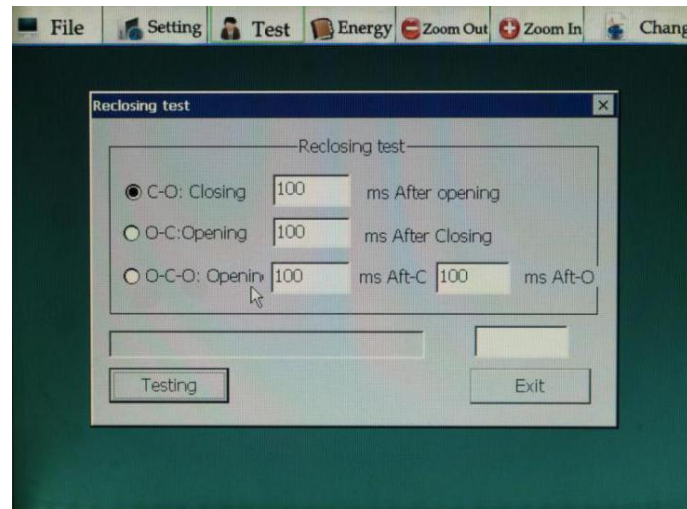
Please set start voltage and accumulation voltage firstly. If it stays in separating status , click "begin to close" menu , its voltage value will display on data display window, click "determination data" menu t lock current state of closing brake low transition until fracture begin to close. On the other hand, stays in closing status, click " begin to separate" menu till fracture begin to separate.

④   Closing opening gate: divide into three statuses of closing opening gate tests, close to separation, separation to close, separation to close to separation. Operation interface as below.
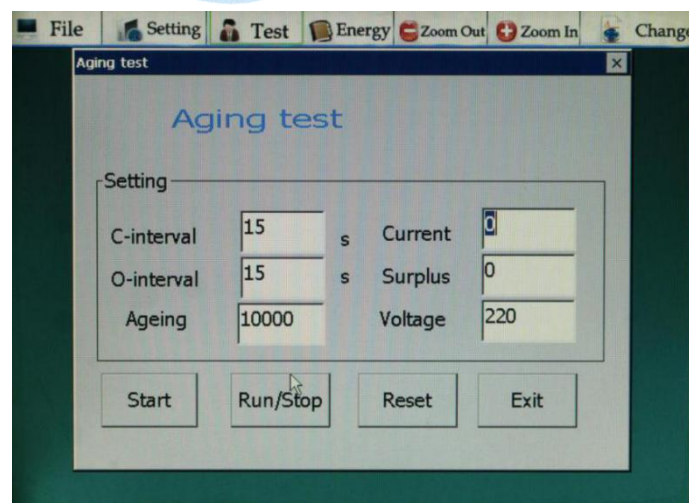
⑤ Vibration test: analyze the switch status through vibration sensor measure witch. Interface and test diagram

Stored energy: click this menu interface as below.

Conduct stored energy , stored energetic voltage and stored time adjustment to breaker, automatically turn-off power after storing energy or click "exit storing energy".

Ⅷ Test data

1) Click interface to proceed testing after setting parameters.

2) testing data , like fracture bounce waveform, times, coil current, velocity waveform, are adjustable to amplify or reduce through "-" and "+".

3) Double clicks on any point of testing graph to page turning to get the testing result report.

4) If you need print or save data, click " file",

Turn off its power directly when finish testing.

Ⅸ Daily maintenance

1. this instrument is one precise and valuable. Prevent it from falling and hit when use. Operate under shady field possibly to avoid the LED screen long exposing in outside.

2. store in a place when it is not in use, where keeps in -10~40℃, relative humidity less than 80%, ventilation, no corrosive air. In humid seasons, electrify it around 30 minutes once per month when it is long-term unused.

Ⅹ Packing List

NO.	ITEM	unit	Quantity
1	host	pcs	1
2	Port line	pcs	2
3	Port connection line	pcs	2
4	Opening and closing line	pcs	1
5	Energy storage test line	pcs	1
6	short circuit line	pcs	1
7	Ground wire	pcs	1
8	power line	pcs	1
9	10A fuse	pcs	2
10	Printing paper	pcs	2
11	50mm linear sensor	pcs	1
12	360°Rotation Sensor	pcs	1
13	Acceleration sensor	pcs	1
14	magnetic gauge seat	pcs	1
15	Tacho-generator connector	pcs	1
16	Screwdriver	pcs	1
17	mouse	pcs	1
18	Accessory box	pcs	1
19	manual	pcs	1
20	Test Report	pcs	1
21	Certificate/warranty card	pcs	1