Know your transformers more accurately.

KINGRUN INSTRUMENT CO., LTD

Tel: 0086 312 5959618 / Fax: 0086 312 5959618

info@kritester.com   www.kritester.com

Operation Manual

JYH (C) CT PT Analyzer

Preface

Dear users:

Welcome! Thanks for choosing the instrument products of JYH (C) CT PT analyzer. In order to use the instrument correctly, please read this reference manual before using it, especially the part of safety precautions.

If you have read through the entire reference manual, we suggest you keep it properly at the same place with the instrument or anywhere you can get to read easily, therefore, you can search for relative information in the future.

Safety Precautions

1. In order to protect both the instrument and the instructor, please read the reference manual details before testing, and operate strictly with the requirements of the manual.
2. Do not place the instrument on unsteady platform or desk, to prevent it from falling and being damaged.
3. The fan and ventilation holes of instrument side is for ventilating and cooling, so do not plug to ensure the instrument work normally.
4. This is a precision electronic instrument, do not place it under the burning sun to insolate or in high temperature environment in outdoor.And pay attention to keep it out of the sun and keep it in ventilated environment, to prevent overheating to cause instrument measurement precision decline.
5. As a safety measure, the instrument is equipped with protective earthling terminal. the pilot should be installed prior to the grounding terminal side of a reliable ground.
6. The power supply of the instrument is 220V (50/60Hz) AC power, and you should choose 10A or more power line.
7. Do not let any foreign body into the case, in order to avoid short circuit.
8. Please bedding some buffering content such as sponge around the instrument when transport, to avoid vibration to damage the instrument or reduce the accuracy of the instrument
9. Do not arbitrarily delete the preservation of the history test records in the host, to avoid test data loss.

Chapter I   Instrument Characteristics and Parameters

JYH(C) Series Transformer Tester is new product created after widely adopt customers' advices and deep theoretical study. It is based on the automatic FA Series Transformer Tester General which is produced by our company that is widely acclaimed and applied. The adoption of high-performance DSP and ARM, advanced manufacturing technology ensure a stable and reliable product performance, full-featured, high degree of automation, high efficiency, in the domestic leading level, they are the professional testing equipments for transformer check in power industry.

1.1 Characteristics

★ Full-featured, can not only satisfy the test requirements of various CTs (include TP class), such as the excitation characteristics (i.e., volt-ampere characteristics), ratio, polarity, secondary winding resistance, secondary burden, ratio error and phase displacement, but can also be used for the tests of various PTs, including excitation characteristics of the electromagnetic unit, ratio, polarity, secondary winding resistance, ratio error and phase displacement.

★ Automatically give CT, VT parameters, including knee point voltage / current, 10% error curve, the accuracy limit factor (ALF), instrument security factor (FS), the second time constant (Ts), remanence coefficient (Kr), saturated and unsaturated inductance etc.

★Test meet IEC60044 GB1208 (-1) GB16847 (IEC60044-6) CS57.13 .

★ Based on advanced principle of low-frequency test method that can meet the CT test on knee voltage up to 60KV.

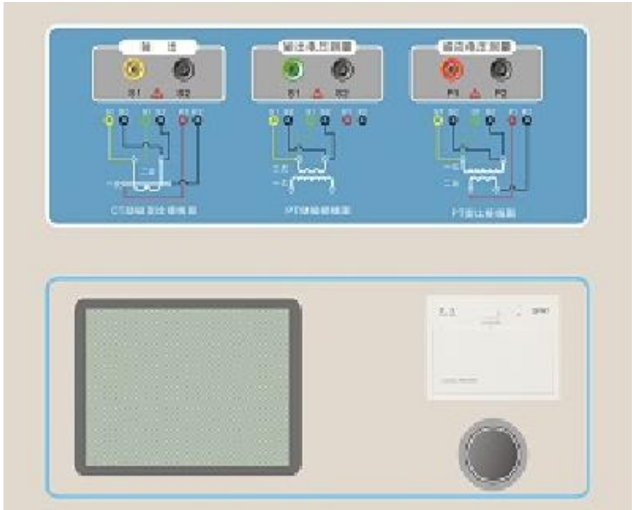
★Friendly interface beautiful, all English graphic interface

★ The instrument can store 1000 groups of test data that won't be lost when power off. After test ended, the data can be coped to PC by USB disk for analysis and being transformed into WORD report.

★ Test is simple and convenient, one-click can complete tests of CT secondary resistance, excitation, ratio and polarity.

★ Easy to carry, because the weight is less than 10Kg.

1.2 Panel



The instrument panel structure is as shown in right figure.

• Yellow S1, black S2 terminal: test power output

• Green S1, black S2 terminal: measure output voltage

• Red P1, black P2 terminal: measure inductive voltage

• Keyboard: Enter the value and operational command

• LCD screen: GUI

1.3 Technical Parameter

		JYH(C)
Usage		CT， PT
Output		0~180Vrms，12Arms，36A（peak value）
Voltage measurement accuracy		±0.1%
CT Ratio	Range	1~40000
	accuracy	±0.05%
PT Ratio	Range	1~40000
	accuracy	±0.05%
Phase	Range	±2min
	accuracy	0.5min
DC resistance	Range	0~300Ω
	accuracy	0.2%±2mΩ
Burden	Range	0~1000VA
	accuracy	0.2%±0.02VA
Power supply		AC220V±10%，50Hz
Environmental Conditions		Operating temperature : -10ºC~50ºC ，Humidity :≤90%
Weight and Dimensions		Dimensions: 365 mm×290 mm×153mm,Weight<10kg

Chapter II User Interface and Method of Operation

2.1 Current transformer

In Para interface,use the Rotating mouse to switch cursor in transformer type frame,then choose the current transformer (CT).

2.1.1 Test connection

Used for selecting one or more experiment item, including four options such as resistance, excitation, ratio, burden etc. According to transformer type, four options can be combinated as shown in below table.

Table 2.1 CT experiment project description

experiment item						Description	Connection diagram
resistance	excitation	ratio	error	limit	burden		
√						Measure CT's secondary winding resistance	Fig 2.1,can disconnection if measuring primary winding.
√	√					Measure CT's secondary winding resistance and excitation characteristic	Fig 2.1,can disconnection if measuring primary winding.
√		√	√			Measure CT's secondary winding resistance, check it's ratio and polarity	Fig 2.1
√	√	√	√	√		Measure CT's secondary winding resistance and excitation characteristic, check it's ratio and polarity	Fig 2.1
					√	Measure CT's secondary burden	Fig 2.2

Note：the '√' means valid ,and the blank means invalid

Step:

Step 1. According to the CT testing project description of the table 2.1 to wire(For all the CT structures,please refer to the description of appendix D for the actual connection mode)

Step 2. The other windings of the same CT should be opened,CT’s primary side to grounding, equipment should be also to ground

Step 3. Power on and prepare parameters Settings.

Step 4. Then switch cursor to the “start” button to start

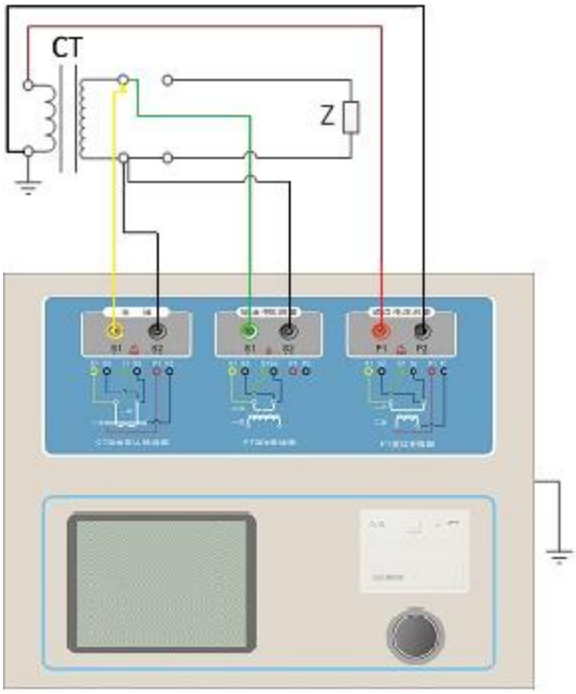


Fig 2.1 DC resistance, excitation,ratio experiment connection

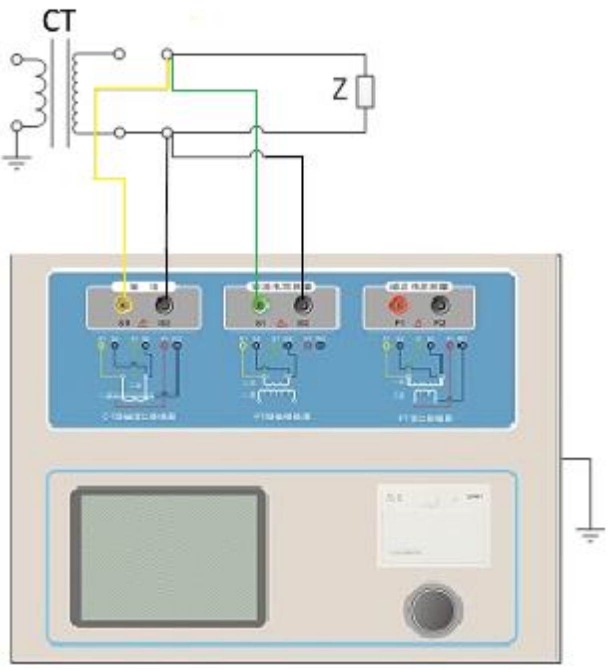


Fig 2.2 Secondary load experiment connection

2.1.2 Expansion parameters

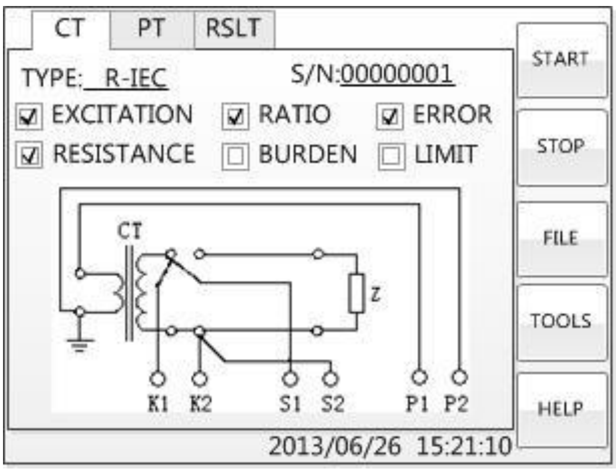


Fig 2.3 Basic parameter Settings interface

parameter Settings:

Switch cursor to where the parameter you want to set by turning the Rotating mouse

1. S/N: Serial number and resistance number:

2. YTPE: For CT, there're 10 options for Measured winding class ,they are R-IEC(IEC-60044-1),R-ANSI(C57.13), TPY(IEC-60044-6), M-IEC(IEC-60044-1),M-ANSI(C57.13), PR(IEC-60044-1), PX(IEC-60044-1), TPS(IEC-60044-6), TPX(IEC-60044-6) and TPZ(IEC-60044-6) etc.
3. I-sn: Rated secondary current, The current transformer's secondary rated current is 1A or 5A generally.
4.Temp-Amb: When measure the temperature of winding, generally input the current room temperature for reference.
5. Freq: Rated frequency.
6. Imax: Maximum measured current, Can be generally set to rated secondary current value. For TPY class, can be generally set to 2 times rated secondary current value. For P class, assumed 5P40, rated secondary current is 5A, so the maximum should be set to 10%*15*5A=7.5A

If user want to measure the bellowing items, user need to set the basic parameters accurately (Suggest user setting himself)
1.Turn ratio error, ratio error and phase error
2. Accurately calculate the limit e.m. f and their corresponding compound error
3. Measured accurately limit coefficient, Instrument security coefficient and symmetrical short-circuit current multiples
4. The measured transient dimensioning coefficient, peak transient error and second time constant

For different CT, different parameters should be set.Details as table 2.2

Table 2.2 CT parameter description

parameters	description	R-IEC R-ANSI	TPY	M-IEC M-ANSI	PR	PX	TPS	TPX	TPZ
rated primary current	Used to calculate the ratio of actual current accurately	√	√	√	√	√	√	√	√
rated burden	Rated load of plate, power factor for 0.8 or 1	√	√	√	√	√	√	√	√
power factor		√	√	√	√	√	√	√	√
Rated accurate limit coefficient K_{alf}	The provisions of the plate,default 10,used to calculate the limit e.m.f. and their corresponding composite error	√							
Rated symmetric short-circuit current coefficient K_{ssc}	The provisions of the plate,default 10,used to calculate the peak and their corresponding limits e.m.f transient error		√				√	√	√
Primary time constant	default :100ms		√					√	√

Second time constant	default :3000ms		√						√
Duty cycle	C-t1-O or C-t1-O-tfr-C-t2-O，default:C-t1-O cycle		√					√	
t1	Current time limit for the first time,default:100ms		√					√	
tal1	Time required to reach the specified accuracy during the first magnetization cycle,default:40ms								
tfr	Time required to reach the specified accuracy during the second magnetization cycle,default:500ms,Choose C-t1-O-tfr-C-t2-O,Cycle will be shown		√					√	
t2	Current time limit for the second time,default:100ms.Choose C-t1-O-tfr-C-t2-O,Cycle will be shown		√		√			√	
tal2	Second the flow by maintaining accurate limits of time,default:40ms choose C-t1-O-tfr-C-t2-O,cycle will be shown		√					√	
Rated instrument security coefficient FS	Nameplate regulation,default:10 Used for calculation of the limit of composite error and their corresponding electromotive force			√					
Rated calculating coefficients						√			
Rated inflection point potential(Ek)						√			

Ie corresponding with Ek						√			
dimensioning factor							√		
Rated Ual	The rated equivalent quadratic limit voltage						√		
Ial corresponding with Ual							√		

Note: "√" expressed the need for settings that do not need to set up a blank.

2.1.3 Test results

The test result interface as shown in fig 2.4

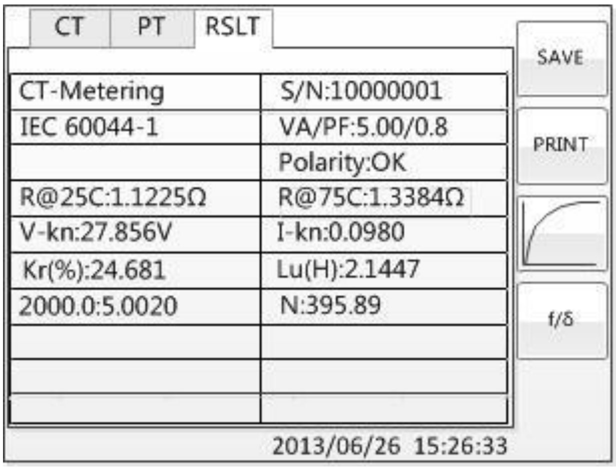


Fig 2.4 The test result interface

For different classes of CT and measured items,the test result will be different too,details as table 2.3:

Table 2.3 CT test results description

result		description	R-IEC R-ANSI	TPY	M-IEC M-ANSI	PR	PX	TPS	TPX	TPZ
Load	Actual load	unit：VA，CT secondary measure actual load	√	√	√	√	√	√	√	√
	Power factor	Power factor of actual load	√	√	√	√	√	√	√	√
	impedance	unit：Ω，CT secondary measure secondary impedance	√	√	√	√	√	√	√	√
Resistance	resistance （25℃）	unit：Ω，CT secondary measure secondary resistance	√	√	√	√	√	√	√	√

	resistance （75℃）	R_{ref} ，unit：Ω，Convert to resistance under 75℃	√	√	√	√	√	√	√	√
excitation	knee voltage and knee current	unit:V and A，According to standard definition，when knee voltage increase 10%,knee current increase 50%.	√	√	√	√	√	√	√	√
	Unsaturated inductance L_u	unit:H,The average inductance of linear section for excitation curve	√	√	√	√	√	√	√	√
	remanence coefficient K_r	ratio of magnetism and magnetic	√	√	√	√	√	√	√	√
	Second time constant T_s	unit：s,the time constant of CT's second connect rated burden	√	√	√	√	√	√	√	√
	limiting e.m.f E_{al}	unit:V,calculation limit e.m.f. according to the CT nameplate and resistance under 75℃	√	√	√	√			√	√
	composite error E_{al}	limiting e.m.f or the composite error of rated knee potential	√		√	√	√			
	Peak transient error ε	Peak transient error of limiting e.m.f		√					√	√
	ALF	actual ALF	√			√				
	Instrument security coefficient	actual instrument security coefficient			√					

	Symmetrical short-circuit current multiples Kssc	actual symmetrical short-circuit current multiples		√				√	√	√
	transient dimensioning factor	actual transient dimensioning factor		√					√	√
	calcuated coefficient Kx	actual calcuated coefficient					√			
	Rated knee potential Ek						√			
	Ie corresponding with Ek	The actual excitation current corresponding with rated knee potential					√			
	Rated voltage Ual	The rated equivalent second limit voltage						√		
	Ial corresponding with Ual	The actual excitation current corresponding with the rated equivalent second limit voltage						√		
Ratio	Ratio	Actual current ratio under rated burden	√	√	√	√	√	√	√	√
	Turns ratio	The ratio of actual secondary winding and primary winding	√	√	√	√	√	√	√	√
	Ratio difference	The current errors under rated load	√	√	√	√	√	√	√	√
	Phase difference	The D-value of phase under rated load	√	√	√	√	√	√	√	√
	Polarity	There're two polarity relationship for primary CT and secondary CT: Positive and Negative	√	√	√	√	√	√	√	√
	Turn ratio error	The relative error between measured trun ratio and rated turn ratio					√	√		

Note: "√" expressed the need for settings that do not need to set up a blank

2.2 Votage transformer

2.2.1 Test connection

Used for selecting one or more experiment item, including three options such as resistance, excitation, ratio etc. According to transformer type,three options can be combinated as shown in table 2.4.

Table 2.4. PT experiment project description

experiment item				Description	Connection diagram
resistance	excitation	ratio	burden		
√				Measure PT's secondary winding resistance	Fig 2.5,must disconnection if measuring primary winding.
√	√			Measure PT's secondary winding resistance and excitation characteristic	Fig 2.5,must disconnection if measuring primary winding.
		√		Check it's ratio and polarity	Fig 2.6
			√	Measure PT's secondary burden	

In Para interface,use the Rotating mouse to switch cursor in transformer type frame,then choose PT.

Experimental wiring procedure is as follows:
Step 1. According to PT testing program description of list 2.4,refer to figure 2.5 or figure 2.6for wiring
Step 2. The other windings of the same CT should be opened
Step 3. Power on and prepare parameters Settings.
Step 4.Then switch cursor to the "start" button to start

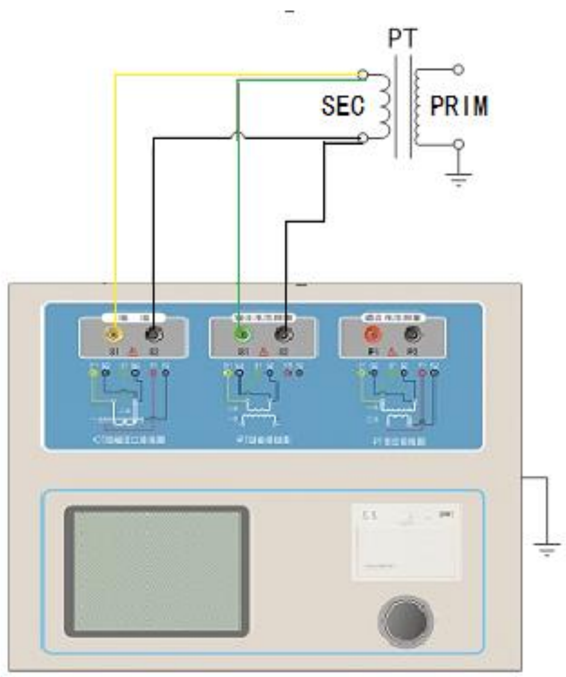


Fig 2.5 PT's DC resistance and excitation

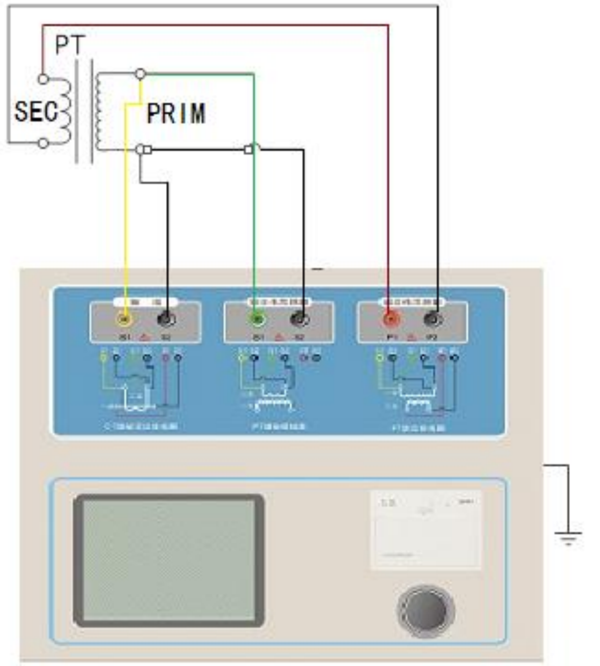


Fig 2.6 PT's ratio and excitation

2.2.2 Expansion parameters

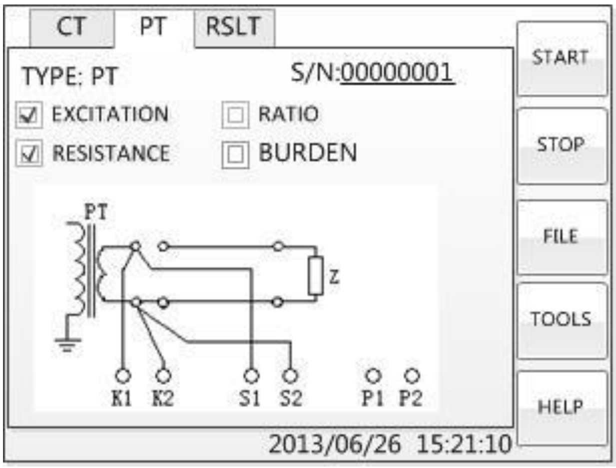


Fig 2.7 PT parameter establish interface

parameter Settings:

Switch cursor to where the parameter you want to set by turning the Rotating mouse

1. S/N: Serial number and resistance number, Input letters and numbers directly.
2. V-pn: Rated primary voltage.
3. V-sn: Rated secondary voltage .
4. Temp-Amb: Current temperature, When measure the temperature of winding,generally input the current room temperature for reference.
5. Freq: Rated frequency.
6. V-max: Maximum test voltage, The equivalent voltage under the maximum frequency of output while testing
7. I-max: Maximum test current, The maximum AC current of output while testing.

2.2.3 Test results

Test results interface as shown in Fig 2.8

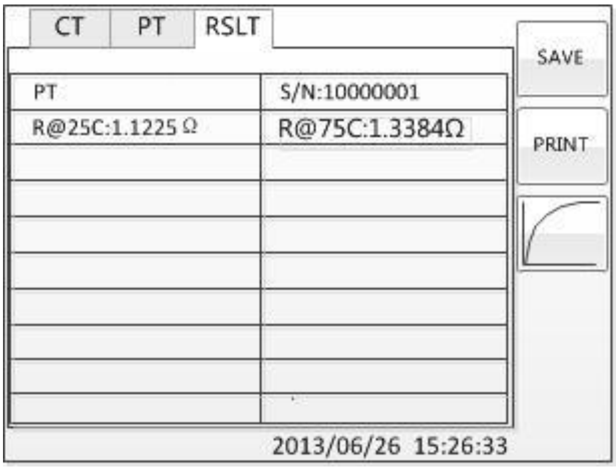


Fig 2.8　PT’s test results interface

According to different voltage transformer type and experiment item, the results will be also different. The detailed as shown in Table 2.5.

Table 2.5　PT test results description

result		description
Resistance	resistance（25℃）R	unit：Ω，resistance value under current temperature
	resistance（75℃）R_{ref}	unit：Ω,Resistance value under reference temperature(the temperature is variable)
excitation	knee voltage and knee current	unit:V and A，According to standard definition，when knee voltage increase 10%,knee current increase 50%.
Ratio	Ratio	Actual current ratio under rated burden
	Turns ratio	The ratio of actual secondary winding and primary winding
	Ratio difference	The current errors under rated load
	Phase difference	The D-value of phase under rated load
	Polarity	There're two polarity relationship for primary and secondary , Positive and Negative

2.3 Self-test page

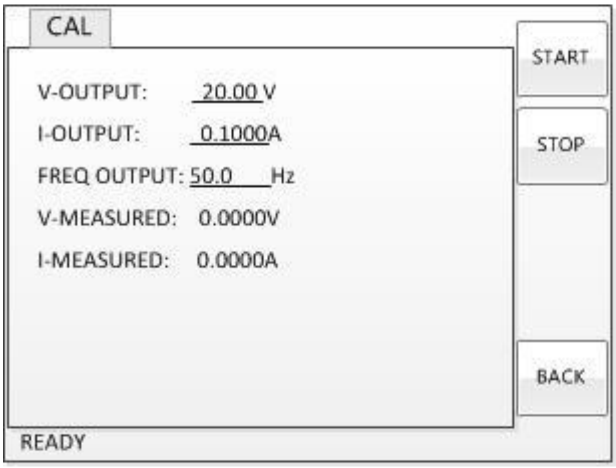


Fig 2.9 Self-test interface

2.4.1 Parameter Setting

The required self-test parameters are shown in the table 2.7:

Table 2.7 Self-test parameters

Parameter	description
V-OUTPUT	The need for device output current, valid value range: 1mA ~ 5A
I-OUTPUT	The need for device output voltage, valid value range: 1V~100V
FREQ OUTPUT	Installation of the output voltage or current frequency, scope: 0 ~ 60Hz

After testing Current test set or test voltage, set the test frequency, the frequency of the device will output the corresponding voltage or current, to detect and display the actual voltage or current. In the choice of voltage, if the burden is too small, resulting in greater than the actual current RMS 5A, show that information overburden. In the selection of current, if the burden too much, leading to the actual test voltage RMS is greater than 100V, it will display information overburden.

2.4.2Connection

When Choosing voltage tests, the two terminals will be short-S1 Then, S2 shorted the two terminals.Use multimeter to get the voltage value between S1 and S2,if the value is the same with actual voltage of instrument,it is OK.

When Choosing Current test, the shorted output S1, S2 terminals. Do not take the wrong attention. Series connecting a multimerter between S1 and S2, if the current value of multimerter is the same with actual current of instrument,it is OK

2.5 Button Function

2.5.1 Button function for parameter interface

(1). Open a report

The interface of opening a report is shown in Fig 2.10 Choose to open a report, the relative information will be displayed in corresponding column.

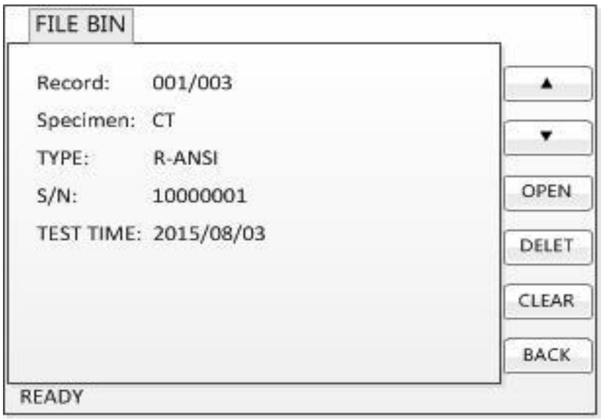
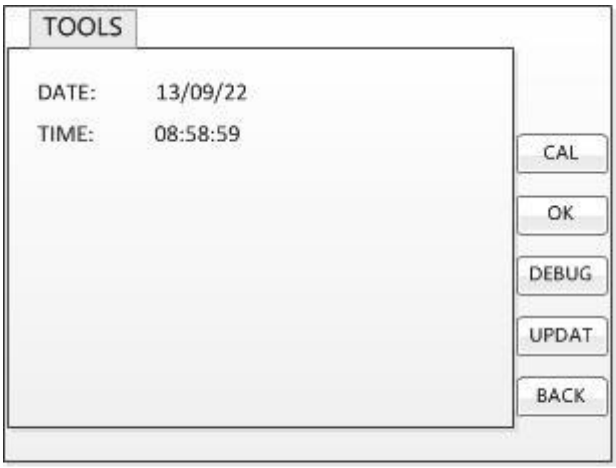


Fig 2.10 Open a report

(2). System Tools

The interface of system tools is shown in Fig 2.11. In this interface, some operations can be performed, such as time adjustment, file delete, system up gradation, etc.

(3). Help



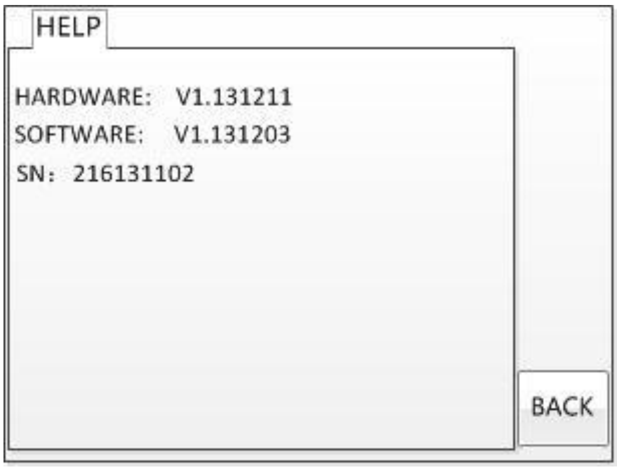


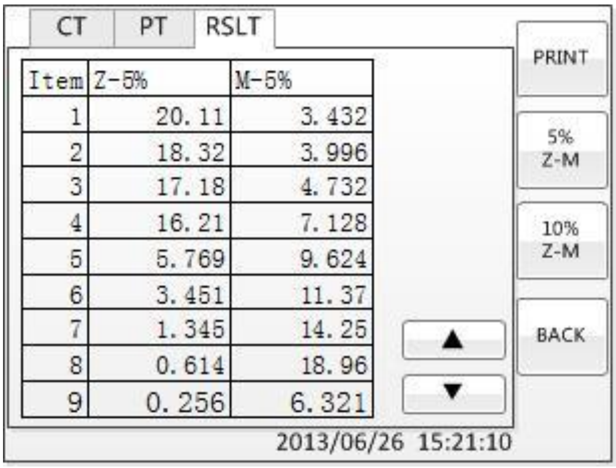
Fig 2.11 system tool interface

Fig 2.12 Help interface

2.5.2 Button function for result page

(1)、Error data

Selecting the error data will show 5% and 10% error cases, the relationship of rated primary current multiple and the maximum burden is shown as Fig 2.13. These data is calculated according to the actual excitation. The calculation Method is given in appendix B.



Item	Z-5%	M-5%
1	20.11	3.432
2	18.32	3.996
3	17.18	4.732
4	16.21	7.128
5	5.769	9.624
6	3.451	11.37
7	1.345	14.25
8	0.614	18.96
9	0.256	6.321

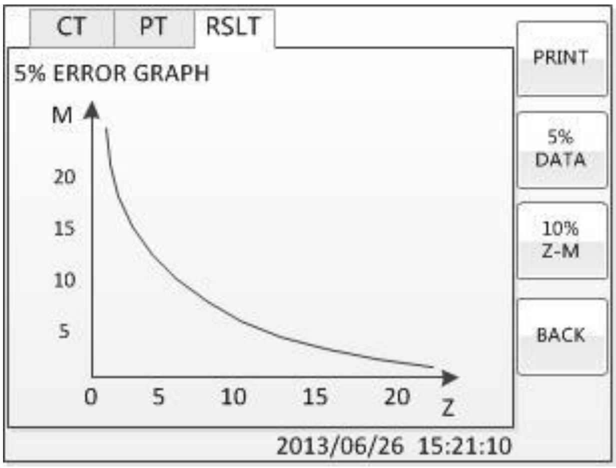


Fig 2.13 5% error data interface

Fig 2.14 5% error curve interface

(2)、error curve

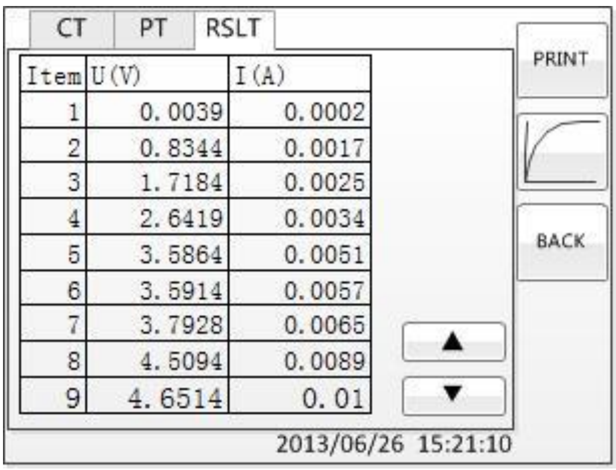
Selecting the error curve, the relationship curve of rated primary current multiple and maximum burden will be shown as fig 2.14 according to 10% (or 5%) error. The x axis is rated primary current multiple; axis y is allowable maximum burden.

(3)、Excitation data

Selecting the excitation data, excitation data interface will be shown fig 2.15. In the figure, knee voltage and current is automatically calculated and shown, the user can print the date.

(4)、Excitation curve

Selecting Excitation curve, the excitation curve of the interface will be shown in Fig 2.16, knee voltage and current is given.



Item	U(V)	I(A)
1	0.0039	0.0002
2	0.8344	0.0017
3	1.7184	0.0025
4	2.6419	0.0034
5	3.5864	0.0051
6	3.5914	0.0057
7	3.7928	0.0065
8	4.5094	0.0089
9	4.6514	0.01

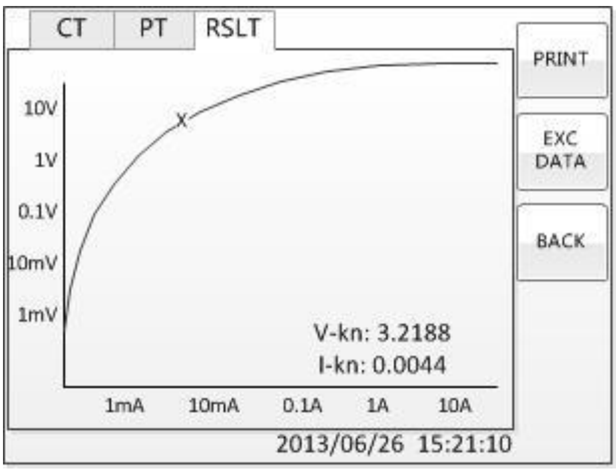
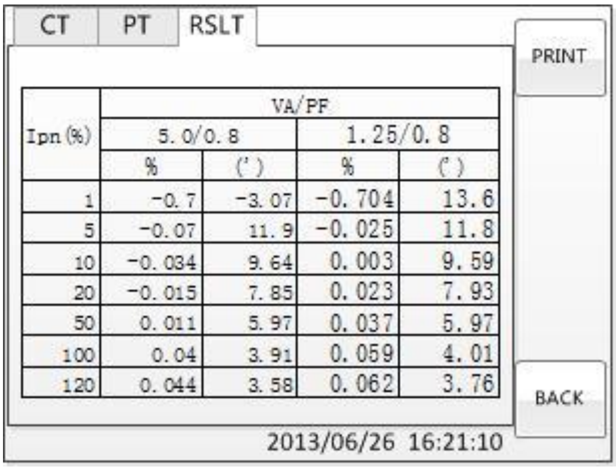


Fig 2.15 excitation data

Fig 2.16 Excitation curve interface

(5)、Ratio page

Used for displaying the test results of ratio. Polarity, ratio error, and phase displacement as shown in fig 2.17.



Ipn (%)	VA/PF			
	5.0/0.8		1.25/0.8	
	%	(')	%	(')
1	-0.7	-3.07	-0.704	13.6
5	-0.07	11.9	-0.025	11.8
10	-0.034	9.64	0.003	9.59
20	-0.015	7.85	0.023	7.93
50	0.011	5.97	0.037	5.97
100	0.04	3.91	0.059	4.01
120	0.044	3.58	0.062	3.76

Fig 2.17 ratio page

Appendix

A. Principle of low-frequency test

IEC60044-6 standard (corresponding to the national standard GB16847-1977) claims, CT test can be done in conditions lower in frequency than the rated, and avoid secondary windings the risk of failing to allow the terminal voltage. The only requirement is that the core has the same size on the magnetic flux.

IEC60044-6 standard formula for calculating the magnetic flux given by:

$$\Psi(t)=\int_0^t [U_{CT}(t)-R_{CT}I_{CT}(t)]dt+\Psi_0 \qquad \text{(A.1)}$$

Where,

R_{CT} : Secondary winding resistance

U_{CT} : Secondary winding terminal voltage

I_{CT} ： Secondary current

Ψ_0 ： The initial flux Alternation

$\Psi(t)$ ： T the magnetic moment of the cross-linking

The definition of Core Voltage:

$$U_C(t)=U_{CT}(t)-R_{CT}I_{CT}(t) \qquad \text{(A.2)}$$

When the core voltage $U_C(t)$ for the sinusoidal signal are: （A.3）

Core voltage RMS to meet:

$$U_{Crms} = \frac{\omega \Psi_m}{\sqrt{2}} = \frac{2\pi f \Psi_m}{\sqrt{2}} = 4.44 f \Psi_m \qquad \text{(A.4)}$$

where：

f ： For the sinusoidal signal frequency

As can be seen, the largest settlement in the same chain of magnetic flux Ψ_m, the core is proportional to voltage and frequency. Therefore, as long as the core has the same size on the magnetic flux, then the test CT can be lower than the rated frequency of the conduct, when the core voltage amplitude required to reduce the requirements, test requirements of the secondary winding of the client voltage also be reduced accordingly. On the frequency of low-frequency test results can be rated after the conversion frequency of CT test results.

B. 10% error curve

Current transformer error was mainly due to the existence of exciting current $\boldsymbol{I}_0$, which allows the secondary current $\boldsymbol{I}_2$ and secondary lateral conversion to a current value $\boldsymbol{I}_1^{'}$ is not only not the same, but different phase, which resulted in the error of current transformer .

The ratio of differential current transformer is defined as:

$$\varepsilon = \frac{I_1^{'} - I_2}{I_1^{'}} \times 100 = \frac{I_0}{I_1^{'}} \times 100 \qquad \text{(B.1)}$$

Current Transformer relay request a current $\boldsymbol{I}_1$ equal to the maximum short-circuit current, the ratio difference is less than or equal to 10%. Difference in the ratio equivalent to 10%, the secondary current $\boldsymbol{I}_2$, and conversion to a secondary lateral excitation current $\boldsymbol{I}_1^{'}$ between the current $\boldsymbol{I}_0$ and meet the following relationship:

$$I_1^{'} = 10 I_0 \qquad \text{(B.2)}$$

$$I_2 = 9 I_0 \qquad \text{(B.3)}$$

Definite M as a multiple of the maximum short-circuit current, K for the current transformer ratio, there are

$$M = \frac{I_{1M}}{I_{1N}} = \frac{K \times I_1^{'}}{K \times I_{2N}} = \frac{10 I_0}{I_{2N}} \qquad \text{(B.4)}$$

Where

I_{1M} The largest one-side short-circuit current

I_{1N} Rated current for one side

I_{2N} Rated current for the secondary side

When Ration error is 10 percent, the maximum allowable burden impedance Z_B is calculated as:

$$Z_B = \frac{E_0}{I_2} - Z_2 = \frac{E_0}{9I_0} - Z_2 \qquad \text{(B.5)}$$

Where

Z_2 For the current transformer secondary winding impedance

E_0 Is Current transformer secondary winding for the induction electromotive force, and the relationship between E_0 and I_0 is the characteristic curves described by the excitation.

Based on the above formula, the final could be a multiple M of the maximum short-circuit current and burden impedance Z_B of the maximum allowable 10% error described curve (see Figure 2.12).

C. Actual Connection Method

JYH(C) for the CT test the basic connection steps (see Figure D.1) as follows:

(1) 4mm2 line the left side of JYH(C) is connected to the grounding terminal protected.

(2) To connect a CT primary side and secondary side terminals of a terminal to protected areas.

(3) To ensure that all the CT terminal of the other transmission lines disconnect from, all other windings open.

(4) 2.5mm2 red and black line CT secondary side connected to the JYH©"Output" S1 and S2 jack, the yellow line and 1.2mm2 line CT secondary side connected to the JYH(C) "Sec" jack of the S1 and S2, the attention of even the two black lines in the CT secondary side has received the same protection to terminal.

(5) Green Line and 1.2mm2 lines CT is connected to a side of JYH(C) 's "Prim" of P1 and P2 terminal, P2 and CT through the black line is connected to the protection of one side of the terminal connected.

(6) No problems in check wiring, to begin testing.

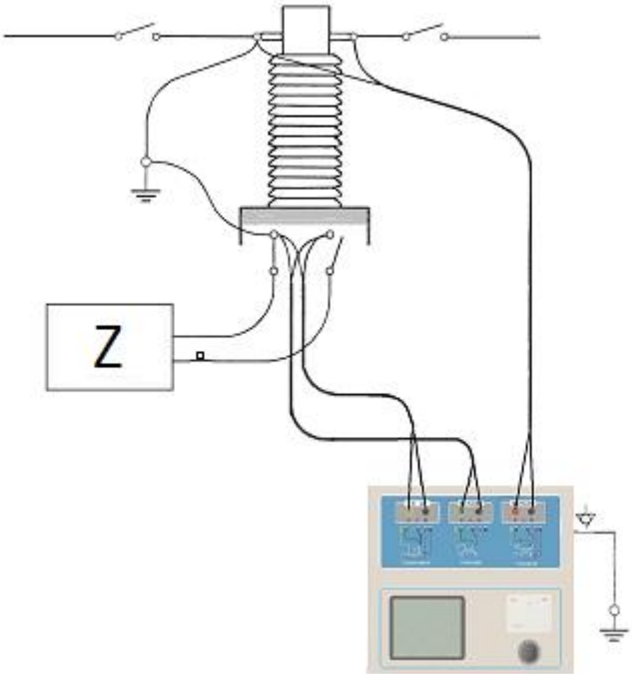


Figure D.1 Typical Connection

1. JYH(C) in the triangle connection transformer CT test conducted on the connection mode as shown in Figure D.2.

Figure D.2 JYH(C) in the triangle on the transformer connection when the connection mode test

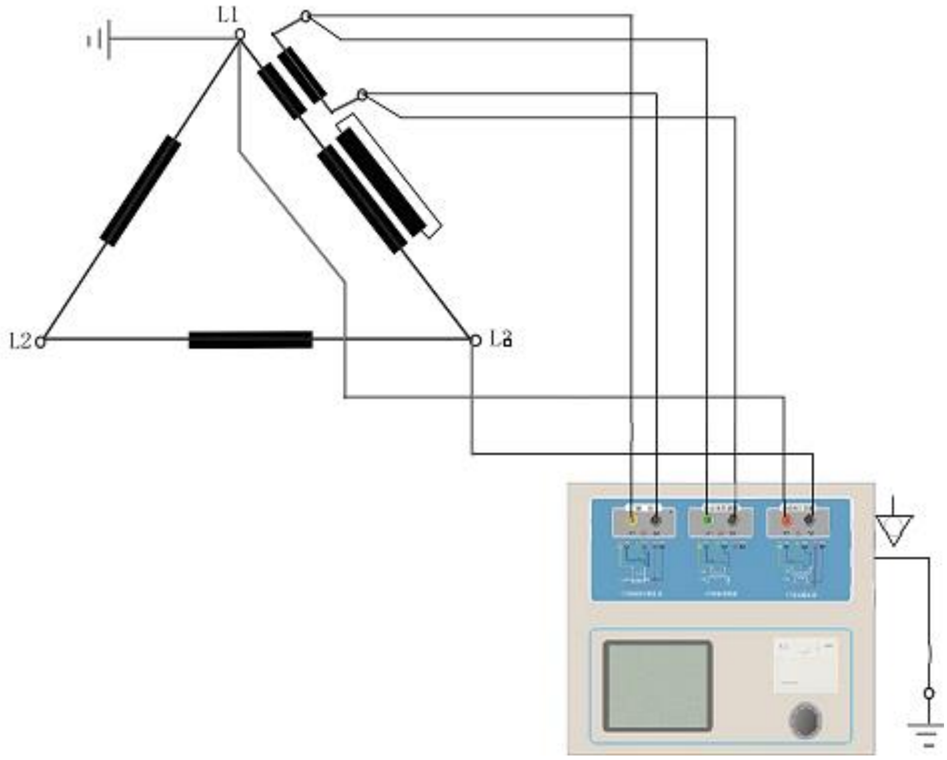


Figure D.2 JYH(C) in the triangle on the transformer connection when the connection mode test

2. JYH(C) for transformer testing casing CT Connection shown in Figure D.3.

Attention: H1 terminal must be disconnected first. Otherwise, if one took the short side, the JYH(C)can not obtain the correct result.

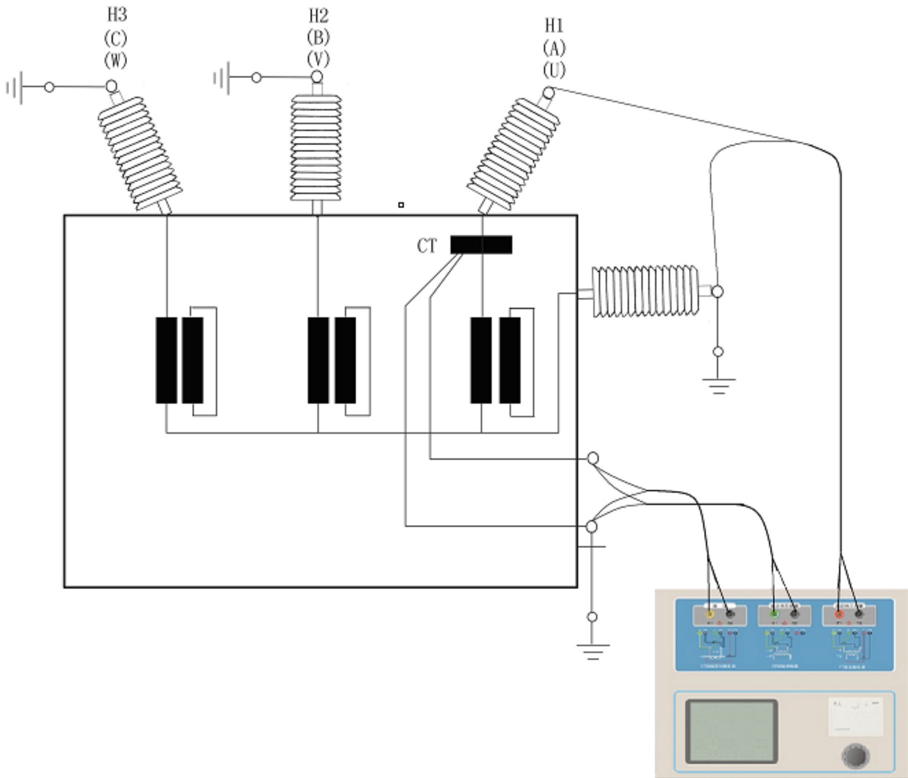


Figure D.3 JYH(C) on the transformer bushing testing at the time of CT Connection

4. JYH(C) in the GIS (SF6) switch on the wiring of the CT test mode as shown in Figure D.4. NOTE: Disconnect all connected with the bus switch, grounding switch closed.

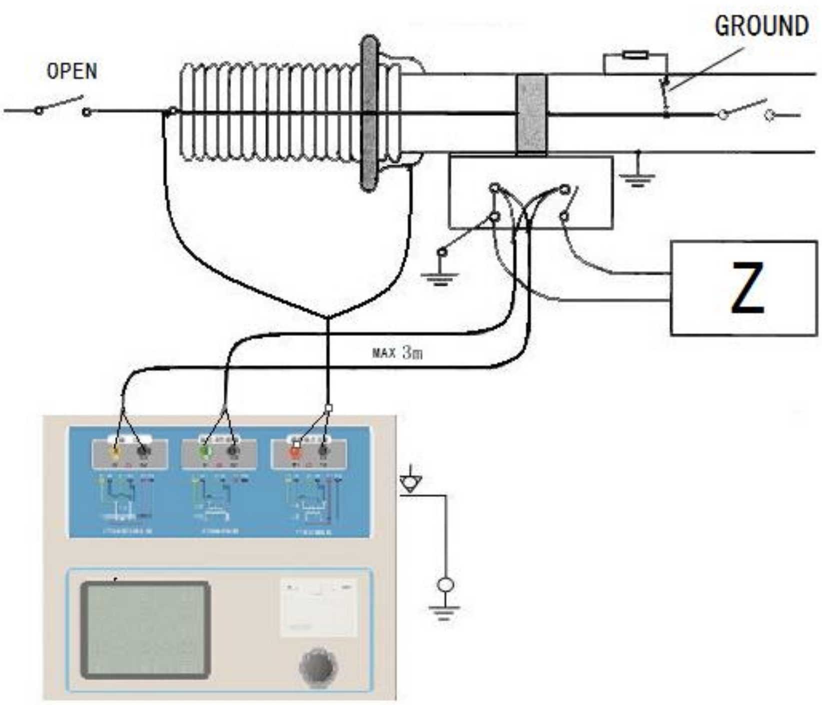


Figure D.4 JYH(C)on GIS (SF6) switch on the test at the time of CT Connection

D. Four-terminal method of measuring principle wiring

Impose a voltage output signal Vs to a source impedance R, will produce a current I, in figure E.1

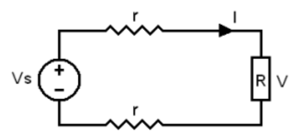


Figure E.1

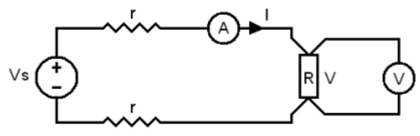


figure E.2

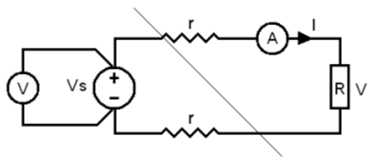


figure E.3

For measurement of the impedance value, the impedance measurement of the voltage U is needed :

$$R = V / I$$

From the measured impedance voltage source to some wires, wires have resistance r, resulting in V = Vs, so if the accurate measurement of impedance R, can not simply replace the Vs with V.

Impedance R of the measuring circuit should be used Figure E.2 connection method, measuring the voltage meter voltage must be separate from the R at both ends with wire connection to the accurate measurement of R value of the voltage V. R is used at both ends by four wire cables, it is known as 4-side wiring method. Figure E.3 of the wiring is wrong.

Adopt JYH(C) measure the resistance, variable ratio, excitation, the law of transformers is required to use 4-side wiring, in figure E.4

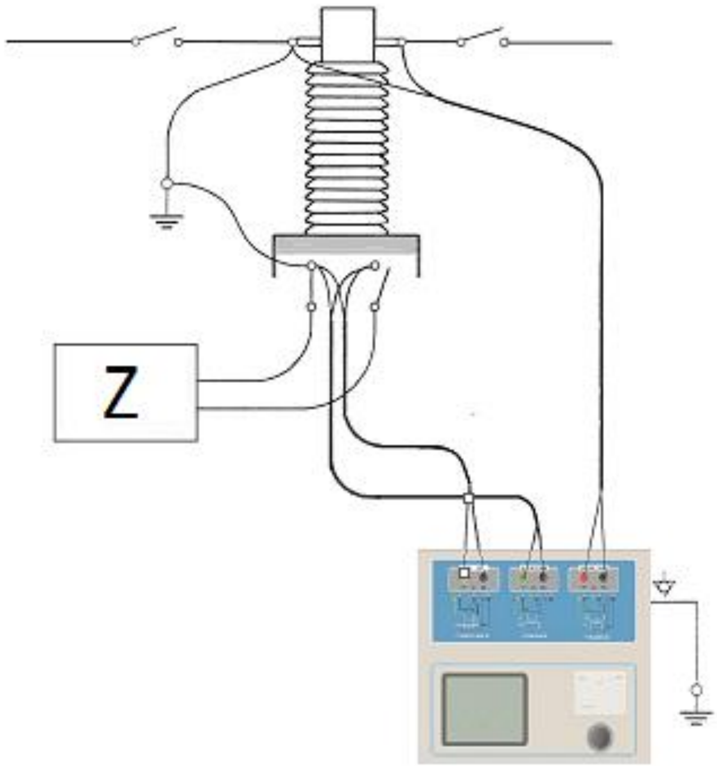


Figure E.4

Four-terminal method under test must pay attention to wiring terminal connection winding.
Figure E.5 the connection is correct, Figure E.6, 7 the connections are wrong.

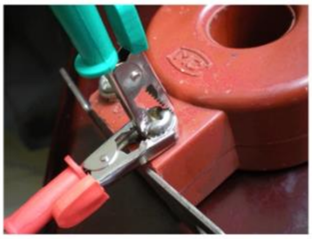
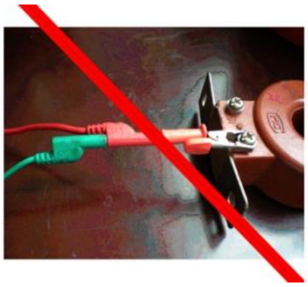


Figure E.5

Figure E.6



FigureE.7