Foreword

Before using this instrument, please read the instruction manual in detail. In order to let you operate the instrument proficiently as soon as possible, we are equipped with a detailed instruction manual, which will help you use the product better. From it, you can get information about product introduction, usage, instrument performance and safety precautions.

When writing this manual, we are very careful and rigorous, and believe that the information provided in the manual is correct and reliable. However, errors and omissions are inevitable. Please bear with me and warmly welcome your corrections.

Our aim is to continuously improve and perfect the company's products. At the same time, we reserve the right to improve and upgrade the function of the instrument. If you find that the function of the instrument is not completely consistent with the description in the manual during use, please refer to the actual instrument The function shall prevail. If you find any problems during the use of the product, please contact us in time! We will try our best to provide perfect technical support!

Contents

1. Use characteristics and performance

Dielectric loss insulation test can effectively discover the overall damp deterioration and local defects of the insulation of electrical equipment. It is widely used in electrical manufacturing, electrical equipment installation, handover and preventive testing.

The anti-interference precision dielectric loss measuring instrument is used for on-site anti-interference dielectric loss measurement or laboratory precision dielectric loss measurement. The instrument is an integrated structure with built-in dielectric loss bridge, variable frequency power supply, test transformer and standard capacitors. The instrument adopts frequency conversion anti-interference and Fourier transform digital filtering technology, automatic and intelligent measurement, and the measurement data is very stable under strong interference. The measurement results are displayed by a large-screen LCD, and the instrument has a built-in micro printer that can print out the test results.

1.1 Main technical indicators

Rated working conditions: Ambient temperature: -10℃～50℃
Relative humidity: <85%

Input power: 180V～270VAC, 50Hz/60Hz±1%, power supply from mains or generator

Accuracy: Cx: ±(reading×1%+1pF)
tgδ: ±(reading×1%+0.00040)

Anti-interference index: frequency conversion anti-interference, the above accuracy can still be achieved under 200% interference

Capacity range: Internal high voltage: 3pF～60000pF/10kV 60pF～1μF/0.5kV
External high voltage: 3pF～1.5μF/10kV 60pF～30μF/0.5kV

Resolution: up to 0.001pF, 4 significant digits

Range of tgδ: Unlimited, resolution 0.001%, three kinds of test samples of capacitance, inductance and resistance are automatically identified.

Test current range: 10μA～5A

Internal high voltage: Setting voltage range: 0.5～10kV

Maximum output current: 200mA

Lifting and pressing method: continuous and smooth adjustment

Voltage accuracy: ±(1.0%×reading+10V)

Voltage resolution: 0.1V

Test frequency: 45, 50, 55, 60, 65Hz single frequency
45/55Hz, 55/65Hz, 47.5/52.5Hz automatic dual frequency conversion
Frequency accuracy: ±0.01Hz

High voltage applied externally: Maximum test current 5A for positive and negative wiring

CVT self-excitation method measurement: output voltage 3～50V, output current 3～30A
C1/C2 measurement at the same time, high voltage connection can be dragged to the ground

CVT transformation ratio measurement: transformation ratio measurement accuracy: ±reading×1% ,transformation ratio measurement range: 10～99999,Phase measurement accuracy: ±0.02° ,Phase measurement range: 0～359.99°

High voltage dielectric loss: support high voltage dielectric loss of frequency conversion and resonance power supply
Measuring time: about 30s, related to the measuring method
Real-time clock: real-time display of time and date
Internal storage: 100 sets of measurement data can be stored inside the instrument
U Disk: Support U Disk Storage
Printer: Mini thermal printer
Computer interface: Standard RS232 interface (optional)
Dimensions and weight: Dimensions 368mm×288mm×280mm; host weight 22kg.

1.2 Main features

1. It has multiple working modes such as positive/reverse wiring, internal/external standard capacitance, internal/external high voltage, reverse wiring low-voltage shielding, CVT and transformation ratio. Can automatically distinguish capacitance, inductance, and resistance type samples. Integrated structure, automatic and intelligent measurement, easy to use and carry.
2. Frequency conversion anti-interference, accurate measurement under 200% interference, stable test data, suitable for on-site anti-interference dielectric loss test.
3. Using digital waveform analysis and bridge self-calibration technology, the accuracy and stability of the positive and negative wiring are consistent, and the high-precision three-terminal standard capacitor is used to achieve high-precision dielectric loss measurement.
4. Built-in series and parallel dielectric loss measurement models, and can simulate the work of Xilin bridge and current comparator, which is convenient for instrument verification.
5. During CVT self-excitation measurement, the measuring line can be grounded, and C1/C2 can be measured at the same time during one connection. It automatically compensates for the effect of busbar grounding and the partial voltage of standard capacitors, without changing wires and connecting any external accessories.
6. With reverse wiring low-voltage shielding function, when the 220kVCVT bus is grounded, 10kV reverse wiring dielectric loss measurement can be performed on C11 without disconnecting the wiring, and the capacitance and dielectric loss value of the lower shielding part can be measured at the same time.
7. With CVT ratio measurement function, it can measure CVT ratio, polarity and phase error.
8. Safety measures

High-voltage protection: short-circuit, breakdown or high-voltage current fluctuations of the test product can cut off the output at a high speed in a short-circuit mode.

Power supply protection: wrong connection of 380V, power supply fluctuation or sudden power failure, start protection, will not cause overvoltage.

Grounding protection: It has a grounding detection function, and the voltage cannot be boosted when it is not grounded. If the grounding of the instrument is poor during the measurement process, the grounding protection will be activated.

CVT protection: Four protection limits for high-voltage side voltage and current, low-voltage side voltage and current, will not damage the equipment; wrong menu selection will not output excitation voltage. There is no 10kV high voltage output during CVT measurement.

Misoperation prevention: two-level power switch; real-time monitoring of voltage and current; multiple keystrokes to confirm; terminal high/low voltage is distinct; slow boosting, rapid decompression, sound and light alarm.

Anti- "capacity rise": When measuring large-capacity samples, there will be a "capacity rise" effect of increased voltage. The instrument can automatically track the output voltage and keep the test voltage constant.

High-voltage cable: It is a high-voltage resistant insulated wire that can be used for mopping the ground.

Anti-seismic performance: The instrument adopts a unique anti-seismic design, which can withstand strong long-distance transportation vibration and bumps without being damaged.

9. Print and storage: The instrument comes with a micro-printer, which can print out the measurement results and store the measurement results in the instrument (100 sets of measurement data can be stored) or U disk for future reference.

10. Real-time clock: the instrument has a real-time clock, real-time display, and can record the date and time of the measurement.

2. Panel description

2.1 High voltage output socket (100V～10000V, maximum 200mA)

Position: The front side of the box.

Function: internal high voltage output; detection of reverse wiring test current; high voltage end of internal standard capacitor.

Wiring method: pin 1 of the socket is connected to the high-voltage wire core wire (red clip), and pins 2 and 3 are connected to the high-voltage wire shield (black clip). When connecting positively, both the core wire (red clip) and shielding (black clip) of the high-voltage wire can be used as a pressurizing wire; when connecting reversely, only the core wire can be used to pressurize the high-voltage end of the test product. If the high-voltage end of the test product has a shielding pole (such as a shielding ring on the high-voltage end), it can be connected to a high-voltage shield. If there is no shield, the high-voltage shield is suspended. The configured high-voltage test line has a grounding shielding layer, and the grounding shielding layer of the high-voltage measuring line needs to be connected to the measurement ground under the socket side.

Precautions:

(1) High-voltage sockets and high-voltage lines have dangerous voltages. It is absolutely forbidden to touch high-voltage sockets, cables, clamps and live parts of the test sample! Make sure to wire after the power is off, and be sure to stay away during measurement!

(2) When using a standard dielectric loss device (or standard capacitor) to verify the accuracy of the reverse wiring, a fully shielded plug should be used to connect the test product, otherwise the exposed core wire will cause measurement errors.
(3) Ensure that the high-voltage line is connected to the high-voltage end of the test sample with zero resistance, otherwise it may cause errors or data fluctuations, and may also cause instrument protection.
(4) When removing the wiring under strong interference, disconnect the connection while keeping the cable grounded to prevent induced electric shock.

2.2 Low voltage output jack (3～50V, 3～30A)

Function: The low-voltage excitation power required by the CVT self-excited method is output between the jack and the grounding pole.
Precautions:
(1) Because the low-voltage output current is large, the instrument's special low-resistance wire should be used to connect the CVT secondary winding. Poor contact will affect the measurement.
(2) Depending on the CVT capacity, select the appropriate voltage and current protection threshold from the menu.
(3) When the positive/reverse wiring is selected, there is no low voltage output.

2.3 Measuring grounding:

It is connected to the housing and the ground wire of the power socket. There is also a grounding jack in the lower left corner of the high-voltage panel. If the high-voltage line provided with the instrument has a ground shielding plug, it can be inserted into this jack nearby. Although the instrument has grounding protection, no matter what kind of measurement, the instrument should be grounded reliably and independently to ensure the safety of users and the accuracy of measurement results.

2.4 Printer: Mini thermal printer, used to print test data.

2.5 USB: For USB communication.

2.6 RS232: Use online with computer.

2.7 U Disk: Used to save data with an external U disk.

2.8 Test product input Cx socket (10μA～5A)

Function: Input the current of the positive wiring test product.
Precautions:
(1) It is strictly forbidden to unplug the plug during the measurement to prevent the current of the test product from entering the ground through the human body!
(2) When using a standard dielectric loss device (or standard capacitor) to test the accuracy of the positive wiring of the instrument, a fully shielded plug should be used to connect the test product, otherwise the exposed core wire will cause measurement errors.
(3) Ensure that the lead wire is connected to the resistance of the low-voltage end of the test product, otherwise it may cause errors or data fluctuations, and may also cause

instrument protection.

(4) When removing the wiring under strong interference, disconnect the connection while keeping the cable grounded to prevent induced electric shock.

2.9 Standard capacitance input Cn socket (10 μ A～5A)

Function: used to input external standard capacitor current

Precautions:

(1) Use fully shielded plug wires to connect external standard capacitors. This method is mainly used for external high-voltage standard capacitors to achieve high-voltage dielectric loss measurement.

(2) Select the "external standard" mode in the menu.

(3) Put the C and tg δ of the external standard capacitor into the instrument to realize the absolute value measurement of the dielectric loss of the Cx capacitor.

In principle, any capacitor with capacity and dielectric loss can be used as a standard capacitor after the parameters are placed in the instrument. The difference is that standard capacitors can provide better accuracy and long-term stability.

(4) Regardless of the positive connection or the reverse connection, the external standard capacitor is always connected to the positive connection.

2.10 Main power switch: used to switch the machine, it can be turned off at any time when an abnormality is found.

2.11 Power supply socket: connect to 220V mains, the socket has a built-in fuse holder, and the fuse specification is 10A / 250V. If it is damaged, replace it with a fuse of the same specification. If the replacement fuse still blows, the instrument may be faulty, and the manufacturer can be notified to deal with it.

2.12 Internal high voltage switch: the main power switch of the built-in high voltage system or CVT self-excited low voltage output system. This switch is controlled by the main power switch.

2.13 Keys: Press the " ↑ ", " ↓ ", "←", "→" keys to move the cursor and modify the content at the cursor. The "Confirm" key is used to confirm or end the parameter modification. Long press "Confirm" in the test interface Press to start measurement.

2.14 Liquid crystal display: 320 × 240 dot matrix gray-white backlit liquid crystal display, displaying menus, measurement results or error messages. Avoid prolonged exposure to the sun and avoid heavy pressure.

2.15 Backlight adjustment: When the LCD display is dark or unclear, the potentiometer can be adjusted to a suitable position to make the display bright and clear.

2.16 Indicator light: cooperate with the internal buzzer of the instrument to carry out test, alarm and other sound and light warnings.

3. Operating instructions

3.1 Initial menu interface

After turning on the main power switch, the system enters the initial menu interface.

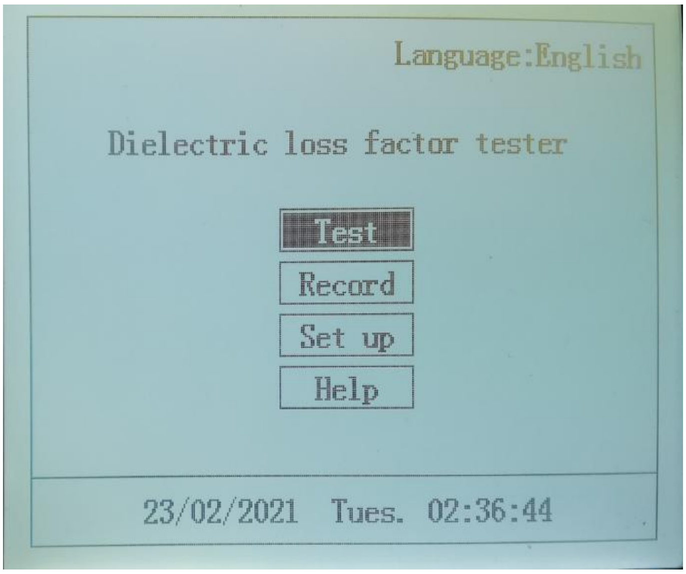

Figure 3-1 the initial menu interface

Language: Chinese and English menu switching
Test mode: select test mode and set various test parameters,
History: View the saved historical data
System setting: factory parameter setting and system time calibration
Help: You can check the software version and other information

3.2 Test mode

3.2.1 Test mode menu interface

In the initial menu interface, move the cursor to "Test Mode" and press the OK button to enter the start test menu interface, as shown in Figure 3-2.

The left side of the interface is the parameter setting options. Move the cursor to the relevant parameter options and press the "OK" button to set the relevant test parameters. The display on the right shows that the test parameters have been set. The cursor stays in the "Start test" column and long press the "OK" button The test can be started.

The lower right side of the interface is the information prompt line. If the internal and external high voltage is selected incorrectly, it will prompt "Currently in internal high voltage mode, please turn on internal high voltage" or "Currently in external high voltage mode, please turn off internal high voltage"; if the instrument is not grounded, it will prompt "Please check the grounding", the instrument cannot start normally when there is an error prompt, the instrument can only start the test when the prompt "long press the confirm key to start the test".

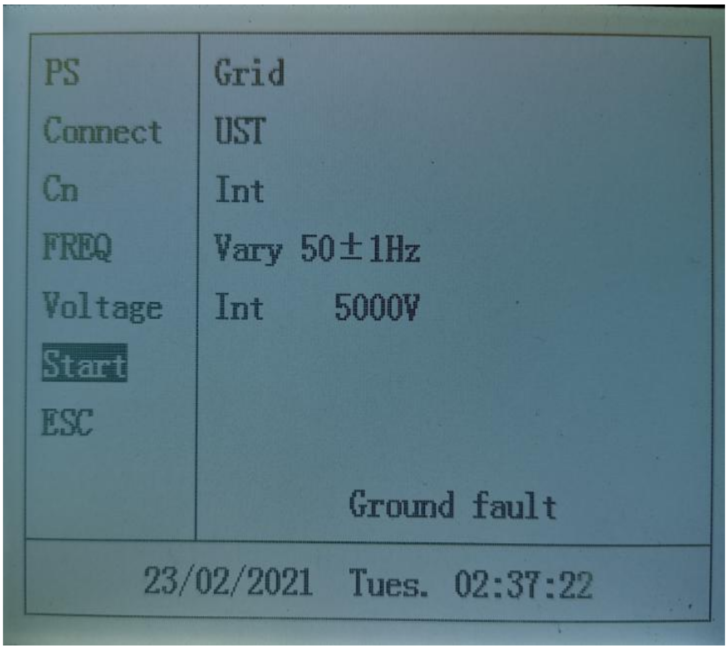

Figure 3-2 the menu interface for test starting

3.2.2 Setting the power supply mode of the instrument

Move the cursor to the "Instrument Power Supply" function option, press the "Enter" key to enter the setting state, the ↑ ↓ keys can select the "mains" or "generator" power supply mode, and press the "Enter" key to exit the setting state after setting. Generally, if the generator is powered on site, the instrument must be selected as the generator power supply mode, otherwise the instrument cannot work normally.

3.2.3 Wiring mode setting

Move the cursor to the "wiring mode" function option, press the "OK" key to enter the setting state, the ↑, ↓ keys can select positive wiring, reverse wiring, reverse wiring low-voltage shielding, CVT self-excited method, and transformation ratio.

3.2.4 Standard capacitance setting

Move the cursor to the "standard capacitance" function option, press the "confirm" key and then the ↑ and ↓ keys to select the appropriate standard capacitance. When selecting an external standard capacitor, the capacitance and dielectric loss of the external standard capacitor should be set at the same time.

When selecting external standard capacitance, move the cursor to Cn=xxxxx e x pF and tg δ =xx.xxx% and press ↑ ↓ to select the appropriate value, and press the OK key to exit after setting.

Cn adopts scientific notation, such as 5.000e1=5.000×101=50.00, 1.000e2=1.000×102=100.0, etc. The range is 0.000e0～9.999e5 (ie 0～999900pF). The setting range of tg δ is 0～±9.999%.

The internal standard capacitance can usually be used for positive and negative wiring measurement and CVT self-excitation measurement. The external standard method is used for high voltage dielectric loss, and the external capacitance parameters need to be put into the instrument.

3.2.5 Test frequency setting

The test frequency can be fixed frequency or variable frequency, and the frequency selection range is as follows:

Fixed frequency:

"45~65Hz": Single frequency measurement, used when studying the change of dielectric loss at different frequencies, the ↑ ↓ keys will display in a 1Hz step cycle.

Auto: Valid in the external high pressure measurement mode (cannot be changed), the system automatically recognizes the frequency of external high pressure.

frequency conversion:

"50 ± 1Hz": 49/51Hz automatic frequency conversion, suitable for measurement under 50Hz grid power frequency interference.

"50 ± 2Hz": 48/52Hz automatic frequency conversion, suitable for measurement under 50Hz grid power frequency interference.

"60 ± 1Hz": 59/61Hz automatic frequency conversion, suitable for measurement under 60Hz grid power frequency interference.

"60 ± 2Hz": 58/62Hz automatic frequency conversion, suitable for measurement under 60Hz grid power frequency interference.

note:

"50Hz" or "60Hz" is power frequency measurement. This setting cannot be used in a 50Hz or 60Hz interference environment. It is recommended to use “50±1Hz” or “60±1Hz” instead of “50Hz” or “60Hz”, which can resist interference and will not affect the measurement accuracy.

3.2.6 Test voltage setting

Preset voltage selection:

Forward/reverse/transformation ratio mode can be selected "0.1/0.2/0.3/ 0.5 /0.6 /0.8 /1 /1.5 /2 /2.5 /3 /3.5 /4 /4.5 /5 /5.5 /6 /6.5 /7 /7.5 / 8 /8.5 /9 /9.5 /10.0kV" (the maximum output voltage of F type is 12kV), the appropriate test voltage should be selected according to the high voltage test procedure.

Any voltage setting:

If you can’t find a suitable test voltage in the preset voltage, you can set the test voltage to any value you need (within the range of 100V~10000V): move the cursor to the voltage value and press the "confirm" key for more than 1 second, and then set it all Voltage. When the cursor is at the voltage value, press the "confirm" key for more than 1s to switch back and forth between the "preset voltage" and "arbitrary voltage" states.

In CVT mode, you can select "0.1/0.2/0.3/ 0.5 /0.6 /0.8 /1 /1.5 /2 /2.5 /3 /3.5 /4.0kV". For CVT self-excitation method, the internal high voltage permission switch must be turned on, which is provided by the machine. The excitation voltage is output between "low voltage" and "ground". For safety, the CVT self-excitation method also needs to set the following protection limits:

Move the cursor to xxkV / xxmA / xxV / xxA, press ↑ ↓ to select the appropriate value, and then press the confirm key to exit.

xxxxV: The high voltage test voltage cannot exceed 4000V.

xxmA: High voltage current upper limit, 10~200mA is optional.

xxV: Low voltage upper limit, 3~50V optional.

xxA: Low-voltage current upper limit, 3~30A is optional.

note:

Generally, the low-voltage excitation voltage can reach 20V when measuring C1, and the low-voltage excitation current can reach 15A when measuring C2. Generally, the high-voltage voltage can be set to 2~3kV, and the high-voltage current limit is rarely used, and the maximum can be set to 200mA.

After starting the CVT measurement, the excitation high voltage is displayed here, and the high voltage current (uA or mA), low voltage voltage (V) and low voltage current (A) are displayed in sequence below. The brackets such as [30V] indicate that the amount has reached the protection limit.

3.2.7 Series connection

The cursor is at the "wiring mode", long press the "→" key to display or cancel the RC series symbol "" on the right side of the line. The instrument with this symbol simulates the operation of the Xilin-type bridge, and the instrument without this symbol simulates the operation of the current comparator bridge. At the same frequency, the dielectric loss measured by the two methods is the same. The dielectric loss values measured at 50±1Hz and 50Hz are also basically the same.

Only when the dielectric loss is large, the capacitance value measured by the Xilin bridge will be larger than that of the current comparator. When verifying with a standard loss device in the laboratory, if the capacitance of the standard loss device is calibrated according to the series model, the series model should be selected. Otherwise, the parallel model should be selected.

3.2.8 Start measurement

The cursor is at the "start test", press the "confirm" key for more than 1.5s to start the measurement.

After starting the measurement, the instrument emits an audible and visual alarm and displays the measurement progress. During the measurement, you can press "Any" to cancel the measurement, and turn off the main power immediately in case of emergency. The sample current displayed during the measurement is for reference only.

3.2.9 Test data

According to different measurement methods, the instrument will display different data. As shown in the following table:

Type of sample	Display Data	Remarks
Capacitance	Cx，DF，U，I，Φ，PF，P， F1，F2	|DF|>1 shows capacitance and series/parallel resistance; |Q|<1 shows inductance and series resistance.
Inductance	Lx，Q，U，I，Φ，PF，P， F1，F2	
Resistance	Cx(Lx)，Rx，U，I，Φ，PF，P，F1，F2	
Transformation ratio	K，Cx，DF，Φ，U1，U2，I，F1，F2	Cx and DF are the test data of high voltage end reverse wiring.
CVT self-excitation	C_1，DF，C_2，DF，U_1，U_2，F1，F2	The sample connected to Cx is C1, and the sample connected to high

method		voltage is C2. U1 is the voltage when measuring C1, U2 is the voltage when measuring C2.
Reverse wiring low voltage shield	Cx，DF，Cg，DF，Ux，Ug，F1，F2	Cx shielded reverse wiring test product, Cg shielded positive wiring test product

Note: DF (dissipation factor) has the same meaning as tgδ (dielectric loss factor, referred to as dielectric loss), and English PF (Power factor) has the same meaning as cosΦ (power factor, where Φ=90°-δ).

The instrument automatically distinguishes capacitance, inductance and resistance type samples: capacitance type samples display Cx and DF (tgδ); inductance type samples display Lx and Q; resistance type samples display Rx and additional Cx or Lx. The unit is automatically selected.

C: The capacitance of the test product [1μF=1000nF nanofarad / 1nF=1000pF], if it displays 10.00nF, it means 10000pF

DF (tgδ): Dissipation factor [1%=0.01]

L: Inductance of the sample [1MH MegaHenry=1000kH / 1kH=1000H]

Q: quality factor [no unit]

R ：Resistance value of test product [1MΩ=1000kΩ / 1kΩ=1000Ω]

U: Test voltage [1kV=1000V / 1V=1000mV]

I ：Test product current [1A=1000mA / 1mA=1000μA]

Φ: The angle at which the current of the test sample leads the test voltage [° degree] or the angle at which the primary voltage leads the secondary voltage when the transformation ratio is measured

PF: power factor

K: When measuring the CVT ratio, the primary voltage is only compared with the secondary voltage

P: Power loss of the sample [1kW=1000W / 1W=1000mW]

F1: Frequency [Hz], display the frequency of the first test

F2: Frequency [Hz], display the second test frequency

Display over indicates that the measurement data exceeds the range.

3.3 Historical data

Enter the historical data menu interface as shown in Figure 3-3.

Move the cursor to the "U Disk" option and press the "OK" button to export the data to the U disk, move up to the "Clear" option and press the "OK" button to clear all the saved data. Move the cursor to the ">>>>" option and press the "OK" key to enter the data selection interface. The cursor position defaults to the last saved single piece of data. If you want to view other data, you can move the cursor up and down to select. Press the "OK" button to enter the single historical data display interface.

After entering the single historical data display interface, move the cursor up and down in the functional option area on the left to choose to print, delete and exit the single historical data display interface.

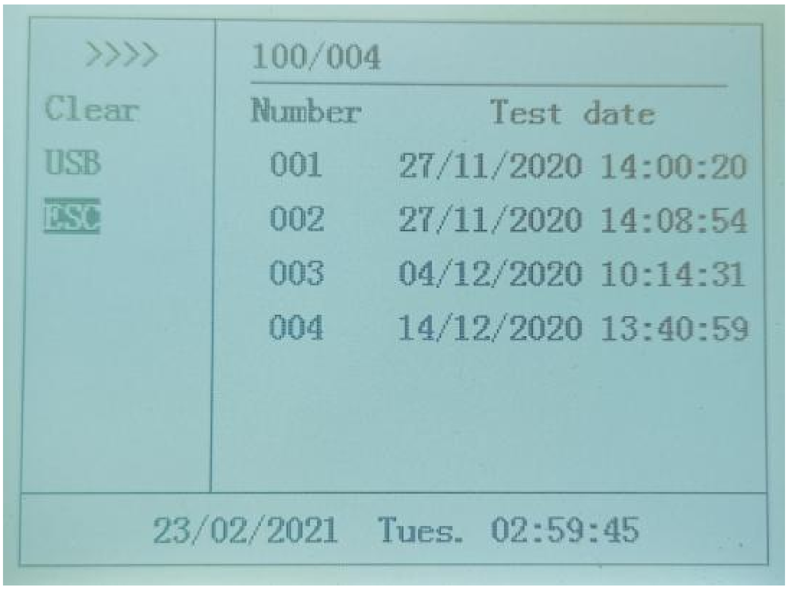

Figure 3-3 historical data

3.4 System Settings

Enter the system setting menu to calibrate the system time. The "factory settings" parameter prohibits the user to modify, and only the manufacturer is allowed to set the factory parameters.

3.5 help

You can view the relevant operating instructions of the instrument.

3.6 Contrast adjustment

The contrast of the LCD screen has been calibrated at the factory. If you feel that it is not clear enough, adjust the potentiometer on the panel to make the LCD display clear.

4. Reference wiring

4.1 Positive wiring

4.1.1 Internal standard capacitance, internal high voltage

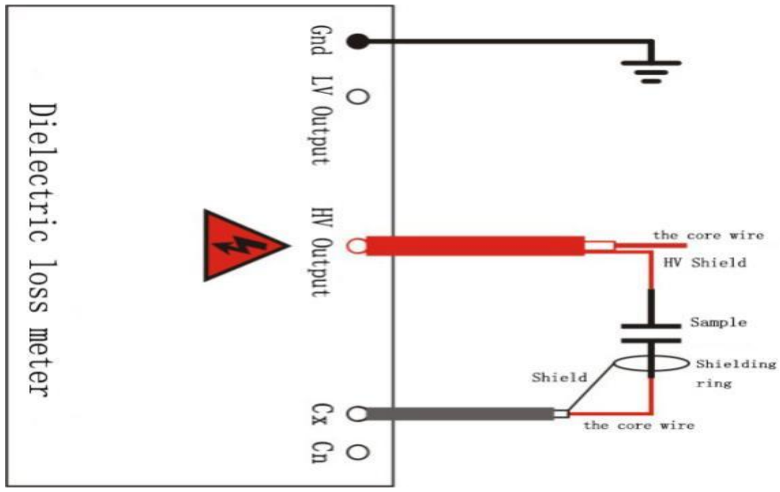

Figure 4-1. 1 conventional direct connection wiring reference diagram

The black clip of the Cx line is equivalent to grounding, the black clip can be connected to the low-voltage shielding ring of the test product, and the black clip can be suspended when there is no shielding ring.

When the internal high voltage is applied to the positive wiring, the core wire (red clip) and shield (black clip) of the high voltage wire must be connected to the high voltage end of the test product. If only the core wire is used for pressure, the resistance of the core wire is relatively high, which may cause additional dielectric loss. The high-voltage cable for the instrument is a double-shielded high-voltage cable, and its ground shield must be grounded.

4.1.2 External standard capacitor, external high voltage (high voltage dielectric loss)

When using an external standard capacitor Cn, you must use a shielded wire with a shielded plug to connect, and put the capacitance value C and the dielectric loss value tg δ of the external standard capacitor Cn into the instrument. The applied high voltage level depends on the voltage level of the test product Cx and the external standard capacitor Cn, and has nothing to do with the instrument. The instrument is at low potential.

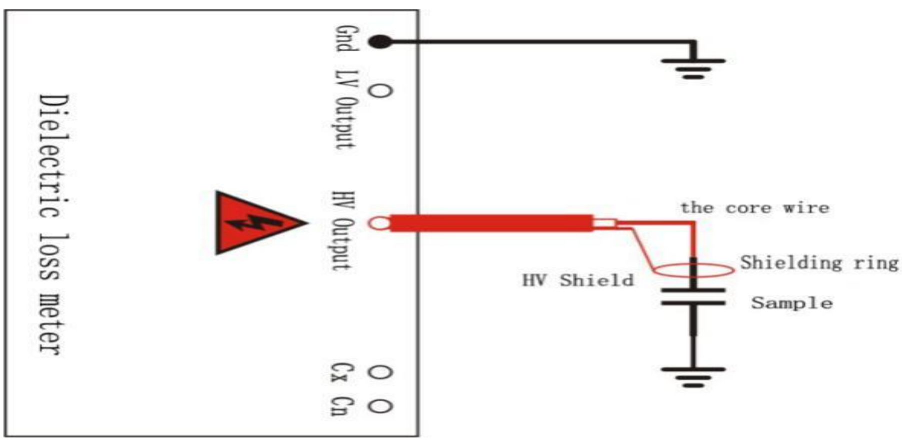

Figure 4-1. 2 conventional reverse connection reference wiring diagram

4.1.3 Internal standard capacitance, external high voltage (for measuring large-capacity samples)

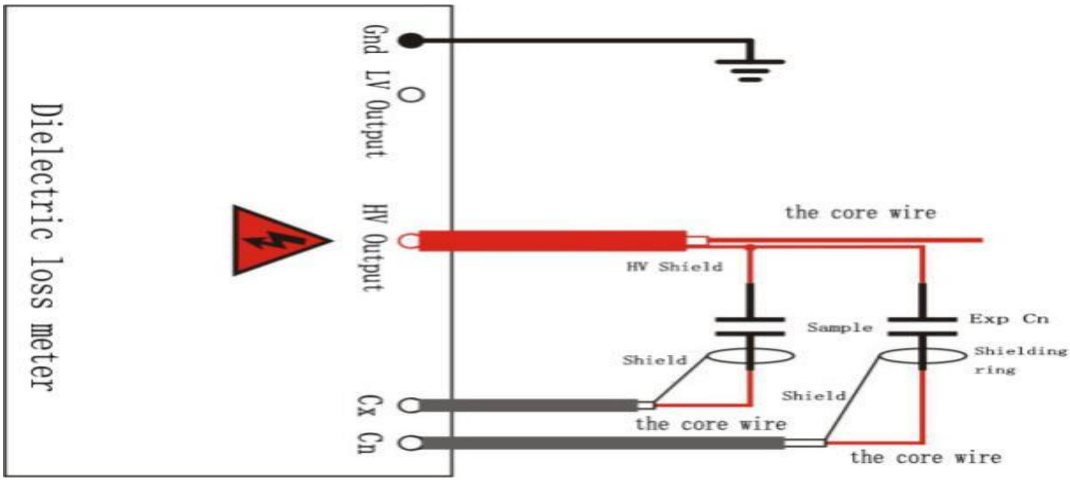

Figure 4-1.3 positive wiring, external standard capacitance, internal high voltage

The applied high voltage can provide a larger test current and can measure a larger capacity sample. Due to the limitation of the internal standard capacitance, the applied high voltage cannot exceed the maximum voltage of the instrument (10kV).

4.1.4 Positive wiring calibration

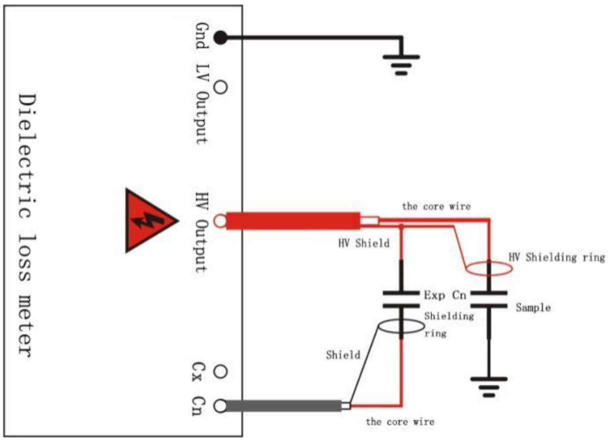

Figure 4-1.4 reverse wiring, external standard capacitor, internal high voltage

When calibrating with a standard loss device, a shielded wire with a shielded plug must be used for connection. It is recommended to use the "frequency conversion" method. If the capacitance of the standard loss device is calibrated according to the RC series model, the instrument should select the RC series model. Multi-channels of positive wiring share one measurement loop, and only need to calibrate according to single channel.

4.2 Reverse wiring

4.2.1 Internal standard capacitance, internal high voltage

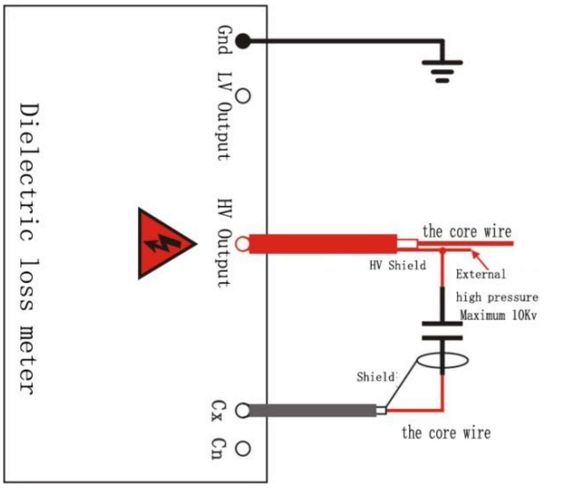

Figure 4-2.1 positive wiring, internal standard capacitor, external high voltage

Use the high-voltage core wire (red clip) to connect the high-voltage end of the test sample. The high-voltage shield (black clip) is used to connect the high-voltage shield, especially to shield off the shunt branch, such as C1 and C2 in the above figure. When shielding is not required, the black clip is suspended.

4.2.2 Internal standard capacitance, external high voltage (for measuring large-capacity samples)

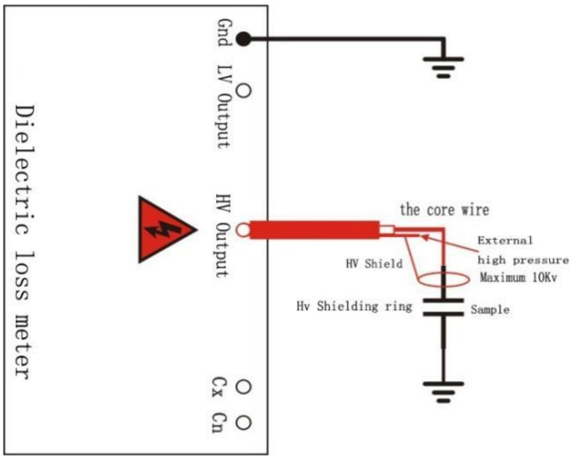

Figure 4-2.2 reverse wiring, internal standard capacitor, external high voltage

The applied high voltage can provide a larger test current and can measure a larger capacity sample. Due to the internal standard capacitance and current sensor withstand voltage limitation, the external high voltage cannot exceed the maximum voltage of the instrument (10kV).

4.2.3 External standard capacitors, external high voltage

The external standard capacitor is connected between the Cn socket and the high-voltage shield, and the C/tg δ is placed in the instrument. Since the reverse wiring must use the current sensor inside the instrument, even if the external standard capacitor and external high voltage are used, the maximum voltage of the instrument (10kV) cannot be exceeded. Therefore, this method is not recommended.

4.2.4 Reverse wiring calibration

When calibrating with a standard loss device, a shielded wire with a shielded plug must be used for connection. The standard loss device is used upside down, its shell has high voltage, and the high voltage terminal is grounded. The insulating feet of the standard loss device should be able to withstand the test voltage of 10kV.

It is recommended to use the "frequency conversion" method. If the capacitance of the standard loss device is calibrated according to the RC series model, the instrument should select the RC series model (the cursor is at the "wiring mode", long press the "→" key to use or cancel the RC series model).

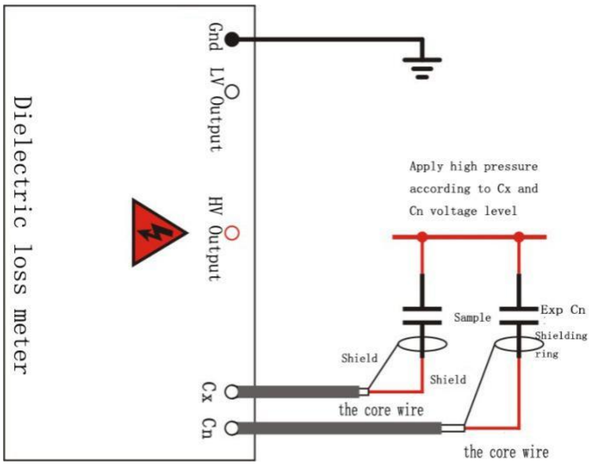

Figure 4-2.4 positive wiring, external standard capacitor, external high voltage

4.3 Reverse wiring low voltage shield

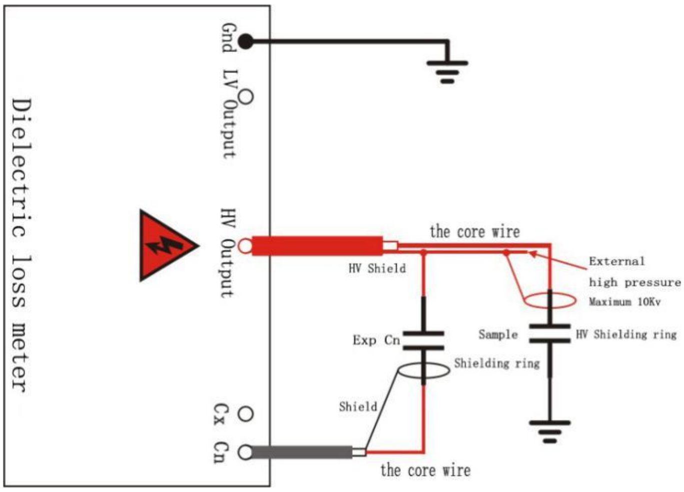

Figure 4-3.1 reverse wiring, external standard capacitor, external high voltage

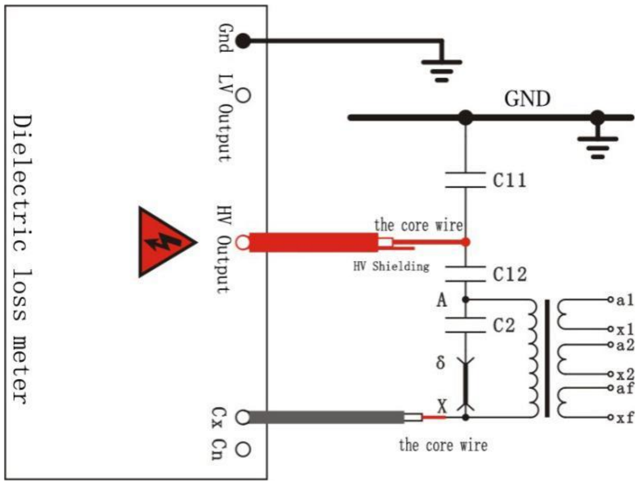

Figure 4-3.2 low voltage shielding of reverse connection

Choose reverse wiring low voltage shield. The low-voltage terminal of the capacitor Cg that needs to be shielded cannot withstand high voltage and cannot be shielded by conventional reverse wiring high voltage shields, so reverse wiring low-voltage shields can only be used. The instrument uses the reverse wiring to measure the total current of Cx and Cg, while using the positive wiring to measure the Cg current, the difference between the two is the Cx current, and Cx and Cg are calculated from this. The instrument simultaneously displays Cx and Cg data. Figure 4-9 is a schematic diagram of measuring the capacitance C11 of the upper section of the CVT with the busbar grounding.

4.4 CVT self-excitation method

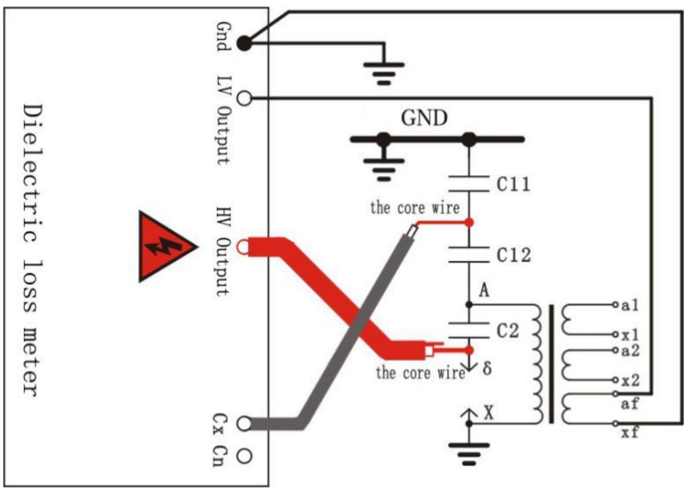

Figure 4-4 CVT self excitation method

The high-voltage core wire is connected to the end of C2, and the Cx core wire is connected to the upper end of C12. Whether the bus bar is grounded does not affect the measurement. But when there is only one section C1 on the upper part of the CVT, the bus bar cannot be grounded, otherwise the Cx core wire will be short-circuited to the ground.

The low-voltage excitation voltage is output between the low-voltage output and ground. They can be connected to any secondary winding of the CVT, and there is no polarity requirement. The protection threshold is recommended to set low-voltage voltage 30V, low-voltage current 20A, and high-voltage current 200mA

Two results are obtained in one measurement: C1 is the data of C12, and C2 is the data of C2.

4.4 transformation ratio

4.4.1 Electromagnetic PT ratio

Various voltage transformers (electromagnetic PT or CVT, etc.) can measure its transformation ratio. Note: the primary voltage (between A-X) cannot exceed the allowable voltage of PT, and the secondary voltage (between a-n) cannot exceed 120V. Note that the PT end with the same name and the core wire/shield of Cx should not be reversed, otherwise the phase will change 180° . The measured data K is the ratio of the primary voltage to the secondary voltage; Φ is the angle at which the primary voltage leads the secondary voltage. C and DF are the dielectric loss data of the reverse wiring, so you don't need to care about it.

4.4.2 CVT ratio

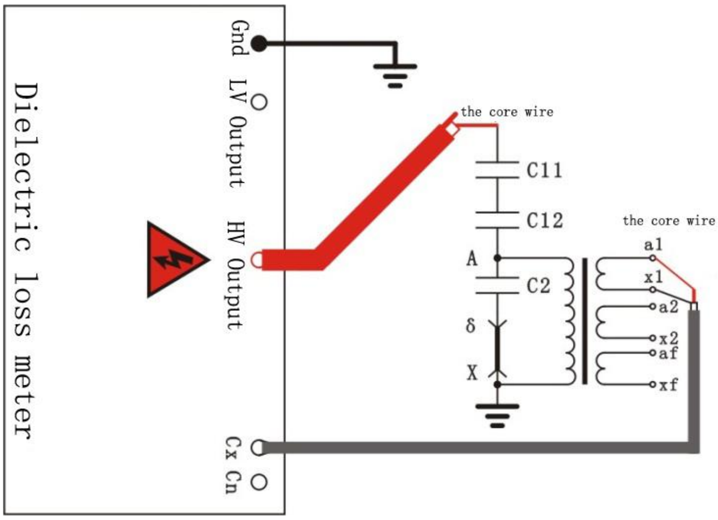

Figure 4-11 CVT ratio test

The core wire (red clip) of the high-voltage line of the instrument is connected to the upper end of the CVT, the bus bar is disconnected from the ground, the lower end of the CVT is grounded, and the red and black clips of the low-voltage line are connected to the secondary winding.

5. Common CVT measurement methods

Common capacitive voltage transformers can be divided into 110kV, 220kV, 500kV and other different voltage levels. Generally, 110kV CVT has one C1 section, 220kV CVT has two C1 sections, and 500kV CVT has three C1 sections.

5.1 The measurement method of 500kV CVT

1) C11 measurement method

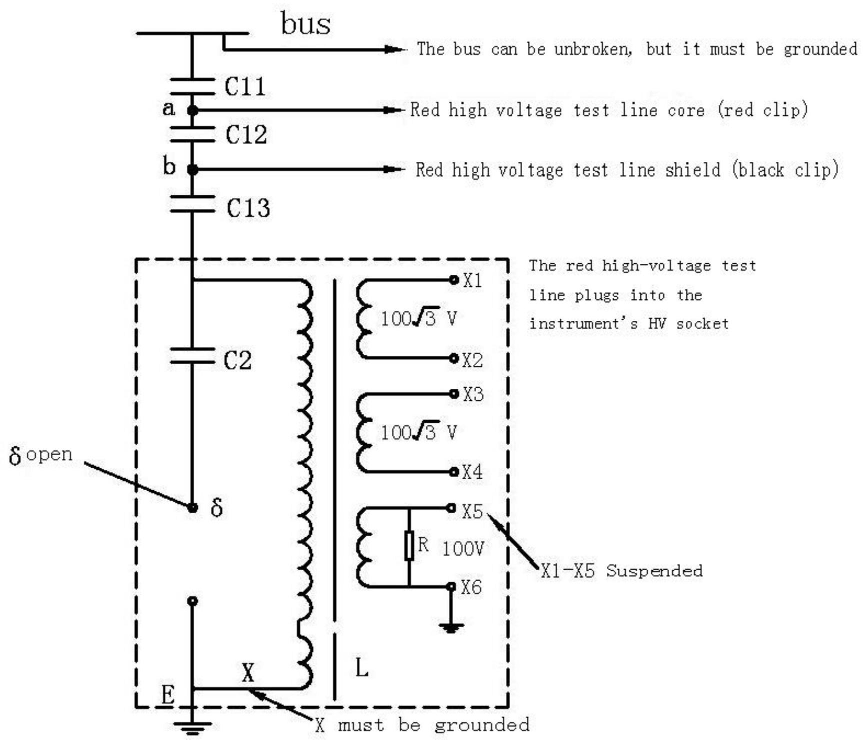

Figure 5-1 C11 measurement methods (selection of internal standards, reverse wiring, 10kV test voltage)

When selecting reverse wiring for the wiring method, pay special attention to disconnecting the J terminal and the X terminal must be grounded.

2) C12 measurement method

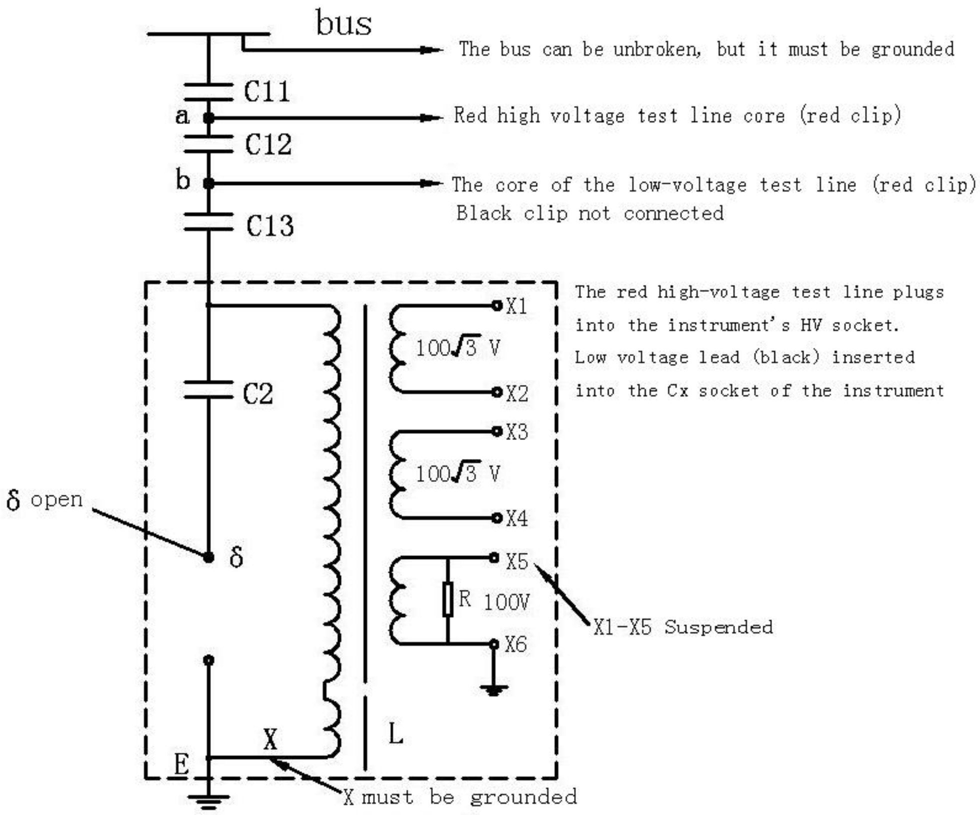

Figure 5-2 C12 measurement methods (selection of internal standards, positive wiring, 10kV test voltage)

The wiring method is positive wiring, and special attention should be paid to disassembling the J terminal, and the X terminal must be grounded.

3) Measurement methods of C13 and C2

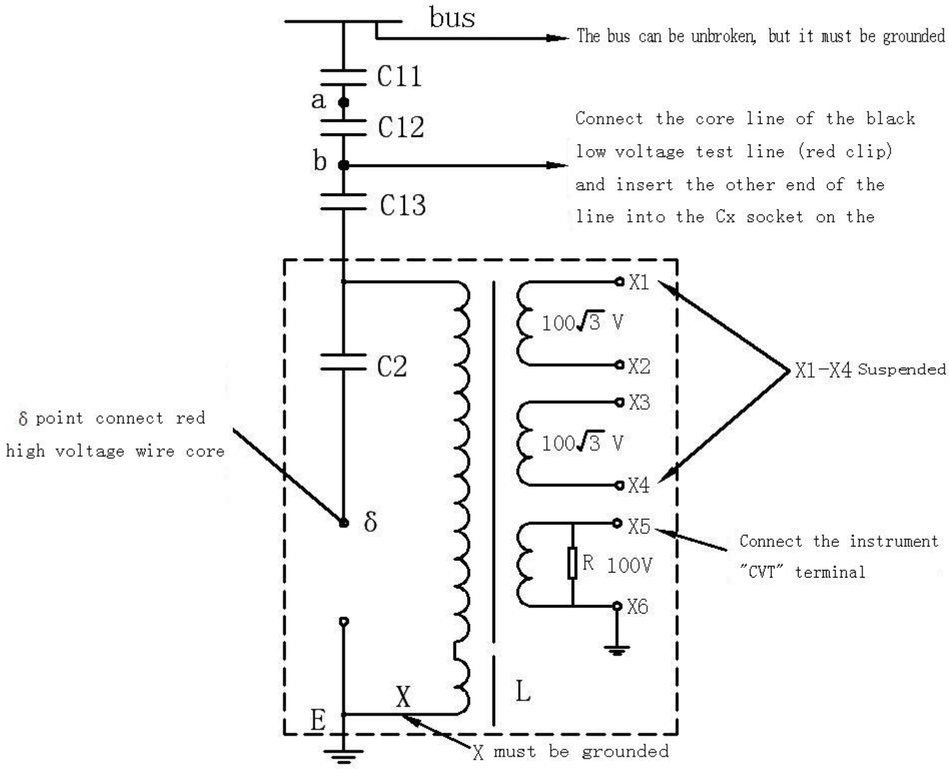

Figure 5-3 measurement methods for C13 and C2 (selection of internal standard, CVT self excitation method, 2kV test voltage)

The connection method selects the CVT self-excitation method, and the test voltage can be set to 2kV. The CVT self-excitation method can measure the dielectric loss and capacitance of the two capacitors C13 and C2 at one time.

5.2 Measuring method of 220kV CVT

1) C11 measurement method

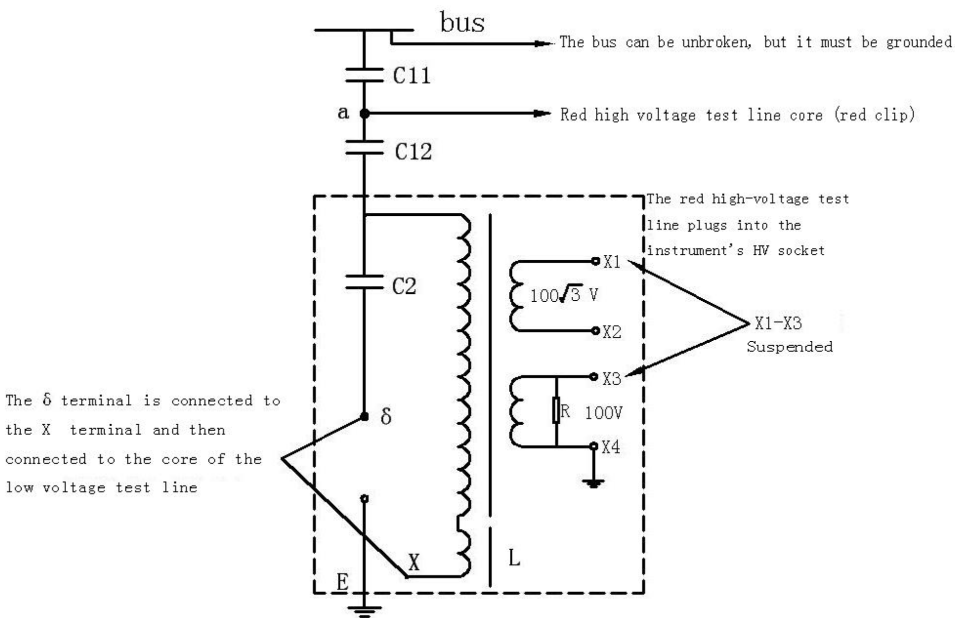

Figure 5-4 C11 measurement methods (selection of internal standards, reverse wiring, low voltage shielding, 10kV test voltage)

The wiring method is reverse wiring low-voltage shielding. When measuring C11, pay attention to the connection between J and X and separate them from grounding.

2) Measurement methods of C12 and C2

The connection method selects the CVT self-excitation method, and the test voltage can be set to 2kV. The CVT self-excitation method can measure the dielectric loss and capacitance of the two capacitors C12 and C2 at one time.

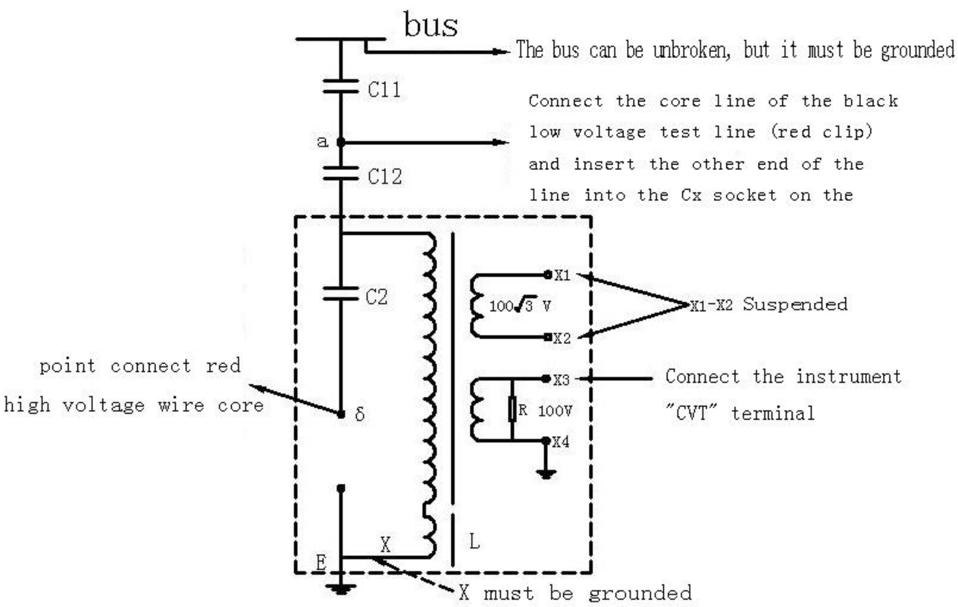

Figure 5-5 measurement methods for C12 and C2 (selection of internal standard, CVT self excitation method, 2kV test voltage)

5.3 Measuring method of 110kV CVT

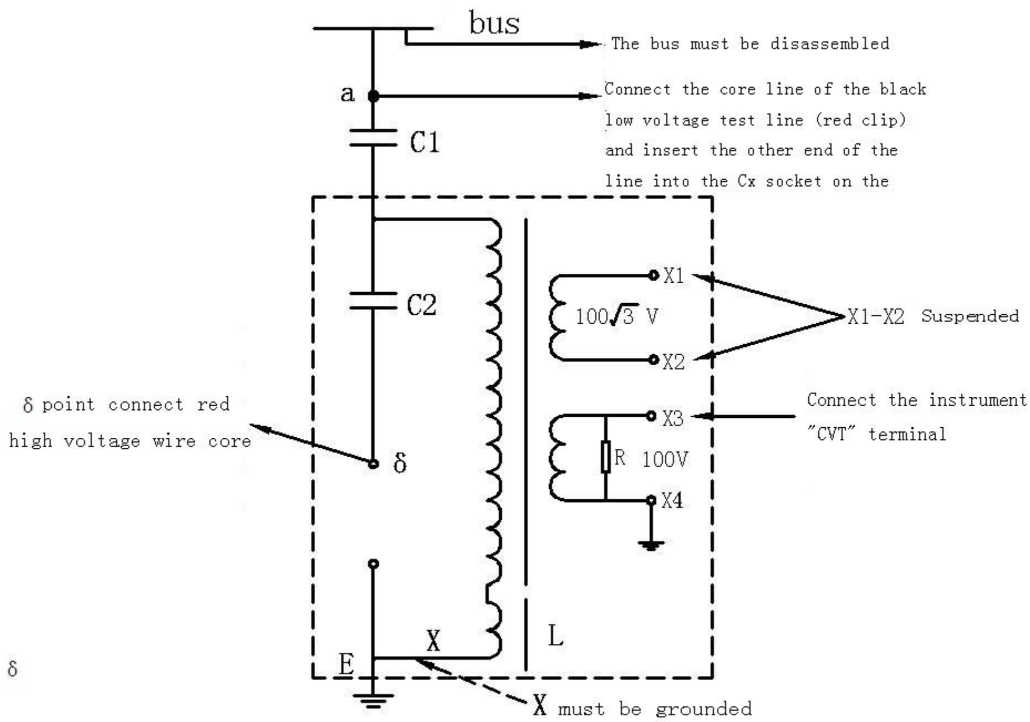

Figure 5-6 measurement methods for C1 and C2 (selection of internal standard, CVT self excitation method, 2kV test voltage)

The connection method selects the CVT self-excitation method, and the test voltage can be set to 2kV. The CVT self-excitation method can measure the dielectric loss and capacitance of the two capacitors C1 and C2 at one time.

6. Precautions for field test

If the test data is obviously unreasonable during use, please find the reason from the following aspects:

6.1 Poor contact of the hook

When using the hook to connect the test product in the field measurement, the hook must be in good contact with the test product, otherwise the discharge of the contact point will cause serious data fluctuations! Especially if the oxide layer of the drainage wire is too thick, or the wind blows the wire, it is easy to cause poor contact.

6.2 Poor grounding contact

Poor grounding can cause instrument protection or severe data fluctuations. The paint and rust on the grounding point should be scraped off, and 0 resistance grounding must be ensured!

6.3 Direct measurement of CVT or end shielding method to measure electromagnetic PT

Direct measurement of the coupling capacitor in the lower section of the CVT will result in negative dielectric loss. To eliminate the negative dielectric loss, the following measures can be taken or the CVT self-excitation method can be used to measure:

1) During the test, the ground terminal of the measuring instrument is directly connected to the metal base of the tested product, and a good contact should be ensured.

2) When conditions permit, short-circuit the non-tested windings as much as possible to reduce the influence of inductance and core loss.

3) There should be no iron frame, scaffolding, wooden ladder and other objects around the tested product, so as to minimize the influence of distributed impedance.

4) The angle between the test lead and the test product should be as close as possible to 90° to reduce the distributed capacitance between the line and the test product.

When using the end shielding method to measure the electromagnetic PT, the negative dielectric loss will appear due to the "T-shaped network interference" caused by damp, just dry the bottom three skirt porcelain sleeve and the wiring terminal plate. It can also be measured by conventional method or terminal pressure method.

6.4 The air humidity is too high

The humidity of the air makes the measured value of dielectric loss abnormally increase (or decrease or even become negative) and unstable. If necessary, a shielding ring can be added. Because the shielding ring is artificially added to change the electric field distribution of the test sample, this method is controversial, and you can refer to the relevant regulations.

6.5 Generator power supply

When the generator is powered, it can work in a fixed frequency 50Hz mode.

6.6 Test line

1) Due to long-term use, it is easy to cause hidden open circuit of the test wire, or short circuit of the core wire and shield, or poor contact of the plug. The user should maintain the test wire frequently.

2) When testing standard capacitor samples, fully shielded plugs should be used to eliminate the influence of additional stray capacitance, otherwise the accuracy of the instrument will not be reflected.

6.7 Working mode selection

After connecting the wire, please select the correct measurement mode, no error can be selected. Especially in the interference environment, the frequency conversion anti-interference mode should be selected.

6.8 Influence of test method

Since the dielectric loss measurement is greatly affected by the test method, it is necessary to distinguish between the test method error and the instrument error. When there is a problem, you can first check the wiring, and then check whether it is an instrument failure.

6.9 Instrument failure

1) Use a multimeter to measure whether the test wire is open, or whether the core wire and shield are short-circuited;

2) The input power 220V is too high or too low; whether the grounding is good;

3) Use the positive and negative wiring to test a standard capacitor or a capacitor sample with known capacity and dielectric loss. If the result is correct, you can judge that the instrument has no problem;

4) Unplug all test leads and perform an empty test boost. If it does not work normally, the instrument may be faulty.