

Dear Client,

Thank you for Purchasing our UHV-342 Transformer Tan Delta Tester. Please read the manual in detail prior to first use, which will help you operate the equipment skillfully.



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



The input/output terminals and the test column may bring voltage, when you plug in/pull out test line or power outlet, they will cause electric spark. PLEASE CAUTION RISK OF ELECTRIC SHOCK! To avoid risk of electric shock, be sure to follow the operating instructions!

Company Address:

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- ◆ Website: www.cnuhv.com

◆ **SERIOUS COMMITMENT**

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

◆ **SAFETY REQUIREMENTS**

Please read the following safety precautions carefully to avoid personal injury and to prevent the product or any other attached products being damaged. In order to avoid possible danger, this product can only be used within the scope of the provision.

Only qualified technician can carry out maintenance or repair work.

--To avoid fire hazard or personal injury:

Use Proper Power Cord

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

Connect and Disconnect Correctly

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

Grounding

The product is grounded through the power cord; besides, the ground pole of the shell must be grounded. To prevent electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, please do check that the product is properly grounded.

Pay Attention to the Ratings of All Terminals

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

Do Not Operate without Covers

Do not operate this product when covers or panels removed.

Use Proper Fuse

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

Avoid Touching Bare Wire and Charged Conductor

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

Do Not Operate with Suspicious Faults

If you encounter operating faults/suspect there is damage to this product, do not continue. Please contact with our maintenance staff.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in Explosive Atmospheres.

Ensure Product Surfaces Clean and Dry.

— Security Terms

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

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

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1. Product Overview

Dielectric loss measurement is a basic method in insulation test and effectively detect damp, degradation and partial defect of insulation of electrical equipment. This method is widely used in electric manufacturing, electric equipment installation, connection and preventive test. Measurement on dielectric loss of transformer, mutual inductor, reactor, capacitor, bushing and arrester is the most basic method to test their insulation property. TKC fully-automatic anti-interference dielectric loss tester breaks through the traditional bridge testing method and adopts variable frequency power technology, single chip and modernized electrical technology to carry out automatic frequency shift, analog-to-digital conversion and data computing. It features strong anti-interference capacity, high test speed, high precision, automatic digitization and easy operation. It adopts high-power switching power supply, which outputs 45Hz and 55Hz pure sine wave and automatically increase the voltage to a maximum value 12 KV. It can filter 50Hz interference automatically, and it is applicable to the site test of substation and other places with large electromagnetic interference. This methods is extensively applied in dielectric loss measurement of transformer, mutual inductor, reactor, bushing, capacitor, arrester and others equipments in power industry.

1.1 Technical specification

1.1.1 Dielectric loss and capacitance measurement

Accuracy: $C_x: \pm (\text{reading} \times 1\% + 1\text{pF})$

$\text{tg}\delta: \pm (\text{reading} \times 1\% + 0.00040)$

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

Capacitance range: applied high voltage: 3pF~60000pF/10kV 60pF~1.2μF/0.5kV

Applied high pressure: 3pF~1.5μF/10kV 60pF~30μF/0.5kV

Resolution: up to 0.001pF, 4 significant digits

Tg delta range: no limit, resolution 0.001%, automatic identification of capacitor, inductor and resistor.

Test current range: 10μA ~5A

Internal application of high voltage: setting voltage range: 0.5~10kV

Maximum output current: 200mA

Lifting pressure mode: continuous smooth adjustment

Voltage accuracy: $\pm(1.5\% \times \text{reading} + 10\text{V})$

Voltage resolution: 1V

Test frequency: integer frequency of 45~65Hz

49/51Hz, 45/55Hz automatic double frequency conversion

Frequency accuracy: $\pm 0.01\text{Hz}$

Apply high voltage externally: the maximum test current is 5A / 40~70Hz in the forward connection

The maximum test current during reverse wiring is 10kV / 5A / 40~70Hz

CVT self-excitation method low voltage output: output voltage 3~50V, output current 3~30A

Measurement time: about 30s, which is related to the measurement method

1.1.2 Other indicators

Input power: 220VAC, 50Hz, municipal power supply or generator power supply

Computer interface: standard RS232 interface

Printer: with its own micro thermal printer

Ambient temperature: $-10^{\circ}\text{C} \sim 50^{\circ}\text{C}$

Relative humidity: <90%, no condensation

1.2 Capacitance and dielectric loss measurement main features

1.2.1 Frequency conversion anti-interference

Using frequency conversion anti-interference technology, it can still measure accurately under 200% interference, and the test data is stable, which is suitable for anti-interference dielectric loss test in the field.

1.2.2 High-precision measurement

Using the technology of frequency fluctuation, digital waveform analysis and bridge self-calibration, the high-precision dielectric loss measurement can be achieved by combining with the high-precision three-terminal standard capacitor, and the accuracy and stability of forward/reverse connection measurement are consistent.

All range input resistance is lower than 2Ω instrument, which eliminates the influence of additional capacitance test line.

Can be externally connected to oil cup for precision insulation oil dielectric loss test,

can be externally connected to solid material measurement electrode for precision insulation material dielectric loss test.

1.2.3 Good compatibility

Automatic identification of 50Hz / 60Hz system power supply, support generator power supply, even if the frequency fluctuation is large, it can be measured normally. The built-in series and parallel dielectric loss measurement models are fully compatible with the calibration platform and dielectric loss standard, so as to facilitate instrument verification.

1.2.4 Multi-stage safety protection to ensure the safety of person and equipment

High voltage protection: short circuit, breakdown or high voltage current fluctuation, can cut off the output by short circuit.

Low voltage protection: misconnected 380V, power fluctuation or sudden power failure, start protection, it will not cause overvoltage.

Grounding protection: when the instrument is not grounded properly and the enclosure has dangerous voltage, start the grounding protection.

C V T: high voltage and current, low voltage and current four protection limits, will not damage the equipment; Incorrect menu will not output excitation voltage. No 10kV high voltage output when CVT is measured.

Anti-misoperation: two-stage power switch; Real-time voltage and current monitoring; Multiple button confirmation; Clear high/low voltage terminals; Slow speed boost, can quickly reduce the pressure, sound and light alarm.

Anti "capacitance rise" : the voltage rise effect occurs when measuring large volume test products. The instrument can automatically track the output voltage and keep the test voltage constant.

Seismic performance: the instrument adopts unique seismic design, which can withstand strong long-distance transportation vibration and turbulence without damage.

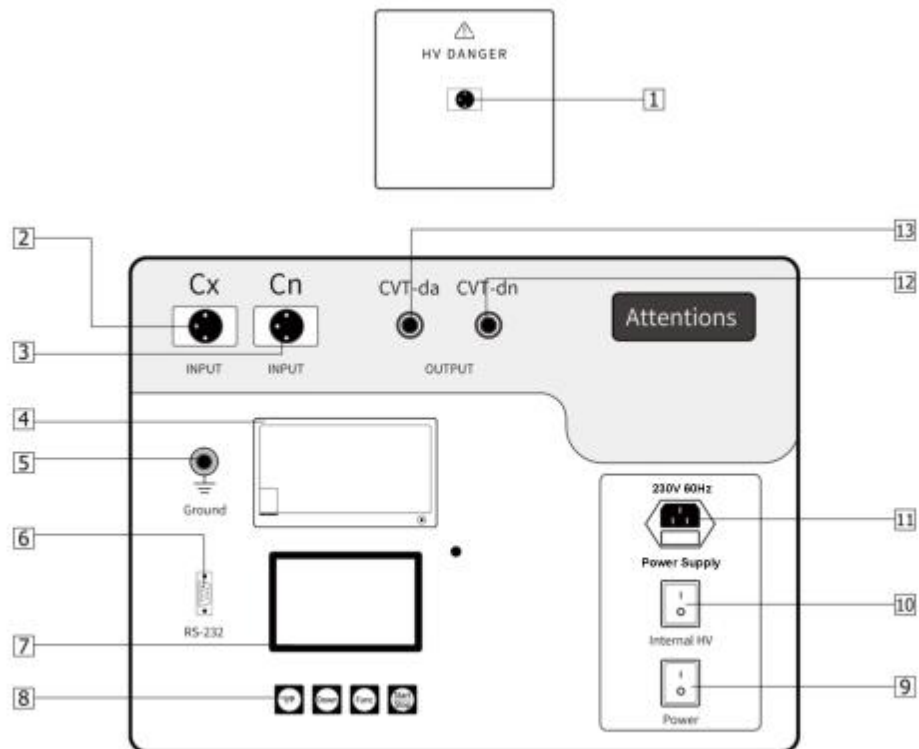
High voltage cable: it is high voltage resistant insulated conductor, which can be towed.

1.2.5 Technological breakthrough, powerful function

(1) With forward/reverse connection, internal/external standard capacitor, internal/external high voltage, multiple working modes and integrated structure, it can do all kinds of conventional dielectric loss test and insulation resistance measurement without any external auxiliary equipment.

- (2) It has external standard capacitor interface, which can automatically track the frequency of external test power supply from 40Hz to 70Hz, supports power frequency power supply and series resonant power supply to conduct large-capacity and high-voltage dielectric loss test.
- (3) It has the function of reminding the circuit of bad contact discharge, so as to determine whether the connection is reliable or not.
- (4) With CVT self-excitation measurement function, C1/C2 can be measured at the same time by wiring, and automatically compensate for the influence of bus grounding and voltage division of standard capacitor. There is no need to change the wire and connect any accessories externally, and the high-voltage connection line can drag the ground.
- (5) With the function of CVT variable ratio, CVT variable ratio, polarity and phase error can be measured.(optional)
- (6) It has anti-wiring low-voltage shielding function. Under the condition of 220kV CVT bus grounding, 10kV anti-wiring dielectric loss measurement can be carried out on C11 without disconnecting the wires, and the main and subordinate capacitors can be measured at the same time with one connection.
- (7) English text and text menu, large-screen backlight LCD display.
- (8) Equipped with thermal printer, the printing data is clear, fast and noiseless.
- (9) With calendar clock, can store 100 sets of measurement data.
- (10) With computer interface. Through this interface, measurement, data processing and report output can be achieved, and internal measurement software can be upgraded. A computer can control 32 instruments, which can be integrated into the comprehensive high-voltage test vehicle.

2. Panel Description



1. High voltage output
2. Cx input
3. Cn standard capacitor input
4. Printer
5. Ground end
6. RS232
7. Display screen
8. Function key
9. Power switch
10. Internal HV switch
11. Power supply socket
12. CVT-dn
13. CVT-da

2.1 High voltage output socket (0.5~10kV, Max. 200mA)

Function: internal high voltage output; when GST, test the current of the measured object.; The high voltage end of the internal standard capacitor.

2.2 Cx input socket (10 μ A ~ 5A)

The 4-channel models are attached Cx-A/Cx-B/Cx-C terminals.

Function: Input test current for UST.

Wiring method: The core wire (red clamp) is connected to the low-voltage signal end of the measured object during UST. If there is a shielding terminal (such as the shielding ring of the low-voltage side) at the low-voltage side of the measured object, the shielded wire (black clamp) can be connected to the shielded terminal. If there is no shielded terminal, the shielded wire (black clamp) is suspended.

Notes:

- (1) It is forbidden to unplug the plug during measurement to prevent the test electricity flowing through the human body into the ground!
- (2) When using standard dielectric (or standard capacitor) to test the UST wiring accuracy of the instrument, the fully shielded plug should be used to connect the sample, otherwise the exposed core wire will cause errors.
- (3) The Cx wire should be connected with 0 resistance at the low voltage end of the test product, otherwise it may cause errors or data fluctuations, or cause instrument protection.
- (4) When dismantling the wiring under strong interference, disconnect the connection while keeping the cable grounded to prevent inductive electric shock.

2.3 Standard capacitor input Cn socket (10 μ A~5A)

Function: Input current to the external standard capacitor

Wiring method: similar to Cx socket

- (1) When using external standard motors, fully shielded plugs should be used.
- (2) Select ExCn from the menu.
- (3) Measure the consumption value of Cx power in external standard power C and TG

δ dynamic meters.

In principle, any capacity and resource parameters entered can be used as a standard.

(4) The standard capacitor connection method is UST for both UST and GST measurements.

2.4 RS232

It can be connected to the communication port of laptop or computer. To ensure normal communication, the SAME baud rate and address are used

Note: remote control instrument should be carried out in visual range to ensure that people stay away before starting the measurement.

2.5 Grounding end

It is connected to the housing and the ground wire of the power outlet.

Notes:

(1) All measurements of the instrument shall be reliably and independently grounded, notwithstanding that the instrument has a grounding protection function

(2) Resistance grounding is 0. Check the grounding conductor carefully to avoid paint or rust. Otherwise, clean the grounding conductor. Minor bad grounding can lead to errors or data fluctuations, serious bad grounding can lead to danger!

2.6 Internal thermal printer

When the test is complete, click "Print" and all test results will be printed automatically.

2.7 Power supply switch

Turn on the power supply switch, first display the name and number of the instrument, then automatically enter the measurement menu after a few seconds. **In case of emergency, turn off this switch immediately.**

2.8 Internal high voltage switch

After this switch is turned on, the instrument will enter the measurement interface. This switch is controlled by the main power switch.

2.9 Power supply socket (180V~270V 50HZ/60HZ)

Notes:

- (1) The instrument can automatically adapt to 50Hz/60Hz power frequency.
- (2) When the generator is used for power supply, the frequency fluctuates greatly, and there is no interference when the generator is used. Select "FF" mode (fixed frequency) to eliminate the influence of generator power frequency fluctuation.

The fuse

Fuse and low-voltage power socket, specification for 5A / 250V, specification for $\phi 5 \times 20$ mm.

Note: Fuse of the same specification should be used. If the backup fuse is still blown, the instrument may be malfunctioning. Contact the manufacturer.

2.10/2.11 CVT-dn/ CVT-da

CVT self-excited low-voltage output socket (3~50V, 3~30A)

Function: a low-voltage variable-frequency excitation power supply for CVT measurement output from the socket and grounding terminal.

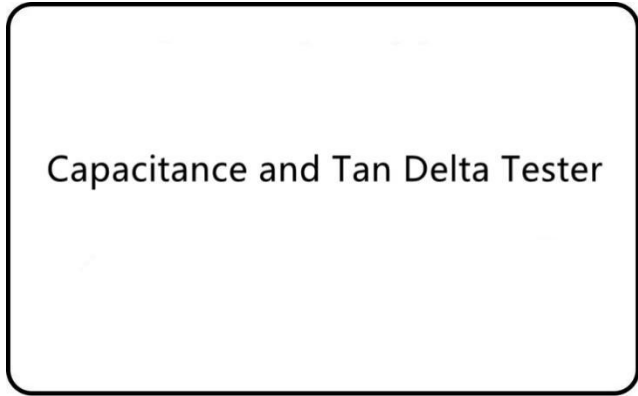
3. Instructions for the use of measuring dielectric loss and capacitance

3.1 Contrast adjustment

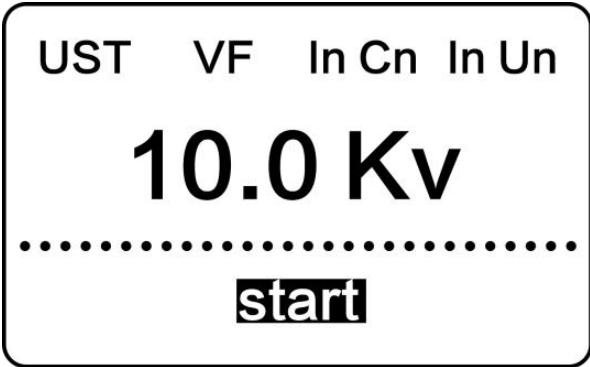
The contrast of the LCD screen has been adjusted at the factory

3.2 Enter the menu interface

When open the switch, the start screen will be on:



Then it automatically enters the menu screen. Please open the internal HV switch. Press the "start /stop" button to enter the following interface.



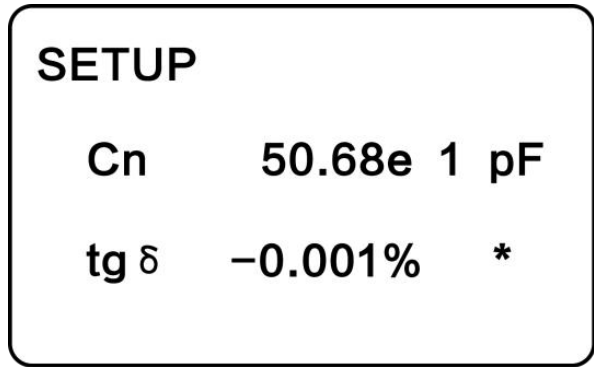
3.3 Select the mode of wiring

When the cursor is on "UST", press "up" and "down" button to select "UST", "GST", "CVT", "GSTg",

3.4 Select internal and external standard capacitors

The cursor is on (In Cn), press "up" and "down" button, select "In Cn " and "Ex Cn", this means using an internal or external standard capacitor.. Usually, internal standard capacitor can be used for UST, GST and CVT self-excited method measurement. For high voltage dielectric loss test, select "Ex Cn", and external capacitance parameters need to be input into the instrument:

Move the cursor to the "Ex CN" and hold down the "start/stop" button until the screen displays :



Move the cursor, press "up" and "down" buttons to modify the content at the cursor. After setting, press and hold the "start / stop" button until return to the measurement menu. At the same time, the parameters are saved and the data is valid.

The "*" in the lower right corner indicates that other data are not allowed to be modified. These data are factory parameters of the instrument, which will seriously affect the measurement once it is changed!

3.5 Select test frequency

3.5.1 Default frequency

The cursor on "VF" indicates 45/55Hz automatic frequency conversion. The instrument automatically measures 45Hz and 55Hz respectively, and then calculates 50Hz data without interference. This frequency mode is the default frequency mode when the instrument is powered on. Recommended.

3.5.2 Select more frequencies

"VF" is a fixed frequency, "FF" is a fixed frequency, the instrument has multiple sets of frequencies for selection, the default is frequency conversion.

3.6 Select the test high voltage


3.6.1 Select high voltage for UST/GST

Press "up" and "down" button, select test voltage. The test high voltage should be selected according to the high voltage test procedure.

3.6.2 Select high voltage and protection limit under CVT self-excitation wiring mode.

When the CVT self-excited measurement is selected. The internal HV switch must be turned on,
and the excitation voltage is output from the inside of the instrument, which is output by “CVT-da” and “CVT-dn” .

3.7 Automatic printing

When the cursor is on “10KV”, press the “start /stop” button to display or cancel the printer icon. This icon  indicates that the printer will print automatically after the measurement.

3.8 Start test

Press "start/stop" for 2 seconds to start

Alarm will be started after starting the test;The progress bar indicates 0% ~ 99% of the measurement progress.

During the measurement, press the “start /stop” button to cancel the measurement. In case of emergency, turn off the main power supply immediately.

3.9 Query test data

After displaying the results, press the "up" and "down" buttons to view other data, and press the "Print" button to print data.

Automatic identification of capacitance, inductance and resistance measured objects: capacitive measured object is shown Cx and $Tg \delta$; Inductive measured object is shown as LX and Q; Resistance type samples show RX and additional CX or LX. Automatically select and display units of measurement.

Measured object	Data	Note
capacitance	Cx, $tg\delta$, U, I, Φ , P, F, t	$ tg\delta > 1$ shows capacitance and series/parallel resistance.
inductance	Lx, Q, U, I, Φ , P, F, t	$ Q < 1$ shows inductance and series resistance.
resistance	Cx(Lx), Rx, U, I, Φ , P, F, t	

CVT self-excited method	C1, $\text{tg}\delta$, C2, $\text{tg}\delta$, U1, U2, F, t	C1 connected to Cx and C2 connected to HV. U1 is the voltage when C1 is measured, and U2 is the voltage when C2 is measured.
CVT ratio	κ , Φ , F, t, U, I, Cx, $\text{tg}\delta$	Cx and $\text{tg}\delta$ are the result of the high voltage terminal GST wiring..

Cx: The capacity of the measured object [1 μ F =1000nF nF / 1nF=1000pF],

Tg δ : delta dielectric loss factor [1%=0.01]

Lx: Inductance of the measured object [1MH =1000kH / 1kH=1000H]

Q: quality factor [no units]

Rx: Resistance of the measured object [1M Ω =1000k Ω / 1k Ω =1000 Ω]

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

I: current [1A=1000mA / 1mA=1000 μ A]

K: When test CVT, the ratio of primary voltage to secondary voltage

Φ : Phase that the voltage (0°) lag current [$^\circ$]

P: Dissipation power [1kW=1000W / 1W=1000mW]

F: frequency [Hz], the set frequency displays the actual frequency, and the automatic frequency conversion mode displays the average frequency

T :temperature [$^\circ$ C], Measured by a sensor in the instrument, the error may be large due to the influence of heating of the instrument.The instrument displays data without temperature conversion.

Frequency: 50HZ1: 45-55HZ

50HZ2:49-51HZ

50HZ3:47.5-52.5HZ

60HZ1:55-65

60HZ2:59-61HZ

Displays "over" indicates that the measured data is out of range.

3.10 Connect to the computer

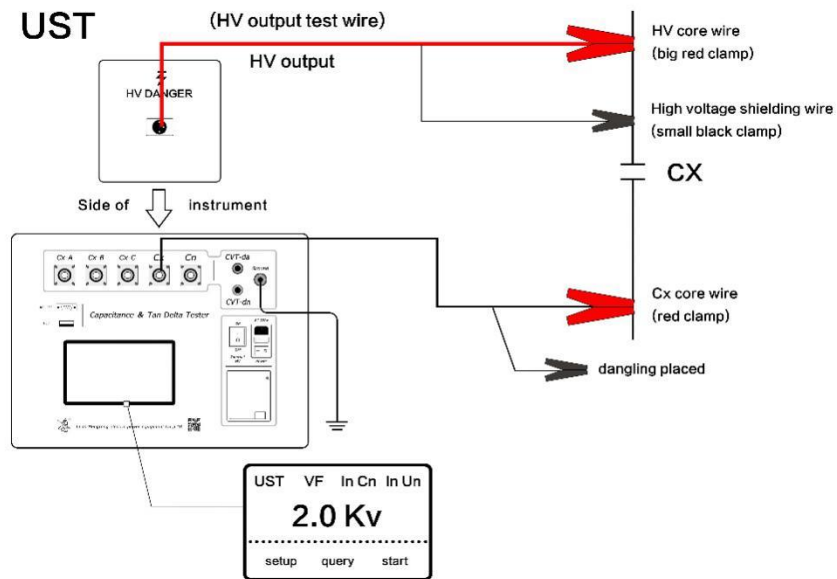
After connecting the computer, the equipment can be controlled by the computer.

3.11 Test Mode

3.11.1 UST internal reference、internal HV

When applying internal high voltage, the core wire (red clip) and shield (black clip) of the high voltage wire should be connected with the high voltage end of the test product.

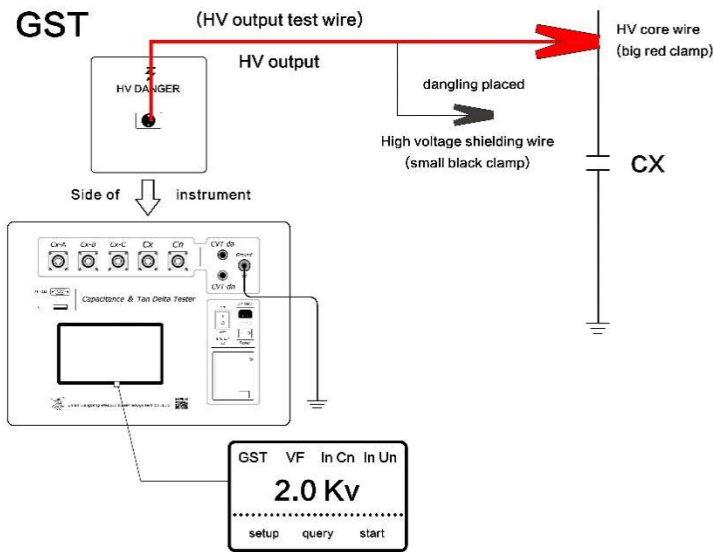
If only the core wire is pressurized, the core wire resistance is large, which may cause additional dielectric loss. If a double-shielded high-voltage wire with an earthing shield is used, the earthing shield must be grounded. The black clip of the Cx line is equivalent to ground. The black clip can be connected to the low voltage shielding pole of the sample. The black clip can be suspended when there is no shielding pole.



3.11.2 GST internal reference、internal HV

High voltage output wire, high voltage core wire (big red clip, high voltage shielding wire (small black clip), screen selection, setting, view, start.

Connect the high voltage end of the sample with high voltage core wire (red clip). The high voltage shield (black clip) is used to connect the high voltage shield, especially to shield the shunt branch, as shown in the figure C1/C2. No shielding required, black clip suspended.



3.11.3 CVT self-excited method

It is strongly recommended to use the high voltage cable of high voltage socket with black Cx wire and hang in the air, big red clip, high voltage shielding wire (small black clip), high voltage core wire (big red clip), disconnect, screen selection, positive connection, frequency conversion, external Cn, external Un, setting, view, start, bus, if C1 is a single saving capacity, the bus cannot be grounded. If C1 is multi-saving capacity, the bus can be grounded, C11 and C12 can be measured by conventional positive and negative wiring, and C13 and C2 can be measured by self-excitation method.

The high-voltage core wire is connected to the C2 end J, and the Cx core wire is connected to the C12 upper end. Do not connect Cx to C2, high voltage wire to C12, the data error is larger.

Whether the bus is grounded does not affect the measurement. However, when there is only one C1 in the upper part of CVT, the bus 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 the ground. They can be connected to any secondary winding of CVT, and there is no

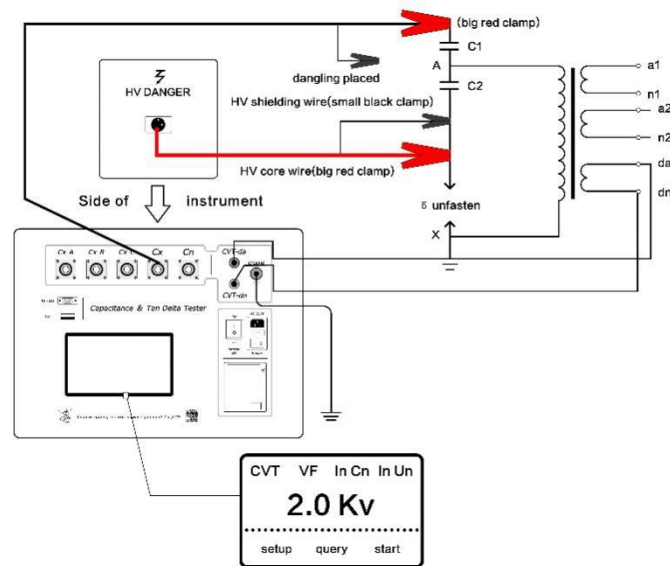
polarity requirement.

Press the "start and stop" button at the position of "3kV" to set the protection limit. It is recommended to set high voltage 3kV/200mA and low voltage 20V/10A.

Two results are obtained from a single measurement: C1 is the data of C11, and C2 is the data of C2.

When CVT self-excitation method, the measuring line of the old instrument should be suspended for use. If the instrument is equipped with a special yellow CVT wire, it can be used to mop the floor, but the yellow line data should be manually calibrated regularly and put into the instrument; The new instrument can automatically calibrate the impact of the measuring line without suspension.

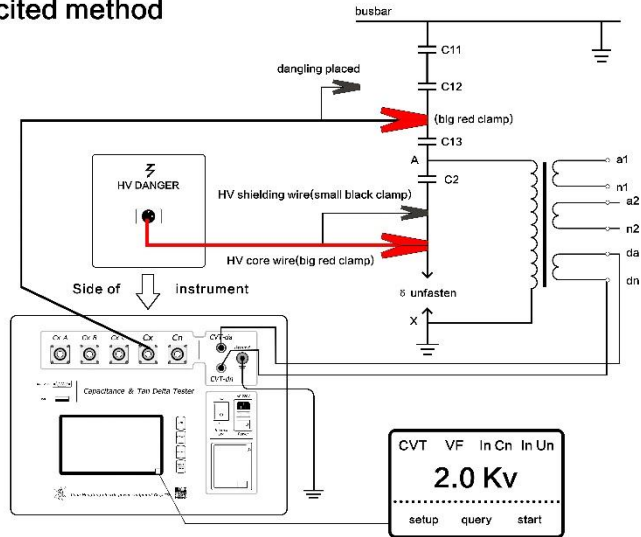
CVT self-excited method



CVT self-excited method

Tips:

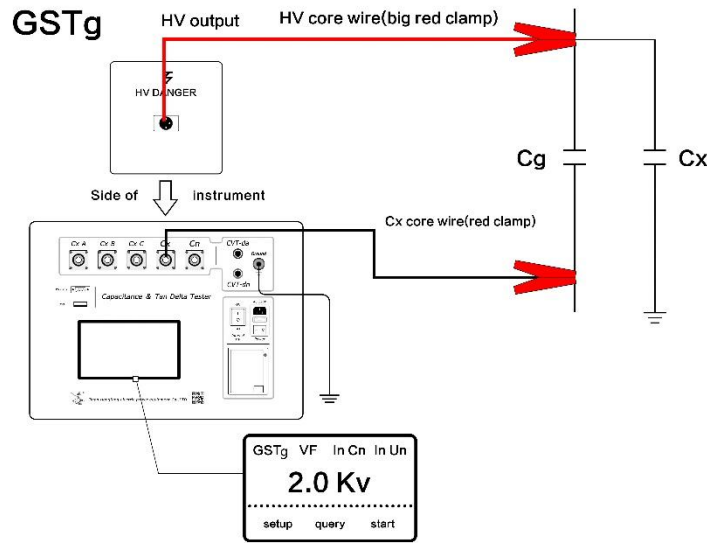
- 1.If C1 is a one-section capacitance, the busbar is not grounded.
- 2.If C1 is a multi-section capacitance, the busbar can be grounded.
- 3.C11 and C12 can be measured with conventional UST and GST.
- 4.C13 and C2 are measured by CVT self-excited method.



3.11.4 GSTg

Start the GSTg function. Choose "GSTg:mode,The low-voltage terminal of the capacitor that needs to be shielded cannot withstand high voltage, and the 10kV high-voltage shield with conventional reverse wiring cannot be used, so the reverse wiring low-voltage shield can only be used.

Application: under the condition of 220kV CVT bus grounding, C11 can be measured by 10kV reverse wiring dielectric loss without disconnection. As shown in the figure below: the busbar is grounded, the upper end of C11 is not disassembled, the lower end of C11 is connected to the high-voltage core wire, and the end of C2 J and X are connected to the Cx core wire. In this way, C12 and C2 are shielded by low voltage, and C11 is measured by "reverse wiring /10kV/M" measurement method.



4. Precautions for field test

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

4.1 Bad hook contact

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.

4.2 Poor ground 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!

4.3 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 cause negative dielectric loss, so the self-excitation method should be used instead.

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 terminal block. It can

also be measured by conventional method or terminal pressure method。

4.4 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, please refer to the relevant regulations。

4.5 Generator power supply

The input frequency is unstable when the generator is powered, it can work in the fixed frequency 50Hz mode。

4.6 Test Line

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

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;

When measuring CVT by self-excitation method, the non-dedicated high-voltage line should be suspended in the air, otherwise the additional stray capacitance and dielectric loss to the ground will cause measurement errors。

4.7 Working mode selection

Please select the correct measurement mode (positive, negative and CVT) after connecting the wire, no error can be selected. Especially in the interference environment, the frequency conversion anti-interference mode should be selected.

4.8 Influence of test method.

Since the dielectric loss measurement is greatly affected by the test method, it should be distinguished whether it is the error of the test method or the error of the instrument. When there is a problem, you can first check the wiring, and then check whether it is an instrument failure。

4.9 Instrument failure

Use a multimeter to measure whether the test line is open, or whether the core wire and the shield are short-circuited; the input power 220V is too high or too low; whether the grounding is good.

Use positive and negative wiring to test a standard capacitor or a capacitor sample

with a known capacity and dielectric loss. If the result is correct, you can judge that the instrument has no problem;

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

After starting the CVT measurement, measure the low-voltage output, and a voltage of 2~5V should appear, otherwise the instrument will malfunction.

5.Anti-interference ability

Set up a loop to inject a quantitative interference current into the instrument.

Note:

- 1) It should be considered that the circuit may become part of the test product.
- 2) After the instrument is started, the 220V power supply circuit will have a measurement frequency component. If the frequency component enters the instrument through the interference current, the anti-interference ability of the instrument cannot be tested.
- 3) It is not recommended to use adjacent high-voltage conductors to impose interference, because it is easy to produce short-distance tip discharge, this kind of discharge resistance is non-linear, and it is easy to produce co-frequency interference.

6.Frequencyconversionmeasurementdiscussion

6.1 Frequency conversion measurement

When the interference is very serious, the frequency conversion measurement can get accurate and reliable results. For example, when 55Hz is used for measurement, the measurement system only allows 55Hz signals to pass, and 50Hz interference signals are effectively suppressed. The reason is that the measurement system can easily distinguish different frequencies. The following simple calculations can illustrate the effect of frequency selective measurement.:

Two sine waves with a frequency difference of 1 time are superimposed together. The high frequency is interference, and the amplitude is 10 times that of the low frequency.:

$$Y=1.234\sin(x+5.678^{\circ})+12.34\sin(2x+87.65^{\circ})$$

Get 4 measured values at $x=0/90/180/270^\circ$ $Y_0=12.4517$, $Y_1= -11.1017$, $Y_2=12.2075$,
 $Y_3= -13.5576$,

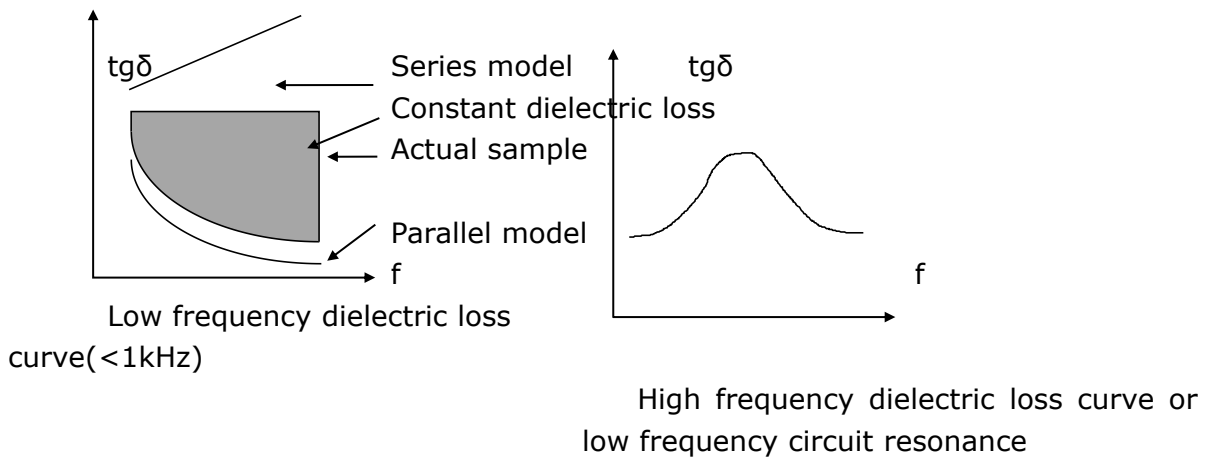
Calculate $A=Y_1-Y_3=2.4559$, $B=Y_0-Y_2=0.2442$, then:

$$\varphi = \text{tg}^{-1}(B/A) = 5.678^\circ \quad V = \sqrt{A^2 + B^2} / 2 = 1.234$$

This is just the phase and amplitude of the low frequency part, and the interference is suppressed. The actual waveform measurement points are as many as tens of thousands, and the calculation amount is very large. The result reflects the overall characteristics of the waveform.

6.2 The relationship between frequency and dielectric loss

Dielectric loss has two ideal models of RC series and parallel: series model $\text{tg } \delta = 2\pi fRC$, parallel model $\text{tg } \delta = 1/(2\pi fRC)$, $\text{tg } \delta$ is proportional and inversely proportional to frequency f , respectively. As shown in the figure, f has a greater impact on the two models, fully proportional and fully inversely proportional. But the actual capacitor is a mixed model of multiple models interlaced, at this time the influence of f is small.



6.3 Automatic frequency conversion is equivalent to 50Hz

The instrument uses automatic frequency conversion to measure one point on each side of the interference frequency of 50 Hz (45 Hz and 55 Hz), and then calculate the data at the frequency of 50 Hz. Except for the low-frequency resonance of multiple component circuits, the medium in a single sample cannot cause an energy absorption peak at low frequencies, and the dielectric loss near the power frequency always changes monotonously with frequency. Therefore, this measurement method will not bring significant errors. In fact, the two dielectric loss values before averaging are very close, even if they are not average, they have full reference value. At present, the frequency conversion dielectric loss meter has become a conventional instrument for

dielectric loss measurement, and its excellent anti-interference ability and accuracy have been recognized.

Scope of supply

- | | |
|-----------------------------------|--|
| (1) Instrument host | (2) Instruction manual and product certificate |
| (3) Dedicated test cable | (4) Power cord and grounding wire |
| (5) Spare printing paper and fuse | (6) See "Packing List" for details |

