GD6800

Capacitance & Tan Delta Tester

Cautions

- This instrument can be used only on equipment after cutting power.
- The instrument is equipped with a voltage booster. Insulation condition of HV lead and personal safety must be noted.
- Insulation of test object must be tested before the dielectric loss test.
- Make sure that the instrument has been grounded well before test.
- Choose the proper rated voltage, according to withstand voltage level of test object, to avoid breakdown.
- Although the HV cable for the instrument has been examined to be qualified before delivery, it still should be kept far away from human body during the test.
- The input voltage shall be AC220V±10%, and any excess might affect the test precision.
- The maximum input voltage is AC264V, while any excess would cause permanent damage without warranty.
- The printer might have paper jam in printing due to loose coil paper during transporting.
- The instrument should be kept away from moisture and violent shock.
- If power is to be supplied by a generator, please make sure that the neutral line has been grounded well. Otherwise, erroneous earthing will be prompted.

Warranty

The warranty period for this series is one year from the date of shipment. Please refer to your invoice or shipping documents to determine appropriate warranty dates. HV Hipot corporation warrants to the original purchaser that this product will be free from defects in material and workmanship under normal use. Throughout the warranty period, provide that such defects are not determined by HV Hipot to have been caused by abuse, misuse, alteration, improper installation, neglect or adverse environmental condition, HV Hipot is

limited solely to repair or replacement of this instrument during the warranty period.

Packing List

Main unit	1pc
Accessory case	1 pc
HV test lead	1 pc
LV test lead	1 pc
Power cord	1 pc
CVT Connecting lead	1 pc
Ground lead	1 pc
Print paper	1 roll
Fuse	2 pcs
User's Guide	1 pc
Factory Test report	1 pc

HV Hipot Electric Co., Ltd. has strictly and carefully proofread the manual, but we can not guarantee that there are no errors and omissions completely in the manual.

HV Hipot Electric Co., Ltd. is committed to making continuous improvement in product functions, and improving service quality, so the company remains the right to change any products and software programs described in this manual as well as the content of this manual without prior notice.

I. General information

GD6800 measures the capacitance and dielectric loss factor (tgδ) of high voltage electric equipment. It is integrated structure, built-in dielectric loss test bridge, variable frequency adjustable power supply, boosting transformer and SF6 standard capacitor.

It can test grounded equipment, ungrounded equipment, completely-sealed CVT (Capacitive Voltage Transformer), if adding a insulation cup and temperature control device, dielectric loss of insulating oil can be tested.

High voltage source is generated by internal inverter of the instrument, which is used for testing test object after transformer boost. The frequency can be changed to 50Hz, 47.5Hz/52.5Hz, 45Hz/55Hz, 60Hz, 57.5Hz/62.5Hz, 55Hz/65Hz. The digital notch technique is adopted to avoid the interference of the power frequency electric field to the test and fundamentally solve the problem of accurate measurement under the interference of strong electric field. At the same time, it is applicable to the detection occasions with generator after power failure.

II. Features

- Touch LCD screen display.
- Calendar chip and large storage inside. Save testing result according to time order, check history record and print the result.
- The instrument data can be exported through U disk and can be used to view and manage the data through the software on PC.
- Multiple testing mode, with modes of internal high voltage, external high voltage, internal standard, external standard, GST/UST, self-excitation. High voltage (more than 10kV) dielectric loss test can be made in the situation of external standard outside high voltage.
- Test full sealed CVT (Capacitive Voltage Transformer) C_1 and C_2 dielectric loss and capacitance at the same time. Also test CVT transformation ratio and voltage angle difference.
- No need to dismantle cable to measure dielectric loss and capacitance of CVT.
- The dielectric loss and capacitance value of C0 in the upper end of CVT can be measured by using the reverse shielding method.
- High speed sampling signal. Inverter and sampling circuit inside are digitized controlled. Output voltage is adjusted continuously.
- LCR automatic measurement. Inductance, capacitance, resistance can be

measured and displayed.

- Multiple protection of input voltage fluctuation, output short circuit, over-voltage, over-current, temperature, secure and reliable. Meanwhile, it has the function of grounding testing, that voltage boost is not permitted for non-grounding equipment.
- Frequency can be changed into 50Hz, 47.5Hz/52.5Hz, 45Hz/55Hz, 60Hz, 57.5Hz/62.5Hz, 55Hz/65Hz.

III. Abbreviations

Followings are meanings of abbreviations that may appear on interfaces of the instrument.

Int**.** ……Internal

Ext**.** .....External

Freq.....Interference Frequency

IV. Specifications

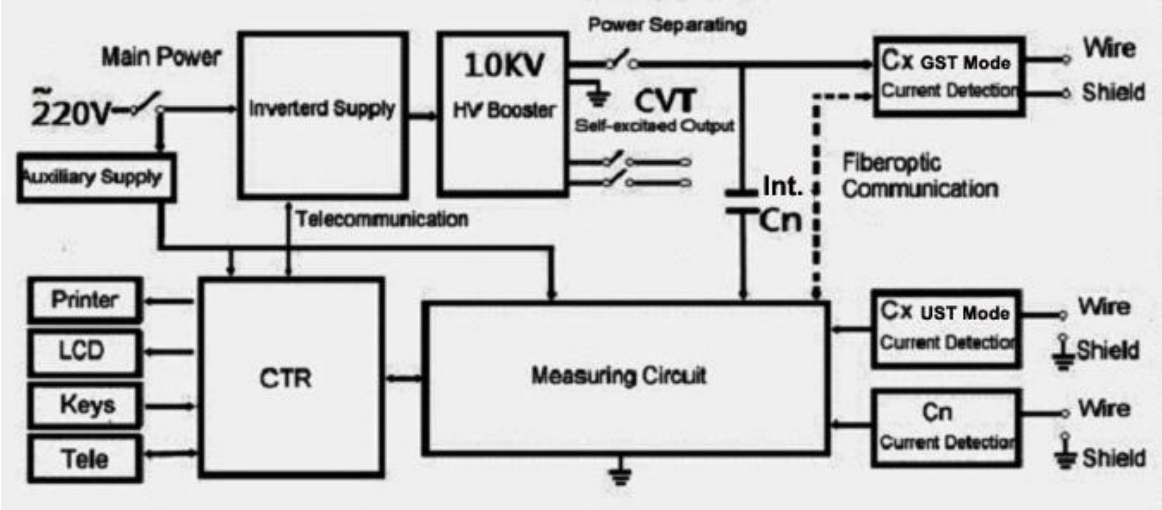
Working condition	-15℃~40℃	RH<80%
Anti-interference principle	Frequency conversion	
Power supply	AC 220V±10%	Generator can be used.
High voltage output	0.5KV~10KV	Every 0.1kV
	Accuracy	2%
	Max. current	200mA
	Capacity	2000VA
Self-excitation power	AC 0V~50V/15A	45HZ/55HZ 47.5HZ/52.5HZ 55HZ/65HZ 57.5HZ/62.5HZ
Resolution	tgδ: 0.001%	Cx: 0.001pF
Accuracy	∆tgδ: ±(reading*1.0%+0.040%)	
	∆C x: ±(reading*1.0%+1.00PF)	
Measurement range	tgδ	Without limit

	C x	15pF < Cx < 300nF		
		10KV	Cx < 60 nF	
		5KV	Cx < 150 nF	
		1KV	Cx < 300 nF	
	CVT test		Cx < 300 nF	
LCR measurement range	L>20H(2kV)		R>10KΩ(2kV)	
LCR measurement accuracy	0.1%	Angle resolution		0.01
CVT ratio range	10~10000			
CVT ratio accuracy	0.1%			
CVT ratio resolution	0.01			
Dimension	Main unit: 350(L)×270(W)×270(H)			
	Accessory box: 350(L)×270(W)×160(H)			
Memory capacity	200 groups, USB flash disk storage is supported.			
Weight	Main unit: 23.5Kg			
	Accessory box: 5.25Kg			

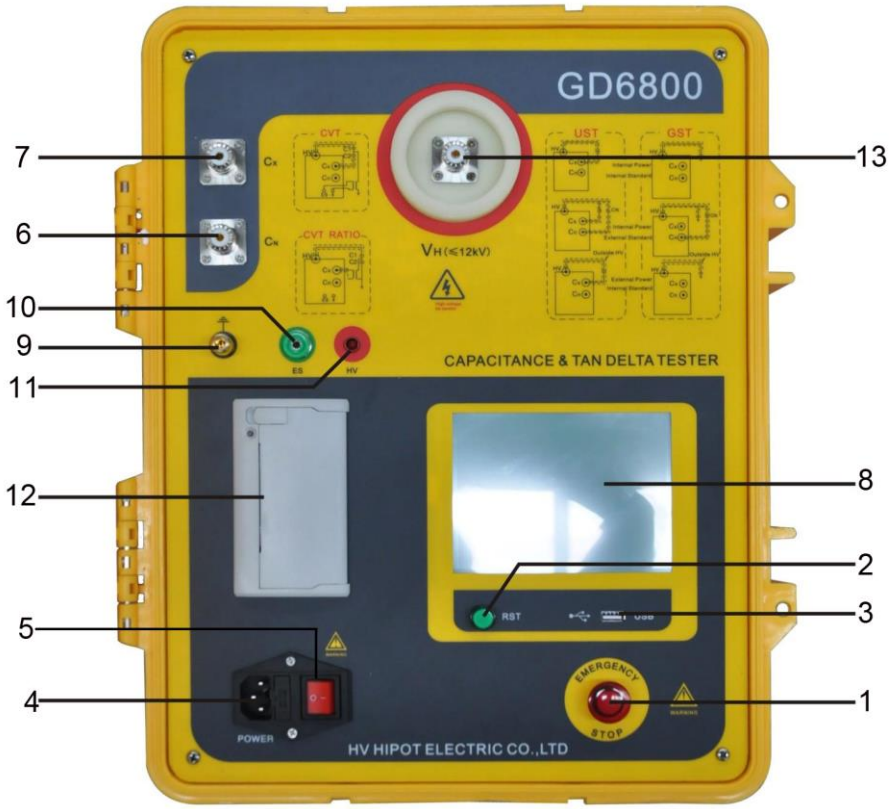
V. Working Principle

Under AC voltage, the dielectric dissipates a part of electric energy, which is called Dielectric Loss. Between the voltage and current of the dielectric, there is phase difference (Φ). The complementary angle of Φ is tgδ, which is called Dielectric Loss Angle, and tgδ is called Dielectric Loss Factor which is used to evaluate dielectric loss.

The circuit of measuring tgδ is as following, where Cn is the standard capacitor, and Cx is the test object.



VI. Panel Instruction



1	Emergency Stop button with High Voltage Indicator
2	Reset
3	USB interface
4	Power socket
5	Power switch

6	Cn: Input socket for standard capacitor
7	Cx: Input socket for test object
8	Touch LCD screen
9	Ground terminal
10	ES self-excitation output
11	High voltage indicator
12	Printer
13	HV output socket

1. Emergency Stop and High Voltage Indicator
During testing, press this button to cut off HV output in any emergency situation. It will also flash when there is high voltage boosting.

2. Reset

It has reset function.

3. USB interface

The test data saved inside the instrument can be imported and saved to the U disk.

Note: During the data transmission process, it is forbidden to pull out the U disk. Only after the data transmission is completed and the tips for pulling out the U disk is displayed on the LCD screen, then the U disk can be pulled out. Otherwise, the U disk may be burned.

4. Power socket
Connect the socket to power supply or the generator.

Note*:* There are protection fuses inside the socket. Under abnormal circumstances, it will burn the fuse to ensure that the instrument is cut off and protect the internal of instrument.

5. Power switch
Switch it on to start the instrument. If any emergency, please switch it off and pluck the input power cord.

6. Cn socket (Standard capacitor input)
Function: External standard test signal.
Wiring method: In external standard testing mode, the core of cable should be connected with test terminal of standard capacitor, the shielding layer of cable is connected with shaded pole of standard capacitor. Whatever in UST or GST

mode, wiring method of standard capacitor is the same. This method is used to connect external high voltage standard capacitor to realize dielectric loss measurement at high voltage level.

7. Cx socket (Test Object Low voltage input)

Function: Input testing signal of test object in UST Mode.

Wiring method: The core of socket should be connected with core of black signal wire, and the metal shell of socket should be connected with the shielding layer of black signal wire. Under UST mode, core of black signal wire is connected to LV signal terminal of test object. If there is shaded pole (such as the shielding ring at LV side), the shielding layer of black signal wire should be connected with shaded pole. If there is no shield pole, the shielding layer should be hang in air.

Cautions：

- It is strongly prohibited to pluck off the plug during the test, in case that an electric shock may occur due to the current applied on test object.
- When using standard capacitor to test the accuracy of UST connection, it should be connected by the shielded plug, otherwise the testing result might be inaccurate due to interference.
- During test, make sure that the core wire of the testing lead is connected to the zero resistance at LV side of the test object, otherwise the test data might be unstable.
- If disconnecting the wires in high interference condition, please keep the wires grounded in order to avoid electric shock.

8. Touch LCD screen

120mm*90mm LCD screen with English menu. Each operation is clear.

9. Ground terminal

Function: Used for protective grounding.

Note: The instrument is equipped with grounding protection device. If it is not grounded well, test cannot be proceeded.

10. ES self-excitation

Function: Self-excitation output, the internal of the instrument is one end of a self-excitation output transformer(the other end of the transformer has been grounded), when uses self-excitation method to test the CVT dielectric loss and is connected to the self-excitation coil (da), and dn is grounded to provide HV power supply for the CVT measurement.

Note: The current is very high at low voltage output. It should be well-connected to secondary winding of CVT, using the original wire for this

equipment. When measuring with UST and GST modes, self-excitation output is closed.

11. High voltage indicator

When there is a high voltage output during the instrument test, the high voltage indicator lights up.

12. Printer

It's an automatic thermal printer. Please use special paper for thermal printer of 55mm width.

13. HV output socket

When using UST connection, both the core and the shielding layer of HV socket can output high voltage to the HV terminal of test object. but only the core of HV socket can output high voltage when using GST connection, and if there is a shaded pole in the HV terminal of test object (such as a shielding ring on the HV terminal), then the shielding layer of HV socket should be connected to shaded pole of test object. The shielding layer can be hanged in the air if not use.

 ***Caution:*** It is dangerous to touch the socket and relevant equipment during testing.

When using standard dielectric loss or standard capacitor to test UST connection accuracy, shielded plug is used to connect dielectric loss device or standard capacitor, which will protect the exposed core from interference. During the testing process, it is necessary to ensure that the red core wire of the socket center is connected to the high voltage end of the tested product with zero resistance, otherwise, it may cause the data fluctuation of the measurement result.

VII. Operation

1. Main Menu

Switch on the power, and LCD displays main menu as in below Fig. 7-1.
Select corresponding item to measure.

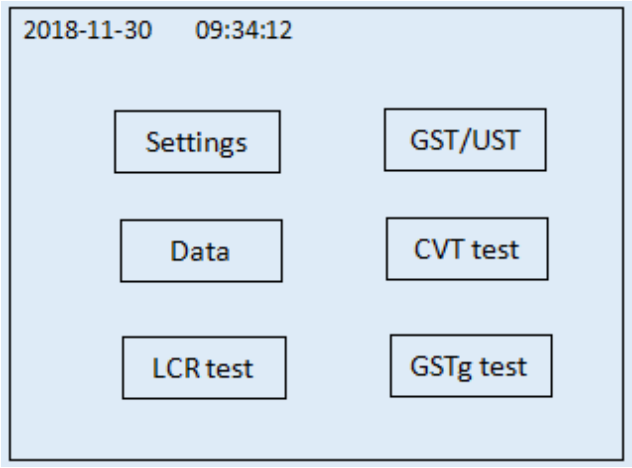


Fig. 7-1

2. General Test

Before test, please connect the instrument with the tested object correctly according to wiring diagram. Press "UST/GST" to enter the sub-menu as shown in Fig. 7-2.

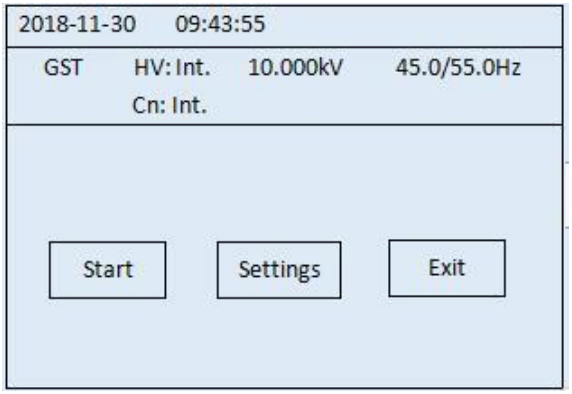


Fig. 7-2

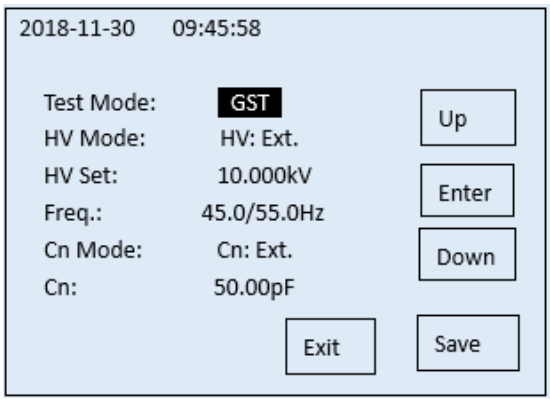


Fig. 7-3

Before choosing "Start", please set Voltage and Mode according to test requirements. Press “Settings” to set the parameters (shown in Fig. 7-3).

When the setting is done, press Exit to return to previous menu and choose "Save" to save parameters.

After setting, press “Start” for few seconds and it will enter into Test Menu. The voltage will be increased to setting value and then test is started automatically, the frequency is automatically converted to the corresponding frequency according to the selected test frequency. After testing, the test result will be displayed and saved automatically, shown as figure 7-4. Press Print to print the result.

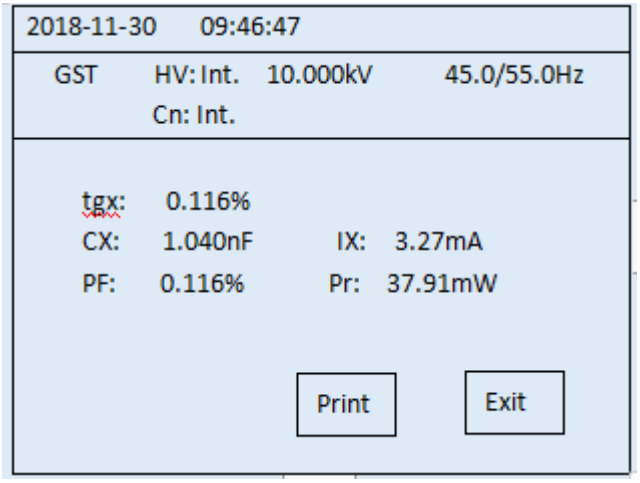


Fig. 7-4

3. CVT Test

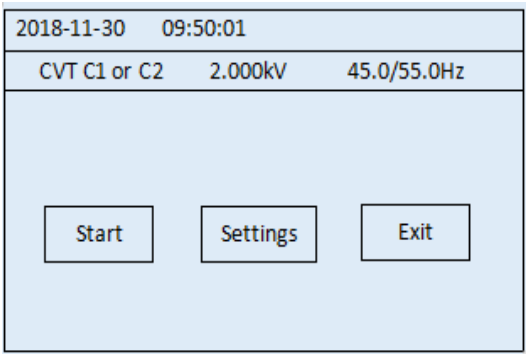


Fig. 7-5

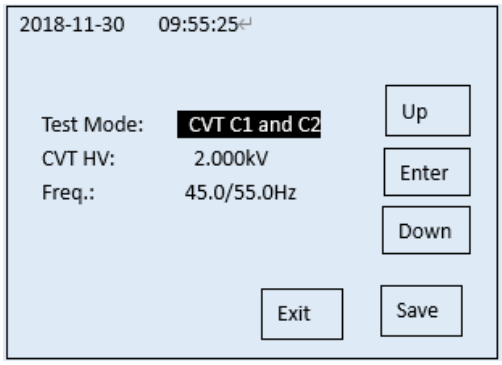


Fig. 7-6

Test methods include CVT C1 or C2, CVT C1 and C2 and CVT ratio.
CVT C1 or C2: test C1 or C2 separately.
CVT C1 and C2: test C1 and C2 at the same time.
CVT ratio: test CVT voltage transformer ratio

1) CVT C1 or C2 Test

Firstly, connect the wires of instrument well according to wiring diagram. Turn on power and select the "CVT Test" item on the main interface, to enter into the next menu, shown as Fig.7-5. Click on each item that needs to be set, and click "Up", "Down" or "Sel." to modify it. After the modification is completed, click "Save" to save the modified parameters and return to the CVT test interface. Click "Exit" and do not save and return to the CVT test interface.

After setting, press “Start” for few seconds and it will enter into Test Menu, shown as figure 7-7. The voltage will be increased to setting value and then test is started automatically, the frequency is automatically converted to the corresponding frequency according to the selected test frequency. After testing,

the test result will be displayed and saved automatically, shown as figure 7-8. Press Print to print the result.

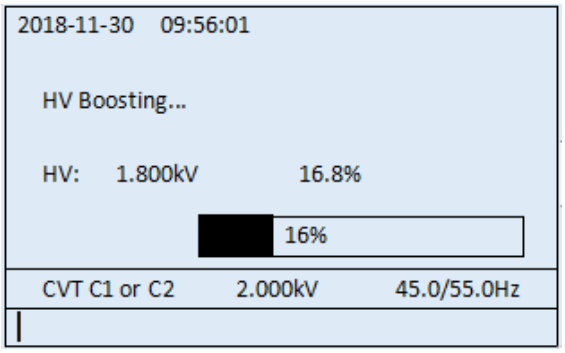


Fig. 7-7

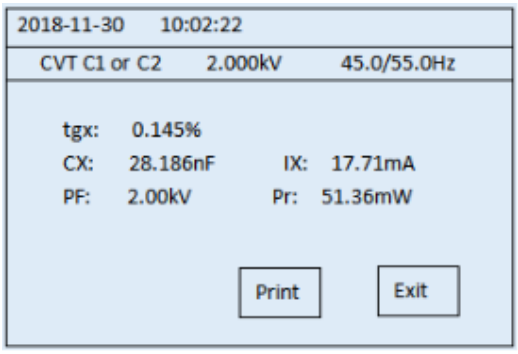


Fig. 7-8

2) CVT C1 and C2 Test

Firstly, connect the wires of instrument well according to wiring diagram. Select the "CVT Test" item on the main interface, to enter into the next menu, shown as Fig.7-5. Then click "Parameter Settings" to enter the settings menu (Figure 7-9) for detailed test parameter settings. Click on each item that needs to be set, and click "Up", "Down" or "Sel." to modify it. After the modification is completed, click "Save" to save the modified parameters and return to the CVT test interface. Click "Exit" and do not save and return to the CVT test interface.

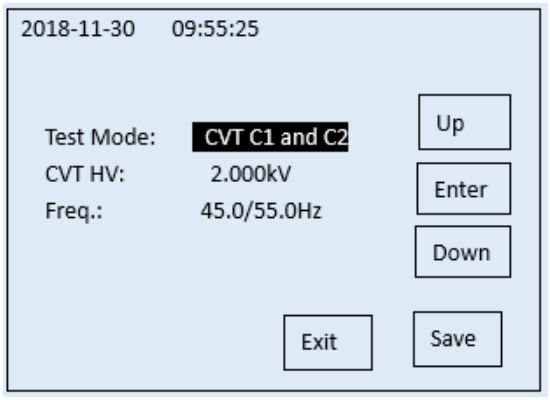


Fig. 7-9

After setting, press “Start” for few seconds and it will enter into Test Menu, shown as figure 7-10. The voltage will be increased to setting value and then test is started automatically, the frequency is automatically converted to the corresponding frequency according to the selected test frequency. After testing, the test result will be displayed and saved automatically, shown as figure 7-11. Press Print to print the result.

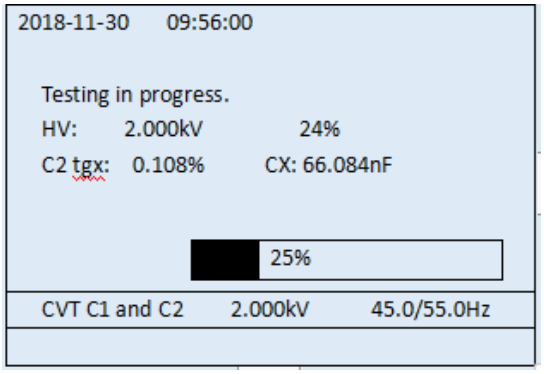


Fig. 7-10

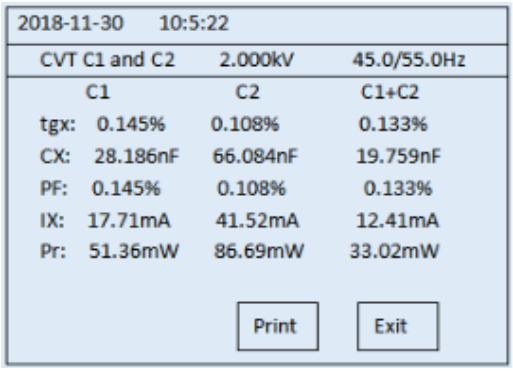


Fig. 7-11

3) CVT ratio test

Firstly, connect the external wires of instrument well according to wiring diagram, enter the CVT test menu, select “CVT ratio” (see figure 7-12) in the parameter setting, and then return to the start test interface (Figure 7-13). Press "Start" for a few seconds to start the measurement (Figure 7-14). After the test is completed, the test result is automatically displayed (Figure 7-15). The test results are automatically saved. Click the "Print" button to print the test results.

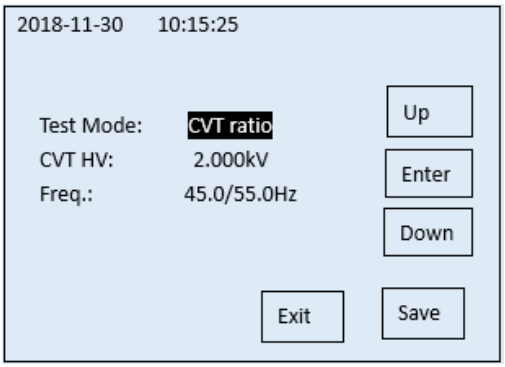


Fig. 7-12

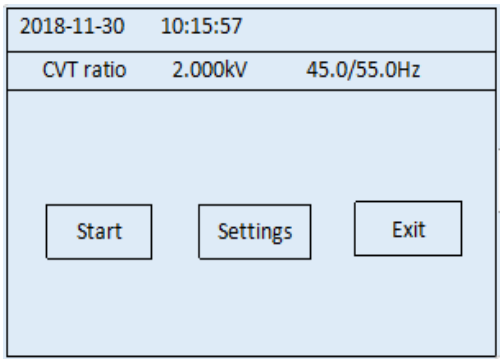


Fig. 7-13

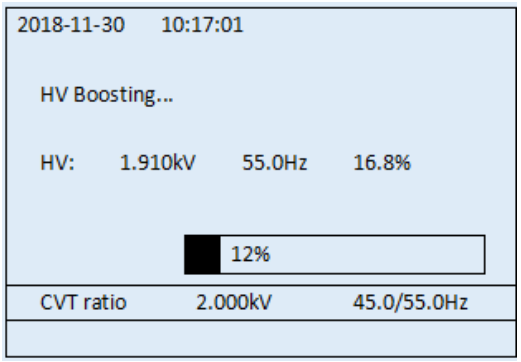


Fig. 7-14

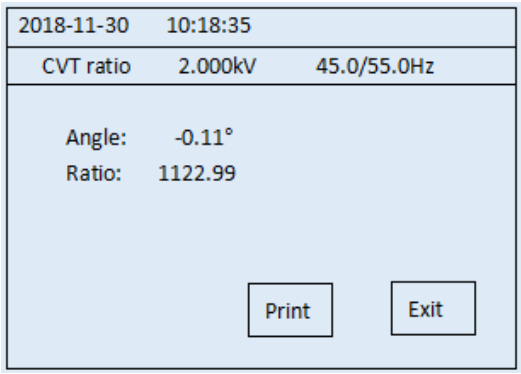


Fig. 7-15

4. GSTg Test

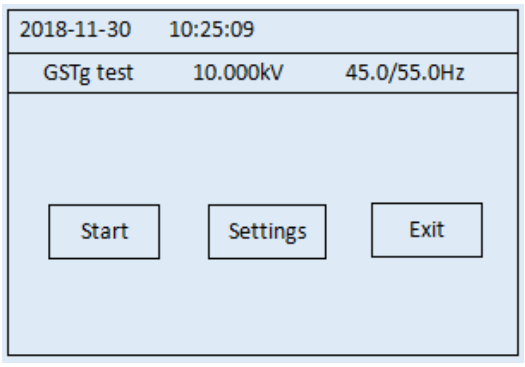


Fig. 7-16

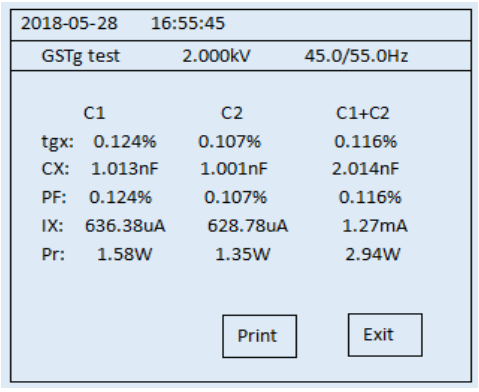


Fig. 7-17

Firstly, connect the external wires of instrument well according to wiring diagram, enter the GSTg test menu, select the high voltage voltage that needs to be tested in the parameter setting, and then save and return (see Figure 7-16), and press "Start" for a few seconds to start measurement, and automatically display the test results after the test is completed (see Figure 7-17). The test results can be saved automatically.

5. LCR Test

Firstly, connect the external wires of instrument well according to wiring diagram, enter the LCR menu test items through the main menu, select the high voltage to be tested and the test connection (as general test) in the parameter settings, then save and return (see Figure 7-18), and press "Start" for a few seconds to start measurement, and automatically display the test results after the test is completed (see Figure 7-19). The test results can be saved automatically. Click the "Print" button to print the test results.

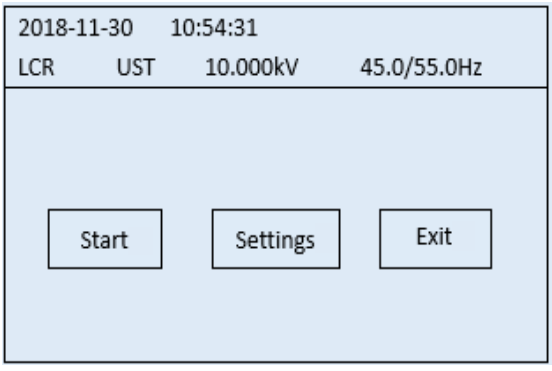


Fig. 7-18

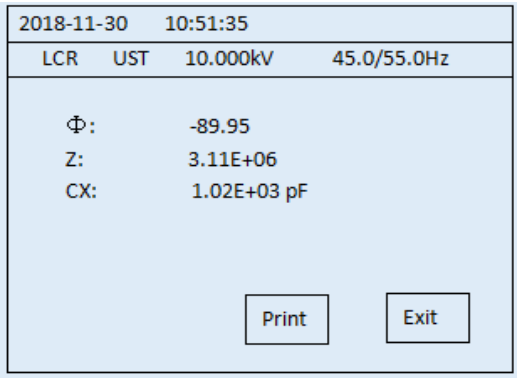


Fig. 7-19

6. Parameter Settings

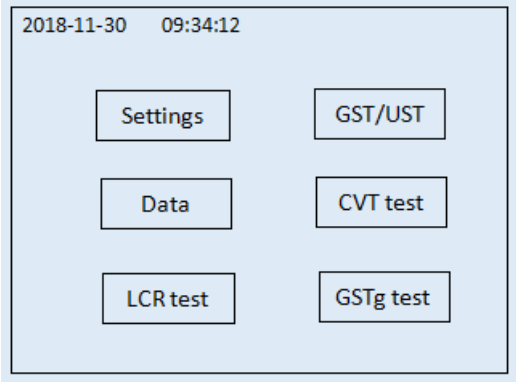


Fig. 7-20

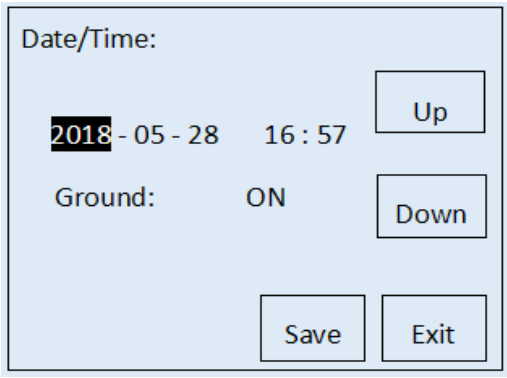


Fig. 7-21

Time settings: after opening the instrument, click the "Settings" (Figure 7-20) directly into the time setting interface. After entering the time menu (see Figure 7-21), click on the time data item that need to modify, then adjust the corresponding "time", "minute", "second" by Up and Down key, and then click "Save" to save time settings, click " Exit" to exit settings and return to the main interface.

If all steps are not set properly or need to change again, users can press the exit key to return to the previous step. If press the exit key cannot be returned. Users can press the reset key directly to the main menu and reset the settings.

7. Data Viewing

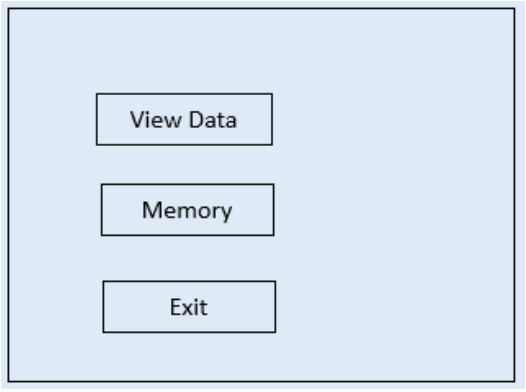


Fig. 7-22

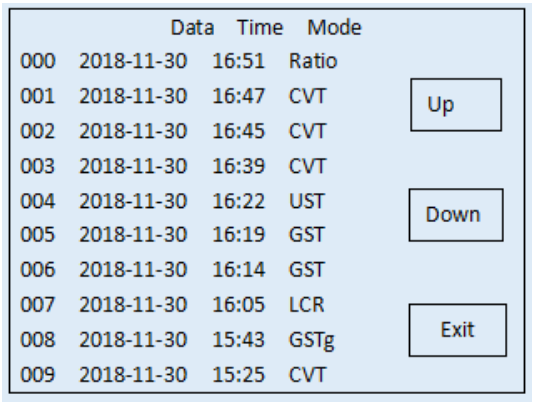


Fig. 7-23

In the main menu, press Data to enter into data menu, shown as figure 7-22. Press “View Data” to see all data, shown as figure 7-23. Press Up or Down to move the cursor to the data item you want to view. (The data stored in the instrument are arranged according to the order of measurement time, the

000th data is the latest data and the 199th data is the oldest data.) Then click on the corresponding data to enter the data print item. In this menu, you can press the up or down key to page to the corresponding data serial number to print the data.

VIII. Wiring

There are four connection modes to test UST mode, GST mode, GSTg mode and completely sealed CVT mode.

UST mode is used to test ungrounded object. HV port is connected to high-voltage terminal of test object, and Cx to low-voltage terminal.

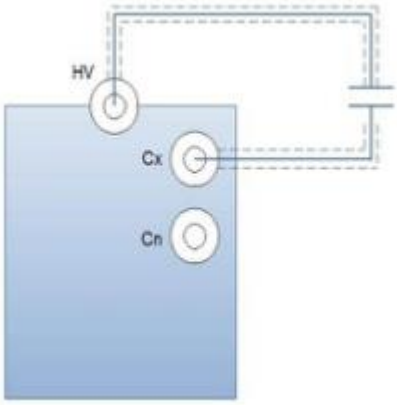
GST mode is used to test grounded object. HV port is connected to high-voltage terminal of test object, and Cx not to be connected because the low-voltage terminal of test object is connected to Earth.

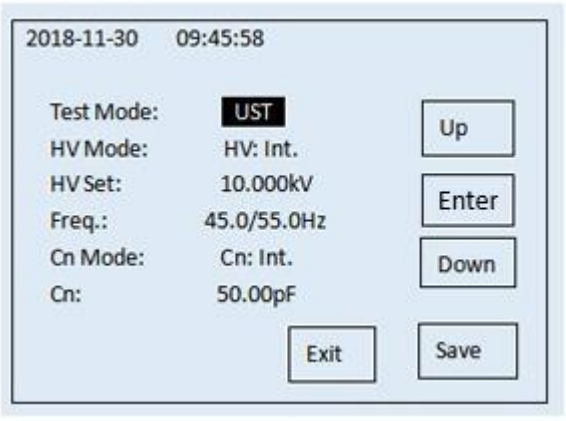
GSTg mode is used to test two capacitance of object. HV port is connected to high-voltage terminal of test object, Cx to one low-voltage terminal. The other low-voltage terminal is connected to Earth.

CVT connection mode is used to test CVT. da, dn should be connected to the two terminals of 100V output of CVT, and one of da and dn terminals can be connected to Earth. Cx port is connected to test capacitor (C1 or C2), and HV port to another capacitor. You can exchange C1 and C2 to test another capacitor.

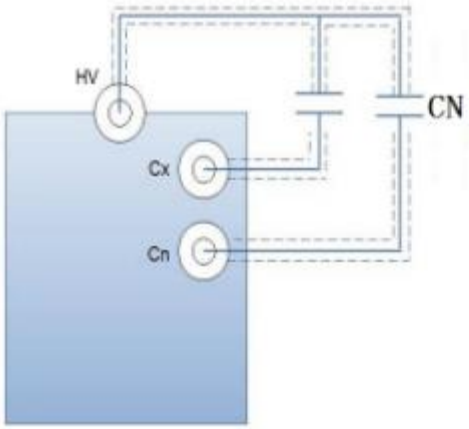
1. UST Mode

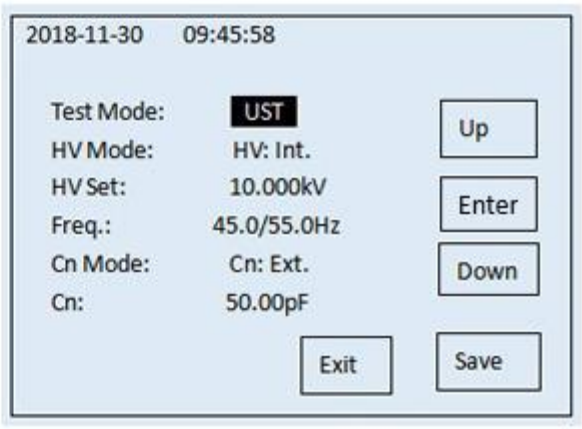
① HV: Internal; Cn: Internal; Mode: UST



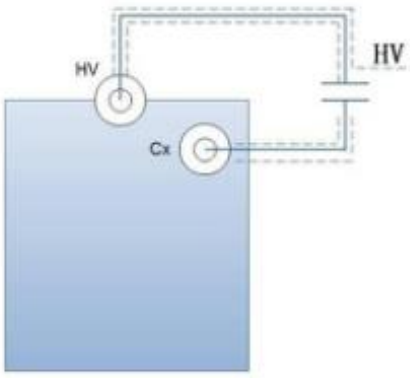


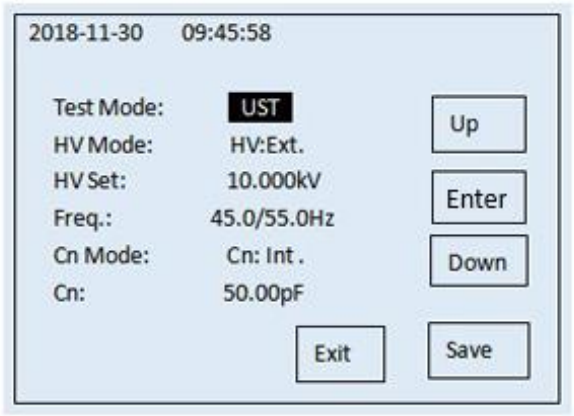
② HV: Internal; Cn: External; Mode: UST
(External standard capacity should be set well first.)



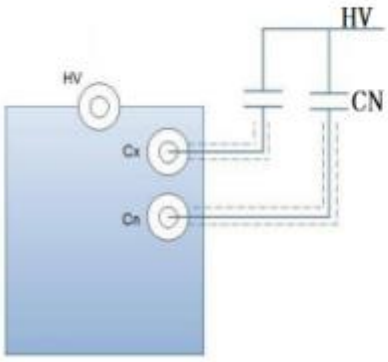


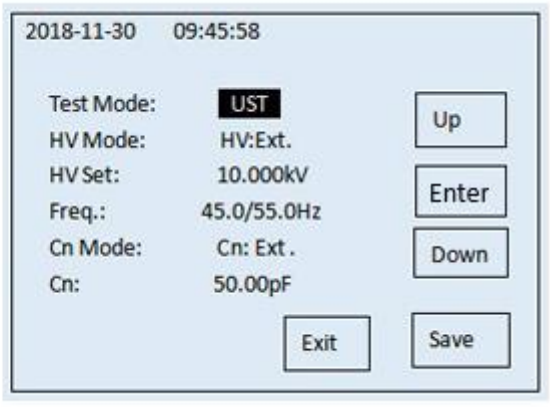
③ HV: External; Cn: Internal; Mode: UST





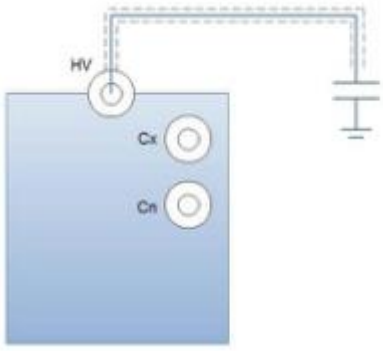
④ HV: External; Cn: External; Mode: UST
(External standard capacity should be set well first.)

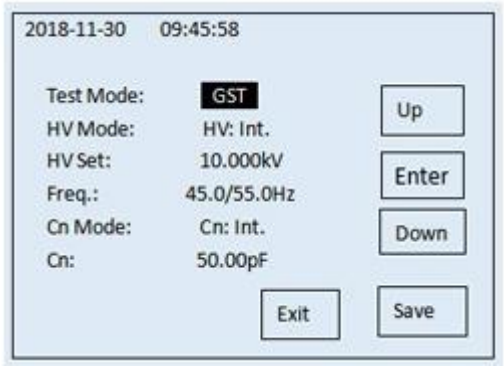




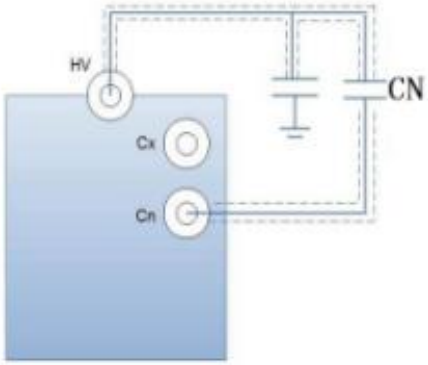
2. GST Mode

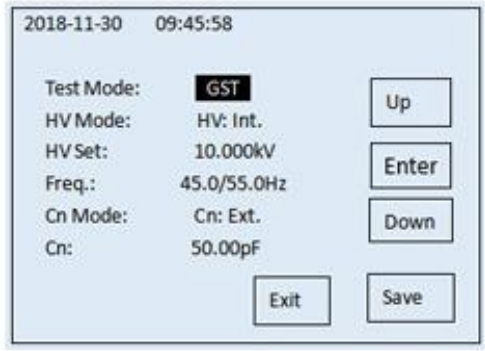
①HV: Internal; Cn: Internal; Mode: GST



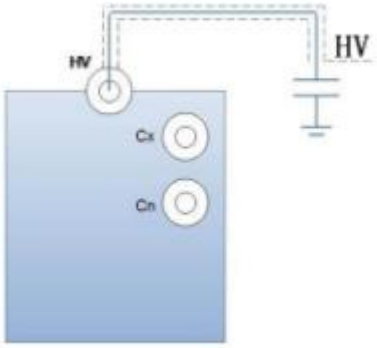


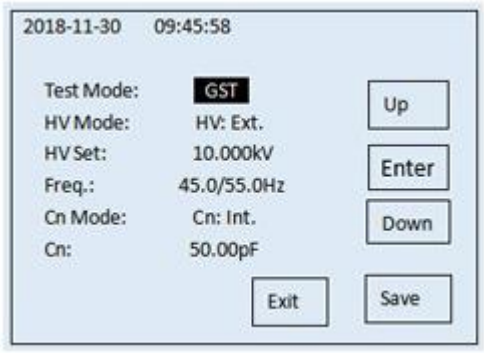
② HV: Internal; Cn: External; Mode: GST
(External standard capacity should be set well first.)



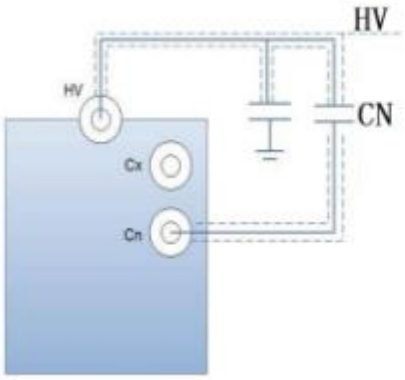


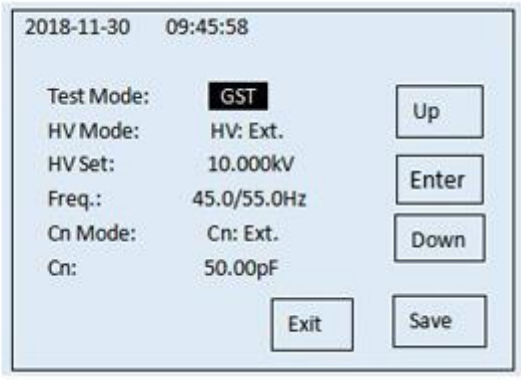
③ HV: External; Cn: Internal; Mode: GST





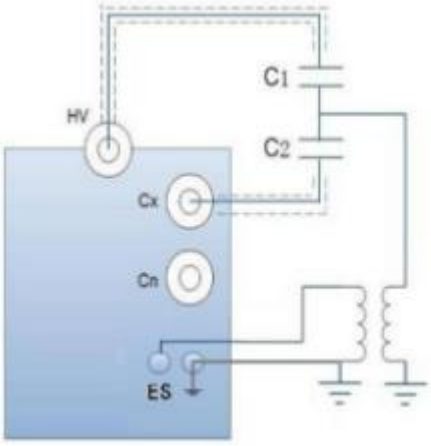
④ HV: External; Cn: External; Mode: GST
(External standard capacity should be set well first.)

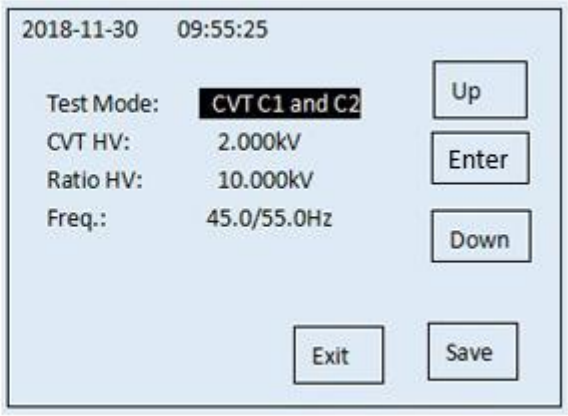




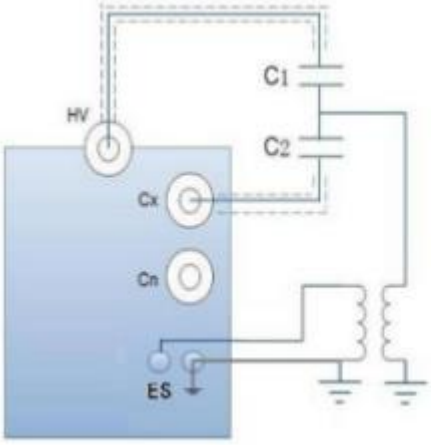
3. CVT Test

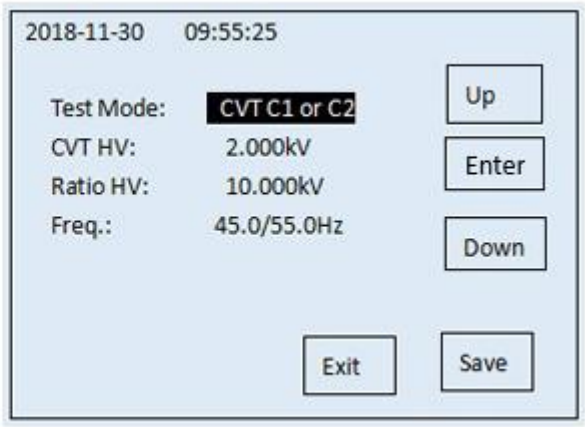
① Testing C1 and C2 at the same time.





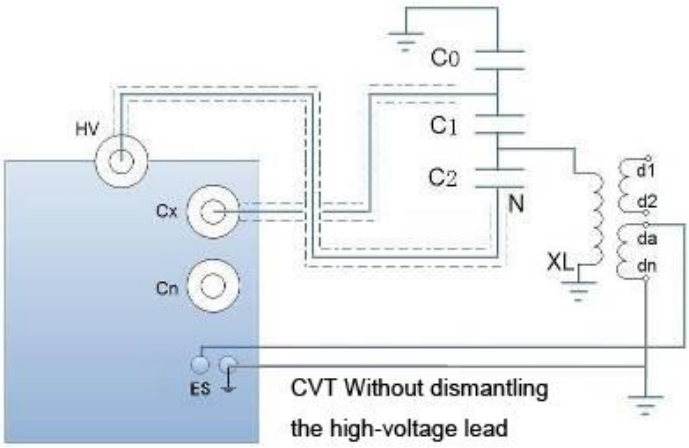
② Testing C1 or C2 separately.



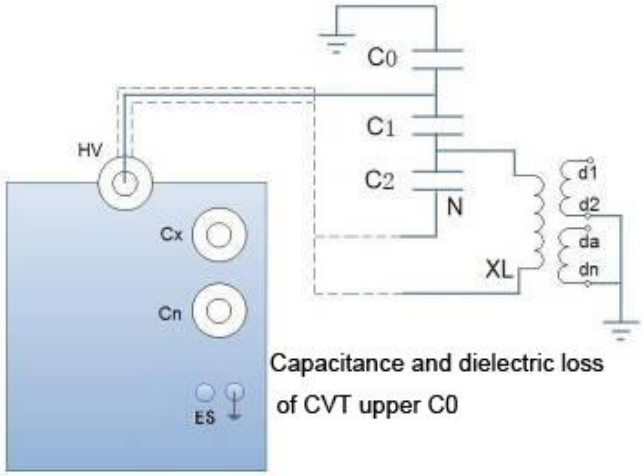


③ Do not dismantling the high-voltage lead to test CVT capacitance and

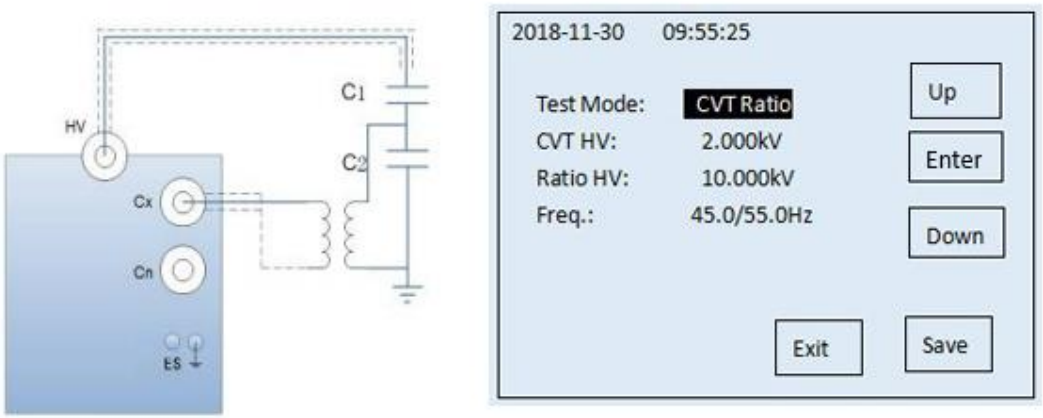
dielectric loss: CVT self-excitation method. Voltage ≤2kV.



④ Reverse connect shielding method is used to measure the capacitance and dielectric loss of CVT upper C0: reverse connection method. Voltage ≤2kV.

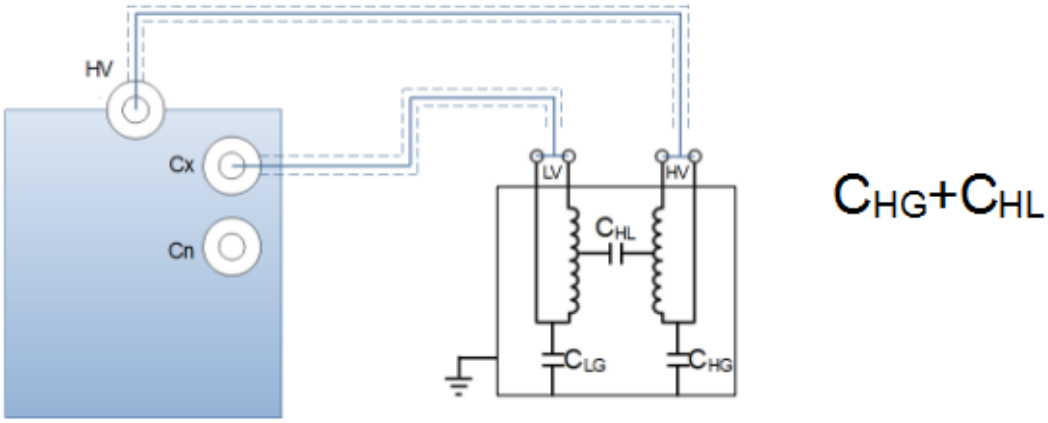


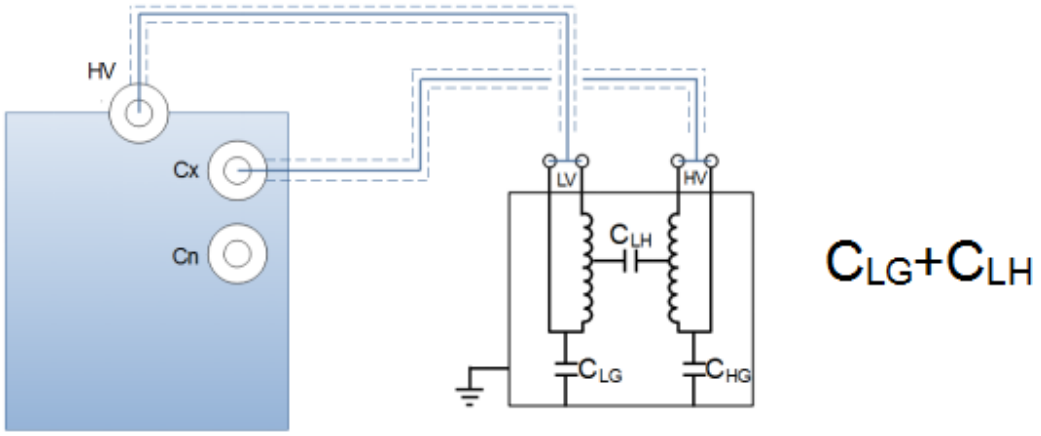
4. CVT Ratio Test

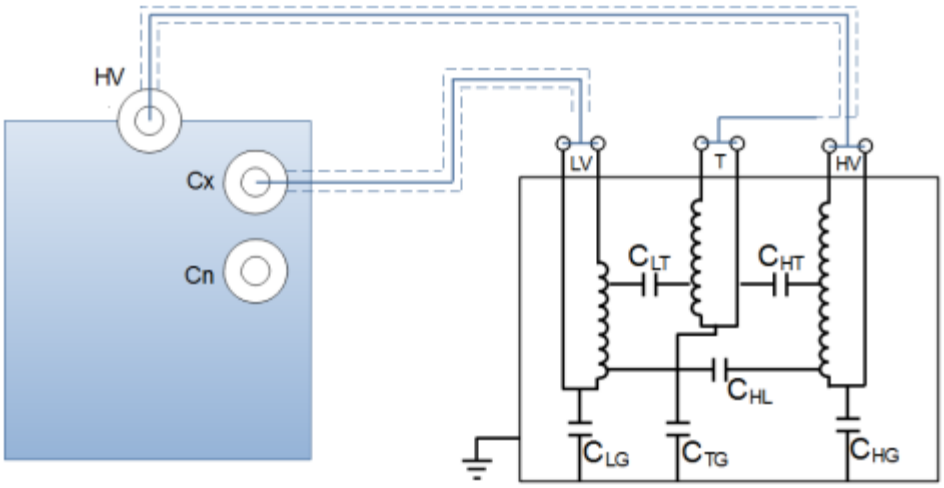


5. GSTg test

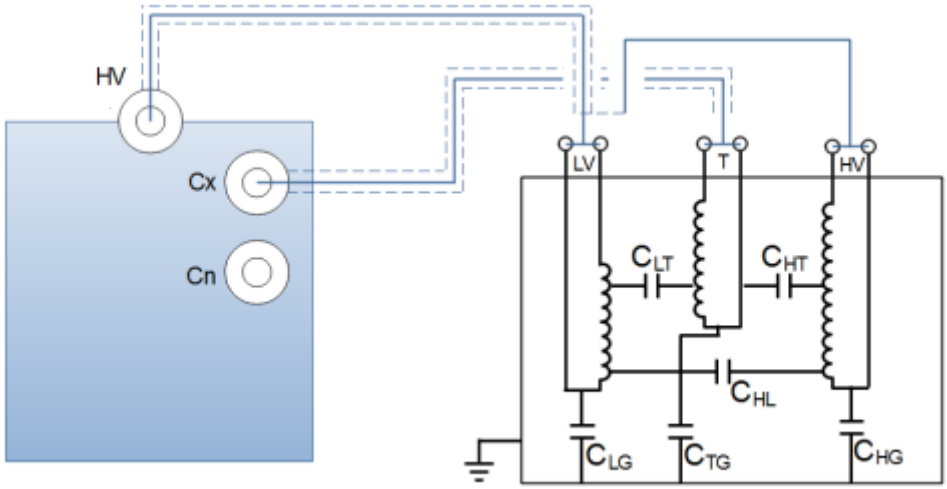
HV: Internal; Cn: Internal; Mode: GSTg



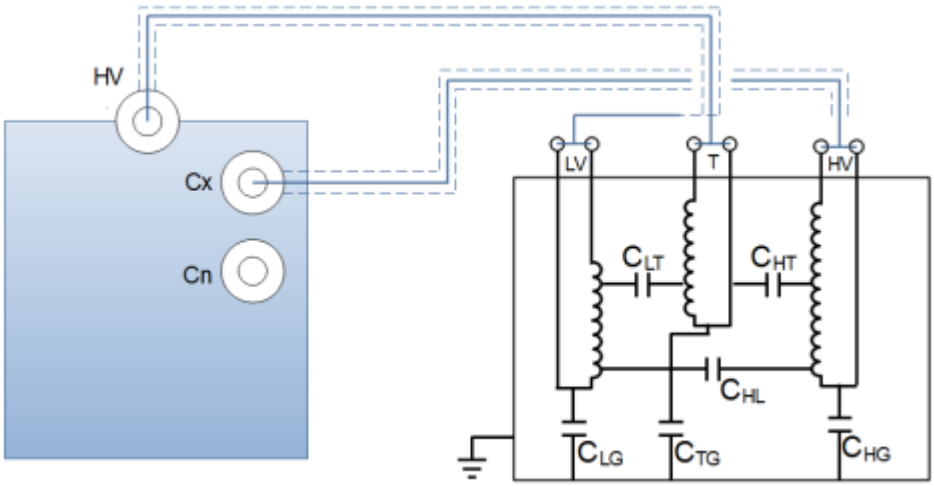




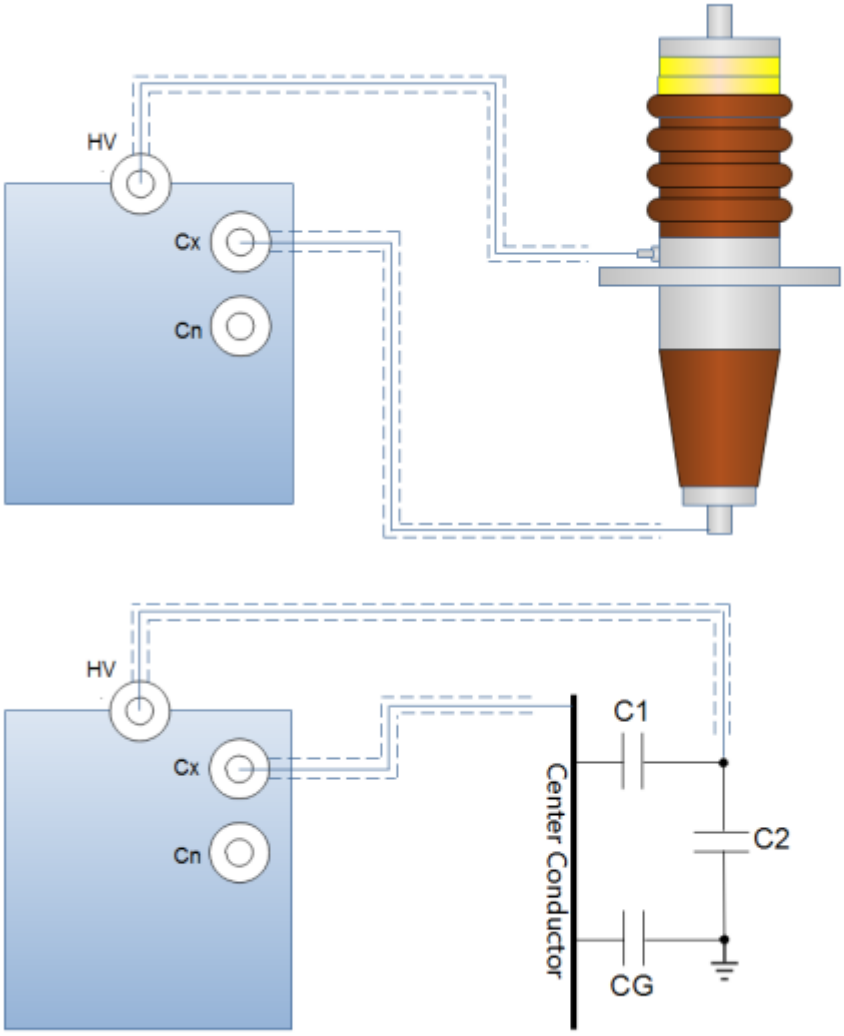
$C_{HG}+C_{HL}$ (High voltage wire shielded T winding)



C_{LG}+C_{LT} (High voltage wire shielded HV winding)

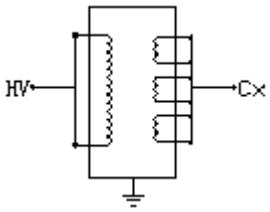


C_{TG}+C_{HT} (High voltage wire shielded LV winding)

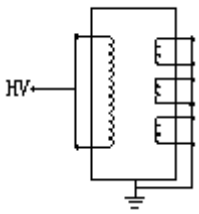


6. PT (Potential Transformer) Test

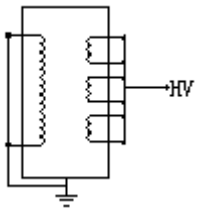
①Dielectric loss between primary side and secondary side (UST, Voltage:2kV)



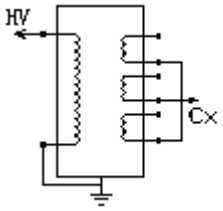
② Dielectric loss between primary side and secondary side & ground (GST, Voltage



③ Dielectric loss between secondary side and primary side & ground (GST, Voltage:2kV)

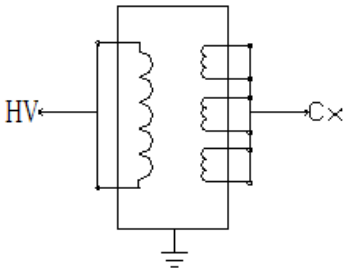


④ End shielding Method (UST, Voltage:10kV)

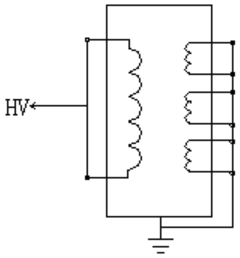


7. CT (Current Transformer) Test (Voltage: 10kV)

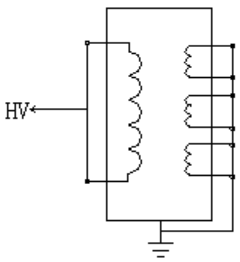
① Dielectric loss between primary side and secondary side (UST)



② Dielectric loss between primary side and end shielding (GST)

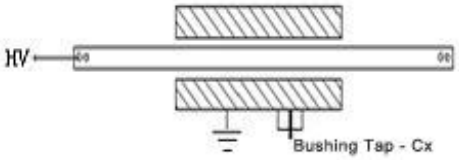


③Dielectric loss between primary side and secondary side & ground (GST)

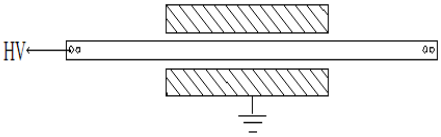


8. HV Bushings (Voltage: 10kV)

① Dielectric loss between core rod and bushing tap (UST, to disconnect bushing tap with ground)

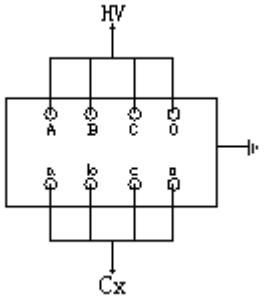


② Dielectric loss between core rod and bushing tap&Ground (GST)

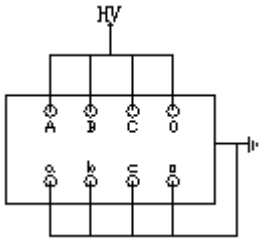


9. Power Transformer Test (Voltage: 10kV)

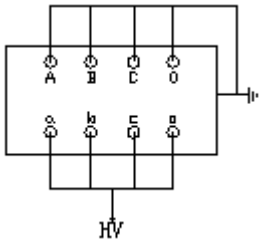
① Dielectric loss between primary winding and secondary winding (UST)



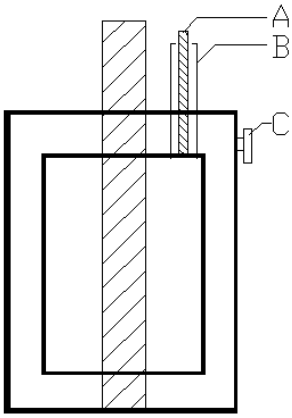
② Dielectric loss between primary winding and secondary winding & ground (GST)



③ Dielectric loss between secondary winding and primary winding & ground (GST)

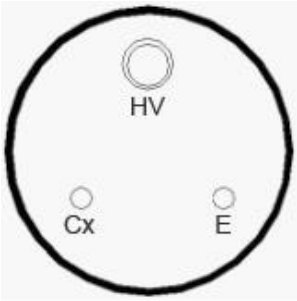


10. Dielectric Loss of Insulating Oil Test



- ✧ Pay attention that the oil cup is under high voltage.
- ✧ UST connection mode.
- ✧ Connect HV with red HV test cable.
- ✧ Connect Cx with black LV test cable, shielding layer connected to the earth of oil cup.
- ✧ Voltage: 2kV.
- ✧ (C High Voltage) connected to HV.
- ✧ (A Testing) connected to Cx.
- ✧ (B Shielding) connected to earth.

11. Standard Capacitor, Calibration Standard



A. UST mode

- ✧ Connect HV with red HV test cable to HV of test object.
- ✧ Connect Cx with black LV test cable to LV of test object.
- ✧ Shielding layer of black LV test cable connected to test object E.

B. GST mode

- ✧ HV of test object should be connected to earth.
- ✧ Connect HV with red HV test cable to LV of test object.
- ✧ Shielding layer of red HV test cable should be connected to test object E .
- ✧ Cx hang in the air.
- ✧ The barrel body is under high voltage, please pay attention.

Note: Dotted lines stand for cable shields, while solid lines for cable core wires. Please use the original test cable so as not to reduce the accuracy.