

HZ-9003C

Multifunctional Partial Discharge Tester



Dear user:

Thank you for choosing HZ-9003C Multifunctional Partial Discharge Tester.

We hope that this instrument can make your work easier and more enjoyable, so that you can get the feeling of office automation in the test and analysis work.

Before using the instrument, please read this manual, and operate and maintain the instrument according to the manual to prolong its service life. "Just a light press, the test will be completed automatically" is the operating characteristics of this instrument.

If you are satisfied with this instrument, please tell your colleagues; if you are not satisfied with this instrument, please call (0312) 6775656 to tell you to serve you at all times-Baoding Huazheng Electric Manufacturing Co., Ltd., our company will definitely make you satisfied !

Contents

I.Adoption standard.....	1
II.Operation Notice.....	1
III.Overview.....	1
IV.Measurement Procedures.....	9
VI.Maintenance.....	24
VII.Packing List.....	25

I.Adoption standard

The HZ-9003C multifunctional partial discharge tester is designed per the following standards:

GB/T 7354-2003 Partial discharge measurement

GB 4793.1-2007 Safety requirement for electric equipment for measurement, control, and laboratory use- Part 1: General requirements,

GB/T 2423.8-1995 Environmental testing for electric and electronic products,

GB 2900 Electrotechnical terminology

GB/T 16927 High voltage testing techniques

DL/T 356-2010 Calibration specification of partial discharge measuring devices

DL/T 417-2006 Guide for Partial Discharge Measuring of Power Equipment

IEC1000 Electromagnetic compatibility

II.Operation Notice

- 1.Read the manual carefully before operating the measuring device.
- 2.When use different sensors for measurement during the testing, should setup correct parameters at the “ parameter settings” to ensure the measurement accuracy.
3. If needs to replace sensors during the testing, should turn off the “ output voltage”.
4. During the testing, should handle the device with care, to avoid any bumps.
- 5.After testing, please turn off the power and then charge the device.

III.Overview

HZ-9003C multifunctional partial discharge tester is used for on-line detection and location of partial discharge of HV equipment, which is designed based on our many years experiences in the partial discharge measuring fields.

The system is equipped with composite TEV sensors, ultrahigh frequency sensors, High-frequency current transformers and high sensitivity ultrasonic sensors to collect partial discharge signals at high voltage equipment. The system adopts multilevel detect frequency reduction techniques to reduce the discharge frequency of the signals, meantime using high-speed AD conversion circuit to complete the signal digitization, also by using digital signal processing, adaptive filtering interference signal processing

methods to ensure the reliability of the testing data. By collecting different signals produced from the partial discharge in different high equipment, the equipment operation status can be detected rapidly. The tester can be installed for detection with equipment operation and without any effect to the equipment operation. This will help the workers to make evaluation timely for the switchgear cabinet operation status, and thus greatly improve the equipment operation reliability, safety and effectiveness.

HZ-9003C Multifunctional Partial Discharge Tester include: device host、special partial discharge detection software、TEV sensor (TEV) 、ultrasonic sensor (USS)、ultrasonic concentrator (ELTW) 、high frequency CT (HFCT) 、UHF sensor (UHF) 、earphone and connecting wire.



Multifunctional Partial Discharge Tester

3.1 Main Tester Panel



Multifunctional Partial Discharge Tester main tester front panel

The Multifunctional Partial Discharge Tester main computer is divided with several function areas, according to the above number indications,

1. Wave display
2. F1- F5 Menu Buttons
3. Power indicator
4. MEAS: measurement menu
5. AUTORANGE: Auto
6. MENU OFF: Menu off
7. MENU: Menu button
8. AUTO: Auto setting button
9. RUN/STOP: On/Off
10. Direction Key
11. TRIG: Trig menu
12. LEVEL: Adjust trigger level
13. TIME/DIV: Time base
14. POSITION: Adjust level trigger position
15. HORI: Level menu
16. VERTICAL: Adjust vertical position
17. VOLTS: Voltage shift
18. Power Switch
19. REF: REF menu
20. MATH: MATH function keys
21. CH2: display CH2 menu
22. CH1: display CH1 menu
23. UTILITY: Auxiliary function
24. SAVE RECALL: Save/Recall
25. RECORDER: Multi-meter trend chart, Oscilloscope trend chart, wave recorder.
26. SCOPE/DMM: Function interface switch button, switch to the multi-meter over signal interface.
27. CURSOR: Cursor measurement

3.2 Charge Main Tester

The main tester should be charged when first use, the fully-charged time is 7 hours. The charging time will reduce if the tester is partially charged. The charging will be stopped if the battery is fully charged. The charging status is indicated by the charging light at the panel.

1) light on : battery is charging



2) light off: Battery is not charging, charging is completed or charger is off.



3.3 Main tester Run/Off

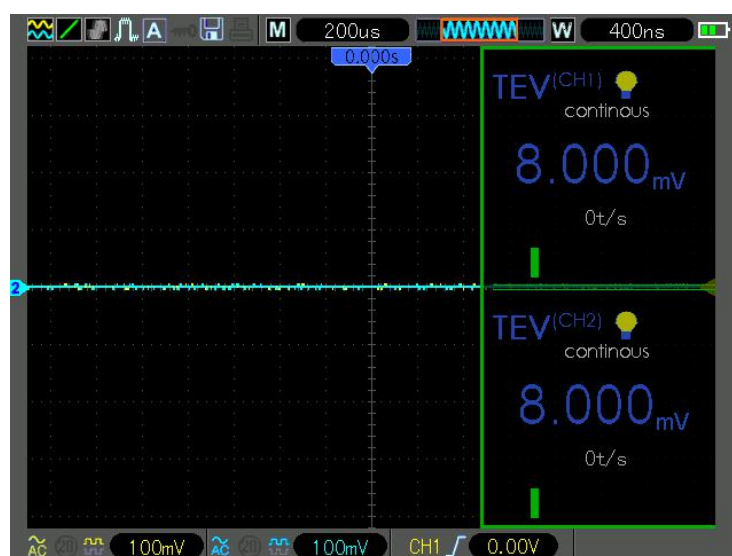
1) Start: Press the Run button to power on, wait for 30 seconds the tester will be started, the start button will be in yellow light.

2) Off: Press and hold down the start button to stop the main tester. The tester is off when the main display is black.

3) Standby: The main tester will be at standby automatically when the main tester is not operated for long, the start button will be in red light.

When the main tester is at standby state, press any key to activate the main tester.

3.4 Display zones



1. Multifunctional Partial Discharge Tester host setting status information

T The Multifunctional Partial Discharge Tester host has detected a trigger and collecting information after triggering.

A The Multifunctional Partial Discharge Tester host is at automatic mode and collecting wave without trigger.

S The Multifunctional Partial Discharge Tester host is continuously collecting wave data by scanning method and displaying the wave data.

- The Multifunctional Partial Discharge Tester host stops wave data collection.

S The Multifunctional Partial Discharge Tester host has completed the single sequence acquisition.

2. Multifunctional Partial Discharge Tester host tool icons

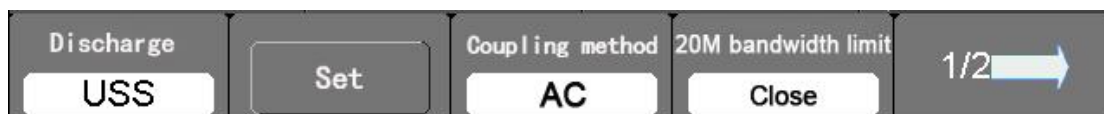
 : turn brighter means keyboard is locked, the tester is controlled by USB and the keyboard is locked.

 : turn brighter means USB is connected, if grey means no USB.

 : Turn bright When connected with PC by USB, otherwise it is grey.

1.5 Menu

Press" Menu" button, menu bar is shown at the bottom of the display.



Change the setting options by pressing F1-F5 buttons when needs to change a different requirement at the test.



3.6 Menu bar and operation

1. Channel selection: Press" CH1", " CH2" buttons to select current channel.

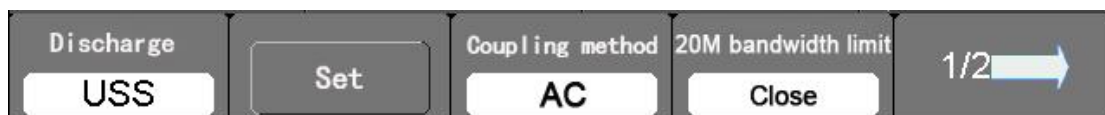
Press CH1 to select Channel 1, then press " Menu" button to setup or change current channel 1 data or parameters.

Press CH2 to select Channel 2, then press" Menu" button to setup or change current channel 2 data or parameters.

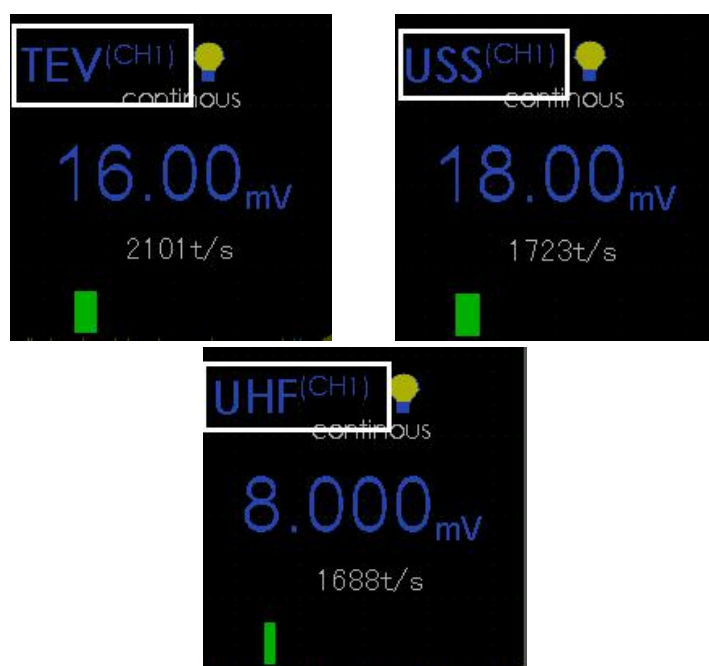
Watch the red box shown at the below screen to know chosen Channel 1 or Channel2, displaying CH1 means Channel 1, displaying CH2 means Channel2.



2. **Menu:** Press "Menu" button to start the menu bar, then conduct settings per the testing requirement.



1) Discharge detect: Press F1 key to select output discharge signals circularly, then setup the signal output type per the detection requirement.



"TEV" Output ground wave signal

"USS" Output ultrasonic wave signal

"UHF" Output UHF signal

"CT" Output to-ground current signal

Close: If only one channel is required for detection, then the other channel can be closed.

If channel1(channel2) is closed, press "Menu" to start the menu bar, select the current channel to CH1(CH2). If CH1(CH2) is open, then press CH1(CH2), the current channel will not display at the screen which means it is closed. If to open the Channel 1(Channel2) again, then press CH1(CH2) to open CH1(CH2), which means current

channel selection is CH1(CH2).

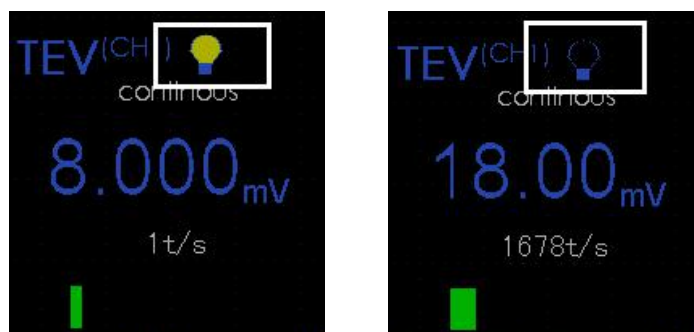
2) Setting: Press" setting" F2 key to activate the current channel setting options.



Output voltage: Set output voltage for the sensors of the equipment which is to be tested.

Press " output voltage" F1 key to open the output voltage, press F1 key once to close the voltage. When open the output voltage, the light will be on at the display screen.

When close the output voltage, the light will be off at the display screen.



Unit: Switch the measurement unit of the current channel discharge amount, mv, dB,dbmW, dBuV, dBmV.

Press " Unit" F2 key to change the current channel discharge Unit, This option is circular selection, the unit selection can be determined by the discharge detection type.

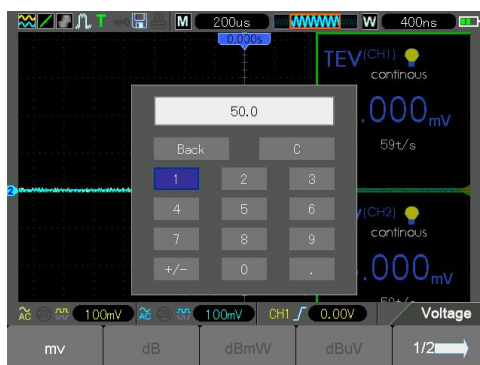
Reading set, discharge numbers and sensors: Keep them as default values, non-professionals are forbidden to make any change.

Traffic light: Change the current channel traffic light, The color can be changed per requirement.

Press Traffic light F2 key to activate traffic light color setting menu, traffic light colors are green, yellow, red. Double press keys to change color.



If change to " Green", double press green" F1" key, then make change by pressing arrow keys at the pop-up dialog box.



Press the direction keys to select number, and then press the middle Enter button for confirmation, after that press the unit button, the green color setting is changed to the setting data. Traffic light unit is aligned with the pre-set unit. Press Cancel key to interrupt settings, the color will not change. The other colors can be set following the green color setting.

3.7 Measurement mode

Press" TRIG" Key to open the trigger data setting menu bar, then press trigger mode" F4" Key to make change of the current channel trigger mode.

Trigger Mode: Select trigger mode, Trigger mode can be automatic, normal and single trigger.



At default condition, the Multifunctional Partial Discharge Tester host tool icons is at " Automatic" mode. If the Multifunctional Partial Discharge Tester host doesn't detect any trigger in a certain period, then trigger will be forced automatically.

When select" normal" mode, the Multifunctional Partial Discharge Tester host can update the wave display only when the effective trigger is being detected. The Multifunctional Partial Discharge Tester host displays the existing waves before the new waves.

When select “ single trigger” mode, the Multifunctional Partial Discharge Tester host can display the waves only after first trigger.

When trigger mode is selected as “ single trigger”, the channel display will show” single”.

When trigger mode is selected as “ automatic” or “ normal”, the channel display will show “ continuous ”.

IV.Measurement Procedures

When use the Multifunctional Partial Discharge Tester and with one sensor for testing , select Channel 1 to conduct detect. When use two sensor for detection , then use Channel2.

Be noted: Turn off “output voltage” to replace sensor during the detection process.

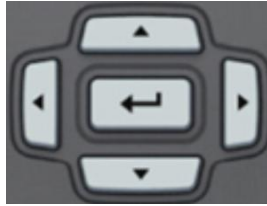
4.1 TEV Measurement (mainly detect PD of switchgear cabinet)

1. Composite TEV sensor wiring

Use BNC-SMA cable, connect the BNC to the tester CH1 channel BNC port and connect the SMA to the TEV sensor “ RF-OUT” SMA port.



Composite TEV sensor wiring



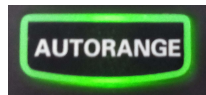
Composite TEV sensor wiring

2. Tester setting

Open the tester, press and select CH1 to choose current channel to Channel1. Press “menu” button and then press F1 Key to select the” discharge detect” to TEV. Press F2 key to setup “output voltage” and “unit”. When use composite TEV sensors for detection the output voltage must be required.

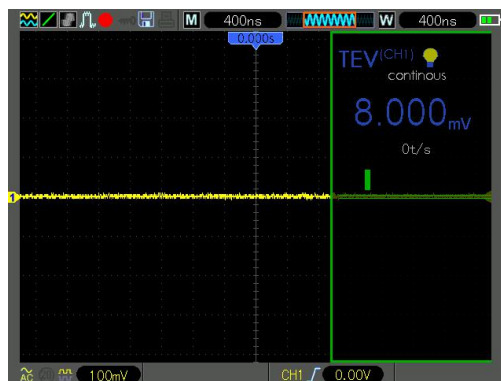
3. Start Measurement

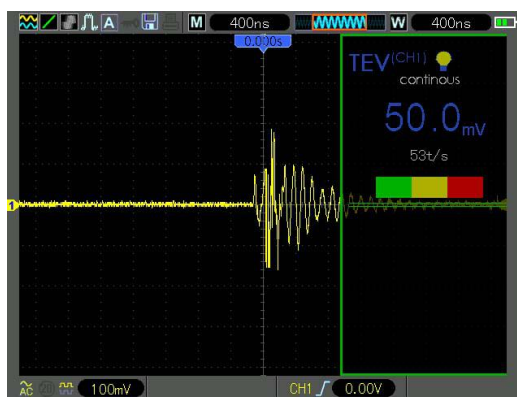
Press “ AUTORANGE” button, the tester is starting to measure when the button turns green.



AUTORANGE open

Press the button, the tester will be at automatic trigger mode, The display screen channel 1 will display the current composite TEV sensor detecting PD signals.

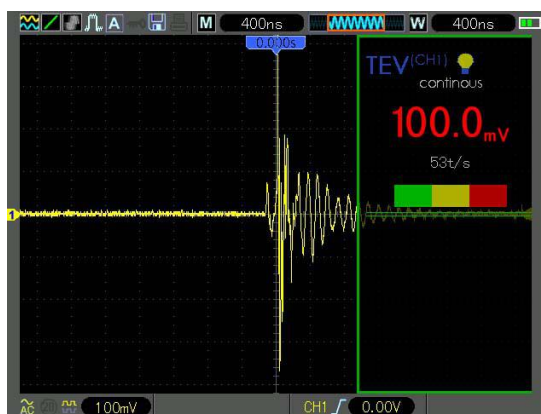




Non discharge signals

With discharge signals

When the discharge signal detected by the switchgear cabinet PD tester is too large, the display screen data will change into red, the sensor is saturated at this time.



Sensor saturated

4. Background noise

Instantaneous grounding voltage may occur outside of the switchgear cabinet due to the electromagnetic signal sources. These sources can be overhead line insulators, transformer tubing, strong radio signal even near highway traffic. These sources can produce instantaneous earth voltage signals to the metals such as substation doors or fences without touching or connecting. Therefore, the background noise on these surfaces shall be measured before conducting switchgear cabinet detection.

Measure the background noise of the metal door ,fence which are not part of the switchgear cabinet. Record down three continuous values of these metal parts, take the intermediate amplitude as the reading for the background measurements.

5. Measurement precautions

After the main tester starts, make sure that the TEV sensor is in the free space away from

the metal bodies, otherwise it will affect the self-test. In order to make measurement, the TEV sensor shall be vertically parallel to the metal body to be measured. Once the tester is at continuous measurement mode, the readings will be display immediately. But if the TEV sensor is removed from the metal body, then the readings will not be displayed at the screen.

If in a single measurement mode, once pressing down the button, the readings shall be remained on the screen. Repeated the measurements several times can make sure the consistency.

For measurement of the cabinet components such as cable box, current transformer room, bus terminal room, circuit breakers and voltage transformers shall be conducted at the center position. The locations of circuit breaker and other middle and high voltage switches shall be recorded down. If these switches are in disconnected position, then the components would not be electrified, there will be no measurement readings of them. Record the first group readings of each locations. If the measurement amplitude is 10dB higher than background interference level, and the self-amplitude is greater than 20db, should record at least three sets of reading in a row.

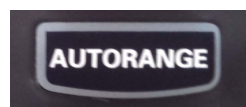
6. Save

To save the current discharged signal, You need to prepare a USB disk to store the graphics.

Save Graphics: Press" SAVE/RECALL", open the save/recall menu bar, press " graphic" F5 key to save, the discharge signals will be stored at the USB. After testing, plug the USB at the PC, you can read the stored discharge signal waves at PC.

7. Close

After the testing, press" AUTORANGE" key to close automatic trigger till the key light is off. After closing the automatic trigger, Press" Menu off" to close the menu bar if the menu bar is popping-up.



AUTORANGE Close

4.2 High Frequency current transformer measurement

(Mainly measure transformer inside partial discharge)

1. High frequency current transformer connection

Use BNC-BNC cable to connect to the tester CH1 channel BNC port, the other end to the high frequency current transformer BNC end.



High frequency current transformer connection

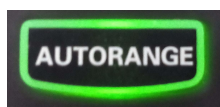
2. Tester settings

Open the tester, press and select the current channel to CH1, Press" MENU" key, then press F1 key to select " discharge test" as HFCT, press F2 Key to set" output voltage" and " unit". When test the high frequency current transformer it would require output voltage.



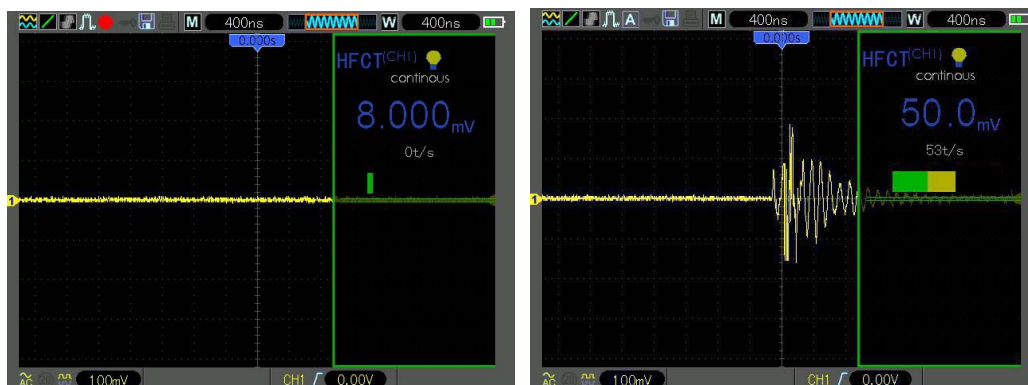
3. Start measurement

Press" AUTORANGE" Key till the light is on to green, then the tester is about to measure.



AUTORANGE Open

The tester will be then at automatic trigger state, the Channel 1 screen will display the current high frequency current transformer testing discharge signals .



Non-discharge Signals

with discharge signals

When the discharge signal is too large ,the value at the screen will then turn red, at this moment the sensor is in saturation state.



Sensor Saturated

4. Save

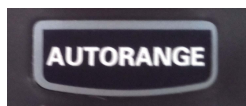
To save the current discharged signal, You need to prepare a USB disk to store the graphics.

Save Graphics: Press" SAVE/RECALL", open the save/recall menu bar, press " graphic" F5 key to save, the discharge signals will be stored at the USB. After testing, plug the USB at the PC, you can read the stored discharge signal waves at PC.

5. Close

After the testing, press" AUTORANGE" key to close automatic trigger till the key light is off.

After closing the automatic trigger, Press" Menu off" to close the menu bar if the menu bar is popping-up.



AUTORANGE Close

4.3 Ultrasonic Measurement (Mainly support the measurement of transformer inside partial discharge)

1. Ultrasonic sensor connection

Use BNC-BNC cable to connect to the tester CH1 channel BNC port, the other end to the high frequency current transformer BNC end.



Ultrasonic sensor connection



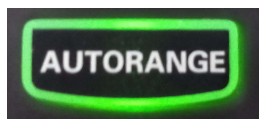
2. Tester settings

Open the tester, press and select the current channel to CH1, Press" MENU" key, then press F1 key to select " discharge test" as HFCT, press F2 Key to set" output voltage" and " unit". When use ultrasonic sensor to conduct measurement it would require output voltage.



3. Start measurement

Press" AUTORANGE" Key till the light is on to green, then the tester is about to measure.



AUTORANGE Open

The tester will be then at automatic trigger state, the Channel 1 screen will display the current ultrasonic sensor testing discharge signals .



Non-discharge Signals



with discharge signals

When the discharge signal is too large ,the value at the screen will then turn red, at this moment the sensor is in saturation state.



Sensor Saturated

4. Measurement

Open the tester and select USS (ultrasonic mode), plug the headset and adjust volume. The readings will be displayed at the screen. Take measurement of the background noise. At any case, should follow the safe distance requirement.

5. Save

To save the current discharged signal, You need to prepare a USB disk to store the graphics.

Save Graphics: Press" SAVE/RECALL", open the save/recall menu bar, press " graphic" F5 key to save, the discharge signals will be stored at the USB. After testing, plug the USB at the PC, you can read the stored discharge signal waves at PC.

6. Close

After the testing, press" AUTORANGE" key to close automatic trigger till the key light is off. After closing the automatic trigger, Press" Menu off" to close the menu bar if the menu bar is popping-up.

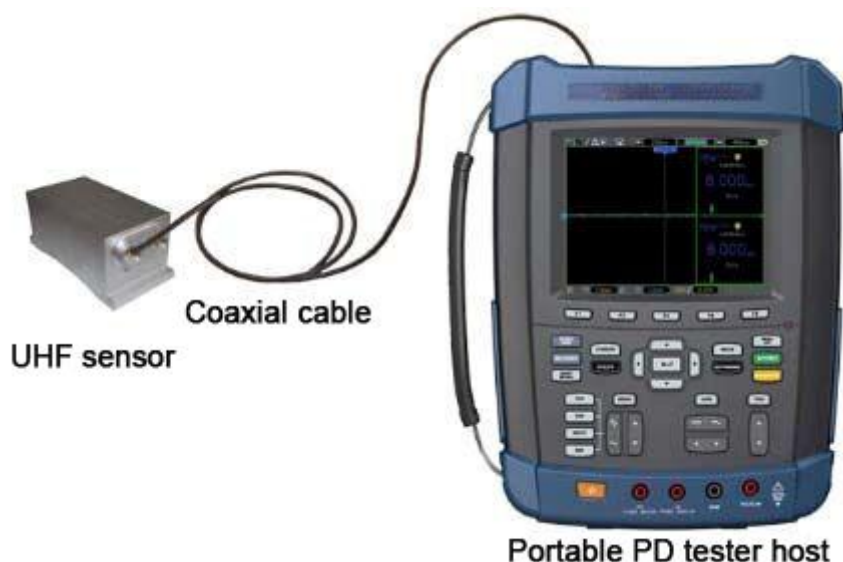


AUTORANGE Close

4.4 Ultra-High frequency measurement (Mainly measure GIS internal Partial Discharge)

1. Ultra-high frequency sensor connection

Use BNC-SMA cable to connect to the tester CH1 channel BNC port, the other SMA end to the ultrahigh frequency cable " OUT+12V" Port.



Ultra-high frequency sensor connection.

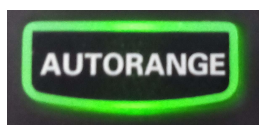
2. Tester settings

Open the tester, press and select the current channel to CH1, Press" MENU" key, then press F1 key to select " discharge test" as UHF, press F2 Key to set" output voltage" and " unit". When use ultrasonic sensor to conduct measurement it would require output voltage.



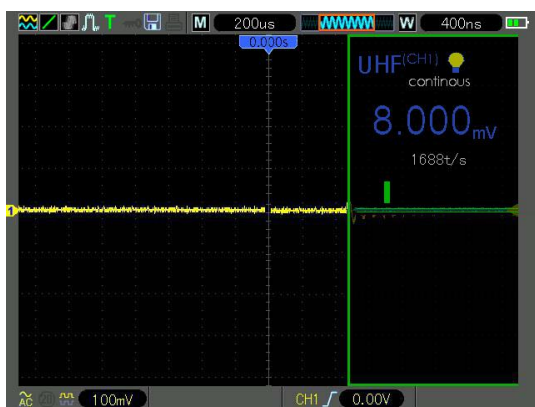
3.Start measurement

Press" AUTORANGE" Key till the light is on to green, then the tester is about to measure.



AUTORANGE Open

The tester will be then at automatic trigger state, the Channel 1 screen will display the current ultra-high frequency sensor testing discharge signals .



Non-discharge Signals



with discharge signals

When the discharge signal is too large ,the value at the screen will then turn red, at this moment the sensor is in saturation state.



Sensor Saturated

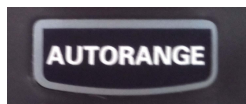
4. Save

To save the current discharged signal, You need to prepare a USB disk to store the graphics.

Save Graphics: Press" SAVE/RECALL", open the save/recall menu bar, press " graphic" F5 key to save, the discharge signals will be stored at the USB. After testing, plug the USB at the PC, you can read the stored discharge signal waves at PC.

5. Close

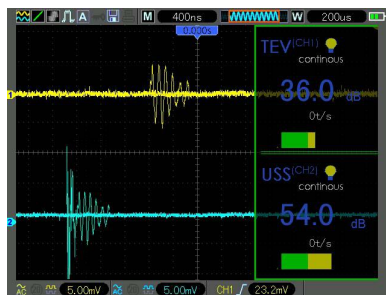
After the testing, press" AUTORANGE" key to close automatic trigger till the key light is off. After closing the automatic trigger, Press" Menu off" to close the menu bar if the menu bar is popping-up.



AUTORANGE Close

4.5 Two Channels testing

If use two channels for testing, you should connect two sensors. Open the two channels simultaneously and setup respectively. The channel 1 is set as TEV, and channel 2 is set as USS.



Two Channels setting screen

1. Connections

Composite TEV sensor connection

Use BNC-SMA cable, the BNC end is connected to main tester CH1 channel BNC port, the SMA end is connected to the composite TEV sensor output port.

Ultrasonic sensor connection

Use BNC-SMA cable, the BNC end is connected to the main tester CH2 channel BNC

port, the BNC end is connected to the ultrasonic sensor BNC port.



Two channels tester connection

2. Main tester settings

Open the main tester, Press CH1 to select the current channel at channel 1, then press" Menu" key and F1 key to set " discharge test" as TEV, Press F2 key to set " output voltage" and " unit". Use the composite TEV sensor for testing shall set the output voltage.

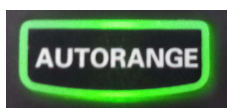
Press CH2 to select current channel at Channel2, then press" Menu" key and F1 key to set " discharge test" as USS. Press F2 key to set "output voltage" and "Unit".

Use the ultrasonic sensor for testing shall set the output voltage.



3. Start measurement

Press" AUTORANGE" Key till the light is on to green, then the tester is about to measure.



AUTORANGE Open

The tester will be then at automatic trigger state, the Channel1 screen will display the current composite TEV sensor testing signals, the channel2 screen will display the current ultrasonic sensor testing signals. If the focus is at CH1, then the screen will mainly display the CH1 settings, If the focus is at CH2, then the screen will mainly display the CH2 settings.

When the discharge signal is too large ,the value at the screen will then turn red, at this moment the sensor is in saturation state.

4. Measurement

Measurement and background can refer to 5.1 and 5.2 .

5.Save

To save the current discharged signal, You need to prepare a USB disk to store the graphics.

Save Graphics: Press" SAVE/RECALL", open the save/recall menu bar, press " graphic" F5 key to save, the discharge signals will be stored at the USB. After testing, plug the USB at the PC, you can read the stored discharge signal waves at PC.

6. Close

After the testing, press" AUTORANGE" key to close automatic trigger till the key light is off. After closing the automatic trigger, Press" Menu off" to close the menu bar if the menu bar is popping-up.



AUTORANGE Close

V. Tester Technical Specification

5.1 Applications

The tester is applicable to switchgear cabinet, transformer and GIS Partial discharge online test and positioning.

5.2 Environment

Altitude: $\leq 3000\text{m}$

Temperature: $-20\sim 60^{\circ}\text{C}$

Relative humidity : $\leq 95\%$

5.3 Technical data

5.3.1 Tester measurement data requirement

(1) Composite TEV measurement

Sensor: Capacitive	Range: 0~60dBmV
Resolution: 1dB;	Error: ±1dB
Detection Bandwidth: 5~70MHz	Pulse/Cycle maximum: 655
Threshold adjustment range: 3~57dB	

(2) High frequency current transformer

Detection Bandwidth: 10kHz~30MHz Signal transit mode: 50Ω cable

Detection sensitivity: 10pC

(3) Ultrasonic concentrator

Measurement range: -7dB μ V $\sim$ 68 dB μ V Resolution: 1dB
Error: $\pm$ 1dB Sensor sensitivity: -65dB (0dB = 1volt/ μ bar effective value SPL)
Sensor central frequency: 20 $\sim$ 50kHz Sensor diameter: no more than 50mm
Heterodyne frequency: 38.4kHz

(4) Non - contact ultrasonic energy collector

Effective acceptance distance: 30m; Sensor center frequency: 40 kHz;
Diameter of sensor: 16mm; External diameter of parabolic reflector: 275mm;
Standard diameter of parabolic reflector: 250mm; Weight: 0.6kg;

(5) Ultrahigh frequency sensor

Detection bandwidth: 300MHz~1.5GHz Signal transit mode: 50Ω cable
Detection sensitivity: 1dB Gain: >65dbm

(6) Anti-interference Earphone Mic

Earphone Mic: vivo

5.3.2 Hardware

Enclosure: With protective enclosure, the protection grade is reached or better than IP53.

Connectors: Earphone port, low voltage DC charger input, external ultrasonic sensor input.

Main tester weight: no more than 3Kg.

Display: LED and with battery state indication.

5.3.3 Power Supply

Internal battery: equipped with rechargeable battery, when the battery voltage is low the main tester will shut down itself.

Battery continuous operation time: Single channel mode is more than 6 hours, Multiple channels mode is more than 3 hours.

Battery charging: Use 220V power to charge, the charging time is no more than 8 hours.

The battery charge protection grade: IP54.

VI.Maintenance

6.1 Routine Maintenance

When store or place the main tester, don't expose the LCD display to the direct sunlight for long time.

Note: To avoid damage the main tester, don't place the tester in fog, liquid or solvent environment.

6.2 Cleaning

Check the main tester regularly based on the operation conditions. Clean the tester following the below procedures:

- 1) Use lint free cloth to remove dust from the main tester and sensors. Please be careful and don't scratch the bright screen filter materials.
- 2) Use soft cloth soaked with water to clean the main tester. For more thorough cleaning, you can use 75% isopropyl alcohol as water solvent.

Caution: Don't use any corrosive or chemical cleaning agent to avoid any damage of the main tester or sensors.

VII.Packing List

No.	Item	Qty
1	Multifunctional Partial Discharge Tester host	1
2	U disk	1
3	TEV sensor	1
4	Ultrasonic sensor (GIS)	1
5	Ultrasonic sensor(transformer)	1
6	Ultrasonic concentrator	1
7	High frequency current transformer	1
8	Ultrahigh frequency sensor	1
9	Coaxial Cable	2
10	earphone	1
11	Self-check device	1