Chroma

Partial Discharge Tester

19501-K

User's Manual

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Partial Discharge Tester
19501-K
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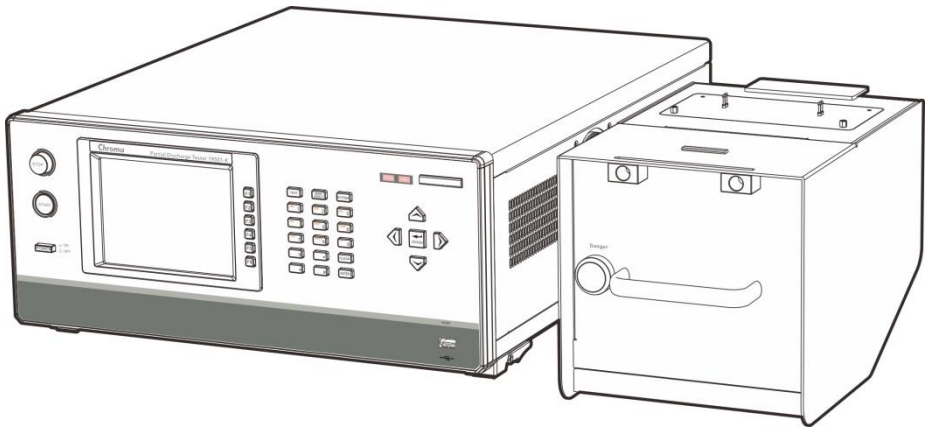

Version 1.2
September 2021

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88 Wenmao Rd., Guishan Dist., Taoyuan City 333001, Taiwan

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Material Contents Declaration

The recycling label shown on the product indicates the Hazardous Substances contained in the product as the table listed below.

: See **<Table 1>**.

: See **<Table 2>**.

<Table 1>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls/ Polybromodiphenyl Ethers	Selected Phthalates Group
	Pb	Hg	Cd	Cr^{6+}	PBB/PBDE	DEHP/BBP/DBP/DIBP
PCBA	O	O	O	O	O	O
CHASSIS	O	O	O	O	O	O
ACCESSORY	O	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

“O” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

“×” indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

Remarks:
1. The CE marking on product is a declaration of product compliance with EU Directive 2011/65/EU and 2015/863/EU.
2. This product is complied with EU REACH regulation and no SVHC in use.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

<Table 2>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls/ Polybromodiphenyl Ethers	Selected Phthalates Group
	Pb	Hg	Cd	Cr^{6+}	PBB/PBDE	DEHP/BBP/DBP/DIBP
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

"O" indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006, EU Directive 2011/65/EU, and 2015/863/EU.

1. Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product's specification.
3. This product is complied with EU REACH regulation and no SVHC in use.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

www.chromaate.com Chroma

Declaration of Conformity

For the following equipment :

Partial Discharge Tester

(Product Name/ Trade Name)

19501-K

(Model Designation)

Chroma ATE Inc.

(Manufacturer Name)

88 Wenmao Rd., Guishan Dist., Taoyuan City 333001, Taiwan

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2013 Class A

EN 61000-3-2:2014, EN 61000-3-3:2013

EN 61326-1:2013(industrial locations)

EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010, EN 61000-4-4:2012,
EN 61000-4-5:2014, EN 61000-4-6:2014, EN 61000-4-8:2010, EN 61000-4-11:2004

EN 61010-1:2010

The equipment describe above is in conformity with Directive 2011/65/EU and 2015/863/EU of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

.

The following importer/manufacturer or authorized representative established within the EUT is responsible for this declaration :

Chroma ATE Europe B.V.

(Authorized Representative Name)

Morsestraat 32, 6716 AH Ede, The Netherlands

(Authorized Representative Address)

Person responsible for this declaration:

Mr. Vincent Wu

(Name, Surname)

T&M BU/Vice President

(Position/Title)

Taiwan	**2021.07.26**	Vincent Wu
(Place)	(Date)	(Legal Signature)

Safety Summary

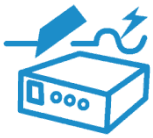
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the instrument. *Chroma* assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER

Verify that the power is set to match the rated input of this power supply.

PROTECTIVE GROUNDING

Make sure to connect the protective grounding to prevent an electric shock before turning on the power.



NECESSITY OF PROTECTIVE GROUNDING

Never cut off the internal or external protective grounding wire, or disconnect the wiring of protective grounding terminal. Doing so will cause a potential shock hazard that may bring injury to a person.

FUSES

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. The instrument should be used in an environment of good ventilation.

DO NOT REMOVE THE COVER OF THE INSTRUMENT

Operating personnel must not remove the cover of the instrument. Component replacement and internal adjustment can be done only by qualified service personnel.

⚠WARNING

1. Lethal voltage. The output may up to 10kV voltage.
2. Touching the connected circuit or output terminal on the front panel when power is on may result in death.

Safety Symbols

	DANGER – High voltage.
	Explanation: To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.
	High temperature: This symbol indicates the temperature is now higher than the acceptable range of human. Do not touch it to avoid any personal injury.
	Protective grounding terminal: To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.
	Functional grounding: To identify an earth (ground) terminal in cases where the protective ground is not explicitly stated. This symbol indicates the power connector does not provide grounding.
	Frame or chassis: To identify a frame or chassis terminal.
	Alternating Current (AC)
	Direct Current (DC) / Alternating Current (AC)
	Direct Current (DC)
	Push-on/Push-off power switch
	The **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.
	The **CAUTION** sign denotes a hazard. It may result in personal injury or death if not noticed timely. It calls attention to procedures, practices and conditions.
	The **Notice** sign denotes important information in procedures, applications or the areas that require special attention. Be sure to read it carefully.

Hazard Operations

1. Do not touch testing area when the tester's output is enabled. Electrical shock could result cause harm or death.

   Be sure to obey the following:
   - The earth wire must be connected exactly and use a standard power cord.
   - Do not touch the output terminal.
   - Do not touch the test wire that connected to the terminal in test.
   - Do not touch any unit under test.
   - Do not touch any component that connected to output terminal for charge.
   - Do not touch the test unit right after the test is ended or when the output is just turned off.

2. The electric shock incident may occur when:
   - The earth terminal of the tester is not connected properly.
   - The insulating gloves are not in use during test.
   - Users touch the test unit right after the test is done.

3. Remote controlling the tester: The tester can be remote controlled generally for high voltage output via external control signal. When performing it, it is necessary to follow the control guidelines below for safety and precautions.

   - Do not allow any accidental high voltage output that may cause hazard.
   - When there is high voltage output from the tester, do not allow any operator or other personnel to touch the UUT, test cable or probe output, etc.
   - Remote control is generally controlled by the high voltage test bar; however, other control circuits can also be used to control it instead. The test bar is the switch for controlling high voltage output, so the connected control wire should not near the high voltage site and test cable to avoid causing any hazard.

⚠WARNING Do not tie up the high voltage wire with USB, LAN, RS232 and Handler control cables or other low voltage side wires. If so, it could cause the product or PC to be down or damaged.

CAUTION See Chapter 3 "*Precautions before Use*" for the details of using notes and dangerous operation.

Storage, Freight, Maintenance & Cleaning

Storage
When not in use, please pack the device properly and store in a suitable environment.

Freight
Please pack the device carefully before moving it. If any of the original packing material is missing, please use suitable alternative material and mark it “fragile” and “keep away from water” to avoid damaging the product.

This product is a piece of precision test equipment, so please do not drop or hit it.

Maintenance
In case of any malfunction or abnormality, please refer to the manual, or contact our local distributor for prompt service. Do not touch any parts inside the instrument to avoid any danger to yourself or damage to the product.

This product requires regular check and calibration to ensure it meets the specification. The suggested calibration period is 12 months.

Cleaning
Be sure to unplug the input power cord from the device before cleaning. Use a brush to clean the dust on the machine surface and use a low pressure air gun to clean the dust inside the device or send it to the agent for cleaning.

Revision History

The following lists the additions, deletions and modifications in this manual at each revision.

Date	Version	Revised Sections
Nov. 2017	1.0	Complete this manual.
Jun. 2020	1.1	Modify the following: – "*Specifications*" chapter – "*Precautions before Use*" chapter – "*Front Panel*", "*High Voltage Module*", "*Setting the SYSTEM Parameters*", and "*Setting a PROGRAM*" sections in "*Operation*" chapter – "*Pin Assignment*" and "*Timing Diagram*" sections in "*HANDLER Interface*" chapter – "*Commands Summary*" and "*Command Description*" sections in "*Using Remote Interface*" chapter Add the following: – "*Tester Outline and Dimensions*" section in "*Specifications*" chapter – "*Top Panel*" section in "*Operation*" chapter
Sep. 2021	1.2	Change of address and "*CE Declaration of Conformity*".

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1. Preface

1.1 Product Overview

The Chroma 19501-K Partial Discharge Tester is mainly to perform discharge detection on low-capacity small coulomb number (pC). The maximum output is 10kV AC voltage to test 1pC to 2000pC. The tester has HVCC (High Voltage Contact Check), 3-stage voltage test, 1P.D. to 10P.D. continuous discharge detection, real-time partial discharge display, 3-stage discharge data and break down voltage test functions providing an effective way to identify poor photocoupler manufacturing process. The tester is compliant to IEC 60270 and IEC 60747-5-5 standards.

The tester's display clearly shows all settings including time, current, voltage, resistance and memory number on the screen to avoid the need for the user to memorize test parameters set previously.

This tester can do pass fail determinations from preset limits and can be remotely controlled via RS232, HANDLER, USB and LAN interfaces, which are all standard options. With the above functions, the tester can perform photocoupler partial discharge measurement via highly efficient and accurate tests.

1.2 Features

- Hi-pot and partial discharge measurement
- PD[pC] detected value display
- PD (partial discharge) measurement: 1pC~2000pC
- High precision and resolution ammeter: 0.01uA~300.0uA
- PD occurrences (1 to 10 times) setting for defect judgment
- Built-in IEC60747-5-5 test standard
- 3-stage voltage test to meet safety and quality test requirements
- Contact check function
- Save up to 200 test conditions in memory
- Graphical editing function
- Screen capture function (USB)
- Traditional Chinese, Simplified Chinese and English operating interface
- USB, LAN, RS-232 and Handler remote user interface

1.3 Inspection

Before shipment, this tester was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, user should inspect for any damage that may have occurred in transit. Save all packing materials in case the tester has to be returned. If damage is found, please file a claim with the carrier immediately. Do not return the product to Chroma without prior approval.

1.4 Common Environment

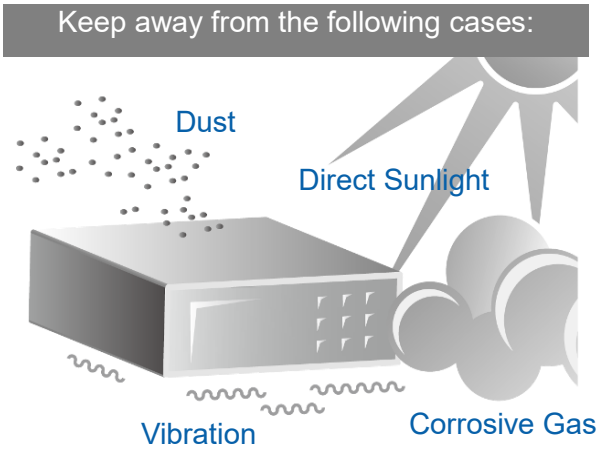
1. Indoor use only.
2. Altitude up to 2000 meter.
3. 2500V maximum transient overvoltage for main power supply.
4. Level II pollution degree.

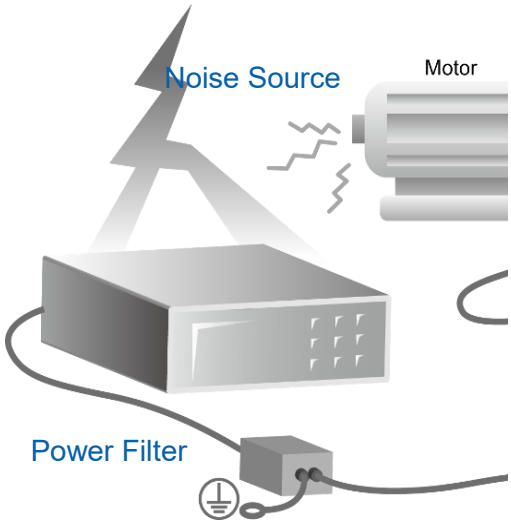
1.5 Ambient Environment

1. Do not use the tester in a dusty or vibrating location. Do not expose to sunlight or corrosive gas. Be sure that the ambient temperature is 0°C ~ +45°C and that the relative humidity is between 15% ~ 95%.

2. The tester has been carefully designed to reduce the conducted output noise on the input facility. If noise is inevitable, please install an AC power filter.

3. The tester should be stored within the temperature range of -10°C ~ +50°C. For long-term storage, it is recommended that the unit be packaged within its original box or a similar package and kept in a location free from direct sunlight and humidity.





2. Specifications (18°C ~ 28°C RH ≤ 70%)

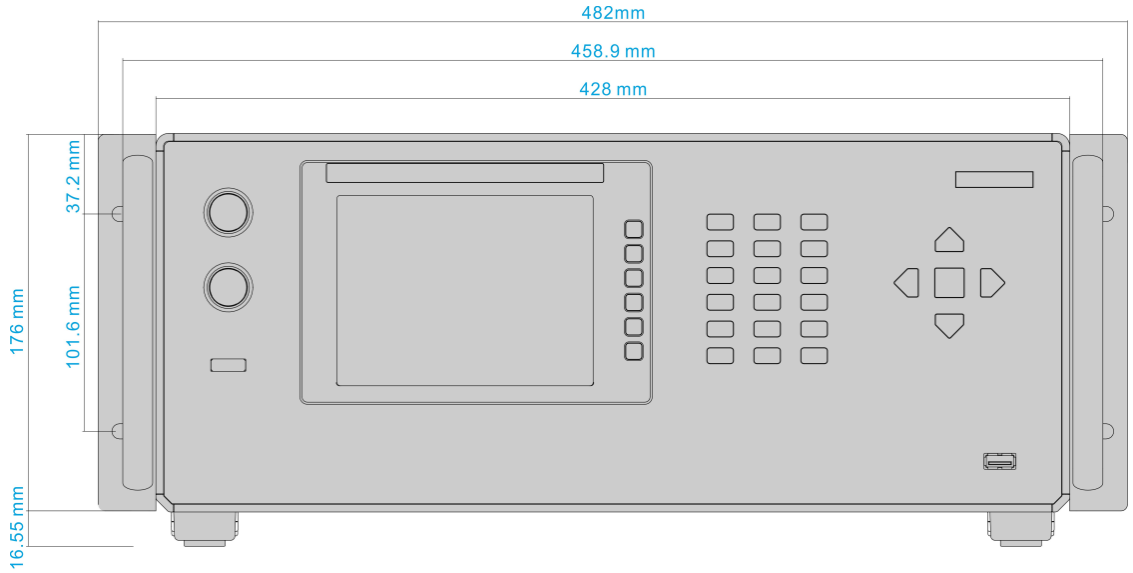
Specifications (18°C~28°C RH ≤ 70%)

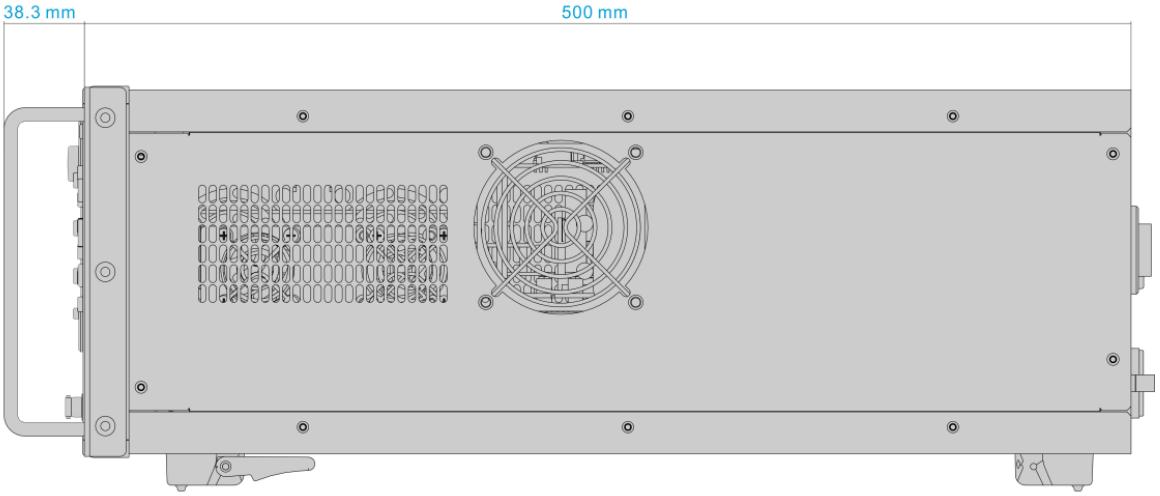
■ Output Voltage	
❑ Range	0.10kV~10.00kV, steps 0.01kV
❑ Voltage Accuracy	±(1% of setting + 0.5% of full Scale)
❑ Load Regulation	±(1% of setting + 0.5% of full scale)
❑ Frequency	50Hz, 60Hz ± 0.1%, sine wave
■ Measurement	
❑ V-display Accuracy	± (1% of reading + 0.5% of full scale), 10V resolution
❑ Cutoff Current	0.01uA~300.0uA
❑ Leakage Current Meter (Note1)	30uA: 0.50uA~29.99uA 300uA: 30.00~300.0uA Accuracy ± (1% of reading + 2% of full scale)
■ Partial Discharge Detector	
❑ Range	1.0pC~200.0pC, 0.1pC resolution 10pC~2000pC, 1pC resolution
❑ Accuracy (Note2)	± (1% of reading + 0.5% of full scale)
■ Test Timer	Test time: 0.3~99.9sec, steps 0.1sec Ramp/Fall time: 0.1~9.9sec, steps 0.1sec PD detection delay time: 0~9.9sec, steps 0.1sec
❑ Accuracy	Test time: ± (0.2% of setting + 10msec)
■ HVCC	1. Added HV & RTN contact terminal, test current <10mA and open voltage is 5Vdc typ. 2. Check function to select ON or OFF.
■ Handler interface	36 pins connector, all input/output are negative true logic and optically isolated open collector signals. (General-speed photo-coupler used)
	* All outputs must be pulled up with 10kohm resistor to +VEXT (external power supply). * All input optic-diode must be series with current limit (10mA±4mA for +3V ~ +26V) circuit.
■ Remote interface	
❑ RS-232	The programming language is SCPI.
❑ USB (B-type)	Meet USB TMC.
❑ LAN	Support 10M/100M Ethernet.
■ Memory Storage	200 instrument setups.
■ USB flash drive (A-type)	Test parameters, result and waveform (BMP) storage. (EXP. function)
	One memory of test procedure and parameter can be storage/recall.
	Backup/restore all memory data to USB flash.
	Support USB Flash up to 32GB in size.
■ General	
❑ Specifications range	18 to 28°C (64 to 82°F), ≤ 70% RH
❑ Operable range	0°C to 45°C, 15% to 95% RH@ ≤40°C and no condensation
❑ Storage range	-10 to 50°C, ≤ 80% RH
❑ Power Requirement	100Vac ~ 240Vac, 50/60 Hz.
❑ Power Consumption	No Load: <150W, Rated Load: <400W.

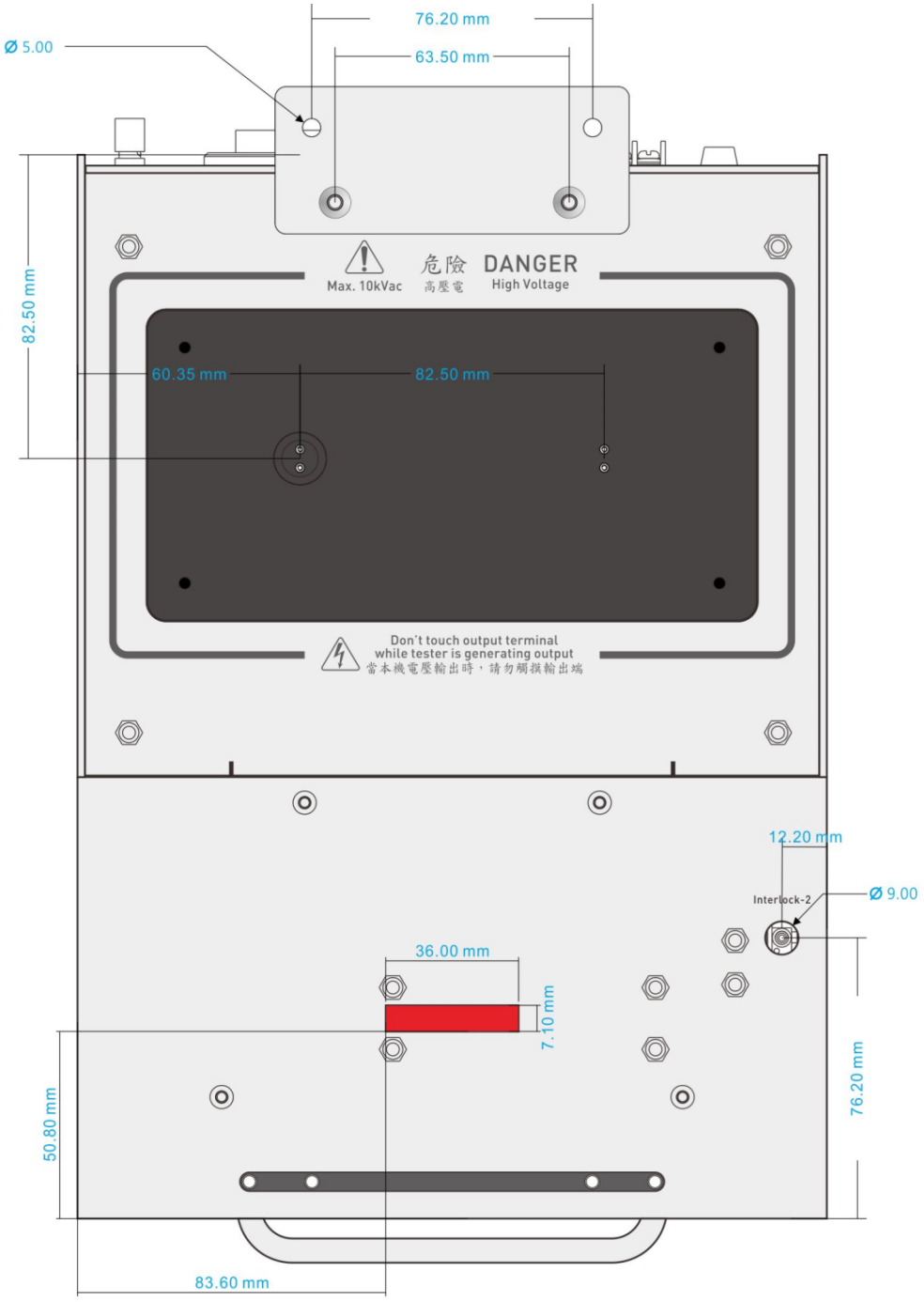
❑ Dimension(W×H×D)	Host: 428x176x500mm / 16.85x6.93x19.69 inches HV Module: 203.2x200.3x307.35mm / 8x7.89x12.1 inches
❑ Weight	20.5 kg / 45.19 lbs. 13.2 kg / 29.10 lbs.

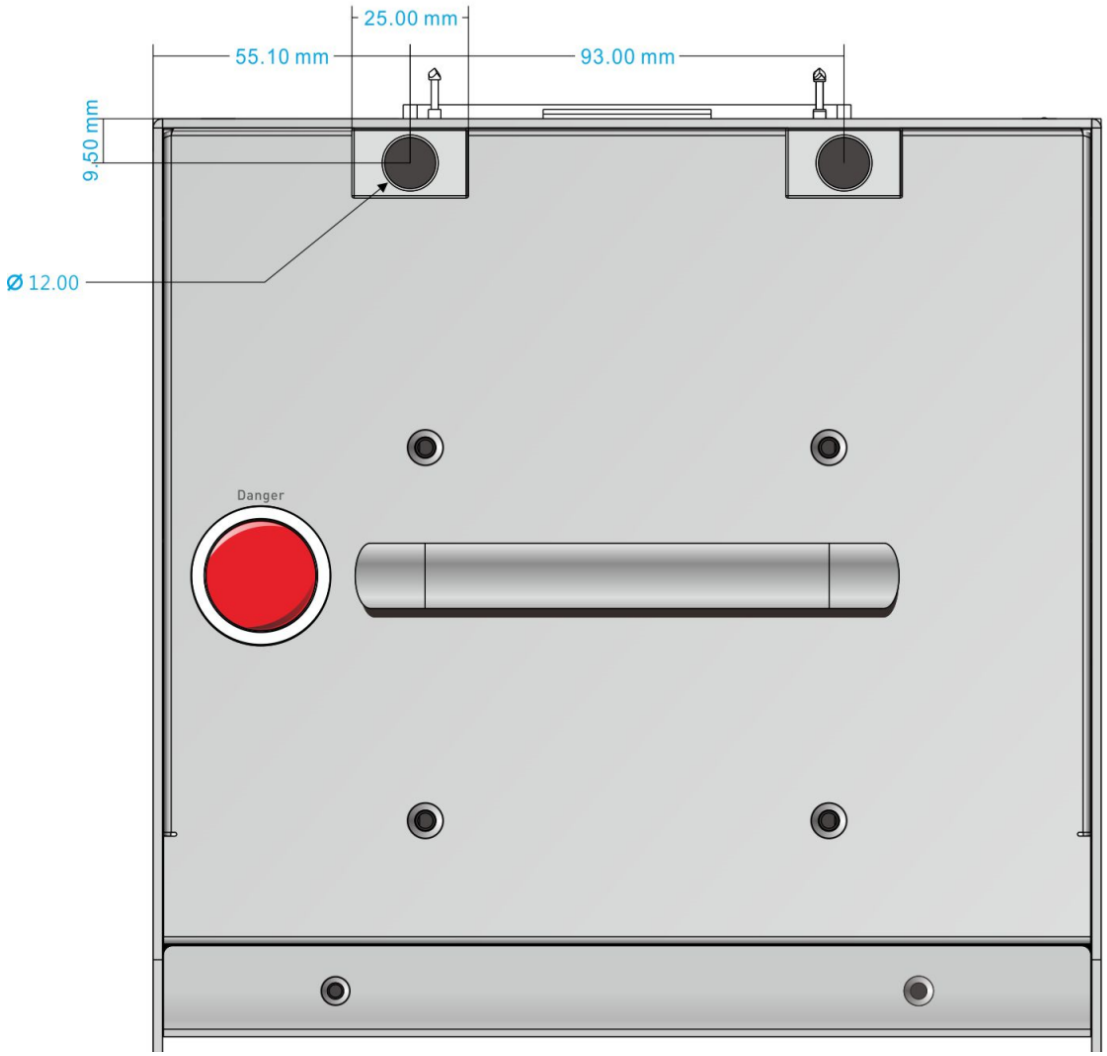
Note
1. The current accuracy is only valid for capacitive load.
2. The PD measurement uses correction pulse generator compliant to IEC60270 for verification. The specification of measurement accuracy is defined as the relative error of correction generator.

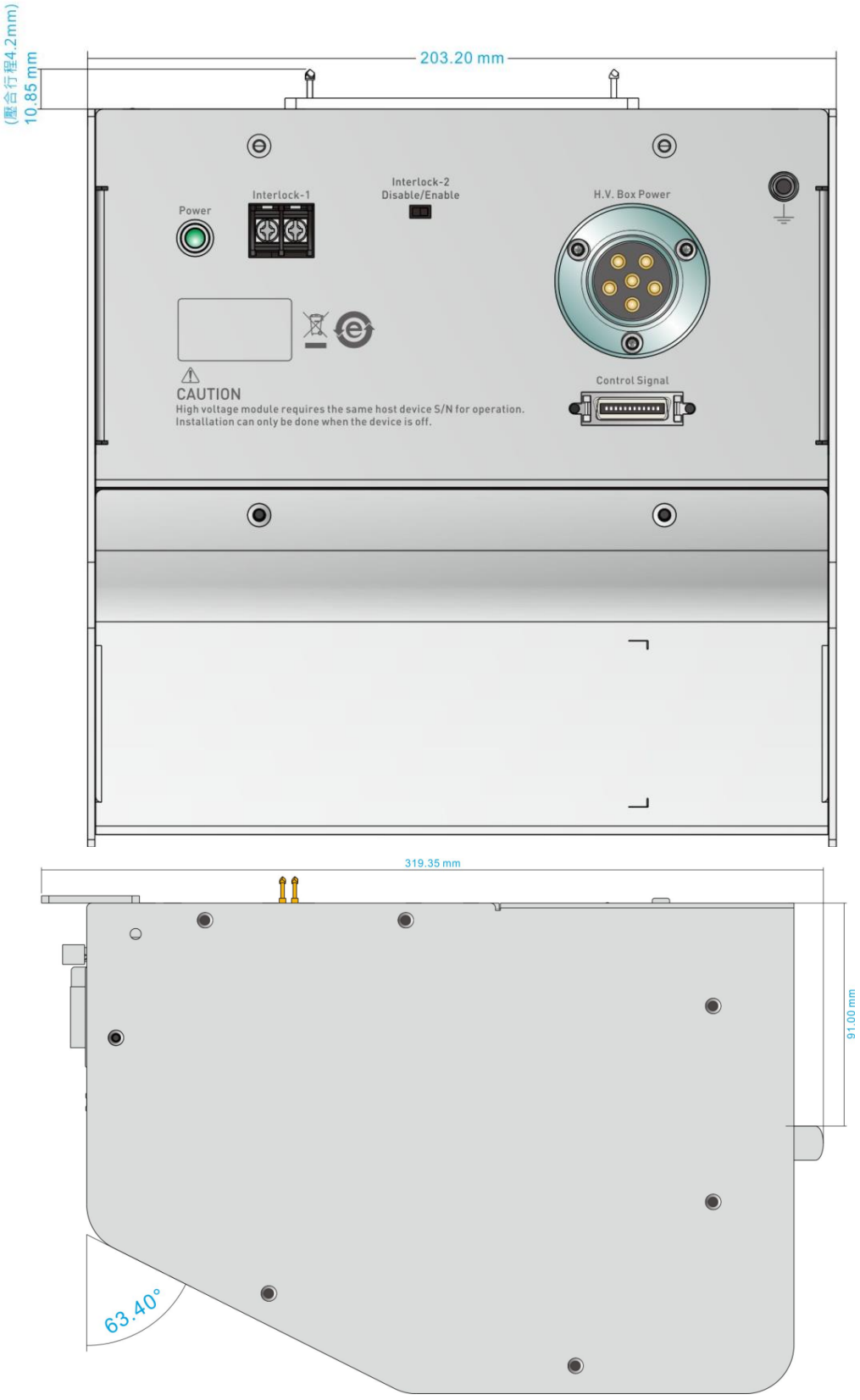
2.1 Tester Outline and Dimensions






76.20 mm
63.50 mm
Ø 5.00
82.50 mm
危險 DANGER
Max. 10kVac
高壓電
High Voltage
60.35 mm
82.50 mm
Don't touch output terminal
while tester is generating output
當本機電壓輸出時，請勿觸摸輸出端
12.20 mm
Ø 9.00
Interlock-2
36.00 mm
7.10 mm
50.80 mm
76.20 mm
83.60 mm


25.00 mm
55.10 mm
93.00 mm
9.50 mm
Ø 12.00
Danger


(壓合行程4.2mm)
10.85 mm
203.20 mm
Power
Interlock-1
Interlock-2
Disable/Enable
H.V. Box Power
Control Signal
CAUTION
High voltage module requires the same host device S/N for operation.
Installation can only be done when the device is off.
319.35 mm
91.00 mm
63.40°

3. Precautions before Use

This tester can deliver high voltage up to **10kV** on its output terminals. Accidents may occur or even cause death if using the tester incorrectly. It is strongly recommended that the following be read and followed carefully to avoid any injury or even death.

1. **Electric shock**
   To prevent electric shock, it is suggested to wear insulated rubber gloves first before using the tester.

2. **Grounding**
   A safety ground terminal is located on the tester rear chassis. Be sure to ground it properly. Dangerous condition can occur if ground is loose or becomes disconnected during testing as the chassis may carry a high potential. Anyone touching the device in this case may result electric shock. Therefore, it is necessary to connect the safety ground terminal to earth properly and securely as Figure 3-1 shows.

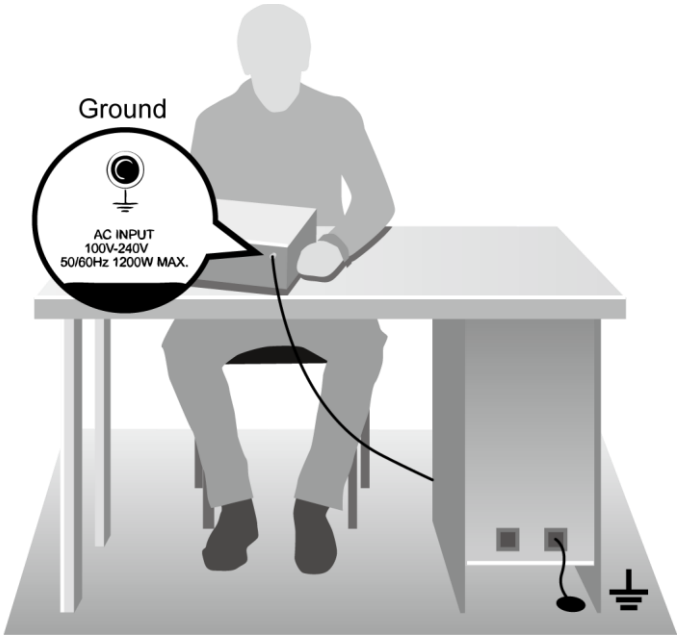


Figure 3-1 Diagram for Safety Grounding

3. **Fragile liquid panel**
   Do not press the liquid panel heavily or use a sharp object to touch the panel as it may cause the panel to break or display improperly.

Handling Precautions

The gross weight of the Partial Discharge Tester is about 21kg (49.3 lbs.) It is recommended to mount the handle and ear racks came along with the shipment, and use a trolley when moving the tester to avoid causing any personnel injuries.

4. Connecting host and high voltage module

This tester can only be operated when the host and high voltage module are connected. The high voltage and host should have the same serial number. There are two connecting cables between the host and high voltage module. The cables can only be unplugged in OFF state. When the tester is activated, make sure the power light of high voltage module is turned on. A message "fixture not exists" will appear if the cable is having poor contact.

Always check the test cable on HIGH/RTN and see if it is well connected without loose or falling when using the tester. It is very dangerous if the test cable is not properly connected or dropped as the entire DUT may full of high voltage.

CAUTION The tester must use the host and high voltage module with the same serial number. Be sure to calibrate again if a host or a module of different serial number is in use.

5. End of test

When the test is done or the tester is no longer in use or is unattended for a while, it is necessary to toggle the power switch to OFF (i.e. to shut down the power) as Figure 3-2 shows.

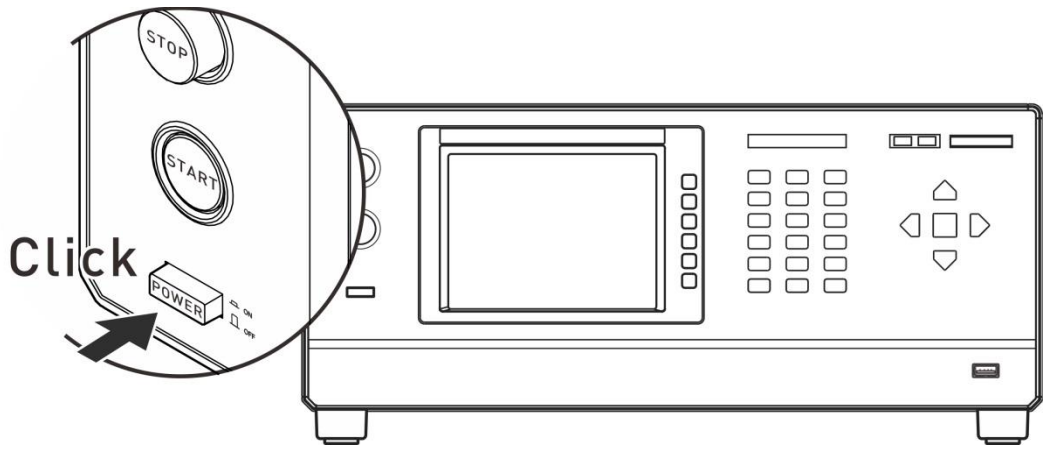


Figure 3-2 Power Switch Off

6. Do not touch hazard areas when the tester is in test mode

When the tester is in use, it is a very dangerous to touch the DUT, test cable, probe and output terminal that contain high voltage.

CAUTION Do not touch the high voltage module probe and the black fiberglass as shown in Figure 3-3. When the host is in testing state, it may cause hazardous due to not enough insulation.

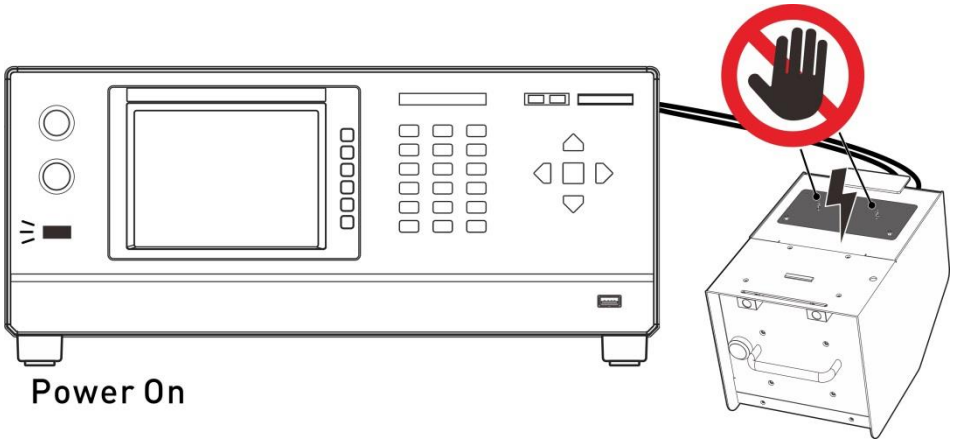


Figure 3-3 No Touch When Outputting High Voltage

<<< Warning! When output terminal is cutoff >>>

7. **Ensure the test is done**
   If it is necessary to touch the high voltage areas such as DUT, high voltage test cable or output terminal etc. due to configuration or test related change, be sure that the power switch is turned off.

8. **Remote controlling the tester**
   The tester can be remotely controlled for high voltage output via external control signal. When performing it, it is necessary to follow the control guidelines for safety and precautions.
   - Do not allow any accidental high voltage output that may cause hazard.
   - When there is high voltage output from the tester, do not allow any operator or other personnel to touch the DUT, test cable or probe output, etc.

✳✳ CAUTION ✳✳

9. **Turning on or off the power switch**
   When the power switch is turned off, it needs to wait for a few seconds to turn it on again. Do not power it on and off continuously to avoid errors. It is very dangerous to power it on and off continuously when in high voltage output state in particular. **When turning on or off the power, the high voltage output terminal cannot connect to any object to avoid the hazard caused by abnormal high voltage output.**

10. **Other notices**
    Do not short-circuit the output line, grounding wire, communication cable or other device's grounding wire or AC power to avoid charging the entire tester with dangerous voltage. To short-circuit the terminals of high voltage output and RTN/LOW, it is necessary to ground the tester chassis to earth properly.

<<< Emergency Case >>>

11. **Process for emergency case**
    To avoid causing bigger hazard when in emergency like electric shock, DUT or tester burnout, please perform the steps below:

    - **First, cut off the power.**
    - **Second, unplug the power cord.**

<<< Resolving Problem >>>

12. Problems occurred

Problems occurred in the following situation are very dangerous. The output terminal may still have high voltage output even the [STOP] key is pressed; therefore, the user should be extremely careful when dealing with it.

- The DANGER LED indicator keeps on when [STOP] key is pressed.
- The DANGER LED indicator is on but the voltage meter has no readings.

When the above situation occurs, shut down the power and unplug the AC power cord immediately. Do not use the device again as failure is extremely hazardous. Please send the hardware back to Chroma or its distributor for repair service.

13. DANGER Indicator failure

If the voltage meter already has readings when pressing the [START] key, and the DANGER LED indicator is still off, it means the indicator may out of order. Please power off the hardware and replace it with another device, then send the tester back to Chroma or its distributor for repair service.

14. Applicable AC INPUT for this tester is 100Vac ~ 240Vac, 50/60 Hz

Be sure to replace the fuse when the power cord is unplugged to avoid electric shock. Use a flat screwdriver to pry the fuse holder inside the power socket and remove the fuse to replace with a new one by pushing it in gently, and then push the power socket back to its position.

⚠WARNING Be sure to use the fuse with correct specification (10A / 250V) or it may cause hazard.

15. This tester is normally operated under AC power

If the power supply is unstable, it may cause the device to work inaccurately or abnormally. Thus, please use appropriate equipment such as a power supply regulator to convert it to a suitable one.

16. This tester draws large current instantly

When the device to be tested draws a great amount of current, the current (about 10amp) may flow in for more than 10ms before judging for the defect item and cutting off the output current. The same situation may occur before testing, thus it is necessary to watch out the power cord capacity and the connecting cables used for other instruments or devices.

17. Storage

The operating temperature range of the tester is 5°C~40°C, 15%~95% RH@ ≤ 40°C. The device may act strangely if exceeding the temperature range. Do not fix the tester to avoid difficulties while disconnecting the device. The storage temperature range for the tester is from -10°C to 50°C, 80% RH. If it is not in use for a long time, please pack it with its original package for storage. For proper test and safety measures, do not place the tester under direct sunlight, high temperature, trembling, humid or dusty area.

18. Warming up

The tester is activated when the power is on; however, in order to meet the accuracy specified in the specification, be sure to warm it up for 15 minutes or longer.

19. Warning label during test
"DANGER – HIGH VOLTAGE TEST IN PROGRESS, UNAUTHORIZED PERSON KEEP AWAY"

20. Keep test cables away from the panel
When operating the device, be sure to keep the high voltage wire or DUT at least 30 cm away from the panel to avoid high voltage discharge from interrupting the display.

21. Precautions for connecting automated device
- The grounding system of the tester and automatic device should be connected together.
- High voltage cable must be separated from the control cable.
- High voltage cable must keep appropriate distance from the device/panel.

4. Operation

4.1 Front Panel

The front panel is divided into several easy-to-use areas. This section introduces each control item and the information displayed on the LCD.

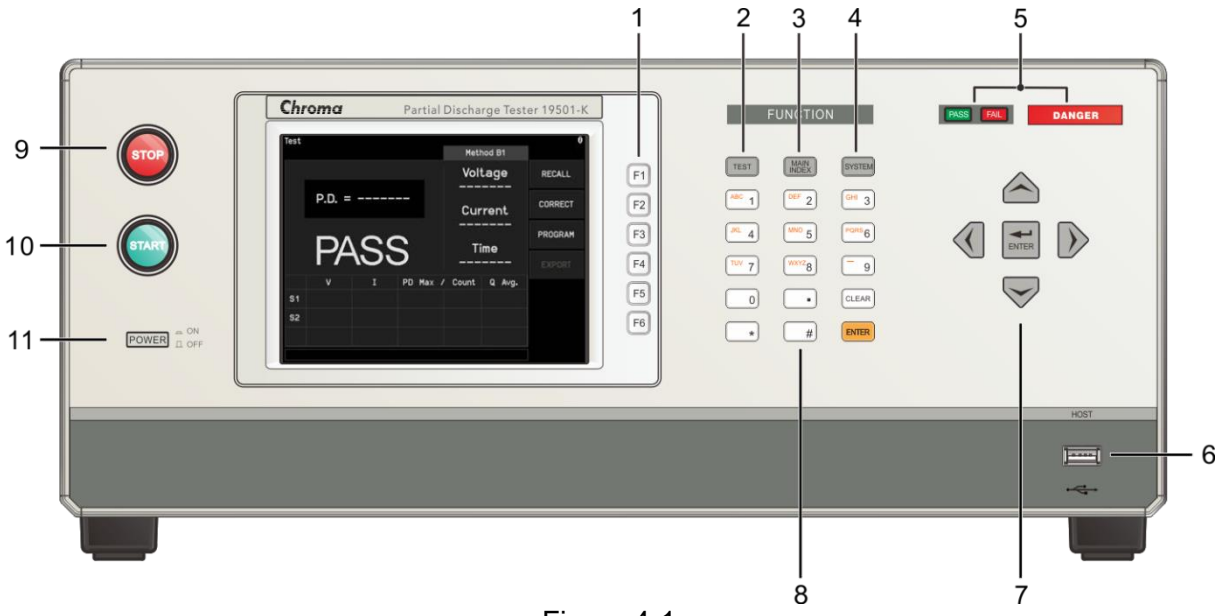
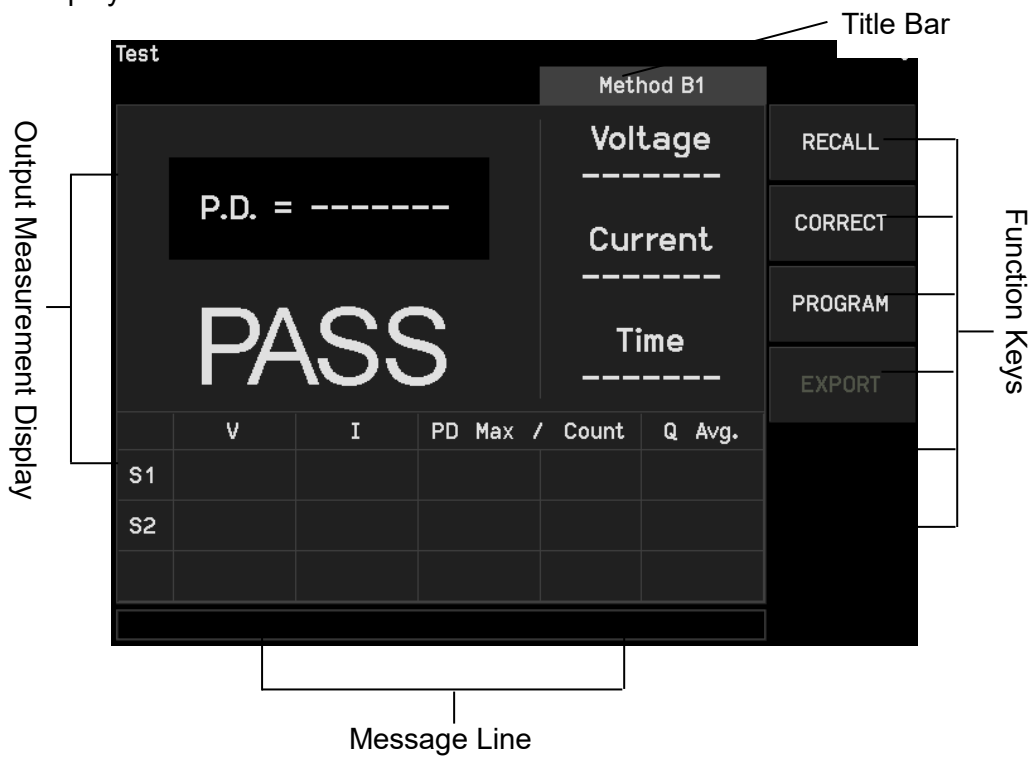
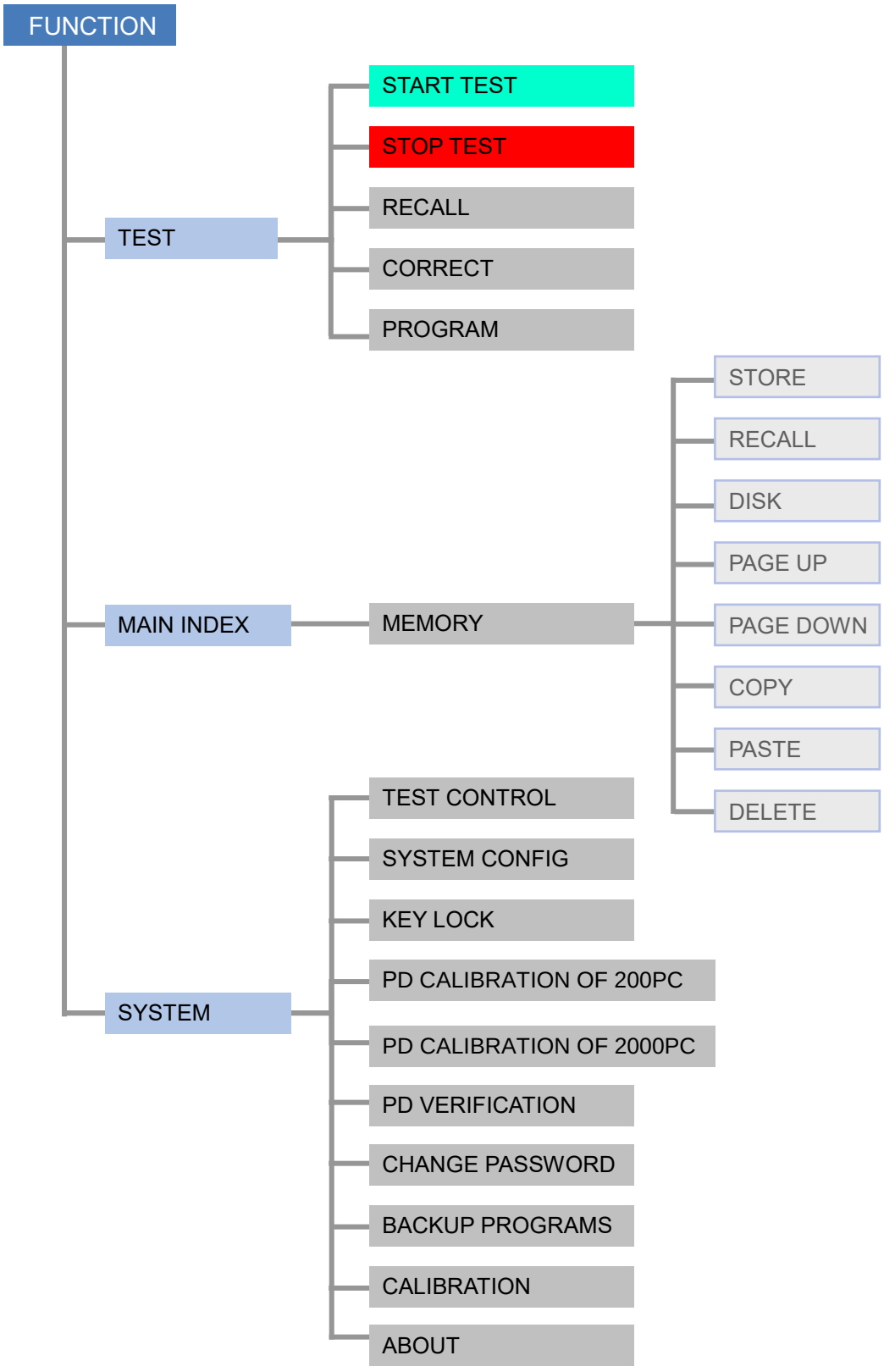


Figure 4-1

■ Display Area Zoom In



Function Keys Flow Chart



Buttons

(1) Function Key : The functions are varied when in different screen. The mapping function names are listed on the right of LCD. If the mapping area is blank or grayed out it indicates the function key is invalid.

(2) TEST : Press this key in any screen can return to [TEST] mode.

(3) MAIN INDEX : It is the key to manage the test. Press this key can enter into the memory management screen for saving and deleting test procedures as well as operating in **IWT BDV MODE**.

(4) SYSTEM : It is the key to enter the system setting menu.

(5) Indicator : It has TESTING LED and judgment LED indicators.

(6) HOST : It can be used as extended memory with common USB flash drive on the market.

(7) Cursors : [▲] [▼] [◀] [▶] are the cursor movement keys for setting functions or editing test procedures. Press **ENTER** to confirm the entry.

(8) Data Entry Keys/ Program Keys

[0][.]～[9] [*] [#] : The numeric/character keys to input various programs (value or English alphabet.)

[ENTER] : It is the confirmation key. Press this key to confirm the entered value of program.

[CLEAR] : It is the clear key. Press this key to clear the error data when entering the program.

(9) Power Switch : It is the AC power switch of the Partial Discharge Tester. Be sure to read Chapter 3 *Precautions before Use* before using this switch.

(10) START Key : It is the reset key. When pressed the tester will cutoff output immediately or return to ready-to-test state and clear all judgments.

(11) STOP Key : It is the test activation key. The tester is in test state when pressed, which means there is output on test terminal and the judging functions are activated at the same time.

4.2 Rear Panel

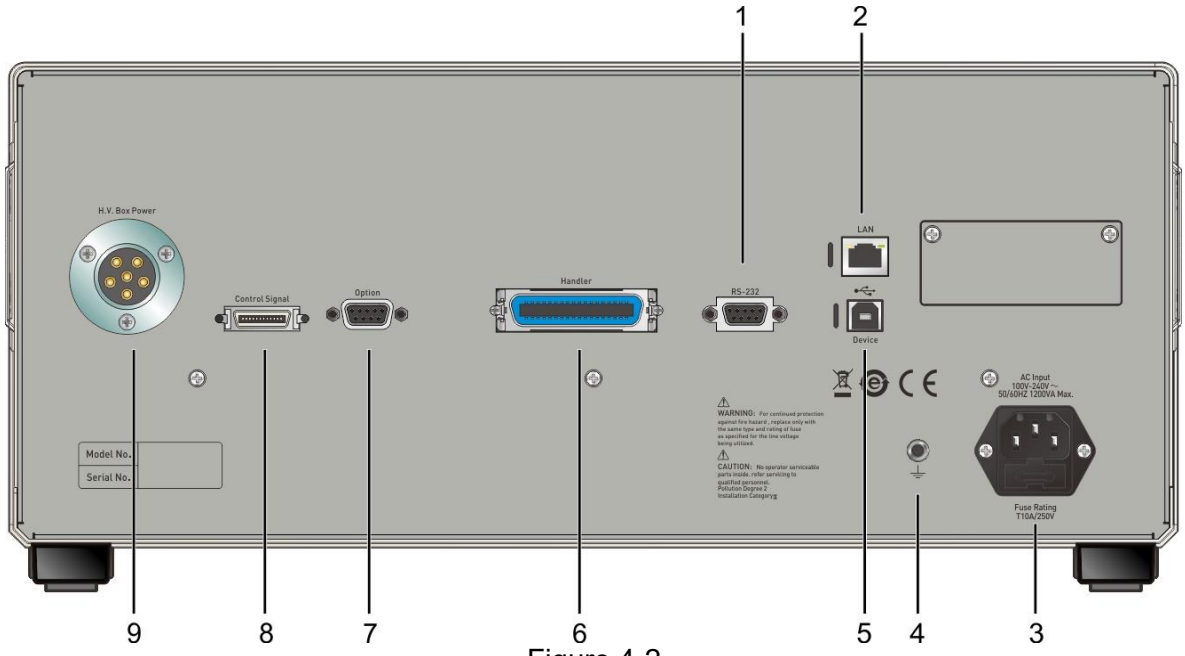


Figure 4-2

(1) RS232 Interface : This connector is the interface for connecting the RS232 interface card on PC.

(2) LAN Interface : This connector is the interface for connecting the LAN interface on PC.

(3) AC LINE : It contains a three-wire AC power socket and a fuse holder. The AC power required by the tester is supplied by this power socket. For detail specification of fuse, please see Chapter 3 *Precautions before Use* or the instruction on the rear panel.

(4) GND Terminal : It is the grounding terminal for safety. Be sure to use an appropriate tool to connect it to earth properly. If it is not properly grounded, the tester chassis may contain high voltage when the power circuit or any device's cable is shorted with the grounding terminal, and it is very dangerous as anyone who touches it may encounter electric shock. Therefore, the ground terminal must properly connect to earth.

(5) DEVICE Interface : This connector is the interface for connecting the USB terminal on PC.

(6) HANDLER Interface : This connector is for the optional HANDLER interface. See Chapter 5 *HANDLER Interface* for detail usage.

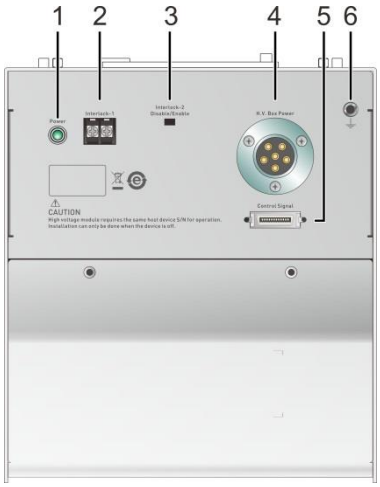
(7) Option : Used when connecting an optional device.

(8) Control Signal : The connector for connecting the control signal cable that must be connected during normal operation. It controls and returns high voltage module signals.

(9) HV Box Power : The power signal cable to supply power source to high voltage module.

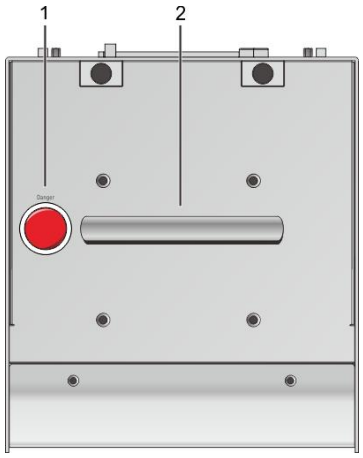
4.3 High Voltage Module

4.3.1 Front Panel



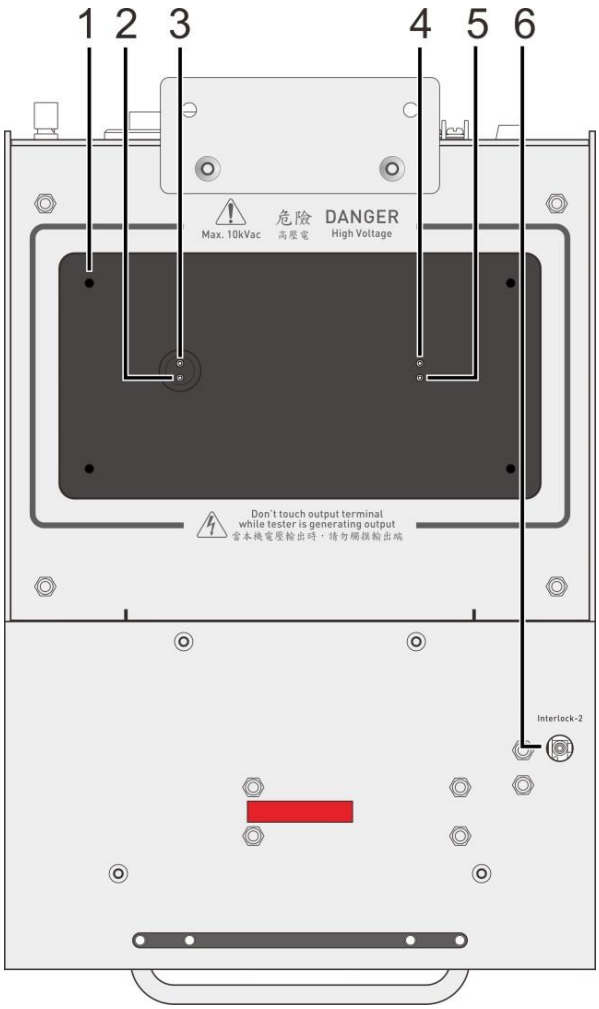
(1) Power Light	:	It is on when the high voltage module is powered on.
(2) INTERLOCK-1	:	High voltage outputs only when these two terminals are short-circuited.
(3) INTERLOCK-2	:	When enabled, the INTERLOCK-2 switch needs to be pressed and the INTERLOCK-1 two terminals need to be short-circuited to output high voltage. It will not detect if disabled.
(4) HV Box Power	:	It is to supply power source to high voltage module.
(5) Control Signal	:	The connector for connecting the control signal cable that must be connected during normal operation. It controls and returns high voltage module signals.
(6) GND Terminal	:	It is the grounding terminal for safety. Be sure to use an appropriate tool to connect it to earth properly. If it is not properly grounded, the tester chassis may contain high voltage when the power circuit or any device's cable is shorted with the grounding terminal, and it is very dangerous as anyone who touches it may encounter electric shock. Therefore, the ground terminal must properly connect to earth.

4.3.2 Rear Panel



(1) Danger Light : It warns the device is outputting high voltage.
(2) Handle : It is for hand carry.

4.3.3 Top Panel



(1) Nut	:	It secures the test fixture. The thread length of lock screw must be smaller than 6mm; the torque must be less than 10kgm.
(2) RTN/LOW	:	The reference terminal during high voltage testing that is the low potential terminal. It is almost equal to the grounding terminal on the outer case.
(3) HVCC-RTN	:	HVCC high voltage contact check on RTN terminal
(4) HVCC-HV	:	HVCC high voltage contact check on HV terminal
(5) HV	:	It is the high potential terminal for high voltage test. Do not touch it when testing and the DANGER light is on.
(6) INTERLOCK-2	:	When the INTERLOCK-2 is enabled, this microswitch needs to be pressed.

4.4 Notices before Use and Operating Procedure

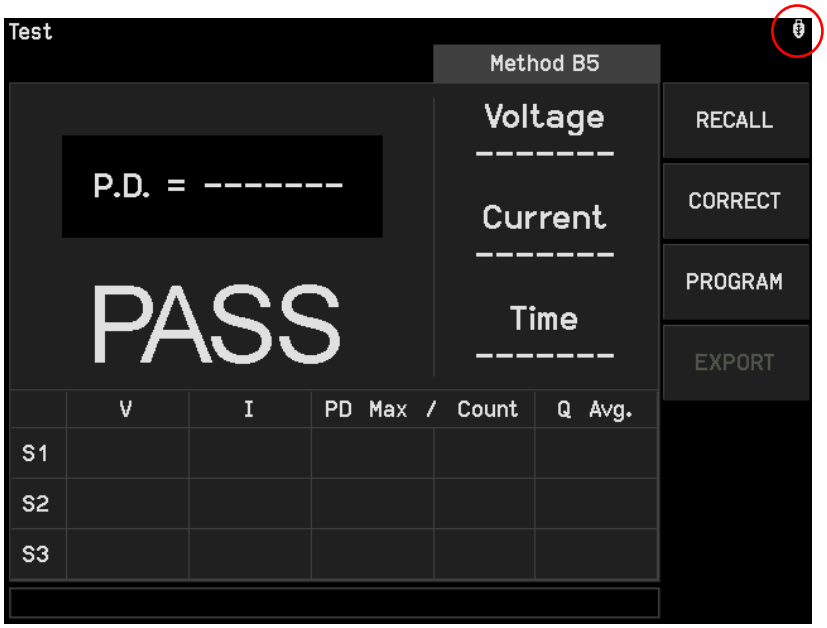
1. Before plugging in the AC power cord, make sure the power in use matches the power indicated on the rear panel and the switch is OFF.
2. Read the precautions described in Chapter 3 *Precautions before Use* carefully before power-on the tester.
3. Firmly connect the power cord and control cable on the tester and the high voltage module before turning them on.
4. Once the tester is powered on, it will start self-test. If any abnormal occurs, turn off the power switch immediately and unplug the power cord.

4.5 Icons on Title Bar

When the following occurs, a mapped icon will appear on the right side of the title bar to remind the user.

Icon	Description
	There is error message in remote command queue. Use **":SYSTem:ERRor[:NEXT]?"** to read the command
	It shows the remote status.
	The defect is locked.
	The keyboard is locked.
	The USB flash drive is working.
	The USB flash drive is available for use.

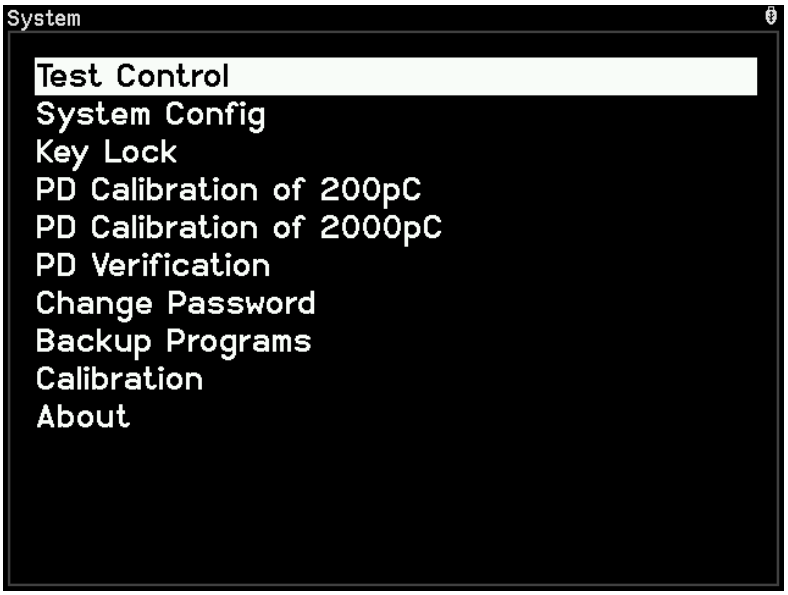
Insert a USB flask drive in standby mode and a USB flash drive icon will appear on the title bar to indicate it is inserted successfully as shown in the figure below. Pressing [*] and [#] can capture the screen and save it to the USB flash drive.



4.6 Setting the SYSTEM Parameters

4.6.1 Entering the SYSTEM Setting Menu

Press **SYSTEM** in any menu will show the following:



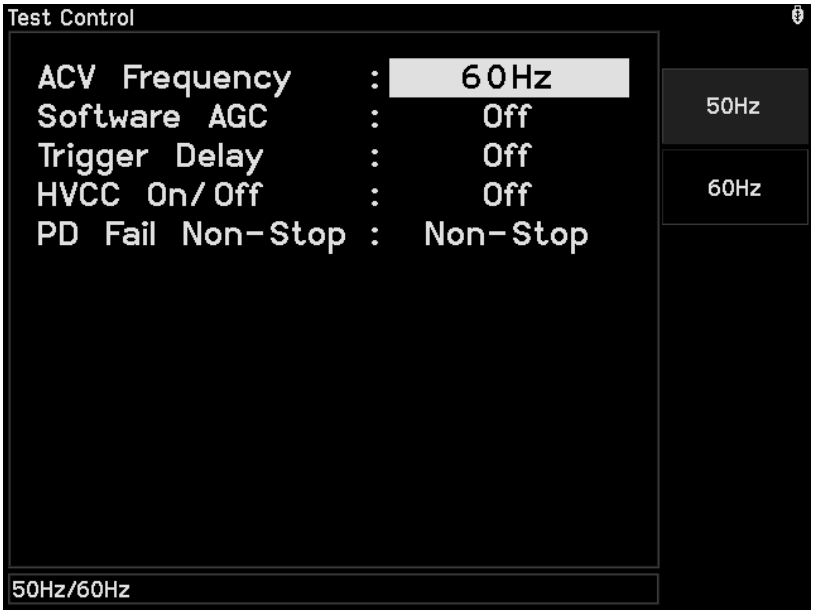
Use the cursor key [▲] [▼] to move the highlight to the item desired. Press **ENTER** to go to the setting menu of selected function.

Table 4-1 List of System Setting Items

Item	Description
Test Control	It sets the related parameters for test.
System Config	It sets the system related parameters.
Key Lock	It sets the keyboard lock function.
PD Calibration of 200pC	It sets the PD calibration for 200pC range.
PD Calibration of 2000pC	It sets the PD calibration for 2000pC range.
PD Verification	It sets for PD measurement verification.
Change Password	It changes the user's password.
Backup Programs	It backups the data set in PROGRAM menu.
Calibration	It sets the calibration related function.
About	It shows the version related information.

4.6.2 Setting Test Control

In System setup screen, move the highlight to Test Control and press **ENTER** to go to Test Control setting menu as shown below:



When in Test Control menu, press ▲ ▼ to move the highlight to the item desired and press a numeric key or Function Key **F1** **F2** **F3** **F4** **F5** **F6** to set the mapped functions.

Table 4-2 Setting Items in Test Control

Item	Range	Default	Description
ACV Frequency	50Hz/60Hz	60Hz	Set the output voltage frequency.
Software AGC	ON/OFF	ON	Enable software voltage compensation after contact check.
Trigger Delay	0 (OFF), 10~9999ms	OFF	Set the test delay time when START is pressed.
HVCC On/Off	ON/OFF	OFF	Perform high voltage contact test when set to ON.
PD Fail Non-Stop	Non-Stop/ Stop	Stop	Set if finishing the subsequent test items when PD fails during the test.

4.6.3 Setting System Config

In System setup menu, move the highlight to System Config and press **ENTER** to go to the System Config menu as shown below:

When in System Config menu, press ▲ ▼ to move the highlight to the item desired and press a numeric key or function key **F1** **F2** **F3** **F4** **F5** **F6** to set the mapped functions.

Table 4-3 Setting Items in System Config

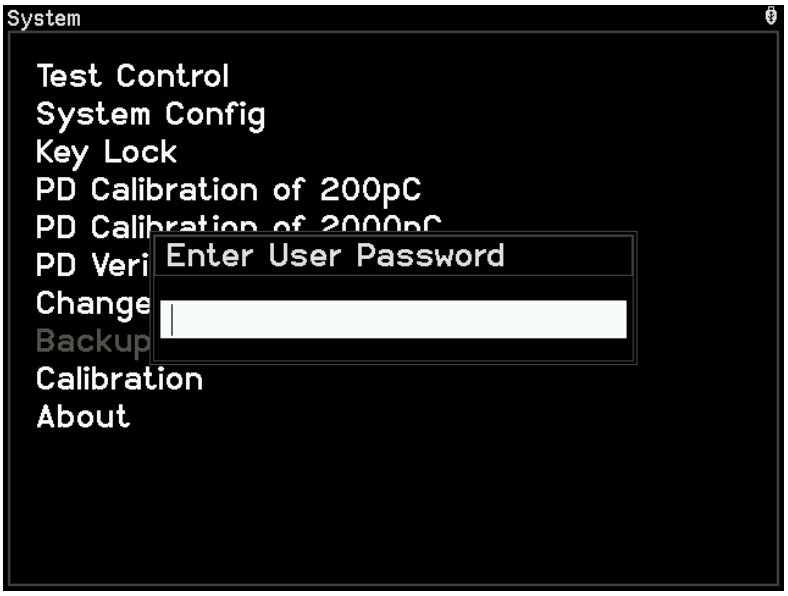
Item		Range	Default	Description
Language		English, Traditional/Simplified Chinese	English	It sets the display language.
Contrast		1 - 16	8	It adjusts the LCD brightness.
Buzzer		High / Medium /Low / Off	Medium	It adjusts the buzzer volume.
RS232	Baud Rate	9600 / 19200 / 38400 / 57600 / 115200	9600	It sets the transmission baud rate of RS232 interface.
	Flow Control	None / Hardware	None	It sets if enable hardware flow control.
Ethernet	IP Style	Dynamic IP / Static IP	Dynamic IP	It sets the IP address of LAN interface. If Dynamic IP is selected, the IP is specified by PC and the IP is set by the host if Static IP is selected. It sets the transmission baud rate of RS232 interface.
	IP Address	0~255.0~255.0~255.0~255	192.168.1.101	
	Subnet Mask	0~255.0~255.0~255.0~255	255.255.255.0	
DATE & TIME	Year	NONE	NONE	It sets the time on the host.
	Month			
	Date			
	Hour			
	Minute			
	Second			

Notice When the Language is reset, it is necessary to reboot the tester to display the set language.

4.6.4 Setting Key Lock

The way to set key lock:

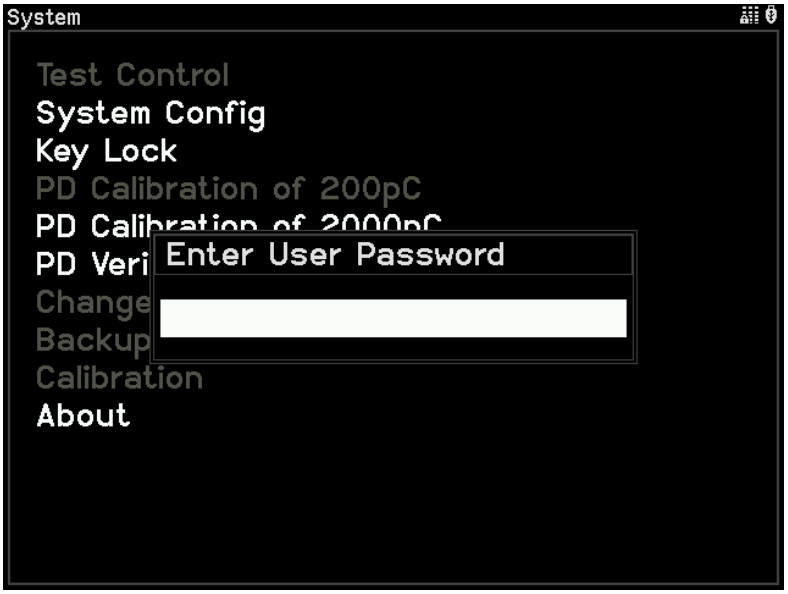
In System setup menu, move the highlight to Key Lock and press **ENTER** to go to Key Lock setting menu as shown below:



1. In Key Lock menu, press numeric keys to enter the password (the default is 0000.)
2. Press **ENTER** to prompt a selection window to select if locking recall memory. The users can use Function Keys **OFF**, **ON** to select if locking the memory recall function as well.
3. When Key Lock is ON, the locked function will show in light gray. The “CORRECT”, “PROGRAM” and “Store”, “Delete”, “Copy”, “Paste” of MEMORY in [MAIN INDEX] as well as the “Test Control”, “Fail Lock”, “Change Password”, “Calibration” in [System] all cannot be entered for setting.
4. When setting Key Lock, if RECALL LOCK is ON, the MEMORY RECALL function is also invalid.

The way to release key lock:

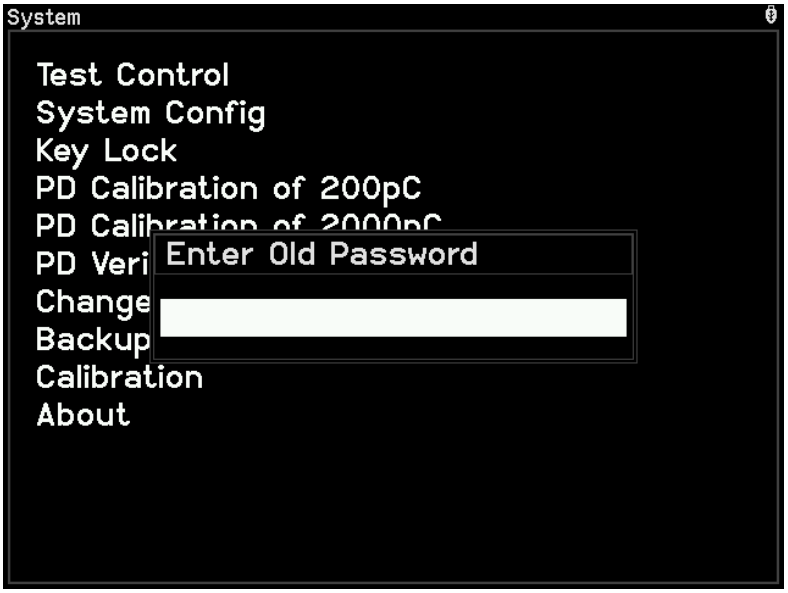
To release key lock, press **SYSTEM** to select Key Lock as shown below:



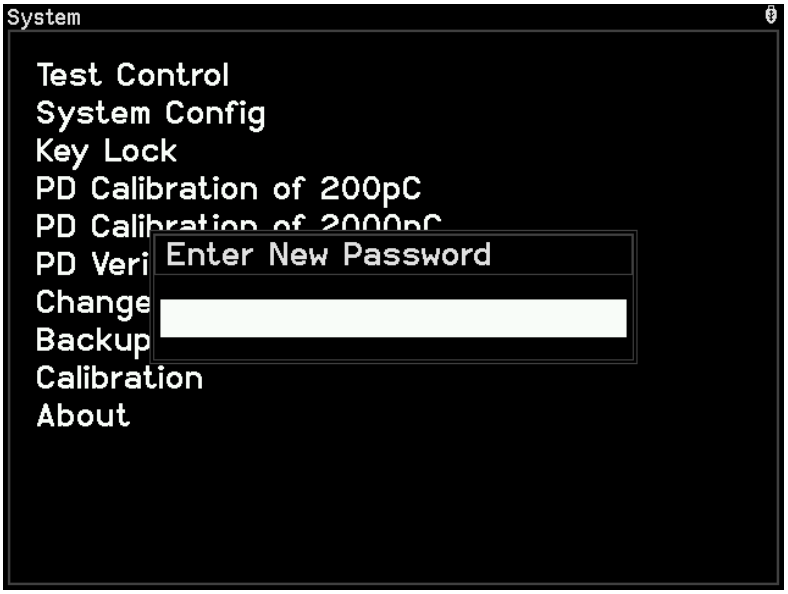
Use numeric keys to enter the password and press **ENTER** again, the text of "KEY LOCK" will return to normal color to indicate the KEY LOCK function has been disabled.

4.6.5 Changing Password

In System setup menu, move the highlight to Change Password and press **ENTER** to go to Change Password screen as shown below:



1. Use numeric keys to enter the password (enter 0000 if the password has not been set.) Press **ENTER** and a box of "Enter New Password" will appear.



2. Use numeric keys to enter a new password (maximum 10 characters) and press **ENTER**, an “Enter New Password Again” window will appear.
3. Use numeric keys to enter the new password again and press **ENTER** to complete the password change.

Notice

Please follow the procedure described in section 4.7.4 to erase the memory and reset the password to its initial 0000 when the set password is forgotten.

4.6.6 Using USB to Backup Host Memory

Follow the steps below to import or export all test programs from a USB flash drive:

1. Insert the USB flash drive into the HOST connector on the front panel. Be aware that the drive capacity should be less than 32G and the format should be FAT16/FAT32.
2. Press **SYSTEM** and select Backup Programs as the figure shown below.

Use the function keys [EXPORT] and [IMPORT] to export or import the test programs saved in the drive.

Notice This function is unable to import or export a single memory set. Please use Memory function to do it.

4.7 Managing Programs and Test Control Memory

The 19501-K has 200 sets of memory and each of them contains programs, Test Control parameters and the name of the memory.

4.7.1 Entering the Memory Menu

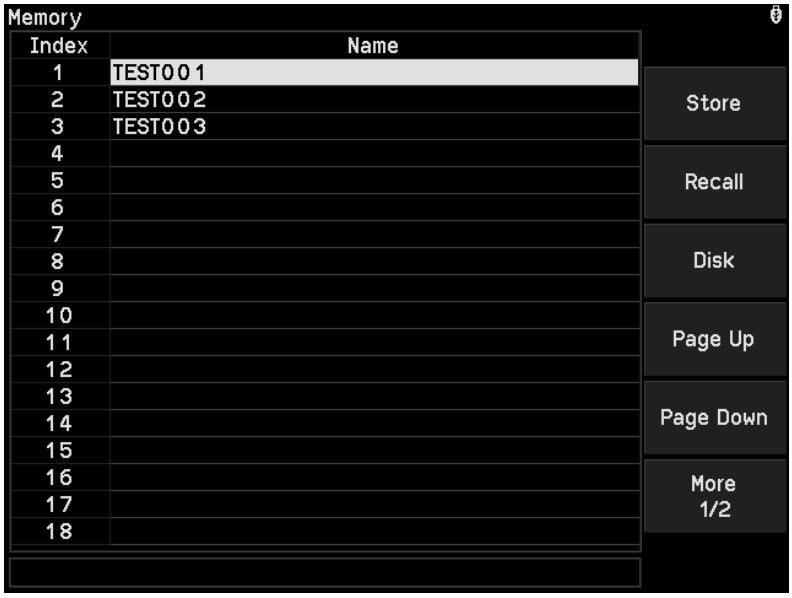
1. Press **MAIN INDEX** in any menu will appear the following:

2. Press **ENTER** to get in Memory mode as shown below.
3. Use ▲ ▼ to move the highlight to the desired memory and follow the instruction of function key to read, save or delete the memory.

4.7.2 Saving the Memory

Follow the steps below to save the set programs into memory:

1. Use ▲ ▼ to move the highlight to the memory to be saved and press function key [Store].



2. When the cursor highlight is reversed, use numeric or character keys to input the memory name. Press the same number or letter repeatedly can cycle between the number and English letter case for display.
3. When a character is entered, the cursor will automatically move to next position for

input.

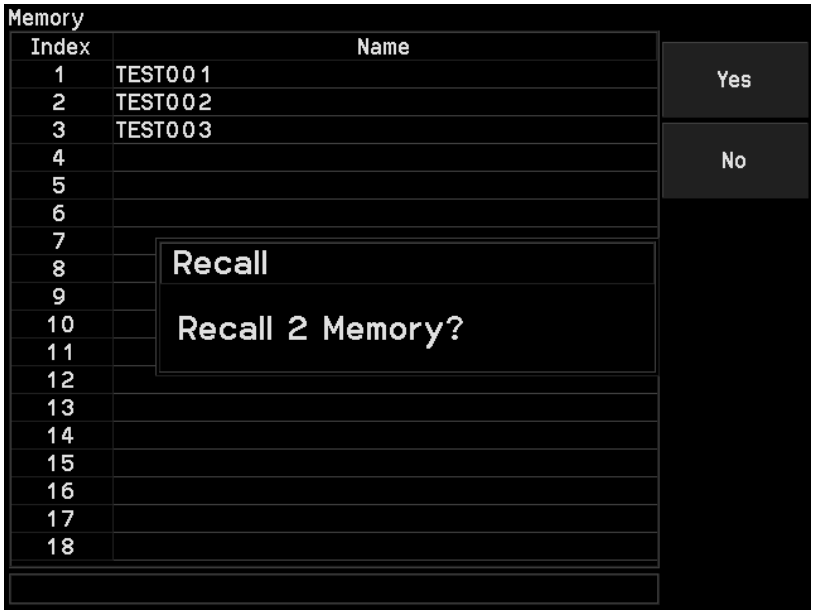
4. Press **ENTER** to complete the task.

CAUTION The data will be overwritten if there is data in the memory. Be sure to confirm it before saving.

4.7.3 Recalling the Memory

Follow the steps below to recall the programs stored in memory:

1. Use ▲ ▼ to move the highlight to the memory to be recalled and press function key [Recall].

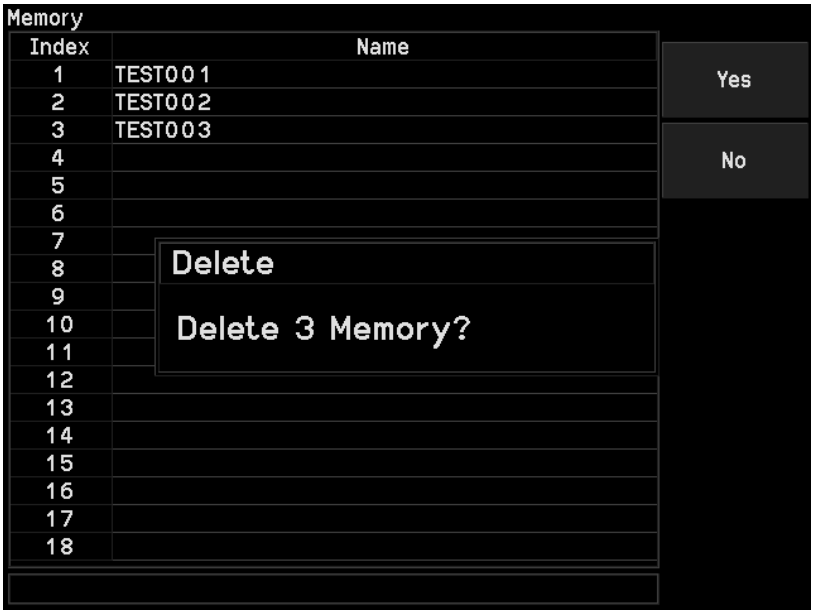


2. A confirmation dialog box will prompt. Press function key [Yes] to confirm it or [No] to cancel it.

4.7.4 Deleting the Memory

Follow the steps below to recall the programs stored in the memory:

1. Use ▲ ▼ to move the highlight to the memory to be deleted and press function key [DELETE].

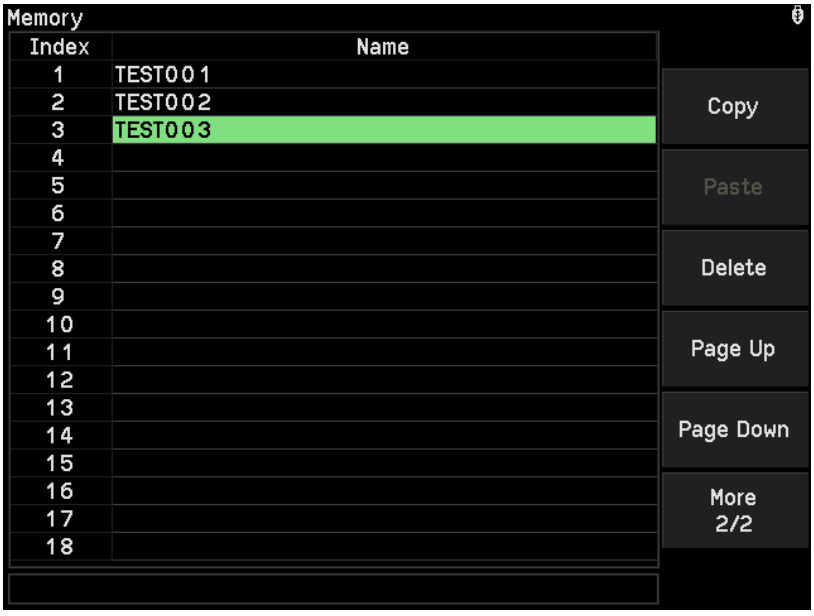


2. A confirmation dialog box will prompt. Press function key [Yes] to confirm it or [No] to cancel it.

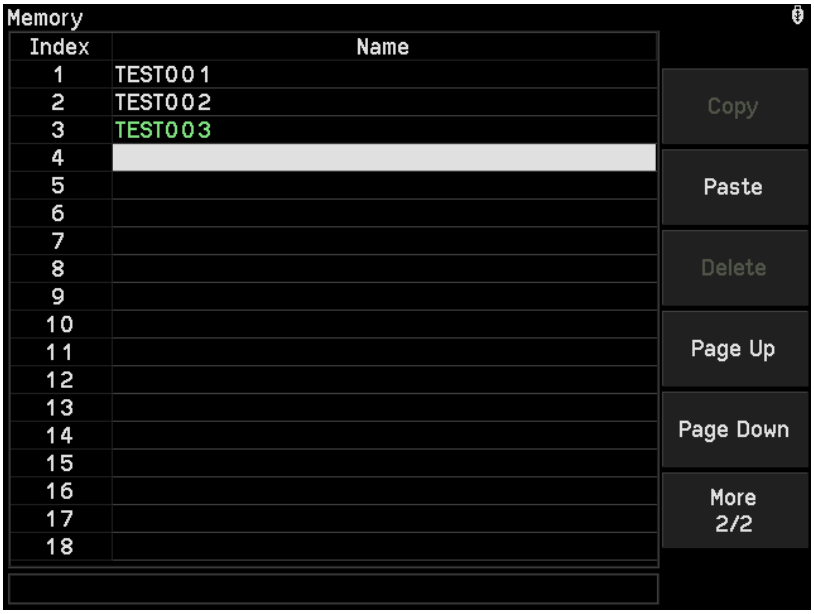
4.7.5 Coping and Pasting the Memory

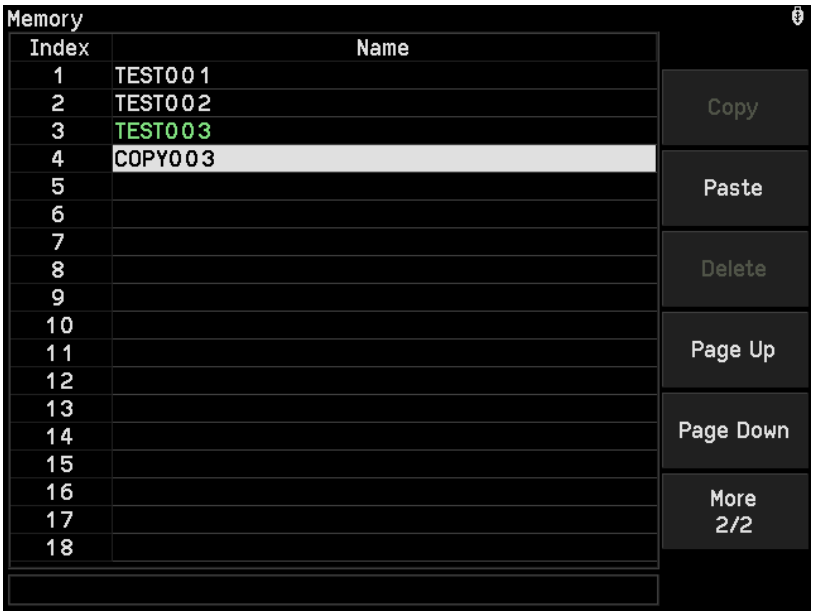
Follow the steps below to copy the program stored in the memory:

1. Use ▲ ▼ to move the highlight to the program desired for copying and press function key [COPY].



2. The highlight of selected program will turn to green and then use ▲ ▼ to move the highlight to the position for pasting the program, press function key [Paste]. Enter the memory name and press **ENTER** to save it.





4.7.6 Using USB for Memory Management

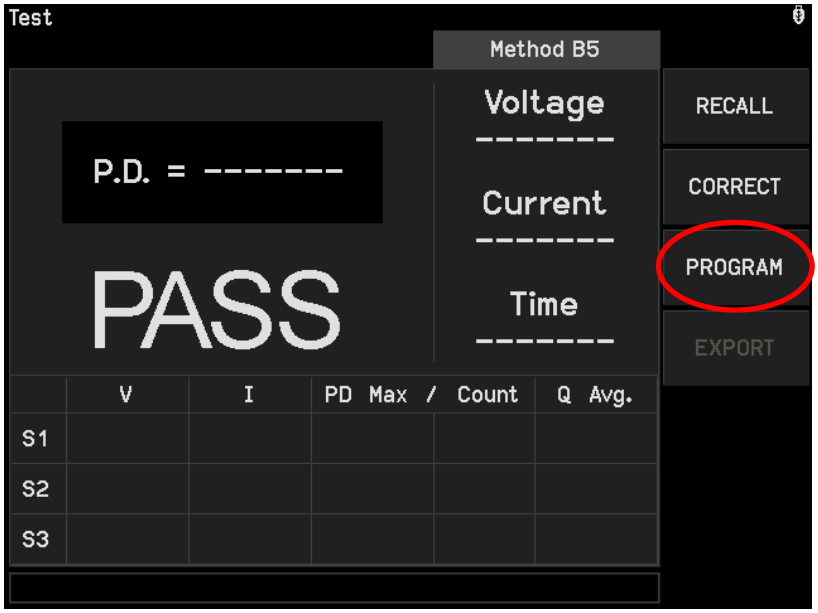
Follow the steps listed below if USB is used to manage the program.

1. Insert the USB flask drive into the HOST connector on the front panel. Be aware that the capacity should be less than 32G and the format must be FAT16/FAT32.
2. Press the function key [Disk] to enter into USB memory for management as the figure shown below.

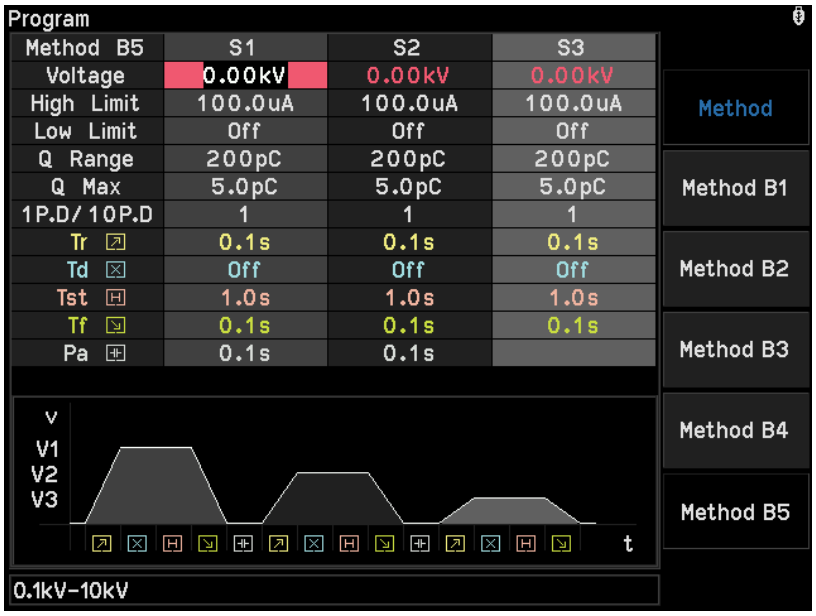
Use function keys [Store], [Recall], [Delete] to manage the program.

4.8 Setting a PROGRAM

Press TEST on the front panel and select PROGRAM to enter the screen.



In PROGRAM screen:



Item	Description
Voltage	Set the output voltage rms value.
High Limit	Set the current output upper limit
Low Limit	Set the current output lower limit.
Q Range	Set the partial discharge capacity range for detection. It has 200pC and 2000pC two ranges.
Q Max	Set the maximum permissible value of partial discharge capacity.
Q Avg.	Set the average of partial discharge capacity on voltage cycle.
1 P.D/10 P.D	Set the number of partial discharge occurred in continuous time. It can set 1 to 10P.D.
Tr	Set the voltage rise time. **Note**
Td	Set the voltage delay time for detection.
Tst	Set the hi-pot or partial discharge detection time.
Tf	Set the voltage fall time.
Pa	Set the time for entering to next stage when the voltage is 0.

Notice

The 1P.D/10P.D setting means that partial discharge occurs in continuous four and a half cycles and exceeds Q Max, it will be treated as 1P.D and shows PD Fail when it adds up to the set 1P.D/10P.D value. If multiple discharges over Q Max occurred in a half cycle, it is treated as 1P.D. If no partial discharge over Q Max has been occurred in four and a half cycles, the 1P.D/10P.D accumulated value will reset to zero.

Note

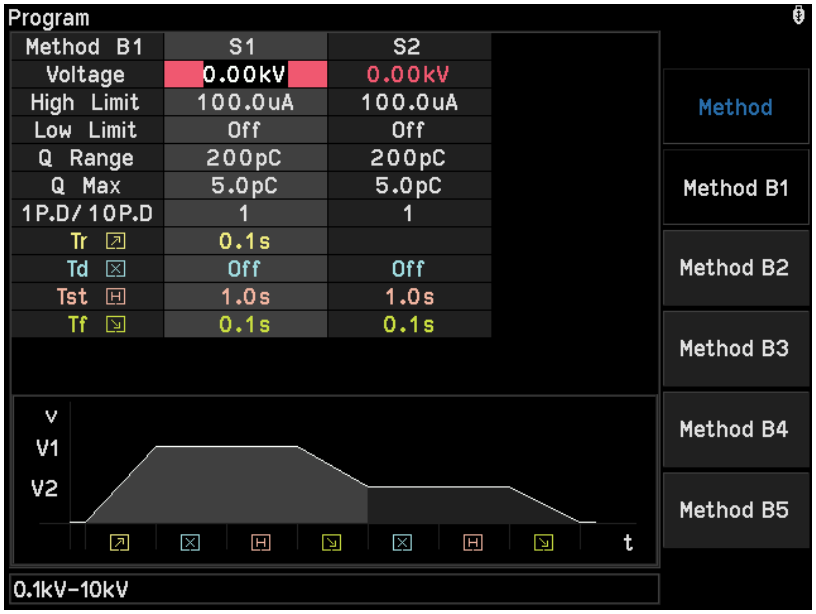
When set to 0.1s, the output voltage will reach about 80% of the set voltage.
When set to 0.2s, the output voltage will reach about 95% of the set voltage
When set to 0.3s, the output voltage will reach about 99% of the set voltage.

4.8.1 Testing Method

The testing methods are described as follows:

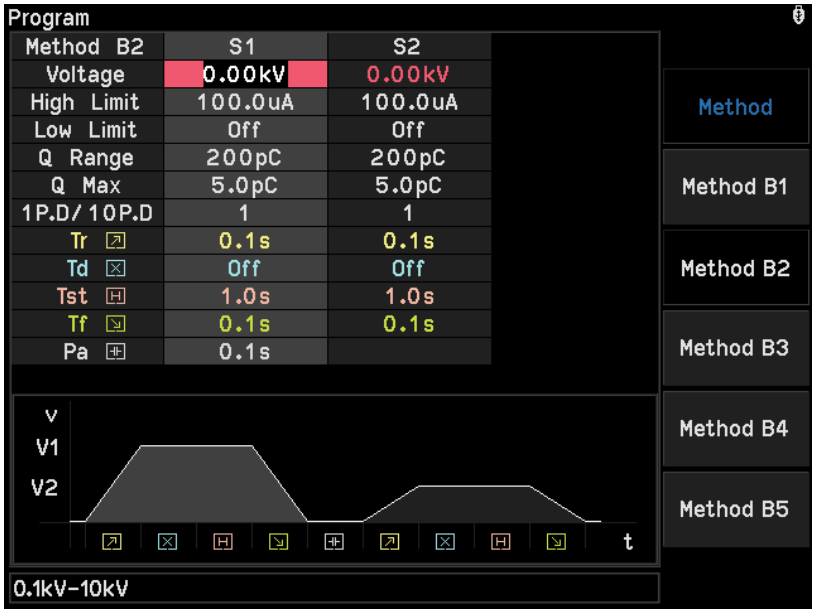
Method B1:

Use S1 to do hi-pot test, and go to partial discharge test when the voltage drops to S2. This test method is compliant with IEC60747-5-5 Method b1.



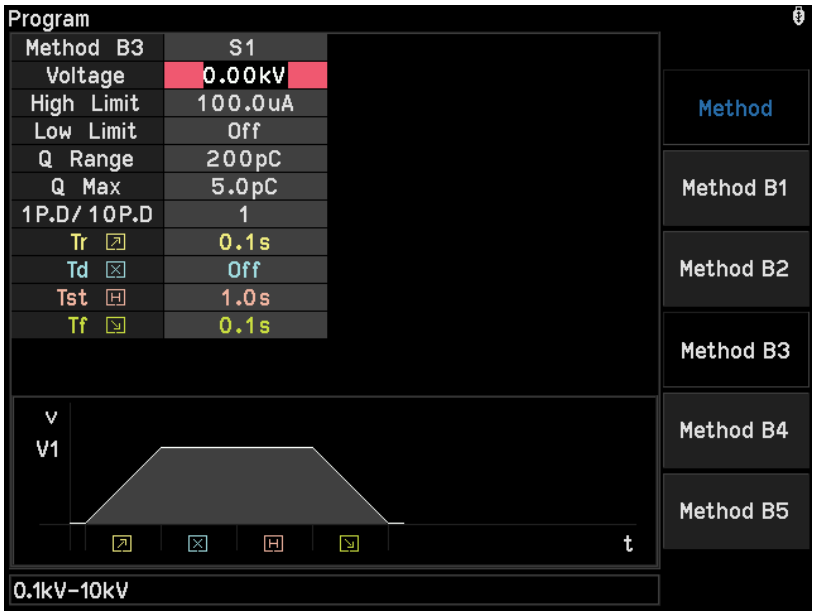
Method B2:

Use S1 to do hi-pot test, and go to S2 partial discharge test when the voltage is reset to zero. This test method is compliant with IEC60747-5-5 Method b2.



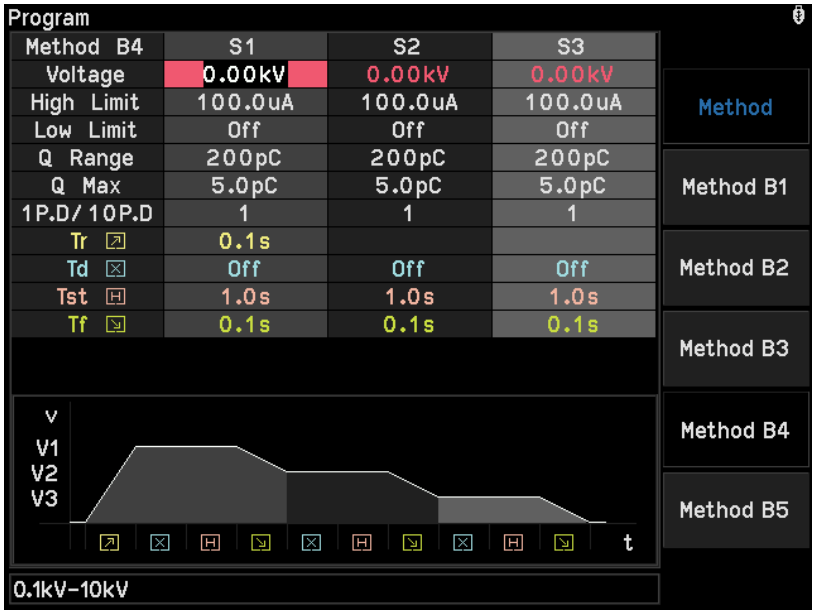
Method B3:

The S1 includes hi-pot and partial discharge test that is compliant with IEC60747-5-5 Method b3.



Method B4:

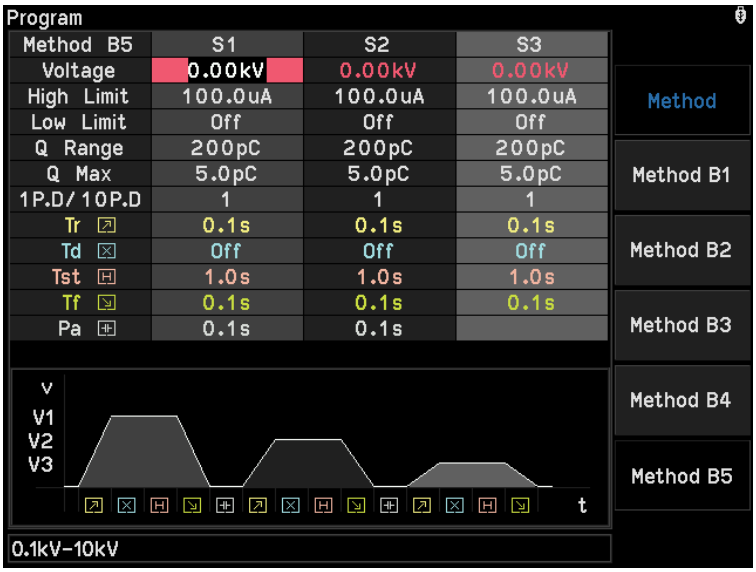
It is a 3-stage voltage test. The S1 is for hi-pot test, S2 is for quality test and S3 is for partial discharge test. The new S3 voltage test is for customers to develop specifications that are more stringent to meet their products requirements. The voltage between S1, S2 and S3 will not drop to 0V.



Method B5:

It is a 3-stage voltage test. The S1 is for hi-pot test, S2 is for quality test and S3 is for partial discharge test. It can add a new test section for customers to develop specifications that are

more stringent to meet their products requirements. The voltage between S1, S2 and S3 will drop to 0V and rise to the set voltage of next section.



The setting of each item is listed below:

Program Item	Range
Voltage	0.1kV – 10kV
High Limit	0.01uA – 300uA
Low Limit	OFF, 0.01uA – High
Q Range	Select PD range 200pC/2000pC
Q Max	OFF, 1pC – 200pC, 10pC – 2000pC
1P.D/10P.D	1 – 10
Tr	0.1s – 9.9s
Td	OFF, 0.1s – 9.9s
Tst	0.5s – 99.9s
Tf	0.1s – 9.9s
Pa	0.1s – 99.9s

4.9 Conducting the Test

4.9.1 Connecting the Tester and High Voltage Module

Turn off the tester, use a power test cable and a control signal cable to connect the tester and high voltage module, and then turn on the tester again by pressing the POWER button.

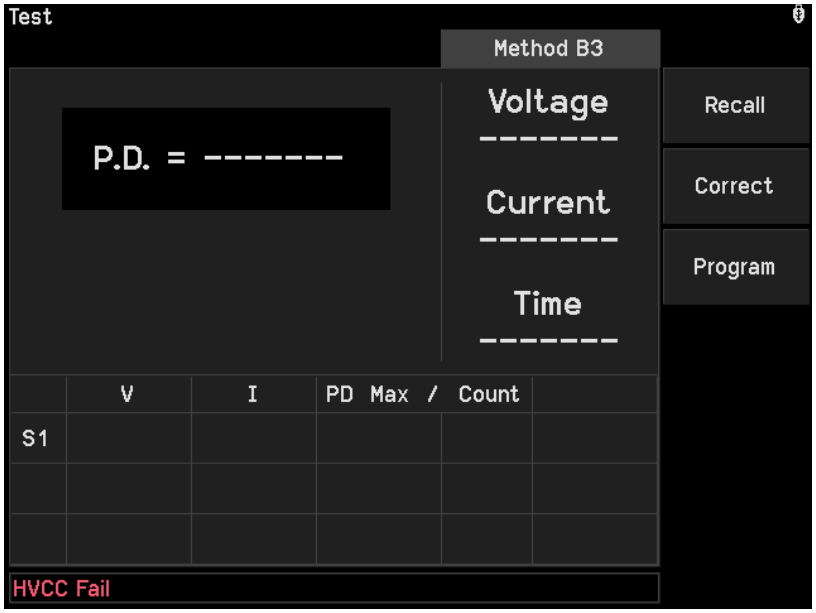
4.9.2 Connecting the DUT

First, make sure there is no voltage output and the DANGER LED is off. Connect the test cable to the probe output terminal on the high voltage module. If HVCC (high voltage contact check) is enabled, it needs to short-circuit the two high potential probes and the two low potential probes respectively for testing. Connect the low potential test cable (black) to the

DUT and the high potential test cable (red) to the DUT. Be sure to use a test cable with shielding effect such as a coaxial cable as the low potential test cable.

4.9.3 Conducting HVCC

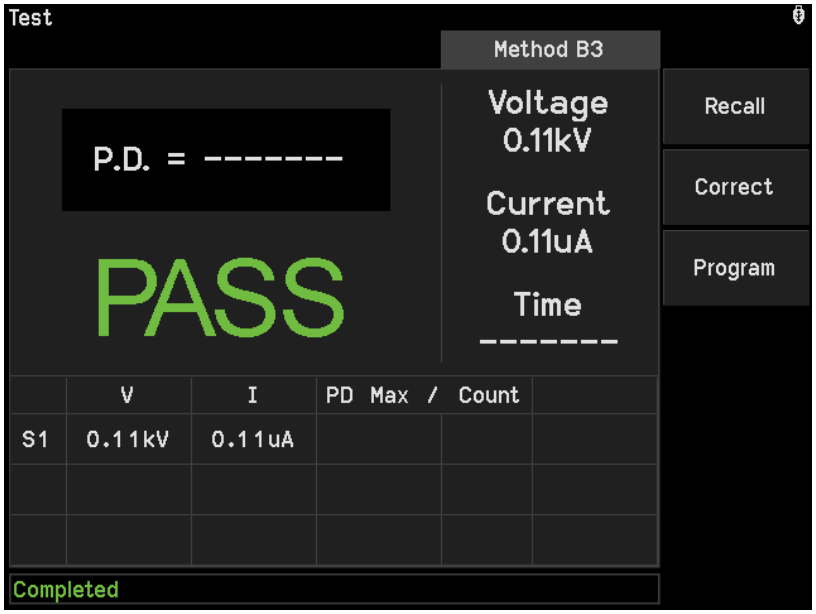
1. Press **SYSTEM** and select Test Control, and the HVCC ON/OFF to ON.
2. Press **TEST** to return to standby screen.
3. Press **STOP** to prepare for testing and the message line shows "STANDBY."
4. Press [START] to enable the test. If contact check fails, the message "HVCC Fail" will appear.
5. If HVCC passes, it will start testing directly.



4.9.4 Current Get Offset

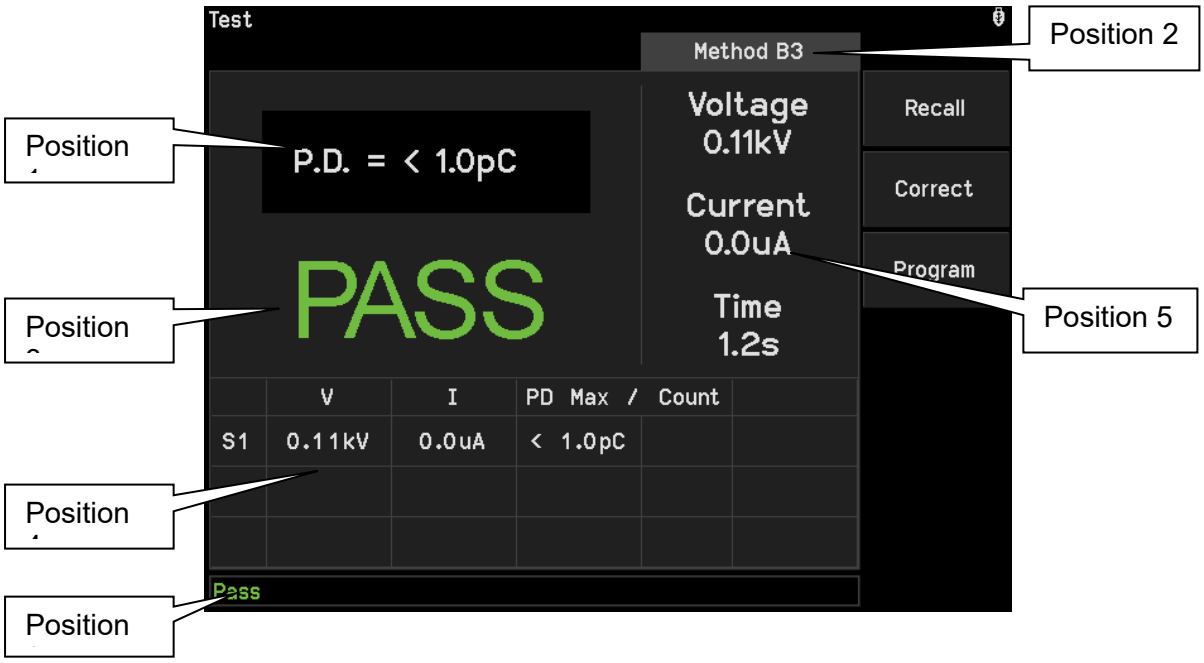
Before the test begins, conduct "Get Offset" to empty the load current. Connect the cable two ends to the high voltage module without placing any DUT.

1. Press **TEST** to return to standby screen.
2. Press **F2** to select Correct and press **F1** to select "Get" to enter into Get Offset menu.
3. Press [START] to initiate Get Offset. When done, the message line shows "Completed."



4.9.5 Partial Discharge Test Procedure

1. Before testing, conduct current Get Offset first.
2. Press **TEST** to return to standby screen, press **STOP** to prepare for testing. The message shows “STANDBY.”
3. Press [START] to initiate the test.
   The voltage starts to output when this key is pressed. The DANGER indicator is on and the message line shows “Testing” which means there is voltage output during testing.
4. The PASS screen shows as below after tested.



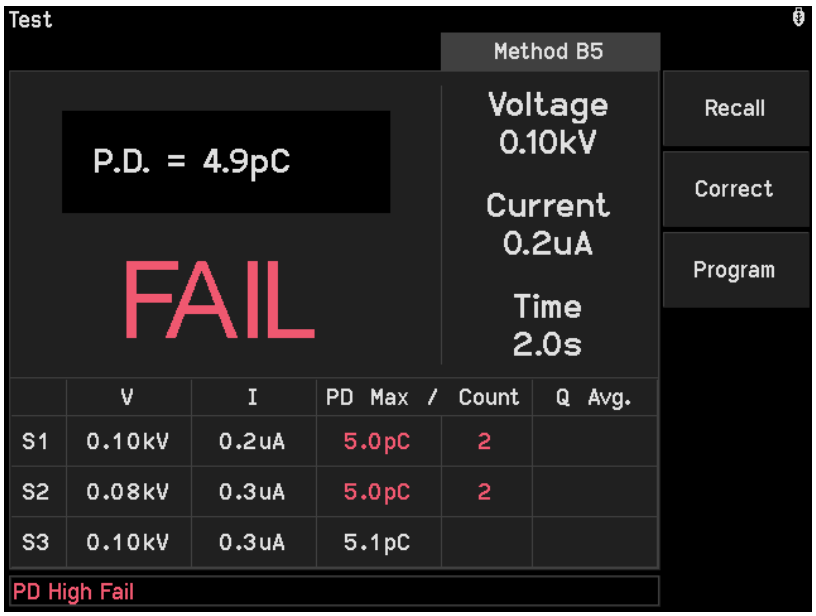
Position 1: Partial discharge capacity real-time display.
Position 2: Test mode.
Position 3: Display PASS, FAIL or Testing.

Position 4: Display the last values of V and I, and the maximum of measured PD of the test.
Position 5: Display the voltage, current and time in real-time.
Position 6: Display the test result on message line.

4.9.6 PD Non-Stop Testing

1. Press **SYSTEM** and select Test Control to adjust PD Fail Non-Stop to Non-Stop.

2. As the figure shown below, if both S1 and S2 have PD Fail during testing, it will still wait until the S3 is done to show FAIL.



5. HANDLER Interface

5.1 Specification

5.1.1 Driving Capability

Internal Signal Output Specification: DC 24V, 20~40mA
External Signal Input Specification: DC 3V~26V (HIGH), 10mA± 4mA

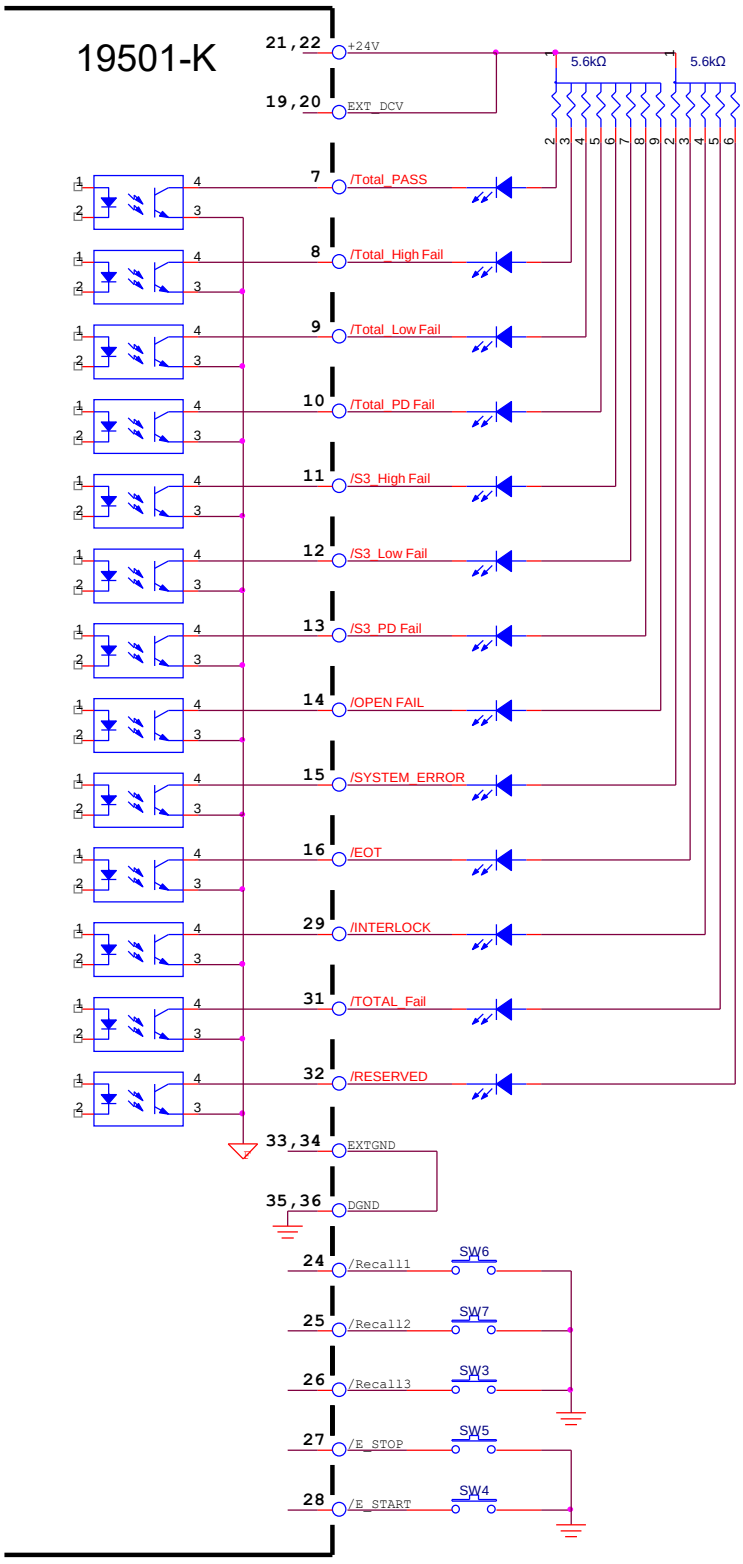
5.1.2 Pin Assignment

Pin No.	Signal PD	Input/ Output	Description
1	/S1_High Fail	Output	In Method B1-B3, High Fail means over the current upper limit and Lo Fail means over the current lower limit. PD Fail means the partial discharge capacity exceeds Q Max.
2	/S1_ Low Fail		
3	/S1_PD Fail		
4	/S2_High Fail		
5	/S2_Low Fail		
6	/S2_PD Fail		
7	/Total_PASS	Output	All stages are passed during testing.
8	/Total_HIGH FAIL	Output	At least one stage is judged over the current high limit during testing.
9	/Total_Low Fail	Output	At least one stage is judged under the current low limit during testing.
10	/Total_PD Fail	Output	At least one stage is judged over the maximum of partial discharge capacity during testing.
11	/S3_High Fail	Output	In Method B4 and B5, the S3 test stage is over the current high limit.
12	/S3_Low Fail	Output	In Method B4 and B5, the S3 test stage is under the current low limit.
13	/S3_PD Fail	Output	In Method B4 and B5, the S3 test stage is over the maximum of partial discharge capacity.
14	/OPEN Fail	Output	HVCC fails.
15	/SYSTEM_ERROR	Output	The signal output pin for internal system error. When the output is LOW, it means the system is having internal error.
16	/EOT	Output	When this signal is HIGH, it indicates the test program is under testing. When this signal is LOW, it indicates the test program is ended or is standby.
17	RESERVED	Output	Reserved pin.
18	/TEST_TIME	Output	When this signal is LOW, it indicates the test program is in hipot or partial discharge testing time (Tst).
19,20	+VEXT	——	External DC voltage input ranged from +3V to +26V.

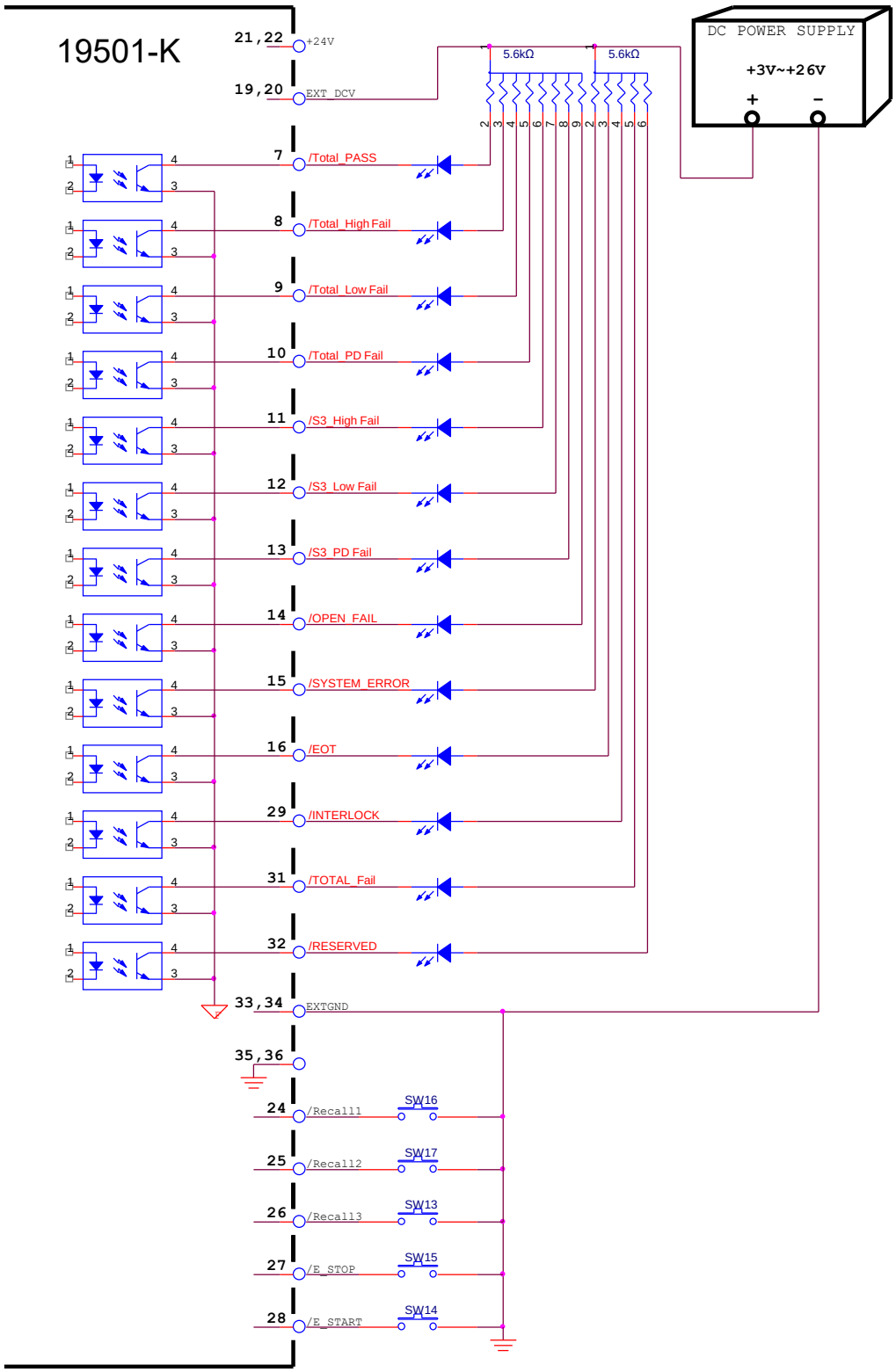
21,22	+24VF1	——	Internal DC voltage output and the output voltage is +24V.
23	RESERVED	Input	Reserved pin.
24	/RECALL1	Input	/Recall1~/Recall3 signals are the memory code for reading. 3 bits indicate 8 sets of memories (INDEX 1 ~8). The input is in binary format (/Recall1 is low bit while /Recall3 is high bit).
25	/RECALL2	Input	
26	/RECALL3	Input	
27	/E_STOP	Input	It is external STOP signal output, and acts when the signal state is LOW.
28	/E_START	Input	It is external START signal output, and acts when the signal state is LOW.
29	/INTERLOCK	Output	Interlock.
30	/SYSTEM_ERROR_HW	Output	The hardware is error.
31	/TOTAL_FAIL	Output	High means the test result is PASS, and Low means the test result is FAIL.
32	RESERVED	Output	Reserved pin.
33,34	EXTGND	——	Low voltage end for input/output signal.
35,36	DGND	——	Low voltage end for internal voltage output.

5.2 Example of External Control Circuit

5.2.1 Example of Using Internal Power Supply



5.2.2 Example of Using External Power Supply



5.3 Timing Diagram

Use Method B1 and PD Fail Non-Stop to do the testing. The external signal makes the S1 and S2 stages over the PD upper limit. When the test is done, /S1_PD Fail and /S2_PD Fail, /Total_FAIL are /Total_PD FAIL are all High.

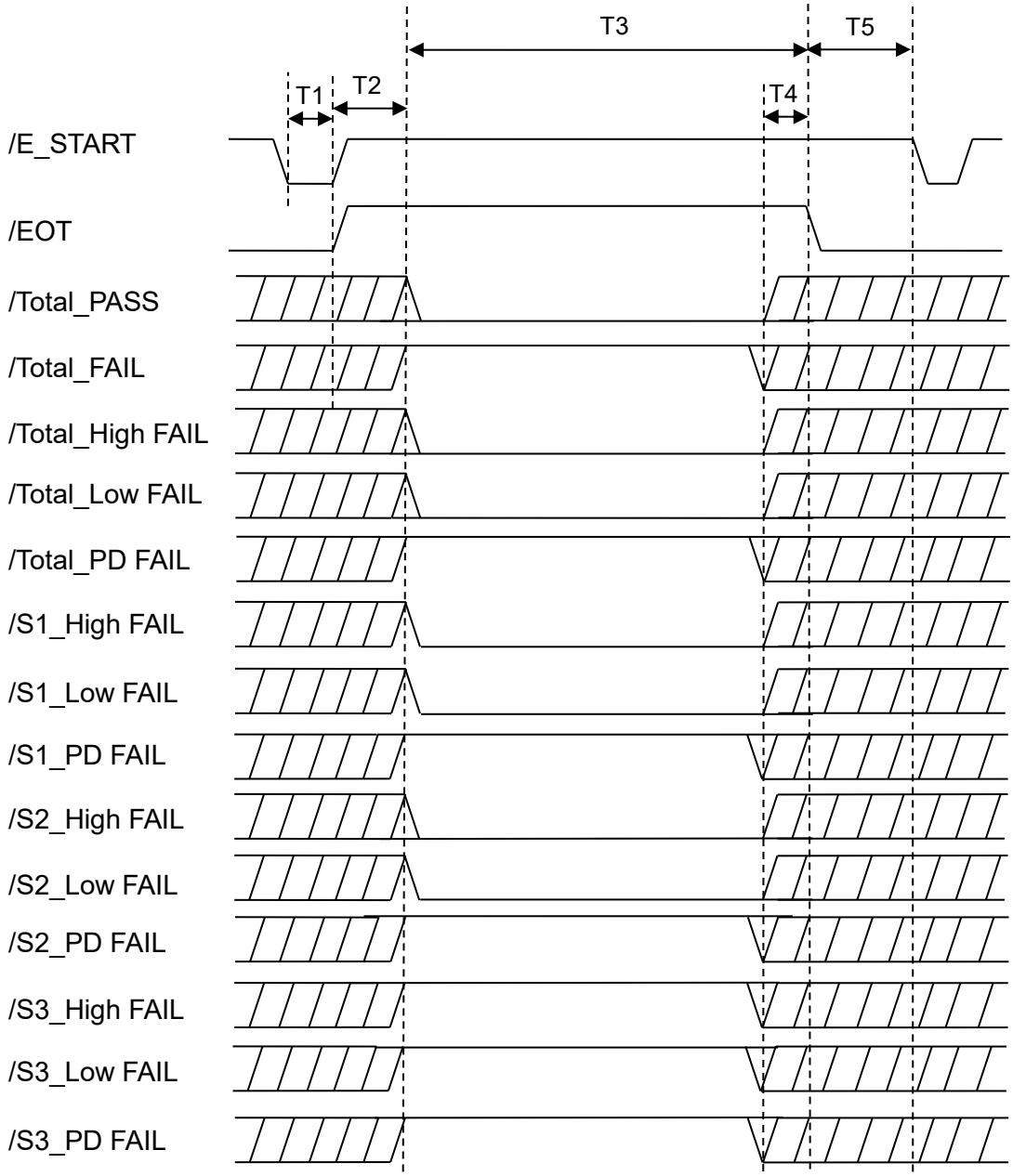


Figure 5-1 Timing Diagram

Timing	Description
T1	Remaining time for external trigger signal (/EXT_START) (**Note:** >1ms)
T2	/EOT signal action time.
T3	/EOT signal time, including test time of each phase
T4	/PASS, /FAIL waiting time for signals to be stable.
T5	The minimum time required for trigging next external signal when the /EOT signal is ended.

6. Using Remote Interface

6.1 Introduction

The tester can be controlled by PC for data transmission through remote interfaces.

6.2 RS232 Interface

6.2.1 Data Format

- Baud rate: 9600 / 19200 / 38400 / 57600 / 115200
- Flow control: None / Hardware
- Transmission bit: 1 start bit
- 8 data bits
- 1 stop bit

6.2.2 Command Format

The function of RS232 interface is to input the ASCII code composed commands for remote control and setting. The command string length is limited to 8291 characters including End Code. [Command+Parameter] forms an instruction and semicolon ";" is used to connect any two commands with an end code at last. The End Code can be one of the following formats:

End Code of Command

ASCII Code	Hexadecimal Code
LF	0A
CR + LF	0D + 0A

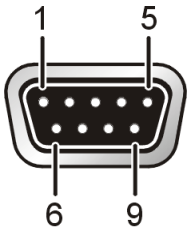
If a command has several retuned data entries, use ";" to connect any two data entries and add an end code at last. The end code of returned data for RS232 interface is CR + LF (0D + 0A).

End Code of Returned Data

ASCII Code	Hexadecimal Code
CR + LF	0D + 0A

6.2.3 Connector

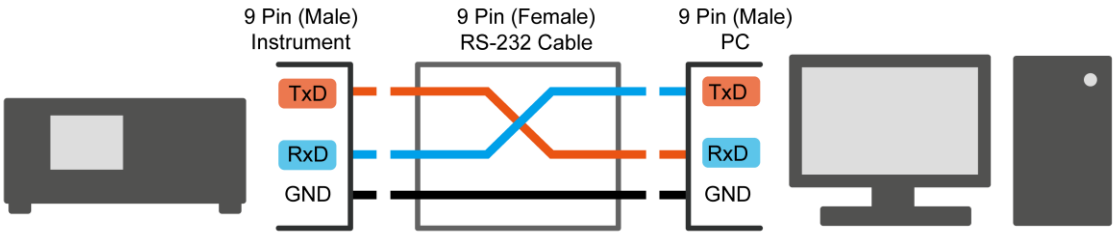
The RS232 connector of this tester is a male 9-pin connector.



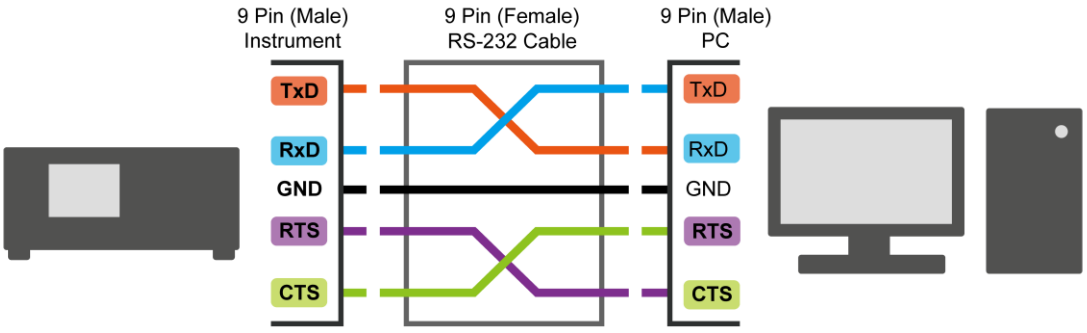
Pin No.		Description
1	*	Unused
2	RxD	Sending data
3	TxD	Receiving data
4	*	Unused
5	GND	Grounding signal
6	*	Unused
7	RTS	Request to Send
8	CTS	Clear to Send
9	*	Unused

6.2.4 Connection

When the flow control sets to NONE:



When the flow control sets to HARDWARE:



6.3 USB Interface

6.3.1 Specification

USB (B-type): USBTMC standard compliant.

6.3.2 Command Format

The function of USB interface is to input the ASCII code composed commands for remote control and setting. The command string length is limited to 8192 characters including End Code. [Command+Parameter] forms an instruction and semicolon ";" is used to connect any two commands with an end code at last. The End Code can be one of the following formats:

End Code of Command

ASCII Code	Hexadecimal Code
LF	0A
CR + LF	0D + 0A

If a command has several retuned data entries, use ";" to connect any two data entries and add an end code at last. The end code of returned data for USB interface is LF (0A).

End Code of Returned Data

ASCII Code	Hexadecimal Code
LF	0A

6.4 LAN Interface

6.4.1 Specification

The LAN is a 10M/100M Ethernet interface. Its IP address setting can use floating IP, which is configured by the network server and sub network mask, or static IP for setting manually. When the IP address setting is done and a network cable is used for connection, the IP address and 2101 communication port will be used to create a TCP connection with the tester. Use the remote interface commands described later in this to control the tester.

6.4.2 Command Format

The function of LAN interface is to input the ASCII code composed commands for remote control and setting. The command string length is limited to 8192 characters including End Code. [Command+Parameter] forms an instruction and semicolon ";" is used to connect any two commands with an end code at last. The End Code can be one of the following formats:

End Code of Command

ASCII Code	Hexadecimal Code
LF	0A
CR + LF	0D + 0A

If a command has several retuned data entries, use ";" to connect any two data entries and add an end code at last. The end code of returned data for LAN interface is LF (0A).

End Code of Returned Data

ASCII Code	Hexadecimal Code
LF	0A

6.5 Commands for Remote Interface

6.5.1 Commands Summary

- **IEEE 488.2 Commands**

  *CLS
  *ESE < *enable value* >
  *ESE?
  *ESR?
  *IDN?
  *OPC
  *OPC?
  *PSC < *boolean* >
  *PSC?
  *RST
  *RCL < *memory number* >
  *SAV < *memory number* >
  *SRE < *enable value* >
  *SRE?
  *STB?

- **SCPI Commands**

The parameter syntax of SCPI command includes:

(1) The "< >" in the middle of the command is the suffix variable defined by standard SCPI command that has to be in integer format. Ex. The command SOURce:PDIScharge:METHod4:STAGe2:TIME:TEST? Queries the 2nd stage test time setting in Method 4. The range of each suffix variable varies with the condition.
   Ex. METHod<m> suffix variable <m> range1~5.
   METHod1:STAGe<s> suffix variable <s> range 1~2.
   METHod2:STAGe<s> suffix variable <s> range 1~2.
   METHod3:STAGe<s> suffix variable <s> range 1.
   METHod4:STAGe<s> suffix variable <s> range 1~3.
   METHod5:STAGe<s> suffix variable <s> range 1~3.
(2) The "< >" after the command space indicates the defined parameter of standard SCPI command.
(3) Use vertical bar "|" to indicate OR which means either one can be selected.
(4) Use brackets "[ ]" to indicate the parameter can be omitted.
(5) "< numeric value >" is a decimal data in the following formats:
   a. "< NR1 >" integer, ex. 123.
   b. "< NR2 >" decimal fractional, ex. 3.14.
   c. "< NR3 >" index, ex. +1.23456E+01.

d. “< NRf >” means <NR1>, <NR2> and <NR3> are all acceptable.

(6) “<boolean>” is Boolean program data with value 0 or 1.

(7) “<string>” is string data marked by double quote (“), ex. “ABC”.

(8) When the returned data is +9.90000E+37, it means the data is infinite (INF).

(9) When the returned data is +9.91000E+37, it means the data is invalid (NaN).

```
:MEMory
|       :DELete
|       |       [:NAME]        < name >
|       |       :LOCation      < register number >
|       :NSTates?
|       :STATe
|       |       :DEFine        < name >, < register number >
|       |       :DEFine?       < name >
:TRIGger
|       [:SEQuence]
|       |       :SOURce        IMMediate | EXTernal | MANual
|       |       :SOURce?

:DISPlay
|       :MENU
|       |       [:NAME]        “Test” | “Open Correction”
|       |       [:NAME]?

:SYSTem
|       :DATE          <year>, <month>, <day>
|       :DATE?
|       :ERRor
|       |       [:NEXT]?
|       :HVModule
|       |       [:EXISt]?
|       :INTerlock?
|       :KLOCk         <boolean> | ON | OFF                                   (RS232 only)
|       :KLOCk?
|       :LOCK
|       |       :OWNer?
|       |       :RELease                                                      (RS232 only)
|       |       :REQuest?                                                     (RS232 only)
|       :TCONtrol
|       |       :AC
|       |       |       :FREQuency             <number>
|       |       |       :FREQuency?
|       |       :AGC
|       |       |       [:SOFTware]            <boolean> | ON | OFF
|       |       |       [:SOFTware]?
|       |       :HVCC
|       |       |       :ENABle                <boolean> | ON | OFF
|       |       |       :ENABle?
|       |       :PDIScharge
|       |       |       :FAILL
|       |       |       |       :OPERation     STOP | NONStop
|       |       |       |       :OPERation?
|       |       :TRIGger
|       |       |       [:DELay]       <number value> | OFF
|       |       |       [:DELay]?
|       :TIME          <hour>, <minute>, <second>
|       :TIME?
|       :VERSion?
[:SOURce]
```

```
|       :PDIScharge
|       |       :ACTive                <method number>
|       |       :ACTive?
|       |       :METHod<m>
|       |       |       :CORRection
|       |       |       |       :CURRent
|       |       |       |       |       :OPEN
|       |       |       |       |       |       :ENABle         <boolean> | ON | OFF
|       |       |       |       |       |       :ENABle?
|       |       |       :DELete
|       |       |       :STAGe<s>
|       |       |       |       :CHARge
|       |       |       |       |       :LIMit
|       |       |       |       |       |       :AVERage        OFF | <value>
|       |       |       |       |       |       :AVERage?
|       |       |       |       |       |       :MAXimum        OFF | <value>
|       |       |       |       |       |       :MAXimum?
|       |       |       |       |       :OCCurrence             <number>
|       |       |       |       |       :OCCurrence?
|       |       |       |       |       :RANGe
|       |       |       |       |       |       [:LOWer]        <value>
|       |       |       |       |       |       [:LOWer]?
|       |       |       |       :CORRection
|       |       |       |       |       :CURRent
|       |       |       |       |       |       :OPEN
|       |       |       |       |       |       |       :RANGe
|       |       |       |       |       |       |       |       :ALL        <range 1> , <range 2>
|       |       |       |       |       |       |       |       :ALL?
|       |       |       |       |       |       |       |       [:BEST]     <value>
|       |       |       |       |       |       |       |       [:BEST]?
|       |       |       |       :CURRent
|       |       |       |       |       :LIMit
|       |       |       |       |       |       [:HIGH]         <value>
|       |       |       |       |       |       [:HIGH]?
|       |       |       |       |       |       :LOW            OFF | <value>
|       |       |       |       |       |       :LOW?
|       |       |       |       :TIME
|       |       |       |       |       :DELay
|       |       |       |       |       |       :EXISt?
|       |       |       |       |       |       [:VALue]        OFF | <value>
|       |       |       |       |       |       [:VALue]?
|       |       |       |       |       :FALL
|       |       |       |       |       |       :EXISt?
|       |       |       |       |       |       [:VALue]        <value>
|       |       |       |       |       |       [:VALue]?
|       |       |       |       |       :PAUSe
|       |       |       |       |       |       :EXISt?
|       |       |       |       |       |       [:VALue]        <value>
|       |       |       |       |       |       [:VALue]?
|       |       |       |       |       :RISE
|       |       |       |       |       |       :EXISt?
|       |       |       |       |       |       [:VALue]        <value>
|       |       |       |       |       |       [:VALue]?
|       |       |       |       |       :TEST
|       |       |       |       |       |       :EXISt?
|       |       |       |       |       |       [:VALue]        <value>
|       |       |       |       |       |       [:VALue]?
|       |       |       |       :VOLTage        <value>
|       |       |       |       :VOLTage?
```

```
|       |       :RESult
|       |       |       :ACTive?
|       |       |       :AREPort
|       |       |       |       :ENABle         <boolean> | ON | OFF                (RS232 only)
|       |       |       |       :ENABle?                                           (RS232 only)
|       |       |       |       :FIELd
|       |       |       |       |       :NAME?
|       |       |       |       |       :NUMBer?
|       |       |       |       |       :SNUMber?
|       |       |       |       |       :VALid?
|       |       |       :MEASurement
|       |       |       |       :CHARge
|       |       |       |       |       :AVERage
|       |       |       |       |       |       [:VALue]?
|       |       |       |       |       :MAXimum
|       |       |       |       |       |       [:VALue]?
|       |       |       |       :CURRent
|       |       |       |       |       [:VALue]?
|       |       |       |       :TIME
|       |       |       |       |       :ELAPsed?
|       |       |       |       :VOLTage
|       |       |       |       |       [:VALue]?
|       |       |       :SNUMber?
|       |       |       :STAGe<s>
|       |       |       |       :CHARge
|       |       |       |       |       :AVERage
|       |       |       |       |       |       :JUDGement:
|       |       |       |       |       |       |       [:PASS]?
|       |       |       |       |       |       |       :STRing?
|       |       |       |       |       |       [:VALue]?
|       |       |       |       |       :MAXimum
|       |       |       |       |       |       :JUDGement:
|       |       |       |       |       |       |       [:PASS]?
|       |       |       |       |       |       |       :STRing?
|       |       |       |       |       |       :OCCurrence?
|       |       |       |       |       |       [:VALue]?
|       |       |       |       :CURRent
|       |       |       |       |       :JUDGement:
|       |       |       |       |       |       [:PASS]?
|       |       |       |       |       |       :STRing?
|       |       |       |       |       [:VALue]?
|       |       |       |       :VOLTage
|       |       |       |       |       [:VALue]?
|       |       |       :STATe
|       |       |       |       :JUDGment?
|       |       |       |       :STRing?
|       |       |       |       :TESTing?
|       |       :SNUMber?
|       |       :STARt
|       |       |       :CORRection
|       |       |       |       :OPEN
|       |       |       [:ONCE]
|       |       :STOP

:DIAGnostic
|       :VERification
|       |       :PDIScharge
|       |       |       :DATE?
|       |       |       :MARK
```

```
|       |       |       :MEASure?
|       |       |       :RANGe
|       |       |       |       [:LOWer]           <value>
|       |       |       |       [:LOWer]?
|       |       |       :STARt
|       |       |       :STOP
|       |       |       :TIME?
|       |       :RELease
|       |       :REQuest?
```

6.5.2 Command Description

- **IEEE 488.2 Commands**

  ***CLS**
  It clears the data structure of status in the following actions:
  - Clear the error queue.
  - Clear the standard event register.
  - Clear the byte register except MAV bit (bit 4)

  ***ESE <*decimal data*>**
  It sets the value for standard event enable register. The value is a <decimal data> within 0~255.

  ***ESE?**
  It queries the standard event enable register value of the device. The output format is <decimal data> within 0~255.

  ***ESR?**
  It queries the standard event register value of device. The register is cleared to 0 when this command is executed. The output format is <decimal data> within 0~255.

  ***IDN?**
  It reads the basic data of device. The output format is divided by comma into 4 columns, which are manufacturer, device model no., serial no. and firmware version.

  ***OPC**
  It completes the operation.

  ***OPC?**
  It queries the operation for completeness. It output an ASCII character "1" when done.

  PSC *0 | 1
  It clears the power on state. 1 means that the standard event status enable register (ESE) and service request enable register (SRE) will be cleared to 0 at startup, and the Auto Report Enable flag will be cleared to OFF. 0 means the ESE, SRE register and Auto Report Enable flag will maintain the value set before the device shutdown last time.

  ***PSC?**
  It queries the power on state for clearing. The output format is an ASCII character "1" or "0".

***RST**
It resets the device by stopping the test.

RCL** ***<decimal data>
It is a read back command. This command reads back the settings saved in the memory of the device. The parameter is the memory serial no.

SAV** ***<decimal data>
It is a save command. This command saves the settings at present of the device to memory. The parameter is the memory serial no.

SRE** ***<decimal data>
It sets the value for service request enable register. The value is a <decimal data> within 0~255.

***SRE?**
It reads the value of service request enable register. The output format is <decimal data> within 0~255.

***STB?**
It reads the value of status bit register. The output format is <decimal data> within 0~255.

- **SCPI Commands**

:MEMory:DELete[:Name] ***<name>***
It deletes the parameter data specified by <name> in main memory. <name> is a string.

:MEMory:DELete:LOCation ***<register number>***
It deletes the parameter data specified by < register number > in main memory. <register number> is an integer.

:MEMory:STATe:DEFine ***<name>, <register number>***
It sets a name for memory specified by <register number>.

:MEMory:STATe:DEFine? ***<name>***
It queries the memory's <register number> specified by <name>. <name> is a text string.

:MEMory:NSTates?
It queries the capacity of main memory. The value returned is the maximum of *SAV / *RCL command parameter plus 1.

:TRIGger[:SEQuence]:SOURce ***IMMediate*** **|** ***EXTernal*** **|** ***MANual***
It sets the interface to trigger the test signal in remote condition. When set to IMMediate, only the remote controlled trigger command is valid. When set to EXTernal, it means besides the remote controlled trigger command is valid, the EXT_TRIGGER of Handler interface is also valid. This parameter is set automatically during power on. When set to MANual, it means besides the remote controlled trigger command is valid, the START key on the front panel is also valid.

:TRIGger[:SEQuence]:SOURce?
It queries the interface to trigger the test signal in remote condition.

:DISPlay:MENU[:NAME] ***"Test"*** **|** ***"Open Correction"***
It switches the display menu of the device. The parameters are in string format where "Test" means switching to the test menu, "Open Correction" means switching to the menu that reads the open circuit value. Some of the menus that support remote operation use special commands for entering such as "PD Verification". If the command switching to remote control is received in the menu that does not support remote operation, the device will automatically switch to the test menu.

:DISPlay:MENU[:NAME]?
It queries the device display menu. The returned data is as follows:

"Test"	Test menu
"Open Correction"	Read open circuit value menu
"PD Verification"	PD measurement verification menu
"Calibration"	Calibration menu
"Nameless"	Menu that does not support remote operation. The device will automatically switch to test menu when receiving a switching to remote control command in the menu.

:SYSTem:ERRor[:NEXT]?
This command reads the messages in Error Queue. See Section 6.6 *Error Messages* for the returned message.

:SYSTem:KLOCk ***<boolean>*** **|** ***ON*** **|** ***OFF***
It locks the panel control. The command is only valid for the Remote/Local state of RS232.

:SYSTem:KLOCk?
It queries if the panel is locked.

:SYSTem:LOCK:OWNer?
It queries if the tester is in panel control or remote control state.

:SYSTem: LOCK:RELease
It switches back to panel control state.

:SYSTem:LOCK:REQuest?
It switches to remote control state. It returns 1 if success or it returns 0.

:SYSTem:HVModule[:EXISt]?
It queries if the high voltage module is normally connected. It returns 1 if normal and 0 if not.

:SYSTem:INTerlock?
It queries if Interlock occurs. If Interlock is not connected, it indicates that Interlock has occurred and returns 1; otherwise, it will return 0.

:SYSTem:TCONtrol:AC:FREQuency ***<numeric value>***
It sets the output voltage frequency for testing. The setting range is 50Hz or 60Hz.

:SYSTem:TCONtrol:AC:FREQuency?
It queries the output voltage frequency during testing.

:SYSTem:TCONtrol:AGC[:SOFTware] ***<boolean>*** **|** ***ON*** **|** ***OFF***

It sets if enabling the AGC function.

:SYSTem:TCONtrol:AGC[:SOFTware]?
It queries if the AGC function is enabled.

:SYSTem:TCONtrol:HVCC:ENABle ***<boolean>*** **|** ***ON*** **|** ***OFF***
It sets if enabling the HVCC function.

:SYSTem:TCONtrol:HVCC:ENABle?
It queries if the HVCC function is enabled. It returns character 0 or 1 (0 means the HVCC is not disabled and 1 means the HVCC is enabled.)

:SYSTem:TCONtrol:PDIScharge:FAIL:OPERation ***STOP*** **|** ***NONStop***
It sets the action when the test step is judged as FAIL. If *NONStop* is set, the test continues when FAIL is detected. If *STOP* is set, the test will stop when FAIL is detected.

:SYSTem:TCONtrol:PDIScharge:FAIL:OPERation?
It queries the setting of PD FAIL Non-Stop.

:SYSTem:TCONtrol:TRIGger[:DELay] ***<numeric_value>***
It sets the time delayed for trigger. The unit is second.

:SYSTem:TCONtrol:TRIGger[:DELay]?
It queries the time delayed for trigger. The unit is second.

:SYSTem:TIME ***<hour>,<minute>,<second>***
It sets the system time by accepting 3 numeric parameters in the order of hour, minute, and second. The hour is ranged 0~23. For instance, the command of 3:30 pm is ":SYST:TIME 15,30,0".

:SYSTem:DATE?
It reads the system time and returns it in the sequence of hour, minute, and second separated by comma (,).

:SYSTem:VERSion?
It queries supported SCPI version of this device.

[:SOURce]:PDIScharge:ACTive ***<method number>***
It sets the Method number for testing. The range is 1~5.

[:SOURce]:PDIScharge:ACTive?
It queries the Method number for testing.

[:SOURce]:PDIScharge:METHod<m>:CORRection:CURRent:OPEN:ENABle
<boolean> **|** ***ON*** **|** ***OFF***
It sets if enabling current open to zero for the selected Method. <m> is the selected Method number ranged from 1 to 5.

[:SOURce]:PDIScharge:METHod<m>:CORRection:CURRent:OPEN:ENABle?
It queries if current open to zero for the selected Method is enabled. <m> is the selected Method number ranged from 1 to 5.

[:SOURce]:PDIScharge:METHod<m>DELete
It deletes all parameters of the selected Method. Each parameter will reset to default.

<m> is the selected Method number ranged from 1 to 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:LIMit:AVERage *OFF* | *<value>*
It sets the PD Average for the selected Method and Stage. The acceptable value is OFF, 1e-12~99999e-12, and the unit is C (Coulomb). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:LIMit:AVERage?
It queries the PD Average of the selected Method and Stage. The unit is C (Coulomb). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:LIMit:MAXimum *OFF* | *<value>*
It sets the PD Maximum for the selected Method and Stage. The acceptable value is OFF,1e-12~2000e-12, and the unit is C (Coulomb). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:LIMit:MAXimum?
It queries the PD Maximum of the selected Method and Stage. The unit is C (Coulomb). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:OCCurrence *<number>*
It sets the PD Count for the selected Method and Stage. The acceptable value is 1~10. <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:LIMit:MAXimum?
It queries the PD Count of the selected Method and Stage. <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:RANGe[:LOWer] *<value>*
It sets the PD Range for the selected Method and Stage. The acceptable value is 200e-12 or 2000e-12, and the unit is C (Coulomb). The 200e-12 indicates selecting 200pC range and 2000pC indicates selecting 2000pC range. <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CHARge:RANGe[:LOWer]?
It queries the PD Range of the selected Method and Stage. The unit is C (Coulomb). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage

number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CORRection:CURRent:OPEN:RANGe:ALL ***<range 1>,<range 2>***
It sets the current open zero value for the selected Method and Stage. <range 1> is 30μA and <range 2> is 300μA. The acceptable range is 0~300e-6 and the unit is A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CORRection:CURRent:OPEN:RANGe:ALL?
It queries the current open zero value of selected Method and Stage. Comma (,) is used to separate the returned two values which are 30μA and 300μA in the unit of A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CORRection:CURRent:OPEN:RANGe[:BEST] ***<value>***
It sets the current open to zero value for the selected Method and Stage. <value> is the open zero value of all ranges. The acceptable value is 0~300e-6, and the unit is A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CORRection:CURRent:OPEN:RANGe[:BEST]?
It queries the current open zero value of the selected Method and Stage. The unit is A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CURRent:LIMit[:HIGH]
It sets the current high limit for the selected Method and Stage. The acceptable value is 0.01e-6~300e-6, and the unit is A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CURRent:LIMit[:HIGH]?
It queries the current high limit of the selected Method and Stage. The unit is A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CURRent:LIMit:LOW ***OFF*** **|** ***<value>***
It sets the current low limit for the selected Method and Stage. The acceptable value is OFF, 0.01e-6 ~ current high limit, and the unit is A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:CURRent:LIMit:LOW?
It queries the current low limit of the selected Method and Stage. The unit is A (ampere). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:DELay:EXISt?
It queries if there is delay time parameter for the selected Method and Stage. 1 means yes while 0 means no.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:DELay[:VALue] ***OFF*** **|** ***<value>***
It sets the delay time for the selected Method and Stage. The acceptable value is OFF, 0.1~9.9, and the unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:DELay[:VALue]?
It queries the delay time of selected Method and Stage. The unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:FALL:EXISt?
It queries if there is fall time parameter for the selected Method and Stage. 1 means yes while 0 means no.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:FALL[:VALue] ***<value>***
It sets the fall time for the selected Method and Stage. The acceptable value is 0.1~9.9 and the unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:FALL[:VALue]?
It queries the fall time of the selected Method and Stage. The unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:PAUSe:EXISt?
It queries if there is time pause parameter for the selected Method and Stage. 1 means yes while 0 means no.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:PAUSe[:VALue] ***<value>***
It sets the pause time for the selected Method and Stage. The acceptable value is 0.1~99.9, and the unit is S (second). <m> is the selected Method number that accepts 2 or 5 only. <s> is the selected stage number and its range varies with the selected Method, which is 1 for Method 2 and 1~2 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:PAUSe[:VALue]?

It queries the pause time of the selected Method and Stage. The unit is S (second). <m> is the selected Method number that accepts 2 or 5 only. <s> is the selected stage number and its range varies with the selected Method, which is 1 for Method 2 and 1~2 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:RISE:EXISt?
It queries if there is rise time parameter for the selected Method and Stage. 1 means yes while 0 means no.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:RISE[:VALue] ***<value>***
It sets the rise time for the selected Method and Stage. The acceptable value is 0.1~9.9, and the unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1 for Method 1, 1~2 for Method 2, 1 for Method 3, 1 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:RISE[:VALue]?
It queries the rise time of the selected Method and Stage. The unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1 for Method 1, 1~2 for Method 2, 1 for Method 3, 1 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:TEST:EXISt?
It queries if there is test time parameter for the selected Method and Stage. 1 means yes while 0 means no.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:TEST[:VALue] ***<value>***
It sets the test time for the selected Method and Stage. The acceptable value is 0.5~99.9, and the unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:TIME:TEST[:VALue]?
It sets the test time of the selected Method and Stage. The unit is S (second). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:VOLTage ***<value>***
It sets the test voltage for the selected Method and Stage. The acceptable value is 0.1e3~10e3, and the unit is V (volt). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:METHod<m>:STAGe<s>:VOLTage?
It queries the test voltage of the selected Method and Stage. The unit is V (volt). <m> is the selected Method number ranged from 1 to 5. <s> is the selected stage number and its range varies with the selected Method, which is 1~2 for Method 1, 1~2 for Method 2, 1 for Method 3, 1~3 for Method 4, and 1~3 for Method 5.

[:SOURce]:PDIScharge:SNUMber?
It queries the stage number of the Method selected by [:SOURce]:PDIScharge:ACTive command.

[:SOURce]:PDIScharge:STARt:CORRection:OPEN
It enables the current open to zero action, which will output high voltage.

[:SOURce]:PDIScharge:STAR[:ONCE]
It enables the test that will output high voltage.

[:SOURce]:PDIScharge:STOP
It stops testing emergently.

[:SOURce]:PDIScharge:RESult:ACTive?
It queries the tested Method number.

[:SOURce]:PDIScharge:RESult:AREPort:ENABle ***<boolean> | ON | OFF***
It enables or disables the Auto Report function. This setting will not disappear after shutdown. If *PSC command sets to 1, this setting will clear to OFF after powered on. Auto Report function is only applicable to RS232 interface. If Auto Report is enabled, the tested data will send out via RS232 when the test is done. Each entry of data has Method number, Method judgment, and the test data of each Stage. Each Stage test data entry has Stage number, voltage, current, current judgment, PD maximum, PD count, PD maximum judgment, PD average, and PD average judgment. Each of them is separated by comma (,). If some of the fields have no test data because the test item is not opened or executed, these fields will not send out any data. It means that there is no test data between 2 adjacent commas (, ,). For the name and sequence of each field, please refer to the description of [:SOURce]:PDIScharge:RESult:AREPort:FIELd:NAME? command. The data type of each field is listed in the table below.

Field	Data Type	Description
Method	NR1	Method no., the range is 1~5.
Judgment	string	Method judgment, the data is "Pass" or "Fail".
Stage	NR1	Stage no. the range is 1~3.
Voltage	NR3	Voltage measurement, the unit is V (volt).
Current	NR3	Current measurement, the unit is A (ampere).
Current Judgment	string	Current judgment, the data is "Pass", "Current High Fail" or "Current Low Fail".
PD Maximum	NR3	PD Maximum measurement, the unit is C (Coulomb).
PD Count	NR1	PD Count test value.
PD Maximum Judgment	string	PD Maximum judgment, the data is "Pass" or "PD High Fail".
PD Average	NR3	PD Average measurement, the unit is C (Coulomb).
PD Average Judgment	string	PD Average judgment, the data is "Pass" or "PD Average High Fail".

For instance, assuming the Method is set to 3 with 1 Stage, which has PD Maximum judgment enabled, PD Average disabled, and the result is PD Maximum Fail, it will return the data as listed below:

3,"Fail",1,+8.00000E+01,+9.00000E-07,"Pass",+9.59000E-11,1,"PD High Fail",,

[:SOURce]:PDIScharge:RESult:AREPort:ENABle?

It queries if the Auto Report function is enabled.

[:SOURce]:PDIScharge:RESult:AREPort:FIELd:NAME?
It queries the name of data field and sequence sent by Auto Report function. Each field name is a <string> parameter enclosed by double quotes (") and separated by comma (,).The data returned by this command will send the corresponding data according to the number of Stage in the Method under editing. For example, the Method at present is 1 and the number of Stage is 2, so this command returns 2 sets of Stage measured data fields. The returned data is as follows:

"Method","Judgment","Stage","Voltage","Current","Current Judgment","PD Maximum","PD Count","PD Maximum Judgment","PD Average","PD Average Judgment","Stage","Voltage","Current","Current Judgment","PD Maximum","PD Count","PD Maximum Judgment","PD Average","PD Average Judgment"

[:SOURce]:PDIScharge:RESult:AREPort:FIELd:NUMBer?
It queries the number of data field sent by Auto Report function. Assuming the Method has 2 data fields and the Stage has 9 data fields, the data returned by this command will send the corresponding data according to the number of Stage in the Method under editing. For example, the Method at present is 1 and the Stage number is 2, so the command returns 20 (2 + 9 * 2).

[:SOURce]:PDIScharge:RESult:AREPort:FIELd:SNUMber?
It queries the Stage number in the Method under editing. For example, the Method at present is 1 and the returned data is 2.

[:SOURce]:PDIScharge:RESult:AREPort:FIELd:VALid?
It queries if each of the data field sent by Auto Report function is valid. It returns 1 if yes and 0 if not. Each data field is separated by comma (,). For example, the Method is set to 3 with only 1 Stage, which has PD Maximum judgment enabled, PD Average disabled, so the data returned has PD Average only. As the PD Average Judgment field is 0 and other fields are 1, the returned data is 1,1,1,1,1,1,1,1,1,0,0.

[:SOURce]:PDIScharge:RESult:MEASurement:CHARge:AVERage[:VALue]?
It queries the final PD Average value of the test. The unit is C (Coulomb).

[:SOURce]:PDIScharge:RESult:MEASurement:CHARge:MAXimum[:VALue]?
It queries the final PD Maximum value of the test. The unit is C (Coulomb).

[:SOURce]:PDIScharge:RESult:MEASurement:CURRent[:VALue]?
It queries the final current value of the test. The unit is A (ampere).

[:SOURce]:PDIScharge:RESult:MEASurement:TIME:ELAPsed?
It queries the elapsed time of the test. The unit is S (second).

[:SOURce]:PDIScharge:RESult:MEASurement:VOLTage[:VALue]?
It queries the final voltage of the test. The unit is V (volt).

[:SOURce]:PDIScharge:RESult:SNUMber?
It queries the Stage number (including untested stage) of the test result.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CHARge:AVERage:JUDGment[:PASS]?
It queries if the PD Average test result of the selected stage is PASS. When 1 is returned, it means the test result is PASS while 0 indicates FAIL. <s> is the selected

stage number, and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CHARge:AVERage:JUDGment:STRing?
It queries the PD Average test result string of selected stage. <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CHARge:AVERage[:VALue]?
It queries the PD Average test value of selected stage. The unit is C (Coulomb). <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CHARge:MAXimum:JUDGment[:PASS]?
It queries if the PD Maximum test result of selected stage is PASS. When 1 is returned, it means the test result is PASS while 0 indicates FAIL. <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CHARge:MAXimum:JUDGment:STRing?
It queries the PD Maximum test result string of selected stage. <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CHARge:MAXimum:OCCurrence?
It queries the PD Count test value of selected stage. <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CHARge:MAXimum[:VALue]?
It queries the PD Maximum test value of selected stage. The unit is C (Coulomb). <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CURRent:JUDGment[:PASS]?
It queries if the current test result of selected stage is PASS. When 1 is returned, it means the test result is PASS while 0 indicates FAIL. <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CURRent:JUDGment:STRing?
It queries the current test result string of selected stage. <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:CURRent[:VALue]?
It queries the current test value of selected stage. The unit is A (ampere). <s> is the selected stage number and the range is 1 to [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests

are done.

[:SOURce]:PDIScharge:RESult:STAGe<s>:VOLTage[:VALue]?
It queries the voltage test value of selected stage. The unit is V (volt). <s> is the selected stage number and the range is [:SOURce]:PDIScharge:RESult:SNUMber? command returned stage number. This command is only accepted when all stages tests are done.

[:SOURce]:PDIScharge:RESult:STATe:JUDGment?
It queries the test results. Returning 1 means Pass, -1 means Fail, and 0 means no test results.

[:SOURce]:PDIScharge:RESult:STATe:STRing?
It queries the test result in string format such as “Pass”. It usually returns the message text at the lower left corner of test menu. The possible text strings are as follows:

- "Standby"
- "Testing"
- "Abort"
- "Skip"
- "Completed"
- "Pass"
- "Output Fail"
- "Over Current Protection"
- "Current High Fail"
- "Current Low Fail"
- "PD High Fail"
- "PD Average High Fail"
- "HVCC Fail"
- "System Fail"
- “Interlock”
- “Fixture Not Exist”

Note: The list may increase due to new functions, thus the actual return string may not be in the above list.

[:SOURce]:PDIScharge:RESult:STATe:TESTing?
It queries if the test is running. It is in testing when 1 is returned and not in testing if 0 is returned.

:DIAGnostic:VERification:PDIScharge:DATE?
It reads the last verification date and returns 3 fields in year, month and day sequence separated by comma. For example, 2019,1,23.

:DIAGnostic:VERification:PDIScharge:MARK
It saves the system date and time making it the last verification date and time.

:DIAGnostic:VERification:PDIScharge:MEASure?
It reads the PD measurement after started the verification procedure.

:DIAGnostic:VERification:PDIScharge:RANGe[:LOWer] <value>
It sets the PD Range after the verification procedure is stopped. The value acceptable is 200e-12 or 2000e-12, and the unit is C (Coulomb). 200e-12 means selecting 200pC

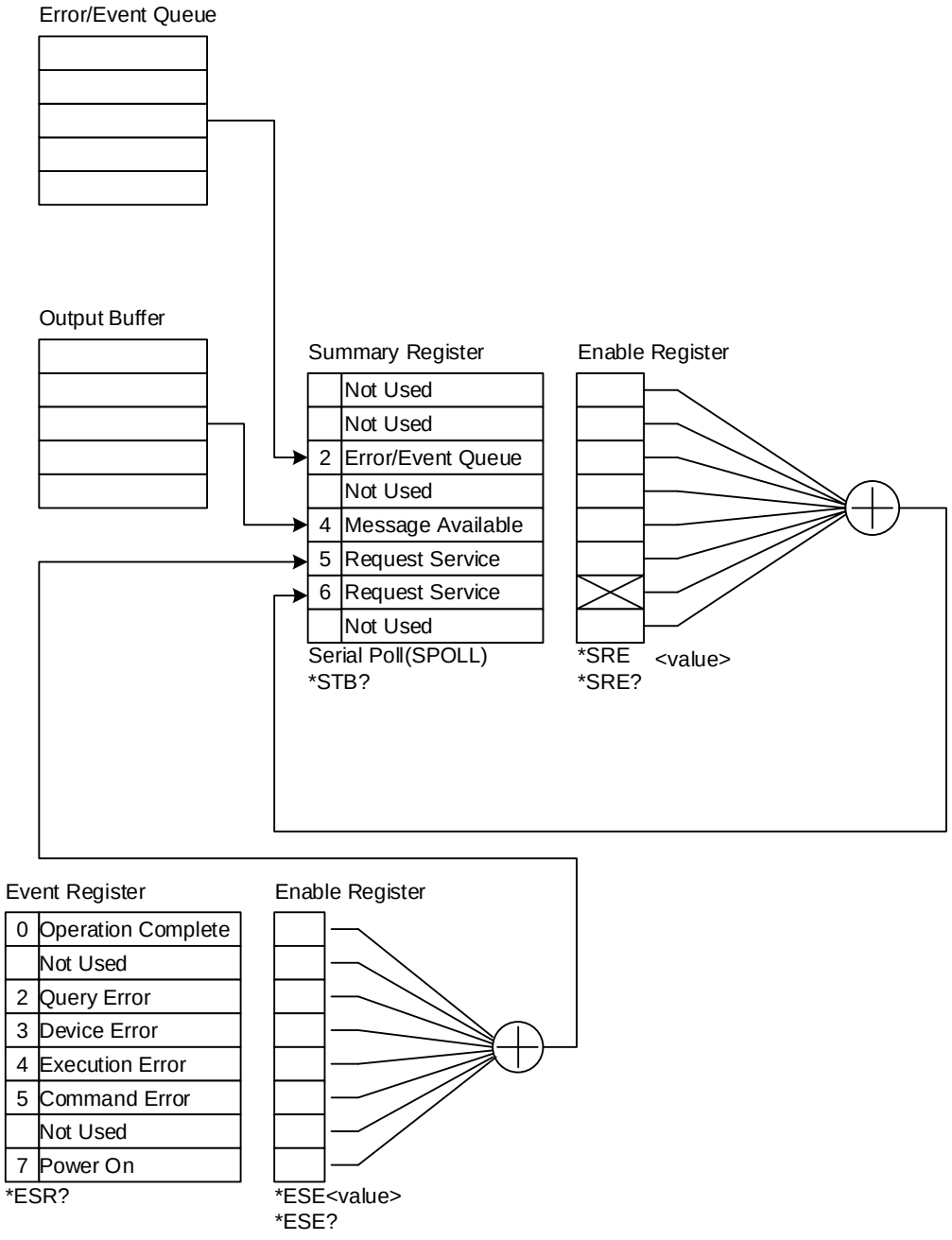
range while 2000pC means selecting 2000pC range.

:DIAGnostic:VERification:PDIScharge:RANGe[:LOWer] ?
It queries the PD Range setting. The unit is C (Coulomb).

:DIAGnostic:VERification:PDIScharge:STARt
It starts the verification procedure.

:DIAGnostic:VERification:PDIScharge:STOP
It stops the verification procedure.

6.5.3 SCPI System Status



6.6 Error Messages

Notice

- The error messages stored in error queue will be returned in the way of first in first out (FIFO) which means the first error message returned is the first one being saved.
- When error messages exceed 10, the last one be stored in the error queue will be –350 “Queue overflow”. It means the error queue is unable to store another error message until the error messages are extracted.
- If no error is generated, +0 “No error” will be stored in the first position of error queue.

-101	Invalid character
-102	Syntax error
-103	Invalid separator
-104	Data type error
-108	Parameter not allowed
-109	Missing parameter
-111	Header separator error
-112	Program mnemonic too long
-113	Undefined header
-114	Header suffix out of range
-120	Numeric data error
-141	Invalid character data
-151	Invalid string data
-158	String data not allowed
-161	Invalid block data
-168	Block data not allowed
-171	Invalid expression error
-178	Expression data not allowed
-200	Execution error
-203	Command protected
-221	Settings conflict
-222	Data out of range
-241	Hardware missing
-292	Referenced name does not exist
-293	Referenced name already exist
-350	Queue overflow
-363	Input buffer overrun
-410	Query INTERRUPTED
-420	Query UNTERMINATED

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