HIPOT Analyzer

Guardian 500VA Plus/Guardian 500VA Plus with Corona Detection

Instruction Manual

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Instruction Manual

Part Number: 150942
Version A2
January 2011

Legal Notices

The information in this document is subject to change without notice.

Quadtech, Inc. makes no warranty of any kind in regarda to this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Quadtech, Inc. shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Quadtech, Inc.
800-253-1230 or http://www.quadtech.com

Warranty

All Quadtech, Inc. instruments are warranted against defects in material and workmanship for a period of one year after the date of shipment. Quadtech, Inc. agrees to repair or replace any assembly or component found to be defective, under normal use during this period. Quadtech's obligation under this warranty is limited solely to repairing any such instrument, which in Quadtech's sole opinion, proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Transportation to the factory or service center is to be prepaid by the purchaser. Shipment should not be made without prior authorization by Quadtech, Inc..

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Quadtech, Inc.
800-253-1230

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Material Contents Declaration

Quadtech, Inc. provides material contents declaration for RoHS compliant products as below:

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
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 and EU 2005/618/EC.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the available collection systems. 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 your old appliances for disposal at least for free of charge.

CE Conformity Declaration

For the following equipment:
Product Name: DC Electronic Load
Model Name: 44040, 44020, 44001, 44002, 44003, 44004, 44005, 44006, 44007, 44009
Manufacturer's Name: QuadTech, Inc.
Manufacturer's Address: www.quadtech.com or 800-253-1230

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 (89/336/EEC) and electrical equipment designed for use within certain voltage limits (73/23/EEC;93/68/EEC)

For electromagnetic compatibility, the following standards were applied:

EMC: EN61326-1:2006, Table 2 CISPR 11: 2003+A1: 2004+A2: 2006, (Class A)
IEC 61000-4-2: 1995+A1: 1998+A2: 2000
IEC 61000-4-3: 2002+A1: 2002
IEC 61000-4-4: 2004
IEC 61000-4-5: 1995+A1: 2000
IEC 61000-4-6: 1996+A1: 2000
IEC 61000-4-8: 1993+A1: 2000
IEC 61000-4-11: 2004
EN61000-3-2: 2000+A2: 2005, Class A
EN61000-3-3: 1995+A1: 2001+A2: 2005

For safety requirement, the following standard was applied:

Safety: IEC/EN61010-1: 2001

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 the specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacturing, and intended use of the instrument. *Quadtech, Inc.* 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. Doing 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.

DO NOT REMOVE THE COVER OF THE INSTRUMENT

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

⚠WARNING

1. Lethal voltage. AC source may output 426 V peak voltage.
2. Touching the connected circuit or output terminal on the front or rear 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.
	**Protective grounding terminal:** To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to the ground before operation of equipment.
	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.

Inspection and Examination

Before the instrument exits the factory, we have a series of inspections and measurements on mechanical and electrical characteristics. Make sure its function of operating for the quality warranty of the product. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing materials in case of return. If damage is found, please file claim with carrier immediately. Do not return the instrument to Quadtech, Inc. without prior approval.

Standard Accessory

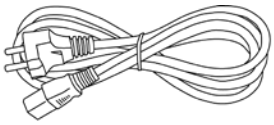
Standard Equipment

Main unit

User's Manual USB Stick

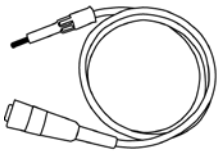
Standard Equipment (Cable)

■ USA-type power cord 90° elbow 1.8m x 1



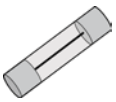
■ Euro-type power cord 1.8m x 1 (Only in Europe)

■ Power adapter 3PIN to 2PIN x 1



■ HV terminal used test cable x 2

■ W38000044 RTN/LOW terminal used BNC test cable



■ 10A fuse x 2

320241 BNC to Binding Post Adapter

Note : When ordering the accessories, please name the item.

The Danger of Operating

1. When the instrument is under output voltage, please don’t touch the test area, there is a shock hazard and could result in death.
   Please obey the following guidelines.
   - Make sure the grounding cable is connected correctly and using the standard power cord.
   - Don’t touch the output terminal.
   - Don’t touch the test cable of connecting test termination.
   - Don’t touch the test termination object.
   - Don’t touch any charge component of the connecting output terminal.
   - As the instrument ends the test or output is turned off, please don’t touch test the unit immediately.

2. Shock accidents usually occur with the following conditions.
   - When the grounding terminal of the instrument doesn’t connect correctly.
   - When the insulation glove for testing is not used.
   - After the test is completed, touching the test unit immediately.

3. **Remote control for the instrument:** This instrument provided a remote control, normally used to control high voltage output with the external signal. For safety reasons and to prevent hazards, please follow instructions below exactly, while using remote control.
   - Unexpected high voltage output may exist. Make sure if this instrument is under testing or remote control before accessing the probes.
   - When the instrument is under testing or operation, any access to DUT, test cable and probe output terminal are prohibited, both for the operator or service personnel.
   - Normally, the remote control of this instrument is controlled by the high voltage test bar. However, use of other control circuits is also possible. For safety reasons and to prevent from hazard, please notice that unintentional access to the control test bar or bridging the control circuit to high voltage terminal and test cables may cause potential hazard. Please keep this terminal or control from unintentional bridging or access to avoid danger.

⚠WARNING Don't tie the HV cable, RS232, Handler, GPIB control cable and other low voltage cable together. Or it may cause product to be damaged or the PC to crash.

Notice The details on using the notice items and the dangers of operation are in Chapter 3 “Notice items before using” of this manual.

Storage, Freight, Maintenance

Storage
When not using the device, please pack it properly and store it in a good environment. (The packing is not needed when the device is stored in an appropriate environment.)

Freight
Please use the original packing material when moving the device. If the packing material is missing, please use the equivalent buffer material to pack and mark it as fragile and waterproof, etc. to avoid the device from being damaged during movement. The device has precise equipment, please use-qualified transportation as possible. Avoid impact etc. that may damage the device.

Maintenance
Please contact Quadtech, Inc. or dealer where the instrument was purchased and discuss any malufunctions. Please do not perform any maintenance on this instrument unless noted in this manual.

Revision History

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

Date	Version	Revised Sections
January 2011	1.0	Initial Release of this manual

Table of Contents

1. Introduction

1.1 An Overview of Product

Automatic withstand/insulation/grounding testers of this instrument are designed for automatic withstand, insulation resistance and short/open circuit detection of electromechanical and electronic equipments.

In respect to withstand voltage testing, the output power is AC: 500VA(5kV, 100mA), DC: 120VA(6kV, 20mA). Therefore, use this for withstand testing of electronic, electromechanical and component.

In respect to the testing of insulation resistance, the measurement range is 0.1MΩ ~ 50GΩ and the test voltage range is 50V ~ 5000V. This can be set arbitrary.

In respect to the testing of short/open circuit detection, please test if capacitance is short or open before testing the high voltage. Please make sure the DUT has good contact and processes the high voltage test.

All of the settings status: time, current, voltage, resistance value, memory number, etc. are listed on the display, it is unnecessary to remember any of the parameter status.

The tester is equipped with “Good” and “No Good” judgment machinery and signals the output of the testing results and the remote control. It is also for RS232 interface, HANDLER interface and GPIB interface of the automatic test system. The above equipments make highly efficient and accurate tests for electromechanical, electronic and component.

1.2 Features

- Floating high-voltage/current simultaneous measurement patent-design
- Standard RS232/USB interface
- AC / DC withstand voltage, insulation resistance, short/open circuit detection three-in-one model
- DC open circuit detection patent-design
- Reformation DC quick discharge patent-design
- 0.2sec quick discharge
- Keypad locked and data protected function
- Eight kinds of judgment result indication window
- Charge current low limit detection function
- Storage of 500 test setups or 100 sets of memory functions
- GPIB interface optional
- Full-function front panel calibration
- With bar code scanning to trigger the test function

1.3 Initial Inspection

Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, inspect for any damage that may

have occurred in transit. Save all packing materials in case the instrument has to be returned. If damage is found, please file claim with the carrier immediately. Do not return the instrument to Quadtech, Inc. without prior approval.

1.4 Common Environment Conditions

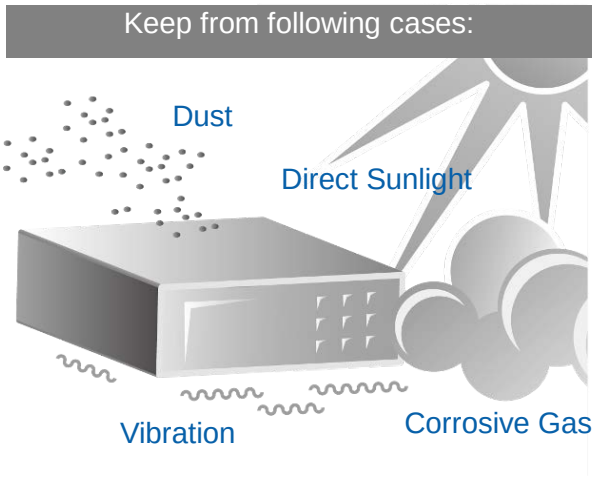
1. Indoor use
2. Altitude: 2000 m
3. Transient Overvoltage at Mains Supply: 2500V
4. Pollution Degree: 2

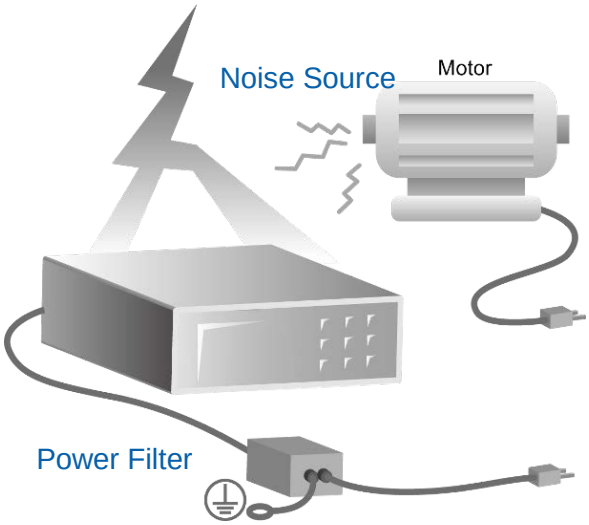
1.5 Ambient Environment

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

2. The meter has been carefully designed to reduce the noise from the AC power source. However, it should be used in as much of a noise-free environment as possible. If noise is inevitable, please install a power filter.

3. The meter should be stored within the temperature range -10°C ~ +50°C. If the unit is not to be in use for a long time, please store it in the original or similar packaging and keep it away from direct sunlight and humidity.





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

■ **AC/DC Withstanding Test**	
❑ Output Voltage	AC:0.05-5.0kV, steps 0.002kV, DC: 0.05-6.0kV,steps 0.002kV
❑ Load Regulation	≤ (1% of setting + 0.1% of full scale), Rated load
❑ Voltage Accuracy	± (1% of setting + 0.1% of full scale)
❑ Cutoff Current (Note 1)	AC: 0.001mA ~ 120mA (voltage ≤ 4kV) AC: 0.001mA ~ 100mA (voltage > 4kV) DC: 0.0001mA ~ 20mA 0.1uA DC resolution
❑ Output Voltage monitor	± (1% of reading + 0.1% of full scale), 2V resolution
❑ Leakage Current Meter	AC current: 3mA range: 0.001mA – 2.999mA, 0.001mA resolution 30mA range: 0.01mA -- 29.99mA, 0.01mA resolution 120mA range: 0.1mA -- 120.0mA, 0.1mA resolution Measurement Accuracy: ± (1% of reading + 0.5% of range) DC current: 300uA: 0.1uA– 299.9uA, 0.1uA resolution 3mA range: 0.001mA – 2.999mA, 0.001mA resolution 20mA range: 0.01mA – 20.00mA, 0.01mA resolution Measurement Accuracy: ± (1% of reading + 0.5% of range) AC real current: ± (1% of reading + 5% of total current)
❑ Output Waveform	50Hz - 600Hz Programmable, sine wave
❑ Test Time (Note 2)	0.3 ~ 999 Sec., and Continue
❑ Ramp Time	0.1 ~ 999 Sec., and Off
❑ Fall Time	0.1 ~ 999 Sec., and Off
❑ DWELL Time	0.1 ~ 999 Sec., and Off (WDC only)
❑ Maximum Short Current	Up to 4kV 200mA AC only
■ **ARC Detection** (Note 3)	
❑ Detection Current	AC: 1mA – 20mA, DC: 1mA – 10mA, resolution 0.1mA
■ **Corona Detection** (Model Guardian 500VA Plus with Corona Detection)	
❑ Detection Rage	0.1 ~ 99.9, and Off
■ **HFCC**	
❑ Capacitance Range	1pF ~ 100pF
❑ Display Range	1pF ~ 200pF
❑ Measuring Accuracy	± (50% of reading + 3pF)
■ **Insulation Resistance Test**	
❑ Test Voltage	DC: 0.050 ~ 5.000 kV, steps 0.002kV
❑ V-display Accuracy	± (1% of reading + 0.1% of full scale)
❑ Resistance Range	0.1MΩ ~ 50GΩ

❑ Measuring Accuracy	≥ 1kV: 1 MΩ ~ 1GΩ: ± (3% of reading + 0.1% of full scale) 1GΩ ~ 10GΩ: ±(7% of reading + 2% of full scale) 10GΩ ~ 50GΩ: ±(10% of reading + 1% of full scale) 500V~ 1kV: 1 MΩ ~ 1GΩ: ± (3% of reading + 0.1% of full scale) 1GΩ ~ 10GΩ: ±(7% of reading + 2% of full scale) 10GΩ ~ 50GΩ: ±(10% of reading + 1% of full scale) < 500V: 1MΩ ~ 1GΩ: ±(5% of reading + (0.2 x 500V/Vs)% of full scale)
❑ Test Time (Note 2)	0.3 ~ 999 Sec., and Continue
■ **Secure Protection Function**	
□ **Ground Fault Interrupt leakage current (for WVAC only)**	AC:0.25mA~0.75mA, ON/OFF selectable
□ Fast Discharge	Approx. 0.2S (Discharge Voltage 5.1kV)
□ Panel Operation Lock	YES, with password On/Off
■ **Floating Output** (NOTE 4)	
□ Function	WAC, WDC, IR
□ H.V Floating Output	Front panel H.V output only
□ Leakage Current	Less than 3.5mA AC or dc
■ **Memory Storage**	
□ Memories, Steps	100 groups of memory, each memory includes max.50 Steps (TOTAL 500 steps)
■ **PASS/FAIL Judgment Window**	
□ Indication, Alarm	PASS: (Short Sound) FAIL: W-Arc, W-Hi, W-Lo, IR-Lo, IR-Hi, GFI (Long Sound)
■ **Remote Connector**	
□ Interlock	2 pins connector, pin1 pull-up to digital +V source with 4.7kohm resistor, and pin 2 tied to digital GND
■ **Handler Interface**	24 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 22kohm resistor to $+V_{EXT}$ (external power supply). All input optic-diode must be series with current limit (10mA ± 4mA for +3V ~ +26V) circuit.
■ **RS232 Interface**	The programming language is SCPI.
■ **USB Interface**	USB meet USBTMC
■ **GPIB (Optional)**	Complies with IEEE488.1 and 488.2. The programming language is SCPI.
■ **Ambient Temperature and Relative Humidity**	
❑ Specifications range	18 to 28°C, 20 to 70% RH.
❑ Operable range	0 to 45°C, 15% to 95% RH.

❑ Storage range	-10 to 50°C, ≤ 80% RH.
■ **Power Requirement**	
❑ Line Input	100Vac ~ 240Vac, 47~66 Hz
❑ Power Consumption	No load: <100W, Rated load: 1200W
❑ Dimension	430 W x 130 H x 500 D mm
❑ Weight	< 25 kg
■ **SAFETY**	
❑ Ground Bond	Less than 100mΩ at 25Amp, 2sec.
❑ Hi-Pot L + N to Earth:	Less than 15mA at WVAC 1.5kV, 60Hz, 60sec no flashover happen(ARC level<5mA).
	Less than 0.1mA at WVDC 2.2kV, 60sec no flashover, ramp time 2sec(ARC level<5mA).
❑ Insulation L + N to Earth:	Greater than 20MΩ at 500V dc, 2sec.
❑ Line leakage current:	Less than 3.5mA at 256V Vin max, normal and reverse.

Note 1: Less than 1/2 duty cycle of 120sec when output power is greater than 300VA.
The current resolution is 1.2count for WAC, and 1.6count for WDC calculated value.
Note 2: The minimum testing time arrives at 90% output voltage specification (NO load).
Note 3: Design in Specifications. Validation point is 1.25kV with a 250kΩ resistor.
Note 4: Except GFI ON/OFF.

3. Notices Before Using

The tester is capable of high-voltage output up to 6KV sending to external test. Injury or death may as a result from an error in operation. Please read the notice in this chapter to avoid accident.

1. **Shock Hazard**
   Prevent shock before it occurs. Before using the tester, first put on the insulation glove and then run functions related to electricity.

2. **Grounding**
   There is a ground terminal on the rear panel cover of the tester. Please use an appropriate implement to connect the ground terminal to the actual earth. If not done properly, there may be existing high-voltage on the cover of the tester. The machine is a danger to whatever touches if proper precautions are not used. It may cause a shock hazard, therefore please be sure to connect the ground terminal to the earth as shown in Figure 3-1.

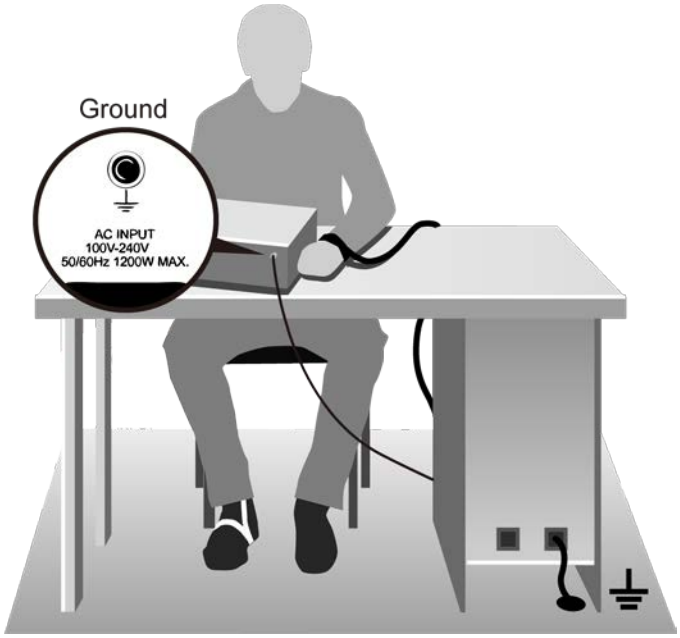


Figure 3-1 Safety Grounding

3. **Connect test cable to HV1/HV2 terminal**
   It is necessary to check if there is a loosened or drop occurring in the test cables of HV1 and HV2 terminals under operating conditions at any time. If you want to connect the DUT by test cable, please connect the test cable of HV2 or RTN/LOW terminal to the DUT(Device Under Test). The incomplete connection of the test cables of HV2 or RTN/LOW terminal or drop is very dangerous, the DUT is full of high voltage. After plugging the high-voltage jack in the HV1 and HV2, rotate the screw 90° clockwise to avoid a drop in the test cable.

4. **Connection test of high voltage output terminal**
   After the test cable of HV2 terminal has been connected. Follow the procedures below to the connect high voltage output cable.
   - Press [STOP] key firstly.

- Confirm DANGER indication LED does not light.
- The test cable of HV2 or RTN/LOW terminal with HV1 terminal is shorted; confirm there is no output voltage.
- Plug the high voltage test cable in HV1 terminal.
- Connect the test cable of HV2 or RTN/LOW terminal to the DUT, then the HV1 high voltage test cable can be connected as well.

5. Test stop

When the test is over and there is no need to use, or the tester is not under running status or the user needs to exit during use, please be sure power switch is in the OFF position (that is turn off power) as shown in Figure 3-2.

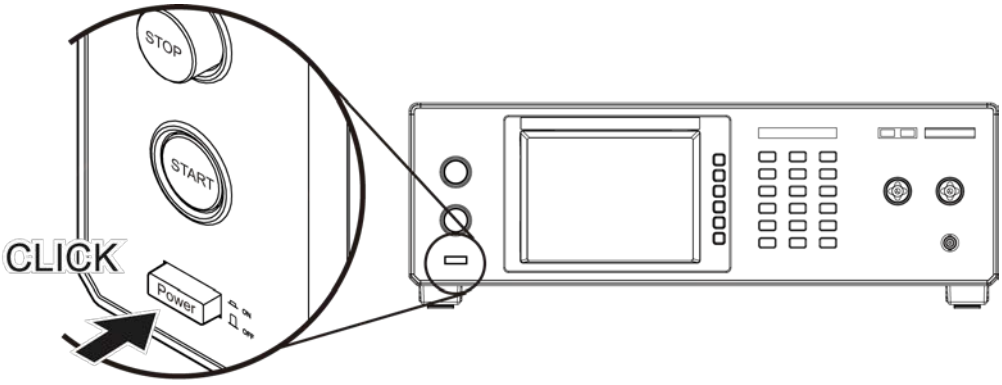


Figure 3-2 POWER SWITCH OFF

6. The dangerous area under test mode

It is very dangerous to touch the high voltage area under operation status. Do not touch the DUT, test cable, probe and output terminal.

※ When the main unit is under test status, please don't touch the alligator clip on the test cable. The insulation of the plastic layer is not enough, touching it may prove to be a hazard as shown in Figure 3-3.

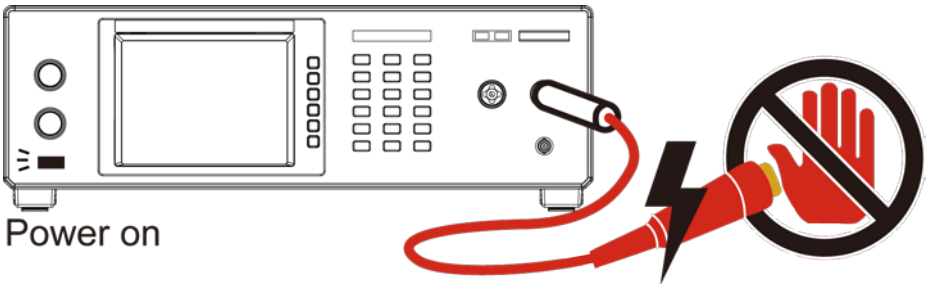


Figure 3-3 Don't touch here when outputing high voltage

<<< Warning ! When the output terminal is cut off >>>

7. Test complete confirmation

You may touch the DUT, high voltage test cable or output terminal, etc. in high voltage areas under the modifying circuit or others test requested conditions. First, please confirm the following:

※ Power switch is turned to the off position.

※ As the insulation resistance test unit, the DUT may full of high voltage when the test is completed. In the meantime, you need to pay attention to and obey the

descriptions of item 8 and 9. Please follow the described procedures to execute.

<<< Notice! Insulation resistance is charging as testing. >>>

8. Charge

When the insulation resistance is testing, the DUT, capacitor, test cable, probe and output terminal–including the tester–may be full of high voltage. After turning the power to off, it needs a period of time to discharge. Please obey the above instructions, don't touch any place that may cause shock especially, when the power has just been turned off.

9. Confirm that thecharging voltage has been discharged completely

The discharged time of the charging voltage depends on the testing voltage and the DUTs' characteristics. Assuming that the high voltage adding to the DUT is equivalent to high voltage adding to the 0.01uF capacitor parallel to the 100MΩ resistance circuit. After turning the power off, the voltage, which adds on testing and the DUT decreases to lower than 30V and the necessary time about 3.5 seconds. When the test voltage is 500V it requires about 2.8 seconds. Assuming the time constant of the DUT is known, if you want to know the voltage decrease, it is below 30V needed time. Please follow the above procedures, multiply the necessary time below 30V by time constant as shown in Figure 3-4.

Formula: $Vo\, e^{-t/RC} = V_{IL}$

Ex. : $1000V \times e^{-t/RC} = 30V$

$e^{-t/RC} = 0.03$

$-t/RC = \ln 0.03 \quad \therefore t = 3.5$ Sec

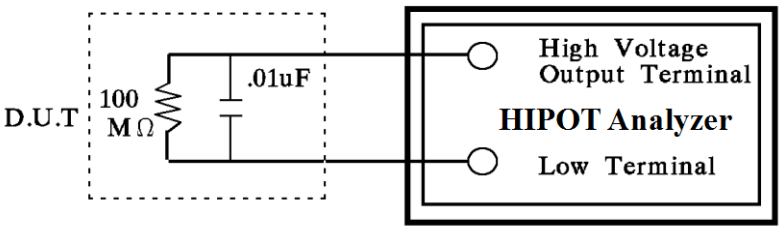


Figure 3-4

10. Remote control the main unit

The instrument's high voltage output can be controlled by an external control signal with a remote control. For your safety and to prevent a hazard, please obey the following rules.

- Don't allow any unexpected high voltage output, it may cause a danger.
- When the main unit outputs high voltage, don't permit the operator or other personnel to touch the DUT, test cable and probe output terminal.

※ Notice ※

11. Turn on or turn off power switch

When the power switch is cut off, it requires a few seconds of down time before it will turn back on. Please don't turn the switch on and turn off continuously. It is very dangerous to do that under the high voltage output conditions. **When turning on or turn off power, don't connect any object to high voltage output terminal to avoid hazards that result from abnormally high voltage output.**

12. Other notice items

Don't create short-circuits of the output cable, grounding cable, transmission cable or AC power to prevent the analyzer from being full of voltage. First, please connect the cover of the analyzer to earth firstly when high voltage output terminal HV1 is short-circuited with HV2 or RTN/LOW terminal.

<<< Dangerous Event >>>

13. The danger management

Under any dangerous circumstances, such as shock, the DUT burning or the main unit burning, please obey the following procedures to avoid more serious dangers.

- First, cut off power switch.
- Now, pull off the plug on the power cord.

<<< Solution >>>

14. Problems

Under the circumstances below, the problems that can occur are very dangerous. After pressing [STOP] key, the output terminal may output high voltage.

- When pressing [STOP] key, DANGER indicates the LED is still light.
- The voltage meter without the voltage reading, indicates the DANGER LED is still light. When the above conditions have occurred, please turn off power and pull off the AC power plug immediately. Don't use it any more, please send it to our company or office for repair.

15. DANGER indication LED error

When pressing the [START] key, there was already a reading on the voltage meter and DANGER LED is still not light. In the meantime, the indication LED may be an error. Please turn it off immediately and send it to Quadtech, Inc. or the dealer for repair.

16. If the analyzer has been used a long time using under normal operation. Please note the following items.

If the high limit setting value is 100.0mA (withstand voltage test), please notice its ambient temperature. When the ambient temperature is higher than 40°C, please stop operation until it cools down to normal temperature.

17. The used AC INPUT power of the analyzer is 100Vac ~ 240Vac, 47 ~ 66 Hz.

A fuse can only be replaced fuse under power-disconnected status. Remove the fuse stand from the power socket and press the new fuse slightly into the fuse stand and plug it in the power socket.

⚠WARNING Please use correct specifications for replacing the fuse or it may cause a hazard.

18. Normal operation of the unit is AC power

If the power is unstable, it may cause the unit to function abnormally.
Therefore, please use appropriate equipment to return to suitable power such as power stabilizer.

19. Output power is 500VA

When the DUT is drawing mass current before the deadline of fail judgment and the output current, it may cause flows of mass current (about ten amperes) up to ten milliseconds. Before processing the test, there also may be the same conditions. Please

notice the capacity of the power cord and the current cable that links with other instruments or equipment.

20. Storage

The unit's normal operating temperature humidity range is 5°C ~ 40°C, 80% RH. If the reading is over this range then this function may misfire. Please don't position the equipment so that it is difficult to reach the disconnecting device. The unit storage temperature range is -10°C ~ 50°C, 80% RH. If you don't use it for a long time, please use the original packing materials and store properly. For correct test and safety, please keep it from direct sunlight, high temperature, vibration, humidity and dusty place.

21. Warm up

All functions of the analyzer are activated when the power switch is turned on. However, please warm the instrument 15 plus minutes to attain our specific precision.

22. Warning signal of testing

"DANGER – HIGH VOLTAGE TEST IN PROGRESS, UNAUTHORIZED PERSON KEEP AWAY"

4. Description of Panel

4.1 Front Panel

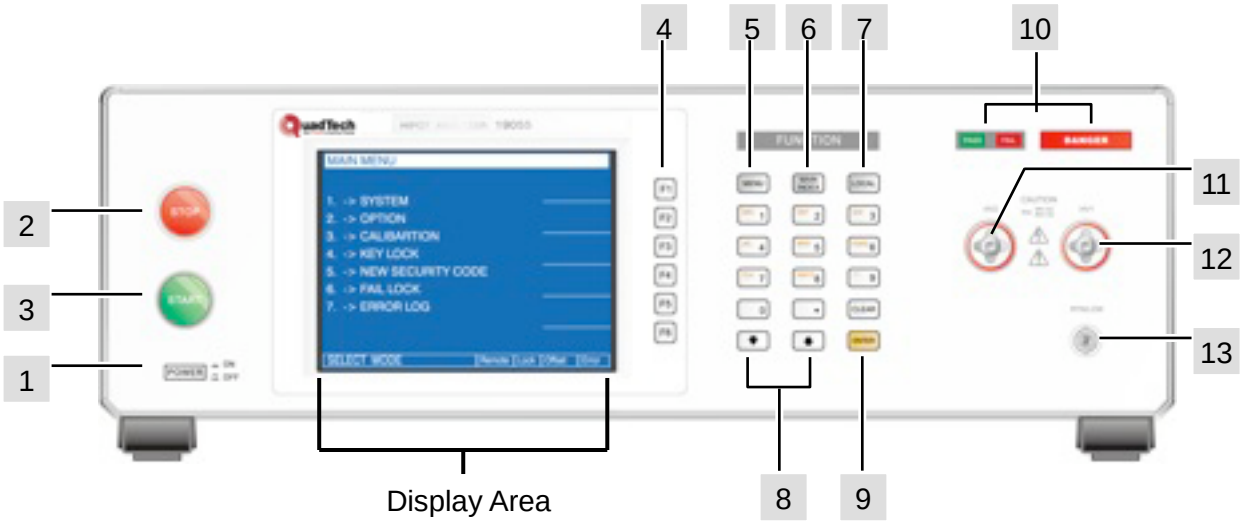
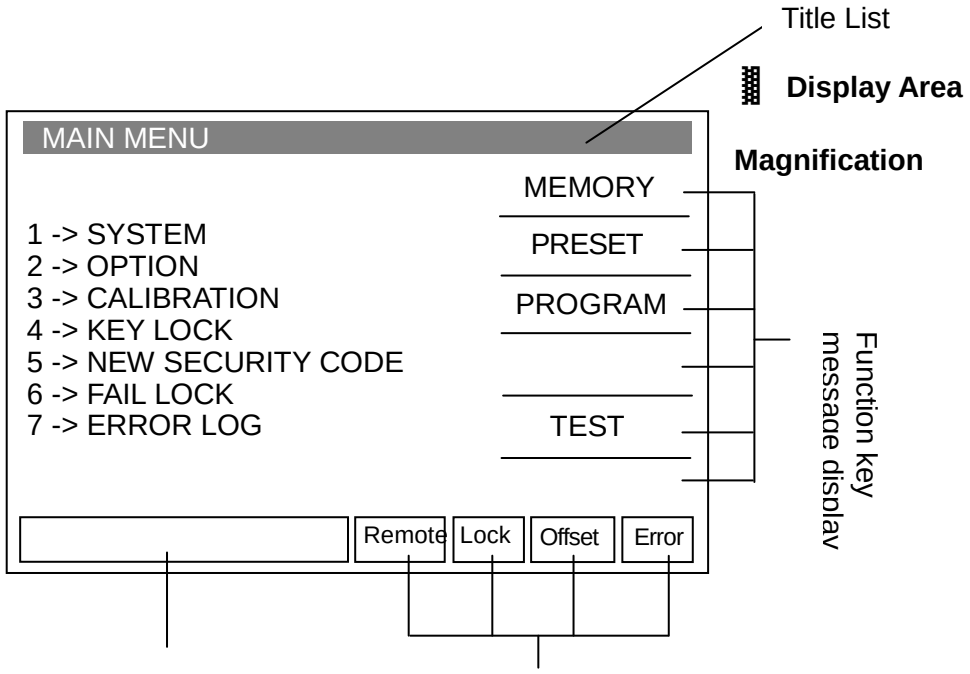


Figure 4-1

Front panel includes several function areas, which are easy to use. This paragraph will introduce each control and information on the screen to you.



Display Area

Title List: This list displays the current settings of the main unit or testing mode.

Function key message display area:
Under different display menus, there are different function descriptions. The right side of the display has corresponding function keys. If the description is blank or gray scale font, it means the corresponding function is invalid.

Message Bar: This list indicates the setting method, the range of the setting value and the testing time.

Message Indication Diagram:

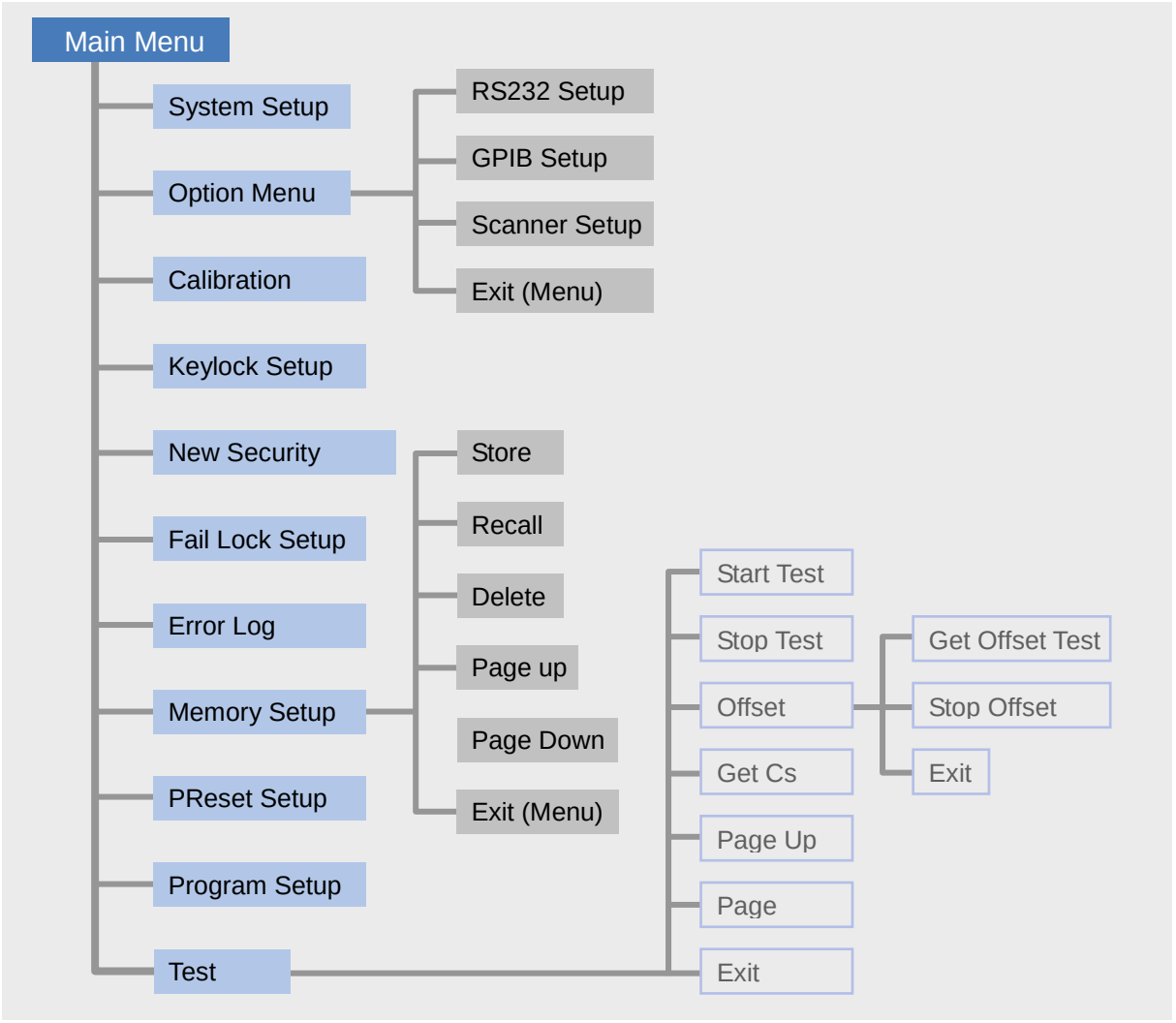
Remote : When this area is highlighted, it means the main unit is under Remote status. That is the main unit controlled by PC through RS232 or GPIB connect to the PC. At the same time, all of the keys are for malfunctions except for the [STOP] and [LOCAL] keys.

Lock : When this area is highlighted, it means the main unit is under the setting parameter-protected mode. Other keys are for malfunction except for the "MEMORY," "TEST" and "KEY LOCK" keys.

Offset : When this area is highlighted, it means the main unit zeroed the leakage current of the test cable and the test lead currently.

Error : When this area is highlighted, it means there is an error message produced.

Simplified Function Flow Chart



Key Area

(1) Power Switch : The switch provides the AC power source that the analyzer needs to preform. Before starting, please read Chapter 3 “Notices before Using.”

(2) STOP Key : Reset key, after pressing this key the main unit returns to standby testing status immediately. It cuts output and cleans all of the judgments simultaneously.

(3) START Key : After pressing this key, the main unit is under testing status. The testing terminal has output and each judgment function starts simultaneously.

(4) Function Keys : Under different display menus, there are different functions. The right side of the display has corresponding function description. If the descriptions is blank or in gray scale font, it means the corresponding function is invalid.

(5) MENU Key : Under each main display mode, press this key to return to the “MAIN MENU” mode.

(6) MAIN INDEX : Press this key to enter GENERAL and BREAKDOWN MODEs for menu selection.

(7) LOCAL Key : When the main unit is under Remote status, return the control right to main unit by pressing this key.

(8) Cursor Keys : The [△] and [▽] keys are for moving highlighted cursors.

(9) Data Entry Keys/Program Keys

[0][.] ~ [9] : Numeral/character key is for inputting each test parameter data (numeral or alphabet). Under the “MAIN MENU” display mode, [1], [2], [3], [4], [5] keys can enter various display modes.

[ENTER] : Confirmation key. After inputting test parameters, press this confirmation key. Thus, the value of inputting will be confirmed.

[CLR] : Clear key. When inputing test parameters, if there are any errors, press this key to cancel the error data and then input again.

(10) Indicator : With UNDER TEST to indicate LED and judge/display LED.

(11) HV2 : High voltage output RTN terminal (when GFI setting is FLOAT). Therefore, this terminal is very dangerous. Don’t touch it when DANGER LED is lit, there is high voltage outputting.

(12) HV1 : High electric potential terminal of high voltage output. This terminal belongs to high electric potential output, usually outputting high voltage. Therefore, this terminal is very dangerous. Don’t touch it when the DANGER LED is lit, there is high voltage outputting.

(13) RTN/LOW : Common test terminal is a reference terminal as high voltage testing, *i.e.* low electric potential terminal. This terminal is almost equal to earth terminal of the cover.

4.2 Rear Panel

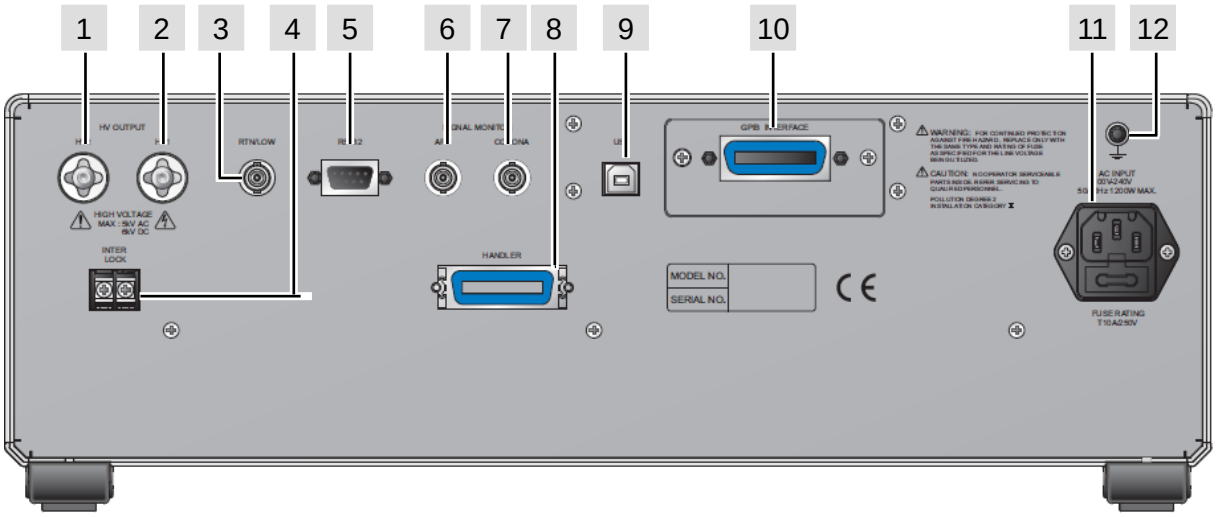


Figure 4-2

(1) HV2 : High voltage output RTN terminal (when GFI setting is FLOAT). Therefore, this terminal is very dangerous. Don't touch it when DANGER LED is lit, there is high voltage outputting.

(2) HV1 : High electric potential terminal from high voltage output. This terminal belongs to high electric potential output, usually outputting high voltage. Therefore, this terminal is very dangerous. Don't touch it when DANGER LED is lit, there is high voltage outputting.

(3) RTN/LOW : Common test terminal is a reference terminal as high voltage testing, *i.e.* low electric potential terminal. This terminal is almost equal to the shell earth terminal.

(4) INTER LOCK : The high voltage can be outputted when the two terminals are short-circuited.

(5) RS232 Interface : This socket is for RS232 interface of the instrument. GPIB and RS232 interfaces can't be used simultaneously.

(6) ARC Monitor : ARC test signal can be observed from this BNC socket.

(7) CORONA Monitor : The CORONA test signal can be observed from this BNC socket.

(This function is for the Guadian 500VA Plus with Corona Detection.)

(8) HANDLER Interface: This socket is for HANDLER interface of the instrument.

(9) USB Interface : USB terminal

(10) GPIB Interface (option): This socket is for optional GIPB interface. The detailed descriptions, please refer "Chapter 5 – Description of GPIB Interface" in this manual.

(11) AC LINE : AC power socket and fuse holder. A tri-cord power and fuse holder. Input AC power, which the analyzer is needed from AC power

Socket. The detailed specifications of using fuse please refer

"Chapter 3 – Notice Items before Using" or descriptions of the rear panel in this manual.

(12)GND Terminal : Safety GND terminal, please use adaptable implement to connect the actual grounding terminal. If there is no actual grounding, the circuit with GND terminal or other instruments connecting cable with GND terminal are short-circuited. The cover of the analyzer may exist high voltage. This is very dangerous, do not touch the analyzer during any of the above circumstances. Therefore, it is necessary to connect safety GND terminal to ground.

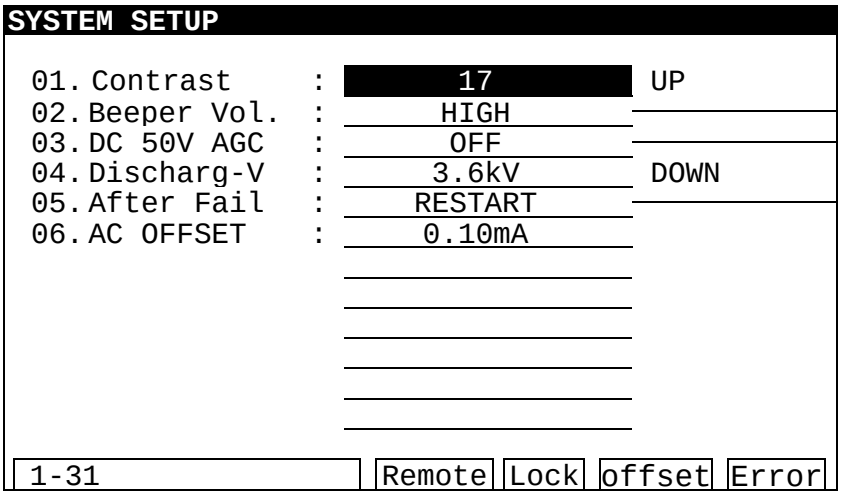
4.3 Notices and Procedures before Operating

1. Before plugging in the AC power cable first, please confirm power use, the description of rear panel is match or not and power switch is in OFF status.
2. Before turning on power, please peruse "Chapter 3 – Notice Items before Using" and remember it.
3. When turning on power, the analyzer will self-test. If there is an abnormal condition, please turn off the switch and pull the power cord immediately.

4.4 System Parameter Setting

Operation methods:

1. When title shows "SYSTEM SETUP," press [△], [▽] keys to move the highlighted cursor to the parameter items in which you want to set.
2. Press numeral/character key or Function Keys to set this item parameter data.
3. If the blinking cursor shows, it means the parameter data is not completed. When data input is in error, can press [CLR] to clear and input again. Please press [ENTER] to confirm the parameter data is correct finally.



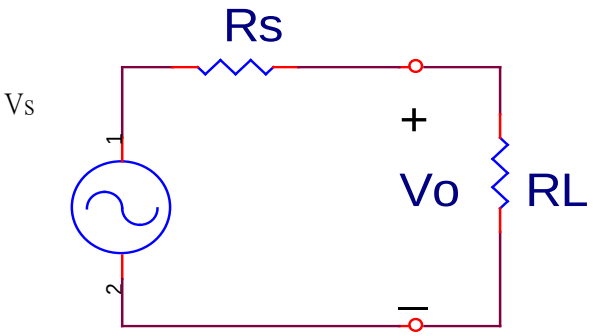
System parameter setting data description:

Setting Item	Range	Initial Setting	Description
Contrast	1~31	17	Adjust LCD brightness

Beeper Volume	LOW /MEDIUM/ HIGH/OFF	HIGH	Adjust the buzzer volume
DC 50V AGC	ON/OFF	OFF	Hardware compensation for above DC 50V
Discharg-V	0.05-5.1KV	3.60KV	DC discharge setting
After Fail	CONTINUE / RESTART / STOP	RESTART	(1) When set as CONTINUE, and any one among STEPs judged as "No Good." It will continue until all STEPs are tested. (2) When set as START, and any one among STEPs judged as "No Good," press START to directly restart. (3) When set as STOP, and any one among STEPs judged as "No Good." It is necessary to press STOP, then can restart test by pressing START.
AC OFFSET	0 ~ 2.5mA	0.10mA	(1) When Offset value is higher than **AC OFFSET** value, Current reading = Current real measurement value – Offset value. (2) When Offset value is lower than **AC OFFSET** value, Current value = $\sqrt{(\text{Real measurement value})^2 - (\text{Offset})^2}$

4.4.1 Hardware/Software AGC

The output voltage is changed by load effect, and then executing AGC function.
ACV : 50V~5KV (Hardware AGC is always ON, software AGC initial setting is ON and also can be set as OFF.)
DCV : 50V~499V (Hardware AGC initial setting is OFF and also can be set as ON. Software AGC initial setting is ON and also can be set as OFF.)
DCV : 500V~6KV (Hardware AGC is always ON, software AGC initial setting is ON and also can be set as OFF.)
IR : 50V~5KV (No hardware AGC, software AGC is always ON.)



Vo / Vs = RL / (Rs + RL)

1. Hardware AGC: Because Vo<Vs result from load effect, Vo using hardware comparison circuit. Vo voltage compensation is the same as Vs within 0.1sec.
2. Software AGC: This analyzer using software AGC under DC 50V-500V and IR

50V-1000V. Software compensation speed moves more slowly, so it won't cause voltage shock to DUT. The general IR RL is larger than Rs of this analyzer, so Vo=Vs approximately.

4.4.2 Discharg-V

Discharg-V: The high limit setting of DC discharge, the range is 0.05 ~ 5.1kV. The voltage below Discharg-V setting will be discharged quickly in 0.2sec.

4.4.3 OFFSET

1. DC OFFSET: Before testing WDC mode, first please connect the test cable. After the fixture is tested, then process OFFSET to ensure test value accuracy. The current calculation formula: Current reading = Current real measurement value – Offset value.
2. AC OFFSET: Before testing WAC mode, first please connect test cable. After the fixture is tested, then process OFFSET to ensure test value accuracy. Especially, when test voltage is higher and leakage current of the test fixture and the instrument is increasingly. The result of Offset current is often caused by capacitance feature. According to mathematics, when test a resistive load, its' current value = $\sqrt{(\text{Resistance load value})^2 + (\text{Offset})^2}$. Therefore, when measured out resistive load current value, current reading = $\sqrt{(\text{Real measurement value})^2 - (\text{Offset})^2}$. When testing a capacitive load, current reading = (real measurement value) – (Offset).
3. OSC OFFSET: There is stray capacitance on wire or fixture, this does OFFSET elimination again on changing wire or fixture every time to ensure the accuracy of testing.

4.5 Memory Management of Test Parameter and Test Preset Parameter

When the title displays "MAIN MENU," press Function Key [MEMORY] and then the title will display the "MEMORY SETUP." At the same time, the memory can be read, stored or deleted. Each memory includes test parameters, test preset parameters and the memory name.

4.5.1 Read Memory

1. If there are many sets of test parameters value, which can be saved in the main memory. Follow the procedures below to recall test parameters.
2. When title displays "MEMORY SETUP," press [△], [▽] keys or the Function Key [NEXT PAGE] to move the highlighted cursor to the memory name in which you want to recall.
3. Press Function Key [RECALL] and then show the confirmation window.
4. Press [ENTER] to confirm or press the Function Key [EXIT] to cancel.

4.5.2 Store Memory

1. If you want to save the testing parameter-data which be set in memory, please follow the procedures below to process. When title displays “MEMORY SETUP,” press [△], [▽] keys or Function Key “NEXT PAGE” to move the highlighted cursor to the memory number position in which want to store.
2. Press the Function Key [STORE], the highlighted cursor becomes the underscore blinking cursor. At the same time, input the memory name by using numeral/character keys. Pressing the same numeral/character keys repeatedly can circle switch display between numeral and alphabet. If you want to input a name, you can use the Function Key [NEXT CHAR.] to move the underscore blinking cursor to the next character.
3. Press [ENTER] to confirm or press Function Key [EXIT] to cancel.

4.5.3 Delete Memory

1. If you want to delete test parameter data, which be stored in memory, please follow the below procedures to process.
2. When title displays “MEMORY SETUP,” press [△], [▽] keys or Function Key [NEXT PAGE] to move the highlighted cursor to the memory name in which you want to delete.
3. Press the Function Key [DELETE] and then show confirm window.
4. Press [ENTER] to confirm or press Function Key [EXIT] to cancel.

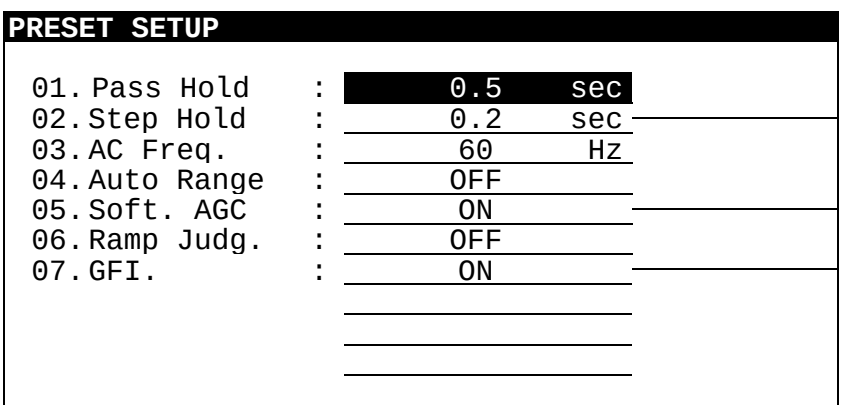
4.6 Test for Preset Setting

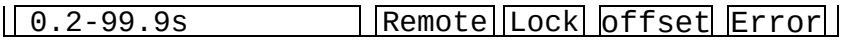
4.6.1 Operation Method

1. When the title shows “PRESET SETUP”, press [△], [△] keys to move the highlighted cursor to the parameter item which want to set.
2. Press numeral key/character key or Function Keys to set this item parameter data.
3. Press [ENTER] to confirm or press [CLR] to reset.

4.6.2 Simple Setting Wizard

1. When the title shows ”PRESET SETUP,” press [ENTER] key to move the highlighted cursor to the parameter item in which you want to set.
2. Press numeral key/character key or Function Keys to set this item parameter data.
3. When the highlighted cursor on the last parameter, pressing the [ENTER] key will go to test parameter setting menu directly for user continuous settings.



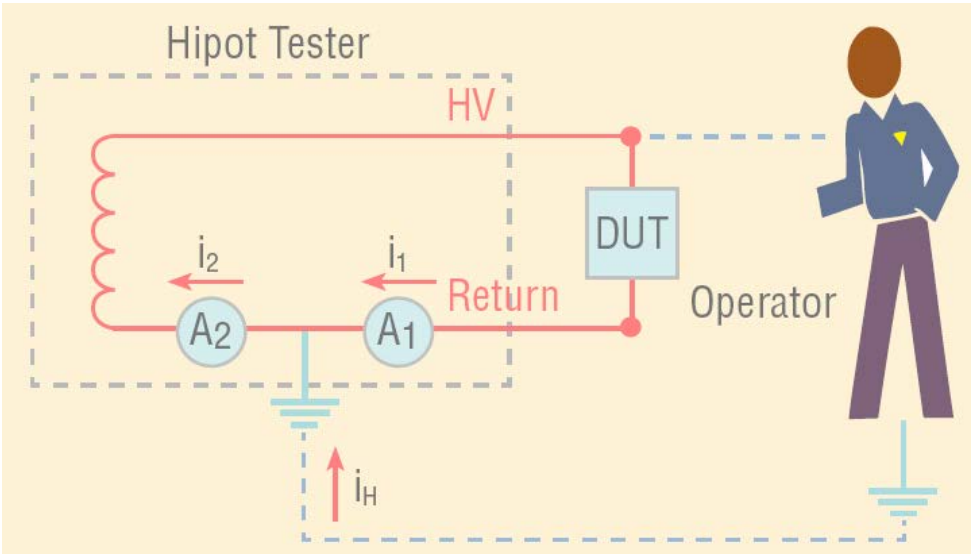

0.2-99.9s
Remote
Lock
offset
Error

Test preset parameter function description table:

No.	Setting Item	Range	Initial Setting	Description
01	Pass Hold	0.2~99.9	0.5	It sets PASS buzzer sound continuous time.
02	Step Hold	0.1~99.9 / KEY	0.2	It sets interval time between test procedures. Key: It sets test procedure interruptions (Please press [START] to continue when test stop.)
03	AC Freq.	50-600Hz	60	It sets whether the frequency of outputting voltage when testing AC withstanding.
07	Auto Range	ON/OFF	OFF	It sets whether the withstand voltage auto-range function is open or not.
08	Soft. AGC	ON/OFF	ON	It sets whether the software auto gain compensation function is open or not.
13	Ramp Judg.	ON / OFF	OFF	When Ramp. Judg. Is set to ON, it will judge if the current value is over High Limit setting value as the DC mode is executing Ramp time. When set Ramp. Judg. to OFF, it won't judge if the current value is over the High Limit setting value as DC mode is executing Ramp time.
14	GFI (Ground Fault Interrupt)	ON / OFF/ FLOAT	ON	It sets the function of GFI.

4.6.3 ON/OFF/FLOAT Setting of GFI (Ground Fault Interrupt)

4.6.3.1 Set GFI to ON



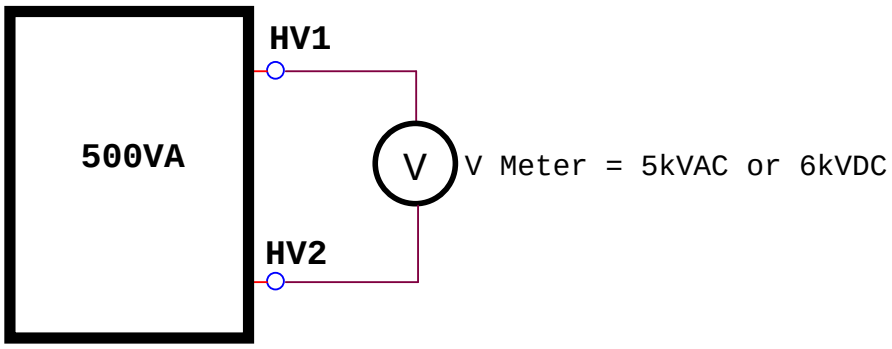
There is a current i_H produced and flowed through the human body when users carelessly touch the high voltage terminal.

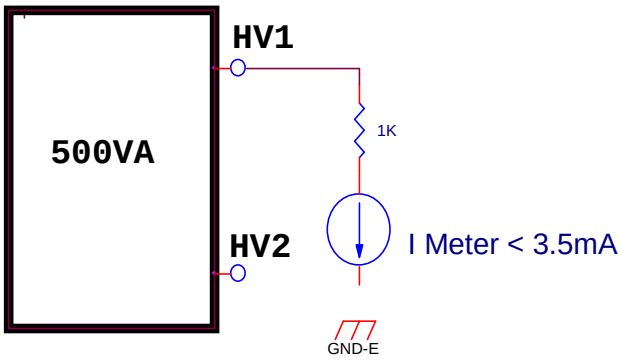
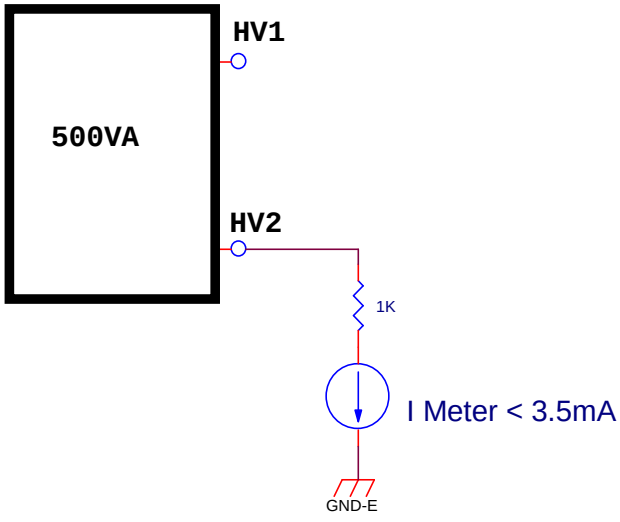
$$i_2 = i_1 + i_H$$

If i_H is over 0.5mA, the high voltage will be cut off to protect the safety of the operator.

4.6.3.2 Set GFI to FLOAT

The Guardian 500VA Plus and Guardian 500VA Plus with Corona Detection has high voltage displays Floating status when set GFI to FLOAT. The high voltage output terminals HV1 and HV2 on the Guardian 500VA Plus and Guardian 500VA Plus with Corona Detection are outputting high voltage 5kVAC or 6kVDC, the relationship of the HV1or HV2 terminal to Earth is shown in the figure below.



Relationship of 500VA HV1 terminal to Earth	Relationship of 500VA HV2 terminal to Earth
	

4.6.4 Auto Range

(1) **Auto Range** function sets as **ON**.
(2) The current range sets to high range *i.e.* 40mA as shown in Figure 4-3.

0.6 sec before ending the test, if the tested current can be represented by low current range, then auto range to low as shown in Figure 4-4.

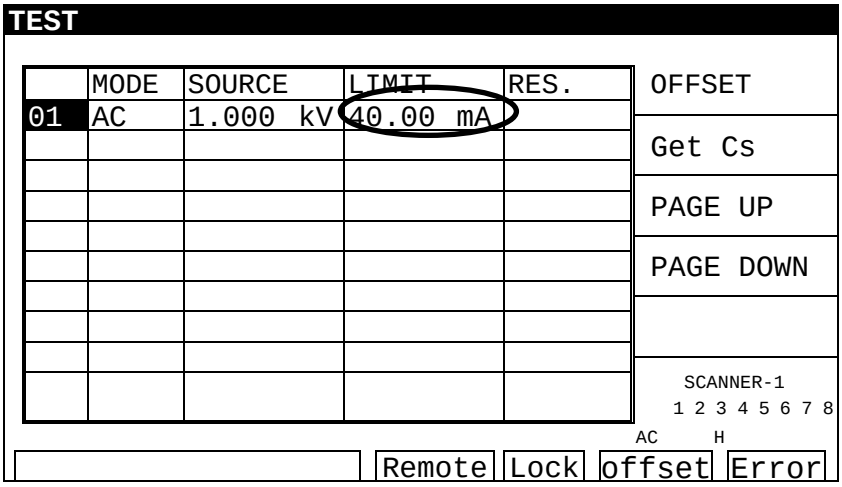


Figure 4-3

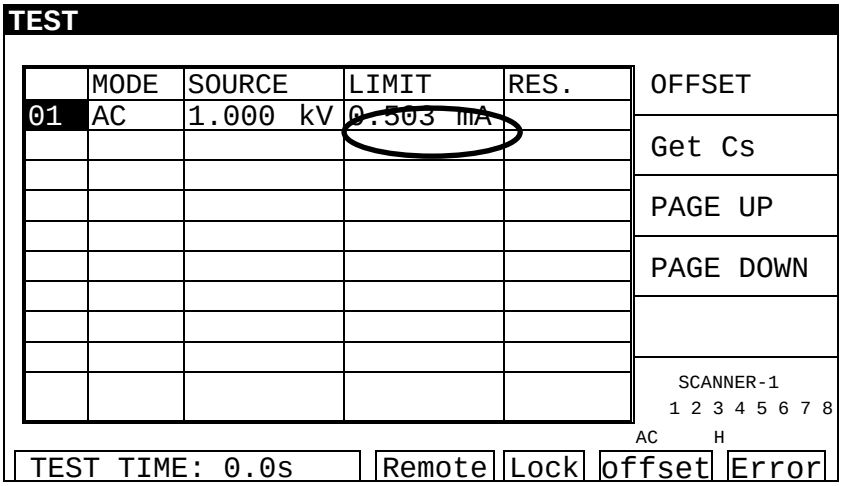


Figure 4-4

4.7 Program Setting

4.7.1 Operation Method

1. When the title shows “STEP SETTING,” press [△], [▽] keys to move the highlighted cursor to the parameter item in which you want to set.
2. Press numeral/character keys or Function Keys to set this item parameter data.
3. Press [ENTER] to confirm or press [CLR] to reset.

4.7.2 Various Parameter Settings

TEST STEP: It sets test step.
TEST MODE: It selects test mode. There are AC / DC / IR / PA /OSC test modes can be selected. The following described parameter settings of various test modes.

Withstand Voltage Test Mode (AC)
VOLTAGE: It sets withstand voltage test required voltage
HIGH LIMIT: It sets high limit value of leakage current.

LOW LIMIT: It sets low limit value of leakage current. The range is lower than high limit value of leakage current or OFF.
REAL LIMIT: It sets high limit value of real leakage current. The range is lower than high limit value of leakage current or OFF.
ARC LIMIT: It sets high limit value of ARC.
LIM: It sets high limit value of CORONA. (This function is for Guardian 500VA Plus with Corona Detection.)
HFCC: 1. C_S: It sets standard capacitance of High Frequency Contact Check (HFCC).
2. OPEN: It sets the condition to judge test result as open. The test reading compares with read standard capacitance.
3. SHORT: It sets the condition to judge test result as short. The test reading compares with read standard capacitance.
TIME: 1. RAMP TIME: It sets the required time to increase to setting voltage.
2. TEST TIME: It sets test needed time.
3. FALL TIME: The required time from setting voltage value to decrease to low voltage.

Withstand Voltage Test Mode (DC)
VOLTAGE: It sets withstand voltage test required voltage.
HIGH LIMIT: It sets high limit value of leakage current.
LOW LIMIT: It sets low limit value of leakage current. The range is lower than high limit value of leakage current or OFF.
ARC LIMIT: It sets high limit value of ARC.
LIM: It sets high limit value of CORONA. (This function is for Guardian 500VA Plus with Corona Detection.)
HFCC: 1. C_S: It sets standard capacitance of High Frequency Contact Check (HFCC).
2. OPEN: It sets the condition to judge test result as open. The test reading compares with read standard capacitance.
3. SHORT: It sets the condition to judge test result as short. The test reading compares with read standard capacitance.
TIME: 1. RAMP TIME: It sets the required time to increase to setting voltage.
2. DWELL TIME: It sets DWELL needed time. (During DWELL TIME, don't judge the
high and low limit value of leakage current. The limitation is not
over high limit of setting range.)
3. TEST TIME: It sets test needed time.
4. FALL TIME: The required time from setting voltage value to decrease to low voltage.

Insulation Resistance Test Mode (IR)
VOLTAGE: It sets insulation resistance test required voltage.
LOW LIMIT: It sets low limit value of insulation resistance.
HIGH LIMIT: It sets high limit value of insulation resistance. The value is higher than low limit value of insulation resistance or OFF.
TIME: 1. RAMP TIME: It sets the required time to increase to setting voltage.
2. TEST TIME: It sets test needed time.
3. FALL TIME: The required time from setting voltage value to decrease to low voltage.
RANGE: It sets the test file of insulation resistance, AUTO means auto range. The relationship between current range and resistance measurement scope are shown as below table.

Range	IR Value	
	Setting Voltage 50V ~ 499V	Setting Voltage 500V ~ 1000V
10mA(3~10mA)	0.1MΩ~1MΩ	0.1MΩ~4.5MΩ
3mA(0.3~3mA)	0.5MΩ~4.5MΩ	3.0MΩ~15.0MΩ
300uA(30~300uA)	3.0MΩ~15.0MΩ	10.0MΩ~45MΩ
30uA(3~30uA)	10.0MΩ~45MΩ	35.0MΩ~450MΩ
3uA(0.3~3uA)	45MΩ~0.45GΩ	0.40GΩ~4.5GΩ
300nA(20~300nA)	0.40GΩ~4.9GΩ	4.0GΩ~50.0GΩ

Note: Please follow test voltage and insulation impedance of the DUT to calculate the value of current thus, follow this to choose suitable current range.

Pause test mode (PA)
MESSAGE: Message hint string. The string are inputted by alphabet, Arabic numerals or symbol [-]. The max. is 13 characters.
TEST TIME: It sets the action method of pause mode.
(1) When set to CONTINUE, pause mode will be ended till **START** is pressed on the panel or re-trigger START signal on rear panel.
(2) The setting is 0.3 ~ 999sec: When the setting time is up then end the pause mode.

Open/Short Circuit Detection Mode (OSC)
OPEN CHK: It sets the condition to judge test results as open. The test reading compares with read standard capacitance [Cs].
SHORT CHK: It sets the condition to judge test results as short. The test reading compares with read standard capacitance [Cs].
C_S: It sets standard capacitance of open/short circuit detection.

4.8 How to Process Test

4.8.1 Offset Value Calibration of Test Cable/Fixture

1. First of all, the DUT will be removed from test cable or fixture. Press the Function Key [OFFSET], the display will show the “MESSAGE” window.
2. After pressing the [START] key, the title will show “GET OFFSET TEST.”
3. DANGER LED on front panel lights up, the voltage output time is five seconds (when TEST TIME setting is over 5 seconds). The main unit starts to measure leakage current of the test cable and shows its value on the display then stored it to the memory.
4. When test time is ended, [Offset] is highlighted.

4.8.2 Operation of Standard Capacitance (GET Cs)

1. Before testing open/short detection mode (OSC Mode) or changing capacitance under test, it is necessary to read the standard capacitance (GET Cs).
2. Before reading standard capacitance (GET Cs), please press the Function Key [OFFSET] to do OFFSET elimination. Doing OFFSET elimination again on the changing wire or

fixture every time to ensure the accuracy of testing.
3. Before reading the standard capacitance (GET Cs), please use the standard capacitance sample in testing as the DUT. Press the Function Key [GET Cs] to read the standard capacitance for the standard value in testing.
4. When testing under open/short circuit detection mode (OSC Mode), judge OPEN/SHORT test condition by the GET Cs reading.

4.8.3 Method of DUT Connection

Withstand Voltage / Insulation Resistance Test Mode (AC / DC / IR / OSC)
First of all, please confirm there is no voltage output and the DANGER LED isn't lit. Then connect the test cable of low electric potential to RTN/LOW or HV2 terminal of the main unit. This test cable and high voltage output terminal are short-circuited and confirm there is no high voltage output. At the same time, plug the high voltage test cable (red or white) in to the high voltage output terminal OUTPUT. Connect the test cable of low electric potential (RTN/LOW or HV2) to the DUT first, and the test cable of high electric potential connects to the DUT.

4.8.4 Test Procedure

4.8.4.1 AC/DC/IR Test Procedure

1. Connection is completed correctly by connecting the DUT device method.
   When the title shows "MAIN MENU," press Function Key [TEST] for entering TEST function list, the title will show "TEST." The display shows a list with STEP, which can be set and wait for testing. The first field is STEP, the second field is test mode, the third field is test setting value, the fourth field is outputting high limit value, and the fifth field is the test result.

2. Please press the [STOP] key, ready for testing.
   Press the [START] key to start the test. When pressing this key, start test current / voltage output. At the same time, DANGER LED will be lit. Warning: Now is test status with mass voltage output. The third field will show output voltage reading, the fourth will show output current reading. The timer count down or start to count and displayed on status list.

3. PASS judgment
   When all of test statuses are been tested and the fifth field test result shows PASS, then main unit is judged as PASS and output is cut off. The rear panel outputs PASS signal, the buzzer activated simultaneously.

4. FAIL judgment
   If the measurement is abnormal, the main unit is judged as FAIL and stop output immediately. The rear panel outputs FAIL signal, the buzzer activated simultaneously. Keep on activating until [STOP] key of main unit be pressed. The fifth field test result will show fail status.

Fail Status Description Table

Test Result	Meaning
HIGH	Measurement current value over high limit
LOW	Measurement current value over low limit
ARC	Current arc over high limit
LIM	CORONA over high limit (This function is for Guardian 500VA Plus with Corona Detection.)
GFI	Ground fail interrupt
ADNO	Voltage / current reading over hardware valid digit
ADIO	Current / resistance reading over hardware valid digit
PWHI	Power measurement over high limit
PWLO	Power measurement over low limit

Under any circumstances the user only needs to press [STOP] key if users want to stop testing output.

4.8.4.2 OSC Test Procedure

1. Connection is completed correctly by connecting the DUT device method.
   When title shows the “MAIN MENU,” press Function Keys [TEST] for entering TEST function list, the title will show “TEST.” The display shows a list with STEP, which be set and waiting for testing. The first field is STEP, the second field is test mode (OSC), the third field is output voltage setting value, the fourth field is capacitance reading and the fifth field is the test result.
2. Please press the [STOP] key, ready for testing.
   Press the [START] key to start test. When pressing this key, start test voltage output. At the same time, DANGER LED will be lit. Warning: Now is the test status with voltage output. The third field will show an output voltage reading and the fourth field will show a capacitance reading. The timer counts down simultaneously, as well as, shows on status list.
3. “GOOD” judgment
   When all of the test statuses have been tested and the fifth field result shows PASS, then the main unit is judged as “GOOD” and the output is cut off. The rear panel outputs PASS signal, the buzzer activates simultaneously.
4. “No good” judgment
   If the measurement value is abnormal, the main unit is judged as FAIL and stops the output immediately. The rear panel outputs FAIL signal, the buzzer activates simultaneously. Keep on functioning until **STOP** key of the main unit is pressed. The fifth field test result will show “No good” status.

No good status

Test Result	Meaning
OPEN	Capacitance open circuit/reading is fewer than OPEN CHK setting.
SHRT	Capacitance short circuit/reading is larger than SHORT CHK setting.

Under any circumstances the only reason to press the **STOP** key is if you want to stop the test output.

Note: When OSC Mode is testing, Getting the Cs current range at this time decides the display of capacity valid digit.

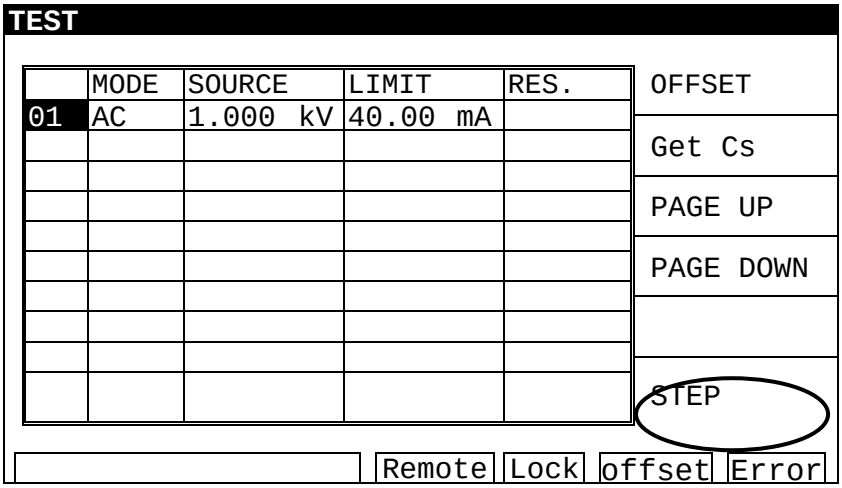
Example: Get Cs voltage 0.018kV, Get Cs capacitance value 17.4nF, current= 1.18mA -- at the mass current range.
Get Cs voltage 0.016kV, Get Cs capacitance value 17.42nF, current=

0.97mA -- at the medium current range.

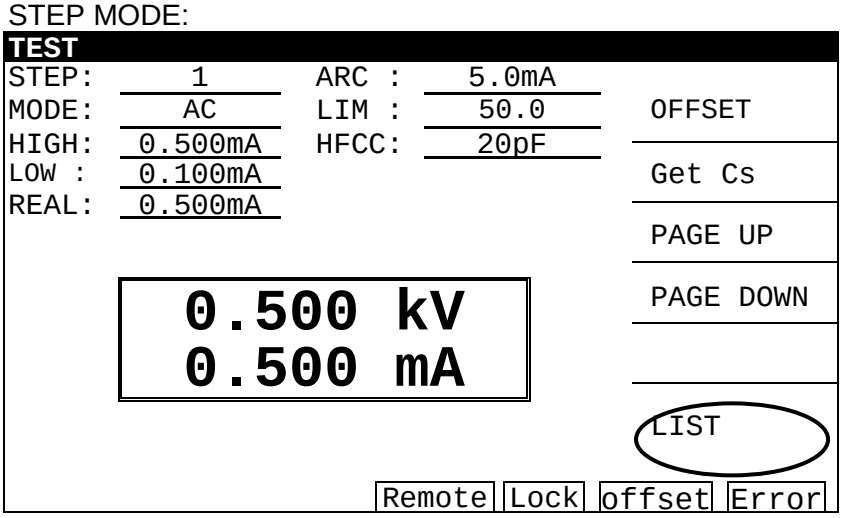
4.8.5 Description for STEP MODE Test Menu

In addition to the in the LIST MODE test menu, the analyzer adds a STEP MODE in the test menu for the displayed requirements of ARC, HFCC and CORONA functions. Select “STEP” item by the Function Key (F6) in the original the test menu and then can change test menu to STEP MODE as shown below in figure. If users want to return to the LIST MODE in the test menu, the user only needs to select “LIST” item by Function Key (F6) in the STEP MODE menu.

LIST MODE:

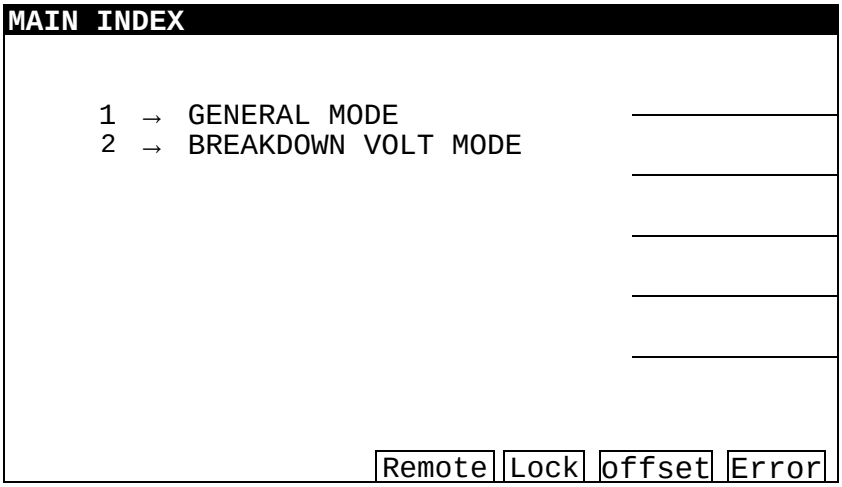


STEP MODE:

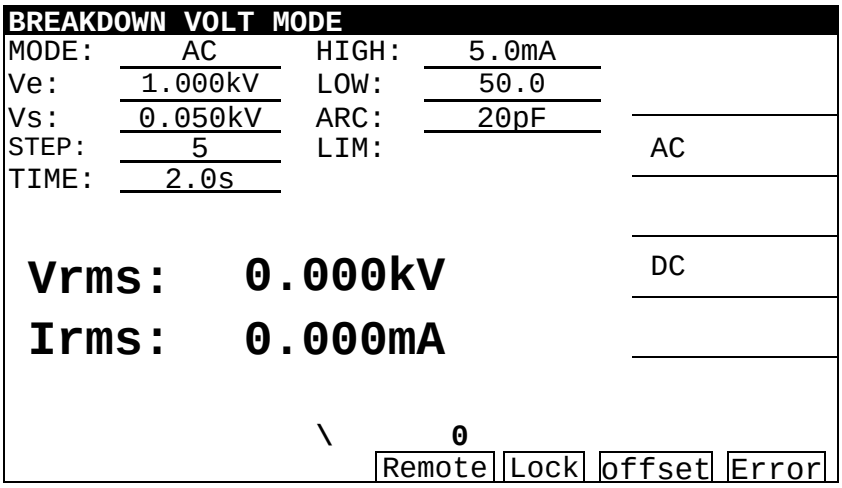


4.9 Description for BREAKDOWN VOLT MODE Interface

Enter the selection menu of the GENERAL MODE and the BREAKDOWN VOLT MODE by pressing the “MAIN INDEX” as shown below in figure. Selecting 1 can return to the GENERAL MODE and selecting 2 can enter the BREAKDOWN VOLT MODE.



The menu is as shown in the following figure when entering the BREAKDOWN VOLT MODE. If users want to exit the BREAKDOWN VOLT MODE test menu, the user only needs to press the “MAIN INDEX” key.



Parameter Function Description Table

Item	Range	Initial Value	Description
MODE	AC/DC	AC	Test mode selection includes AC and DC
Ve	0.05-5kV	0.050kV	It sets the voltage end value.
Vs	0.05kV-Ve	0.050kV	It sets the voltage start value.
STEP	2-999	2	It sets the voltage rising STEP quantity.
TIME	0.3-999 sec	3.0s	It sets the test time of each STEP.
HIGH	AC:0.001-100mA DC:0.0001-20mA	0.500mA 0.500mA	It sets the high limit of leakage current.
LOW	AC:0-HIGH limit DC: 0-HIGH limit	OFF OFF	It sets the low limit of leakage current.
ARC	AC:1-20mA DC:1-10mA	OFF OFF	It sets the high limit of arc.
LIM	0-99.9	OFF	It sets high limit of CORONA. (This function is for Guardian 500VA Plus with Corona Detection.)

4.10 Description for HANDLER Interface

4.10.1 Specification

4.10.1.1 Drive Capability

Internal signal output specification: DC 5V, 40~60mA
External signal input specification: DC 3V~26V (HIGH), 10mA ± 4mA

4.10.1.2 Pin Description

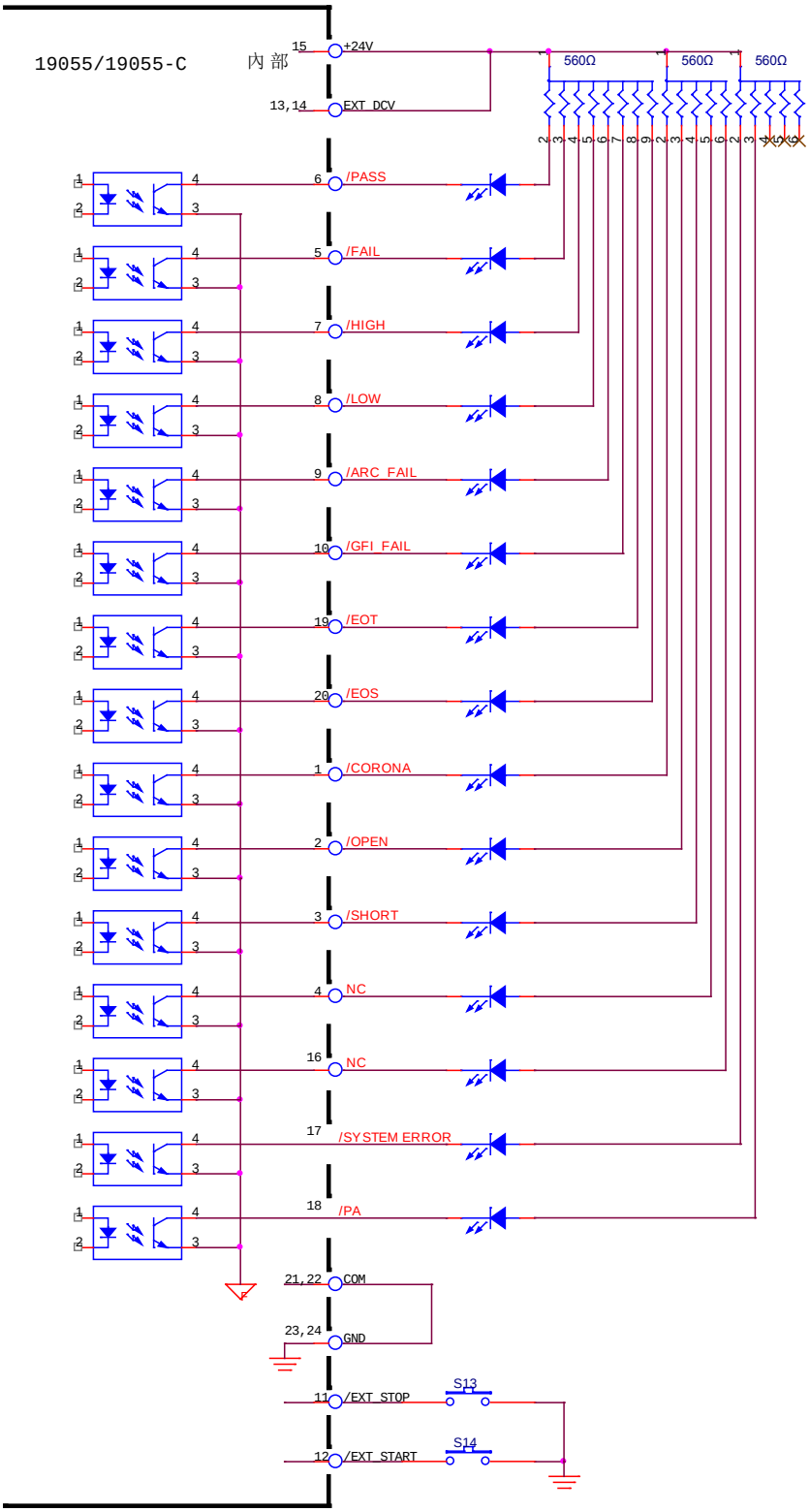
Pin No.	Signal Name	Input/Output	Description
1	/CORONA	Output	CORONA output, this signal is used with /PASS and /FAIL.
2	/OPEN		HFCC OPEN output, this signal is used with /PASS and /FAIL.
3	/SHORT		HFCC SHORT output, this signal is used with /PASS and /FAIL.
4	NC		Reserved, unused
5	/FAIL		The test result is FAIL for outputting LOW, meanwhile /HI, /LO, /ARC_FAIL and /GFI_FAIL signals will be outputted (LOW activated).
6	/PASS		The test result is PASS for outputting LOW, meanwhile /HIGH, /LOW, /ARC_FAIL and /GFI_FAIL signals won't be outputted (all HIGH).
7	/HIGH		Test result is HIGH FAIL for outputting LOW.
8	/LOW		Test result is LOW FAIL for outputting LOW.
9	/ARC_FAIL		Test result is ARC_FAIL for outputting LOW.
10	/GFI_FAIL		Test result is GFI_FAIL for outputting LOW.
11	/EXT_STOP	Input	External STOP signal input, signal status LOW for functioning.
12	/EXT_START	Input	External START signal input, signal status LOW for functioning.
13,14	EXT_DCV	Input	+VEXT: External DC voltage input, input voltage range +3V~+26V
15,16	+24V	Output	Internal DC voltage output
17	/SYSTEM ERROR	Output	Internal system error signal output pin When the output is LOW stand for system internal error produced.
18	/PA	Output	When the test is activated, this signal is LOW. Afterwards, every time passes PA mode for once, HIGH or LOW level of /PA signal and COM terminal will be changed once.
19	/EOT	Output	When this signal is HIGH stand for Program under testing. When this signal is HIGH stand for Program already ended or standby.
20	/EOS		When this signal is HIGH stand for STEP is currently under testing. When this signal is LOW stand for STEP is already ended and the next step has not yet proceeded or all steps are ended.

21,22	COM	- - -	Low voltage terminal of input/output signal
23,24	GND	- - -	Low voltage terminal of internal voltage output

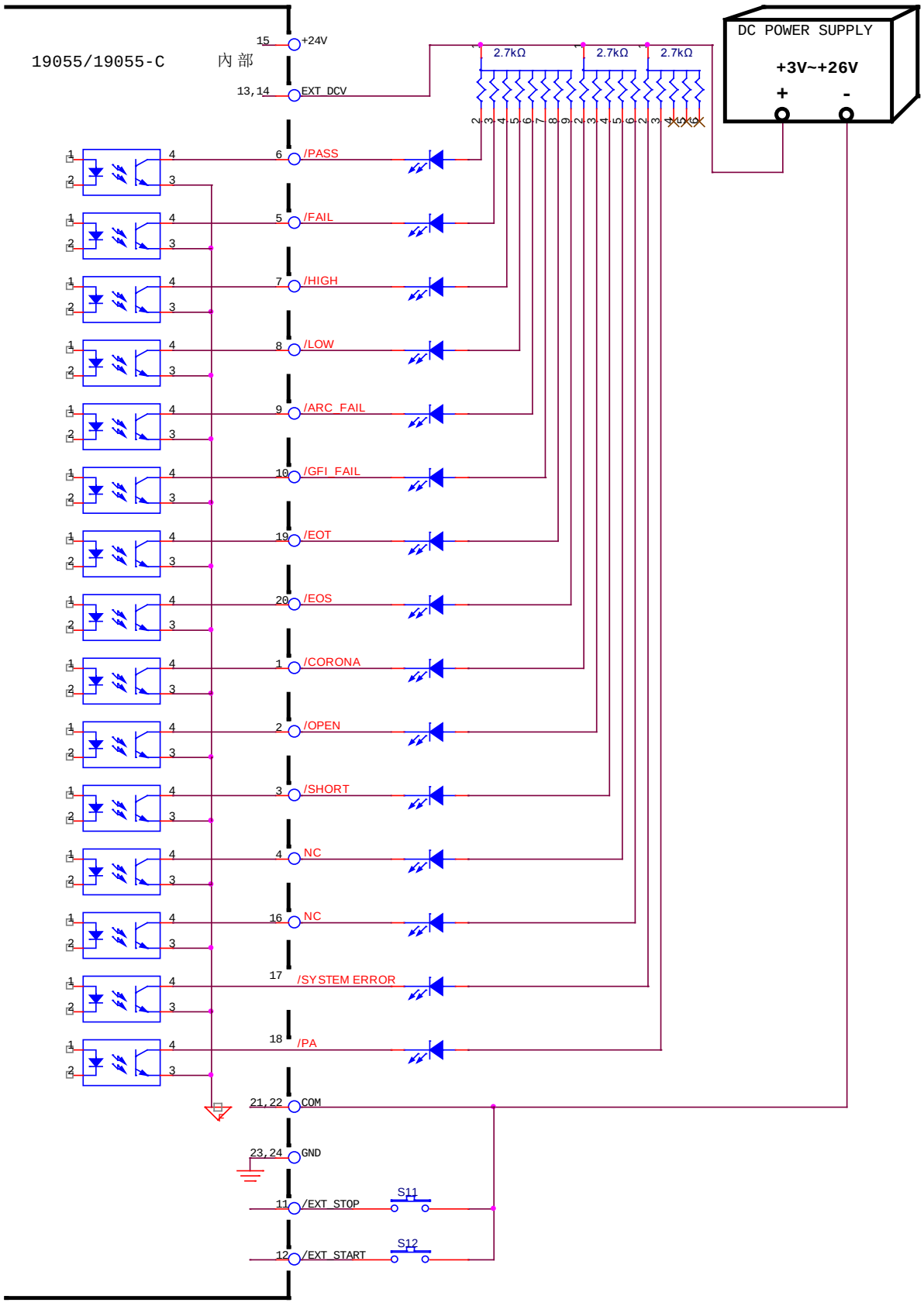
Note (1): Test step code signal of Handler Board consists of the Main Step and the Sub Step, which is submitted in sequence.

4.10.2 External Control Circuit Diagram

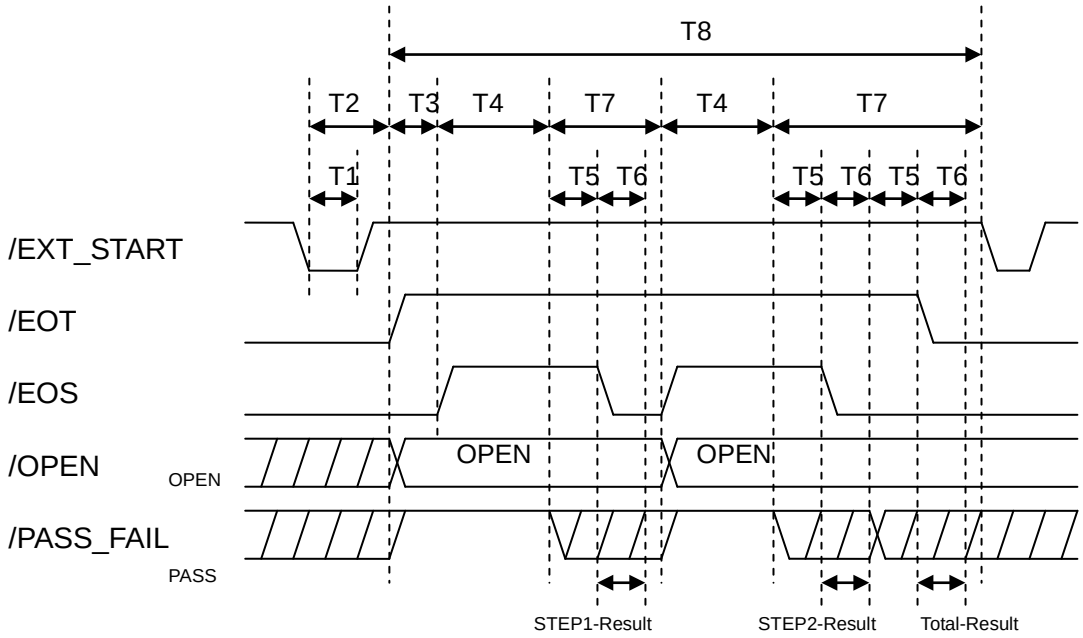
4.10.2.1 Use Internal Power as an Example



4.10.2.2 Use External Power as an Example



4.10.3 Timing Diagram



Timing Diagram – Take an example by two test steps

Time	Limit	Description
T1	> 10mS	External trigger signals (/EXT_START) remaining time required to be larger than 10mS.
T2	< 20mS	The time of start external trigger signals (/EXT_START) to /EOT that the signal cleared, it will be fewer than 20mS.
T3	-	Trigger Delay setting time
T4	-	Various Steps test needed time
T5	> 10mS	/PASS_FAIL signal stable waiting time will be larger than 10mS.
T6	> 10mS	EOS Hold time, EOS HOLD time + SUB PASS time or /EOT signals that the stable waiting time will be larger than 10mS.
T7	-	Each test step ends required time
T8	-	PROGRAM required time

4.11 CALIBRATION Function

4.11.1 Enter Calibration Method

1. Open the upper cover, press **SW402,** and power on the analyzer.
2. When the title bar shows the “MAIN MENU,” press numerical key, which corresponds to **CALIBRATION** then it will show “ENTER CALIBRATION PASSWORD” window.
3. By using numerical keys to input PASSWORD [7] [9] [3] [1].
4. Press **ENTER**, select **[DEVICE]** and enter calibration procedure.

4.11.2 Clear Memory

1. When title list shows the “MAIN MENU,” press the numerical key that corresponds to **CALIBRATION** then it will show “ENTER CALIBRATION PASSWORD” window.

2. By using numerical keys to input PASSWORD [8] [5] [2] [4] [6].
3. After pressing the [ENTER] key, “MESSAGE” shows in the window. Users can select if want to clear the memory by Function Keys [YES], [NO] or press [EXIT] to abort the memory clearance.
4. If Function Key [YES] is selected, all of saved data will be cleared and all setting parameters will be reset to the initial value.
5. After clearing the memory, Option parameters needs to be reset.

4.12 KEY LOCK Function

KEY LOCK setting method:

1. When title list shows in the “MAIN MENU,” if text block “LOCK” isn’t highlighted the press numerical key that corresponds to KEY LOCK will show in “KEY LOCK” window.
2. By using numerical key to input PASSWORD (please input 0000, when NEW SECURITY CODE does not be set).
3. Pressing [ENTER] key will show the “MESSAGE” window and the text block “LOCK” will be highlighted. Users can select if lock “MEMORY RECALL” function together by Function Keys [YES], [NO].
4. Press the Function Key [EXIT] to complete KEY LOCK function.

Note: When the 150942 is set as KEY LOCK ON restart, and directly enter the TEST menu.

KEY LOCK release method:

1. When the title list shows the “MAIN MENU,” if text block “LOCK” is highlighted pressing the numerical key that corresponds to KEY LOCK. It will display the “RELEASE KEY LOCK” window.
2. By using numerical key, to input the PASSWORD (please input 0000, when NEW SECURITY CODE does not be set).
3. Press the [ENTER] key, text block “LOCK” will release the highlight. This means the KEY LOCK Function had been cancelled.

4.13 User Password Setting

1. When the title list shows the “MAIN MENU,” press the numerical key that corresponds to the NEW SECURITY CODE. It will displays the “ENTER USER PASSWORD” window.
2. By using the numerical key to input the PASSWORD (please input 0000, when PASSWORD does not be set), pressing [ENTER] key will show the “ENTER NEW PASSWORD” window.
3. By using the numerical key to input the NEW PASSWORD (the maximum is twelve characters), pressing the [ENTER] key will show the “ENTER CONFIRM PASSWORD” window.
4. Using the numerical key to input the CONFIRM PASSWORD (is the same as NEW PASSWORD), pressing the [ENTER] key will show the “MESSAGE” window. At the same time, the setting has been done and you may press any key to exit.

Note: If users forgot the password, please follow paragraph 4.11.2 “Clear Memory” to clear the memory, the PASSWORD will be reset to initial value, *i.e.* 0000.

4.14 FAIL LOCK Function

4.14.1 FAIL LOCK Setting and Using

1. When the title list shows the “MAIN MENU”, press the numerical key that corresponds to the FAIL LOCK. It will display the “FAIL LOCK” window.
2. By using the numerical keys to input the PASSWORD [0] [0] [0] [0] (when NEW SECURITY CODE does not be set).
3. After the [ENTER] key is pressed, a message indication box [LOCK] will be highlighted. All keys are invalid temporarily except for [STOP], [START], Function Key [TEST] and FAIL LOCK until the FAIL LOCK function is unlocked.
4. When the FAIL LOCK function is activated, if the DUT is judged as FAIL, then it will show as in Figure 4-5.

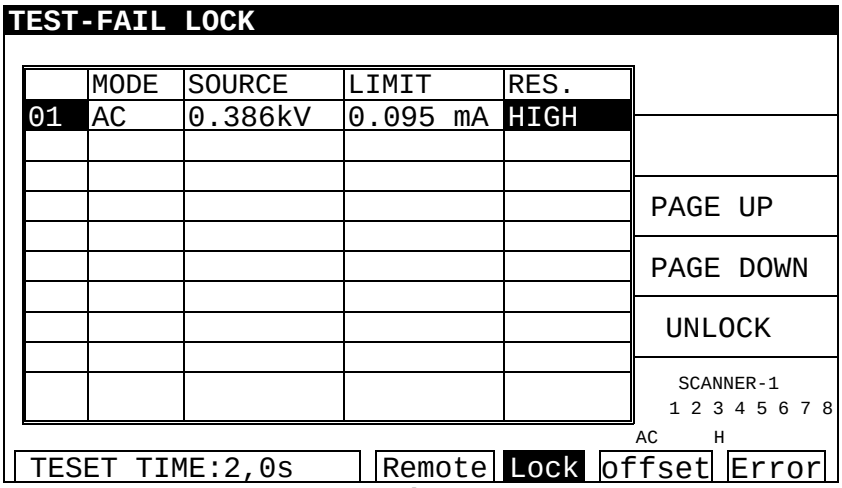


Figure 4-5

5. Meanwhile, press [STOP] and the Function Key [UNLOCK] to clear the buzzer sound. It will then display the “UNLOCK” window.
6. By using the numerical keys to input the PASSWORD [0] [0] [0] [0] (when NEW SECURITY CODE does not be set). Pressing the [START] key will restart the test.
7. Press [MENU] to return to the MAIN MENU.

Note: When 150942 is set as FAIL LOCK ON, restart and directly enter the TEST menu.

4.14.2 Release FAIL LOCK

1. When the title list shows the “MAIN MENU,” press the numerical key that corresponds to FAIL LOCK. It will display the “RELEASE FAIL LOCK” window.
2. By using the numerical keys to input the PASSWORD [0] [0] [0] [0] (when NEW SECURITY CODE does not be set).
3. Press the [ENTER] key and the FAIL LOCK function will be released. A message indication box with “LOCK,” highlighted will also be released.

4.15 Output Signal

The analyzer includes the LED and the buzzer as two kinds of indication signals. The rear panel of analyzer has the following output signals.

UNDER TEST: When the analyzer is under testing, the output terminal will short circuit. Users can apply this short-circuit condition to control the external signal. The junction specification 125VAC current is lower than 1A.

PASS: When the analyzer judged the DUT as “good,” the output terminal will short circuit. Users can apply this short-circuit condition to control the external signal. The junction specification 125VAC current is lower than 1A. Operating time is from DUT judged as pass to be stopped or restart.

FAIL: When the analyzer judged the DUT as “no good,” the output terminal will short-circuit. Users can apply this short-circuit condition to control the external signal. The junction specification 125VAC current is lower than 1A. Operating time is from DUT judged as fail to be stopped or restart.

5. Description for GPIB/RS232 Interface (IEEE-488.2)

5.1 Guide

Users can use the computer via GPIB (IEEE 488-1978) or RS232 interface to remotely control and transfer data.

5.2 GPIB Interface (Option)

5.2.1 Adaptable Standard

IEEE488-1978 standard

5.2.2 Interface Capability

Code	Meaning
SH1	Source Handshake
AH1	Acceptor Handshake
T4	Basic Talker requirement
L4	Basic Listener requirement
SR1	Service request requirement
RL1	All remote/local requirement
PP0	No Parallel poll requirement
DC1	All device clear requirement
DT0	No device trigger requirement
C0	No controller requirement

5.2.3 Interface Message

The analyzer is capable of responding to the following messages.

Message	Meaning	Response
GTL	Go To Local	Switch the analyzer to Local status
SDC	Selected Device Clear	Restart the analyzer
LLO	Local Lockout	From [LOCAL] key switch to Local status is forbidden
IFC	Interface Clear	Reset GPIB interface

5.2.4 Command Format Description

The analyzer GPIB function is composed of a command string, which is inputted by ASCII code to attain functions of the remote control and setting. The length of the command string is limited to 1024 characters (including end code) [Command + Parameter] composes a command. Two commands can be connected by semicolon and ended by end code. The end code can be any one of the following types, the analyzer can distinguish by itself.

End Code

LF
CR+LF
EOI
LF+EOI
CR+LF+EOI

5.2.5 Related Panel Description

1. **Address Setting**
   - Under the title list “MAIN MENU,” press the numerical key that corresponds to “OPTION MENU” to enter the title list “OPTION MENU.”
   - Press the Function Key [GPIB] to enter “GPIB SETUP” and select the GPIB Address by using the Function Key [UP] or [DOWN].
   - The setting is completed and pressed Function Key [EXIT] to exit.

2. **Remote / Local Control**
   - The signal block “Remote” is highlighted, it means the analyzer is on Remote status.
   - On Remote status the operator can use the [LOCAL] key on the panel to switch the analyzer to Local status.
   - On Remote status, all of the panel keys are do not work except for the [LOCAL] (switch to Local) and the [STOP] (reset instrument) keys.
   - By using the LLO [Local Lockout] command of GPIB, it makes the [LOCAL] key malfunction.

5.3 RS232 Interface Specification

5.3.1 Data Format

Baud Rate: 9600 / 19200 / 38400

Parity: NONE / ODD / EVEN

Flow Control: NONE / SOFTWARE

Bits: 1 start bit
8 data bits or 7 data bits add 1 parity bit
1 end bit

5.3.2 Command Format

The analyzer RS232 interface function is composed of a command string, which is inputted by ASCII code to attain functions of the remote control and settings. The length of the

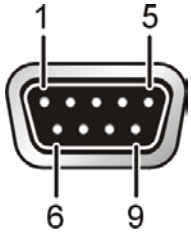
command string is limited to 1024 characters (including end code) [Command + Parameter] compose a command. Two commands can be connected by a semicolon and ended by an end code. The end code is one type of the following–the analyzer can distinguish by itself.

End of String

LF
CR+LF

5.3.3 Connector

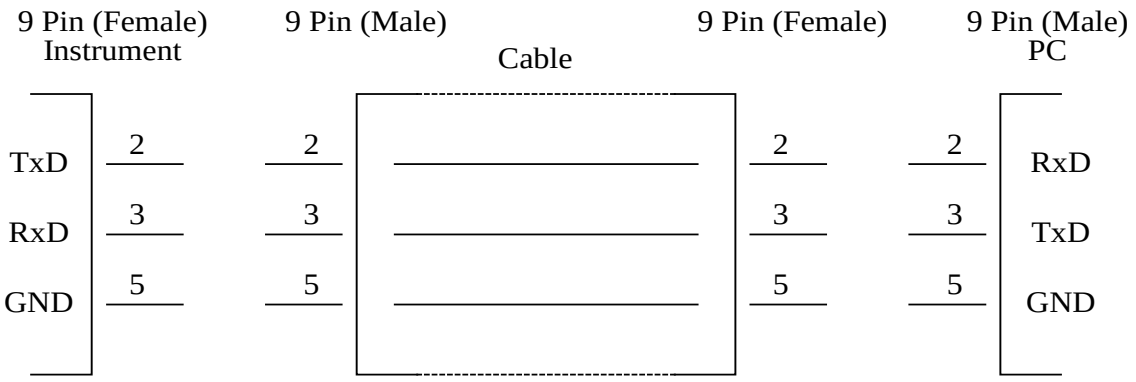
RS232 connector of the analyzer is a 9 pin female connector.



Pin No.		Description
1	*	Not to be used
2	TxD	Transmit data
3	RxD	Receive data
4	*	Not to be used
5	GND	Signal grounding
6	*	Not to be used
7	*	Not to be used
8	*	Not to be used
9	*	Not to be used

5.3.4 Cable Wiring Method

RS232 connector of the analyzer is a 9 pin female connector.



5.4 Remote Command

5.4.1 Command Summary

- **IEEE 488.2 Command**

*CLS
*ESE < enable value >
*ESE?
*ESR?
*IDN?
*OPC
*OPC?
*PSC *0 | 1*
*PSC?
*RST
*RCL < register number >
*SAV < register number >
*SRE < enable value >
*SRE?
*STB?

The parameter syntax format of SCPI command includes the following:
(1) Dual arrow symbol “< >” denote the defined parameter of SCPI command standard.
(2) “< numeric value >” is metric system value, “< boolean >” is Boolean equation data and its value is 0 or 1.
(3) Vertical line ” | “ denotes OR parameter.
(4) “< channel list >” denotes Scanner and Channel status, their meanings are: (@S(C1, C2…)) S denotes Scan number and C1, C2… denotes Channel number.

- **SCPI Command**

```
:MEMory
|    DELete
|    |    [:NAME] <name>
|    |    :LOCAtion
|    :STATe
|    |    :DEFine <name>,<register number>
|    |    :DEFine? <name>
|    :FREE
|    |    :STATe?
|    |    :STEP?
|    :NSTates?
:SYSTem
|    :ERRor
|    |    [:NEXT]?
|    :VERSion?
[:SOURce]
|    :FUNCtion <GENeral|BREakdown>
|    :FUNCtion?
|    :SAFEty
|    |    :FETCh? [<item>][,<item>]
|    |    :STARt
|    |    |    [:ONCE]
|    |    |    :OFFSet GET|OFF
|    |    |    :OFFSet?
|    |    |    : CSTandard GET
|    |    :STOP
|    |    :STATus
|    |    :SNUMber?
|    |    :RESult
|    |    |    :ALL
```

```
|   |   |   | [:JUDGment]?
|   |   |   | :OMETerage?
|   |   |   | :RMETerage?
|   |   |   | :MMETerage
|   |   |   | |   [:NORMal]?
|   |   |   | :CMETerage?
|   |   |   | :CCMETerage?
|   |   |   | :MODE?
|   |   |   | :TIME
|   |   |   | |   [:ELAPsed]
|   |   |   | |   |   :RAMP?
|   |   |   | |   |   [:TEST]?
|   |   |   | |   |   :DWELl?
|   |   |   | |   |   :FALL?
|   |   |   :COMPleted?
|   |   |   [:LAST]
|   |   |   |   [:JUDGmemt]?
|   |   |   :AREPort <boolean>|ON|OFF (RS232 interface only)
|   |   |   :AERPort? (RS232 interface only)
|   |   |   :ITEM [<item>][,<item>] (RS232 interface only)
|   |   |   :ITEM?
|   |   |   :ASAVE <boolean>|ON|OFF
|   |   |   :BREakdown
|   |   |   |   [:JUDGment]?
|   |   |   |   [:JUDGement]?
|   |   |   |   :MMETerage?
|   |   |   |   :OMETerage?
|   |   |   |   :CMETerage?
|   |   |   |   :MODE?
|   |   |   |   :STEP?
|   |   |   |   :TIME
|   |   |   |   |   [:ELAPsed]
|   |   |   |   |   |   [:TEST]?
|   |   |   |   |   |   :DWELl?
|   |   |   |   :WVoltage?
|   |   :STEP<n>
|   |   |   :DELete
|   |   |   :SET?
|   |   |   :MODE?
|   |   |   :AC
|   |   |   |   [:LEVel] <numeric value>
|   |   |   |   [:LEVel]?
|   |   |   |   :LIMit
|   |   |   |   |   [:HIGH] <numeric value>
|   |   |   |   |   [:HIGH]?
|   |   |   |   |   :LOW <numeric value>
|   |   |   |   |   :LOW?
|   |   |   |   |   :REAL <numeric value>
|   |   |   |   |   |   [:HIGH] <numeric value>
|   |   |   |   |   |   [:HIGH]?
|   |   |   |   |   :CORona <numeric value>
|   |   |   |   |   :CORona?
|   |   |   |   |   :ARC
|   |   |   |   |   |   [:LEVel] <numeric value>
|   |   |   |   |   |   [:LEVel]?
|   |   |   |   |   :OPEN <numeric value>
|   |   |   |   |   :OPEN?
|   |   |   |   |   :SHORt <numeric value>
|   |   |   |   |   :SHORt?
|   |   |   |   :CSTandard <numeric value>
|   |   |   |   :CSTandard?
|   |   |   |   :HFCC
|   |   |   |   |   :OFFSet <numeric value>
|   |   |   |   |   :OFFSet?
|   |   |   |   :CURRent
|   |   |   |   |   :OFFSet
|   |   |   |   |   |       [:NORmal] <numeric value>
|   |   |   |   |   |       [:NORmal]?
|   |   |   |   |   |       :REAL <numeric value>
|   |   |   |   |   |       :REAL?
|   |   |   |   :TIME
|   |   |   |   |   :RAMP <numeric value>
|   |   |   |   |   :RAMP?
|   |   |   |   |   [:TEST] <numeric value>
```

```
|   |   |   |   |   [:TEST]?
|   |   |   |   |   :FALL <numeric value>
|   |   |   |   |   :FALL?
|   |   |   :DC
|   |   |   |   [:LEVel] <numeric value>
|   |   |   |   [:LEVel]?
|   |   |   |   :LIMit
|   |   |   |   |   [:HIGH] <numeric value>
|   |   |   |   |   [:HIGH]?
|   |   |   |   |   :LOW <numeric value>
|   |   |   |   |   :LOW?
|   |   |   |   |   :CORona <numeric value>
|   |   |   |   |   :CORona?
|   |   |   |   |   :ARC
|   |   |   |   |   |   [:LEVel] <numeric value>
|   |   |   |   |   |   [:LEVel]?
|   |   |   |   |   :OPEN <numeric value>
|   |   |   |   |   :OPEN?
|   |   |   |   |   :SHORt <numeric value>
|   |   |   |   |   :SHORt?
|   |   |   |   :CSTandard <numeric value>
|   |   |   |   :CSTandard?
|   |   |   |   :HFCC
|   |   |   |   |   :OFFSet <numeric value>
|   |   |   |   |   :OFFSet?
|   |   |   |   :CURRent
|   |   |   |   |   :OFFSet <numeric value>
|   |   |   |   |   :OFFSet?
|   |   |   |   :TIME
|   |   |   |   |   :DWELI <numeric value>
|   |   |   |   |   :DWELI?
|   |   |   |   |   :RAMP <numeric value>
|   |   |   |   |   :RAMP?
|   |   |   |   |   [:TEST] <numeric value>
|   |   |   |   |   [:TEST]?
|   |   |   |   |   :FALL <numeric value>
|   |   |   |   |   :FALL?
|   |   |   :IR
|   |   |   |   [:LEVel] <numeric value>
|   |   |   |   [:LEVel]?
|   |   |   |   LIMit
|   |   |   |   |   :HIGH <numeric value>
|   |   |   |   |   :HIGH?
|   |   |   |   |   [:LOW] <numeric value>
|   |   |   |   |   [:LOW]?
|   |   |   |   :TIME
|   |   |   |   :RAMP <numeric value>
|   |   |   |   :RAMP?
|   |   |   |   [:TEST] <numeric value>
|   |   |   |   [:TEST]?
|   |   |   |   :FALL <numeric value>
|   |   |   |   :FALL?
|   |   |   |   :RANGe
|   |   |   |   |   [:UPPer] <numeric value>
|   |   |   |   |   [:UPPer]?
|   |   |   |   |   :LOWer <numeric value>
|   |   |   |   |   :LOWer?
|   |   |   |   |   :AUTO <ON|OFF or boolean>
|   |   |   |   |   :AUTO?
|   |   |   :PAuse
|   |   |   |   [:MESSage] <string data>
|   |   |   |   [:MESSage]?
|   |   |   |   |TIME   [:TEST] <numeric value>
|   |   |   |   |TIME   [:TEST]?
|   |   |   :OSC
|   |   |   |   :LIMit
|   |   |   |   |   [:OPEN] <numeric value>
|   |   |   |   |   [:OPEN?]
|   |   |   |   |   :SHORt   <numeric value>
|   |   |   |   |   :SHORt?
|   |   |   |   :CRANge? <MAXimun|MINimum|NOW>
|   |   |   |   : CURRent<m>
|   |   |   |   |   : OFFSet <numeric value>
|   |   |   |   |   : OFFSet?
```

```
|   |   |   |   :CSTandard <numeric value>
|   |   |   |   :CSTandard?
|   |   :PRESet
|   |   |   :TIME
|   |   |   |   :PASS <numeric value>
|   |   |   |   :PASS?
|   |   |   |   :STEP <numeric value>
|   |   |   |   :STEP?
|   |   |   :AC
|   |   |   |   :FREQuency <numeric value>
|   |   |   |   :FREQuency?
|   |   |   :WRANge
|   |   |   |   [:AUTO] <boolean> |ON|OFF
|   |   |   |   [:AUTO]?
|   |   |   :AGC
|   |   |   |   [:SOFTware] <Boolean> |ON|OFF
|   |   |   |   [:SOFTware]?
|   |   |   :RJUDgment <boolean> |ON|OFF
|   |   |   :RJUDgment?
|   |   |   :GFI <FLOAT|ON|OFF>
|   |   |   :GFI?
|   |   :BREakdown
|   |   |   :MODE?
|   |   |   :AC
|   |   |   |   [:LEVEl] <start>,<end>
|   |   |   |   [:LEVEl]?
|   |   |   |   :LIMit
|   |   |   |   |   [:HIGH] <numeric value>
|   |   |   |   |   [:HIGH]?
|   |   |   |   |   :LOW <numeric value>
|   |   |   |   |   :LOW?
|   |   |   |   |   :ARC <numeric value>
|   |   |   |   |   :ARC?
|   |   |   |   |   :CORona <numeric value>
|   |   |   |   |   :CORona?
|   |   |   |   :TIME
|   |   |   |   |   [:TEST] <numeric value>
|   |   |   |   |   [:TEST]?
|   |   |   |   :STEP   <numeric value>
|   |   |   |   :STEP?
|   |   |   :DC
|   |   |   |   [:LEVEl] <start>,<end>
|   |   |   |   [:LEVEl]?
|   |   |   |   :LIMit
|   |   |   |   |   [:HIGH] <numeric value>
|   |   |   |   |   [:HIGH]?
|   |   |   |   |   :LOW <numeric value>
|   |   |   |   |   :LOW?
|   |   |   |   |   :ARC <numeric value>
|   |   |   |   |   :ARC?
|   |   |   |   |   :CORona <numeric value>
|   |   |   |   |   :CORona?
|   |   |   |   :TIME
|   |   |   |   |   [:TEST] <numeric value>
|   |   |   |   |   [:TEST]?
|   |   |   |   |   :DWELl <numeric value>
|   |   |   |   |   :DWELl?
|   |   |   |   :STEP   <numeric value>
|   |   |   |   :STEP?
:TRIGer
|   :SOURce
|   |   :EXTernal
|   |   |   :STATe <boolean>|ON|OFF
|   |   |   :STATe?
```

5.4.2 Command Description

- **IEEE 488.2 Command**

  ***CLS**

  Clear status command data configuration, the following actions are required.

Clear standard event status register
Clear status bit group register except for MAV bit (bit 4).

***ESE < numeric value >**
It uses the setting standard event status enable register value, <metric system value> range is 0 ~255.

***ESE?**
The controller is used for quering standard event status of the device enable register value. The output format is <metric system value>, its range is 0 ~255.

***ESR?**
The controller queries the standard event register value of the device. After performing this command, the standard event register value will be cleared to 0. The output format is <metric system value>, its range is 0 ~255.

***IDN?**
The controller is used to read the basic data of the device. The output format separates the four fields by comma, it denotes separately: manufacturer, device model, serial number and firmware version.

***OPC**
Operation completed command.

***OPC?**
Operation completed query command. The output format is ASCII character ”1“.

PSC *0* | *1
Power-on status clear command
Note: This command parameter is “0” or “1”.

***PSC?**
Power-on status clear query command
The output format is ASCII character ” 1 “ or ” 0 “.

***RST**
The device reset command.

***RCL < *Metric system numeric value* >**
Recall command. This command is recalling the saved parameters.
Note: This command parameter is “0” or “1.”

***SAV < *Metric system numeric value* >**
Save command. This command is saving the current parameters to memory.
Note: This command parameter is “0” or “1.”

***SRE < *Metric system numeric value* >**
It is used for setting service requests register value, its <metric system value> is 0 ~ 255.

***SRE?**
The controller is used for reading service request enabled register initial settings. The output format is <metric system value>, its range is 0 ~255.

Note: Bit “6” in this command is always zero.

***STB?**
The controller is used for reading status bit register value.
The output format is <metric system value>, its range is 0 ~255.

- **SCPI Command**

:MEMory:DELete[:NAME] < *name* >
This command deletes the parameter data of the <name> indicated in the main memory.
The < name > is character data.
Example: Input command “**MEM:DEL:LOCA 123”**
Description: This command is used to delete parameter data of “LOCA 123” in the main memory.

:MEMory:DELete:LOCAtion < *register number* >
This command deletes the parameter data of the <register number> in the main memory.
< register number > is integral data.
Example: Input command **“MEM:DEL:LOCA 1”**
Description: This command is used to delete the first parameter data in the main memory.

:MEMory:STATe:DEFine < *name* >, < *register number* >
The command sets the memory name of <register number> in the main memory.
Example: Input command **“MEM:STAT:DEF TEST,1”**
Description: This command is used to set parameter data name TEST of the first memory in the main memory.

:MEMory:STATe:DEFine? < *name* >
The command queries the <register number> memory, which <name> indicated.
Example: Input command **“MEM:STAT:DEF? TEST”**
Return message **“1”**
Description: Return message **“1”** means the location of the TEST parameter data is at the first group.

:MEMory:FREE:STATe?
This command queries the rest PRESET parameter number in the main memory.
Example: Input command **“MEM:FREE:STAT?”**
Return message “**97,3”**
Description: Return message “**97,3”** means the rest parameter there data are 97 groups can be set, there are 3 groups have been used.

:MEMory:FREE:STEP?
This command queries the rest STEP number in the main memory.
Example: Input command **“MEM:FREE:STEP?”**
Return message **“497,3”**
Description: Return message **“497,3”** means the rest can be set STEPs there are 497 steps, there are 3 steps have been used.

:MEMory:NSTates?
This command queries the maximum value, plus 1 of the analyzer *SAV / *RCL parameter, can be used.
Example: Input command **“MEM:NST?”**

Return message **“101”**
Description: Return message **“101”** means the storage capacity of the main memory is 100 groups (101-1).

:SYSTem:ERRor[:NEXT]?
This command reads message in Error Queue. For the returned message, please see section 5.5 Error Message.
Example: Input command **“SYST:ERR?”**
Return message **“+0, “No error”**
Description: Return message “**+0, “No error”** means there is no error message in queue.

:SYSTem:VERSion?
This command queries the SCPI version of this device.
Example: Input command “**SYST:VERS?”**
Return message “**1990.0**”
Description: Return message “**1990.0**” means the device supporting the SCPI version is 1990.0.

[:SOURce]:FUNCtion *< GENeral | BREakdown>*
This command switches GENERAL MODE or BREAKDOWN VOLT MODE.
Example: Input command “**FUNC GEN”**
Description: Switch to the GENERAL MODE

[:SOURce]:FUNCtion?
This command queries measurement mode.
Example: Input command “**FUNC?**”
Return message “**GENERAL**”
Description: Return message “**GENERAL**” means it is in the GENERAL MODE currently.

[:SOURce]:SAFEty:FETCh? *[< item >] [, < item >]*
The command can query the measurement data. The < item > is character data. The command responds the following data:

Character Data	Return Data
STEP	Step serial number at present
MODE	Mode at present
OMETerage	Output meterage at present
MMETerage	Measured meterage at present
RMETerage	AC MODE Real Current measured meterage at present
CMETerage	Corona meterage at present (This function is for Guardian 500 VA Plus with Corona Detection.)
CCMETerage	C meterage of HFCC in AC MODE and DC MODE at present
RELApsed	The elapsed time of ramp at present
RLEAve	The leave time of ramp at present
DELApsed	The elapsed time of dwell at present
DLEAve	The leave time of dwell at present
TELApsed	The elapsed time of test at present Return 9.9000001E+37 while Test Time sets as CONT. and it is higher than 999 sec.
TLEAve	The leave time of test at present Return the leave time when Test Time is limited time.

	Return 9.9000001E+37 when Test Time is CONT.
FELApsed	The elapsed Fall Time at present
FLEAve	The leave Fall Time at present

Example: Input command "**SAFE: FETH?"STEP, MODE, OMET**
Return message "**1, AC, +5.000000E+02**"
Description: Return message "**1, AC, +5.000000E+02**" means STEP, MODE and output value results are STEP1, AC MODE and 0.500kV.

[:SOURce]:SAFEty:STARt[:ONCE]
This command is for beginning the test.
Example: Input command "**SAFE:STAR"**
Description: This command is used to start the test.

[:SOURce]:SAFEty:STARt:OFFSet *GET* | *OFF*
This command gets offset values when the parameter is GET and disables the offset function when the parameter is OFF.
Example: Input command "**SAFE:STAR OFFS GET"**
Description: It means to start the function of getting offset value.

[:SOURce]:SAFEty:STARt:OFFSet?
This command queries whether to perform an offset action or not.
Example: Input command "**SAFE:STAR OFFS?"**
Return message **"0"**
Description: Return message **"0"** means the main unit is zeroed without doing an offset action.

[:SOURce]:SAFEty: STARt: CSTandard GET
This command is for starting GET Cs function of short/open detection mode.
Example: Input command "**SAFE: STAR: CST GET"**
Description: It is used to start GET Cs function of the short/open circuit detection mode.

[:SOURce]:SAFEty:STOP
This command is used for stopping the test.
Example: Input command **"SAFE:STOP"**
Description: It is used to stop the main unit test.

[:SOURce]:SAFEty:STATus?
This command queries the execution status of the current device. Return character data RUNNING|STOPPED.
Example: Input command "**SAFE:STAT?"**
Return message "**RUNNING"**
Description: Return message "**RUNNING"** means the main unit is testing now.

[:SOURce]:SAFEty:SNUMber?
This command queries how many steps have been set in the memory.
Example: Input command "**SAFE:SNUM?"**
Return message "**+2"**
Description: Return message "**+2"** means 2 steps in the main memory have been set.

[:SOURce]:SAFEty:RESult:ALL:OMETerage?
This command queries OUTPUT METER reading of all steps.

Example: Input command "**SAFE:RES:ALL:OMET?"**
Return message "**5.100000E+01"**
Description: Return message "**5.100000E+01"** means the query OUTPUT METER result is 0.051kV.

[:SOURce]:SAFEty:RESult:ALL:RMETerage?
This command queries REAL CURRENT METER readings of all STEPs under GENERAL MODE.
Example: Input command "**SAFE:RES:ALL:RMET?"**
Return message "**7.000000E-05"**
Description: Return message "**7.000000E-05"** means the query REAL CURRENT METER result is 0.07mA.

[:SOURce]:SAFEty:RESult:ALL:CMETerage? (This function is for Guardian 500VA Plus with Corona Detection.)
This command queries CORONA METER readings of all STEPs under GENERAL MODE.
Example: Input command **"SAFE:RES:ALL:CMET?"**
Return message "**1.200000E+01"**
Description: Return message "**1.200000E+01"** means query CORONA METER result is 12.

[:SOURce]:SAFEty:RESult:ALL:CCMETerage?
This command queries C reading of HFCC in all STEPs under GENERAL MODE.
Example: Input command **"SAFE:RES:ALL:CCMET?"**
Return message **"1.000000E-08"**
Description: Return message **"1.000000E-08"** means the query C measured results of HFCC is 10pF.

[:SOURce]:SAFEty:RESult:ALL:MMETerage[:NORMal]?
This command queries MEASURE METER reading of all STEPs.
Example: Input command "**SAFE:RES:ALL:MMET?"**
Return message "**7.000000E-05"**
Description: Return message "**7.000000E-05"** means query MEASURE METER result is 0.07mA.

[:SOURce]:SAFEty:RESult:ALL:MODE?
This command queries MODE of all STEPs. Return character data AC|DC|IR|PA|OSC.
Example: Input command "**SAFE:RES:ALL:MODE?"**
Return message "**DC"**
Description: Return message "**DC"** means to set the mode as DC.

[:SOURce]:SAFEty:RESult:ALL:TIME[:ELAPsed]:RAMP?
This command queries elapse time of ramp of all STEPs.
Example: Input command "**SAFE:RES:ALL:TIME: RAMP?"**
Return message "**1.000000E+00"**
Description: Return message "**1.000000E+00"** means ramp to the setting voltage required time is 1 second.

[:SOURce]:SAFEty:RESult:ALL:TIME[:ELAPsed][:TEST]?
This command queries the test time of all steps.
Example: Input command "**SAFE:RES:ALL:TIME?"**

Return message "**3.000000E+00"**
Description: Return message "**3.000000E+00"** means the test required time result is 3 seconds.

[:SOURce]:SAFEty:RESult:ALL:TIME[:ELAPsed]:DWELL?
This command queries the dwell time of testing all steps.
Example: Input command "**SAFE:RES:ALL:TIME:DWELL?"**
Return message "**2.500000E+00"**
Description: Return message "**2.500000E+00"** means the test dwell time is 2.5 seconds.

[:SOURce]:SAFEty:RESult:ALL:TIME[:ELAPsed]:FALL?
This command queries the fall time of testing all STEPs.
Example: Input command **"SAFE:RES:ALL:TIME:FALL?"**
Return message "**1.000000E+00"**
Description: Return message "**1.000000E+00"** means the fall time of testing is 1.0 second.

[:SOURce]:SAFEty:RESult:ALL[:JUDGment]?
This command queries the judgment results of all steps. Return formats are: First Step Result, Second Step Result..., Last Step Result. Code meanings are given as in the below table.

Test Result Code List:

Mode	AC		DC		IR		OSC		ALL	
Code	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
STOP									**70**	**112**
USER STOP									**71**	**113**
CAN NOT TEST									**72**	**114**
TESTING									**73**	**115**
PASS									**74**	**116**
HIGH FAIL	**21**	**33**	**31**	**49**	**41**	**65**				
LOW FAIL	**22**	**34**	**32**	**50**	**42**	**66**				
ARC FAIL	**23**	**35**	**33**	**51**						
HIGH FAIL	**24**	**36**	**34**	**52**			**64**	**100**		
CHECK FAIL			**35**	**53**						
OUTPUT A/D OVER	**26**	**38**	**36**	**54**	**46**	**70**	**66**	**102**		
METER A/D OVER	**27**	**39**	**37**	**55**	**47**	**71**	**67**	**103**		
REAL HIGH FAIL	**2A**	**42**								
CORONA FAIL	**2B**	**43**								
SHORT FAIL							**61**	**97**		
OPEN FAIL							**62**	**98**		
GFI FAIL	**2D**	**45**	**3D**	**61**	**4D**	**77**	**6D**	**109**		
HFCC OPEN FAIL	**2E**	**46**	**3E**	**62**						
HFCC SHORT FAIL	**2F**	**47**	**3F**	**63**						

Example: Input command "**SAFE:RES:ALL?"**
Return message "**116"**
Description: Return message "**116"** means judgment result is pass.

[:SOURce]:SAFEty:RESult:COMPleted?
This command queries if the device complete the execution action of all setting values. Return 1 or 0.

Example: Input command "**SAFE:RES:COMP?"**
Return message "**1"**
Description: Return message "**1"** means the execution actions of all setting values are completed.

[:SOURce]:SAFEty:RESult[:LAST][:JUDGment]?
This command queries the judgment result code of the last step.
Example: Input command "**SAFE:RES:LAST?"**
Return message "**116"**
Description: This command means the judgment result of the last step is pass.

[:SOURce]:SAFEty:RESult:BREakdown[:JUDGment]?
This command queries the judgment result code under the BREAK DOWN VOLT MODE.
Example: Input command **"SAFE:RES:BRE?"**
Return message **"116"**
Description: This command means the judgment result of the main unit is pass.

[:SOURce]:SAFEty:RESult:BREakdown:MMETerage?
This command queries the MEASURE METER reading under the BREAK DOWN VOLT MODE.
Example: Input command **"SAFE:RES:BRE:MMET?"**
Return message **"7.000000E-05"**
Description: It returns **"7.000000E-05"** to indicate the results of the query MEASURE
METER is 0.07mA.

[:SOURce]:SAFEty:RESult:BREakdown:OMETerage?
This command queries the OUTPUT METER reading under the BREAK DOWN VOLT MODE.
Example: Input command **"SAFE:RES:BRE:OMET?"**
Return message **"5.100000E+01"**
Description: It returns **"5.100000E+01"** to indicate the results of the query OUTPUT
METER is 0.051kV.

[:SOURce]:SAFEty:RESult:BREakdown:CMETerage? (This function is for Guardian 500VA Plus with Corona Detection.)
This command queries the CORONA METER reading under the BREAK DOWN VOLT MODE.
Example: Input command **"SAFE:RES:BRE:CMET?"**
Return message **"1.200000E+01"**
Description: It returns **"1.200000E+01"** to indicate the results of the query CORONA
METER is 12.

[:SOURce]:SAFEty:RESult:BREakdown:MODE?
This command queries the selected MODE under the BREAK DOWN VOLT MODE, and returns the character data AC or DC.
Example: Input command **"SAFE:RES:BRE:MODE?"**
Return message **"DC"**
Description: It returns **"DC"** to indicate its mode is DC.

[:SOURce]:SAFEty:RESult:BREakdown:STEP?

This command queries the executed STEP number under the BREAK DOWN VOLT MODE.
Example: Input command **"SAFE:RES:BRE:STEP?"**
Return message **"**2**"**
Description: It returns **"2"** to indicate the executed 2 STEPs.

[:SOURce]:SAFEty:RESult: BREakdown:TIME[:ELAPsed][:TEST]?
This command queries the executed test time of the STEP under the BREAK DOWN VOLT MODE.
Example: Input command **"SAFE:RES: BRE:TIME?"**
Return message **"3.000000E+00"**
Description: It returns "**3.000000E+00"** to indicate the tested time of the STEP is 3 seconds.

[:SOURce]:SAFEty:RESult: BREakdown:TIME[:ELAPsed]:DWELl?
This command queries the executed dwell time of the STEP under the BREAK DOWN VOLT MODE.
Example: Input command **"SAFE:RES: BRE:TIME:DWEL?"**
Return message **"3.000000E+00"**
Description: It returns **"3.000000E+00"** to indicate the tested dwell time of the STEP is 3 seconds.

[:SOURce]:SAFEty:RESult: BREakdown:WVoltage?
This command returns voltage value before FAIL occurred under the BREAK DOWN VOLT MODE. The command returns 9.910000E+37 indicating the test has passed.
Example: Input command **"SAFE:RES: BRE:WV?"**
Return message "7.5**00000E+01"**
Description: It returns "7.5**00000E+01"** to indicate voltage value is 75V before FAIL occurred.

[:SOURce]:SAFEty:STEP<n>:DELete
This command will delete <n> represented step and the step which is behind <n> will fill a vacancy forward under the GENERAL MODE.
Example: Input command **"SAFE:STEP 1:DEL"**
Description: It is used to delete STEP 1 setting value in working memory of the main unit.

[:SOURce]:SAFEty:STEP<n>:SET?
This command queries all settings in the selected the STEP under the GENERAL MODE.
Example: Input command **SAFE:STEP 1:SET?**
Return message **1,AC,+5.000000E+03, +6.000000E-04,+7.000000E-06, +8.000000E-06,+8.000000E-03,+3.300000+E01, +5.000000E-01,+3.000000E+00,+2.600000E-08, +3.000000E+00, +1.000000E+00, +2.000000E+00**
Description: It indicates STEP settings in working memory are STEP1, AC, VOLT: 5.000kV, HIGH:0.600mA, LOW:0.007mA, Real Limit:0.008mA, ARC:8.0mA, Corona:33, HFCC C:26pF, HFCC OPEN:50%, HFCC SHORT:300%, TIME:3.0s, RAMP:1.0s, FALL:2.0s

[:SOURce]:SAFEty:STEP<n>:MODE?
This command queries the MODE in the selected STEP under the GENERAL

MODE. It will return the character data AC, DC, IR, PA or OSC.
Example: Input command **"SAFEty:STEP1:MODE?"**
Return message **"DC"**
Description: It returns **"DC"** to indicate its mode is DC.

[:SOURce]:SAFEty:STEP<n>:AC[:LEVel] < *numeric value* >
This command sets the selected STEP, the required voltage value as testing AC withstand. The unit is in volt (V).
Range: 50~5000
Example: Input command **"SAFE:STEP 2:AC 3000"**
Description: This command is used to set the required voltage value of STEP 2 in the main unit to 3000V as testing AC withstand.

[:SOURce]:SAFEty:STEP<n>:AC[:LEVel]?
This command queries the selected STEP, the required voltage value as testing AC withstand.
Example: Input command **"SAFE:STEP 2:AC?"**
Return message **"3.000000E+03"**
Description: Return message "**3.000000E+03"** means the required voltage value of STEP 2 in the main unit is 3000V as testing AC withstand.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit[:HIGH]< *numeric value* >
This command sets the selected STEP, the high limit value of AC withstand leakage current under the GENERAL MODE. The unit is in Ampere (A).
Range: 0.000001~0.12 when 50V~4kV, 0.000001~0.10 when it is above 4.001kV.
Example: Input command **"SAFE:STEP 2:AC:LIM 0.01"**
Description: This command sets the STEP 2 high limit of AC withstand leakage current in the main unit is 10mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit[:HIGH]?
This command queries the selected STEP, the high limit value of AC withstand leakage current under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:LIM?"**
Return message **"1.000000E-02"**
Description: Return message "**1.000000E-02"** means STEP 2 high limit of the AC withstand leakage current in the main unit is 10mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:LOW < *numeric value* >
This command sets the selected STEP, the low-limit value of AC withstand leakage current under GENERAL MODE.
Range: 0=OFF, 0.000001~0.12 (low-limit value of leakage current ≤ high-limit value of setting)
Example: Input command **"SAFE:STEP 2:AC:LIM:LOW 0.00001"**
Description: This command sets STEP 2 low-limit of AC withstand leakage current in the main unit is 0.01mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:LOW?
This command queries the selected STEP, the low-limit value of the AC withstand leakage current under the GENERAL MODE. The unit is in Ampere (A).
Example: Input command **"SAFE:STEP 2:AC:LIM:LOW?"**
Return message "**1.000000E-05"**
Description: It returns **"1.000000E-05"** to indicate the STEP 2 low limit of AC withstand leakage current in the main unit is 0.01mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:REAL < *numeric value* >
This command sets the selected STEP, the high limit value of AC withstand leakage Real Current under the GENERAL MODE.
Range: 0=OFF, 0.000001~0.12 (high limit value of Real Current ≤ high limit value of setting)
Example: Input command **"SAFE:STEP 2:AC:LIM: REAL 0.00001"**
Description: It sets STEP 2 high limit value of leakage Real Current in the main unit is 0.01mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:REAL?
This command queries the selected STEP, the high limit value of AC withstand Real Current under the GENERAL MODE. The unit is in Ampere (A).
Example: Input command **"SAFE:STEP 2:AC:LIM: REAL?"**
Return message **"1.000000E-05"**
Description: It returns **"1.000000E-05"** to indicate STEP 2 high limit of AC withstand of Real Current in the main unit is 0.01mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:ARC[:LEVel] < *numeric value* >
This command sets the selected STEP, its ARC detection value under the GENERAL MODE. The unit is in Ampere (A).
Range: 0 or 0.001~0.02, 0 is for setting OFF.
Example: Input command **"SAFE:STEP 2:AC:LIM:ARC 0.004"**
Description: It sets STEP 2 ARC detection value in the main unit is 4mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:ARC[:LEVel]?
This command queries the selected STEP, its ARC detection value under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:LIM:ARC?"**
Return message **"4.000000E-03"**
Description: It returns **"4.000000E-03"** to indicate the STEP 2 ARC detection value in the main unit is 4.0mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:CORona < *numeric value* >
This command sets the selected STEP, its Corona high limit value of the AC withstand under the GENERAL MODE. (This function is for Guardian 500VA Plus with Corona Detection.)
Range: 0=OFF, 0.1-99.9
Example: Input command **"SAFE:STEP 2:AC:LIM: COR 20.2"**
Description: It sets STEP 2 Corona high-limit values of the AC withstand in the main unit to **20.2.**

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:CORona? (This function is for Guardian 500VA Plus with Corona Detection.)
This command queries the selected STEP, its Corona high-limit value of the AC withstand under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:LIM:COR?"**
Return message **"+2.020000E+01"**
Description: It returns **"+2.020000E+01"** to indicate STEP 2 Corona high limit values of the AC withstand in the main unit is 20.2.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:OPEN < *numeric value* >
This command sets the selected STEP, its OPEN high-limit value of the AC withstand leakage HFCC under the GENERAL MODE.

Range: 10%-100%
Example: Input command **"SAFE:STEP 2:AC:LIM: OPEN 0.2"**
Description: It sets STEP 2 OPEN high-limit value of the AC withstand leakage HFCC in the main unit to 20%.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:OPEN?
This command queries the selected STEP, its OPEN high-limit value of AC withstand leakage current HFCC under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:LIM:OPEN?"**
Return message "**+2.000000E-01"**
Description: It returns **"+2.000000E-01"** to indicate STEP 2 OPEN high limit values of AC withstand leakage current in the main unit is 20%.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:SHORt < *numeric value* >
This command sets the selected STEP, its SHORT high-limit value of the AC withstand HFCC under the GENERAL MODE.
Range: When Cs is below 40 pF (included), the setting is 0 (*i.e.* OFF), 100%-500%. When Cs is above 41 pF (included), it only can set 0 (*i.e.* OFF).
Example: Input command **"SAFE:STEP 2:AC:LIM:SHOR 3"**
Description: It sets STEP 2 SHORT high-limit values of the AC withstand HFCC to 300%.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit: SHORt?
This command queries the selected STEP, its SHORT high limit value of the AC withstand HFCC under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:LIM:SHOR?"**
Return message **"+3.000000E+00"**
Description: It returns **"+3.000000E+00"** to indicate STEP 2 SHORT high-limit value of AC withstand leakage current is 300%.

[:SOURce]:SAFEty:STEP<n>:AC:CSTandard < *numeric value* >
This command sets the selected STEP, its C value of AC withstand leakage current HFCC under GENERAL MODE.
Range: 0=OFF,1-100pF
Example: Input command **"SAFE:STEP 2:AC: CST 20E-12"**
Description: It sets STEP 2 C value of AC withstand leakage current HFCC in the main unit to 20pF.

[:SOURce]:SAFEty:STEP<n>:AC: CSTandard?
This command queries the selected STEP, its C value of AC withstand leakage current HFCC under GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC: CST?"**
Return message **"+2.000000E-11"**
Description: It returns **"+2.000000E-11"** to indicate STEP 2 C value of the AC withstand leakage current HFCC in the main unit is 20pF.

[:SOURce]:SAFEty:STEP<n>:AC:CURRent:OFFSet[:NORmal] <numeric value>
This command sets the AC Offset value under the GENERAL MODE. The unit is in Ampere (A).
Range:
High-Limit setting range is 0.001~2.999mA, the OFFSET setting range is 0.000000~0.002999.

High-Limit setting range is 3~29.99mA, the OFFSET setting range is 0.00000~0.02999.
High-Limit setting range is 30~120mA, the OFFSET setting range is 0.00000~0.100.
Example: Input command **"SAFE:STEP 1:AC:CURR:OFFS 0.005"**
Description: It sets STEP 1 AC Offset of the main unit is 5mA.

[:SOURce]:SAFEty:STEP<n>:AC:CURRent:OFFSet[:NORmal]?
This command queries Offset value of the selected STEP under the GENERAL MODE.
Example: Input command **"SAFE:STEP 1:AC:CURR:OFFS?**
Return message **"5.000000E-03"**
Description: It returns **"5.000000E-03"** to indicate Offset value of STEP1 in the main unit is 5mA.

[:SOURce]:SAFEty:STEP<n>:AC:CURRent:OFFSet :REAL <numeric value>
This command sets Offset value of the AC Real Current under the GENERAL MODE. The unit is in Ampere (A).
Range:
High-Limit setting range is 0.001~2.999mA, OFFSET setting range of the Real Current is 0.000000~0.002999.
High-Limit setting range is 3~29.99mA, OFFSET setting range of the Real Current is 0.00000~0.02999.
High-Limit setting range is 30~120mA, OFFSET setting range of the Real Current is 0.00000~0.100.
Example: Input command **"SAFE:STEP 1:AC:CURR:OFFS:REAL 0.005"**
Description: It sets Offset of STEP 1, AC Real Current in the main unit to 5mA.

[:SOURce]:SAFEty:STEP<n>:AC:CURRent:OFFSet:REAL?
This command queries the selected STEP, its Offset value of the Real Current under the GENERAL MODE.
Example: Input command **"SAFE:STEP 1:AC:CURR:OFFS:REAL?**
Return message **"5.000000E-03"**
Description: It returns **"5.000000E-03"** to indicate STEP1 Offset value of Real Current in the mian unit is 5mA.

[:SOURce]:SAFEty:STEP<n>:AC:HFCC:OFFSet <numeric value>
This command sets C value Offset of AC HFCC under GENERAL MODE. The unit is in Farad (F).
Range: 0~100nF
Example: Input command **"SAFE:STEP 1:AC:HFCC:OFFS 20E-12"**
Description: It sets C value Offset of STEP 1, AC HFCC in the main unit to 20pF.

[:SOURce]:SAFEty:STEP<n>:AC:HFCC:OFFSet?
This command queries the selected STEP, its C value Offset of HFCC under the GENERAL MODE.
Example: Input command **"SAFE:STEP 1:AC:HFCC:OFFS?**
Return message **"+2.000000E-11"**
Description: It returns **"+2.000000E-11"** to indicate STEP 1, C value Offset of HFCC in the main unit is 20pF.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:RAMP < *numeric value* >
This command sets the selected STEP, its required time ramp to setting voltage under the GENERAL MODE. The unit is in second (s).

Range: 0 or 0.1~999.0, 0 is for setting OFF.
Example: Input command **"SAFE:STEP 2:AC:TIME:RAMP 5"**
Description: It sets the required time of STEP 2 in the main unit to ramp to setting voltage is 5.0 sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:RAMP ?
This command queries the selected STEP, its required time ramp to setting voltage under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:TIME:RAMP?"**
Return message **"5.000000E+00"**
Description: It returns **"5.000000E+00"** to indicate the required time of STEP 2 in the main unit to ramp to setting voltage is 5.0 sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME[:TEST] < *numeric value* >
This command sets the selected STEP, its required time of testing under the GENERAL MODE.
Range: 0 or 0.3~999.0, 0is for setting CONTINUE.
Example: Input command **"SAFE:STEP 2:AC:TIME 10"**
Description: It sets the required time of testing STEP 2 in the main unit to 10.0 sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME[:TEST]?
This command queries the selected STEP, its required time of testing under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:TIME?"**
Return message **"1.000000E+01"**
Description: It returns **"1.000000E+01"** to indicate STEP 2 required time of testing in the main unit is 5 sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:FALL < *numeric value* >
This command sets the selected STEP, its required time of setting voltage value to fall to 0 under the GENERAL MODE. The unit is in second (s).
Range: 0 or 0.1~999.0, 0 is for setting OFF.
Example: Input command **"SAFE:STEP 2:AC:TIME:FALL 3"**
Description: It sets the required time of STEP 2 setting voltage value in the main unit to fall to 0 is 3.0 sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:FALL?
This command queries the selected STEP, its required time of setting voltage value to fall to 0 under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:AC:TIME:FALL?"**
Return message **"3.000000E+00"**
Description: It returns **"3.000000E+00"** to indicate the required time of STEP 2 setting voltage value in the main unit to fall to 0 is 3.0 sec.

[:SOURce]:SAFEty:STEP<n>:DC[:LEVel] < *numeric value* >
This command sets the selected STEP, its required voltage value of testing the DC withstand voltage under the GENERAL MODE. The unit is in Volt (V).
Range: 50~6000
Example: Input command **"SAFE:STEP 3:DC 4000"**
Description: It sets the required voltage value of testing STEP 3 DC withstand voltage in the main unit to 4000V.

[:SOURce]:SAFEty:STEP<n>:DC[:LEVel]?
This command queries the selected STEP, its required voltage value of testing the

DC withstand voltage under the GENERAL MODE.
Example: Input command **"SAFE:STEP 3:DC?"**
Return message **"4.000000E+03"**
Description: It returns **"4.000000E+03"** to indicate STEP 3 voltage value of testing DC withstand voltage in the main unit is 4000V.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit[:HIGH]< *numeric value* >
This command sets the selected step, its high limit value of DC withstand voltage leakage current under GENERAL MODE. The unit is Ampere (A).
Range: 0.0000001~0.020
Example: Input command **"SAFE:STEP 3:DC:LIM 0.002999"**
Description: This command sets STEP 3 high-limit value of the DC withstand voltage leakage current to 2.999mA.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit[:HIGH]?
This command queries the selected STEP, its high limit value of DC withstand voltage leakage current under the GENERAL MODE.
Example: Input command "**SAFE:STEP 3:DC:LIM?"**
Return message "**2.999000E-03"**
Description: It returns **"2.999000E-03"** to indicate STEP 3 high-limit value of DC withstand voltage leakage current to 2.999mA.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit:LOW < *numeric value* >
This command sets the selected STEP, its low limit value of the DC withstand voltage leakage current under the GENERAL MODE. The unit is Ampere (A).
Range: 0 or 0.0000001~0.02, 0 is for setting OFF (low limit value of leakage current ≤ high limit value of setting)
Example: Input command "**SAFE:STEP 3:DC:LIM:LOW 0.000001"**
Description: This command sets STEP 3 low limit value of the DC withstand voltage leakage current in the main unit is 0.001mA.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit:LOW?
This command queries the selected STEP, its low limit value of the DC withstand voltage leakage current under the GENERAL MODE.
Example: Input command "**SAFE:STEP 3:DC:LIM:LOW?"**
Return message "**1.000000E-06"**
Description: Return message "**1.000000E-06"** to indicate STEP 3 low limit value of The DC withstand voltage leakage current in the main unit is 0.001mA.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:ARC[:LEVel] < *numeric value* >
This command sets the selected STEP, its ARC detection value under GENERAL the MODE. The unit is in Ampere (A).
Range: 0 or 0.001~0.01, 0 is for setting OFF
Example: Input command **"SAFE:STEP 3:DC:LIM:ARC 0.0025"**
Description: This command sets ARC detection value of STEP 3 in the main unit to 2.5mA.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:ARC[:LEVel]?
This command queries the selected STEP, its ARC detection value.
Example: Input command **"SAFE:STEP 3:DC:LIM:ARC?"**
Return message **"2.500000E-03"**
Description: It returns **"2.500000E-03"** to indicate STEP 3 ARC detection value in

the main unit is 2.5mA.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:CORona < *numeric value* >
This command sets the selected STEP, its Corona high-limit value of the DC withstand voltage under the GENERAL MODE. (This function is for Guardian 500 VA Plus with Corona Detection.)
Range: 0=OFF, 0.1-99.9
Example: Input command **"SAFE:STEP 2:DC:LIM: COR 20.2"**
Description: It sets STEP 2 Corona high limit value of the DC withstand voltage in the main unit to **20.0**.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:CORona? (This function is for Guardian 500 VA Plus with Corona Detection.)
This command queries the selected STEP, its Corona high-limit value of the DC withstand voltage under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:DC:LIM:COR?"**
Return message **"+2.020000E+01"**
Description: It returns **"+2.020000E+01"** to indicate STEP 2 Corona high-limit value of the DC withstand voltage in the main unit is 20.2.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:OPEN?
This command queries the selected STEP, its OPEN high-limit value of the DC withstand voltage HFCC under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:DC:LIM:OPEN?"**
Return message **"+2.000000E-01"**
Description: It returns **"+2.000000E-01"** to indicate STEP 2 OPEN high-limit value of the DC current withstand voltage in the main unit is 20%.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:SHORt < *numeric value* >
This command sets the selected STEP, its SHORT high-limit value of the DC withstand voltage HFCC under the GENERAL MODE.
Range: When Cs is below 40 pF (included), its setting is 0 (*i.e.* OFF), 100%-500%.
When Cs is above 41 pF (included), it only can set as 0 (*i.e.* OFF)
Example: Input command **"SAFE:STEP 2:DC:LIM:SHORT 3"**
Description: It sets STEP 2 SHORT high limit value of the DC withstand voltage HFCC in the main unit to 300%.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit: SHORT?
This command queries the selected STEP, its SHORT high-limit value of the DC withstand voltage HFCC under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:DC:LIM:OPEN?"**
Return message **"+3.000000E+00"**
Description: It returns **"+3.000000E+00"** to indicate STEP 2 SHORT high limit value of the DC withstand voltage HFCC in the main unit is 300%.

[:SOURce]:SAFEty:STEP<n>:DC:CSTandard < *numeric value* >
This command sets the selected STEP, its C value of the DC withstand voltage HFCC under the GENERAL MODE.
Range: 0=OFF, 1-100pF
Example: Input command **"SAFE:STEP 2:DC: CST 20E-12"**
Description: It sets STEP 2 C value of the DC withstand voltage HFCC in the main unit to 20pF.

[:SOURce]:SAFEty:STEP<n>:DC: CSTandard?
This command queries the selected STEP, its C value of the DC withstand voltage HFCC under the GENERAL MODE.
Example: Input command **"SAFE:STEP 2:DC: CST?"**
Return message **"+2.000000E-11"**
Description: It returns **"+2.000000E-11"** to indicate STEP 2 C value of DC withstand voltage HFCC in the main unit is 20pF.

[:SOURce]:SAFEty:STEP<n>:DC:CURRent:OFFSet <numeric value>
This command sets Offset value of DC under the GENERAL MODE. The unit is in Ampere (A).
Range: The Offset setting range is 0.0000000~0.0002999 when High Limit setting range is from 0.1uA to 299.9uA.
The Offset setting range is 0.000000~0.002999 when High Limit setting range is from 0.3mA to 2.999mA.
The Offset setting range is 0.000000~0.02000 when High Limit setting range is from 3mA to 20mA.
Example: Input command **"SAFE:STEP 1:DC:CURR:OFFS 0.005**
Description: It sets STEP 1, DC Offset of in the main unit to 5mA.

[:SOURce]:SAFEty:STEP<n>:DC:CURRent:OFFSet?
This command queries Offset value of the selected STEP under the GENERAL MODE.
Example: Input command **"SAFE:STEP 1:DC:CURR:OFFS?**
Return message **"5.000000E-03"**
Description: It returns **"5.000000E-03"** to indicate Offset value of STEP1 in the main unit is 5mA.

[:SOURce]:SAFEty:STEP<n>:DC:HFCC:OFFSet <numeric value>
This command sets C value Offset of DC HFCC under the GENERAL MODE. The unit is in Farad (F).
Range: 0~100nF
Example: Input command **"SAFE:STEP 1:DC:HFCC:OFFS 20E-12"**
Description: It sets C value Offset of STEP 1, DC HFCC in the main unit to 20pF.

[:SOURce]:SAFEty:STEP<n>:DC:HFCC:OFFSet?
This command queries the selected STEP, its C value Offset of HFCC under the GENERAL MODE.
Example: Input command **"SAFE:STEP 1:DC:HFCC:OFFS?**
Return message **"+2.000000E-11"**
Description: It returns **"+2.000000E-11"** to indicates C value Offset of STEP 1 HFCC is 20pF.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:DWELl < *numeric value* >
This command sets the selected STEP, its DWELL required time under the GENERAL MODE. The unit is in second (s).
Range: 0 or 0.1~999.0, 0 is for setting CONTINUE.
Example: Input command **"SAFE: STEP 3: DC: TIME: DWEL 2.5"**
Description: This command sets dwell required time of STEP 3 in the main unit to 2.5 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:DWELl?
This command queries the selected STEP, its DWELL required time under the

GENERAL MODE.
Example: Input command **"SAFE: STEP 3: DC: TIME: DWEL?"**
Return message **"2.500000E+00"**
Description: It returns **"2.500000E+00"** to indicates DWELL time of the STEP 3 in the main unit is 2.5 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:RAMP < *numeric value* >
This command sets the selected STEP, its required time of testing to ramp to setting voltage. The unit is in second (s).
Range: 0 or 0.1~999.0, 0 is for setting OFF.
Example: Input command **"SAFE: STEP 3: DC: TIME: RAMP 2"**
Description: This command sets the STEP 3 required time of testing to ramp to setting voltage in the main unit to 2.0 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:RAMP?
This command queries the selected STEP, its required time of testing to ramp to setting voltage.
Example: Input command **"SAFE: STEP 3: DC: TIME: RAMP?"**
Return message **"2.000000E+00"**
Description: It returns **"2.000000E+00"** to indicate STEP 3 required time of testing to ramp to setting voltage in the main unit is 2.0 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME[:TEST] < *numeric value* >
This command sets the selected STEP, its required time of testing under the GENERAL MODE. The unit is in second (s).
Range: 0 or 0.1~999.0, 0 is for setting CONTINUE.
Example: Input command **"SAFE:STEP 3:DC:TIME 1"**
Description: This command sets the required time of STEP 3 in the main unit to 1.0sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME[:TEST]?
This command queries the selected STEP, its required time of testing under the GENERAL MODE.
Example: Input command **"SAFE:STEP 3:DC:TIME?"**
Return message **"1.000000E+00"**
Description: It returns **"1.000000E+00"** to indicate STEP 3 required time of testing in the main unit is 1 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:FALL < *numeric value* >
This command sets the selected STEP, its required time of setting voltage value to fall to 0 under the GENERAL MODE. The unit is in second (s).
Range: 0 or 0.1~999.0, 0 is for setting OFF.
Example: Input command **"SAFE:STEP 3:DC:TIME:FALL 3"**
Description: It sets the STEP 3 required time of setting voltage value to fall to 0 in the main unit to 3.0 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:FALL?
This command queries the selected STEP, its required time of setting voltage value to fall to 0 under the GENERAL MODE.
Example: Input command **"SAFE:STEP 3:DC:TIME:FALL?"**
Return message **"3.000000E+00"**
Description: It returns **"3.000000E+00"** to indicate the STEP 3 required time of setting voltage value to fall to 0 in the main unit is 3.0 sec.

[:SOURce]:SAFEty:STEP<n>:IR[:LEVel] < *numeric value* >
This command sets the selected STEP, its required voltage value as testing IR under the GENERAL MODE. The unit is in Volt (V).
Range: 50~5000
Example: Input command **"SAFE:STEP 4:IR 1000"**
Description: This command sets STEP 4 required voltage value as testing IR to 1000V.

[:SOURce]:SAFEty:STEP<n>:IR[:LEVel]?
This command queries the selected STEP, its required voltage value as testing IR under the GENERAL MODE.

Example: Input command **"SAFE:STEP 4:IR?"**
Return message **"1.000000E+03"**
Description: It returns **"1.000000E+03"** to indicate STEP 4 required voltage value as testing IR in the main unit is 1000V.

[:SOURce]:SAFEty:STEP<n>:IR:LIMit:HIGH < *numeric value* >
This command sets the selected STEP, its high limit value of IR under the GENERAL MODE. The unit is in ohm.
Range: 100000~50000000000
Example: Input command **"SAFE:STEP 4:IR:LIM:HIGH 50000000000"**
Description: It sets STEP 4 high limit value of IR in the main unit to 50GΩ.

[:SOURce]:SAFEty:STEP<n>:IR:LIMit:HIGH?
This command queries the selected STEP, its high limit value of IR under the GENERAL MODE.
Example: Input command **"SAFE:STEP 4:IR:LIM:HIGH?"**
Return message **"5.000000E+10"**
Description: It returns **"5.000000E+10"** to indicate STEP 4 high limit value of IR in the main unit is 50GΩ.

[:SOURce]:SAFEty:STEP<n>:IR:LIMit[:LOW] < *numeric value* >
This command sets the selected STEP, its low limit value of IR under the GENERAL MODE. The unit is in ohm.
Range: 100000~50000000000 (low limit value of insulation resistance ≤ high limit value of setting)
Example: Input command **"SAFE:STEP 4:IR:LIM:100000"**
Description: It sets STEP 4 low limit value of IR in the main unit to 0.1 MΩ.

[:SOURce]:SAFEty:STEP<n>:IR:LIMit[:LOW]?
This command queries the selected STEP, its low limit value of IR under the GENERAL MODE.
Example: Input command **"SAFE:STEP 4:IR:LIM?"**
Return message **"1.000000E+05"**
Description: It returns **"1.000000E+05"** to indicate STEP 4 low limit value of IR in the main unit is 0.1MΩ.

[:SOURce]:SAFEty:STEP<n>:IR:TIME:RAMP < *numeric value* >
This command sets the selected STEP, its required time of testing to ramp to setting voltage. The unit is in second (s).
Range: 0 or 0.1~999.0, 0 is for setting OFF

Example: Input command **"SAFE: STEP 4: IR: TIME: RAMP 0.5"**
Description: This command sets STEP 4 required time of testing to ramp to setting voltage to 0.5 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME:RAMP?
This command queries the selected STEP, its required time of testing to ramp to setting voltage under the GENERAL MODE.
Example: Input command **"SAFE: STEP 4: IR: TIME: RAMP?"**
Return message "**5.000000E-01"**
Description: It returns **"5.000000E-01"** to indicate the STEP 4 required time of testing to ramp to setting voltage in the main unit is 0.5 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME[:TEST] < *numeric value* >
This command sets the selected STEP, its required time of testing. The unit is in second (s).
Range: 0 or 0.3~999.0, 0 is for setting CONTINUE
Example: Input command **"SAFE:STEP 4:IR:TIME 1"**
Description: It sets STEP 4 required time of testing in the main unit to 1.0 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME[:TEST]?
This command queries the selected STEP, its required time of testing under the GENERAL MODE.
Example: Input command **"SAFE:STEP 4:IR:TIME?"**
Return message **"1.000000E+00"**
Description: It returns **"1.000000E+00"** to indicate STEP 4 required time of testing in the main unit is 1 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME:FALL < *numeric value* >
This command sets the selected STEP, its required time of setting voltage value to fall to 0 under the GENERAL MODE. The unit is in second (s).
Range: 0 or 0.1~999.0, 0 is for setting OFF
Example: Input command **"SAFE:STEP 4:IR:TIME:FALL 3"**
Description: It sets STEP 4 required time of setting voltage value to fall to 0 in the main unit is 3.0 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME:FALL?
This command queries the selected STEP, its required time of setting voltage value to fall to 0 under the GENERAL MODE
Example: Input command **"SAFE:STEP 4:IR:TIME:FALL?"**
Return message **"3.000000E+00"**
Description: It returns **"3.000000E+00"** to indicate STEP 4 required time of setting voltage value to fall to 0 in the main unit is 3.0 sec.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe: UPPer
This command selects the range upper than the current measured according to current value users inputted under the GENERAL MODE. The unit is in Ampere (A).
Range: 0~0.01
Example: Input command **"SAFE:STEP 4:IR:RANG 0.0003"**
Description: It sets IR measured current value of STEP 4 in the main unit to 300uA thus, the selected IR range upper than the current measured is 3mA.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe: UPPer?
This command queries the range being set under the GENERAL MODE.

Example: Input command **"SAFE:STEP 4:IR:RANG?"**
Return message **"3.000000E-03"**
Description: It returns **"3.000000E-03"** to indicate STEP 4 setting range in the main unit is 3mA.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe: LOWer
This command selects the range lower than the current measured according to current value users inputted under the GENERAL MODE. The unit is in Ampere (A).
Range: 0~0.01
Example: Input command **"SAFE:STEP 4:IR:RANG:LOW 0.0003"**
Description: It sets IR measured current value of STEP 4 in the main unit to 300uA thus, the selected IR range lower than the current measured is 300uA.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe: LOWer?
This command queries the setting range under GENERAL MODE.
Example: Input command **"SAFE:STEP 4:IR:RANG?"**
Return message **"3.000000E-04"**
Description: It returns **"3.000000E-04"** to indicate SETP 4 setting range in the main unit is 300uA.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe: AUTO
This command sets if IR range change to AUTO under the GENERAL MODE.
It sets to AUTO when parameter is ON or 1.
It sets to disable AUTO when parameter is OFF or 0.
Note: It remains the default setting range when AUTO unset and gives OFF parameter. It sets 10mA when the default setting is AUTO and gives OFF parameter.
Example: Input command **"SAFE:STEP 4:IR:RANG:AUTO ON"**
Description: It sets STEP 4 IR measured current range in the main unit to AUTO.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe: AUTO?
This command queries if IR range change to AUTO under the GENERAL MODE.
It sets to AUTO when returns 1.
It sets to disable AUTO when returns 0.
Example: Input command **"SAFE:STEP 4:IR:AUTO?"**
Return message **"1"**
Description: It returns **"1"** to indicate STEP 4 setting range in the main unit is AUTO.

[: SOURce]:SAFEty:STEP<n>:PAuse:MESSage <*string data* >
This command sets the message hint string of PAUSE mode under the GENERAL MODE.
Example: Input command **"SAFE: STEP 5: PA: MESS QUADTECH."**
Description: It sets the message string of STEP 5 in the main unit to Quadtech, Inc.

[: SOURce]:SAFEty:STEP<n>:PAuse:MESSage?
This command queries the setting string of message under the GENERAL MODE.
Example: Input command **"SAFE: STEP 5: PA: MESS?"**
Return message **"QUADTECH"**
Description: It returns **"QUADTECH"** to indicate message string of STEP 5 in the main unit is "QUADTECH."

[: SOURce]:SAFEty:STEP<n>:PAuse:TIME[:TEST] <numeric_value>
This command sets the selected STEP, its required time of testing PA mode under the GENERAL MODE.
Range: 0 or 0.1~999.0, 0 is for setting OFF
Example: Input command **"SAFE:STEP 5:PA:TIME 5"**
Description: It sets STEP 5 required time of testing in the main unit to 5.0 sec.

[: SOURce]:SAFEty:STEP<n>:PAuse:TIME[:TEST]?
This command queries the selected STEP, its required time of testing PA mode under the GENERAL MODE.
Example: Input command **"SAFE:STEP 5:PA:TIME ?"**
Return message **"5.000000E+00"**
Description: It returns **"5.000000E+00"** to indicate STEP 5 required time setting of testing in the main unit is 5.0 sec.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: OPEN < *numeric value* >
This command sets the selected STEP, its setting percentage is judged by open circuit as detecting open/short circuit under the GENERAL MODE. The unit is in percentage (100%).
Range: 0.1~1.0
Example: Input command **"SAFE: STEP 6: OSC: LIM: OPEN 0.3"**
Description: It sets open circuit judgment percentage of STEP 6 in the main unit as detecting open/short-circuit is 30%.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: OPEN?
This command queries the selected STEP, its setting percentage is judged by open circuit as detecting open/short-circuit under the GENERAL MODE.
Example: Input command **"SAFE: STEP 6: OSC: LIM: OPEN?"**
Return message "**3.000000E-01**"
Description: It returns **"3.000000E-01**" to indicate STEP 6 open circuit judgment percentage as detecting open/short circuit in the main unit is 30%.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: SHORt < *numeric value* >
This command queries the selected STEP, its setting percentage is judged by short-circuit as detecting open/short circuit under the GENERAL MODE. The unit is in percentage
(100%).
Range: 0 or 1~5, 0 is for setting OFF
Example: Input command **"SAFE: STEP 6: OSC: LIM: SHOR 3"**
Description: It sets STEP 6 short circuit judgment percentage in the main unit as detecting open/short circuit to 300%.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: SHORt?
This command queries the selected STEP, its setting percentage is judged by Short-circuit as detecting open/short-circuit under the GENERAL MODE.
Example: Input command **"SAFE: STEP 6: OSC: LIM: SHOR?"**
Return message "3.000000E+00"
Description: It returns "3.000000E+00" to indicate STEP 6 short circuit judgment percentage as detecting open/short circuit in the main unit is 300%.

[:SOURce]:SAFEty:STEP<n>:OSC:CRANge? <MAXimum|MINimum|NOW>
This command queries the range can set maximum, minimum value and the range

is operating now under the GENERAL MODE.
Example: Input command **"SAFE:STEP 6:OSC:CRAN? NOW"**
Return message **"3"**
Description: It returns **"3"** to indicate STEP 6 OSC range in the main unit located at 3 now.

[:SOURce]:SAFEty:STEP<n>:OSC:CURRent<m>:OFFSet <numeric value>
This command sets OSC current range and Offset value under the GENERAL MODE.
Range: m:RANGE NUMBER(1~3), numeric value= Cs value. The unit is in F.
Range 1 is 0~9.999nF, range 2 is 0~99.99nF and range 3 is 0~500.0nF.
Example: Input command **"SOURCE:SAFETY:STEP1:OSC:CURR 3:OFFS 0.00000001"**
Description: It sets current range to 3, offset value to 10nF of STEP 1 OSC in the main unit.

[:SOURce]:SAFEty:STEP<n>:OSC:CURRent<m>:OFFSet?
This command queries Offset value of the selected STEP under the GENERAL MODE.
Range: m:RANGE NUMBER(1~3)
Example: Input command **"SAFE:STEP 1:OSC:CURR 1:OFFS?**
Return message **"1.8000000E-11"**
Description: It returns **"1.8000000E-11"** to indicate STEP 1 Offset value in the main unit is 18pF.

[:SOURce]:SAFEty:STEP<n>:OSC:CSTandard <*numeric value*>
This command sets OSC standard capacitance value under the GENERAL MODE.
Range: 0.001-40nF, the unit is in F.
Example: Input command **"SOUR:SAFE:STEP 1:OSC:CST 0.000000009"**
Description: It sets STEP 1 OSC in the main unit, standard capacitance value (Cs) is 9nF.

[:SOURce]:SAFEty:STEP<n>:OSC:CSTandard?
This command queries OSC standard capacitance value under GENERAL MODE.
Example: Input command **"SOUR:SAFE:STEP 1:OSC:CST?"**
Return message "+9.000000E-09"
Description: It returns "+9.000000E-09" to indicate standard capacitance value (Cs) is 9nF.

[:SOURce]:SAFEty:PRESet:TIME:PASS < *numeric value* >
This command sets the buzzer sound continuous time when the main unit passes. The unit is in second (s).
Range: 0.2~99.9.
Example: Input command **"SAFE:PRES:TIME:PASS 3"**
Description: It sets the buzzer sound continuous time to 3 seconds when the main unit passes.

[:SOURce]:SAFEty:PRESet:TIME:PASS?
This command queries the buzzer sound continuous time when the main unit passes.
Example: Input command **"SAFE:PRES:TIME:PASS?"**
Return message **"3.000000E+00"**
Description: It returns **"3.000000E+00"** to indicate the buzzer sound continuous time is 3 seconds when the main unit passes.

Example: Input command **"SAFE:PRES:TIME:PASS?"**
Return message **"3.000000E+00"**
Description: It returns **"3.000000E+00"** to indicate the buzzer sound continuous time is 3 seconds when the main unit passes.

[:SOURce]:SAFEty:PRESet:TIME:STEP < *numeric value* > | *KEY*
This command sets the interval time between step and step, or the next start command to execute the next step under the GENERAL MODE. The unit is in second(s).
Range: KEY or 0.1~99.9.
Example: Input command **"SAFE:PRES:TIME:STEP 0.5"**
Description: It sets the interval time between step and step to 0.5 second.

[:SOURce]:SAFEty:PRESet:TIME:STEP?
This command queries the interval time between step and step, the return value is KEY or the value in second.
Example: Input command **"SAFE:PRES:TIME:PASS?"**
Return message **"5.000000E-01"**
Description: It returns **"5.000000E-01"** to indicate the interval time between step and step is 0.5 second.

[:SOURce]:SAFEty:PRESet:AC:FREQuency < *numeric value* >
This command sets the output voltage frequency as testing the AC withstand voltage under the GENERAL MODE and BREAKDOWN MODE. The unit is Hertz (Hz).
Range: 50~600
Example: Input command **"SAFE:PRES:AC:FREQ 60"**
Description: It sets the output voltage frequency of testing the AC withstand voltage in the main unit to 60Hz.

[:SOURce]:SAFEty:PRESet:AC:FREQuency?
This command queries output voltage frequency of testing the AC withstand voltage.
Example: Input command **"SAFE:PRES:AC:FREQ?"**
Return message **"6.000000E+01"**
Description: It returns **"6.000000E+01"** to indicate output voltage frequency of testing the AC withstand voltage is 60Hz.

[:SOURce]:SAFEty:PRESet:WRANge[:AUTO] < *boolean* > | *ON* | *OFF*
This command sets if withstand voltage auto range function is ON or OFF under the GENERAL MODE.
Example: Input command **"SAFE:PRES:WRAN ON"**
Description: It sets withstand voltage auto range function to ON.

[:SOURce]:SAFEty:PRESet:WRANge[:AUTO]?
This command queries if withstand voltage auto range function is ON or OFF, return 1 or 0. .
Example: Input command **"SAFE:PRES:WARN?"**
Return message **"1"**
Description: It returns **"1"** to indicate withstand voltage auto range function is ON.

[:SOURce]:SAFEty:PRESet:AGC[:SOFTware] < *boolean* > | *ON* | *OFF*
This command sets if software AGC is ON or OFF under the GENERAL MODE.
Example: Input command **"SAFE:PRES:AGC ON"**

Description: It sets software AGC in the main unit to ON.

[:SOURce]:SAFEty:PRESet:AGC[:SOFTware]?
This command queries if software AGC is ON or OFF.
Example: Input command **"SAFE:PRES:AGC?"**
Return message "**1"**
Description: It returns **"1"** to indicate software AGC in the main unit is ON.

[:SOURce]:SAFEty:PRESet:RJUDgmnet < *boolean* > | *ON* | *OFF*
This command sets if Ramp Judg. ON or OFF under the GENERAL MODE.
Example: Input command **"SAFE:PRES:RJUD ON"**
Description: It sets Ramp Judg. ON in the main unit.

[:SOURce]:SAFEty:PRESet:RJUDgment?
This command queries Ramp Judg. ON or OFF.
Example: Input command **"SAFE:PRES:RJUD?"**
Return message **"1"**
Description: It returns **"1"** to indicate Ramp Judg. ON.

[:SOURce]:SAFEty:PRESet:GFI *ON*|*OFF*|*FLOAT*
This command is used for GFI setting under the GENERAL MODE and BREAKDOWN MODE.
Example: Input command **"SAFE:PRES:GFI ON"**
Description: It sets GFI ON.

[:SOURce]:SAFEty:PRESet:GFI?
This command queries GFI setting.
Example: Input command **"SAFE:PRES:GFI?"**
Return message "ON"
Description: It indicates GFI ON.

[:SOURce]:SAFEty:BREakdown:AC[:LEVel] < *start V* >,<*end V*>
This command sets start voltage and end voltage of the AC MODE under BREAKDOWN MODE. The unit is Volt (V).
Range: Start voltage: 50V ~ end voltage
End voltage: start voltage ~ 5000V
Example: Input command "**SAFE:BRE:AC 500,1000"**
Description: It sets start voltage 500V and end voltage 1000V of the AC MODE in the main unit.

[:SOURce]:SAFEty:BREakdown:AC[:LEVel]?
This command queries start voltage and end voltage of AC MODE under BREAKDOWN MODE. The unit is Volt (V).
Example: Input command **"SAFE:BRE:AC?"**
Return message "+5.000000E+02,+1.000000E+03"
Description: It indicates start voltage 500V and end voltage 1000V of AC MODE.

[:SOURce]:SAFEty:BREakdown:AC:LIMit[:HIGH] < *numeric value* >
This command sets leakage current high-limit of the AC MODE under the BREAKDOWN MODE. The unit is Ampere (A).
Range: 0.000001~0.1
Example: Input command **"SAFE:BRE:AC:LIM 0.01"**
Description: It sets leakage current high-limit of the AC MODE in the main unit to 10mA.

[:SOURce]:SAFEty:BREakdown:AC:LIMit[:HIGH]?
This command queries leakage current high limit of the AC MODE under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:AC:LIM?"**
Return message "**1.000000E-02"**
Description: It returns **"1.000000E-02"** to indicate leakage current high limit of AC MODE in the main unit is 10mA.

[:SOURce]:SAFEty:BREakdown:AC:LIMit:LOW < *numeric value* >
This command sets leakage current low limit of the AC MODE under BREAKDOWN MODE.
Range: 0: OFF or 0.000001~0.1 (low limit value of leakage current ≤ high limit value of setting)
Example: Input command **"SAFE:BRE:AC:LIM:LOW 0.00001"**
Description: It sets leakage current low limit of AC MODE in the main unit to 0.01mA.

[:SOURce]:SAFEty:BREakdown:AC:LIMit:LOW?
This command queries leakage current low limit of the AC MODE under the BREAKDOWN MODE. The unit is Ampere (A).
Example: Input command **"SAFE:BRE:AC:LIM:LOW?"**
Description: It returns **"1.000000E-05"** to indicate leakage current low limit of the AC MODE in the main unit is 0.01mA.

[:SOURce]:SAFEty:BREakdown:AC:LIMit:ARC[:LEVel] < *numeric value* >
This command sets ARC detection value of the AC MODE under the BREAKDOWN MODE. The unit is Ampere (A).
Range: 0 or 0.001~0.02, 0 is for setting OFF.
Example: Input command **"SAFE:BRE:AC:LIM:ARC 0.004"**
Description: It sets ARC detection value of the AC MODE in the main unit to 4mA.

[:SOURce]:SAFEty:BREakdown:AC:LIMit:ARC[:LEVel]?
This command queries ARC detection value of the AC MODE under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:AC:LIM:ARC?"**
Return message **"4.000000E-03"**
Description: It returns **"4.000000E-03"** to indicate ARC detection value of the AC MODE in the main unit is 4.0mA.

[:SOURce]:SAFEty:BREakdown:AC:LIMit:CORona < *numeric value* >
This command sets Corona high-limit of the AC MODE under the BREAKDOWN MODE. (This function is for Guardian 500VA Plus with Corona Detection.)
Range: 0=OFF, 0.1-99.9
Example: Input command **"SAFE:BRE:AC:LIM: COR 20.2"**
Description: It sets Corona high limit of the AC MODE in the main unit to **20.2**.

[:SOURce]:SAFEty:BREakdiwn:AC:LIMit:CORona? (This function is for Guardian 500VA Plus with Corona Detection.)
This command queries Corona high limit of AC MODE under BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:AC:LIM:COR?"**
Return message **"+2.020000E+01"**
Description: It returns **"+2.020000E+01"** Corona high limit of AC MODE in the

main unit is 20.2.

[:SOURce]:SAFEty:BREakdown:AC:TIME[:TEST] < *numeric value* >
This command sets test required time of each STEPs under the BREAKDOWN MODE. The unit is second (s).
Range: 0.3~999.0
Example: Input command **"SAFE:BRE:AC:TIME 10"**
Description: It sets test required time of each STEPs in the main unit to 10.0 sec.

[:SOURce]:SAFEty:BREakdown:AC:TIME[:TEST]?
This command queries test required time of each STEPs under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:AC:TIME?"**
Return message **"1.000000E+01"**
Description: It returns **"1.000000E+01"** to indicate test required time of each STEPs is 5 sec.

[:SOURce]:SAFEty:BREakdown:AC:STEP < *numeric value* >
This command sets how many STEP require to test under the BREAKDOWN MODE.
Range: 2~999
Example: Input command **"SAFE:BRE:AC:STEP 10"**
Description: It sets to test 10 STEPs in the main unit.

[:SOURce]:SAFEty:BREakdown:AC:STEP?
This command queries how many STEPs required to test under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:AC:STEP?"**
Return message **"10"**
Description: It returns **"10"** to indicate 10 STEPs had been tested in the main unit.

[:SOURce]:SAFEty:BREakdown:DC[:LEVel] < *start V* >,<*end V*>
This command sets start voltage and end voltage of the DC MODE under the BREAKDOWN MODE. The unit is Volt (V).
Range: Start voltage: 50V ~ end voltage
End voltage: start voltage ~ 6000V
Example: Input command **"SAFE:BRE:DC 500,1000"**
Description: It sets start voltage 500V and end voltage 1000V of the AC MODE in the main unit.

[:SOURce]:SAFEty:BREakdown:DC[:LEVel]?
This command queries start voltage and end voltage of the DC MODE under the BREAKDOWN MODE. The unit is Volt (V).
Example: Input command **"SAFE:BRE:DC?"**
Return message "+5.000000E+02,+1.000000E+03"
Description: It indicates start voltage 500V and end voltage 1000V of DC MODE.

[:SOURce]:SAFEty:BREakdown:DC:LIMit[:HIGH] < *numeric value* >
This command sets leakage current high-limit of the DC MODE under the BREAKDOWN MODE. The unit is Ampere (A).
Range: 0: OFF or 0.0000001~0.02
Example: Input command **"SAFE:BRE:DC:LIM 0.01"**
Description: It sets leakage current high-limit of the DC MODE in the main unit to 10mA.

[:SOURce]:SAFEty:BREakdown:DC:LIMit[:HIGH]?
This command queries leakage current high-limit of DC MODE under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:DC:LIM?"**
Return message **"1.000000E-02"**
Description: It returns **"1.000000E-02"** to indicate leakage current high-limit of the DC MODE is 10mA.

[:SOURce]:SAFEty:BREakdown:DC:LIMit:LOW < *numeric value* >
This command sets leakage current low-limit of DC MODE under the BREAKDOWN MODE.
Range: 0.0000001~0.02 (low-limit value of leakage current ≤ high limit value of setting)
Example: Input command **"SAFE:BRE:DC:LIM:LOW 0.00001"**
Description: It sets leakage current low-limit of the DC MODE in the main unit to 0.01mA.

[:SOURce]:SAFEty:BREakdown:DC:LIMit:LOW?
This command queries leakage current low-limit of the DC MODE under the BREAKDOWN MODE. The unit is Ampere (A).
Example: Input command **"SAFE:BRE:DC:LIM:LOW?"**
Return message **"1.000000E-05"**
Description: It returns **"1.000000E-05"** to indicate leakage current low-limit of DC MODE in the main unit is 0.01mA.

[:SOURce]:SAFEty:BREakdown:DC:LIMit:ARC[:LEVel] < *numeric value* >
This command sets ARC detection value of the DC MODE under the BREAKDOWN MODE. The unit is Ampere (A).
Range: 0 or 0.001~0.01, 0 is for setting OFF.
Example: Input command **"SAFE:BRE:DC:LIM:ARC 0.004"**
Description: It sets ARC detection value of the DC MODE in the main unit to 4mA.

[:SOURce]:SAFEty:BREakdown:DC:LIMit:ARC[:LEVel]?
This command queries ARC detection value of DC MODE under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:DC:LIM:ARC?"**
Return message **"4.000000E-03"**
Description: It returns **"4.000000E-03"** to indicate ARC detection value of the DC MODE in the main unit is 4.0mA.

[:SOURce]:SAFEty:BREakdown:DC:LIMit:CORona < *numeric value* >
This command sets Corona high-limit value of the DC MODE under the BREAKDOWN MODE. (This function is for Guardian 500VA Plus with Corona Detection.)
Range: 0=OFF, 0.1-99.9
Example: Input command **"SAFE:BRE:DC:LIM: COR 20.2"**
Description: It sets Corona high-limit value of the DC MODE in the main unit to 20.2.

[:SOURce]:SAFEty:BREakdiwn:DC:LIMit:CORona? (This function is for Guardian 500 VA Plus with Corona Detection.)
This command queries Corona high limit value of the DC MODE under the BREAKDOWN MODE.

Example: Input command **"SAFE:BRE:DC:LIM:COR?"**
Return message **"+2.020000E+01"**
Description: It returns **"+2.020000E+01"** to indicate Corona high limit value of the DC MODE in the main unit is 20.0.

[:SOURce]:SAFEty:BREakdown:DC:TIME[:TEST] < *numeric value* >
This command sets test required time of each STEPs under the BREAKDOWN MODE. The unit is second (s).
Range: 0.3~999.0
Example: Input command **"SAFE:BRE:DC:TIME 10"**
Description: It sets test required time of each STEPs in the main unit to 10.0sec.

[:SOURce]:SAFEty:BREakdown:DC:TIME[:TEST]?
This command queries test required time of STEP under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:DC:TIME?"**
Return message **"1.000000E+01"**
Description: It returns **"1.000000E+01"** to indicate test required time of each STEPs in the main unit is 5 sec.

[:SOURce]:SAFEty:BREakdown:DC:TIME:DWELl < *numeric value* >
This command sets the dwell time of each of the STEPs under the BREAKDOWN MODE. The unit is second(s).
Range: 0 or 0.1~999.0, 0 indicates without the dwell time.
Example: Input command **"SAFE:BRE:DC:DWEL 10"**
Description: It sets the dwell time of each STEPs in the main unit to 10.0 sec.

[:SOURce]:SAFEty:BREakdown:DC:TIME:DWELl?
This command queries dwell time of STEP under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:DC:TIME:DWEL?"**
Return message **"1.000000E+01"**
Description: It returns **"1.000000E+01"** to indicate the dwell time of each STEP in the main unit is 5 sec.

[:SOURce]:SAFEty:BREakdown:DC:STEP < *numeric value* >
This command sets how many STEPs required to test under the BREAKDOWN MODE.
Range: 2~999
Example: Input command **"SAFE:BRE:DC:STEP 10"**
Description: It sets 10 STEPs for testing in the main unit.

[:SOURce]:SAFEty:BREakdown:DC:STEP?
This command queries how many STEPs to test under the BREAKDOWN MODE.
Example: Input command **"SAFE:BRE:DC:STEP?"**
Return message **"10"**
Description: It returns **"10"** to indicate 10 STEPs for testing in the main unit.

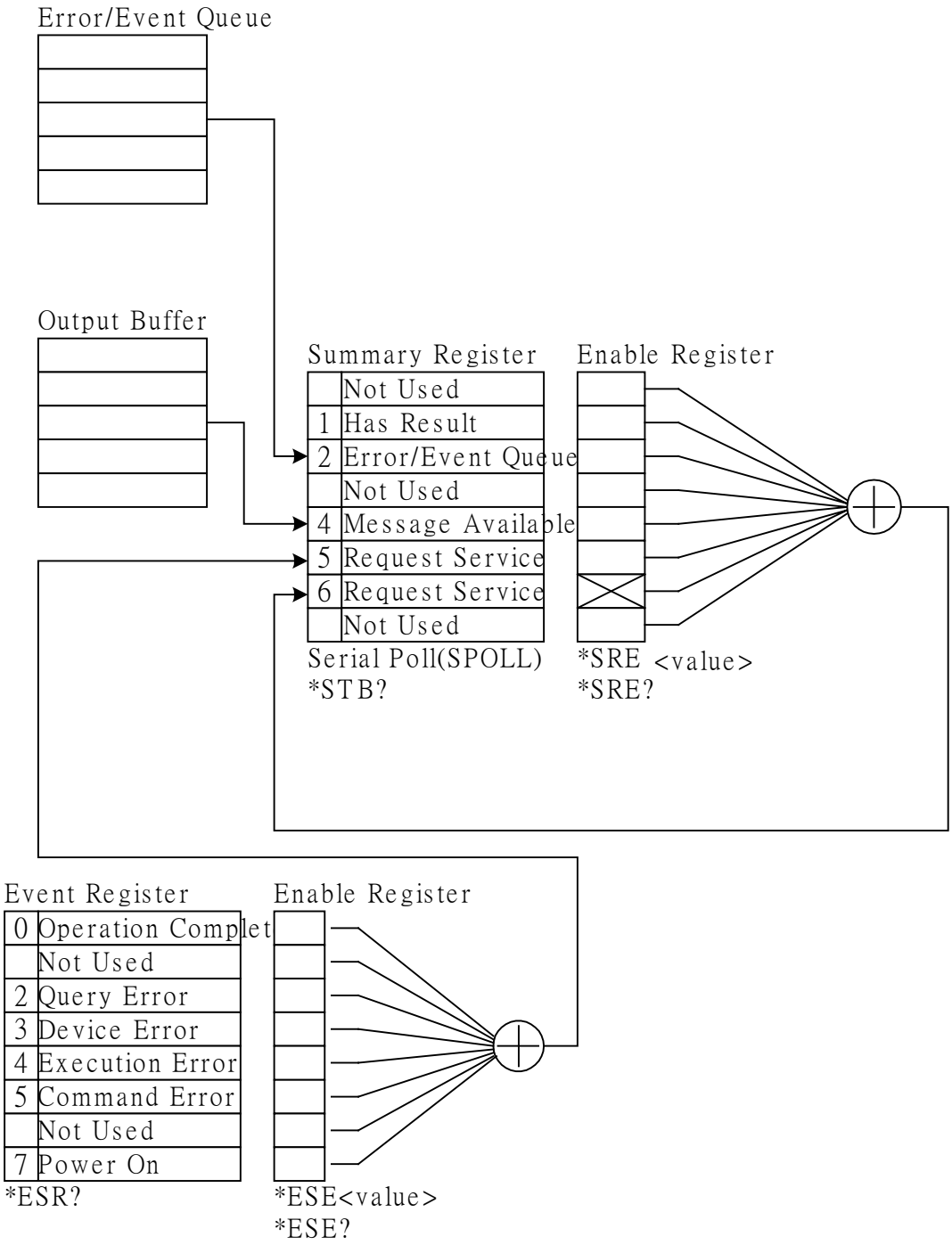
TRIGger:SOURce:EXTernal:STATe < *boolean* > | *ON* | *OFF*
This command sets whether the START KEY is blocked under remote status when the setting is used in the GENERAL MODE and the BREAKDOWN MODE.
When the parameter is 1 and under remote status, it won't block the START KEY.
When the parameter is 0 and under remote status, it will block the START KEY.
Example: Input command **"TRIG:SOUR:EXT:STAT 0"**
Description: It sets the main unit will block the START KEY under remote status.

TRIGger:SOURce:EXTernal:STATe?
This command queries if START KEY is blocked under remote status when the setting is used in the GENERAL MODE and the BREAKDOWN MODE.
Example: Input command **“TRIG:SOUR:EXT:STAT?”**
Return message **“0”**
Description: It returns **“0”** to indicate the main unit will block START KEY under remote status.

5.4.3 Start Test by Serial No.

This device will start a test when the remote interface receives a string to conform to the setting of Serial Number. For example: when Serial No. set as “AA*****” (* means changeable character). Input “AA00001” or “AA00300” from remote interface, this device will start the test.

5.4.4 SCPI Status System



5.5 Error Message

- Error messages are saved in the error queue, which can be accessed by the FIFO method. The first returned error message is the first one saved.
- When the error messages are over 30, the last position will save -350, “Queue overflow.” The error queue can’t save the error messages any more till error messages are removed.
- When no error has occurred, the first position will save +0, “No error” in the error queue.

-102 Syntax error
Syntax error, it usually includes unallowed character symbol in command.
-103 Invalid separator
Invalid separator characters are found in command string.
-108 Parameter not allowed
The device receives unallowed parameter.
-109 Missing parameter
Parameter is missed
-112 Program mnemonic too long
Simple command program header over twelve characters
-113 Undefined header
The device received undefined program header.
-114 Header suffix out of range
The value of a numeric suffix attached to a program mnemonic is out of range.
-120 Numeric data error
The numerical parameter is error.
-140 Character data error
The input character data is error.
-151 Invalid string data
Uncompleted string data, usually double quotation is missed.
-158 String data not allowed
The device is received disallowed string data.
-170 Expression error
The device is received uncompleted parameter data, such as missing the right parenthesis.
-200 Execution error
Command execution error
-203 Command protected
The device does not receive this command.
-221 Settings conflict
The device is occupied and the command is not received.
-222 Data out of range
The parameter value is out of range.
-223 Too much data
Received string length is over, can’t be executed.
-290 Memory use error
Save or read memory error
-291 Out of memory
The data cannot store because the main memory is full.
-292 Referenced name does not exist
Referenced name does not exist.
-293 Referenced name already exist
Referenced name is already existed.

-350 Queue overflow
Error message overflow
-361 Parity error in program message
The parity is error.
-365 Time out error
The device isn't received end character within a certain time.
-363 Input buffer overrun
The input buffer is out of range.
-400 Queue error
The output buffer is out of range.
-410 Query INTERRUPTED
When a query command is received, you don't read out the query result and then received a query command at once. The query will be interrupted.
-420 Query UNTERMINATED
There is no data in queue, meanwhile read the command of output queuded data.

5.6 Basic Example

5.6.1 GPIB

■ **Example of GPIB Basic**

```
REM-----------------------------------------------------------------
REM   Please run the ULI file before this program.
REM   This program is that getting results through GPIB from the device.
REM   GPIB address is 3
REM-----------------------------------------------------------------

CLS
PRINT "Program is running..."
OPEN "GPIB0" FOR OUTPUT AS #1         ‘open #1 for output (write)
OPEN "GPIB0" FOR INPUT AS #2          ‘open #2 for input (read)

PRINT #1, "ABORT"                     ‘initializing message.
PRINT #1, "GPIBEOS IN LF"             ‘set the end code

PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STOP"    ‘send STOP command to device 3
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:SNUMBer?"
PRINT #1, "ENTER 3"
INPUT #2, STEPNUM%

PRINT "DEL STEPS"
IF STEPNUM% > 0 THEN
  FOR I% = STEPNUM% TO 1 STEP - 1
      PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STEP", I%, ":DELete"
  NEXT I%
END IF            ‘clear all steps

PRINT "SET STEPS"
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STEP 1:DC 1000"
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STEP 1:DC:LIMit 0.004"
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STEP 1:DC:TIME 2"

PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STEP 2:AC 1000"
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STEP 2:AC:LIMit 0.02"
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STEP 2:AC:TIME:TEST 3"

PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STOP"
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STARt"     ‘start test

STATUS$ = "RUNNING"
WHILE  STATUS$ <> "STOPPED"
  PRINT #1, "OUTPUT 3;:SAFEty:STATus?"
  PRINT #1, "ENTER 3"
  INPUT #2, STATUS$
  PRINT STATUS$

  IF STATUS$ = "STOPPED" THEN
      PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STOP"
      PRINT #1, "OUTPUT 3;:SAFEty:RESult:ALL:OMET?"
      PRINT #1, "ENTER 3"

      FOR J% = 1 TO STEPNUM%
          INPUT #2, RESULT$
```

```
            PRINT "STEP", J%, ":", RESULT$
        NEXT J%

        PRINT
        PRINT #1, "OUTPUT 3;:SAFEty:RESult:ALL:MMET?"
        PRINT #1, "ENTER 3"

        FOR J% = 1 TO STEPNUM%
            INPUT #2, RESULT$
            PRINT "STEP", J%, ":", RESULT$
        NEXT J%
    END IF
WEND

PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STOP"
CLOSE : SYSTEM
END
```

■ **Saved and recalled from GPIB Basic example**

```
REM ------------------------------------------------------------
REM     Program compiled using Microsoft version 1.1(MS-DOS 6.22)
REM     Please run the ULI file before this program
REM     Device GPIB address is 3
REM ------------------------------------------------------------

OPEN "GPIB0" FOR OUTPUT AS #1      'open #1 for output (write)
OPEN "GPIB0" FOR INPUT AS #2       'open #2 for input (read)
PRINT #1, "ABORT"                  'initializing complete
PRINT #1, "GPIBEOS IN LF"          'set the end code

PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP1:AC:LEVel 500"
PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP1:AC:LIMit:HIGH 0.04"

PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP2:AC:LEVel 5000"
PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP2:AC:LIMit:HIGH 0.04"

PRINT #1, "OUTPUT 3;*SAV 1"         'Work memory were Stored in memory 1
PRINT #1, "OUTPUT 3;MEMory:DEFine AAA,1"   'Define the name of memory 1 is AAA

PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP3:DC:LEVel 700"
PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP3:DC:LIMit:HIGH 0.01"

PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP4:IR:LEVel 800"
PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP4:IR:LIMit:HIGH 5000000"

PRINT #1, "OUTPUT 3;*SAV 3"         'Work memory were Stored in memory 3
PRINT #1, "OUTPUT 3;MEMory:DEFine BBB,3"   'Define the name of memory 3 is BBB

PRINT #1, "OUTPUT 3;*RCL 1"  'Recall the memory 1

CLOSE : SYSTEM
END
```

■ **Using status reporting from GPIB Basic example**

```
REM-----------------------------------------------------------------------
REM   Please run the ULI file before this program.
REM   This program is that getting results through GPIB from the device.
REM   Device GPIB address is 3
REM-----------------------------------------------------------------------

CLS
PRINT "Program is running..."
OPEN "GPIB0" FOR OUTPUT AS #1          'set the talker
OPEN "GPIB 0" FOR INPUT AS #2          'set the listener

REM define the SRQ-handling routine
ON PEN GOSUB MySRQRoutine

REM Enable the on SRQ functionality
PEN ON

PRINT #1, "ABORT"                      'initializing complete
PRINT #1, "GPIBEOS IN LF"              'set the end code
PRINT "waiting for SRQ from device"
PRINT #1, "OUTPUT 3;:SOURce:SAFEty:STOP"       'STOP the Device

PRINT #1, "OUTPUT 3;*SRE 32"           'set status enable register
PRINT #1, "OUTPUT 3;*ESE 60"           'set standard enable register

PRINT #1, "OUTPUT 3;:sdf"              'send undefined command
FOR I% = 1 TO 10000
       PRINT "Please wait for SRQ ", I%
NEXT I%
PRINT "Program is stopped!"

GOTO END1

MySRQRoutine:                          'SRQ interrupt
   PEN OFF
   PRINT "Running the SRQ"
   PRINT #1, "OUTPUT 3;*ESR?"
   PRINT #1, "ENTER 3"
   INPUT #2, C%                        'get the questionable state

   IF C% = 32 THEN
       PRINT "All Pass"
   ELSE
       PRINT "  Fail  "
   END IF                              'End of SRQ interrupt

END1:
CLOSE : SYSTEM
END
```

5.6.2 Example of RS232 Basic

```
REM-----------------------------------------------------------------------
REM    Program compiled using Microsoft version 1.1(MS-DOS 6.22)
REM    RS232 example program
REM-----------------------------------------------------------------------

OPEN "COM1:9600,N,8,1,LF" FOR RANDOM AS #1     'open serial port 2 as device 1
PRINT #1, "SOURce:SAFEty:STOP"                      'send "STOP" command to device

PRINT #1, "SOURce:SAFEty:SNUMBer?"
INPUT #1, STEPNUM%

IF STEPNUM% > 0 THEN
    FOR I% = STEPNUM% TO 1 STEP - 1
         TEMP$ = INPUT$(LOC(1), 1)
         PRINT #1, "SOURce:SAFEty:STEP", I%, ":DELete"        'clear all steps data
    NEXT I%
END IF

PRINT #1, "SOURce:SAFEty:STEP1:AC:LEVel 500"
PRINT #1, "SOURce:SAFEty:STEP1:AC:LIMit:HIGH 0.003"
PRINT #1, "SOURce:SAFEty:STEP1:AC:TIME:TEST 3"

PRINT #1, "SOURce:SAFEty:STEP2:DC:LEVel 500"
PRINT #1, "SOURce:SAFEty:STEP2:DC:LIMIT 0.003"
PRINT #1, "SOURce:SAFEty:STEP2:DC:TIME 3"

PRINT #1, "SOURce:SAFEty:STEP3:IR:LEVel 500"
PRINT #1, "SOURce:SAFEty:STEP3:IR:LIMIT 300000"
PRINT #1, "SOURce:SAFEty:STEP3:IR:TIME 3"

PRINT #1, "SOURce:SAFEty:SNUMBer?"
INPUT #1, STEPNUM%

PRINT #1, "SOURce:SAFEty:STARt"                     'start test

STATUS$ = "RUNNING"
WHILE STATUS$ <> "STOPPED"                          'do while status is not stopped
    PRINT #1, "SOURce:SAFEty:STATUS?"
    INPUT #1, STATUS$                               'read status

    IF STATUS$ = "STOPPED" THEN                     'if status is not TESTING
         PRINT #1, "SOURce:SAFEty:STOP"             'send STOP command
         PRINT #1, "SAFEty:RESult:ALL:OMET?"

         FOR J% = 1 TO STEPNUM%
              INPUT #1, RESULT$
              PRINT "STEP", J%, ":", RESULT$
         NEXT J%
         PRINT
```

```
        PRINT #1, "SAFEty:RESult:ALL:MMET?"
        FOR J% = 1 TO STEPNUM%
             INPUT #1, RESULT$
             PRINT "STEP", J%, ":", RESULT$
        NEXT J%
    END IF
WEND

PRINT #1, "SOURce:SAFEty:STOP"
CLOSE #1
END
```

6. Calibration Step

Before processing the calibration step in this section, the analyzer should warm up for at least 30 minutes.

- Open the top cover, then power on after pressing **SW402**.
- When “MAIN MENU” is displayed on the title bar, press the numerical key corresponding to the **CALIBRATION** that will pop up in the window of “ENTER CALIBRATION PASSWORD.”
- Key in password “7” “9” “3” “1” using numerical keys.
- After pressing **ENTER** to select “**DEVICE”** on the LCD, it will enter the calibration step of the analyzer.
- Press **SW402** once after the calibration is completed. This prevents the calibrated data from being lost.

Voltage Calibration (see section 6.2)

ACV	5kV	Offset (100V)	:AC Voltage	OFFSET	point
ACV	5kV	Full (4kV)	:AC Voltage	FULL	point
DCV	6kV	Offset (100V)	:DC Voltage	OFFSET	point
DCV	6kV	Full (4kV)	:DC Voltage	FULL	point
IRV	1kV	Offset (100V)	:IR Voltage	OFFSET	point
IRV	1kV	Full (1kV)	:IR Voltage	FULL	point

Current Calibration (see section 6.3)

ACA	3mA	Offset (0.12mA)	:AC 2.99mA	range	OFFSET	point
ACA	3mA	Full (2.5mA)	:AC 2.99mA	range	FULL	point
ACA	30mA	Offset (2.5mA)	:AC 29.99mA	range	OFFSET	point
ACA	30mA	Full (25mA)	:AC 29.99mA	range	FULL	point
ACA	100mA	Offset (25mA)	:AC 100.0mA	range	OFFSET	point
ACA	100mA	Full (37.5mA)	:AC 100.0mA	range	FULL	point
RCA	3mA	Offset (0.12mA)	:AC 2.99mA	range	OFFSET	point
RCA	3mA	Full (2.5mA)	:AC 2.99mA	range	FULL	point
RCA	30mA	Offset (2.5mA)	:AC 29.99mA	range	OFFSET	point
RCA	30mA	Full (25mA)	:AC 29.99mA	range	FULL	point
RCA	100mA	Offset (25mA)	:AC 100.0mA	range	OFFSET	point
RCA	100mA	Full (37.5mA)	:AC 100.0mA	range	FULL	point
DCA	0.3mA	Offset (0.012mA)	:DC 299.9uA	range	OFFSET	point
DCA	0.3mA	Full (0.12mA)	:DC 299.9uA	range	FULL	point
DCA	3mA	Offset (0.12mA)	:DC 2.99mA	range	OFFSET	point
DCA	3mA	Full (2.5mA)	:DC 2.99mA	range	FULL	point
DCA	20mA	Offset (2.5mA)	:DC 20mA	range	OFFSET	point
DCA	20mA	Full (10mA)	:DC 20mA	range	FULL	point

Withstand Voltage Mode Arcing Calibration (see section 6.4)

AC	ARC	20mA(5mA)	:AC Arcing	Calibration
DC	ARC	10mA(5mA)	:DC Arcing	Calibration

Insulation Resistance Mode Leakage Current Meter Calibration (see section 6.5)

IRR	370MΩ Offset (40MΩ)	:IR Resistor 370MΩ OFFSET point
IRR	370MΩ Full (250MΩ)	:IR Resistor 370MΩ FULL point
IRR	3.7GΩ Offset (400MΩ)	:IR Resistor 3.7GΩ OFFSET point
IRR	3.7GΩ Full (2.5GΩ)	:IR Resistor 3.7GΩ FULL point

IRR	50GΩ Offset (4GΩ)	:IR Resistor 50GΩ OFFSET point
IRR	50GΩ Full (40GΩ)	:IR Resistor 50GΩ FULL point

6.1 Enter Calibration Menu

Press [3] [ENTER]
Display password
Press [7] [9] [3] [1] [ENTER]
Press Function key [DEVICE]

6.2 Voltage Calibration

6.2.1 ACV Calibration

Connect ACV high voltage meter to withstand tester or connecting 9102 to select ACV MODE [100MΩ].

Display	ACV 5kV Offset (100V)	:ACV OFFSET POINT calibration
Press	[STOP] [START]	: Read out the HV meter value
		: Example 0.092kV
Press	[0] [.] [0] [9] [2] [ENTER]	
Press	[STOP]	: Stop ACV OFFSET POINT calibration
Press	[△] key to display	
Display	ACV 5kV Full (4kV)	:ACV FULL POINT calibration
Press	[STOP] [START]	: Read out the HV meter value
		: Example 4.052kV
Press	[4] [.] [0] [5] [2] [ENTER]	
Press	[STOP]	: Stop ACV voltage calibration

6.2.2 DCV Calibration

Connect DCV high voltage meter to withstand tester or connecting 9102 to select DCV MODE [1.00GΩ].

Press	[△] key to display	
Display	DCV 6kV Offset (100V)	: DCV OFFSET POINT calibration
Press	[STOP] [START]	: Read out the HV meter value
		:
Example 0.092kV		
Press	[0] [.] [0] [9] [2] [ENTER]	
Press	[STOP]	: Stop DCV OFFSET POINT calibration
Press	[△] key to display	
Display	DCV 6kV Full (4kV)	: DCV FULL POINT calibration
Press	[STOP] [START]	: Read out the HV meter value
		: Example 4.052kV
Press	[4] [.] [0] [5] [2] [ENTER]	
Press	[STOP]	: Stop DCV Voltage calibration

6.2.3 IR Voltage Calibration

Connect DCV high voltage meter to the withstand tester or connecting 9102 to select DCV MODE [1.00GΩ].

Press	[△] key to display	
Display	IRV 1kV Offset (100V)	: IRV OFFSET POINT calibration
Press	[STOP] [START]	: Read out the HV meter value
		: Example 0.092kV
Press	[0] [.] [0] [9] [2] [ENTER]	
Press	[STOP]	: Stop IRV OFFSET POINT calibration
Press	[△] key to display	
Display	IRV 1kV Full (1kV)	: IRV FULL POINT calibration.
Press	[STOP] [START]	: Read out the HV meter value
		: Example 1.052kV
Press	[1] [.] [0] [5] [2] [ENTER]	
Press	[STOP]	: Stop IR voltage calibration

6.3 Current Calibration

Caution: The dummy load must be between the high potential terminal and input terminal of ammeter. Otherwise, dangerous conditions may occur.

6.3.1 AC Current Calibration

Connect high potential terminal of the withstand voltage tester to 10MΩ load resistor, and connect to high potential terminal (HV1) of AC ammeter. However, connect the low potential terminal (HV2) of withstand voltage tester to the low potential terminal of AC ammeter.

Press	[△] key to display	
Display	ACA 3mA offset (0.12mA)	: ACA 2.999mA range Offset point calibration
Press	[STOP] [START]	
		: Read out the ammeter value
		: Example 0.124mA
Press	[0] [.] [1] [2] [4] [ENTER]	
Press	[STOP]	: Stop ACA 2.999mA range Offset point calibration

Change the dummy load resistor to 500kΩ 50watt (or higher).

Press	[△] key to display	
Display	ACA 3mA Full (2.5mA)	: ACA 2.999mA range Full point calibration
Press	[STOP] [START]	: Read out the ammeter value
		: Example 2.903mA
Press	[2] [.] [9] [0] [3] [ENTER]	
Press	[STOP]	: Stop ACA 2.999mA range calibration
Press	[△] key to display	
Display	ACA 30mA Offset(2.5mA)	: ACA 30.00mA range Offset point calibration

Press [STOP] [START] ; Read out the ammeter value
: Example 2.903mA
Press [2] [.] [9] [0] [3] [ENTER]
Press [STOP] : Stop ACA 30.00mA range Offset point calibration

Change the dummy load resistor to 50kΩ 200watt (or higher).
Press [△] key to display
Display ACA 30mA FULL(25mA) : ACA 30.00mA range full point calibration.
Press [STOP] [START] : Read out the ammeter value
: Example 24.50mA
Press [2] [4] [.] [5] [0] [ENTER]
Press [STOP] : Stop ACA 30.00mA range calibration

Press [△] key to display
Display ACA 100mA Offset(25mA) : ACA 100.0mA range Offset point calibration
Press [STOP] [START] : Read out the ammeter value
: Example 24.50mA
Press [2] [4] [.] [5] [0] [ENTER]
Press [STOP] : Stop ACA 100.0mA range Offset point calibration

Change the dummy load resistor to 32kΩ 200watt (or higher).
Press [△] key to display
Display ACA 100mA FULL(37.5mA) : ACA 100.0mA range full point calibration
Press [STOP] [START] : Read out the ammeter value
: Example 37.12mA
Press [3] [7] [.] [1] [2] [ENTER]
Press [STOP] : Stop ACA 100.0mA range calibration

6.3.2 RCA Current Calibration

Connect the high potential terminal of withstand voltage tester to 10MΩ load resistor and connect to the high potential terminal (HV1) of AC ammeter. However, connect the low potential terminal (HV2) of the withstand voltage tester to low potential terminal of AC ammeter.

Press [△] key to display
Display RCA 3mA Offset (0.12mA) : RCA 2.999mA range Offset point calibration
Press [STOP] [START] : Read out the ammeter value (Ex. 0.124mA)
Press [0] [.] [1] [2] [4] [ENTER]
Press [STOP] : Stop RCA 2.999mA Offset point calibration

Change the dummy load resistor to 500kΩ/50watt (or higher).
Press [△] key to display
Display RCA 3mA Full (2.5mA) : RCA 2.999mA range Full point calibration
Press [STOP] [START] : Read out the ammeter value (Ex. 2.903mA)
Press [2] [.] [9] [0] [3] [ENTER]
Press [STOP] : Stop RCA 2.999mA range calibration

Press [△] key to display
Display RCA 30mA Offset(2.5mA) : RCA 30.00mA range Offset point calibration
Press [STOP] [START] : 2.903mA)
Press [2] [.] [9] [0] [3] [ENTER]
Press [STOP] : Stop RCA 30.00mA range Offset point calibration

Change the dummy load resistor to 50kΩ/200watt (or higher).
Press [△] key to display
Display RCA 30mA FULL (25mA) : RCA 30.00mA range full point calibration
Press [STOP] [START] : Read out the ammeter value (Ex. 24.50mA)
Press [2] [4] [.] [5] [0] [ENTER]
Press [STOP] : Stop RCA 30.00mA range calibration
Press [△] key to display
Display RCA 100mA Offset(25mA) : RCA 100.0mA range Offset point calibration
Press [STOP] [START] : Read out the ammeter value (Ex. 24.50mA)
Press [2] [4] [.] [5] [0] [ENTER]
Press [STOP] : Stop RCA 100.0mA range Offset point calibration

Change the dummy load resistor to 32kΩ/200watt (or higher).
Press [△] key to display
Display RCA 100mA FULL(37.5mA) : RCA 100.0mA range full point calibration
Press [STOP] [START] : Read out the ammeter value (Ex. 37.12mA)
Press [3] [7] [.] [1] [2] [ENTER]
Press [STOP] : Stop RCA 100.0mA range calibration

6.3.3 DC Current Calibration

Connect the high potential terminal of the withstand voltage tester to 10MΩ load resistor, and connect to the high potential terminal of AC ammeter. However, connect the low potential terminal of the withstand voltage tester to the low potential terminal of DC ammeter or connecti 9102 to select DCA MODE [10MΩ].

Press [△] key to display
Display DCA 0.3mA Offset (0.012mA) : DCA 299.9uA range Offset point calibration
Press [STOP] [START] : Read out the ammeter value
: Ex. 0.012mA
Press [0] [.] [1] [2] [4] [ENTER]
Press [STOP] : Stop DCA 2.999uA Offset point calibration

Press [△] key to display
Display DCA 0.3mA FULL (0.12mA) : DCA 299.9uA range full point calibration
Press [STOP] [START] : Read out the ammeter value
: Example 0.120mA
Press [0] [.] [1] [2] [0] [ENTER]
Press [STOP] : Stop DCA 299.9uA range calibration

Press [△] key to display
Display DCA 3mA Offset (0.12mA) : DCA 2.999mA range Offset point calibration
Press [STOP] [START] : Read out the ammeter value

: Example 0.124mA
Press [0] [.] [1] [2] [4] [ENTER]
Press [STOP] : Stop DCA 2.999mA
Offset point calibration

Change the load resistor to 500kΩ 50watt (or higher) or connect 9102 to select the DCA MODE [500kΩ].
Press [△] key to display
Display DCA 3mA FULL (2.5mA) : DCA 2.999mA range full point calibration.
Press [STOP] [START] : Read out the ammeter value
;
Example 2.039mA
Press [2] [.] [0] [3] [9] [ENTER]
Press [STOP] : Stop DCA 2.999mA range calibration
Press [△] key to display
Display DCA 20mA Offset (2.5mA) : DCA 20.00mA range Offset point calibration
Press [STOP] [START] : Read out the ammeter value
: Example 2.903mA
Press [2] [.] [9] [0] [3] [ENTER]
Press [STOP] : Stop DCA 20.00mA Offset point calibration

Change the load resistor to 100kΩ 100watt (or higher) or connect 9102 to select the DCA MODE [100kΩ].
Press [△] key to display
Display DCA 20mA Full (10mA) : DCA 20.00mA range full point calibration
Press [STOP] [START] : Read out the ammeter value
;
Example 10.01mA
Press [1] [0] [.] [0] [1] [ENTER]
Press [STOP] : Stop DCA 20.00mA range calibration

6.4 Withstand Voltage Mode Arc Calibration

Notice ARC calibration is very special, the high voltage terminal is positioned outside.

Press [△] key to display : AC arc sensitivity calibration
Display AC ARC 40mA (5mA) : AC withstand voltage arc
Press [STOP] [START] : The high voltage output terminal series 250kΩ 5watt resistance by using two high voltage cables. The other high voltage cable (grounding cable) is as close as possible to the first cable, but doesn't contact each other–arc is produced.
Press [2] [.] [2] [ENTER] : For example, 2.2mA is critical point of ARC FAIL and ARC PASS.
Press [STOP] : Stop AC arc calibration

Press [△] key to display : DC arc sensitivity calibration
Display DC ARC 12mA (5mA) : DC withstand voltage arc
Press [STOP] [START] : The high voltage output terminal series

		250kΩ 5 watt resistance by using two high voltage cables. The other high voltage cable (grounding cable) is as close as possible to the first cable, but doesn't contact each other– arc is produced.
Press	[2] [.] [4] [ENTER]	: For example, 2.4mA is critical point of ARC FAIL and ARC PASS.
Press	[STOP]	: Stop DC arc calibration

6.5 Resistor Calibration for Insulation Resistance Mode

The standard load resistor is connected between the high potential terminal and the low potential terminal of withstand voltage tester.

Press	[△] key to display	
Display	IRR 370MΩ Offset (40MΩ)	: Connect IR standard resistor to 40MΩ
Press	[STOP] [START]	: Read out the IRR value : If IR standard resistor is 40MΩ
Press	[4][0] [ENTER]	
Press	[STOP]	: Stop

Change the standard load resistor to 250MΩ.

Press	[△] key to display	
Display	IRR 370MΩ Full (250MΩ)	: Connect IR standard resistor to 250MΩ
Press	[STOP] [START]	: Read out the IRR value : If IR standard resistor is 250MΩ
Press	[2] [5] [0] [ENTER]	
Press	[STOP]	: Stop

Change the standard load resistor to 400MΩ.

Press	[△] key to display.	
Display	IRR 3.7GΩ Offset (400MΩ)	: Connect IR standard resistor to 400MΩ
Press	[STOP] [START]	: Read out the IRR value : If IR standard resistor is 400MΩ
Press	[4] [0] [0] [ENTER]	
Press	[STOP]	: Stop

Change the standard load resistor to 2.5GΩ.

Press	[△] key to display	
Display	IRR 3.7GΩ Full (2.5GΩ)	: Connect IR standard resistor to 2.5GΩ
Press	[STOP] [START]	: Read out the IRR value : If IR standard resistor is 2.5GΩ
Press	[2] [5] [0] [0] [ENTER]	
Press	[STOP]	: Stop

Change the standard load resistor to 4GΩ.

Press	[△] key to display	
Display	IRR 50GΩ Offset (4GΩ)	: Connect IR standard resistor to 4GΩ

Press	[STOP] [START]	: Read out the IRR value
		: If IR standard resistor is 4GΩ
Press	[4] [0] [0] [0] [ENTER]	
Press	[STOP]	: Stop

Change the standard load resistor to 40GΩ.

Press	[△] key to display	
Display	IRR 50GΩ Full (40GΩ)	: Connect IR standard resistor to 40GΩ
Press	[STOP] [START]	: Read out the IRR value
		: If IR standard resistor is 40GΩ
Press	[4] [0] [0] [0] [ENTER]	
Press	[STOP]	: Stop

6.6 Complete Calibration

Press [EXIT]
[MENU]
Go to MAIN MENU

7. Maintenance

7.1 General

Our warranty (at the front of the manual) attests to the quality of the materials and the workmanship in our products. If a malfunction is suspected or other information is desired, applications engineers are available for technical assistance. Application assistance is available in the United States by calling 800-253-1230 and requesting applications support. For support outside of the United States please contact your local Quadtech, Inc. distributor.

7.2 Battery Replacement

Batteries are included in the instrument. Please contact the service center for battery replacements.
Note: Don’t open the cover of the equipment for battery replacement by yourself.

Battery Rating
1. Model number: CR2032L/1HF
2. Nominal voltage: 3V
3. Typical capacity: 225mAh

7.3 Instrument Return

Before returning an instrument to Quadtech, Inc. for service, please call our Service Department at 800-253-1230 for return material authorization. It will be necessary to include a purchase order number to expedient processing. Units found to be within the warranty period will be repaired at no-charge. For any questions on repair costs or shipment instructions, please contact our service department at the above number. To safeguard an instrument during storage and shipping, please use adequate packaging to protect it from damage, i.e., equivalent to the original packaging. Mark the box "Delicate Electronic Instrument." Return requests should be pre-approved by Quadtech, Inc. A return address will be provided to you at that time.

Note 1: This machine is heavy, please use a cart to avoid injury.