Chroma

Electrical Safety Analyzer

19032-P

User's Manual

Electrical Safety Analyzer
19032-P
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Version 1.7
November 2012

Legal Notices

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

Chroma ATE INC. makes no warranty of any kind with regard to this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Chroma ATE 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.

CHROMA ATE INC.
66 Hwaya 1st Rd., Kueishan Hwaya Technology Park, Taoyuan County 33383, Taiwan

Warranty

All Chroma instruments are warranted against defects in material and workmanship for a period of one year after date of shipment. Chroma agrees to repair or replace any assembly or component found to be defective, under normal use during this period. Chroma's obligation under this warranty is limited solely to repairing any such instrument, which in Chroma'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 purchaser. Shipment should not be made without prior authorization by Chroma.

This warranty does not apply to any products repaired or altered by persons not authorized by Chroma, or not in accordance with instructions furnished by Chroma. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

Chroma assumes no responsibility for its product being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. High voltage used in some instruments may be dangerous if misused. Special disclaimers apply to these instruments. Chroma assumes no liability for secondary charges or consequential damages and in any event, Chroma's liability for breach of warranty under any contract or otherwise, shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.

Any recommendations made by Chroma for use of its products are based upon tests believed to be reliable, but Chroma makes no warranty of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Chroma any liability in connection with the sale of our products other than set forth herein.

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Material Contents Declaration

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


: See **<Table 1>**.


: See **<Table 2>**.

<Table 1>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	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 collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

<Table 2>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

“O” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 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.

1. Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product’s specification.

Disposal

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

Verification of Compliance

Product Name	:	**Electrical Safety Analyzer**
Trade Name	:	**Chroma**
Main Model Number	:	**19032-P**
Series Model Number	:	**19055**
Applicant	:	**Chroma ATE INC.**
Address	:	**66, Hwa-Ya 1st Rd., Hwa-Ya Technical Park, Kuei-Shan Hsiang, Taoyuan Hsien 333, Taiwan**
Report Number	:	**C-C150-0812-304**
Issue Date	:	**February 11, 2009**
Applicable Standards	:	**EN 61326-1:2006 Class A** **EN 61000-3-2:2006** **EN 61000-3-3:1995+A1:2001+A2:2005** **EN 61326-1:2006 (Industrial locations)** IEC 61000-4-2:2001 IEC 61000-4-3:2006 IEC 61000-4-4:2004 IEC 61000-4-5:2005 IEC 61000-4-6:2006 IEC 61000-4-8:2001 IEC 61000-4-11:2004

One sample of the designated product has been tested in our laboratory and found to be in compliance with the EMC standards cited above and covered by the EMC Directive 2004/108/EC.

CE

TAF 0905
FCC CAB Code TW1053
NVLAP Lab Code 200575-0
IC Code 4699A
VCCI Accep. No. R-1527, C-1609, T-131, T-1441

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J. Y. Shih

(Tsun-Yu Shih/ General Manager)
Date: February 11, 2009

VERIFICATION

of conformity with Low Voltage Directive

Verification No.: ACT201845LVD

Document holder: CHROMA ATE INC.	*Type of product:* Electrical Safety Analyzer
Address: 66, Hwa-Ya 1st Rd., Hwa-Ya Technology Park, Kuei-Shan Hsiang, Taoyuan Hsien 333, Taiwan	*Type designation:* 19032-P and 19055
	Technical data: 100-240V~, 50/60Hz, 1200W, Class I

A sample of the product has been assessed with respect to CE-marking according to the Low Voltage Directive (2006/95/EC) and found to comply with the essential requirements of the Directive.
The Standard(s) used for showing the compliance and the full details of the results are given in the Test Report as detailed below:

Standard(s)	Report No.	Report Issued Date
IEC/EN 61010-1: 2001	ACT201845	February 20, 2009

The holder of the verification is authorized to use this verification in connection with the EC declaration of conformity according to the Directive. The CE marking may only be used if all relevant and effective EC Directives are complied with. Together with the manufacturer's own documented production control, the manufacturer (or his European authorized representative) can in his EC Declaration of Conformity verify compliance with the Low Voltage Directive.

Approved by:

Vincent Tan
Acts Certification and Testing Services
February 20, 2009

CE Acts LVD TESTED

Acts Certification and Testing Services Co., Ltd.
1st Floor, No. 20, Lane 61, Tianshiang Road, Taipei, Taiwan Tel: +886-2-25958775 Fax: +886-2-25983002

Safety Summary

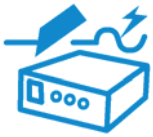
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the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

BEFORE APPLYING POWER

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

PROTECTIVE GROUNDING

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



NECESSITY OF PROTECTIVE GROUNDING

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

FUSES

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

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

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

DO NOT REMOVE THE COVER OF THE INSTRUMENT

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

Safety Symbols

	**DANGER –** High voltage.
	**Explanation:** To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.
	**High temperature:** This symbol indicates the temperature is now higher than the acceptable range of human. Do not touch it to avoid any personal injury.
	**Protective grounding terminal:** To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.
	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.
	This indicates important information or tips for the procedures and applications, etc. The contents should be read carefully.

Inspection and Examination

Before the instrument exit the factory, we have a series of inspection and measurement 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 that the instrument has to be returned. If damage is found, please file claim with carrier immediately. Do not return the instrument to Chroma without prior approval.

Standard Package

Item	Q'ty	Description
USA-type power cord	1	90° elbow USA-type power cord, length 1.8m
Power adapter	1	USA-type power cord 3P – 2P adapter
HV terminal used test cable	2	Alligator clip – cross HV head, red HV test cable, wire length 1m
GB test cable	1	The cable used for GB test, wire length 1m – Max. 40A (one pair, 2 of cables in total).
Power connector test cable	1	Test cable used only for connecting power plug, wire length 1.5m.
10A fuse	2	10A SLOW 250VAC
GB test fixture	1	Test fixture for GB zero
Quick Start Guide	2	One English version and one Traditional Chinese version.
User's Manual CD	1	CD for user's manuals in English and Traditional Chinese

Note When additional item is required, just inform Chroma the item name.

The Danger of Operating

1. When the instrument is under output voltage, please don't touch test area or you may shock hazard and result in death.
   Please obey the following items.
   - Make sure the grounding cable is connected correctly and using the standard power cord.
   - Don't touch the output terminal.
   - Don't touch test cable of connecting test termination.
   - Don't touch test termination object.
   - Don't touch any charge component of connecting output terminal.
   - As the instrument end the test or turn off output, please don't touch test unit immediately.

2. The shock accidents are usually occurred on the following conditions.
   - The grounding terminal of the instrument doesn't connect correctly.
   - The insulation glove for testing is not used.
   - After test is completed to touch test unit immediately.

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

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

Storage, Freight, Maintenance & Cleaning

Storage
When don't use the device, please pack it properly and store under a good environment. (The packing is no needed when the device under appropriate environment.)

Freight
Please use the original packing material when move the device. If the packing material is missing, please use the equivalent buffer material to pack and mark it fragile and waterproof etc to avoid the device damage during movement. The device belongs to precise equipment, please use-qualified transportation as possible. And avoid heavy hitting etc to damage the device.

Maintenance
The device is without any maintenance operation for the general user. (Except for the notice in the manual.) Please contact our company or agent when the device occurred the user judgment abnormal. Don't maintain by yourself to avoid occurred unnecessary danger and serious damage to the device.

Cleaning
Remove all connected wires and cables on the instrument before cleaning. Use a brush gently to clean the dust on it. For internal cleaning, use a low-pressure air gun to vacuum the dust inside or send it back to the distributors or agents of Chroma for cleaning.

Revision History

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

Date	Version	Revised Sections
Feb. 2009	1.0	Complete this manual
Jun. 2010	1.1	Modify Standard Accessory table in "*Inspection and Examination".* Add two new items in the chapter of "*Precaution before Use*".
Nov. 2010	1.2	Modify *"Material Contents Declaration"* to declaration with GP.
Mar. 2011	1.3	Modify *"Material Contents Declaration".*
May 2011	1.4	Modify standard package table in "*Inspection and Examination".*
Jul. 2011	1.5	Modify the following: - the description in the section of *"An Overview of Product"*. - the descriptions of "Cutoff Current", "V-display Accuracy" and "Leakage Currrent Meter" in the section of *"Specification"*. - figure 3-1 and 3-2 in the section of *"Precaution before Use"*. - figure 4-2 and the description in the section of *"Rear Panel"*. - the description in the section of *"System Parameter Setting"*. - figure 4-22 in the section of *"Remote Control"*. - figure 4-27, figure 4-28 and the description in the section of *"Test Parameter and Example"*. Add the following: - "FREQ." mode in the section of *"Various Parameter Settings"*. - "EOS" signal in the section of *"Output Signal"*. Delete the chapter of *"Firmware Update"*.
Mar. 2012	1.6	Modify the description in the sections below: - the description in the section of *"System Parameter Setting"*. - figure 4-11, figure 4-12, figure 4-13 and figure 4-14 in the section of *"Description of GB-Floating Function".* - figure 4-15, figure 4-16 and figure 4-17 in the section of *"Various Parameter Settings".* - figure 4-19 and figure 4-20 in the section of *"Remote Control. "* Add the following: - Timing diagram and its description in the section of *"Output Signal"*.
Nov. 2012	1.7	Add the section of *"OUTPUT/RETURN Setting for I MEAS"*. Modify the description in the sections below: - the description in the section of *"Features".*

- the descriptions of item 3, 4, 7 and 8 in the section of *“Precaution before Use”*.
- the description of item 12 in the section of *“Front Panel”* and the descriptions of item 1, 2 and 8 in the section of *“Rear Panel”*.
- the descriptions in the section of *“DUT Connection Method”*, *“System Parameter Setting”, “Test for Preset Setting”, “Description of GB-Floating Board”, “Program Setting”, “Test Parameter and Example” and “Remote Command”.*

Table of Contents

1. Introduction

1.1 An Overview of Product

Automatic withstand / insulation / grounding testers of the instrument are designed for automatic withstand, insulation resistance, grounding resistance, short/open circuit detection and dynamic leakage current test of electromechanical and electronic equipments.

The aspect of withstand voltage testing, the output power is AC: 500VA(5kV, 100mA), DC: 150VA(6kV, 25mA). Therefore, it is for withstand test of electronic and electromechanical and component.

Testing aspect of insulation resistance, the measurement range is 0.1MΩ ~ 50GΩ and test voltage range is 50V ~ 1000V can be set arbitrary.

Testing aspect of grounding resistance, the grounding resistance range can be measured is 10 ~ 150mΩ, under 10A can up to 510mΩ. The output test current range is 3 ~ 40A can be set arbitrary.

Testing aspect of dynamic leakage current, the measurement range is 0.01mA ~ 50.0mA (rms). The output test voltage range is 90V ~ 280VAC. The test rule matches to IEC950, UL544, UL2601 etc.

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

All of setting status, time, current, voltage, resistance value, memory number etc are list on the display, it is unnecessary to remember any parameter status which be set.

The tester equipped with Good and No Good judgment machinery and signal output of testing result and remote control. It is also for GPIB interface, SCANNING interface, RS232 interface of automatic test system. The above equipments makes high efficient and accurate test.

1.2 Features

- Floating high voltage/current simultaneous measurement patent design
- Capable of selecting DC positive voltage output or negative voltage output patent design
- Capable of selecting measurement output current or feedback current patent design.
- Standard RS232/USB interface
- AC / DC withstand voltage, insulation / grounding resistance, short/open circuit detection and dynamic leakage current scan test (option) six in one model
- Simultaneous Twin-Port output patent design
- Dynamic leakage current simulation compensation patent design
- 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
- GP-IB interface optional
- Dynamic high voltage leakage current automatic scan function optional
- Full-function front panel calibration
- With bar code scanning to trigger the test function
- Ground Bond Smart Start function

1.3 Initial Inspection

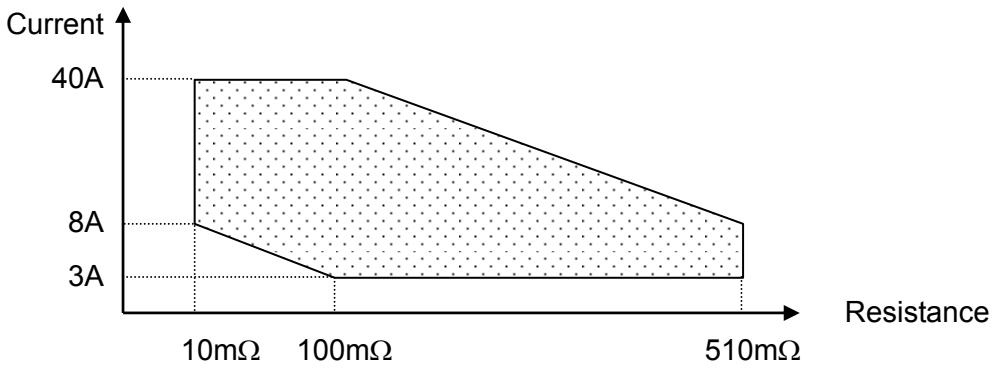
Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing materials in case that the instrument has to be returned. If damage is found, please file claim with carrier immediately. Do not return the instrument to Chroma 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

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

■ **AC/DC Withstanding Test**	
❑ Output Voltage	AC: 0.05-5.0 kV, steps 0.001kV, DC: 0.05-6.0 kV, steps 0.001kV.
❑ Load Regulation	≤ (2% of setting + 0.1% of full scale), Rated load
❑ Voltage Accuracy	± (2% of setting + 0.1% of full scale)
❑ Cutoff Current (Note 1)	AC: 0.1mA ~ 100mA, DC: 0.01mA ~ 25mA 0.1uA DC resolution
❑ V-display Accuracy	± (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 100mA range: 0.1mA - 100.0mA, 0.1mA resolution Measurement Accuracy: ± (2% 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 25mA range: 0.01mA – 25.00mA 0.01mA resolution Measurement Accuracy: ± (2% of reading + 0.5% of range)
❑ Output Waveform	50Hz, 60Hz ± 0.1%, sine wave**.** sinewave, Crest Factor:1.3~1.5
❑ Test Time(Note 2)	0.3 ~ 999 Sec. Continue
❑ Ramp Time	0 ~ 999 Sec. off
❑ Fall Time	0 ~ 999 Sec. off
❑ DWELL Time	0 ~ 999 Sec. Off (WDC only)
❑ Maximum Short Current	Up to 4kV 200mAac only
■ **Flashover (ARC) Detection (SPC) (Note 3)**	
❑ Detection Current	AC: 1mA – 20mA, DC: 1mA – 10mA, resolution 0.1mA
❑ Min. pulse width	40us 20us 10us 4us Approx.
■ **TwinportTM function (SPC)**	
❑ Functions	WV and GB test can be performed at the same time. (ON/OFF)
■ **Insulation Resistance Test (Note 4)**	
❑ Test Voltage	DC: 0.05kV ~ 1kV, Constant Voltage
❑ V-display Accuracy	± (2% of reading + 0.5% of full scale)
❑ Resistance Range	0.1MΩ ~ 50GΩ
❑ Measuring Accuracy	≥ 500V: 1 ~ 1000MΩ: ± (5% of reading + 0.5% of full scale) 1001 ~ 9999MΩ: ±(10% of reading + 0.5% of full scale) 10GΩ ~ 50GΩ: ±(15% of reading + 1% of full scale) < 500V: 0.1 ~ 1000MΩ: ±(10% of reading + 0.5% of full scale) < 100V: 0.1 ~ 1000MΩ: ±(15% of reading + 0.5% of full scale)
❑ Test Time(Note 2)	0.3 ~ 999 Sec. Continue
■ **Ground Bond Test (Note 5)**	

❑ Output Current	3.00 ~ 40.00Aac. Constant Current, 0.01A step
❑ Current Accuracy	± (2% of setting + 0.1% of full scale)
❑ Output Waveform	50Hz, 60Hz ± 0.1%, sine wave
❑ Current Meter	0.00 ~ 40.00A
❑ Meter Accuracy	± (1% of reading + 0.17% of full scale)
❑ Resistance Range	10.0 ~ 510.0mΩ (with offset value)
❑ Resistance Accuracy	± (2% of reading + 0.1% of full scale) at ≥ 10A ± (2% of reading + 1% of full scale) at <10A(<210mΩ) ± (3% of reading + 2% of full scale) at <10A(>210mΩ)
	
❑ Limit Value Setting	HI - LIMIT 0.1 ~ 510.0mΩ
❑ Offset Range	0 ~ 500.0mΩ
❑ Test Time(Note 6)	0.3 ~ 999 sec. Continue
■ **Secure Protection Function**	
□ Ground Fault Interrupt Leakage Current (for WVAC only)	AC:0.25mA~0.75mA, ON/OFF selectable
□ H.V Floating Output	Front panel H.V output only
□ Fast Discharge	Approx. 0.2S (Discharge Voltage 5.1kV)
□ Panel Operation Lock	YES, with password On/Off
■ **Floating Output(Note 7)**	
□ Function	Wac, Wdc, IR
□ Leakage Current	Less than 3.5mAac 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, GR-Hi , GR-Lo, GFI, GBVO (Long Sound)
■ **Remote Connector**	
□ Rear Panel	9-Pins connector: START, RESET, UNDER TEST, PASS, FAIL
□ Start/Reset Control	TTL Low Level Active, minimum 20mS
■ RS232 Interface	Baud rate 300 ~ 19200, data bits: 8. stop bit: 1

■ USB	The programming language is SCPI.
■ Ambient Temperature and Relative Humidity	
❑ Specifications range	18 to 28°C (64 to 82°F), 20 to 70% RH.
❑ Operable range	0 to 40°C (32 to 104°F), 20 to 80% RH.
❑ Storage range	-10 to 50°C (14°C to 122°F), ≤ 80% RH.
■ Power Requirement(Note 8)	
❑ Line Input	90Vac ~ 250Vac , 50 or 60 Hz
❑ Power Consumption	No load: < 100W, Rated load:1000W, Maximum load:1200W
❑ Dimension	430 W x 133 H x 500 D mm
❑ Weight	<24 kg

Ground Bond Floating

Rear Panel Output Only	
HV Output (Fixed port 3)	HV output can set to HV, Low or Off. Maximum Voltage is 5kVac, 6kVdc Maximum Current is 100mA ac or peak dc Wac maximum add 10 counts extra error Wdc maximum add 2 counts extra error
Ground Bound Output (Floating Ground)	Ground Bound can set to Close or Open (Floating Voltage 1000Vrms or 1400Vpeak ac maximum) Ground Bond Close, the maximum current is 40Amp. Maximum add a 2mΩ extra error.

Note

1. Twin Port ON for 50mAac, 6mAdc maximum.
   Twin Port ON for less than 1/2 duty cycle output only.
   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.
2. The minimum testing time arrives at 90% output voltage specification(NO load).
3. Design in Specifications. Validation point is 1.25kV with a 250kΩ resistor.
4. 10GΩ~50GΩ without scan unit only.
5. Twin Port ON for 40Amps output maximum.
   Twin Port ON for less than 1/2 duty cycle output only.
   GB Scanner output add extra 2mΩ error.
   For reaching optimal accuracy, please use the standard four-wires type for measuring.
   When offset lower than 10mΩ, it is over test specification. By using offset can add extra 5mΩ error.
6. The minimum testing time arrives at 90% output current specification(NO load).
7. Except TWIN-PORT ON, GFI ON/OFF, Scanner installed.
8. Except GB-F 4kV option, Scanner installed.

3. Precaution before Use

The tester is with high voltage output up to 6KV sending to external test. It may occur injury and death result from error operation. Please peruse notice item of this chapter and remember to avoid accident.

1. Shock Hazard

For preventing shock be occurred. Before using the tester, put on insulation glove firstly and then running function related to electricity.

2. Grounding

There is a ground terminal on the rear panel cover of the tester. Please use appropriate implement to connect the ground terminal to earth actually. If not, there may be high voltage existed on the cover of the tester. It is very danger whatever touches the machine under the above statuses. It may cause shock hazard, therefore please make sure to connect ground terminal to earth. As Figure 3-1 arrow shown.

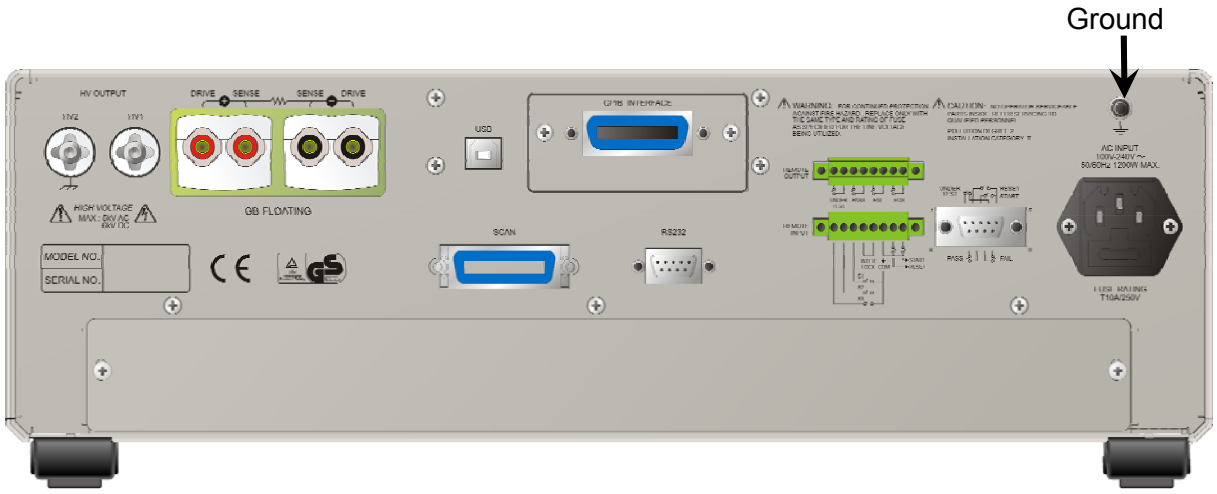


Figure 3-1

3. Connect test cable to HV1/HV2 terminal

It is necessary to check if there is loosen or drop occurred in test cables of HV1, HV2 or DRIVE- terminal under operating condition at any time. If you want to connect DUT by test cable, please connect test cable of HV2 or DRIVE- terminal to DUT(Device Under Test). The uncompleted connection and drop of test cable of HV2 or DRIVE- terminal is very danger, as there is full of high voltage on DUT. After plugging high voltage jack in HV1 and HV2 and then rotate 90° to screw up clockwise for avoiding the drop of test cable.

4. Connection test of high voltage output terminal

After the test cable of HV2 or DRIVE- terminal has been connected. Then follow the below procedures to connect high voltage output cable.

- Press [STOP] key firstly.
- Confirm DANGER indication LED does not light.
- The test cable of HV2 or DRIVE- terminal with HV1 terminal is short-circuited; confirm there is no voltage output.
- Plug high voltage test cable in HV1 terminal.
- Connect the test cable of HV2 or DRIVE- terminal to DUT finally, and then HV1 high voltage test cable also be connected.

5. Test stop

When the test is over the and no need to use, or the tester is not run status or needs to exit during use, please be sure power switch is on OFF (that is turn off power). As Figure 3-2 shown.

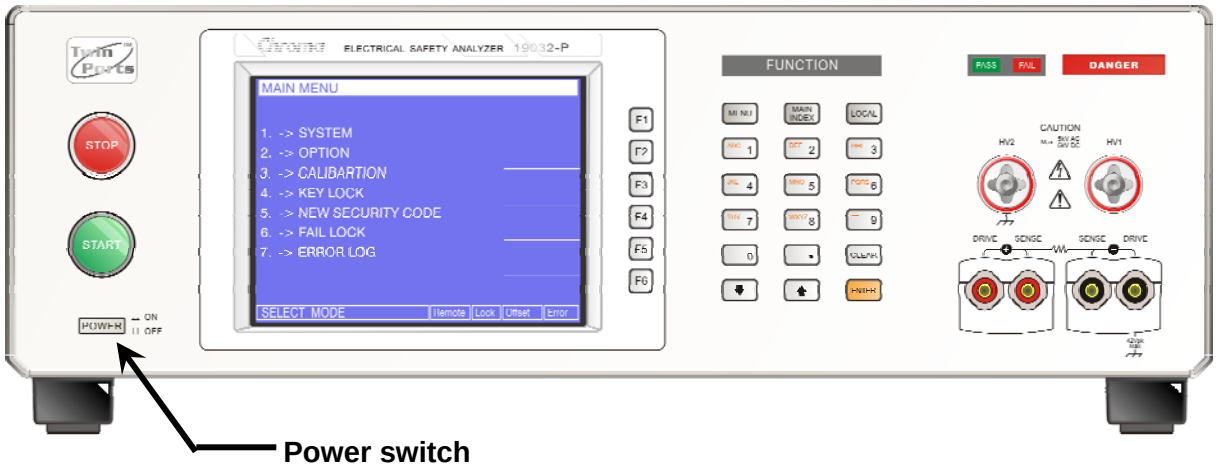


Figure 3-2

6. The dangerous area under test mode

It is very danger to touch high voltage area under operation status. Such as touch DUT, test cable, probe and output terminal.

⚡ CAUTION When the main unit is under test status, please don't touch alligator clip on test cable. Because the insulation of plastic layer is not enough, touch it may cause hazard. As Figure 3-3 shown.

Figure 3-3

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

7. Test complete confirmation

You may touch DUT, high voltage test cable or output terminal etc high voltage areas under modifying circuit or others test requested conditions. Please confirm the following at the first.

※ Power switch is turned off.

※ DUT may full of high voltage when test is completed. In the meantime, you need to pay attention to obey descriptions of item 8 and 9 in this section. Please follow the described procedures to execute.

<<< Notice! When testing insulation resistance is charging. >>>

8. Charge

When it is under testing, DUT, capacitor, test cable, probe and output terminal even includes the tester are full of high voltage. After turning off the power switch, it needs a period of time to discharge. Please obey the above descriptions, don't touch any place may cause shock especially on power just turn off.

9. Confirm charging voltage has been discharged completely

The discharged time of charging voltage depends on testing voltage and DUT characteristic. To assume that high voltage add to DUT is equivalent to high voltage add to 0.01uF capacity parallel 100MΩ resistance circuit. After turning off power, the voltage which add on testing and DUT decrease to lower than 30V and its' needed time about 3.5 seconds. When test voltage is 500V needs about 2.8 seconds. To assume the time constant of DUT is known, if you want to know the voltage decrease to below 30V needed time. Please follow the above procedures, multiply decrease to below 30V needed time-by-time constant. As *Figure 3-4* shown.

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

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

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

$-t/RC = \ln 0.03$ ∴ $t = 3.5$ Sec

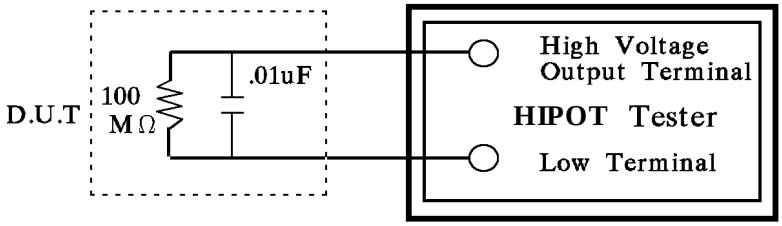


Figure 3-4

10. Remote control the main unit

The instrument with remote control, high voltage output control by external control signal usually. For your safety and prevent from hazard, please obeys the following rules.

- Don't allow any unexpected high voltage output that may cause danger.
- When the main unit output high voltage, don't permit the operator or others personnel to contact DUT, test cable and probe output terminal.

※ Notice ※

11. Turn on or turn off power switch

When power switch is cut off, it needs a few seconds to re-turn on. Please don't turn on and turn off continuously. It is very danger to do that under high voltage output. **When turn on or turn off power, don't connect any object to high voltage output terminal to avoid hazard that result from abnormal high voltage output.**

12. Others notice items

Don't make short-circuited of output cable, grounding cable, transmission cable or AC power to prevent from the analyzer is full of voltage. Please connect the cover of the analyzer to earth firstly when high voltage output terminal HV1 is short-circuited with HV2 terminal.

<<< Dangerous Event >>>

13. The danger management

Under any danger circumstances, such as shock, DUT burning or the main unit burning. Please obey the following procedures to avoid the more danger.

- Cut off power switch firstly.
- Then pull off the plug of power cord.

<<< Solution >>>

14. Problems

Under the below circumstances, the occurred problem are very danger. Even press [STOP] key, the output terminal may output high voltage.

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

15. DANGER indication LED error

When press [START] key, there is already reading on the voltage meter and DANGER LED is still not light. In the meantime, the indication LED may be error please turn off immediately. Please send it to our company or office for reparation.

16. If the analyzer needs long time using under normal operation. Please notice 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 analyzer is 90Vac ~ 250Vac, 50 or 60 Hz.

Only can replace fuse under power-disconnected status, remove fuse stand from power socket and press new fuse slightly into fuse stand then plug in the power socket.

⚠WARNING Please use correct specification when replace fuse or may cause hazard.

18. Normal operation of the unit is AC power

If power is unstable, it may cause the unit function is not actual or abnormal. Therefore, please use appropriate equipment turn to suitable power such as power stabilizer.

19. Output power is 500VA

When DUT drawing mass current before deadline of fail judgment and output current, it may flows mass current (about ten amperes) up to ten milliseconds. Before processing test may be the same condition. Please notice the capacity of power cord and the current cable of linking with other instrument or equipment.

20. Storage

The unit normal operation temperature humidity range is 5°C ~ 40°C, 80% RH. If over this range then function may malfunction. Please don't position the equipment so that it is difficult to operate 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 original material

packing and then store it. For correct test and safety, please keep it from direct sunlight or 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, to attain the precision in the specification, please warm the instrument over 15 minutes.

22. Warning signal of testing

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

23. TWIN PORT

The unit process twin port measurement mode with AC withstand, DC withstand or IR (insulation impedance) on GB (grounding impedance). When process the maximum AC or DC output current of this measurement mode, please don't work over 1/2 the maximum specification continuously.

24. Descriptions of ground bond lead wiring

The maximum output current of this unit is 40amp AC, a no good connection will cause temperature rising and ground bond output terminal may be burned down. Please follows the below steps to make good wiring connection.

- Using box spanner to tighten up test cable of DRIVE+ and DRIVE-.

25. Keep test cable away from the panel

Please keep the high voltage cable or the DUT away from the panel at least 30 cm during operation to avoid the display interference caused by high-voltage discharge.

26. Notices for connecting automated device

- The grounding system of the device and the automated station should be connected together.
- Add anti-interference iron core to the high voltage cable and the 2 ends (device output and DUT) of RTN/LOW test cable with winding at least 1 circle.
- The high voltage and RTN/LOW test cable must be separated from the control cable.
- The high voltage and RTN/LOW test cable must keep proper distance from the analyzer panel.

4. Description of Panel

4.1 Front Panel

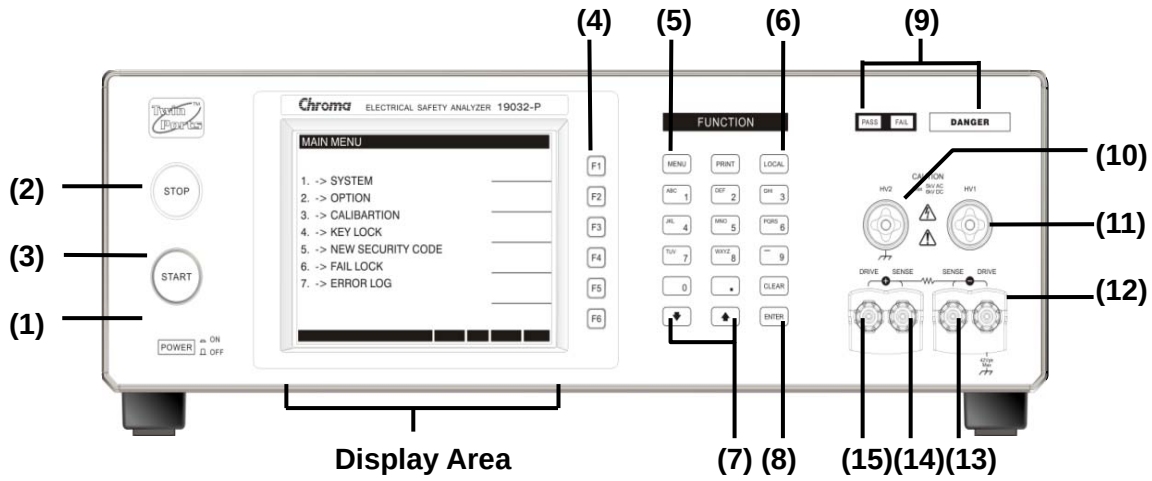
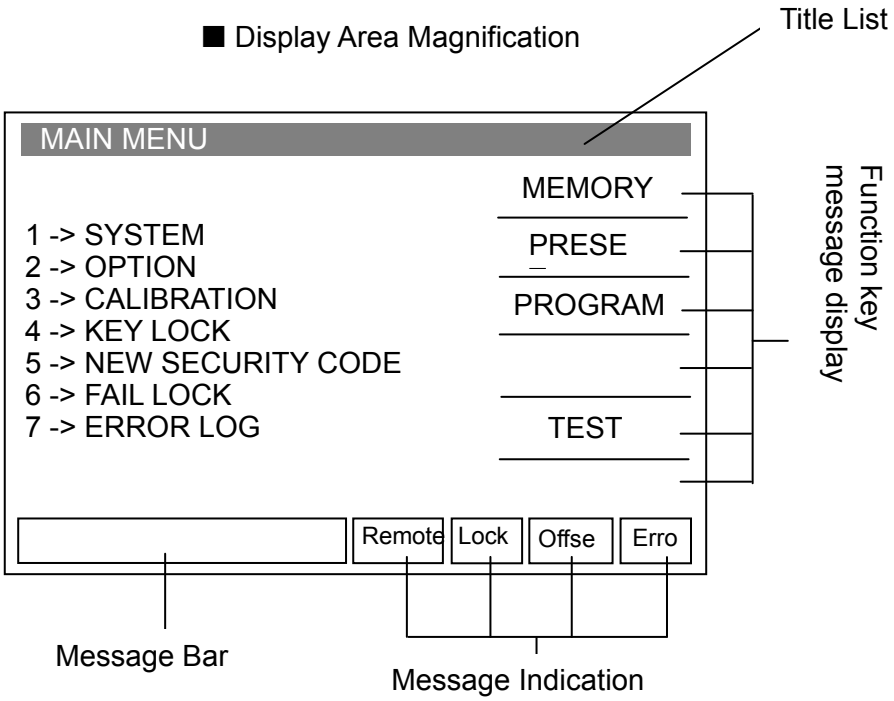


Figure 4-1

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



Display Area
Title List: This list displays the current setting of main unit or testing mode.

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

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

Message Indication Diagram:

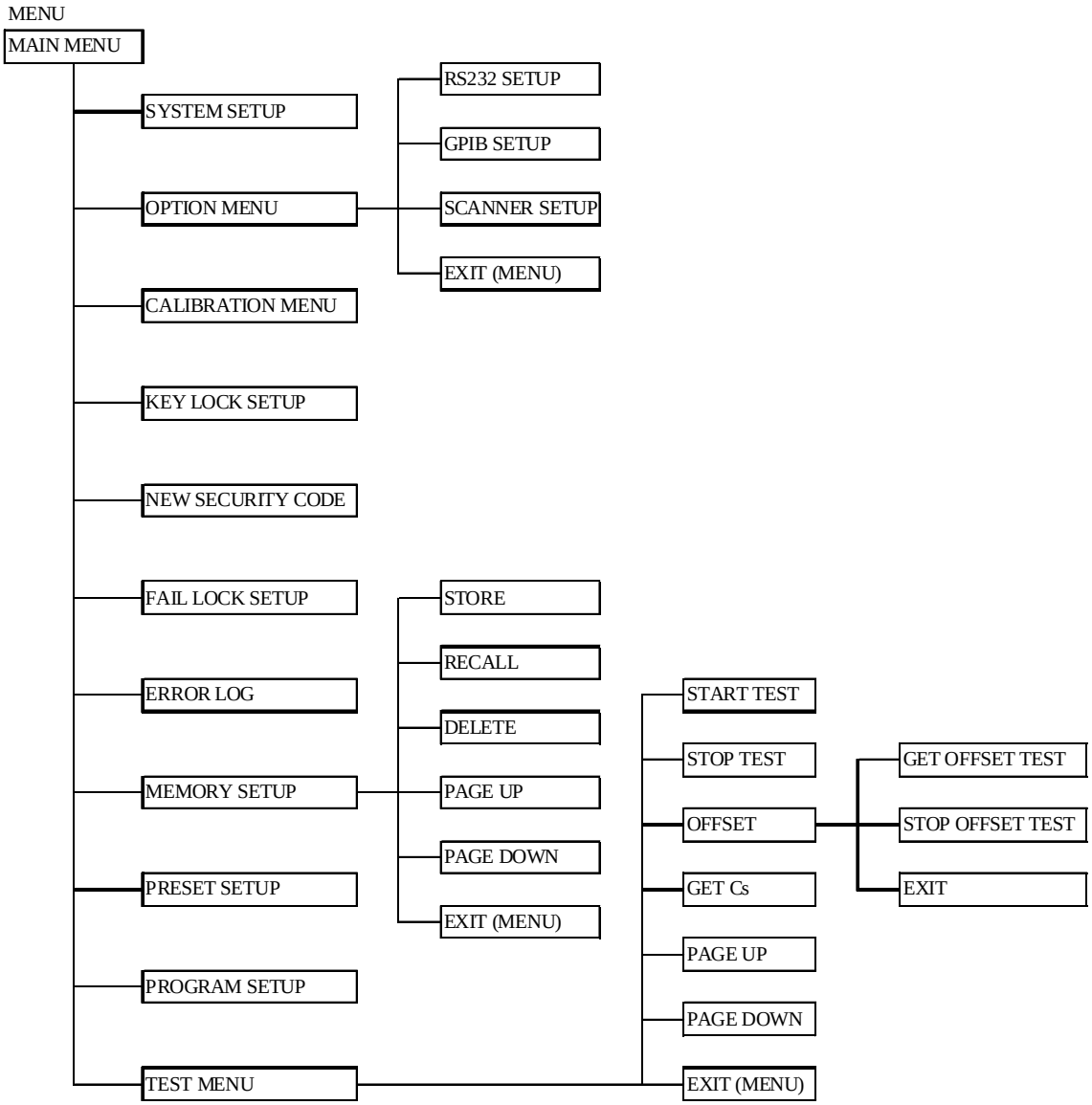
Remote: When this area is highlighted, it means the main unit is under Remote status. That is the main unit controlled by PC through RS232 or GPIB connect to PC. At the same time, all of keys are malfunction except for [STOP] and [LOCAL] keys.

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

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

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

Simplified Function Flow Chart



Key Area

(1) Power Switch : The switch provides AC power source that the analyzer is needed. Before starting, please read Chapter 3 "Precaution before Use" firstly.

(2) STOP Key : Reset key, after pressing this key the main unit returns to standby testing status immediately. That is cut output and clear all of 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 : Function key. Under different display menus, there are different functions. The right side of display has corresponding function description. If the description is blank, it means corresponding function is invalid.

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

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

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

(8) Data Entry Keys/Program Keys

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

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

[CLR]: Clear key. When input test parameter, if there is any error can press this key to cancel error data and then input again.

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

(10) HV2 : This terminal includes two states. (1) High voltage output terminal (when GFI setting is FLOAT) (2) Reference terminal of high voltage output terminal (HV1) is low potential terminal (when GFI setting is ON or OFF).

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

(12)DRIVE (-) : (1) Ground Bond current test terminal
(2) The reference terminal for HV output terminal (HV1) is low potential terminal when GFI option setting is ON or OFF.

(13)SENSE (-) : The grounding impedance test negative, Sense negative terminal.

(14)SENSE (+) : The grounding impedance testing positive terminal, Sense positive terminal.

(15)DRIVE (+) : High electric potential terminal of mass current output. When the terminal is grounding resistances test, the high electric potential terminal of mass current output.

4.2 Rear Panel

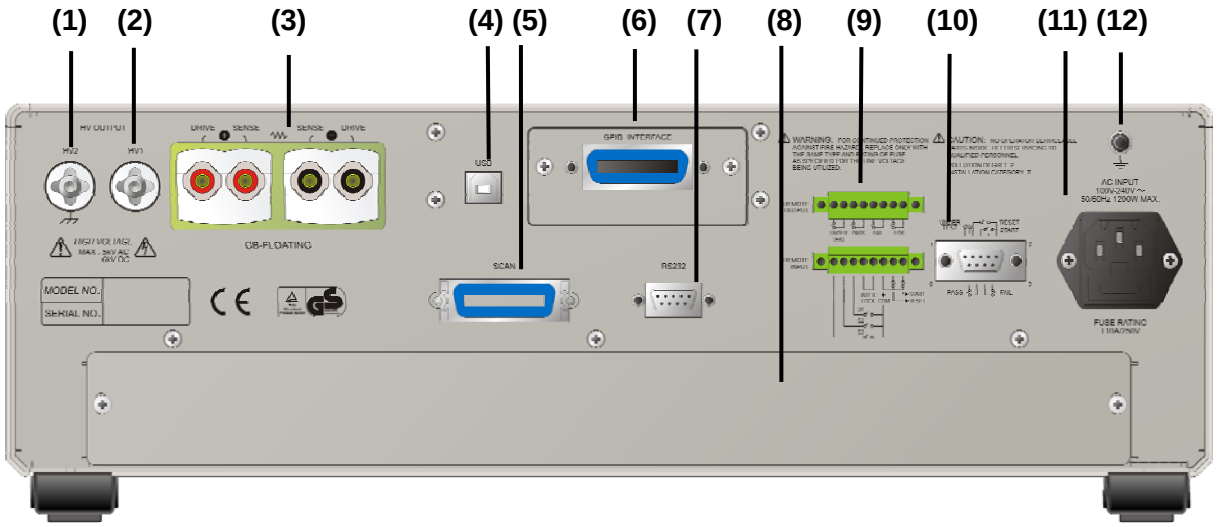


Figure 4-2

(1) HV2 : It is short-circuited with HV2 on front panel.

(2) HV1 : It is coordinated with CHANNEL 3 setting.

① H: High potential terminal for HV output
② L: The reference terminal for HV output terminal (HV1) is low potential terminal when GFI option setting is ON or OFF.
③ X: Open circuit

(3) Rear Panel GB Output Terminal: This terminal Floating status is selectable, that is open-circuited with front panel GB terminal.

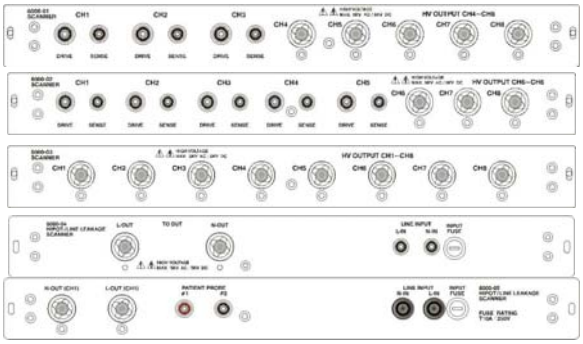
(4) USB : USB terminal

(5) SCAN Interface : This interface can connect with 9030A Scanning Box (Option).

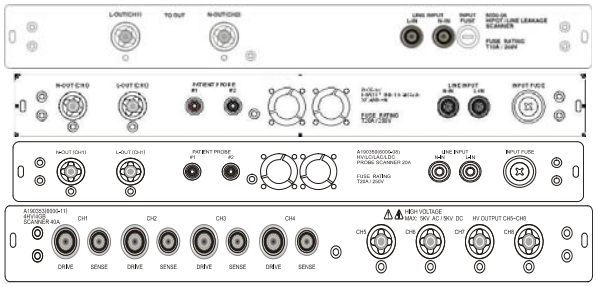
(6) GPIB Interface(Option): This socket is for optional GIPB interface (IEEE-488-1978). The detailed descriptions, please refers “Chapter 5 – GPIB/RS232 Operation Description (IEEE-488.2)” in this manual.

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

(8) Plug in SCANNER Insert Hole (Option):



Option (6000-01): 5 points of HV output & 3 (UL approval) sets of grounding terminals.
Option (6000-02): 3 points of HV output & 5 (UL approval) sets of grounding terminals.
Option (6000-03): 8 points of HV output. (UL approval)
Option (6000-04): HV / LC scanner
Option (6000-05): HV / LC scanner with probe



Option (6000-06): L-N Scanner & Leakage Current Scanner
Option (6000-07): HV / LC scanner with probe 20A
Option (6000-08): HV / LC / LAC / LDC probe scanner 20A
Option (6000-11): 4 points of HV output & 4 sets of grounding terminals

Figure 4-3

After SCANNER is installed GFI=OFF, the analyzer measures current by the mode of measuring OUTPUT Current.

(9) REMOTE I/O : The test result signal input/output terminal.

START: Start test signal input terminal.

RESET: Stop test signal input terminal.

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

UNDER TEST: When the analyzer is under test status, this output terminal will short circuit. Control external signal is by using this short condition. The junction specification 125V AC current is lower than 1A action time. This analyzer is under testing status until STOP is stopped.

PASS: When the analyzer judges DUT as pass, this output terminal will short circuit. Control external signal is by using this short circuit condition. The junction specification 125V AC current is lower than 1A. The action time is from judged as pass to be stopped.

FAIL: When the analyzer judges DUT as fail, this output terminal will short circuit. Control external signal is by using this short circuit condition. The junction specification 125V AC current is lower than 1A. The action time is from judged as fail to be stopped.

EOS: When the tester is performing the test in test step, the output terminal will be short-circuited. By using this short-circuited condition to control external signal. The connection point specification 125V AC current is lower than 1A.

S1: The terminal is short-circuited with COM, recall/read test setting in the first group memory.

S2: The terminal is short-circuited with COM, recall/read test setting in the second group memory.

S3: The terminal is short-circuited with COM, recall/read test setting in the third group memory.

(10)9Pin Connector: All of 9 pin D-Sub connector functions are the same as (9) Remote I/O.

(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 specification of using fuse please refers "*Chapter 3 – Precaution before Use*" or descriptions of rear panel in this manual.

(12)GND Terminal: Safety GND terminal, please use adaptable implement to connect this grounding terminal actually. If there is no grounding actually, the circuit with GND terminal or other instruments connecting cable with GND terminal is short circuit. The cover of analyzer may exist high voltage. This is very dangerous, anyone touch the analyzer under the

above status may cause damage. Therefore, it is necessary to connect safety GND terminal to ground.

4.3 Notice Items and Procedures before Operating

1. Before plugging AC power cable, please confirm power that use firstly and description of rear panel is match or not and power switch is OFF status.
2. Before turning on power, please peruse "*Chapter 3 – Precaution before Use*" and remember it.
3. When turns on power, the analyzer will self-test. If there is abnormal condition, please turns off switch and pulls off power cord immediately.

4.4 DUT Connection Method

- **DUT Connection Method of AC/DC/IR/OSC mode**

4.4.1 Set GFI to FLOAT

To ensure there is no voltage output firstly and DANGER LED doesn't lit. The clips of two test HV cables are short-circuited each other, plug HV connector of test HV cable at two sides into HV1 and HV2 output socket with simultaneous as well as ensure there is no HV output. Connect the HV1 and HV2 terminal connected test HV cable clip to DUT.

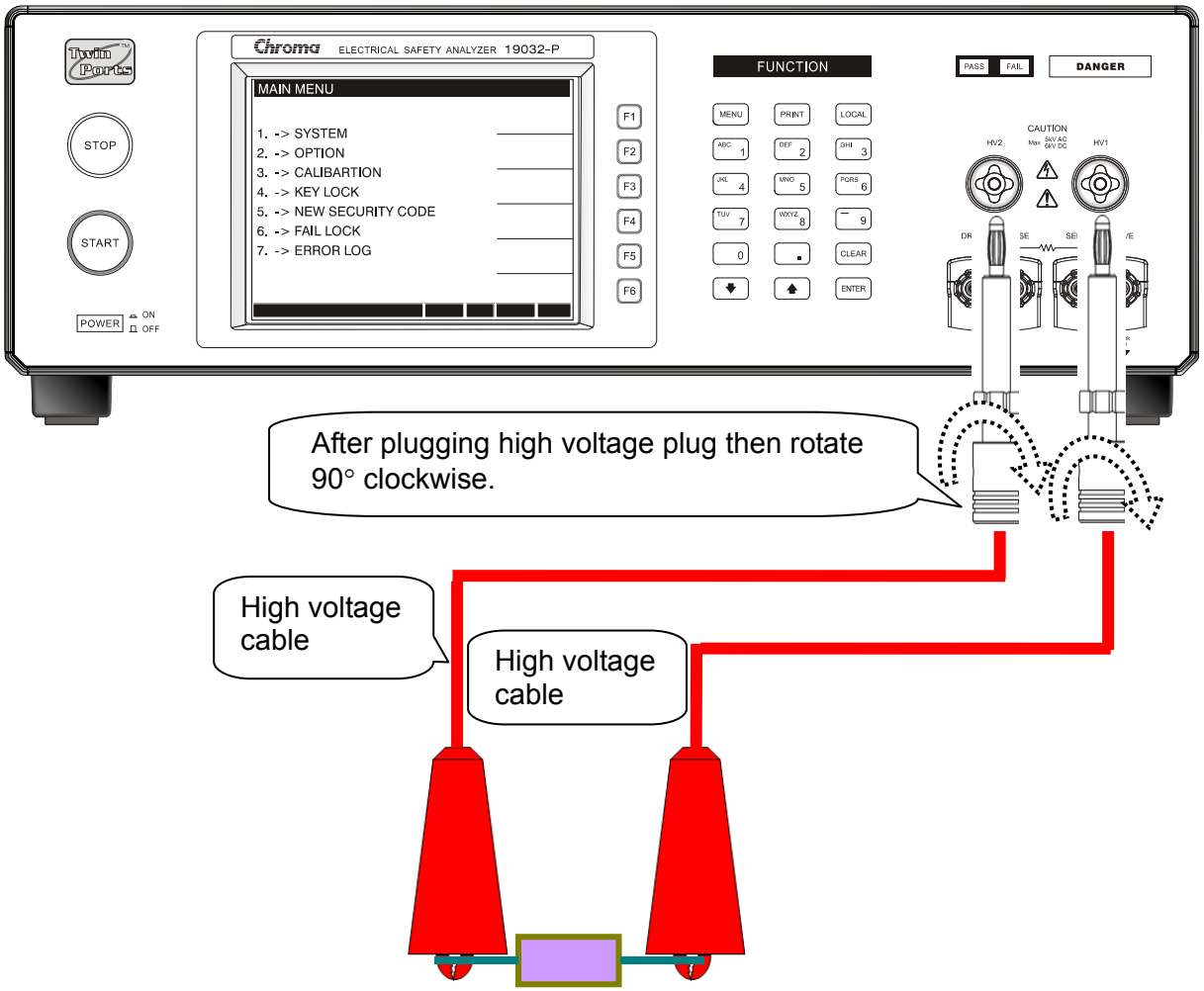


Figure 4-4

HV1 and HV2 of high voltage output terminals are separately connected to DUT by high voltage test cable. After plugging high voltage plug in HV1 or HV2 of high voltage stand, then rotate 90° clockwise to avoid high voltage cable fall off.

4.4.2 Set GFI to ON/OFF

To ensure there is no voltage output firstly and DANGER LED doesn't lit. The clips of test cable for low potential used is short-circuited with test HV cable each other, connect test cable for low potential to DRIVE- terminal of main unit firstly and next plug HV connector of test cable into HV1 output socket as well as ensure there is no HV output. Connect the test cable with low potential (DRIVE-) to the DUT and next connect the one with high potential.

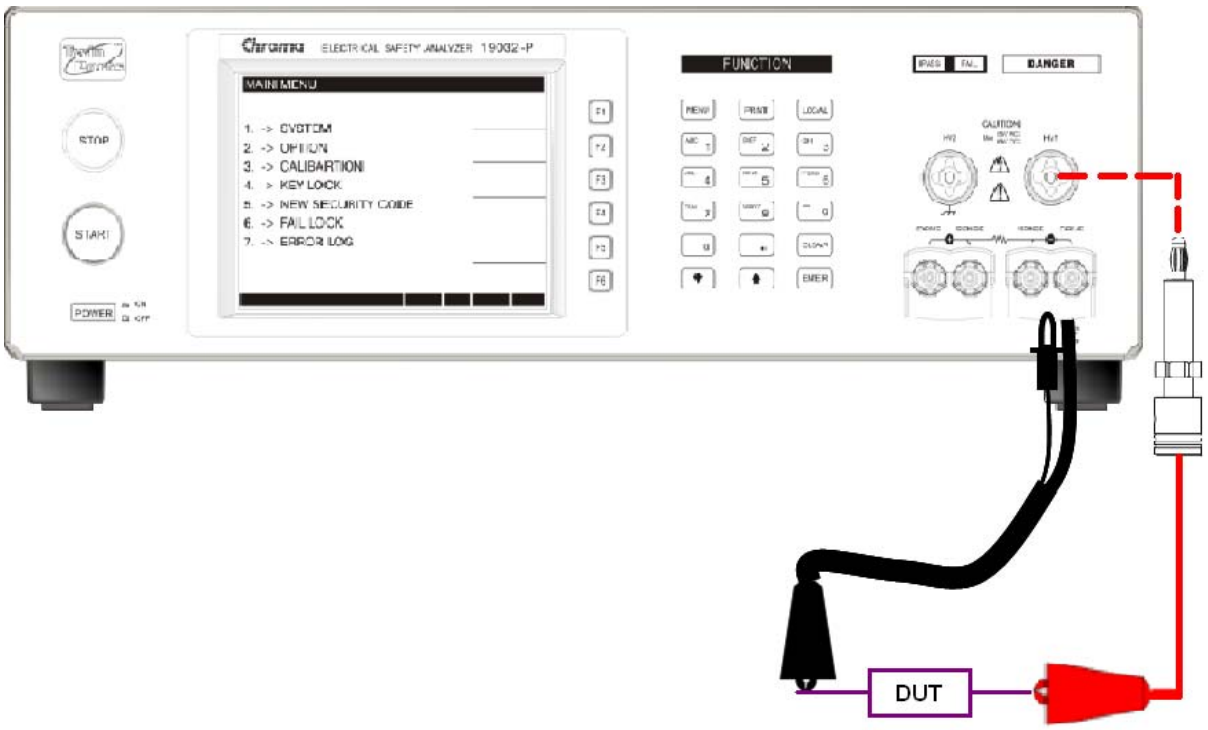


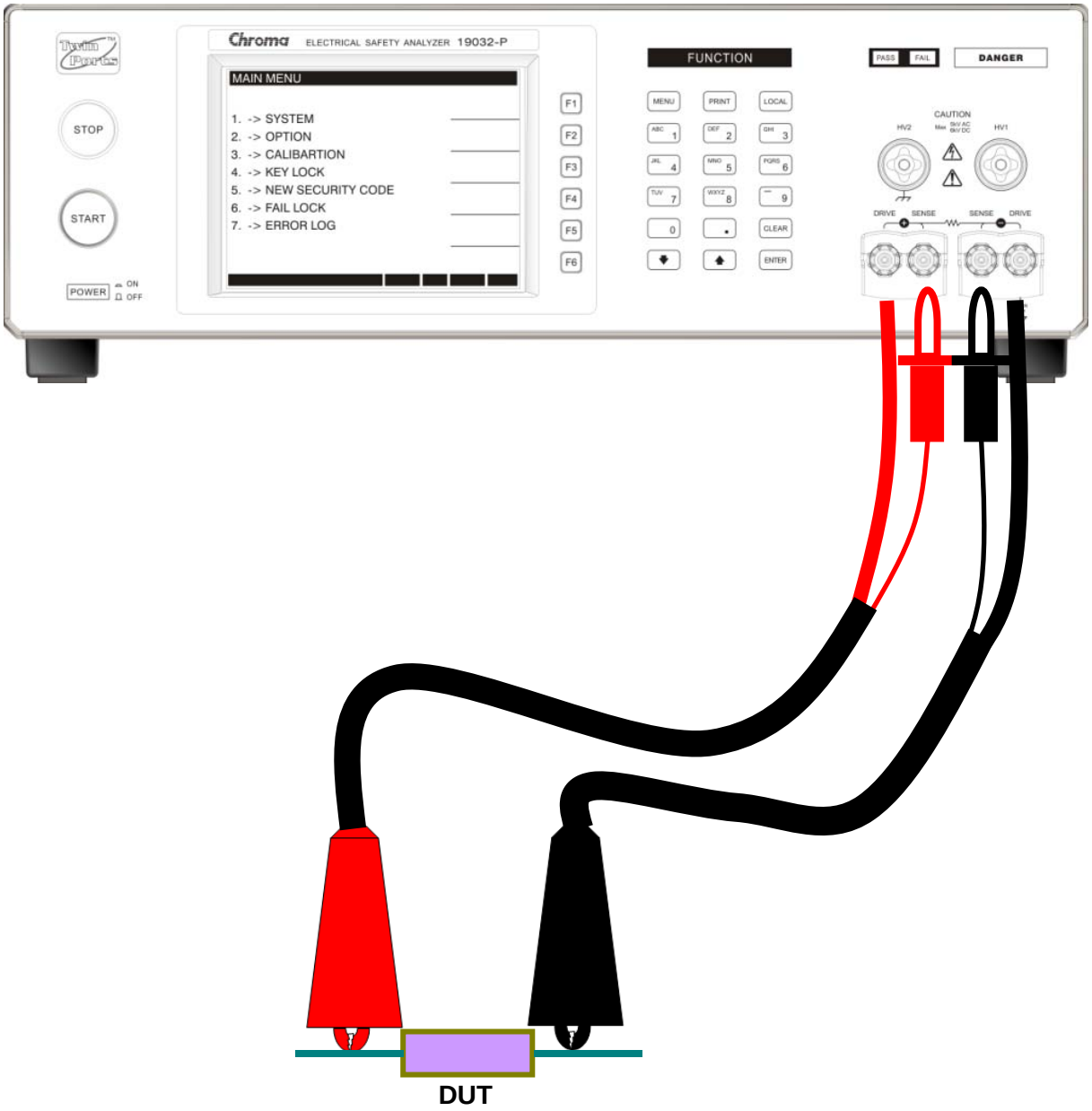
Figure 4-5

HV1 (HV test cable) and low potential DRIVE- of high voltage output terminals are separately connected to DUT by test cable.

Note The connection method of test cable is the same as *Figure 4-4*.

■ **DUT connection method of GB mode**

To ensure there is no voltage output firstly and DANGER LED doesn't lit. To screw up test cable and terminal by sleeve tool then connect the test cable to DUT.



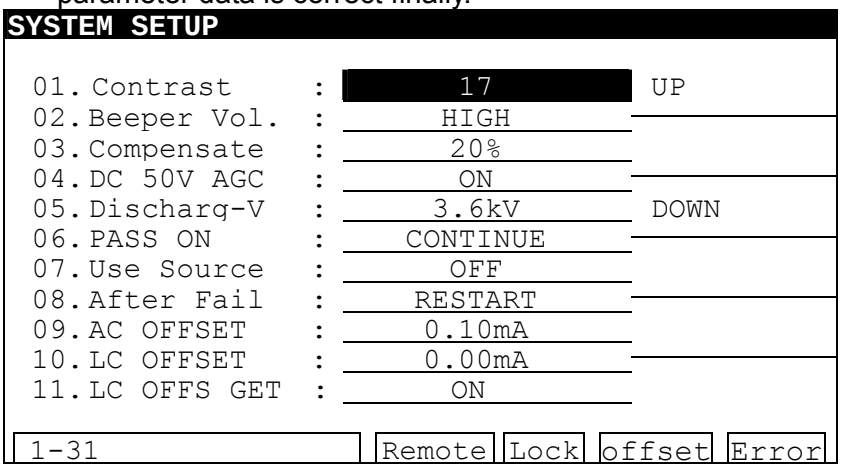
DRIVE+, SENSE+ and DRIVE-, SENSE- of GB output terminals are separately connected to DUT by GB test cable. DRIVE+ and DRIVE- terminals should screw up test cable by sleeve tool.

4.5 System Parameter Setting

Operation methods:

1. When title shows "SYSTEM SETUP", press [△], [▽] keys to move the highlighted cursor to the parameter item which want to set.
2. Press numeral/character key or Function Keys to set this item parameter data.

3. If shows blinking cursor, it means parameter data is not completed. When data input is error, can press [CLR] to clear and input again. Please press [ENTER] to confirm parameter data is correct finally.



System parameter setting data description:

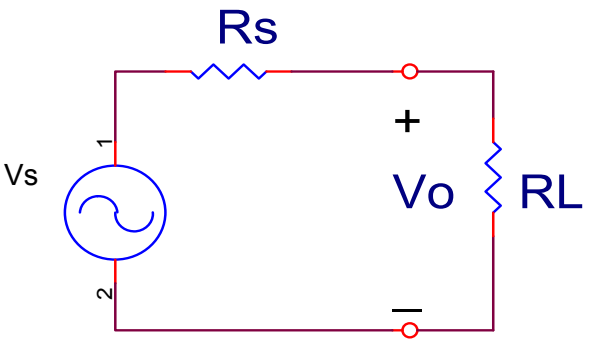
Setting Item	Range	Initial Setting	Description
Contrast	1~31	17	Adjust LCD brightness
Beeper Volume	LOW /MEDIUM/ HIGH/OFF	HIGH	Adjust the buzzer volume
Compensate	5% - 50%	20%	LC input voltage compensation
DC 50V AGC	ON/OFF	ON	Hardware compensation for above DC 50V
Discharg-V	0.05-5.1KV	3.60KV	DC discharge setting
Pass ON	0.1~99.9s, continue	CONTINUE	When DUT judged as Good, PASS signal shorted time of REMOTE terminal on rear panel.
Use Source	ON/OFF	OFF	This instrument connects with AC Source, please set it as ON.
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 restart directly. (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 = $\sqrt{(\text{Real measurement value})^2 - (Offset)^2}$
LC OFFSET	0 ~ 2.5mA	0.00mA	(1) When Offset value is higher than **LC OFFSET** value, Current reading = Current real measurement value – Offset value. (2) When Offset value is lower than LC OFFSET value, Current value = $\sqrt{(\text{Real measurement value})^2 - (Offset)^2}$

LC OFFS GET	ON/OFF	ON	(1) When the setting is ON, LC Mode will be included as processing OFFSET GET. (2) When the setting is OFF, LC Mode won't be included as processing OFFSET GET.
DC OUTPUT	POSITIVE / NEGATIVE / ALTERNAT	POSITIVE	(1) When the setting is POSITIVE, TEST MODE selects DC. HV1 is positive voltage when outputting voltage. (2) When the setting is NEGATIVE, TEST MODE selects DC. HV1 is negative voltage when outputting voltage. (3) When the setting is ALTERNAT, TEST MODE selects DC. REVERSE V can be set to ON or OFF. ■ When REVERSE V is set to ON, HV1 output voltage is negative voltage type. ■ When REVERSE V is set to OFF, HV1 output voltage is positive voltage type.
IR OUTPUT	POSITIVE / NEGATIVE / ALTERNAT	POSITIVE	(1) When the setting is POSITIVE, TEST MODE selects IR. HV1 is positive voltage when outputting voltage. (2) When the setting is NEGATIVE, TEST MODE selects IR. HV1 is negative voltage when outputting voltage. (3) When the setting is ALTERNAT, TEST MODE selects IR. REVERSE V can be set to ON or OFF. ■ When REVERSE V is set to ON, HV1 output voltage is negative voltage type. ■ When REVERSE V is set to OFF, HV1 output voltage is positive voltage type.
IR DYN. RNG	NORMAL / HI DYN.	NORMAL	(1) When the setting is NORMAL, it is applicable for IR MODE test value stable DUT. (2) When the setting is HI DYN. , it is applicable for IR MODE test value with variation that is unstable DUT.
IR AVERAGE	ON / OFF	OFF	(1) When the setting is ON, IR MODE measurement is the value after getting average. (2) When the setting is OFF, IR MODE measurement is the realtime value.

4.5.1 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 ON and also can be set as OFF. 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~1kV (Hardware AGC is always OFF, software AGC initial setting is ON and also

can be set as OFF.)



Vo / Vs = RL / (Rs + RL)

1. Hardware AGC: Because Vo<Vs is 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 is 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.

4.5.2 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.

4.5.3 OFFSET

1. DC OFFSET: Before testing WDC mode, please connects test cable first. After the fixture is tested, then processes OFFSET for ensure test value accuracy. The current calculation formula: Current reading = Current real measurement value – Offset value.
2. AC OFFSET: Before testing WAC mode, please connects test cable firstly. After the fixture is tested, then processes OFFSET for ensure test value accuracy. Especially when test voltage is higher and leakage current of test fixture and instrument is more increase. The happened of Offset current is often caused by capacitance feature. According to mathematics, when test a resistive load, its current value = $\sqrt{(\text{Resistance load value})^2 + (Offset)^2}$. Therefore, when measured out resistive load current value, current reading = $\sqrt{(\text{Real measurement value})^2 - (Offset)^2}$. When tests a capacitive load, current reading = (real measurement value) – (Offset).
3. LC OFFSET: Before testing dynamic leakage current mode, please connects test cable first. After the fixture is tested, then processes OFFSET for ensure test value accuracy especially when measures small current. The leakage current of general test fixture, isolation transformer and the instrument are mostly caused by capacitance feature. According to mathematics, when test a resistive load, its current value = $\sqrt{(\text{Resistance load value})^2 + (Offset)^2}$. Therefore, when measured out resistive load

current value, current reading = $\sqrt{(\text{Real measurement value})^2 - (Offset)^2}$. When tests a capacitive load, current reading = (real measurement value) – (Offset)

4. GB OFFSET: Please use the standard 4-wires test cable to process standard resistance test, doesn't need additional OFFSET operation. If using with our grounding accessories, the maximum test error is possible increased to 2mohm. Before Offset test is done, please be sure offset resistance. When Offset resistance value is lower than 5mohm, do Offset is not recommended. Incorrect Offset may influence error of real test value.
5. OSC OFFSET: There is stray capacitance on wire or fixture, please does OFFSET elimination again on changing wire or fixture every time for ensure the accuracy of testing.

4.6 Memory Management of Test Parameter and Test Preset Parameter

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

4.6.1 Read Memory

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

4.6.2 Store Memory

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

4.6.3 Delete Memory

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

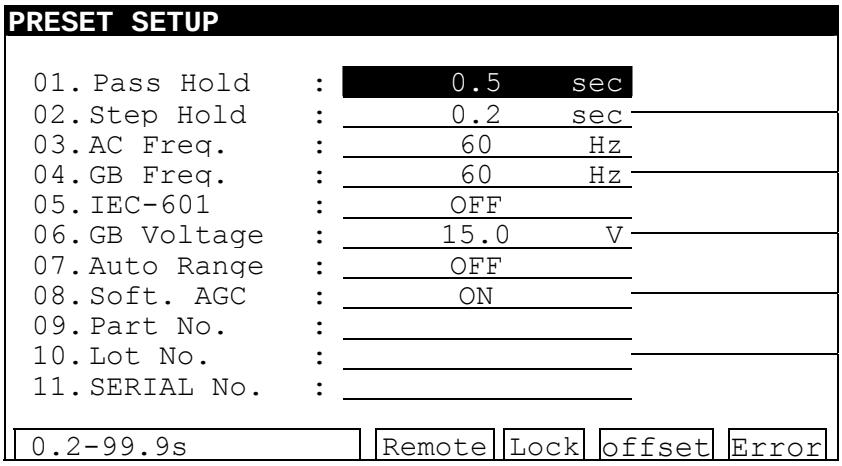
4.7 Test for Preset Setting

4.7.1 Operation Method

1. When title shows “PRESET SETUP”, press [△], [△] keys to move the highlight 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.

4.7.2 Simple Setting Wizard

1. When title shows ”PRESET SETUP”, press [ENTER] key to move the highlight 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. When the highlighted cursor on the last parameter, press [ENTER] key will go to test parameter setting menu directly for user continuous setting.

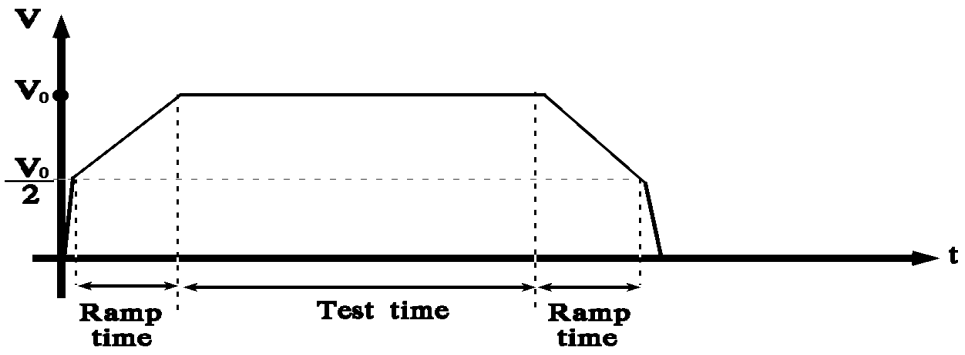


Test preset parameter function description table:

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 interrupted

				(Please press [START] to continue when test stop.)
03	AC Freq.	50-600Hz	60	It sets the frequency of outputting voltage when tests AC withstanding.
04	GB Freq.	50, 60	60	It sets the frequency of outputting current when tests grounding impedance.
05	IEC-601	ON/OFF	OFF	The setting is ON: When begin the test, outputting voltage until it is 1/2 of setting value and then execute RAMP TIME until the output voltage is equal to setting value. When end the test, execute RAMP TIME until the output voltage is 1/2 of setting value and then fast discharge until the test is ended as waveform shown in Note 1.
06	GB Voltage	6.0~15.0	15.0	It sets open voltage when ground impedance testing.
07	Auto Range	ON/OFF	OFF	It sets withstand voltage auto-range function is open or not.
08	Soft. AGC	ON/OFF	ON	It sets software auto gain compensation function is open or not.
09	Part No.	Not over 13 characters	Blank	It sets Part No. of product.
10	Lot No.	Not over 13 characters	Blank	It sets Lot No.of product.
11	Serial No. (Note 2)	Not over 13 characters	Blank	It sets serial No. format of product, * means changeable character.
12	Start Wait	0.1~99.9s / OFF	OFF	Waiting time of Ground Bond Smart Start.
13	Ramp Judg.	ON / OFF	OFF	When set Ramp. Judg. to ON, it will judge if the current value is over High Limit setting value as DC mode executes Ramp time. When set Ramp. Judg. to OFF, it won't judge if the current value is over High Limit setting value as DC mode executes Ramp time.
14	GFI (Ground Fault Interrupt)	ON / OFF/ FLOAT	OFF	(1) When the setting is ON, GFI (Ground Fault Interrupt) function is enabled. (2) When the setting is OFF, GFI (Ground Fault Interrupt) function is disabled. (3) When the setting is FLOAT, HV1 and HV2 on front panel high voltage output appears floating status.
15	I MEAS.	OUTPUT/ RETURN	OUTPUT	Current measurement mode selection: (1) When the setting is OUTPUT, the analyzer measured current by OUTPUT Current mode. (2) When the setting is RETURN, the analyzer measured current by RETURN Current mode.

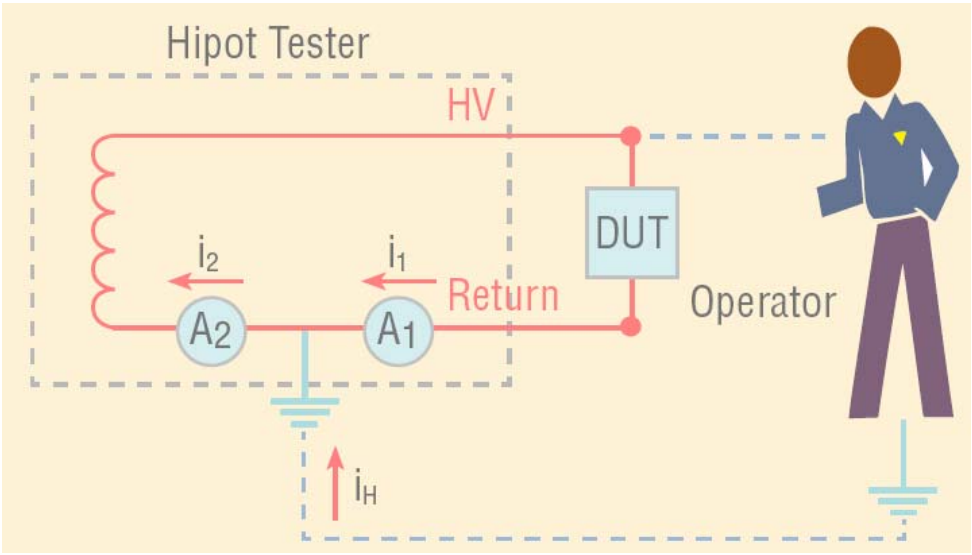
Note 1. When IEC601-1 set as On, the output voltage waveform is as the below shown:



Note 2. The device will start test when it receives a string command, and the format is as same as Serial No. Please refer the description for remote interface.

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

4.7.3.1 Set GFI to ON



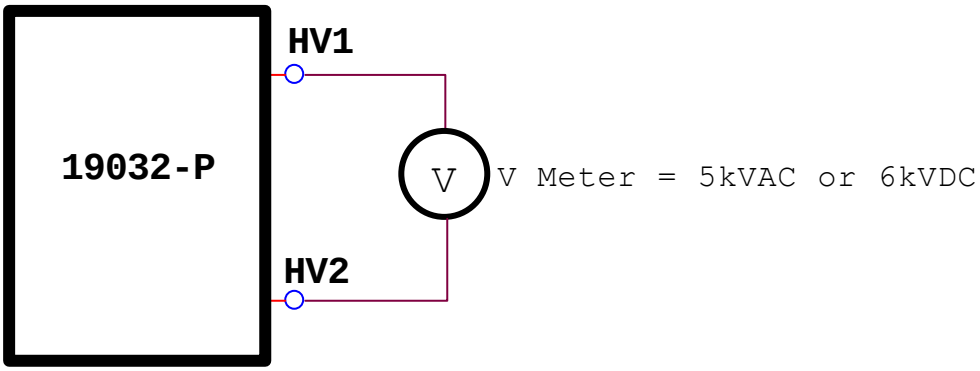
There is a current i_H produced and flowed through human body when users touch high voltage terminal carelessly.

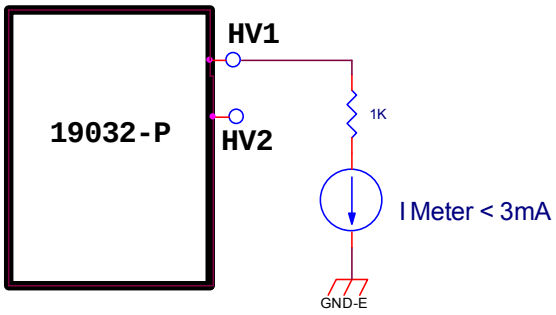
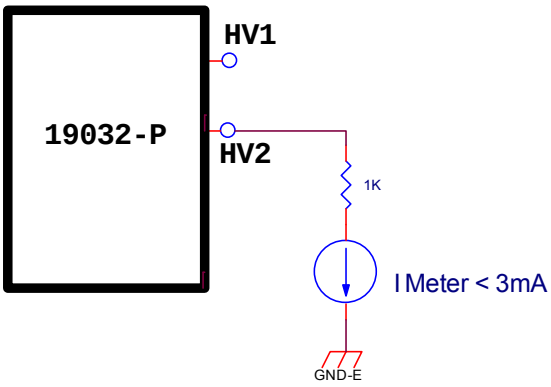
$$i_2 = i_1 + i_H$$

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

4.7.3.2 Set GFI to FLOAT

HV1 and HV2 on front panel of 19032-P high voltage displays Floating status when set GFI to FLOAT. The high voltage output terminals HV1 and HV2 on 19032-P are outputting high voltage 5kVAC or 6kVDC, the relationship of HV1or HV2 terminal to Earth is given as below figure.



Relation of HV1 terminal on front panel of 19032-P to Earth	Relation of HV2 terminal on front panel of 19032-P to Earth
	

Limitations when set GFI to FLOAT:

(1) HV1 and HV2 terminals on rear panel can't set high voltage output when set GFI to FLOAT.

(2) GFI can't set to FLOAT when HV1 and HV2 terminals on rear panel are with high voltage output.

(3) When Dynamic HV Leakage Auto Scanners(6000-XX) are installed in the analyzer, GFI can't set to FLOAT *i.e.* 19032-P is without Floating function.

4.7.4 Auto Range

(1) **Auto Range** function sets as **ON**.
(2) The current range sets to high range *i.e.* 40mA as *Figure 4-6* shown.

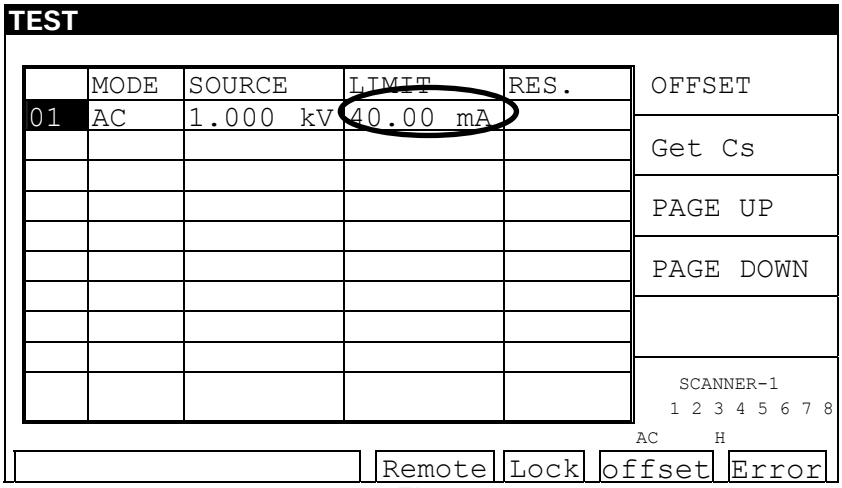


Figure 4-6

Before ending the test 0.6 sec, if the tested current can be represented by low current range then auto range to low as *Figure 4-7* shown.

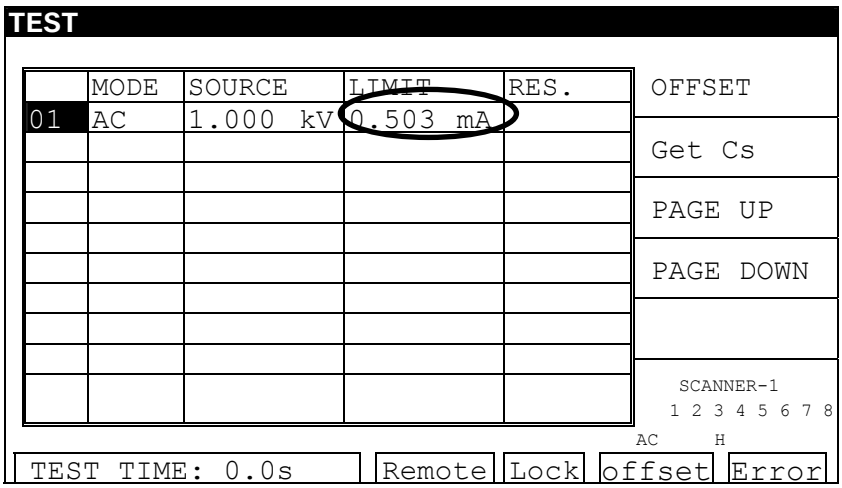


Figure 4-7

4.7.5 Start Wait Function

1. It sets Start Wait time, for example: the setting is 3 seconds.
2. According to paragraph 4.8.2 for setting various parameters of GB MODE. Take for example: CURRENT set as 25.00A, HIGH LIMIT: 100mΩ, TEST TIME: 3.0sec. TEST screen is as *Figure 4-8* shown.

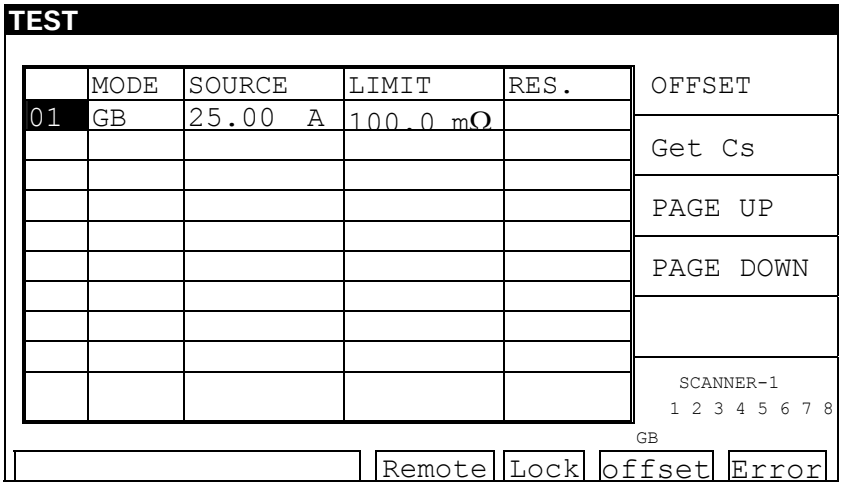


Figure 4-8

3. After DUT is connected, press [Stop] [Test] to start test, meanwhile, GB CONTACT counts down as *Figure 4-9* shown.

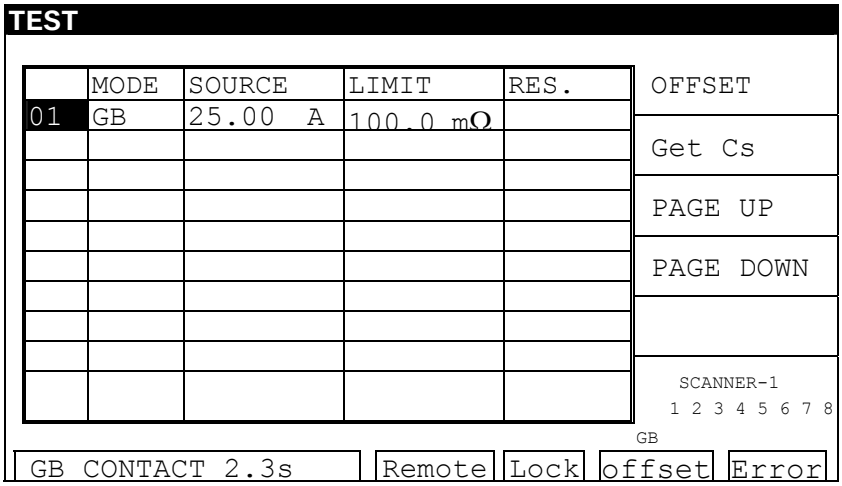


Figure 4-9

4. After GB CONTACT counting down for three seconds (Start Wait setting time), then process test as *Figure 4-10* shown.

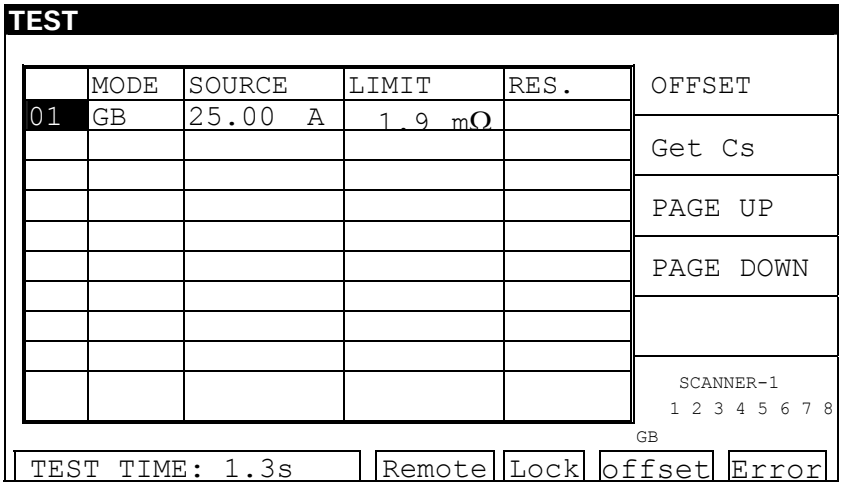


Figure 4-10

5. When the test is end, if judged as PASS, the screen as *Figure 4-11* shown.

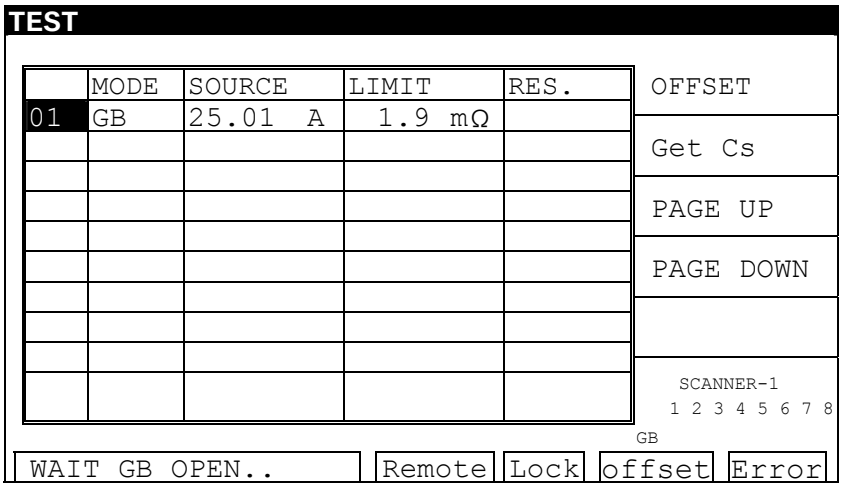


Figure 4-11

6. Meanwhile, the output is stopped and DUT can be changed. When the test cable exits from DUT, the screen as *Figure 4-12* shown.

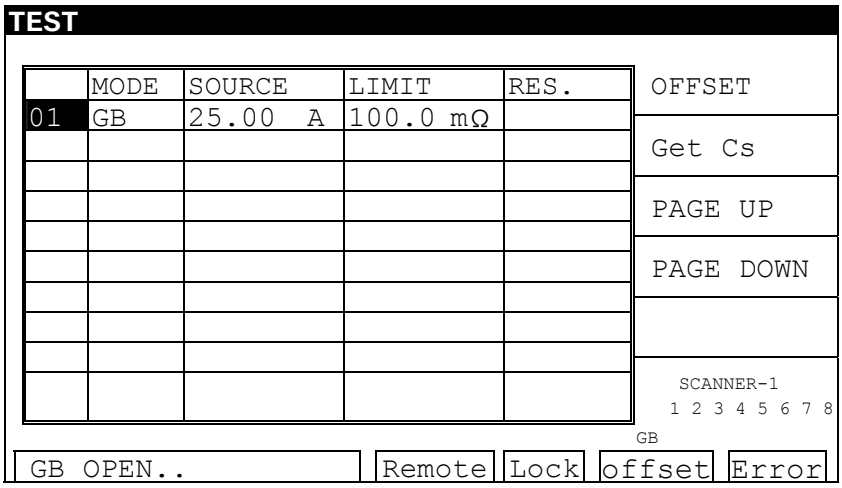


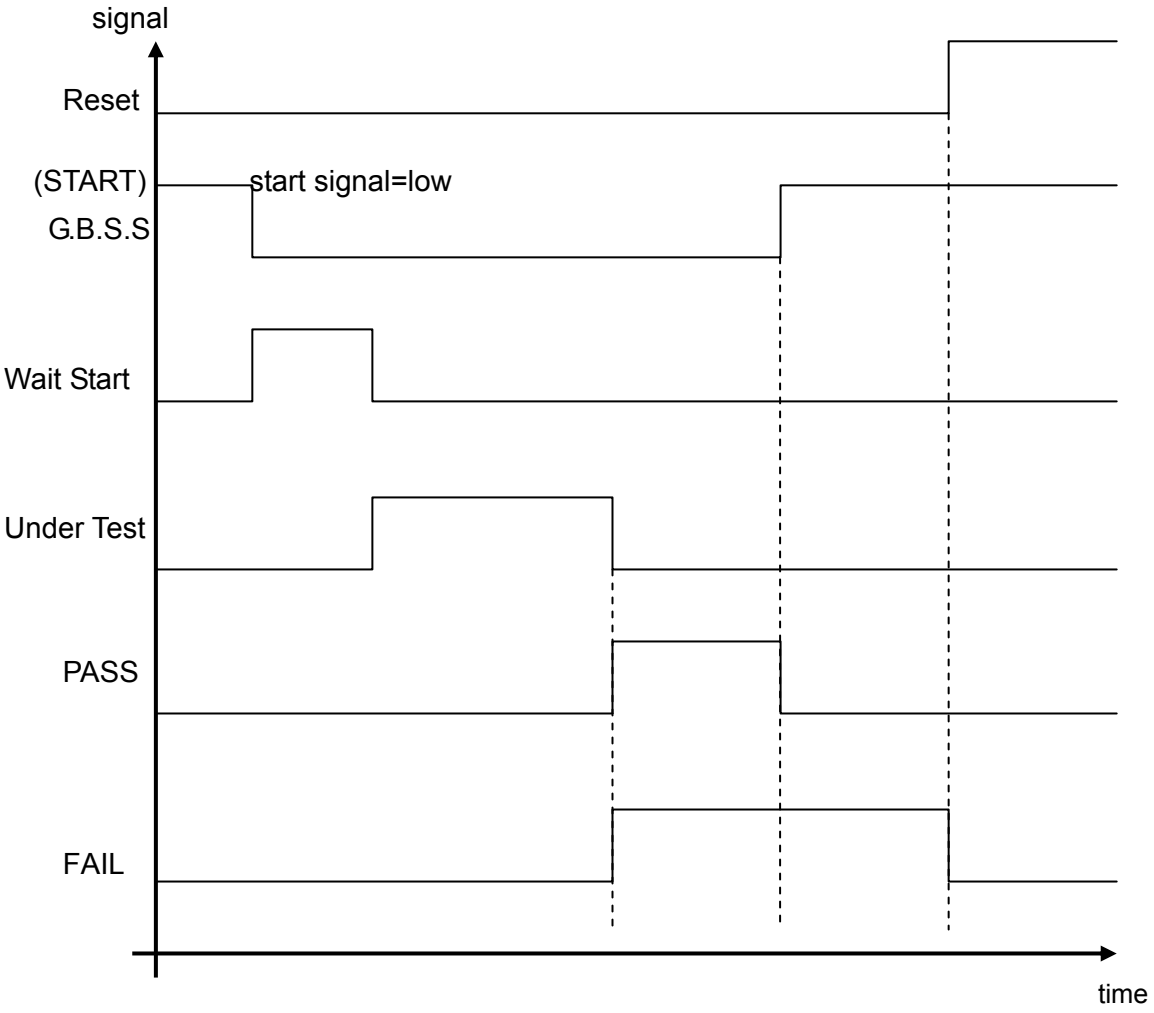
Figure 4-12

7. When the test cable contacts new DUT, it is no need to press [START] key, process GB CONTACT count down for 3 seconds at once (Start Wait setting time). As figure of item 3 shown.

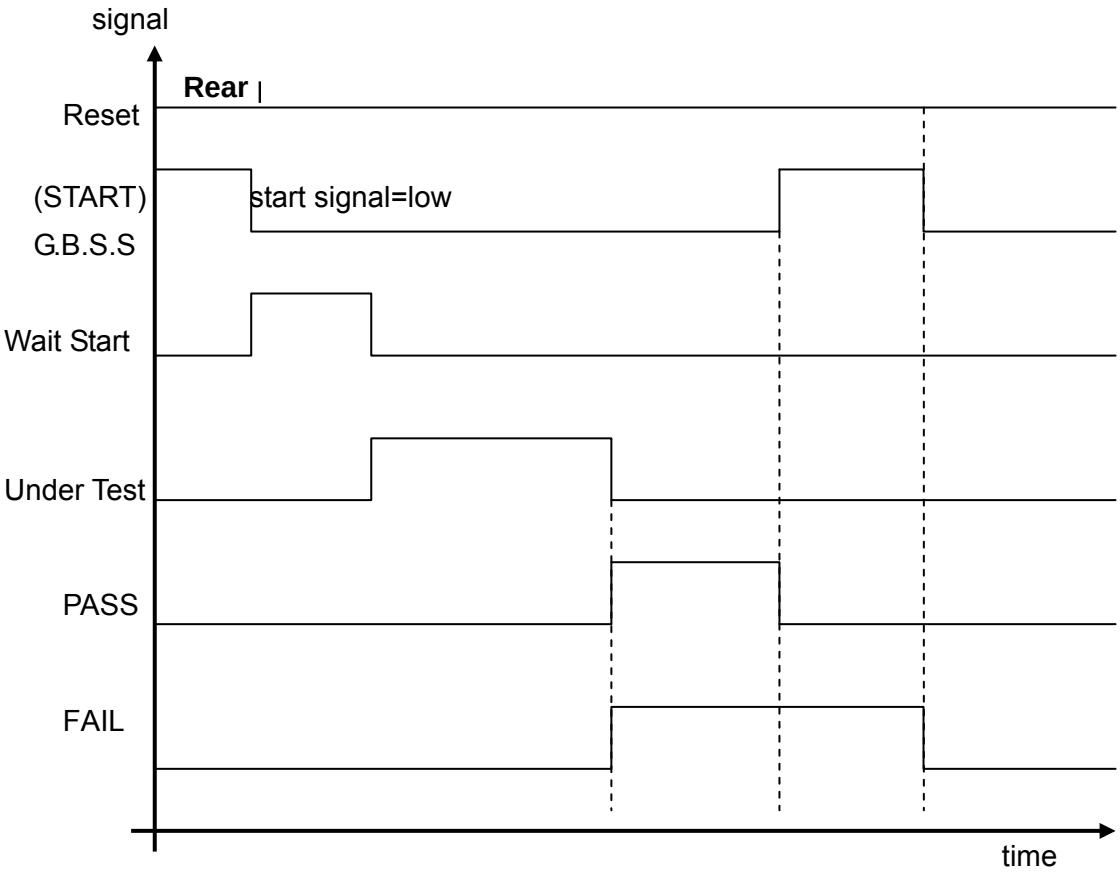
8. After GB CONTACT counting down for 3 seconds (Start Wait setting time), then process test is the same as item 4 description.

■ After Fail =Continue/RESTART / STOP with Ground Bond Smart Start (G.B.S.S) timing diagram

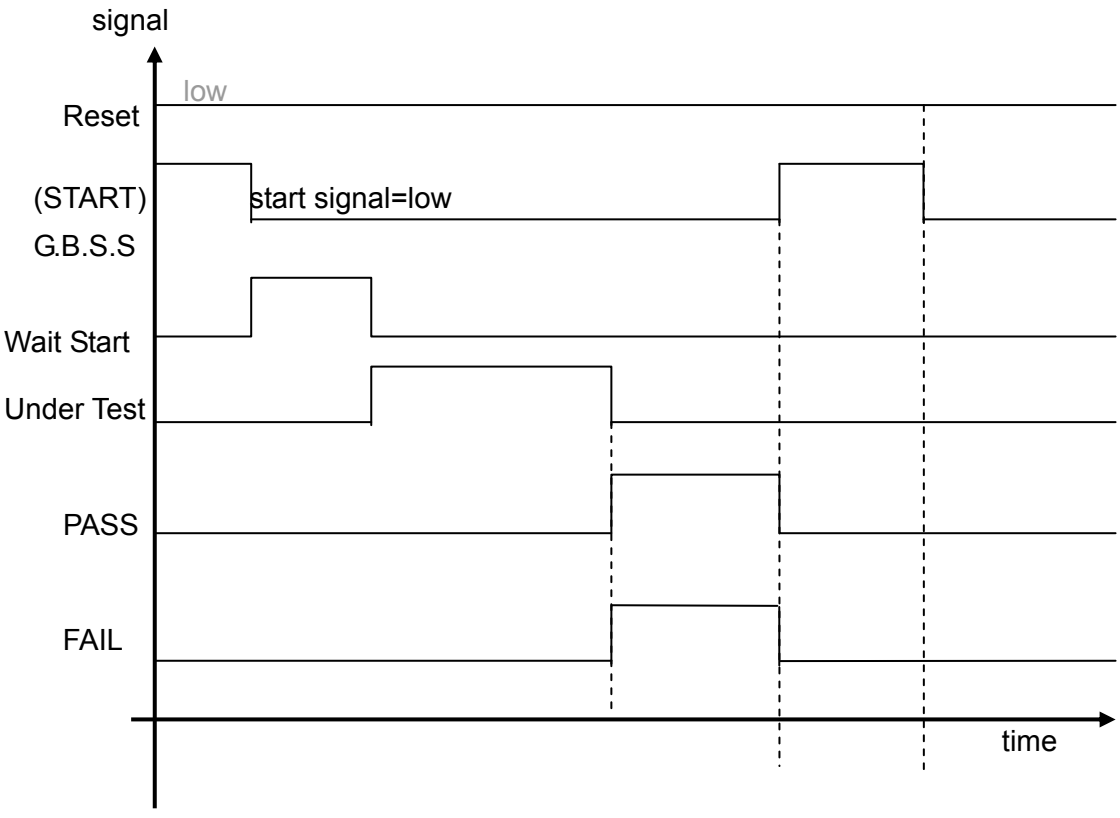
(1) After Fail = STOP signal



(2) After Fail = RESTART



(3) After Fail = Continue

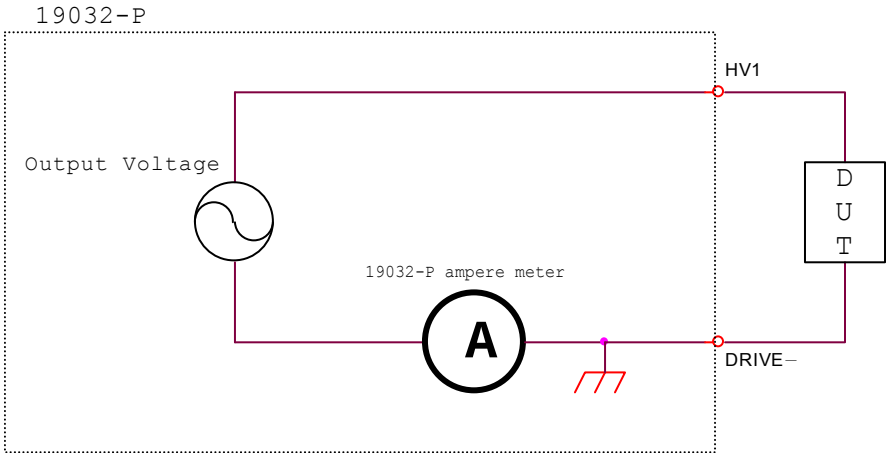


4.7.6 OUTPUT/RETURN Setting for I MEAS.

Select the apporiate current measurement mode for DUT.

4.7.6.1 Set I MEAS. to OUTPUT

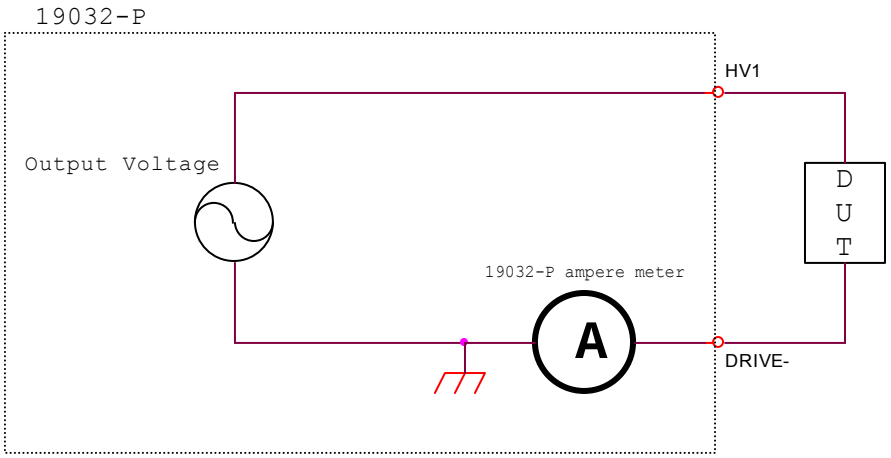
The current is measured by OUTPUT Current mode and is described by the diagram as below.



Usage timing example: DUT which not easy to move and DUT with grounding

4.7.6.2 Set I MEAS. to RETURN

The current is measured by RETURN Current mode and is described by the diagram as below.



Usage timing example: DUT without grounding

4.8 Description of GB-Floating Board

4.8.1 Notice Items before Operating

1. Before turning on power, please peruse *"Chapter 3 – Precaution before Use"* and remember it.
2. When turns on power, the analyzer will self-test. LCD shows "Find GB-Float board", it means the analyzer detected this function.

4.8.2 Description of GB-Floating Function

1. When the test mode is WAC, WDC or IR, capable of setting HV1 terminal on the rear panel is high voltage output terminal, grounding terminal or Floating; HV2 terminal is grounding or Floating.
2. When the test mode is GB or LC (option):
   Drive- on rear panel connects with Drive- on front panel.
   SENSE- on rear panel connects with SENSE- on front panel.
   Drive+ on rear panel connects with Drive+ on front panel.
   SENS+- on rear panel connects with SENSE+ on front panel.
3. The rear panel is equipped with another set of HV1 (Channel 3). When the test mode is WAC, WDC or IR, capable of setting High, Low terminal or Disable. When the test mode is LC (option), HV1 on rear panel only can be set as Low terminal or Disable.

   i. When GFI setting is FLOAT under PRESET option, connection diagram of front panel and rear panel terminal is as *Figure 4-13* shown:

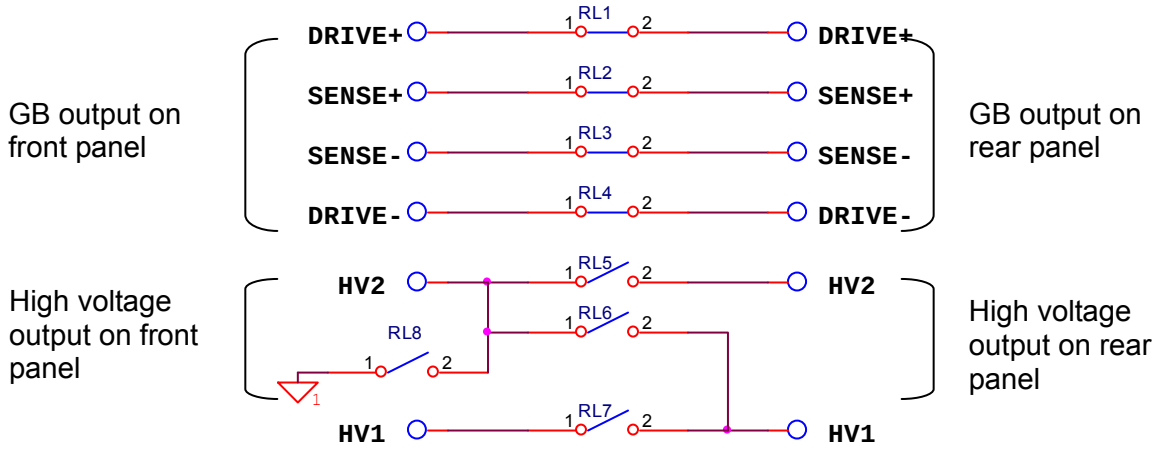


Figure 4-13

RELAY states:

RL1, RL2, RL3, RL4 = ON
RL5, RL6, RL7, RL8 = OFF

   ii. When Channel 3 is set to H and HV1 terminal on rear panel is set to high voltage output, in the meantime GFI settting can't set to FLOAT. The connection diagram of front panel terminal and rear panel terminal is as *Figure 4-14* shown:

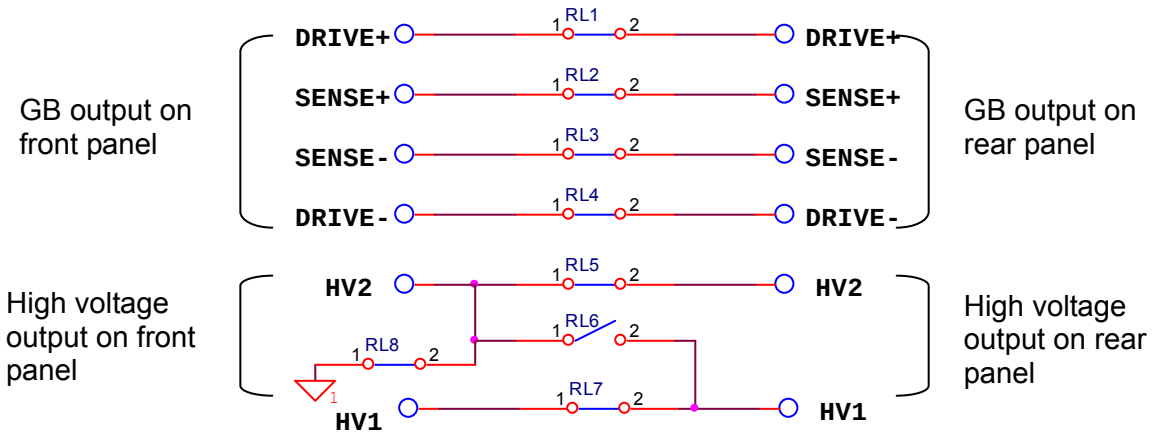


Figure 4-14

RELAY states:

RL1, RL2, RL3, RL4 = ON
RL5, RL7, RL8 = ON
RL6 = OFF

iii. When Channel 3 set to L and HV1 terminal on rear panel set to low voltage terminal, connection diagram of front panel terminal and rear panel terminal is as *Figure 4-15* shown:

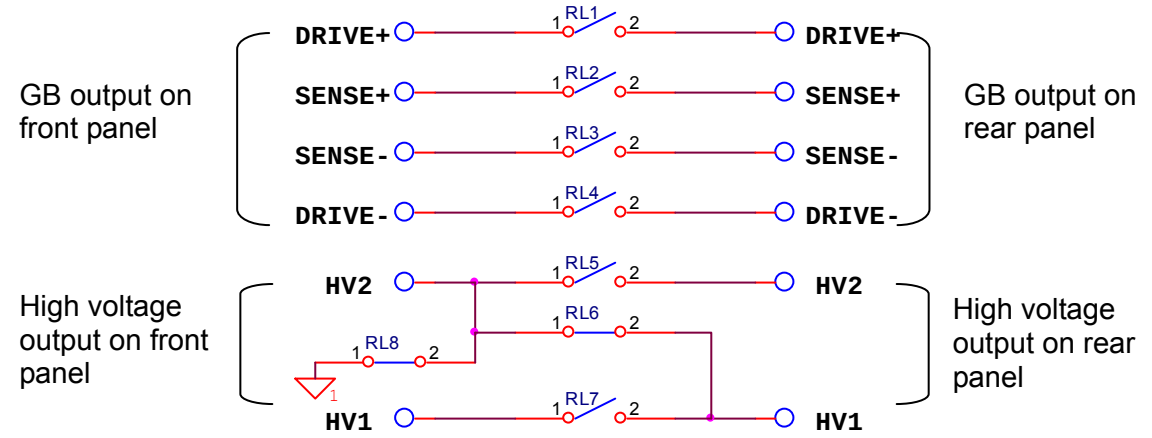


Figure 4-15

RELAY states:

RL1, RL2, RL3, RL4 = OFF
RL5, RL7 = OFF
RL6, RL8 = ON

iv. When Channel 3 set to × and HV1 terminal on rear panel set to Floating, connection diagram of front panel terminal and rear panel terminal is as *Figure 4-16* shown:

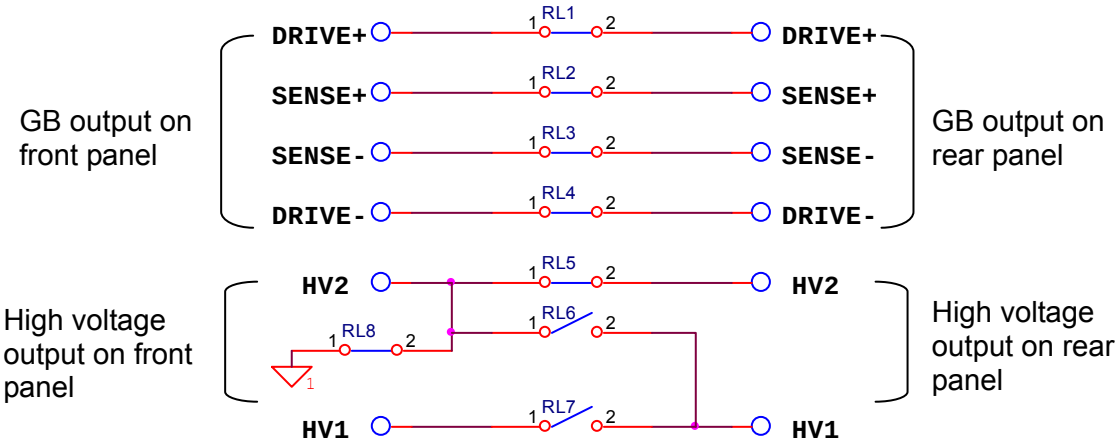


Figure 4-16

RELAY states:

RL1, RL2, RL3, RL4 = ON
RL5, RL8 = ON
RL6, RL7= OFF

4.9 Program Setting

4.9.1 Operation Method

1. When title shows “STEP SETTING”, press [△], [▽] keys to move the highlight cursor to the parameter item which 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.

4.9.2 Various Parameter Settings

TEST STEP:It sets test step.
TEST MODE: Test mode selection. There are GB / AC / DC / IR / LC (option) /PA/OSC test modes can be selected. The following described parameter settings of various test modes.

Ground Resistance Test Mode (GB)
CURRENT:It sets ground resistance test needed current.
Notice: Because the high limit of multiplying test current by resistance can’t higher than 6.3V. High limit of resistance will auto modify to adaptable value when it isn’t correspondence with the above conditions.
HIGH LIMIT: It sets ground resistance judgment high limit value. The high limit value is 510mΩ or 6.3V/CURRENT.
LOW LIMIT: It sets ground resistance judgment low limit value, the range is from 0 to high limit of resistance. Input 0 means OFF.
TEST TIME: It sets test needed time. Input 0 means continuous test.
TWIN PORT: It selects twin port, can select ON / OFF. When set as ON, and next STEP is AC/DC or IR, the two steps can operate simultaneously. The highest AC

rated current when twin port can't over 5kV 50mA and GB current can't over 20A, or it may cause output voltage, current distortion.

CHNL (H-L): It sets scan test point (please set with optional device, for example 6000-01).

Withstand Voltage Test Mode (AC)

VOLTAGE: It sets withstand voltage test needed voltage.

FREQ.: It sets AC withstand test signal frequency, input 0 to indicate DEFAULT that is to follow the frequency which set in section 4.7 for testing.

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.

ARC FILTER: It selects frequency range of detection arc. There are four frequency ranges of 3~23 kHz/3~50 kHz/3~100 kHz/3~230 kHz can be selected.

TEST TIME: It sets test needed time. It inputs 0 means continuous test.

RAMP TIME: The needed time which rises to setting voltage. It inputs 0 means OFF.

FALL TIME: The needed time which falls from setting voltage value to zero, 0 means OFF.

CHNL (H-L): It sets GB-Floating test selection point.

(1) When set CHANNEL 3 to H (high):

(a) Start test: HV1 terminal on front panel and that on rear panel are short-circuited with high voltage output. HV2 terminal on front panel and DRIVE- terminal are short-circuited with low voltage terminal. DRIVE and SENSE terminals on front panel and that on rear panel are short-circuited as *Figure 4-17* shown.

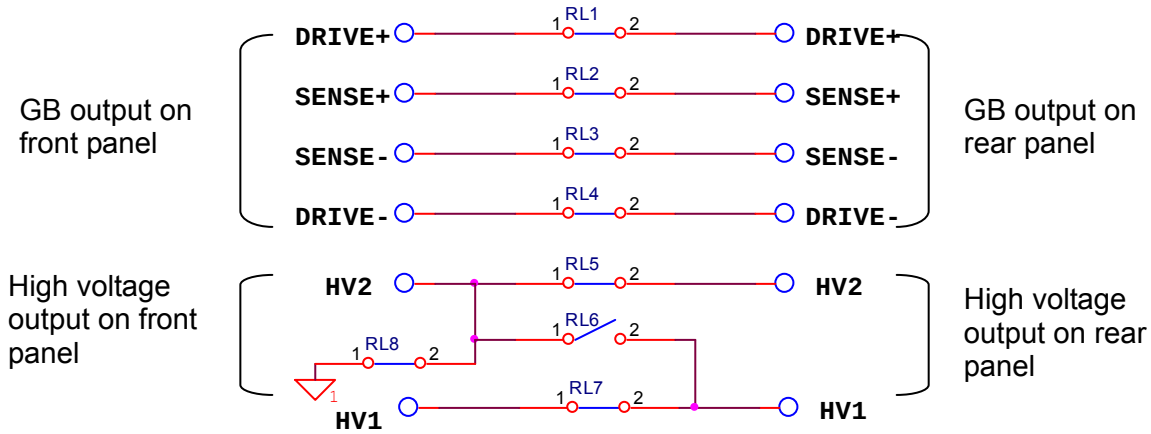


Figure 4-17

(b) End test: HV1 terminal on front panel and that on rear panel are also short-circuited. When [STOP] key is pressed, HV1 terminal on front panel and that on rear panel are open-circuited.

(2) When set CHANNEL 3 as L (low):

(a) Start test: HV1 terminal on rear panel and HV2 on front panel are short-circuited with low voltage terminal. DRIVE, SENSE terminals on front panel and DRIVE, SENSE terminals on rear panel are open-circuited, HV2 terminal and DRIVE- terminal are open-circuited as *Figure 4-18* shown.

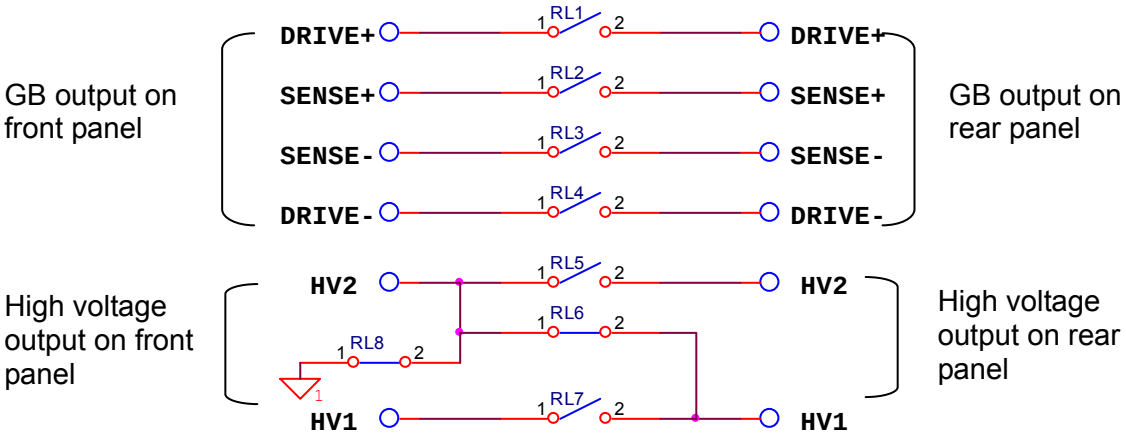


Figure 4-18

(b) End test: HV1 terminal on rear panel and HV2 terminal on front panel are also short-circuited. When [STOP] key is pressed, HV1 terminal on rear panel and HV2 terminal on front panel are open-circuited. DRIVE, SENSE terminals on front panel are short-circuited with DRIVE, SENSE terminals on rear panel.

(3) When set CHANNEL 3 as ×(disable):

(a) HV1 terminal on rear panel and that on front panel are open-circuited. HV2 terminal on rear panel and that on front panel are short-circuited.

(b) DRIVE and SENSE terminals on front panel are short-circuited with DRIVE, SENSE terminals on rear panel, HV2 terminal and DRIVE- terminal are short-circuited with low voltage terminal as *Figure 4-19* shown(GFI=ON or OFF).

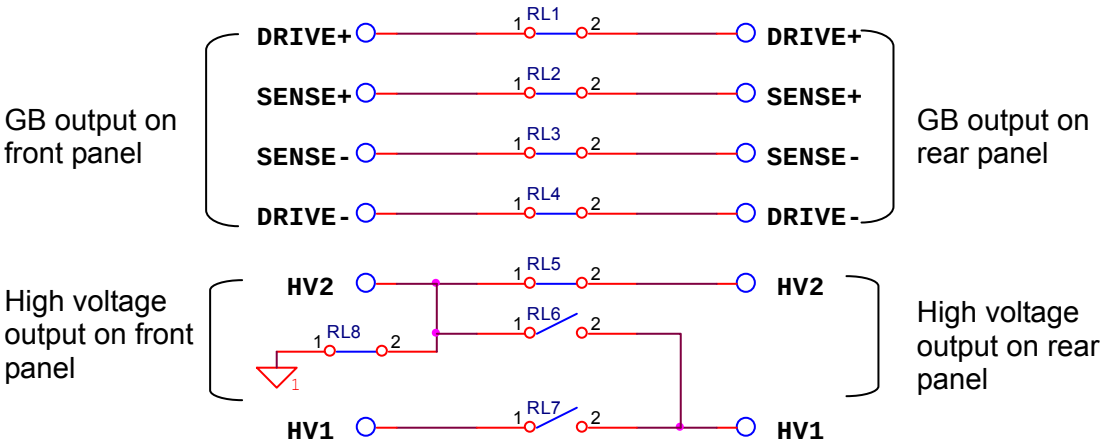
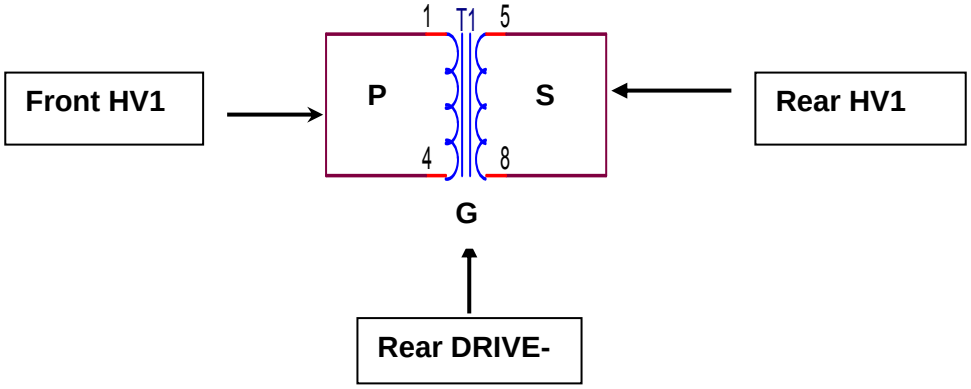


Figure 4-19

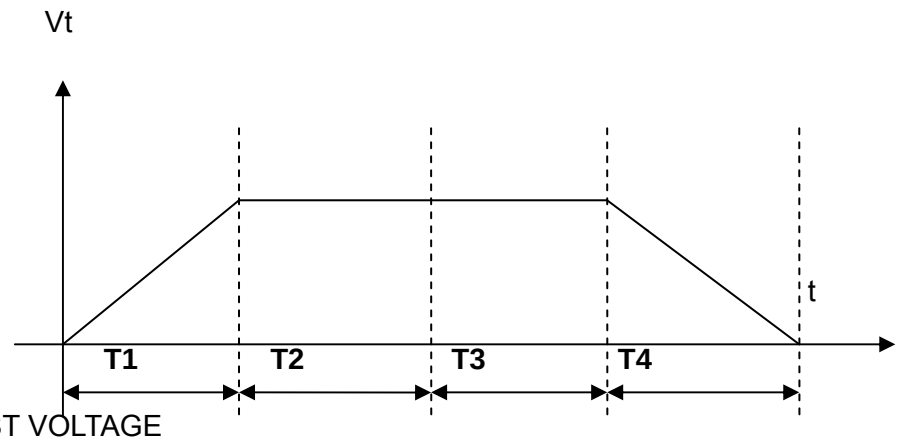
Example:



(1) P – S: It sets CHANNEL 3 to **L.**
(2) P – G: It sets CHANNEL 3 to **×.**
(3) (P+S) – G: It sets CHANNEL 3 to **H.**

Or scanning test selection point (please use with optional device, for example: 6000-03)

Withstand Voltage Test Mode (DC)
VOLTAGE: It sets withstand voltage test required voltage. It can select the output to be positive or negative 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.
DWELL TIME: It sets DWELL needed time, 0 means OFF. (During DWELL TIME, don't judge the high and low limit value of leakage current. The limitation is not over 1.5 multiples of high limit of setting range or high limit of leakage current.)
ARC LIMIT: It sets high limit value of arc.
ARC FILTER: It selects frequency range of detection arc. There are four ranges of 3~23 kHz/3~50 kHz/3~100 kHz/3~230 kHz can be selected.
TEST TIME: It sets test needed time. It inputs 0 means continuous test.
RAMP TIME: The needed time which rises to setting voltage. It inputs 0 means OFF.
FALL TIME: The needed time which falls from setting voltage value to zero, 0 means OFF.
CHNL (H-L): The setting is the same as AC CHANNEL.



Vt: TEST VOLTAGE
T1: RAMP TIME (Voltage Ramping Time)
T2: DWELL TIME (Judgment Delay Time)
T3: TEST TIME
T4: FALL TIME (Voltage Falling Time)

Insulation Resistance Test Mode (IR)

VOLTAGE: It sets insulation resistance test needed voltage. It can select the output to be positive voltage or negative 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.
TEST TIME: It sets test needed time. It inputs 0 means continuous test.
RAMP TIME: The needed time which rises to setting voltage. It inputs 0 means OFF.
FALL TIME: The needed time which falls from setting voltage value to zero, 0 means OFF.
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 DUT to calculate the value of current thus follow this to choose suitable current range.

CHNL (H-L): The setting is the same as AC/DC CHANNEL.
Or scanning test selection point (please use with optional device, for example 6000-03).

Leakage current test mode (LC) ---- Option

Pause test mode (PA)

MESSAGE: Message hint string. The string are inputted by alphabet, Arabic numerals or symbol [-]. The max. is 13 characters.
UNDER TEST: It sets as ON or OFF.
(1) When set as ON: UNDER TEST terminal on rear panel is short-circuited condition under pause mode.
(2) When set as OFF: UNDER TEST terminal on rear panel is open-circuited condition under pause mode.

TEST TIME: It sets the action method of pause mode.
(1) When set to CONTINUE, pause mode will be ended till press **START** on 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.

Short/Open Circuit Detection Mode (OSC)

OPEN CHK: It sets the judgment test result to open condition(compare the test reading with the read standard capacitance value [Cs]).

SHORT CHK: It sets the judgment test result to short condition(compare the test reading with the read standard capacitance value [Cs]).

CHNL (H-L): The setting is the same as AC/DC CHANNEL.

4.10 How to Process Test

4.10.1 Offset Value Calibration of Test Cable/Fixture

1. First of all, ground test adaptable test cable plug in (+) and (-) terminals of DRIVE and SENSE. And then makes test cable short-circuit (please be sure under grounding test status now). Press Function Key [OFFSET], the display will shows "MESSAGE" window.
2. After pressing [START] key, the title will show "GET OFFSET TEST".
3. DANGER LED on front panel lights up, the current output time is five seconds (when TEST TIME set to continue). The main unit starts to measure resistance of testing cable and shows its' value on the display then stored in the memory.
4. When test time is end, [Offset] is highlighted.
5. Press [START] key again, found that line resistance of measured test cable is 0 ~ 0.1mΩ, it means line resistance of test cable had been deducted.

4.10.2 Standard Capacitance Value (GET Cs) Description

1. Before testing short/open detection mode (OSC Mode) or changing capacitance under test, it is necessary to read the standard capacitance value (GET Cs).
2. Before reading standard capacitance value (GET Cs), please press Function Key [OFFSET] to do OFFSET elimination. Doing OFFSET elimination again on changing wire or fixture every time for ensure the accuracy of testing.
3. Before reading the standard capacitance value (GET Cs), please use the standard capacitance sample in testing as DUT. Press Function Key [GET Cs] to read the standard capacitance value for the standard value in testing.
4. When testing under short/open circuit detection mode (OSC Mode), judge OPEN/SHORT test condition is by GET Cs reading.

4.10.3 Method of DUT Connection

See *section 4.4*.

4.10.4 Test Procedure

4.10.4.1 GB/AC/DC/IR Test Procedure

1. Connection is completed correctly by connecting DUT device method.
   When title shows "MAIN MENU", press Function Key [TEST] for entering TEST function list, the title will shows "TEST". The display shows a list with STEP, which 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 output high limit value, and the fifth field is

test result.

2. Please press [STOP] key, ready for testing.
   Press [START] key to start test. When press this key, start test current / voltage output. At the same time, DANGER LED will be lighted. Warning: Now is test status with mass current / voltage output. The third field will show output current / voltage reading, the fourth will show output resistance / current reading. The timer count down or start to count and shows 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 cut off output. The rear panel output PASS signal, the buzzer function simultaneously.

4. FAIL judgment
   If the measurement is abnormal, the main unit is judged as FAIL and stop output immediately. The rear panel output FAIL signal, the buzzer function simultaneously. Keep on function 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 / Resistance value over high limit
LOW	Measurement current / Resistance value over low limit
ARC	Current arc over high limit
GFI	Ground fail interrupt
GBVO	The voltage for measuring ground resistance is over GB voltage setting.
ADNO	Voltage / current reading over hardware valid digit
ADIO	Current / resistance reading over hardware valid digit
PWHI	Power measurement value over high limit
PWLO	Power measurement value over low limit

Under any circumstances only need to press [STOP] key if want to stop test output.

4.10.4.2 OSC Test Procedure

1. Connection is completed correctly by connecting DUT device method.
   When title shows “MAIN MENU”, press Function Key [TEST] for entering TEST function list, the title will shows “TEST”. The display shows a list with STEP, which be set and wait 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 test result.
2. Please press [STOP] key, ready for testing.
   Press [START] key to start test. When press this key, start test voltage output. At the same time, DANGER LED will be lighted. Warning: Now is test status with voltage output. The third field will show output voltage reading and the fourth will show capacitance reading. The timer counts down simultaneously as well as shows on status list.
3. GOOD judgment
   When all of test statuses have been tested and the fifth field result shows PASS, then the main unit is judged as GOOD and cut off the output. The rear panel outputs PASS signal, the buzzer functions simultaneously.
4. No good judgment

If the measurement value is abnormal, the main unit is judged as FAIL and stop to output immediately. The rear panel outputs FAIL signal, the buzzer functions simultaneously. Keep on function until **STOP** key of the main unit be 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 only need to press **STOP** key if you want to stop the test output.

Note When OSC Mode is testing, Get Cs current range at this time decides the display of capacity effective 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.

4.11 CALIBRATION Function

4.11.1 Enter Calibration Method

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

4.11.2 Clear Memory

1. When title list shows "MAIN MENU", press numerical key that corresponds to **CALIBRATION** then will show "ENTER CALIBRATION PASSWORD" window.
2. By using numerical keys to input PASSWORD [8] [5] [2] [4] [6].
3. After pressing [ENTER] key, "MESSAGE" window will be appeared. Users can select if clear memory by Function Keys [YES], [NO] or press [EXIT] to abort memory clearance.
4. If Function Key [YES] is selected, all of saved data will be cleared, all setting parameters will be reset as initial value.
5. After clearing the memory, Option parameter needs to be reset.

4.12 KEY LOCK Function

KEY LOCK setting method:

1. When title list shows "MAIN MENU", if text block "LOCK" isn't highlighted to press

numerical key which corresponds to KEY LOCK then “KEY LOCK” window will be appeared.
2. By using numerical key to input PASSWORD (please input 0000, when NEW SECURITY CODE is not set).
3. Press [ENTER] key will show “MESSAGE” window, “LOCK” text block will be highlighted. Users can select if to LOCK “MEMORY RECALL” function together by Function Keys [YES], [NO].
4. Press Function Keys [EXIT] to complete KEY LOCK function.

Note When 19032 set as KEY LOCK ON then to restart, and enter TEST menu directly.

KEY LOCK release method:
1. When title list shows “MAIN MENU”, if text block “LOCK” is highlighted to press numerical key which corresponds to KEY LOCK then “RELEASE KEY LOCK” window will be appeared.
2. By using numerical key to input PASSWORD (please input 0000, when NEW SECURITY CODE is not set).
3. Press [ENTER] key, text block “LOCK” won’t be highlighted and it means KEY LOCK Function had been cancelled.

4.13 Setting User Password

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

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

4.14 FAIL LOCK Function

4.14.1 FAIL LOCK Setting and Usage

1. When title bar shows “MAIN MENU”, press numerical key which is corresponding to FAIL LOCK then “FAIL LOCK” window will be appeared.
2. By using numerical keys to input PASSWORD [0] [0] [0] [0] (when NEW SECURITY CODE is not set).
3. After pressing [ENTER] key, message indication [LOCK] will be highlighted. All keys are invalid temporary except for [STOP], [START], Function Key [TEST] and FAIL LOCK until FAIL LOCK function is unlocked.
4. When FAIL LOCK function activated, if DUT judged as FAIL then *Figure 4-20* will be shown.

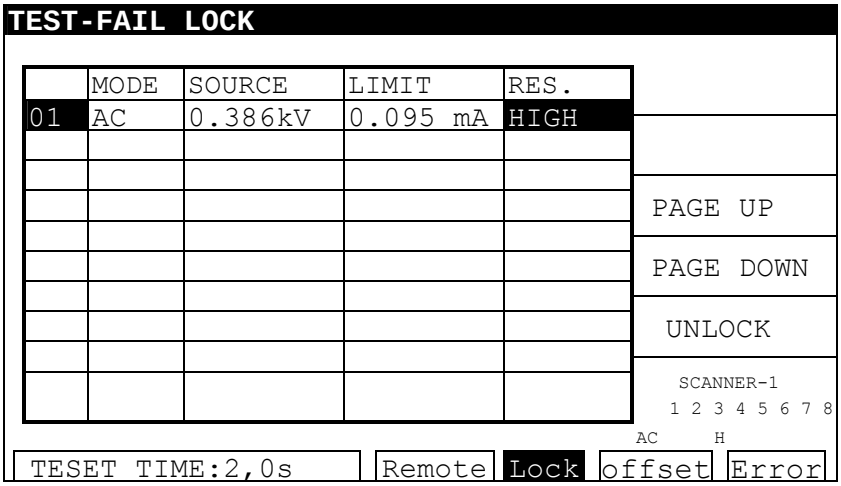


Figure 4-20

5. Meanwhile, press [STOP] and Function Key [UNLOCK] to clear buzzer sound, then "UNLOCK" window will be appeared.
6. By using numerical keys to input PASSWORD [0] [0] [0] [0] (when NEW SECURITY CODE is not set). Press [START] key for restarting the test.
7. Press [MENU] to return to MAIN MENU.

Note When 19032 is set as FAIL LOCK ON then to restart, and enter TEST menu directly.

4.14.2 Release FAIL LOCK

1. When title bar shows "MAIN MENU", press numerical key which is corresponding to FAIL LOCK will show "RELEASE FAIL LOCK" window.
2. By using numerical keys to input PASSWORD [0] [0] [0] [0] (when NEW SECURITY CODE is not set).
3. Press ENTER] key, FAIL LOCK function will be released and message indication box "LOCK" highlight will also be released.

4.15 Remote Control

This analyzer has REMOTE socket of remote switch on rear panel. When you want to control this analyzer by external signal, plug the control cable in the socket. Please don't touch high voltage terminal or it may cause dangerous. Remote control by high voltage test bar usually. You can use other control circuit instead of high voltage bar. Please notice that is switch of controlling high voltage output. Be careful that the control cables don't close high voltage terminal and test cables to avoid dangerous.

1. If users desire to single control START and STOP can refer to as this Figure 4-22 described method to connect to REMOTE position on rear panel.

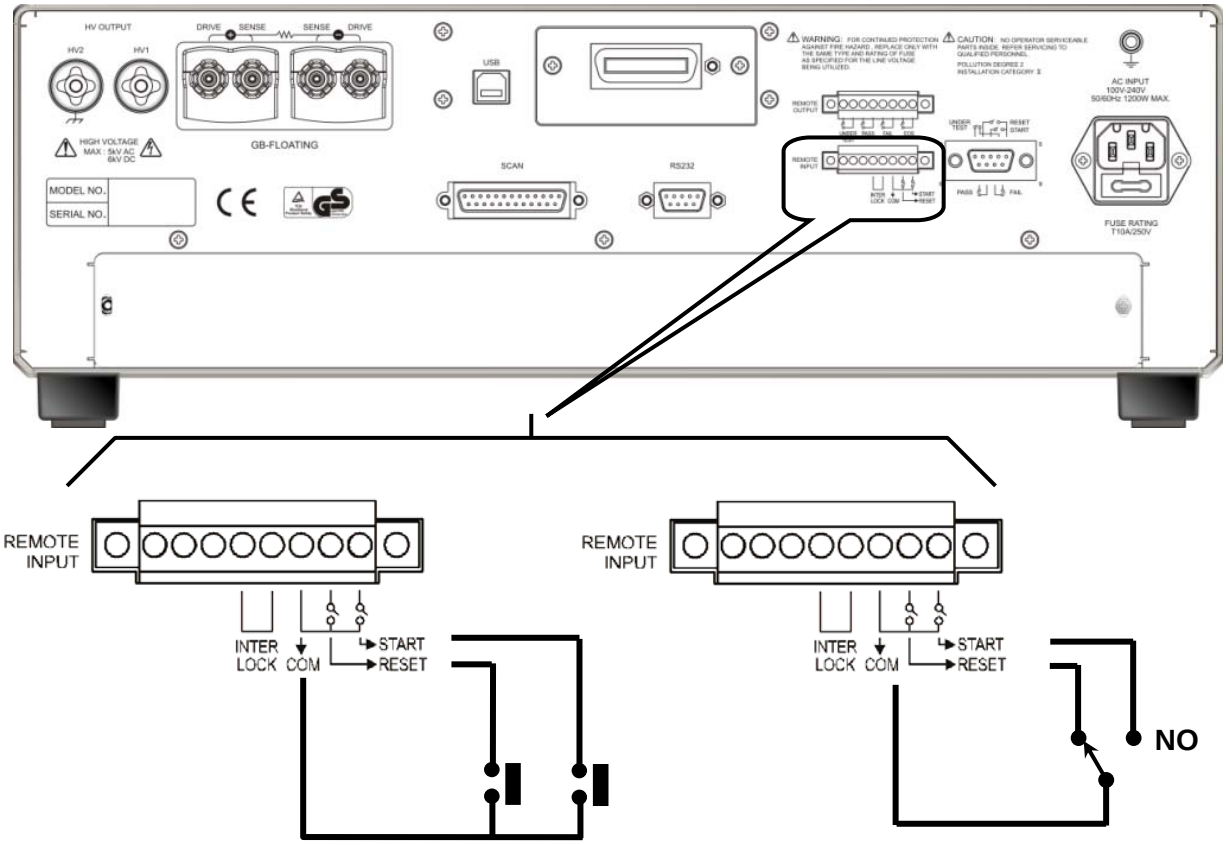


Figure 4-21 Figure 4-22

2. As *Figure 4-22*, the main unit is under STOP status. NC point is connecting to STOP and NO point connecting to START.
3. Some logical components such as transistor, FET, coupler. Also can be used to connect as control circuit as *Figure 4-23*. The connecting signal and circuit as *Figure 4-23*. Only the circuit includes the following statuses, it can control the main unit.
   (1) The signal voltage of HIGH should between 4.5 and 5V.
   (2) The signal voltage of LOW should between 0 and 0.6V.
   (3) The signal of LOW flows current is 2mA or fewer.
   (4) The action time of inputting signal should be over 30mS.

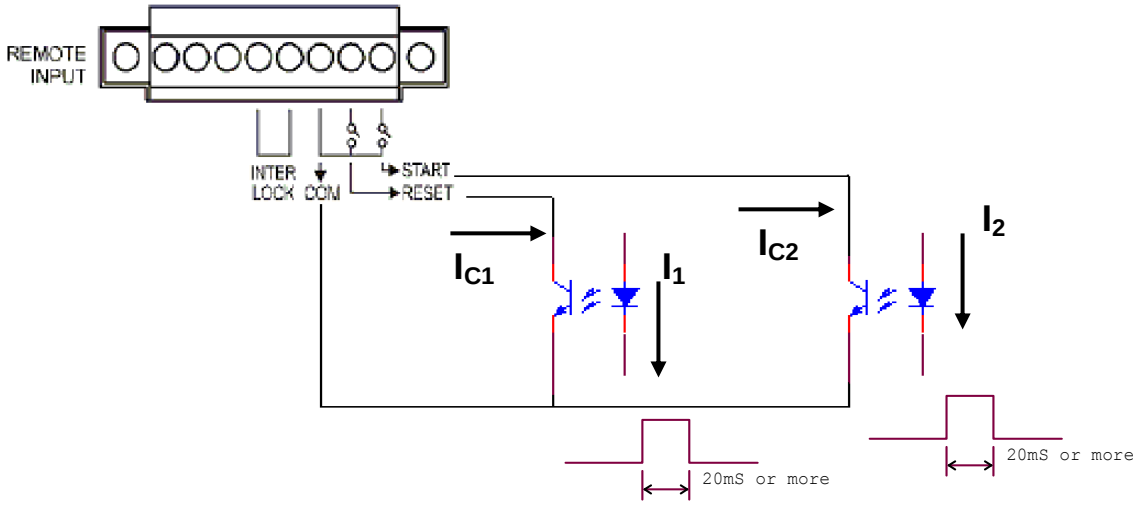


Figure 4-23

4. The relay switch control as *Figure 4-21* and photo-coupler control as *Figure 4-23* are controlled by component contact. It is effective to avoid error operation system which caused by interference. Although the main unit has a lot of preventions, it is necessary to be careful that interferences result from setting measurement system.
5. Pin diagram of REMOTE CONTROL as *Figure 4-24*. When users desire to control by external, please remember this pin diagram.

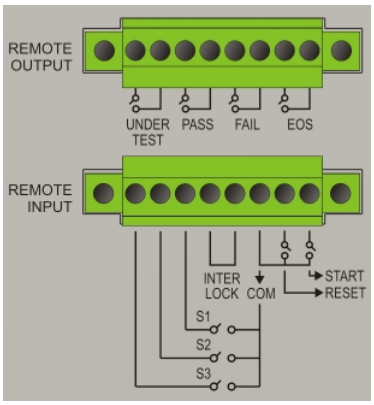


Figure 4-24

4.16 Output Signal

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

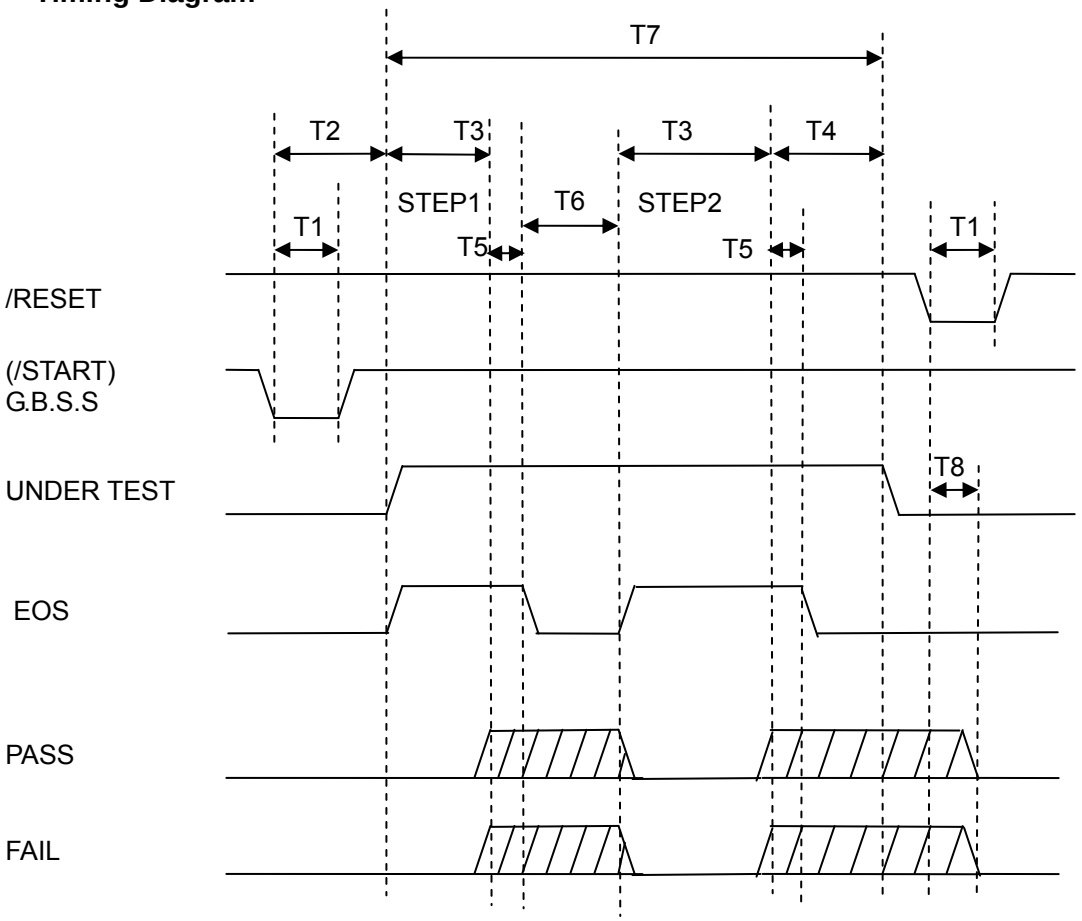
UNDER TEST: When the analyzer is under test, the output terminal will short circuit. Can use this short circuit condition to control external signal. The junction specification 125VAC current is lower than 1A.

PASS: When the analyzer judge DUT is good, the output terminal will short circuit. Can use this short circuit condition to control 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 judge DUT as no good, the output terminal will short circuit. Can use this short circuit condition to control external signal. The junction specification 125VAC current is lower than 1A. Operating time is from DUT judged as fail to be stopped or restart.

EOS: When the analyzer performs the test in test step, the output terminal will be short-circuited. Be able to use this short circuit condition to control external signal. The junction specification 125VAC current is lower than 1A.

■ **Timing Diagram**



Timing diagram – take an example by two test steps

Time	Limit	Description
T1	> 30mS	The time of external trigger signal/START & /RESET to be remained which needs to be larger than 30mS.
T2	< 200mS	The time of external trigger signal /START to /UNDER TEST signal to be cleared, it will be smaller than 200mS. The previous STEP test results of PASS, FAIL signal statuses have been cleared in advance.
	< 300mS	The time of external trigger signal /START to UNDER TEST signal to be cleared, it will be smaller than 300mS. The previous STEP test results of PASS, FAIL signal statuses haven't been cleared in advance.
T3	-	Test needed time of various test steps.
T4	> 30mS	PASS and FAIL signals are sent larger than 30mS, UNDER TEST signal is end.
T5	> 20mS	PASS and FAIL signals stable waiting time will be larger than 20mS.
T6	-	STEP Hold set time(0.1~99.9s, KEY).
T7	-	The equipment used time as testing, the signal is simultaneous with Danger lamp on panel.
T8	>15mS	/RESET signal sent larger than 15mS, PASS and FAIL signals are end.

4.17 Test Parameter and Example

4.17.1 Single Test Mode

a. Grounding impedance test __ GB MODE

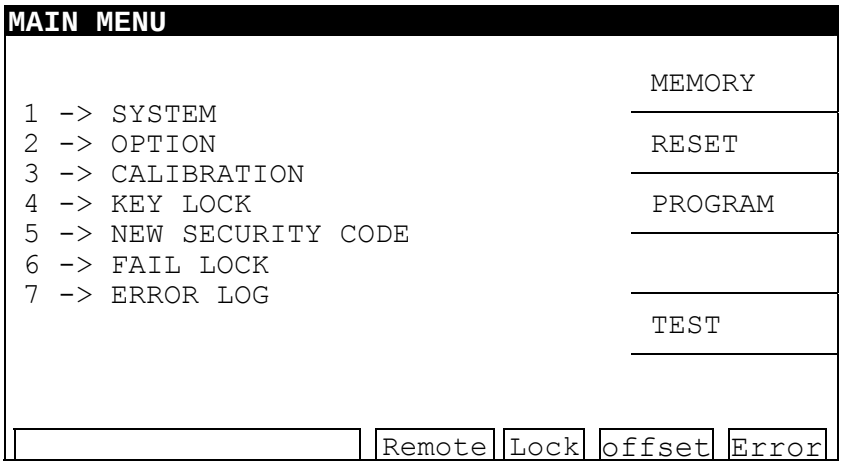


Figure 4-25

After powered-on, press Function Key [PROGRAM] at the right side of MAIN MENU in *Figure 4-25* to enter STEP SETTING screen. Move the highlight to TEST MODE by pressing [↓] key and select GB MODE as *Figure 4-26* shown, key in needed parameter values.

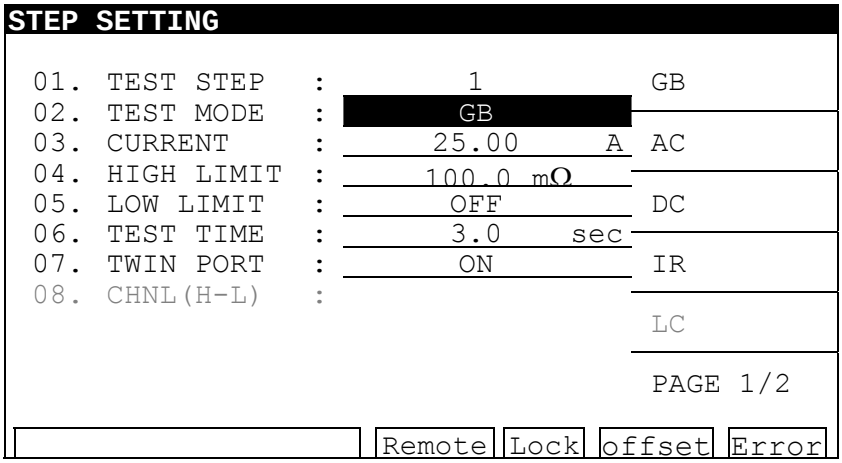


Figure 4-26

Parameter settings are as below:
01. TEST STEP: Select step
02. TEST MODE: Select mode (GB/AC/DC/IR/LC(option)/PA)
03. CURRENT: 3-40A
04. HIGH LIMIT: 0.1-510mΩ
05. LOW LIMIT :0-510mΩ 0 = OFF
06. TEST TIME :0.3-999Sec 0 = CONT.
07. TWIN PORT: Select ON or OFF (When this function is ON, STEP 2 can be set as AC, DC or IR in order to process Twin Port test for STEP1 and STEP2 simultaneously.)

After parameter setting is completed, enter MAIN MENU by pressing Function Key [MENU] and then press Function Key [TEST] to enter TEST menu as *Figure 4-27*.

(TWIN PORT: OFF)

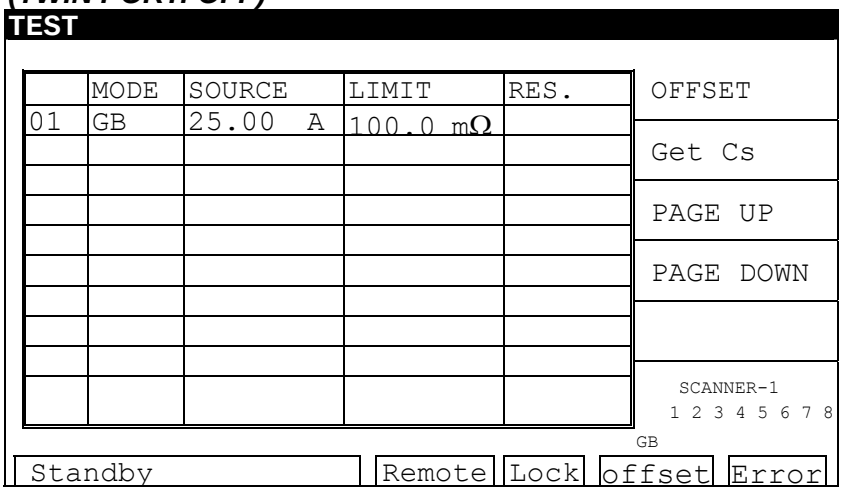


Figure 4-27

Press Function Key [STOP][START] on *Figure 4-27* then to start test.

(TWIN PORT: ON)

EX: STEP 2 is to set IR

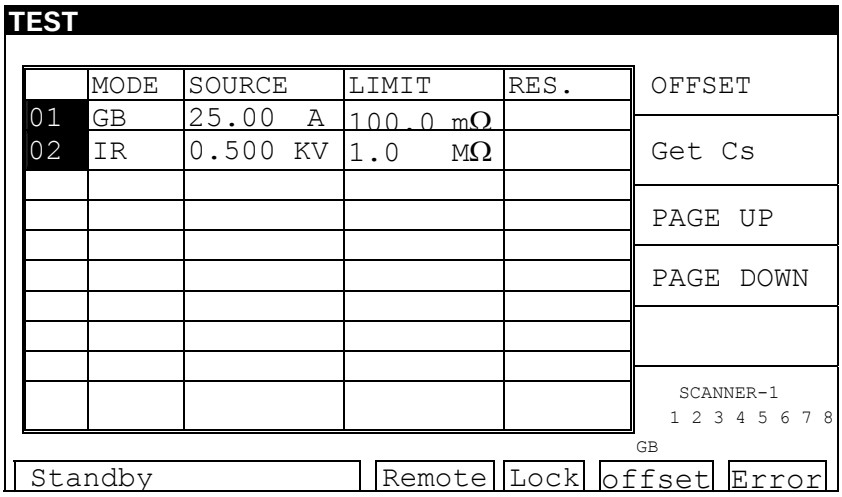


Figure 4-28

Press Function Key [STOP][START] on this menu then to start test.

b. Withstand voltage test __ AC Mode

After entering STEP SETTING menu, move the highlight to TEST MODE by pressing [↓] key and select AC MODE as *Figure 4-29* shown, key in needed parameter value.

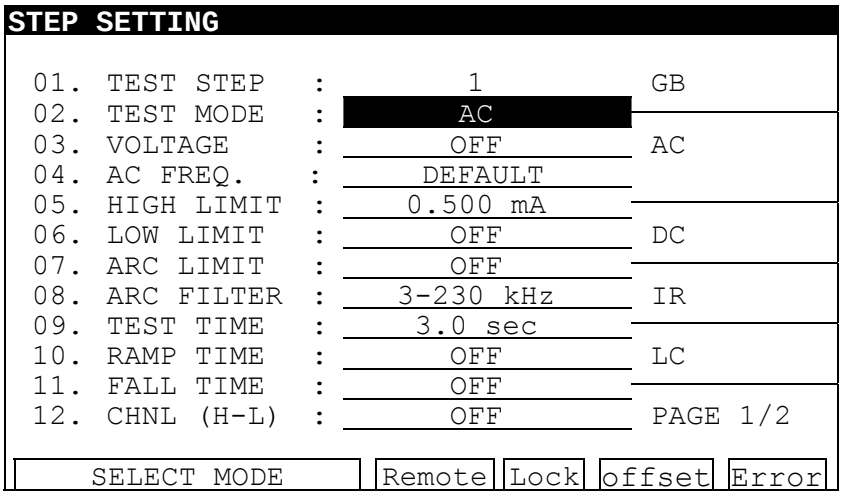


Figure 4-29

Parameter settings are as below:
01. TEST STEP: Select step
02. TEST MODE: Select mode (GB/AC/DC/IR)
03. VOLTAGE: 0.05-5KV
04. AC FREQ.: 50-600 Hz 0=DEF.
05. HIGH LIMIT: 0.001-100mA
06. LOW LIMIT: 0-100mA 0 = OFF
07. ARC LIMIT : 1-20mA 0 = OFF
08. ARC FILTER: Select filter (3-23KHZ/3-50KHZ/3-100KHZ/3-230KHZ)
09. TEST TIME: 0.3-999Sec 0 = CONT.
10. RAMP TIME : 0-999Sec 0 = OFF
11. FALL TIME : 0-999Sec 0=OFF
12. CHNL: Press function key (SETUP)

By pressing [↓] key to set various parameters in sequence as *Figure 4-30* shown.

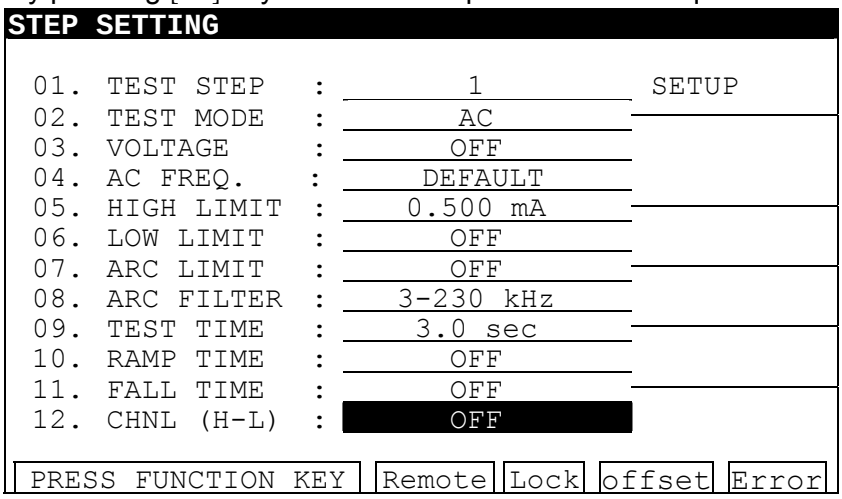


Figure 4-30

By pressing Function Key [SETUP] to enter SETUP SCANNER-1 setting, as the menu in *Figure 4-31*:

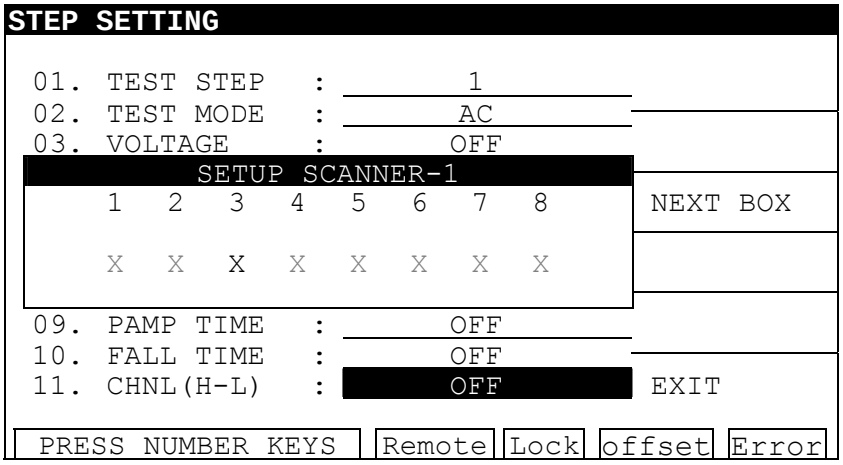


Figure 4-31

In the meantime, press numerical key [3] several times then can select H, L, X.
H: It means HV1 on rear panel and front panel are high voltage output terminals.
L: It means HV1 on rear panel and HV2 on front panel are short-circuited with low voltage terminal, DRIVE- on rear and front panel are Floating.
X: It means HV1 on rear and front panel are open-circuited, *i.e.* HV1 on rear panel is Floating. GB four terminals on front and rear panel are ON. HV2 and DRIVE- are short-circuited.

After the parameter settings are completed, press Function Key [EXIT], [MENU] to enter MAIN MENU and then press Function Key [TEST] to enter TEST menu as *Figure 4-32* shown.

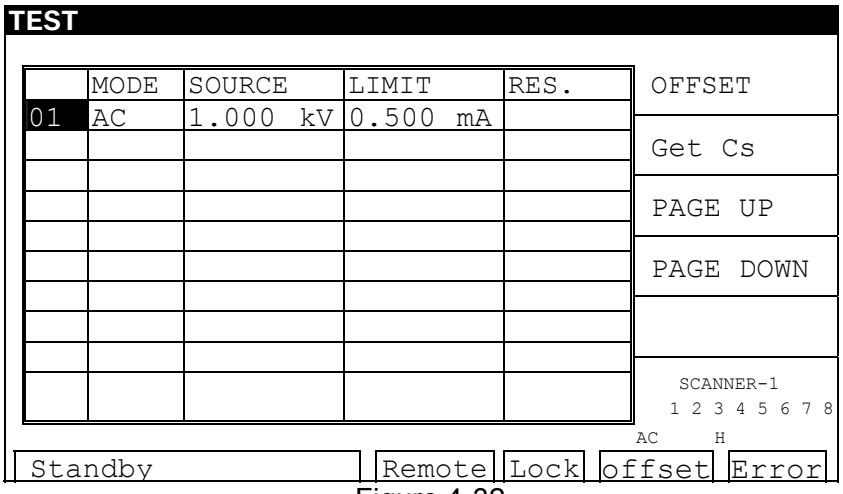


Figure 4-32

Press Function Key [STOP][START] on this menu to start test.

c. Withstand voltage test__DC Mode/Insulation impedance test __ IR Mode

The setting methods are the same as **b. Withstand voltage test __ AC Mode.**

d. Short/open circuit detection test __ OSC Mode

After entering STEP SETTING menu, press [↓] key to move the highlight to TEST MODE for selecting OSC MODE, key in parameter value as your need is shown as *Figure 4-33*.

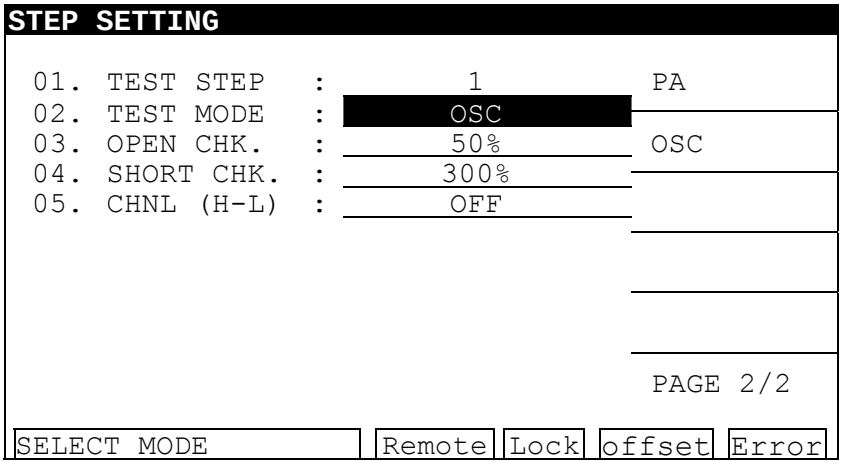
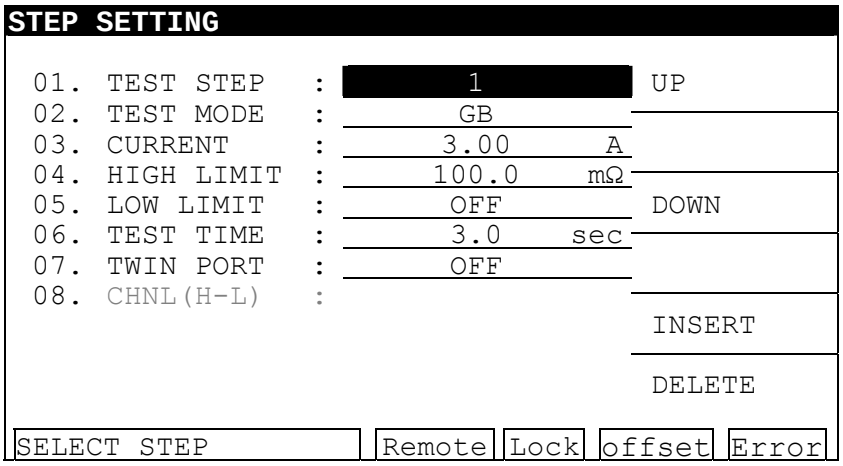


Figure 4-33

Parameter setting ranges are as the following:
01. TEST STEP : Select step
02. TEST MODE : Select mode (OSC)
03. OPEN CHK : Set the judgment test result to open condition(compare the test reading with the read standard capacitance value [Cs]).
04. SHORT CHK : Set the judgment test result to short condition(compare the test reading with the read standard capacitance value [Cs]).
05. CHNL (H-L) : It is the same as AC/DC CHANNEL setting.

4.17.2 Auto Mode Setting

STEP 1: GB



STEP 2: AC

```
STEP SETTING

 01. TEST STEP   :        2          UP
 02. TEST MODE   :       AC
 03. VOLTAGE     :    0.050    KV
 04. AC FREQ.    :  DEFAULT
 05. HIGH LIMIT  :    0.500    mA
 06. LOW LIMIT   :      OFF          DOWN
 07. ARC LIMIT   :      OFF
 08. ARC FILTER  :   3-230    kHz
 09. TEST TIME   :      3.0    sec
 10. RAMP TIME   :      OFF          INSERT
 11. FALL TIME   :      OFF
 12. CHNL(H-L)   :      OFF          DELETE

SELECT STEP | Remote | Lock | offset | Error
```

STEP 3: IR

```
STEP SETTING

 01. TEST STEP   :        3          UP
 02. TEST MODE   :       IR
 03. VOLTAGE     :    0.050    KV
 04. LOW LIMIT   :      0.1    MΩ
 05. HIGH LIMIT  :      OFF          DOWN
 06. TEST TIME   :      OFF
 07. RAMP TIME   :   3-230    kHz
 08. FALL TIME   :      3.0    sec
 09. RANGE       :      OFF          INSERT
 10. CHNL(H-L)   :      OFF
                                     DELETE

SELECT STEP | Remote | Lock | offset | Error
```

Test Step:

a. First of all, please confirm there is no voltage output and high voltage output DANGER LED isn't light. Connect the test cable for low potential to HV2 terminal on the rear panel. To short-circuit the test cable and high voltage output terminal. Confirm there is no high voltage to output.

b. Meanwhile, plug the two high voltage test cables into HV1 terminal (High) on front panel and HV1(Low) on rear panel. In advance, connect the test cable of low potential to DUT and then connect the test cable of high potential to DUT.

c. When do $P_{(L+N)}$ – S withstand voltage test, the ground terminal is Floating. As the connection in below figure.

4.17.3 Test Example for DUT Connection

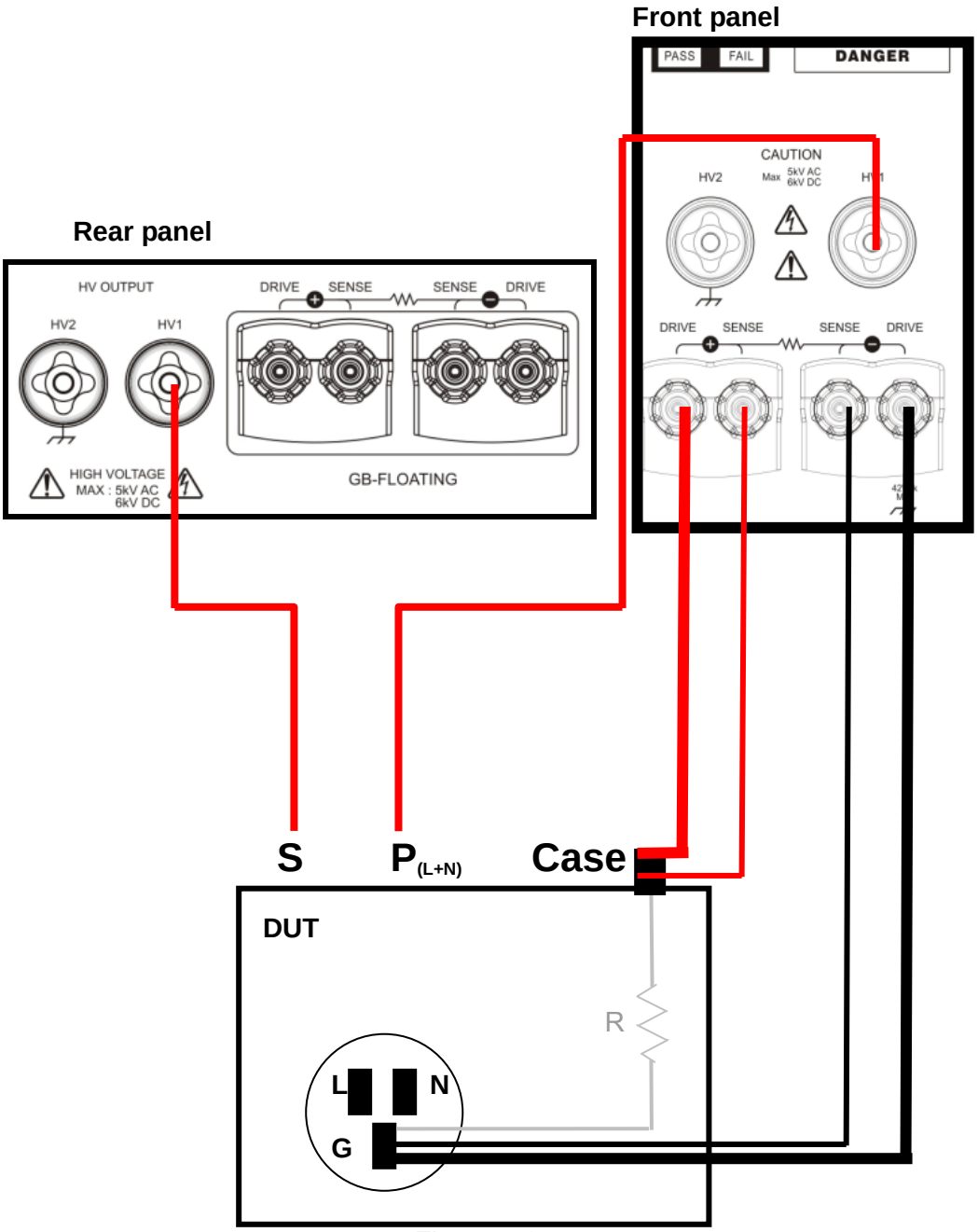


Figure 4-34

DUT connection methods in *Figure 4-34* can be set are as below:
STEP 1 Set GB (Test item: Case to G is ON)
STEP 2 Set AC, Channel 3 setting is H (Test item: Leakage current of P+S to Case)
STEP 3 Set AC, Channel 3 setting is L (Test item: Leakage current of P to S)
STEP 4 Set AC, Channel 3 setting is X (Test item: Leakage current of P to Case)

5. GPIB/RS232 Operation Description (IEEE-488.2)

5.1 Guide

The user can use computer by GPIB (IEEE 488-1978) or RS232 interface to remote control and data transfer.

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	Can 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 command string which inputted by ASCII code to attain functions of remote control and setting. The length of the command string is limited in 1024 characters (include 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 it by self.

End of String

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

5.2.5 Related Panel Description

1. **Address Setting**
   - Under "MAIN MENU" menu, press numerical key to enter "OPTION MENU" menu.
   - Press Function Key [GPIB] to enter "GPIB SETUP" and then selects GPIB Address by using Function Key [UP] or [DOWN].
   - The setting is completed and press 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 can use [LOCAL] key on panel switch the analyzer to Local status.
   - On Remote status, all of panel keys are malfunction except for [LOCAL] (switch to Local) and [STOP] (reset instrument) keys.
   - By using LLO [Local lockout] command of GPIB makes [LOCAL] key is malfunction.

5.3 RS232 Interface Specification

5.3.1 Data Format

Baud Rate: 300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200
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 Description

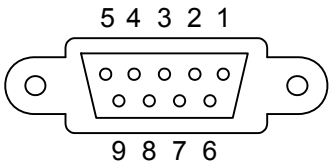
The analyzer RS232 interface function is composed of command string which is inputted by ASCII code to attain function of remote control and setting. The length of the command string is limited in 1024 characters (include end code) [Command + Parameter] compose a command. Two commands can be connected by semicolon and ended by end code. The end code are the following types, the analyzer can distinguish it by self.

End of String

LF
CR + LF

5.3.3 Connector

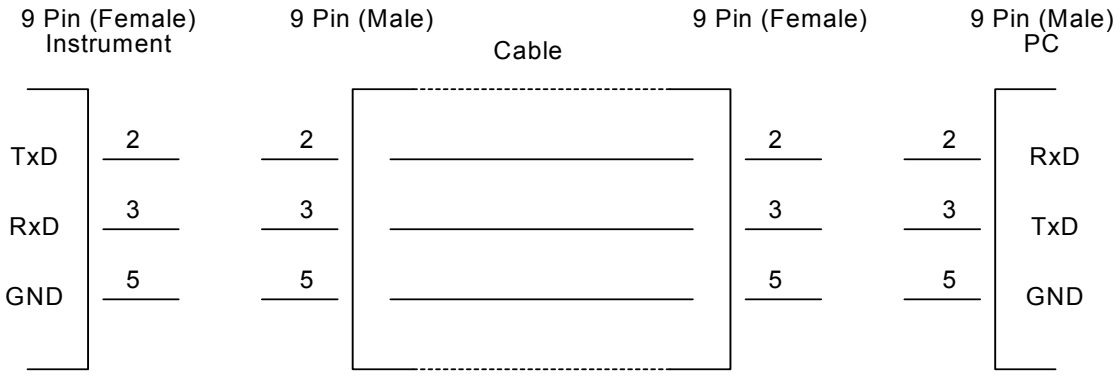
RS232 connector of the analyzer is 9 pins female connector.



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 Pattern

RS232 connector of the analyzer is 9 pins 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 < *register number* >
| :STATe
| | :DEFine < *name* >, < *register number* >
| | :DEFine? < *name* >
| :FREE
| | :STATe?
| | :STEP?
| NSTates?
:SYSTem
| :ERRor
| | [NEXT]?
| :OPTion:
| | :GBCurrent
| | | :RATE?
| | :SCAN
| | | :GBFLoating?
| | | :INSide
| | | | :TYPE?
| | :SOURCE
| | | [:AC]
| :VERSion?

```
[:SOURce]
|       :SAFEty
|       |       :FETCh?  [ < item > ] [ , < item > ]
|       |       :STARt
|       |       |       [:ONCE]
|       |       |       :OFFSet   GET | OFF
|       |       |       :OFFSet?
|       |       |       :CSTandard GET
|       |       :STOP
|       |       :STATus?
|       |       :SNUMber?
|       |       :RESult
|       |       |       :ALL
|       |       |       |       [:JUDGment]?
|       |       |       |       [:JUDGement]?
|       |       |       |       :OMETerage?
|       |       |       |       :MMETerage? [:NORMal]?
|       |       |       |       :MODE?
|       |       |       |       :TIME
|       |       |       |       |       [ELAPsed]
|       |       |       |       |       |       :RAMP?
|       |       |       |       |       |       [:TEST]?
|       |       |       |       |       |       :DWELL?
|       |       |       :COMPleted?
|       |       |       [:LAST]
|       |       |       |       [:JUDGment]?
|       |       |       |       [:JUDGement]?
|       |       |       :AREPort  < boolean > / ON / OFF      (RS232 interface only)
|       |       |       :AREPort?                             (RS232 interface only)
|       |       |       |       :ITEM [ < item > ] [ , < item > ]   (RS232 Interface only)
|       |       |       |       :ITEM?                        (RS232 Interface only)
|       |       |       ASAVe < boolean > / ON / OFF          (RS232 Interface only)
|       |       :STEP<n>
|       |       |       :DELete
|       |       |       :SET?
|       |       |       :MODE?
|       |       |       :GB
|       |       |       |       [:LEVel]    < numeric value >
|       |       |       |       [:LEVel]?
|       |       |       |       :LIMit
|       |       |       |       |       [:HIGH]    < numeric value >
|       |       |       |       |       [:HIGH]?
|       |       |       |       |       :LOW       < numeric value >
|       |       |       |       |       :LOW?
|       |       |       |       :TIME
|       |       |       |       |       [:TEST]    < numeric value >
|       |       |       |       |       [:TEST]?
|       |       |       |       :TPORt    < boolean > | ON | OFF
|       |       |       |       :TPORt?
|       |       |       |       :CHANnel
|       |       |       |       |       [:HIGH]    < channel list >
|       |       |       |       |       [:HIGH]?
|       |       |       |       :CURRent
|       |       |       |       |       :OFFSet   < numeric value >
|       |       |       |       |       :OFFSet?
|       |       |       :AC
|       |       |       |       [:LEVel]    < numeric value >
```

```
|       |       |       |       [:LEVel]?
|       |       |       |       :LIMit
|       |       |       |       |       [:HIGH]    < numeric value >
|       |       |       |       |       [:HIGH]?
|       |       |       |       |       :LOW       < numeric value >
|       |       |       |       |       :LOW?
|       |       |       |       |       :ARC
|       |       |       |       |       |       [:LEVel]    < numeric value >
|       |       |       |       |       |       [:LEVel]?
|       |       |       |       |       |       :FILTer     < numeric value >
|       |       |       |       |       |       :FILTer?
|       |       |       |       :TIME
|       |       |       |       |       :RAMP      < numeric value >
|       |       |       |       |       :RAMP?
|       |       |       |       |       [:TEST]    < numeric value >
|       |       |       |       |       [:TEST]?
|       |       |       |       |       :FALL      < numeric value >
|       |       |       |       |       :FALL?
|       |       |       |       :CHANnel
|       |       |       |       |       [:HIGH]    < channel list >
|       |       |       |       |       [:HIGH]?
|       |       |       |       |       :LOW       < channel list >
|       |       |       |       |       :LOW?
|       |       |       |       :CURRent
|       |       |       |       |       :OFFSet    < numeric value >
|       |       |       |       |       :OFFSet?
|       |       |       :DC
|       |       |       |       [:LEVel]    < numeric value >
|       |       |       |       [:LEVel]?
|       |       |       |       :LIMit
|       |       |       |       |       [:HIGH]    < numeric value >
|       |       |       |       |       [:HIGH]?
|       |       |       |       |       :LOW       < numeric value >
|       |       |       |       |       :LOW?
|       |       |       |       |       :ARC
|       |       |       |       |       |       [:LEVel]    < numeric value >
|       |       |       |       |       |       [:LEVel]?
|       |       |       |       |       |       :FILTer     < numeric value >
|       |       |       |       |       |       :FILTer?
|       |       |       |       :FREQuency < numeric value >
|       |       |       |       :FREQuency?
|       |       |       |       :TIME
|       |       |       |       |       :DWELl     < numeric value >
|       |       |       |       |       :DWELl?
|       |       |       |       |       :RAMP      < numeric value >
|       |       |       |       |       :RAMP?
|       |       |       |       |       [:TEST]    < numeric value >
|       |       |       |       |       [:TEST]?
|       |       |       |       |       :FALL      < numeric value >
|       |       |       |       |       :FALL?
|       |       |       |       :CHANnel
|       |       |       |       |       [:HIGH]    < channel list >
|       |       |       |       |       [:HIGH]?
|       |       |       |       |       :LOW       < channel list >
|       |       |       |       |       :LOW?
|       |       |       |       :CURRent
|       |       |       |       |       :OFFSet    < numeric value >
```

```
|       |       |       |       |       :OFFSet?
|       |       |       |       :REVerse < boolean > | ON | OFF
|       |       |       |       :REVerse?
|       |       |       :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?
|       |       |       |       :CHANnel
|       |       |       |       |       [:HIGH]     < channel list >
|       |       |       |       |       [:HIGH]?
|       |       |       |       |       :LOW        < channel list >
|       |       |       |       |       :LOW?
|       |       |       |       :REVerse < boolean > | ON | OFF
|       |       |       |       :REVerse?
|       |       |       :PAuse
|       |       |       |       [:MESSage]   <string data >
|       |       |       |       :UTSIgnal < boolean > | ON | OFF >
|       |       |       |       [:TEST] <numeric_value>
|       |       |       |       [:TEST]
|       |       |       :OSC
|       |       |       |       :LIMit
|       |       |       |       |       :OPEN       < numeric value >
|       |       |       |       |       :OPEN?
|       |       |       |       |       :SHORT      < numeric value >
|       |       |       |       |       :SHORT?
|       |       |       |       :CHANnel
|       |       |       |       |       [:HIGH]     < channel list >
|       |       |       |       |       [:HIGH]?
|       |       |       |       |       :LOW        < channel list >
|       |       |       |       |       :LOW?
|       |       |       |       :CRANge? <MAXimun|MINimum|NOW>
|       |       |       |       :CURRent<m>
|       |       |       |       |       :OFFSet     < numeric value >
|       |       |       |       |       :OFFSet?
|       |       |       |       : CSTandard <range>,< numeric value >
|       |       |       |       : CSTandard?
|       |       |       :LC           (6000-04, 6000-05, 6000-06, 6000-07 and 6000-08 only)
|       |       |       |       :DEVice    UL1950 | UL1563 | UL544NP | UL544P | UL2601
|       |       |       |       |             1950-U1 |2601-U1
```

```
|    |    |    |    |    |              (1950-U1, 2601-U1 6000-08 only)
|    |    |    |    :DEVice?
|    |    |    |    :DISPlay   RMS | PEAK     ( 6000-08 only )
|    |    |    |    :DISPlay          ?
|    |    |    |    :LAC[:HIGH] <Range 0 ~ high limit, 0 means off> ( 6000-08 only )
|    |    |    |    :LAC[:HIGH]?   ( 6000-08 only )
|    |    |    |    :LDC[:HIGH] <Range 0~high limit, 0 means off> ( 6000-08 only )
|    |    |    |    :LDC[:HIGH]?   ( 6000-08 only )
|    |    |    |    :LINE      NORmal | REVerse | SFNormal | SFReverse
|    |    |    |    :LINE?
|    |    |    |    :METEr    L | P ,   P | G                    (6000-05/07/08 only)
|    |    |    |    :METEr?                                      (6000-05/07/08 only)
|    |    |    |    :GSWItch  < boolean > | ON | OFF            (6000-05/07/08 only)
|    |    |    |    :GSWItch?                                    (6000-05/07/08 only)
|    |    |    |    :LIMit
|    |    |    |    |      [:HIGH]    < numeric value >
|    |    |    |    |      [:HIGH]?
|    |    |    |    |      :LOW       < numeric value >
|    |    |    |    |      :LOW?
|    |    |    |    :TIME
|    |    |    |    |      [:TEST]    < numeric value >
|    |    |    |    |      [:TEST]?
|    |    |    |    |      :DWELl     < numeric value >
|    |    |    |    |      :DWELl?
|    |    |    |    :POWer
|    |    |    |    |      :MODE     VOLTage | CURRent | VA | SIMUlation | SOURce
|    |    |    |    |      :MODE?
|    |    |    |    |      :VOLTage
|    |    |    |    |      |      [:LIMit]
|    |    |    |    |      |      |      [:HIGH]< numeric value >
|    |    |    |    |      |      |      [:HIGH]?
|    |    |    |    |      |      |      :LOW < numeric value >
|    |    |    |    |      |      |      :LOW?
|    |    |    |    |      :CURRent
|    |    |    |    |      |      [:LIMit]
|    |    |    |    |      |      |      [:HIGH]< numeric value >
|    |    |    |    |      |      |      [:HIGH]?
|    |    |    |    |      |      |      :LOW < numeric value >
|    |    |    |    |      |      |      :LOW?
|    |    |    |    : CURRent
|    |    |    |    |      :OFFSet
|    |    |    |    |      |      [:LC] < numeric value >
|    |    |    |    |      |      [:LC] ?
|    |    |    |    |      |      [:LAC] < numeric value >
|    |    |    |    |      |      [:LAC]?
|    |    |    |    |      |      [:LDC] < numeric value >
|    |    |    |    |      |      [:LDC]?
|    |    |    |    |      :VA
|    |    |    |    |      |      [:LIMit]
|    |    |    |    |      |      |      [:HIGH]< numeric value >
|    |    |    |    |      |      |      [:HIGH]?
|    |    |    |    |      |      |      :LOW < numeric value >
|    |    |    |    |      |      |      :LOW?
|    |    |    |    |      :SIMUlation
|    |    |    |    |      |      :TVOLtage        < numeric value >
|    |    |    |    |      |      :TVOLtage?
|    |    |    |    |      : SOURce
```

```
|       |       |       |       |       |       :TVOLtage  < numeric value >
|       |       |       |       |       |       :TVOLtage?
|       |       |       |       |       |       : TFRequency < numeric value >
|       |       |       |       |       |       : TFRequency?
|       |       |       |       |       |       :CURRent
|       |       |       |       |       |       |       [:LIMit]
|       |       |       |       |       |       |       |       [:HIGH] <numeric value>
|       |       |       |       |       |       |       |       [:HIGH]?
|       |       |       |       |       |       |       |       :LOW <numeric value>
|       |       |       |       |       |       |       |       :LOW?
|       |       |       |       |       |       :VA
|       |       |       |       |       |       |       [:LIMit]
|       |       |       |       |       |       |       |       [:HIGH] <numeric value>
|       |       |       |       |       |       |       |       [:HIGH]?
|       |       |       |       |       |       |       |       :LOW <numeric value>
|       |       |       |       |       |       |       |       :LOW?
|       |       |       |       |       |       :POWer
|       |       |       |       |       |       |       [:LIMit]
|       |       |       |       |       |       |       |       [:HIGH] <numeric value>
|       |       |       |       |       |       |       |       [:HIGH]?
|       |       |       |       |       |       |       |       :LOW <numeric value>
|       |       |       |       |       |       |       |       :LOW?
|       |       |       |       |       |       :PFACtor
|       |       |       |       |       |       |       [:LIMit]
|       |       |       |       |       |       |       |       :LOW?
|       |       |       |       |       :CHANnel
|       |       |       |       |       |       [:LOW]     < channel list >
|       |       |       |       |       |       [:LOW]?
|       |       |       |       |       |       :HIGH      < channel list >
|       |       |       |       |       |       :HIGH?
|       |       :PRESet
|       |       |       :TIME
|       |       |       |       :PASS      < numeric value >
|       |       |       |       :PASS?
|       |       |       |       :STEP      < numeric value > | KEY
|       |       |       |       :STEP?
|       |       |       |       :ASTart      < numeric value >
|       |       |       :GB
|       |       |       |       :FREQuncy            < numeric value >
|       |       |       |       :FREQUery?
|       |       |       |       :VOLTage         < numeric value >
|       |       |       |       :VOLTage?
|       |       |       :AC
|       |       |       |       :FREQuncy            < numeric value >
|       |       |       |       :FREQuery?
|       |       |       :WRANge
|       |       |       |       [:AUTO]    < boolean > | ON | OFF
|       |       |       |       [:AUTO]?
|       |       |       :AGC
|       |       |       |       [:SOFTware]     <boolean > | ON | OFF
|       |       |       |       [:SOFTware]?
|       |       |       :NUMber
|       |       |       |       :PART      < string data >
|       |       |       |       :PART?
|       |       |       |       :LOT       < string data >
|       |       |       |       :LOT?
|       |       |       |       :SERIal     < string data >
```

```
|       |       |       |       :SERIal?
|       |       |       :IEC  <boolean > | ON | OFF
|       |       |       :IEC?
|       |       |       :RJUDgment     <boolean > | ON | OFF
|       |       |       :GFI          ON|OFF|FOLAT
|       |       |       :SCREen  <boolean > | ON | OFF
|       |       |       :RJUDgment?
|       |       |       IMEAS <OUTPUT|RETURN>
|       |       |       IMEAS?
 :TRIGger:SOURce:EXTernal:STATe    <boolean > | ON | OFF
 :TRIGger:SOURce:EXTernal:STATe?
```

5.4.2 Command Description

- **IEEE 488.2 Command**

***CLS**
Clear status command data configuration the following actions are needed.
Clear standard event status register
Clear status bit group register except for MAV bit (bit 4).

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

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

***ESR?**
The controller inquires 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 for reading the basic data of the device. The output format separates four fields by comma, it denote separately: manufacturer, device model, serial number and firmware version.

***OPC**
Operation completes command.

***OPC?**
Operation complete inquiry command. The output format is ASCII character "1".

PSC *0* | *1
Power on status clear command

***PSC?**
Power on status clear inquiry command. The output format is ASCII character " 1 " or " 0 ".

***RST**

The device reset command.

***RCL < *numeric value* >**
Recall command. This command is recalling the saved parameters.

***SAV < *numeric value* >**
Save command. This command is saving the current parameters to memory.

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

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

***STB?**
The controller is 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 123"**
Description: This command means to delete parameter data of "LOCA 123" in the main memory.

:MEMory:DELete:LOCAtion < *register number* >
This command deletes the parameter data of <register number> in the main memory.
< register number > is integral data.
Example: Input command **"MEM:DEL:LOCA 1"**
Description: This command means 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 means to set parameter data name TEST of the first memory in the main memory.

:MEMory:STATe:DEFine? < *name* >
The command queries <register number> memory which <name> indicated.
Example: Input command **"MEM:STAT:DEF? TEST"**
Return message **"1"**
Description: Return message **"1"** means the location of 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 data number 97 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 STEP 497 can be set, 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.
Returned message please refer 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:OPTion:GBCurrent:RATE?
It queries ratio value of GB current.
Return GB current rate which be set according to Option screen.
Return values are as below:
1. 30:30
2. 30:40
3. 30:45
4. 30:60

Example: Input command **"SYSTem:OPTion:GBCurrent:RATE?"**
Return message "**30:30**"
Description: Return message "**30:30**" means ratio value of GB current is 30:30.

:SYSTem:OPTion:SCAN:GBFLoating?
It queries if GB Floating Board is installed.
When there is GB Floating, return 1.
When there is no GB Floating, return 0.
Example: Input command **"SYSTem:OPTion:SCAN:GBFloating?"**
Return message **"1"**
Description: Return **"1"** means GB Floating Board is installed.

:SYSTem:OPTion:SCAN:INSide:TYPE?
It queries SCAN TYPE is which type of card.
Return messages are as follows.
1.NONE (means no card inserted)
2.6000-01
3.6000-02
4.6000-03
5.6000-04
6.6000-05
7.6000-06

8.6000-07
9.6000-08
10.6000-11
Example: Input command "**SYSTem:OPTion:SCAN:INSide:TYPE?"**
Return message "**6000-08**"
Description: Return message "**6000-08**" means SCAN TYPE installed is 6000-08.

:SYSTem:OPTion:SOURce[:AC]?
It queries POWER setting of LC mode can be set to SOURCE or SIMULATION.
When return value is 1 means the setting can be set to SOURCE.
When return value is 0 means the setting can be set to SIMULATION.
Example: Input command "**SYSTem:OPTion:SOURce[:AC]?"**
Return message "**0**"
Description: Return message "**1**" means POWER setting of LC mode can be set to SIMULATION.

: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 supported SCPI version is 1990.0.

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

Data	Return Data
STEP	The current step number
MODE	The current mode
OMETerage	The current output meterage
MMETerage	The current measured meterage
LACMETerage	The current LAC meterage
LDCMETerage	The current LDC meterage
RELApsed	The current elapsed time of ramp
RLEAve	The current leave time of ramp
DELApsed	The current elapsed time of dwell
DLEAve	The current leave time of dwell
TELApsed	The current elapsed time of test Return 9.9000001E+37 while Test Time sets as CONT. and it higher than 999 sec.
TLEAve	The current leave time of test Return the leave time when Test Time is limited Return 9.9000001E+37 when Test Time is CONT
FELApsed	The current elapsed Fall Time
FLEAve	The current leave Fall Time
CHANnel	The current Channel

Example: Input command "**SAFE: FETH?"STEP, MODE, OMET**

Return message "**1, AC, +5.000000E+02**"
Description: Return message "**1, AC, +5.000000E+02**" means query the current STEP, MODE and output value results are STEP1, AC MODE and 0.500kV.

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

[:SOURce]:SAFEty:STARt:OFFSet *GET* | *OFF*
This command gets offset value when the parameter is GET and off 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 if do offset action or not.
Example: Input command "**SAFE:STAR OFFS?"**
Return message **"0"**
Description: Return message **"0"** means the main unit is without doing 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 means to start GET Cs function of short/open circuit detection mode.

[:SOURce]:SAFEty:STOP
This command is for stopping the test.
Example: Input command **"SAFE:STOP"**
Description: It means 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 to query OUTPUT METER result is 0.051kV.

[: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 to query MEASURE METER result is 0.07mA.

[:SOURce]:SAFEty:RESult:ALL:MMETerage:LAC?
It queries LAC reading of MEASURE METER in all steps.
Example: Input command **"SAFE:RES:ALL:MMET:LAC?"**
Return message **"1.000000E-04"**
Description: Return message **"1.000000E-04"** means to query LAC reading result of MEASURE METER is 0.10mA.

[:SOURce]:SAFEty:RESult:ALL:MMETerage:LDC?
It queries LDC reading of MEASURE METER in all steps.
Example: Input command **"SAFE:RES:ALL:MMET:LDC?"**
Return message **"1.000000E-06"**
Description: Return message **"1.000000E-06"** means to query LDC reading result of MEASURE METER is 0.001mA.

[:SOURce]:SAFEty:RESult:ALL:MODE?
This command queries MODE of all steps. Return character data AC|DC|GB|IR|LC|PA|OSC.
Example: Input command **"SAFE:RES:ALL:MODE?"**
Return message **"DC"**
Description: Return message **"DC"** means to set 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 needed 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 needed time result is 3 seconds.

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

[: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.

Test Result Code List:

Mode	GB		AC		DC		IR		LC		OSC		ALL	
Code	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
STOP													70	112
USER STOP													71	113
CAN NOT													72	114

TEST														
TESTING													73	115
PASS													74	116
HIGH FAIL	11	17	21	33	31	49	41	65	51	81				
LOW FAIL	12	18	22	34	32	50	42	66	52	82				
ARC FAIL			23	35	33	51								
HIGH FAIL			24	36	34	52	44	68	54	84	64	100		
CHECK FAIL					35	53								
OUTPUT A/D OVER	16	22	26	38	36	54	46	70	56	86	66	102		
METER A/D OVER	17	23	27	39	37	55	47	71	57	87	67	103		
POWER HIGH FAIL									58	88				
POWER LOW FAIL									59	89				
LAC HIGH FAIL									5A	90				
LDC HIGH FAIL									5B	91				
SHORT FAIL											61	97		
OPEN FAIL											62	98		
GFI FAIL			2D	45	3D	61	4D	77			6D	109		
GBVO	1C	28												

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:AREPort< *boolean* > | *ON* | *OFF*
This command sets if automatic reports test result (RS232 Interface only).
Example: Input command "**SAFE:RES:AREP ON"**
Description: It means the main unit auto report test result after the test is completed.

[:SOURce]:SAFEty:RESult:AREPort?
This command queries if auto reports test result. Return 1 or 0 (RS232 interface only).
Example: Input command "**SAFE:RES:AREP?"**
Return message "**1"**
Description: Return message "**1"** means auto report test result after the main unit test is completed.

[:SOURce]:SAFEty:RESult:AREPort:ITEM *[< item >] [, < item >]*
It sets test data for auto report, < item > is for character data, its meaning is listed below.

Character Data	Returned Data
MODE	Measurement MODE.
OMETerage	Output value
MMETerage	Measurement value
LACMETerage	LAC measurement value
LDCMETerage	LDC measurement value
RELApsed	The elapsed time for Ramp.
DELApsed	The elapsed time for Dwell.
TELApsed	The elapsed time for Test. Return 9.9000001E+37 while Test Time sets as CONT. and it higher than 999 sec.
FELApsed	The elapsed time for Fall Time.
STATe	The test result code

The sequence for report data:
MODE, OMETerage, MMETerage, LACMETerage,LDCMETerage, RELApsed, DELApsed, TELApsed, FELApsed, STATe
Example: 1. Input command **"SAFE: RES: AREP ON".** It sets to enable auto report.
2. Input command **"SAFE: RES: AREP: ITEM STAT, MODE, OMET".** It sets the data which require to report.
It assumed the test as AC MODE then return message is as below.
AC, +5.200000E+01, 116
Description: It follows the data reported to set it after the test completed.

Note The parameter setting is no need to follow the sequence but the data will be reported by sequence.

[:SOURce]:SAFEty:RESult:AREPort:ITEM?
It queries data item of device auto report test as well as returns data report item.
(RS232 interface only)
Example: Input command "**SAFE:RES:AREP:ITEM?"**
Return message "MODE,OMET,STAT**"**
Description: The return message means auto report data at present including "Measurement MODE", "Output value" and "Test result code".

SOURce:SAFEty:RESult:ASAVe < boolean > | ON | OFF
This command is for setting if the function of auto report is saved until power on next time.
(RS232 interface only)
Example: Input command "**SOUR:SAFE:RES:ASAV ON"**
Description: There is still the function of with auto report when set this command to ON after powering on next time.

SOURce:SAFEty:RESult:ASAVe?
It queries the device if the function of auto report is saved until power on next time.
Example: Input command "**SOUR:SAFE:RES:ASAV?"**
Description: It returns 1 to represent the setting of auto report function is saved until power on next time.

[:SOURce]:SAFEty:STEP<n>:DELete
This command deletes <n> represented step and the step which behind <n> will fill a vacancy forward.
Example: Input command "**SAFE:STEP 1:DEL"**
Description: This command means to delete step 1 setting value in the main memory.

[:SOURce]:SAFEty:STEP<n>:SET?
This command queries all setting values in the selected step.
Example: Input command **SAFE:SETP 1:SET?**
Return message **1, AC, 5.000000E+03, 6.000000E-04, 7.000000E-06, 8.000000E-03, 2.300000E+05, 3.000000E+00, 1.000000E+00, 2.000000E+00, (0),(0)**
Description: This command means STEP setting value is STEP 1, AC, VOLT: 5.000kV, HIGH: 0.600mA, LOW: 0.007mA, ARC: 8.0mA, ARC FILTER: 230kHz, TIME: 3.0s, RAMP: 1.0s, FALL: 2.0s, SCAN BOX: OFF.

[:SOURce]:SAFEty:STEP<n>:MODE?
This command queries MODE in selected step. Return character data are AC, DC, GB, IR, LC, PA or OSC.
Example: Input command "**SAFE:RES:ALL:MODE?"**
Return message "**DC"**
Description: Return message "**DC"** means the mode is DC.

[:SOURce]:SAFEty:STEP<n>:GB[:LEVel] < *numeric value* >
This command sets selected step, the grounding resistance test needed current value. The unit is ampere (A).
Range: The range can be set is 3~40.
Example: Input command "**SAFE:STEP 1:GB 5"**
Description: This command sets the needed current value is 5A when testing step 1 grounding resistance.

[:SOURce]:SAFEty:STEP<n>:GB[:LEVel]?
This command queries selected step, the grounding resistance test needed current value.
Example: Input command "**SAFE:STEP:GB?"**
Return message "+**5.000000E+00"**
Description: Return message "+**5.000000E+00"** means needed current value of grounding resistance test is 5A.

[:SOURce]:SAFEty:STEP<n>:GB:LIMit[:HIGH] < *numeric value* >
This command sets selected step, the grounding resistance judgment high limit value. The unit is Ohm.
Range: 0.0001 ~ 0.51 (high limit value of grounding resistance judgment x setting current value ≤ 6.3V)
Example: Input command "**SAFE:STEP 1:GB:LIM 0.11"**
Description: This command sets step 1 grounding resistance judgment high limit value is 0.11 ohm.

[:SOURce]:SAFEty:STEP<n>:GB:LIMit[:HIGH]?
This command queries selected step, its' grounding resistance judgment high limit value.
Example: Input command "**SAFE:STEP:GB:LIM?"**
Return message "+**1.100000E-01"**
Description: Return message "+**1.100000E-01"** means grounding resistance judgment high limit value is 0.11 ohm.

[:SOURce]:SAFEty:STEP<n>:GB:LIMit:LOW
This command sets selected step, its' grounding resistance judgment low limit value. The unit is Ohm.
Range: 0 or 0.0001 ~0.51, 0 is for setting OFF (low limit value of grounding resistance judgment ≤ high limit value of the setting)
Example: Input command **"SAFE:STEP 1:GB:LIM:LOW 0.01"**
Description: This command sets step 1 grounding resistance judgment low limit value is 0.01 ohm.

[:SOURce]:SAFEty:STEP<n>:GB:LIMit:LOW?
This command queries the selected step, its' grounding resistance judgment low limit.
Example: Input command **"SAFE:STEP:GB:LIM:LOW?"**
Return message **"+1.000000E-02"**
Description: Return message **"+1.000000E-02"** means grounding resistance judgment low limit value is 0.01 ohm.

[:SOURce]:SAFEty:STEP<n>:GB:TIME[:TEST] < *numeric value* >
This command sets selected step which test needed time. The unit is second.
Range: 0 or 0.3~999.0, 0 is for setting CONTINUE
Example: Input command **"SAFE:STEP 1:GB:TIME 0.5"**
Description: This command sets step 1 test needed time is 0.5 second.

[:SOURce]:SAFEty:STEP<n>:GB:TIME[:TEST]?
This command queries selected step which test needed time.
Example: Input command **"SAFE:STEP:GB:TIME?"**
Return message **"+5.000000E-01"**
Description: Return message **"+5.000000E-01"** means test needed time is 0.5 second.

[:SOURce]:SAFEty:STEP<n>:GB:TPORt < *boolean* > | *On* | *OFF*
This command sets if selected step twin port function on or off. The GFI item setting of PRESET SETUP can be set as ON when it sets as FLOAT.
Example: Input command **"SAFE:STEP 1:GB:TPOR ON"**
Description: This command sets step 1 twin port function on.

[:SOURce]:SAFEty:STEP<n>:GB:TPORt?
This command queries selected step twin port function.
Example: Input command **"SAFE:STEP:GB:TPOR?"**
Return message "1"
Description: Return message **"1"** means twin port output function is on.

[:SOURce]:SAFEty:STEP<n>:GB:CHANnel[:HIGH] < *channel list* >
This command sets selected step the output channels. The < channel list > format as following: (@SN(C1, C2, C3)). The SN is scan box number, the C1, C2 and C3 are channels number.
Example: Input command **"SAFE:STEP 1:GB:CHAN(@2(1,2))"**
Description: This command means output channel of scanning test of the main unit STEP 1 is set to BOX 2 channel 1 and 2 HIGH output.

Example: Input command **"SAFE:STEP 1:GB:CHAN(@2(0))"**
Description: This command means BOX 2 original HIGH output channel of scanning test output channel of the main unit STEP 1 is set to OFF.

[:SOURce]:SAFEty:STEP<n>:GB:CHANnel[:HIGH]?
This command queries selected step, its output terminal setting.

Example: Input command "**SAFE:STEP 1:GB:CHAN?"**
Return message "**(@2(1,2))"**
Description: Return message "**(@2(1,3))"** means output channel of scanning test of the main unit STEP 1 is set to BOX 2 channel 1 and 2 HIGH output.

[:SOURce]:SAFEty:STEP<n>:GB:CURRent:OFFSet <numeric value>
This command sets Offset value of GB. The unit is Ω.
Range: 0.000~0.5000
Example: Input command **"SAFE:STEP 1:GB:CURR:OFFS 0.005"**
Description: This command means setting STEP 1 GB Offset of the main unit is 5mΩ.

[:SOURce]:SAFEty:STEP<n>:GB:CURRent:OFFSet?
This command queries selected step, its Offset value.
Example: Input command **"SAFE:STEP 1:GB:CURR:OFFS?"**
Return message **"5.000000E-03"**
Description: Return message **"5.000000E-03"** means STEP1 Offset value of the main unit is 5mΩ.

[:SOURce]:SAFEty:STEP<n>:AC[:LEVel] < *numeric value* >
This command sets selected step that AC withstand voltage test needed voltage value. The unit is volt (V).
Range: 50~5000
Example: Input command "**SAFE:STEP 2:AC 3000"**
Description: This command means STEP 2 AC withstand voltage test needed voltage value is 3000V.

[:SOURce]:SAFEty:STEP<n>:AC[:LEVel]?
This command queries selected step that AC withstand voltage test needed voltage value.
Example: Input command "**SAFE:STEP 2:AC?"**
Return message "**3.000000E+03"**
Description: Return message "**3.000000E+03"** means voltage value is 3000V when testing STEP 2 AC withstand voltage.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit[:HIGH]< *numeric value* >
This command sets selected step that AC withstand voltage leakage current high limit. The unit is in Ampere (A).
Range: 0.000001~0.1
Example: Input command "**SAFE:STEP 2:AC:LIM 0.01"**
Description: This command sets AC withstand voltage leakage current high limit value of the main unit STEP 2 is 10mA.

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

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:LOW < *numeric value* >
This command sets selected step that AC withstand voltage leakage current low limit value.

Range: 0 or 0.000001~0.1, 0 is for setting OFF (low limit value of leakage current ≤ high limit value of the setting).
Example: Input command **"SAFE:STEP 2:AC:LIM:LOW 0.00001"**
Description: This command sets AC withstand voltage leakage current low limit value of the main unit STEP 2 is 0.01mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:LOW?
This command queries selected step that AC withstand voltage leakage current low limit value. The unit is ampere (A).
Range: 0.000001~0.1 (low limit value of leakage current ≤ high limit value of setting)
Example: Input command **"SAFE:STEP 2:AC:LIM:LOW?"**
Return message **"1.000000E-05"**
Description: Return message **"1.000000E-05"** means AC withstand voltage leakage current low limit value of the main unit STEP 2 is 0.01mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:ARC[:LEVel]< *numeric value* >
This command sets selected step that ARC checking value. The unit is 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: This command means ARC checking value of the main unit STEP 2 is 4mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:ARC[:LEVel]?
This command queries selected step that ARC checking value.
Example: Input command **"SAFE:STEP 2:AC:LIM:ARC?"**
Return message **"4.000000E-03"**
Description: Return message **"4.000000E-03"** means ARC checking value of the main unit STEP 2 is 4.0mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:ARC:FILTer< *numeric value* >
This command sets selected step that ARC bandwidth selection. The unit is hertz (Hz).
Range: ARC bandwidth 23 kHz = 2.300000E+04
ARC bandwidth 50 kHz = 5.000000E+04
ARC bandwidth 100 kHz = 1.000000E+05
ARC bandwidth 230 kHz = 2.300000E+05
Example: Input command **"SAFE:STEP 2:AC:LIM:ARC:FILT 230000"**
Description: This command sets ARC bandwidth of the main unit STEP 2 is 230000Hz (230kHz).

[:SOURce]:SAFEty:STEP<n>:AC:LIMit:ARC:FILTer?
This command queries the selected step that ARC bandwidth selection.
Example: Input command **"SAFE:STEP 2:AC:LIM:ARC:FILT?"**
Return message **"2.300000E+05"**
Description: Return message **"2.300000E+05"** means ARC bandwidth of the main unit STEP 2 is 230000Hz (230kHz).

[SOURce]:SAFEty:STEP<n>:AC:FREQuency <numeric value>
This command sets output frequency of the selected step. The unit is hertz (Hz).
Range: 0 or 50~600, 0 is for setting DEFAULT.
When the setting is DEFAULT, output frequency is decided by AC Freq. setting of Preset Setup.
Example: Input command **"SAFE:STEP 2:AC: FREQ 60"**
Description: It indicates to set AC output frequency of the main unit STEP 2 is 60Hz.

[SOURce]:SAFEty:STEP<n>:AC:FREQuency?

This command queries output frequency of the selected step. The unit is hertz (Hz).
Example: Input command **"SAFE:STEP 2:AC: FREQ?"**
Return message **"6.000000E+01"**
Description: It returns **"6.000000E+01"** to indicate AC output frequency of the mian unit STEP 2 is 60Hz.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:RAMP < *numeric value* >
This command sets selected step that ramps to setting voltage needed time. The unit is 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: This command means test ramps to setting voltage needed time of the main unit STEP 2 is 5.0sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:RAMP?
This command queries selected step that ramps to setting voltage needed time.
Example: Input command "**SAFE:STEP 2:AC:TIME:RAMP?"**
Return message "**5.000000E+00"**
Description: Return message "**5.000000E+00"** means test ramps to setting voltage needed time of the main unit STEP 2 is 5.0sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME[:TEST] < *numeric value* >
This command sets selected step that test needed time. The unit is second (s).
Range: 0 or 0.3~999.0, 0 is for setting CONTINUE
Example: Input command **"SAFE:STEP 2:AC:TIME 10"**
Description: This command sets test needed time of the main unit STEP 2 is 10.0sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME[:TEST]?
This command queries selected step that test needed time.
Example: Input command **"SAFE:STEP 2:AC:TIME?"**
Return message **"1.000000E+01"**
Description: Return message **"1.000000E+01"** means test needed time of the main unit STEP 2 is 5sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:FALL < *numeric value* >
It sets the time required for set voltage to fall to 0 for selected STEP. The unit is 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 time required for set voltage to fall to 0 for STEP 2 of the main unit is 3.0sec..

[:SOURce]:SAFEty:STEP<n>:AC:TIME:FALL?
It queries the time required for set voltage to fall to 0 for selected STEP.
Example: Input command "**SAFE:STEP 2:AC:TIME:FALL?"**
Return message "**3.000000E+00"**
Description: Return message "**3.000000E+00"** means the time required for set voltage to fall to 0 for STEP 2 of the main unit is 3.0sec.

[:SOURce]:SAFEty:STEP<n>:AC:CHANnel[:HIGH] < *channel list* >
This command sets selected step that the setting of output terminal. < channel list > formats are as below:
(@SN(C1, C2, C3)), SN is Scan Box number, C1, C2 and C3 are Channels numbers.
Example: Input command "**SAFE:STEP 2:AC:CHAN(@2(1,2))"**

Description: This command sets output channel status of scanning test of the main unit STEP 2 is BOX 2 channel 1 and 2 HIGH output.

Example: Input command "**SAFE:STEP 2:AC:CHAN(@2(0))"**
Description: This command means output channel status of scanning test of the main unit STEP 2 is set BOX 2 original HIGH output channel to OFF.

[:SOURce]:SAFEty:STEP<n>:AC:CHANnel[:HIGH]?
This command queries selected step which setting of high voltage output terminal.
Example: Input command "**SAFE:STEP 2:AC:CHAN?"**
Return message "**(@2(1,2))"**
Description: Return message "**(@2(1,2))"** means output channel status of scanning test of the main unit STEP 2 is BOX 2 channel 1 and 2 HIGH output.

[:SOURce]:SAFEty:STEP<n>:AC:CHANnel:LOW < *channel list* >
This command sets output status of scanning common test channel (RTN/LOW).
Example: Input command "**SAFE:STEP 2:AC:CHAN:LOW (@2(2,4))"**
Description: This command means output channel status of scanning test of the main unit STEP 2 is set to BOX 2 channel 2 and 4 LOW output.

Example: Input command "**SAFE:STEP 2:AC:CHAN:LOW (@2(0))"**
Description: This command sets LOW output channel of scanning test of the main unit STEP 2 is OFF.

[:SOURce]:SAFEty:STEP<n>:AC:CHANnel:LOW?
This command queries selected step which Return channel setting.
Example: Input command "**SAFE: STEP 2: AC: CHAN: LOW?"**
Return message "**(@2(2,4))"**
Description: Return message "**(@2(2,4))"** means output channel status of scanning test of the main unit STEP 2 is BOX 1 channel 2 and 4 LOW output.

[:SOURce]:SAFEty:STEP<n>:AC:CURRent:OFFSet <numeric value>
This command sets Offset value of AC. The unit is Ampere (A).
Range: The OFFSET setting range is 0.000000 to 0.002999 when High Limit setting range is from 0.001 to 2.999mA.
The OFFSET setting range is 0.00000~0.02999 when High Limit setting range is from 3 to 29.99.
The OFFSET setting range is 0.00000~0.100 when High Limit setting range is from 30 to 100mA
Example: Input command **"SAFE:STEP 1:AC:CURR:OFFS 0.005"**
Description: It means to set AC Offset of STEP 1 in the main unit is 5mA.

[:SOURce]:SAFEty:STEP<n>:AC:CURRent:OFFSet?
This command queries offset value of selected step.
Example: Input command **"SAFE:STEP 1:AC:CURR:OFFS?"**
Return message **"5.000000E-03"**
Description: Return message **"5.000000E-03"** means offset value of STEP 1 in the main unit is 5mA.

[:SOURce]:SAFEty:STEP<n>:DC[:LEVel] < *numeric value* >
This command sets selected step that DC withstand voltage test needed voltage value. The unit is volt (V).
Range: 50~6000
Example: Input command **"SAFE:STEP 3:DC 4000"**

Description: This command sets DC withstand voltage test needed voltage value of the main unit STEP 3 is 4000V.

[:SOURce]:SAFEty:STEP<n>:DC[:LEVel]?
This command queries selected step that DC withstand voltage test needed voltage value.
Example: Input command **"SAFE:STEP 3:DC?"**
Return message **"4.000000E+03"**
Description: Return message **"4.000000E+03"** means DC withstand voltage test voltage value of STEP 3 in the main unit is 4000V.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit[:HIGH]< *numeric value* >
This command sets selected step, its DC withstand voltage leakage current high limit value. The unit is ampere (A).
Range: 0.0000001~0.025
Example: Input command **"SAFE:STEP 3:DC:LIM 0.002999"**
Description: This command sets DC withstand voltage leakage current high limit value of the main unit STEP 3 is 2.999mA.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit[:HIGH]?
This command queries selected step that DC withstand voltage leakage current high limit.
Example: Input command **"SAFE:STEP 3:DC:LIM?"**
Return message **"2.999000E-03"**
Description: Return message **"2.999000E-03"** means DC withstand voltage leakage current high limit value of the main unit STEP 3 is 2.999mA.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit:LOW < *numeric value* >
This command sets selected step that DC withstand voltage leakage current low limit value. The unit is ampere (A).
Range: 0.0000001~0.025, 0 is for setting OFF (low limit value of leakage current ≤ high limit value of the setting).
Example: Input command **"SAFE:STEP 3:DC:LIM:LOW 0.000001"**
Description: This command sets DC withstand voltage leakage current low limit value of the main unit STEP 3 is 0.001mA.

[:SOURce:]SAFEty:STEP<n>:DC:LIMit:LOW?
This command queries selected step that DC withstand voltage leakage current low limit value.
Example: Input command **"SAFE:STEP 3:DC:LIM:LOW?"**
Return message **"1.000000E-06"**
Description: Return message **"1.000000E-06"** means DC withstand voltage leakage current low limit value of the main unit STEP 3 is 0.001mA.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:ARC[:LEVel] < *numeric value* >
This command sets selected step, its ARC checking value. The unit is 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 checking value of STEP 3 in the main unit to 2.5mA.

[:SOURce]:SAFEty:STEP<n>:DC: LIMit:ARC[:LEVel]?
This command queries ARC checking value of selected step.
Example: Input command "**SAFE:STEP 3:DC:LIM:ARC?"**
Return message "**2.500000E-03"**

Description: Return message "**2.500000E-03"** means ARC checking value of STEP 3in the main unit is 2.5mA.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:ARC:FILTer < *numeric value* >
This command sets ARC bandwidth selection of selected step.
Range: ARC bandwidth 23 kHz = 2.300000E+04
ARC bandwidth 50 kHz = 5.000000E+04
ARC bandwidth 100 kHz = 1.000000E+05
ARC bandwidth 230 kHz = 2.300000E+05
Example: Input command **"SAFE: STEP 3: DC: LIM: ARC: FILT 230000"**
Description: This command sets ARC bandwidth of STEP 3 in the main unit is 230000Hz(230kHz).

[:SOURce]:SAFEty:STEP<n>:DC: LIMit:ARC:FILTer?
This command queries ARC bandwidth selection of selected step.
Example: Input command **"SAFE:STEP 3:DC:LIM:ARC:FILT?"**
Return message **"2.300000E+05"**
Description: Return message **"2.300000E+05"** means ARC bandwidth of STEP 3 in the main unit is 230000Hz(230kHz).

[:SOURce]:SAFEty:STEP<n>:DC:TIME:DWELl < *numeric value* >
This command sets selected step which DWELL needed time. The unit is 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 needed time of STEP 3 in the main unit is 2.5 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:DWELl?
This command queries selected step which DWELL needed time.
Example: Input command **"SAFE: STEP 3: DC: TIME: DWEL?"**
Return message **"2.500000E+00"**
Description: Return message **"2.500000E+00"** means dwell time of STEP 3 in the main unit is 2.5 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:RAMP < *numeric value* >
This command sets selected step that ramps to setting voltage needed time. The unit is 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 test ramps to setting voltage needed time of STEP 3 in the main unit is 2.0 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:RAMP?
This command queries selected step that ramps to setting voltage needed time.
Example: Input command **"SAFE: STEP 3: DC: TIME: RAMP?"**
Return message **"2.000000E+00"**
Description: Return message **"2.000000E+00"** means test ramps to setting voltage needed time of STEP 3 in the main unit is 2.0 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME[:TEST] < *numeric value* >
This command sets selected step which test needed time. The unit is second (s).
Range: 0 or 0.3~999.0, 0 is for setting CONTINUE
Example: Input command **"SAFE:STEP 3:DC:TIME 1"**
Description: This command sets test needed time of STEP 3 in the main unit is 1.0sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME[:TEST]?
This command queries test needed time of selected step.
Example: Input command "**SAFE:STEP 3:DC:TIME?"**
Return message "**1.000000E+00"**
Description: Return message "**1.000000E+00"** means test needed time setting of STEP 3 in the main unit is 1 sec.

[:SOURce]:SAFEty:STEP<n>:DC:TIME:FALL < *numeric value* >
It sets the time required for set voltage to fall to 0 for selected STEP. The unit is 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 time required for set voltage to fall to 0 for STEP 3 in the main unit is 3.0sec..

[:SOURce]:SAFEty:STEP<n>:DC:TIME:FALL?
It queries the time required for set voltage to fall to 0 for selected STEP.
Example: Input command "**SAFE:STEP 3:DC:TIME:FALL?"**
Return message "**3.000000E+00"**
Description: Return message "**3.000000E+00"** means the time required for set voltage to fall to 0 for STEP 3 in the main unit is 3.0sec..

[:SOURce]:SAFEty:STEP<n>:DC:CHANnel[:HIGH] < *channel list* >
It sets selected step that the setting of output terminal. < channel list > formats are as below:
(@SN(C1, C2, C3)), SN is Scan Box number, C1, C2 and C3 are Channels numbers.
Example: Input command "**SAFE: STEP 3: DC:CHAN(@2(1,2))"**
Description: This command sets output channel status of scanning test of STEP 3in the main unit is BOX 2 channel 1 and 2 HIGH output.

Example: Input command "**SAFE: STEP 3: DC:CHAN(@2(0))"**
Description: This command sets output channel status of scanning test of STEP 3 in the main unit is set BOX 2 original HIGH output channel to OFF.

[:SOURce]:SAFEty:STEP<n>:DC:CHANnel[:HIGH]?
It queries high voltage output channel setting of selected step.
Example: Input command "**SAFE: STEP 3: DC: CHAN?"**
Return message "**(@2(1,2))"**
Description: Return message "**(@2(1,2))"** means output channel status of scanning test of STEP 3 in the main unit is set BOX 2 channel 1 and 2 to HIGH output.

[:SOURce]:SAFEty:STEP<n>:DC:CHANnel:LOW < *channel list* >
It sets output status of scanning common test channel (RTN/LOW).
Example: Input command **"SAFE:STEP 3:DC:CHAN:LOW (@2(2,4))"**
Description: It sets output channel status of scanning test of STEP 3 in the main unit is BOX 2 channel 2 and 4 LOW output.

Example: Input command **"SAFE:STEP 3:DC:CHAN:LOW (@2(0))"**
Description: It sets LOW output channel of scanning test of STEP 3 in the main unit is OFF.

[:SOURce]:SAFEty:STEP<n>:DC:CHANnel:LOW?
It queries return channel setting of selected step.
Example: Input command "**SAFE: STEP 3: DC: CHAN: LOW?"**

Return message "**(@2(2,4))"**
Description: Return message "**(@2(2,4))"** means output channel status of scanning test of STEP 3 in the main unit is BOX 2 channel 2 and 4 LOW output.

[:SOURce]:SAFEty:STEP<n>:DC:CURRent:OFFSet <numeric value>
It sets offset value of DC. 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 0.000000~0.02500 when High Limit setting range is from 3mA to 25mA.
Example: Input command **"SAFE:STEP 1:DC:CURR:OFFS 0.005"**
Description: It sets DC offset of STEP 1 in the main unit is 5mA.

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

[:SOURce]:SAFEty:STEP<n>:DC:REVerse < *boolean* > | *ON* | *OFF*
This command sets DC REVERSE V parameter to ON or OFF. It is valid only when DC OUTPUT setting is ALTERNAT under SYSTEM SETUP.
Example: Input command "SAFE:STEP 1:DC: REV 1"
Description: It means to set REVERSE V parameter of main unit STEP 1 DC to ON.

[:SOURce]:SAFEty:STEP<n>:DC:REVerse?
This command queries DC REVERSE V parameter to be ON or OFF.
Example: Input command "SAFE:STEP 1:DC:REV?"
Return message "1"
Description: Return message "1" means REVERSE V parameter of main unit STEP 1 DC to be ON.

[:SOURce]:SAFEty:STEP<n>:IR[:LEVel] < *numeric value* >
It sets selected step which IR test needed voltage value. The unit is volt (V).
Range: 50~1000
Example: Input command **"SAFE:STEP 4:IR 1000"**
Description: This command sets IR test needed voltage value of STEP 4 in the main unit is 1000V.

[:SOURce]:SAFEty:STEP<n>:IR[:LEVel]?
It queries selected step which IR test needed voltage value.
Example: Input command **"SAFE:STEP 4:IR?"**
Return message **"1.000000E+03"**
Description: Return message **"1.000000E+03"** means IR test needed voltage value of STEP 4 in the main unit is 1000V.

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

[:SOURce]:SAFEty:STEP<n>:IR:LIMit:HIGH?
It queries IR high limit value of selected step.
Example: Input command **"SAFE:STEP 4:IR:LIM:HIGH?"**
Return message **"5.000000E+10"**
Description: Return message **"5.000000E+10"** means IR high limit value of STEP 4 in the main unit is 50GΩ.

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

[:SOURce]:SAFEty:STEP<n>:IR:LIMit[:LOW]?
It queries IR low limit value of selected step.
Example: Input command **"SAFE:STEP 4:IR:LIM?"**
Return message **"1.000000E+05"**
Description: Return message **"1.000000E+05"** means IR low limit value of STEP 4 in the main unit is 0.1MΩ.

[:SOURce]:SAFEty:STEP<n>:IR:TIME:RAMP < *numeric value* >
It sets selected step which ramps to setting voltage needed time. The unit is 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 test ramp to setting voltage needed time of STEP 4 in the main unit is 0.5 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME:RAMP?
It queries selected step which ramps to setting voltage needed time.
Example: Input command "**SAFE: STEP 4: IR: TIME: RAMP?"**
Return message "**5.000000E-01"**
Description: Return message "**5.000000E-01"** means test ramp to setting voltage needed time of the main unit STEP is 0.5 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME[:TEST] < *numeric value* >
It sets selected step which test needed time. The unit is 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 test needed time of STEP 4 in the main unit is 1.0sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME[:TEST]?
It queries test needed time of selected step.
Example: Input command "**SAFE:STEP 4:IR:TIME?"**
Return message "**1.000000E+00"**
Description: Return message "**1.000000E+00"** means test needed time of STEP 4 in the main unit is 1 sec.

[:SOURce]:SAFEty:STEP<n>:IR:TIME:FALL < *numeric value* >
It sets the time required for set voltage to fall to 0 for selected STEP. The unit is 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 the time required for set voltage to fall to 0 for STEP 4 in the main unit is 3.0sec..

[:SOURce]:SAFEty:STEP<n>:IR:TIME:FALL?
It queries the time required for set voltage to fall to 0 for selected STEP.
Example: Input command **"SAFE:STEP 4:IR:TIME:FALL?"**
Return message **"3.000000E+00"**
Description: Return message **"3.000000E+00"** means the time required for set voltage to fall to 0 for STEP 3 in the main unit is 3.0sec..

[:SOURce]:SAFEty:STEP<n>:IR: RANGe[:UPPer]
It selects the range upper than the current measured according to current value users inputted. The unit is 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]?
It queries the range being set.
Example: Input command **"SAFE:STEP 4:IR:RANG?"**
Return message **"3.000000E-03"**
Description: Return message **"3.000000E-03"** means set range for STEP 4 in the main unit is 3mA.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe:LOWer
It selects the range lower than the current measured according to current value users inputted. The unit is 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?
It queries set range.
Example: Input command **"SAFE:STEP 4:IR:RANG:LOW?"**
Return message **"3.000000E-04"**
Description: Return message **"3.000000E-04"** means set range for STEP 4 in the main unit is 300uA.

[:SOURce]:SAFEty:STEP<n>:IR:RANGe:AUTO < *boolean* > | *On* | *OFF*
It sets if IR range being changed to AUTO.
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 IR measured current range for STEP 4 in the main unit to AUTO.

[:SOURce]:SAFEty:STEP<n>:IR: RANGe:AUTO?
It queries if IR range being changed to AUTO.

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: Return message **"1"** means set range for STEP 4 in the main unit is AUTO.

[:SOURce]:SAFEty:STEP<n>:IR:CHANnel[:HIGH] < *channel list* >
It sets selected step which the setting of output terminal. < channel list > formats are as below:
(@SN(C1, C2, C3)), SN is Scan Box number, C1, C2 and C3 are Channels numbers.
Example: Input command **"SAFE: STEP 4: IR:CHAN(@2(1,2))"**
Description: It sets output channel status of scanning test of the main unit STEP 4 is BOX 2 channel 1 and 2 HIGH output.

Example: Input command **"SAFE: STEP 4: IR:CHAN(@2(0))"**
Description: It sets output channel status of scanning test of STEP 4 in the main unit is being set BOX 2 original HIGH output channel to OFF.

[:SOURce]:SAFEty:STEP<n>:IR:CHANnel[:HIGH]?
It queries selected step which setting of high voltage output channel.
Example: Input command **"SAFE: STEP 4: IR: CHAN?"**
Return message **"(@2(1,2))"**
Description: Return message **"(@2(1,2))"** means output channel status of scanning test of STEP 4 in main unit is being set BOX 2 channel 1 and 2 to HIGH output.

[:SOURce]:SAFEty:STEP<n>:IR:CHANnel:LOW < *channel list* >
It sets output status of scanning common test channel (RTN/LOW).
Example: Input command "**SAFE:STEP 4:IR:CHAN:LOW (@2(2,4))"**
Description: It sets output channel status of scanning test of STEP 4 in the main unit is channel 2 and 4 LOW output.

Example: Input command "**SAFE:STEP 4:IR:CHAN:LOW (@2(0))"**
Description: It sets LOW output channel status of scanning test of STEP 4 in the main unit is OFF.

[:SOURce]:SAFEty:STEP<n>:IR:CHANnel:LOW?
It queries RETURN channel setting of selected step.
Example: Input command **"SAFE: STEP 4: IR: CHAN: LOW?"**
Return message **"(@2(2,4))"**
Description: Return message **"(@2(2,4))"** means output channel status of scanning test of STEP 4 in the main unit is BOX 2 channel 2 and 4 LOW output.

[:SOURce]:SAFEty:STEP<n>:IR:REVerse < *boolean* > | *ON* | *OFF*
This command sets IR REVERSE V parameter to ON or OFF. It is valid only when IR OUTPUT setting is ALTERNAT under SYSTEM SETUP.
Example: Input command **"SAFE:STEP 1:IR: REV 1"**
Description: It means to set REVERSE V parameter of main unit STEP 1 IR to ON.

[:SOURce]:SAFEty:STEP<n>:IR:REVerse?
This command queries IR REVERSE V parameter to be ON or OFF.
Example: Input command **"SAFE:STEP 1:IR:REV?"**
Return message **"1"**
Description: Return message "1" means REVERSE V parameter of main unit STEP 1 IR to be ON.

[: SOURce]:SAFEty:STEP<n>:PAuse:MESSage *<string data >*
It sets the message string of pause mode.
Example: Input command "**SAFE: STEP 5: PA: MESS CHROMA"**
Description: This command sets message string of STEP 5 in the main unit to CHROMA.

[: SOURce]:SAFEty:STEP<n>:PAuse:MESSage?
It queries the setting string of message.
Example: Input command "**SAFE: STEP 5: PA: MESS?"**
Return message "**CHROMA"**
Description: Return message "**CHROMA"** means message string of STEP 5 in the main unit is "CHROMA".

[: SOURce]:SAFEty:STEP<n>:PAuse:UTSIgnal < *boolean* > | *On* | *OFF*
It sets the status of UNDER TEST SIGNAL.
Parameter is ON or 1 indicates the setting ON.
Parameter is OFF or 0 indicates the setting OFF.
Example: Input command **"SAFE: STEP 5: PA: UTSI ON"**
Description: It sets the status of UNDER TEST SIGNAL of the main unit STEP 5 to ON.

[: SOURce]:SAFEty:STEP<n>:PAuse:UTSIgnal?
It queries the status of UNDER TEST SIGNAL.
Return 1 indicates the setting ON.
Return 0 indicates the setting OFF.
Example: Input command **SAFE: STEP 5: PA: UTSI ON**
Return message "**1"**
Description: Return message "**1"** means the status of UNDER TEST SIGNAL of STEP 5 in the main unit is ON.

[: SOURce]:SAFEty:STEP<n>:PAuse:TIME[:TEST] <numeric_value>
It sets the time required of PA mode test for selected STEP.
Range: 0 or 0.3~999.0, 0 is for setting CONTINUE.
Example: Input command **"SAFE:STEP 5:PA:TIME 5"**
Description: It sets the time required for STEP 5 in the main unit is 5.0sec.

[: SOURce]:SAFEty:STEP<n>:PAuse:TIME[:TEST]?
It queries the time required of PA mode test for selected STEP.
Example: Input command "**SAFE:STEP 5:PA:TIME ?"**
Return message "**5.000000E+00"**
Description: Return message "**5.000000E+00"** means the time test required for STEP 5 in the main unit to set to 5.0sec.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: OPEN < *numeric value* >
It sets selected STEP which setting percentage is judged by open circuit as detecting short/open circuit. The unit is 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 short/open circuit is 30%.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: OPEN?
It queries selected STEP which setting percentage is judged by open circuit as detecting short/open circuit.
Example: Input command "**SAFE: STEP 6: OSC: LIM: OPEN?"**

Return message "**3.000000E-01**"
Description: Return message "**3.000000E-01**" means open circuit judgment percentage of the main unit STEP 6 as detecting short/open circuit is 30%.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: SHORT < *numeric value* >
It sets selected STEP which setting percentage is judged by short circuit as detecting short/open circuit. The unit is 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 short circuit judgment percentage of STEP 6 in the main unit as detecting short/open circuit is 300%.

[:SOURce]: SAFEty: STEP<n>: OSC: LIMit: SHORT?
It queries selected STEP which setting percentage is judged by short circuit as detecting short/open circuit.
Example: Input command **"SAFE: STEP 6: OSC: LIM: SHOR?"**
Return message "3.000000E+00"
Description: Return message "3.000000E+00" means short circuit judgment percentage of STEP 6 in the main unit as detecting short/open circuit is 300%.

[:SOURce]: SAFEty: STEP<n>: OSC: CHANnel[:HIGH] < *channel list* >
It sets selected step which the setting of output terminal. < channel list > formats are as below:
(@SN(C1, C2, C3)), SN is Scan Box number, C1, C2 and C3 are Channels numbers.
Example: Input command **"SAFE: STEP 6: OSC: CHAN(@2(1,2))"**
Description: It sets output channel status of scanning test of STEP 6 in the main unit is BOX 2 channel 1 and 2 HIGH output.

Example: Input command **"SAFE: STEP 6: OSC:CHAN(@2(0))"**
Description: It sets output channel status of scanning test of STEP 6 in the main unit is set BOX 2 original HIGH output channel to OFF.

[:SOURce]:SAFEty:STEP<n>:OSC:CHANnel[:HIGH]?
It queries high voltage output terminal setting of selected STEP.
Example: Input command **"SAFE: STEP 6: OSC: CHAN?"**
Return message **"(@2(1,2))"**
Description: Return message **"(@2(1,2))"** means output channel status of scanning test of STEP 6 in the main unit is being set BOX 2 channel 1 and 2 to HIGH output.

[:SOURce]: SAFEty: STEP<n>: OSC: CHANnel:LOW< *channel list* >
It sets the output status of scanning common test channel (RTN/LOW).
Example: Input command **"SAFE: STEP 6: OSC: CHAN: LOW (@2(2,4))"**
Description: It sets output channel status of scanning test of the main unit STEP 6 to channel 2 and 4 LOW output.

Example: Input command "**SAFE:STEP 6: OSC: CHAN: LOW (@(20))"**
Description: It sets output channel status of scanning test of STEP 6 in the main unit to OFF.

[:SOURce]:SAFEty:STEP<n>:OSC:CHANnel:LOW?
It queries RETURN terminal setting of selected STEP.
Example: Input command "**SAFE: STEP 6: OSC: CHAN: LOW?"**
Return message **"(@2(2,4))"**

Description: Return message "**(@(2,4))"** means output channel status of scanning test of STEP 6 in the main unit is channel 2 and 4 LOW output.

[:SOURce]:SAFEty:STEP<n>:OSC:CRANge? <MAXimun|MINimum|NOW>
It queries the maximum, minimum value which range can be set and the range is in operating now.
Example: Input command "**SAFE:STEP 6:OSC:CRAN? NOW"**
Return message **"3"**
Description: Return message **"3"** means OSC range of STEP 6 in the main unit is at 3 now.

[:SOURce]:SAFEty:STEP<n>:OSC:CURRent<m>:OFFSet <numeric value>
It sets current range of OSC and Offset value.
Range: m:RANGE NUMBER(1~3), numeric value= Cs value. The unit is F. Range: 0≤Cs<1000nF
Example: Input command **"SAFE:STEP1:OSC:CURR 3:OFFS 0.00000001"**
Description: It means to set current range to 3, offset value to 10nF of STEP 1 OSC in the main unit.

[:SOURce]:SAFEty:STEP<n>:OSC:CSTandard <range>,<numeric value>
It sets current range and standard capacitance value of OSC.
Range: range:1~3, numeric value= Cs value. The unit is in F.
Range 1: 0.001~9.999nF
Range 2: 0.01~99.99nF
Range 3: 0.1~500.0nF.
Example: Input command **"SAFE:STEP1:OSC:CST 3,0.000000009"**
Description: It means to set current range to 3, standard capacitance vale(Cs) to 9nF of STEP 1 OSC in the main unit.

[:SOURce]:SAFEty:STEP<n>:LC:DEVice *UL1950* | *UL1563* | *UL544NP* | *UL544P* | *UL2601|1950-U1|2601-U1*
It sets human body simulation circuit test mode of selected step.
Example: Input command "**SAFE: STEP 7: LC: DEV UL544NP"**
Description: It sets human body simulation circuit test mode of STEP 7 in the main unit to UL544NP.

[:SOURce]:SAFEty:STEP<n>:LC:DEVice?
It queries human body simulation circuit test mode of selected step.
Example: Input command "**SAFE: STEP 7: LC: DEV?"**
Return message "UL544NP"
Description: Return message "UL544NP" means human body simulation circuit test mode of STEP 7 in the main unit is UL544NP.

[:SOURce]:SAFEty:STEP<n>:LC:DISPlay RMS|PEAK
It sets LC leakage current display mode of selected STEP.
Example: Input command **"SAFE:STEP 7:LC:DISP RMS"**
Description: It sets display mode of LC leakage current for STEP 7 in the main unit is RMS.

[:SOURce]:SAFEty:STEP<n>:LC:DISPlay?
It queries LC leakage current display mode of selected STEP.
Example: Input command **"SAFE:STEP 7:LC:DISP?"**
Description: Return message "RMS" means display mode of LC leakage current for STEP 7 in the main unit is RMS.

[:SOURce]:SAFEty:STEP<n>:LC:LAC[:HIGH] <Range 0 ~ high limit, 0 represents off>
It sets LAC leakage current high limit of selected STEP. The unit is ampere (A).
Range: LAC HIGH LIMIT value ≤ LC HIGH LIMIT value, 0 is for setting OFF
DEVICE is UL544NP : 0.0000001~0.006
DEVICE is UL544P : 0.0000001~0.01
DEVICE is UL1563 : 0.0000001~0.01
DEVICE is UL2601 : 0.0000001~0.01
DEVICE is UL1950 : 0.0000001~0.01
DEVICE is 1950-U1(RMS) : 0.0000001~0.05
DEVICE is 1950-U1(PEAK) : 0.0000001~0.07
DEVICE is 2601-U1 : 0.0000001~0.01
Example: Input command **"SAFE:STEP 7:LC:LAC 0.0001"**
Description: It sets high limit of LAC leakage current for STEP 7 in the main unit is 0.1mA.

[:SOURce]:SAFEty:STEP<n>:LC:LAC?
It queries LAC leakage current value of selected STEP.
Example: Input command "**SAFE:STEP 7:LC:LAC?**
Description: Return message "1.000000E-04" means high limit of LAC leakage current for STEP 7 in the main unit.

[:SOURce]:SAFEty:STEP<n>:LC:LDC[:HIGH] <Range 0 ~ high limit, 0 represents off>
It sets high limit value of LDC leakage current of selected STEP. The unit is ampere (A).
Range: 0 or 0.000001~HIGH LIMIT value. If High Limit value is larger than 1mA, thus the maximum value can set is 0.001. 0 is for setting OFF.
Example: Input command **"SAFE:STEP 7:LC:LDC 0.001"**
Description: It sets high limit value of LDC leakage current for STEP 7 in the main unit to 1.0mA.

[:SOURce]:SAFEty:STEP<n>:LC:LDC[:HIGH]?
It queries LDC leakage current value of selected STEP.
Example: Input command **"SAFE:STEP 7:LC:LDC?"**
Description: Return message "1.000000E-03" means high limit value of LDC leakage current for STEP 7 in the main unit.

[:SOURce]:SAFEty:STEP<n>:LC:LINE *NORmal* | *REVerse* | *SFNormal* | *SFReverse*
It sets power circuit status simulation mode of selected step.
Example: Input command "**SAFE: STEP 7: LC: LINE REV"**
Description: It sets power circuit status simulation mode of STEP 7 in the main unit to Reverse.

[:SOURce]:SAFEty:STEP<n>:LC:LINE?
It queries power circuit status simulation mode of selected step.
Example: Input command "**SAFE:STEP 7:LC:LINE?"**
Return message "REVERSE"
Description: Return message "REVERSE" means power circuit status simulation mode of STEP 7 in the main unit is Reverse.

[:SOURce]:SAFEty:STEP<n>:LC:METEr *L* | *P, P* | *G*
It sets leakage current measurement point of selected step.
Example: Input command "**SAFE: STEP 7: LC: METE L,P"**
Description: It sets leakage current measurement point of STEP 7 in the main unit to L, P.

[:SOURce]:SAFEty:STEP<n>:LC:METEr?

It queries leakage current measurement point of selected step.
Example: Input command "**SAFE: STEP 7: LC:METE?"**
Return message "L, P"
Description: Return message "L, P" means the leakage current measurement point of STEP 7 in the main unit is L-P.

[:SOURce]:SAFEty:STEP<n>:LC:GSWItch < boolean > | ON | OFF
It sets ground switch status of selected step.
Example: Input command "**SAFE: STEP 7: LC: GSWI ON"**
Description: It sets ground switch status of STEP 7 in the main unit to ON.

[:SOURce]:SAFEty:STEP<n>:LC:GSWItch ?
It queries ground switch status of selected step.
Example: Input command "**SAFE: STEP 7: LC: GSWI?"**
Return message "1".
Description: Return message "1" means ground switch status of STEP 7 in the main unit is ON.

[:SOURce]:SAFEty:STEP<n>:LC:LIMit[:HIGH]< *numeric value* >
It sets leakage current high limit value of selected step.
Setting range DEVICE is UL544NP : 0.0000001 ~ 0.006
DEVICE is UL544P : 0.0000001 ~ 0.01
DEVICE is UL1563 : 0.0000001 ~ 0.01
DEVICE is UL2601-1 : 0.0000001 ~ 0.01
DEVICE is UL1950 : 0.0000001 ~ 0.01
DEVICE is 1950-U1(RMS) : 0.0000001 ~ 0.05
DEVICE is 1950-U1(PEAK) : 0.0000001 ~ 0.07
DEVICE is 2601-U1 : 0.0000001 ~ 0.01
Example: Input command "**SAFE: STEP 7: LC: LIM 0.006"**
Description: It sets leakage current high limit value of STEP 7 in the main unit to 6mA.

[:SOURce]:SAFEty:STEP<n>:LC:LIMit[:HIGH]?
It queries leakage current high limit value of selected step.
Example: Input command "**SAFE: STEP 7: LC: LIM?"**
Return message "6.000000E-03".
Description: Return message "6.000000E-03" means leakage current high limit value of STEP 7 in the main unit is 6mA.

[:SOURce]:SAFEty:STEP<n>:LC:LIMit:LOW < *numeric value* >
It sets leakage current low limit value of selected step. The unit is ampere (A).
Range : LOW LIMIT value ≤ HIGH LIMIT value. 0 is for setting OFF.
DEVICE is UL544NP : 0,0.0000001~0.006
DEVICE is UL544P : 0,0.0000001~0.01
DEVICE is UL1563 : 0,0.0000001~0.01
DEVICE is UL2601-1 : 0,0.0000001~0.01
DEVICE is UL1950 : 0,0.0000001~0.01
DEVICE is 1950-U1(RMS) : 0,0.0000001~0.05
DEVICE is 1950-U1(PEAK) : 0,0.0000001~0.07
DEVICE is 2601-U1 : 0,0.0000001~0.01
Example: Input command "**SAFE: STEP 7: LC: LIM: LOW 0.0005"**
Description: This command sets leakage current low limit value of STEP 7 in the main unit to 0.5mA.

[:SOURce]:SAFEty:STEP<n>:LC:LIMit:LOW?
It queries leakage current low limit value of selected step.
Example: Input command "**SAFE: STEP 7: LC: LIM?"**
Return message "5.000000E-04"
Description: Return message "5.000000E-04" means leakage current low limit value of STEP 7 in the main unit is 0.5mA.

[:SOURce]:SAFEty:STEP<n>:LC:TIME[:TEST] < *numeric value* >
It sets test needed time of selected step. The unit is second (s).
Range: 0 or 0.3~999.0, 0 is for setting CONTINUE
Example: Input command "**SAFE: STEP 7: LC: TIME 5"**
Description: It sets test needed time of STEP 7 in the main unit to 5.0sec.

[:SOURce]:SAFEty:STEP<n>:LC:TIME[:TEST]?
It queries test needed time of selected step.
Example: Input command "**SAFE: STEP 7: LC: TIME?"**
Return message "**5.000000E+00"**
Description: Return message "**5.000000E+00"** means test needed time of STEP 7 in the main unit is 5.0sec.

[:SOURce]:SAFEty:STEP<n>:LC:TIME:DWELl < *numeric value* >
It sets dwell time required for selected STEP. The unit is second (s).
Range: 0 or 0.1~999.0, 0 is for setting OFF
Example: Input command "**SAFE:STEP 7:LC:TIME:DWEL 2.0"**
Description: It sets dwell time required for main STEP 7 is 2.0sec.

[:SOURce]:SAFEty:STEP<n>:LC:TIME:DWELl?
It queries dwell time required for selected STEP.
Example: Input command "**SAFE:STEP 7:LC:TIME:DWEL?"**
Return message "**2.000000E+00"**
Description: Return message "**2.000000E+00"** means dwell time setting for STEP 7 in the main unit is 2.0sec.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:MODE *VOLTage* | *CURRent* | *VA* | *SIMUlation* | *SOURce*
It sets power measurement mode of selected STEP.
Example: Input command "**SAFE:STEP 7:LC:POW:MODE VOLTage"**
Description: It sets power measurement mode for STEP 7 of the main unit is VOLTAGE.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:MODE?
It queries power measurement mode of selected step.
Example: Input command "**SAFE: STEP 7: LC: POW: MODE?"**
Return message "**VOLTAGE"**
Description: Return message "**VOLTAGE"** means power measurement mode of STEP 7 in the main unit is VOLTAGE.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VOLTage[:LIMit][:HIGH] < *numeric value* >
It sets power voltage measurement high limit value of selected step. The unit is volt (V).
Range: 0 or 0.1~300.0. 0 is for setting OFF.
Example: Input command "**SAFE: STEP 7: LC: POW: VOLT 220"**
Description: It sets power voltage measurement high limit value of STEP 7 in the main unit to 220V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VOLTage[:LIMit][:HIGH]?

It queries power voltage measurement high limit value of selected step.
Example: Input command "**SAFE: STEP 7: LC: POW: VOLT?"**
Return message "**2.200000E+02"**
Description: Return message "**2.200000E+02"** means power voltage measurement high limit value of STEP 7 in the main unit is 220V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VOLTage[:LIMit]:LOW < *numeric value* >
It sets power voltage measurement low limit value of selected step. The unit is volt (V).
Range: 0 or 0.1~300.0. 0 is for setting OFF (low limit value of voltage measurement ≤ high limit value)
Example: Input command "**SAFE: STEP 7: LC: POW: VOLT: LOW 110"**
Description: It sets power voltage measurement low limit value of STEP 7 in the main unit to 110V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VOLTage[:LIMit]:LOW?
It queries power voltage measurement low limit value of selected step.
Example: Input command **"SAFE: STEP 7: LC: POW: VOLT: LOW?"**
Return message "**1.100000E+02"**
Description: Return message "**1.100000E+02"** means power voltage measurement low limit value of STEP 7 in the main unit is 110V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:CURRent[:LIMit][:HIGH] < *numeric value* >
It sets power current measurement high limit value of selected step. The unit is ampere (A).
Range: The range is 0 or 0.001~10 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 0.001~20 when it is 6000_07 or 6000_08. 0 is for setting OFF.
Example: Input command **"SAFE:STEP 7:LC:POW:CURR 5"**
Description: It sets power current measurement high limit value of STEP 7 in the main unit to 5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:CURRent[:LIMit][:HIGH]?
It queries power current measurement high limit value of selected step.
Example: Input command "**SAFE: STEP 7: LC: POW: CURR?"**
Return message "**5.000000E+00"**
Description: Return message "**5.000000E+00"** means power current measurement high limit value of STEP 7 in the main unit is 5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:CURRent[:LIMit]:LOW < *numeric value* >
It sets power current measurement low limit value of selected step. The unit is in Ampere (A).
Range: The range is 0 or 0.001~10 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 0.001~20 when it is 6000_07 or 6000_08. 0 is for setting OFF.
(The low limit of current measurement ≤ high limit)
Example: Input command **"SAFE:STEP 7:LC:POW:CURR:LOW 0.5"**
Description: It sets power current measurement low limit value of STEP 7 in the main unit to 0.5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:CURRent[:LIMit]:LOW?
It queries power current measurement low limit value of selected step.
Example: Input command **"SAFE: STEP 7: LC: POW: CURR: LOW?"**
Return message **"5.000000E-01"**
Description: Return message **"5.000000E-01"** means power current measurement low

limit value of STEP 7 in the main unit is 0.5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VA[:LIMit][:HIGH] < *numeric value* >
It sets power measurement high limit value of selected step. The unit is volt-ampere (VA).
Range: The range is 0 or 0.1~2200 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 0.1~4400 when it is 6000_07 or 6000_08. 0 is for setting OFF.
Example: Input command **"SAFE: STEP 7: LC: POW: VA 110"**
Description: It sets power measurement high limit value of STEP 7 in the main unit to 110VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VA[:LIMit][:HIGH]?
It queries power measurement high limit value of selected step.
Example: Input command **"SAFE: STEP 7: LC: POW: VA?"**
Return message **"1.100000E+02"**
Description: Return message **"1.100000E+02"** means power measurement high limit value of STEP 7 in the main unit is 110VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VA[:LIMit]:LOW < *numeric value* >
It sets power measurement low limit value of the selected step. The unit is volt-ampere (VA).
Range: The range is 0 or 0.1~2200 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 0.1~4400 when it is 6000_07 or 6000_08. 0 is for setting OFF.
(The low limit of power voltage ≤ high limit)
Example: Input command **"SAFE: STEP 7: LC: POW: VA: LOW 90"**
Description: It sets power measurement low limit value of STEP 7 in the main unit to 90VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:VA[:LIMit]:LOW?
It queries power measurement low limit value of selected step.
Example: Input command "**SAFE: STEP 7: LC: POW: LOW: VA?"**
Return message "**9.000000E+01"**
Description: Return message "**9.000000E+01"** means power measurement low limit value of STEP 7 in the main unit is 90VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SIMUlation:TVOLtage < *numeric value* >
It sets the selected step which target value of power voltage simulation. The unit is volt (V).
Range: 10~300
Example: Input command **"SAFE: STEP 7: LC: POW: SIMU: TVOL 127"**
Description: It sets target value of power voltage simulation of STEP 7 in the main unit to 127V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SIMUlation:TVOLtage?
It queries selected step which target value of power voltage simulation.
Example: Input command "**SAFE: STEP 7: LC: POW: SIMU: TVOL?"**
Return message "**1.270000E+02"**
Description: Return message "**1.270000E+02"** means target value of power voltage simulation of STEP 7 in the main unit is 127V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:TVOLtage < *numeric value* >
It sets source power voltage value of selected step. The unit is volt (V).
Range: 10~300

Example: Input command **"SAFE: STEP 7: LC: POW: SOUR: TVOL 90"**
Description: It sets source power voltage value of STEP 7 in the main unit to 90V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:TVOLtage?
It queries source power voltage value of selected step.
Example: Input command **"SAFE: STEP 7: LC: POW: SOUR: TVOL?"**
Return message **"9.000000E+01"**
Description: Return message **"9.000000E+01"** means source power voltage value of STEP 7 in the main unit is 90V.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce: TFRequency < *numeric value* >
It sets source power frequency value of selected step. The unit is hertz (Hz).
Range: 45~65
Example: Input command **"SAFE: STEP 7: LC: POW: SOUR: TFR 60"**
Description: It sets source power frequency value of STEP 7 in the main unit to 60Hz.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce: TFRequency?
It queries source power frequency value of selected step.
Example: Input command **"SAFE: STEP 7: LC: POW: SOUR: TFR?"**
Return message **"6.000000E+01"**
Description: Return message **"6.000000E+01"** means source power frequency value of STEP 7 in the main unit is 60Hz.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:CURRent [:LIMit][:HIGH] <*numeric value*>
It sets measurement high limit of power source in the selected step. The unit is ampere (A).
Range: The range is 0 or 0.001~10 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 0.001~20 when it is 6000_07 or 6000_08. 0 is for setting OFF.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:CURR 5"**
Description: It indicates to set measurement high limit of power source in the main unit step 7 is 5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:CURRent [:LIMit][:HIGH] ?
It queries measurement high limit of power source in the selected step.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:CURR?"**
Return message **"5.000000E+00"**
Description: Return message **"5.000000E+00"** means measurement high limit of power source in the main unit step 7 is 5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:CURRent [:LIMit]:LOW< *numeric value* >
It sets measurement low limit of power source in the selected step. The unit is ampere (A).
Range: The range is 0 or 0.001~10 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 0.001~20 when it is 6000_07 or 6000_08. 0 is for setting OFF.
(The low limit of current measurement ≤ high limit)
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:CURR:LOW 5"**
Description: It indicates to set measurement low limit of power source in the main unit step 7 is 5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:CURRent [:LIMit]:LOW ?

It queries measurement low limit of power source in the selected step.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:CURR:LOW?"**
Return message **"5.000000E+00"**
Description: Return message **"5.000000E+00"** means measurement low limit of power source in the main unit step 7 is 5A.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:VA [:LIMit][:HIGH] < *numeric value* >
It sets measurement high limit of source power voltage in the selected step. The unit is volt-ampere (VA).
Range: The range is 0 or 1~2200 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 1~4400 when it is 6000_07 or 6000_08. 0 is for setting OFF.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:VA 100"**
Description: It indicates to set measurement high limit of source power voltage in the main unit step 7 is 100VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:VA [:LIMit][:HIGH] ?
It queries measurement high limit of source power voltage in the selected step.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:VA?"**
Return message **"1.000000E+02"**
Description: Return message **"1.000000E+02"** means measurement high limit of power source in the main unit step 7 is 100VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:VA [:LIMit]:LOW <*numeric value*>
It sets measurement low limit of source power voltage in the selected step. The unit is volt-ampere (VA).
Range: The range is 0 or 1~2200 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 1~4400 when it is 6000_07 or 6000_08. 0 is for setting OFF.
(The low limit of power voltage measurement ≤ high limit)
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:VA:LOW 100"**
Description: It indicates to set measurement low limit of source power voltage in the main unit step 7 is 100VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:VA [:LIMit]:LOW ?
It queries measurement low limit of source power voltage in the selected step.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:VA:LOW?"**
Return message **"1.000000E+02"**
Description: Return message **"1.000000E+02"** means measurement low limit of source power voltage in the main unit step 7 is 100VA.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:POWer [:LIMit][:HIGH] < *numeric value* >
It sets measurement high limit of source real power in the selected step. The unit is watt (W).
Range: The range is 0 or 1~2200 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 1~4400 when it is 6000_07 or 6000_08. 0 is for setting OFF.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:POW 100"**
Description: It indicates to set measurement high limit of source real power in the main unit step 7 is 100W.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:POWer [:LIMit][:HIGH] ?

It queries measurement high limit of source real power in the selected step.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:POW?"**
Return message **"1.000000E+02"**
Description: Return message **"1.000000E+02"** means measurement high limit of source real power in the main unit step 7 is 100W.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:POWer [:LIMit]:LOW < *numeric value* >
It sets measurement low limit of source real power in the selected step. The unit is watt (W).
Range: The range is 0 or 1~2200 when it is 6000_04, 6000_05 or 6000_06. 0 is for setting OFF.
The range is 0 or 1~4400 when it is 6000_07 or 6000_08. 0 is for setting OFF.
(The low limit of source real power measurement ≤ high limit)
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:POW 100"**
Description: It indicates to set measurement low limit of source real power in the main unit step 7 is 100W.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:POWer [:LIMit]:LOW ?
It queries measurement low limit of source real power in the selected step.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:VA:LOW?"**
Return message **"1.000000E+02"**
Description: Return message **"1.000000E+02"** means measurement low limit of source real power in the main unit step 7 is 100W.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:PFACtor[:LIMit]:LOW < *numeric value* >
It sets measurement low limit of source power factor in the selected step.
Range: The range is 0 or 0.001~0.999. 0 is for setting OFF.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:PFA:LOW 0.9"**
Description: It indicates to set measurement low limit of source power factor in is 0.9.

[:SOURce]:SAFEty:STEP<n>:LC:POWer:SOURce:PFACtor[:LIMit]:LOW ?
It queries measurement low limit of source power factor in the selected step.
Example: Input command **"SAFE:STEP7:LC:POW:SOUR:PFA:LOW?"**
Return message **"9.000000E-01"**
Description: Return message **"9.000000E-01"** means measurement low limit of source power factor in the main unit step 7 is 0.9.

[:SOURce]:SAFEty:STEP<n>:LC:UPM < *boolean* > | *On* | *OFF*
It sets if UPM function of the selected step is activated.
Example: Input command **":SAFE:STEP7:LC:UPM ON"**
Description: It indicates to activate UPM function of the main unit step 7.

[:SOURce]:SAFEty:STEP<n>:LC:UPM ?
It queries if UPM function of the selected step is activated.
Example: Input command **":SAFE:STEP7:LC:UPM?"**
Return message **"1"**
Description: Return message **"1"** means UPM function of the main unit step 7 is activated.

[:SOURce]:SAFEty:STEP<n>:LC:CHANnel[:LOW] < *channel list* >
It sets RETURN terminal setting of selected step.

Example: Input command **"SAFE:STEP 7:LC:CHAN (@1(3))"**
Description: It sets output channel status of scanning test of STEP 7 in the main unit is BOX 1 channel 3 LOW output.

[:SOURce]:SAFEty:STEP<n>:LC:CHANnel[:LOW]?
It queries return terminal setting of selected step.
Example: Input command **"SAFE:STEP 7:LC:CHAN?"**
Return message **"(@1(3))"**
Description: Return message **"(@1(3))"** means output channel status of scanning test of STEP 7 in the main unit is BOX 1 channel 3 LOW output.

[:SOURce]:SAFEty:STEP<n>:LC:CHANnel:HIGH < *channel list* >
It sets HV output terminal setting of the selected step.
Example: Input command **"SAFE:STEP 7:LC:CHAN (@2(1,2,3))"**
Description: It indicates to set scanning test output channel status of the main unit step 7 as BOX 2 channel 1, 2 and 3 high output.

[:SOURce]:SAFEty:STEP<n>:LC:CHANnel:HIGH?
It queries HV output terminal setting of the selected step.
Example: Input command **"SAFE:STEP 7:LC:CHAN:HIGH?"**
Return message **"(@2(1,2,3))"**
Description: Return message **"(@2(1,2,3))"** means output channel status of scanning test in the main unit step 7 as BOX 2 channel 1, 2, 3 high output.

[:SOURce]:SAFEty:STEP<n>:LC:CURR:OFFSet[:LC] <numeric value>
It sets offset value of LC. The unit is in Ampere (A).
The Offset setting value is above 0 and the ranges are as follows.
6000-05/07 range:
When High Limit setting range is from 0.1uA to 59.9uA, thus
High Limit + Offset setting value ≤ 0.000066.

When High Limit setting range is from 60uA to 599uA, thus
High Limit + Offset setting value ≤ 0.00066.

When High Limit setting is over 600uA (600uA included),
High Limit + Offset setting value of UL544NP ≤ 0.0066.
High Limit + Offset setting value of UL544P ≤ 0.011.
High Limit + Offset setting value of UL1563 ≤ 0.011.
High Limit + Offset setting value of UL2061 ≤ 0.011.
High Limit + Offset setting value of UL1950 ≤ 0.011.

6000-04/06/08 range:
When High Limit setting range is from 0.1uA to 599uA, thus
High Limit + Offset setting value ≤ 0.00066.

When High Limit setting is over 600uA (600uA included),
High Limit + Offset setting value of UL544NP ≤ 0.0066.
High Limit + Offset setting value of UL544P ≤ 0.011.
High Limit + Offset setting value of UL1563 ≤ 0.011.
High Limit + Offset setting value of UL2061 ≤ 0.011.
High Limit + Offset setting value of UL1950 ≤ 0.011.
High Limit + Offset setting value of 1950-U1 (RMS) ≤ 0.055.
High Limit + Offset setting value of 1950-U1 (PEAK) ≤ 0.077.

High Limit + Offset setting value of 2601-U1 ≤ 0.011.

Note Only 6000-08 can set DEVICE 1950-U1 and 2601-U1.

Example: Input command **"SAFE:STEP1:LC:CURR:OFFS 0.0002"**
Description: It means to set LC Offset of STEP 1 in the main unit to 0.2mA.

[:SOURce]:SAFEty:STEP<n>:LC:CURR:OFFSet[:LC]?
It queries offset value of selected step.
Example: Input command **"SOUR:SAFETY:STEP1:LC:CURR:OFFS?"**
Return message **"2.000000E-04"**
Description: Return message **"2.000000E-04"** means offset value of STEP 1 in the main unit is 0.2mA.

[:SOURce]:SAFEty:STEP<n>:LC:CURRent:OFFSet:LAC <numeric value>
It sets offset value of LAC. The unit is in Ampere (A).
The LAC Offset setting value is above 0 and the ranges are as follows.
Range:
When High Limit setting range is from 0.1uA to 599uA, thus LAC High Limit + Offset setting value ≤ 0.00066.
When High Limit setting is over 600uA (600uA included),
LAC High Limit + Offset setting value of UL544NP ≤ 0.0066.
LAC High Limit + Offset setting value of UL544P ≤ 0.011.
LAC High Limit + Offset setting value of UL1563 ≤ 0.011.
LAC High Limit + Offset setting value of UL2061 ≤ 0.011.
LAC High Limit + Offset setting value of UL1950 ≤ 0.011.
LAC High Limit + Offset setting value of 1950-U1 (RMS) ≤ 0.055.
LAC High Limit + Offset setting value of 1950-U1 (PEAK) ≤ 0.077.
LAC High Limit + Offset setting value of 2601-U1 ≤ 0.011.
Example: Input command **"SAFE:STEP1:LC:CURR:OFFS:LAC 0.0002"**
Description: It means to set LAC Offset of STEP 1 in the main unit to 0.2mA.

[:SOURce]:SAFEty:STEP<n>:LC:CURRent:OFFSet:LAC?
It queries LAC offset of the the selected step.
Example: Input command **"SAFE:STEP1:LC:CURR:OFFS:LAC?"**
Return message **"2.000000E-04"**
Description: Return message **"2.000000E-04"** means LAC offset value in the main unit STEP 1 is 0.2mA.

[:SOURce]:SAFEty:STEP<n>:LC:CURRent:OFFSet:LDC <numeric value>
It sets offset value of LDC. The unit is in Ampere (A).
Range: LDC High Limit + Offset value ≤ 0.0011.
Example: Input command **"SAFE:STEP1:LC:CURR:OFFS:LDC 0.0002"**
Description: It means to set LDC Offset of STEP 1 in the main unit to 0.2mA.

[:SOURce]:SAFEty:STEP<n>:LC:CURRent:OFFSet:LDC?
It queries LAC offset of the the selected step.
Example: Input command **"SAFE:STEP1:LC:CURR:OFFS:LDC?"**
Return message **"2.000000E-04"**
Description: Return message **"2.000000E-04"** means LDC offset in the main unit step 1 is 0.2mA.

[:SOURce]:SAFEty:PRESet:TIME:PASS < *numeric value* >

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

[:SOURce]:SAFEty:PRESet:TIME:STEP < *numeric value* > | *KEY*
It sets the interval time between step and step, or the next start command to execute the next step. 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?
It queries the interval time between step and step, the return value is KEY or the unit is second.
Example: Input command **"SAFE:PRES:TIME:PASS?"**
Return message **"5.000000E-01"**
Description: Return message **"5.000000E-01"** means the interval time between step and step is 0.5 second.

[:SOURce]:SAFEty:PRESet:TIME:ASTart < *numeric value* >
It sets the time of Start Wait. The unit is second (s).
Range: 0 or 0.1~99.9. 0 is for setting OFF
Example: Input command **"SAFE:PRES:TIME:AST 1"**
Description: It sets the time of Start Wait to 1 second.

[:SOURce]:SAFEty:PRESet:TIME:ASTart?
It queries the time of Start Wait.
Example: Input command **"SAFE:PRES:TIME:AST?"**
Return message **"1.000000E+00"**
Description: Return message "**1.000000E+00"** means the time of Start Wait is 0.5 second.

[:SOURce]:SAFEty:PRESet:GB:FREQuency < *numeric value* >
It sets the output current frequency when testing ground bond. The unit is Hertz (Hz).
Range: 50/60
Example: Input command **"SAFE:PRES:GB:FREQ 50"**
Description: It sets the output current frequency to 50Hz when testing ground bond.

[:SOURce]:SAFEty:PRESet:GB:FREQuency?
It queries the output current frequency when testing ground bond.
Example: Input command **"SAFE:PRES:GB:FREQ?"**
Return message **"5.000000E+01"**
Description: Return message **"5.000000E+01"** means the output current frequency is

50Hz when testing ground bond.

[:SOURce]:SAFEty:PRESet:GB:VOLTage < *numeric value* >
It sets open circuit voltage when testing ground bond. The unit is volt (V).
Range: 6~15
Example: Input command **"SAFE:PRES:GB:VOLT 15"**
Description: It sets open circuit voltage to 15V when testing ground bond.

[:SOURce]:SAFEty:PRESet:GB:VOLTage?
It queries open circuit voltage when testing ground bond.
Example: Input command **"SAFE:PRES:GB:VOLT?"**
Return message **"1.500000E+01"**
Description: Return message "**1.500000E+01"** means open circuit voltage is 15V when testing ground bond.

[:SOURce]:SAFEty:PRESet:AC:FREQuency< *numeric value* >
It sets the output voltage frequency when testing AC withstand voltage. The unit is hertz (Hz).
Range: 50~600
Example: Input command **"SAFE:PRES:AC:FREQ 60"**
Description: It sets the output voltage frequency to 60Hz when testing AC withstand voltage.

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

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

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

[:SOURce]:SAFEty:PRESet:AGC[:SOFTware] < *boolean* > | *ON* | *OFF*
It sets if software AGC is ON or OFF.
Example: Input command **"SAFE:PRES:AGC ON"**
Description: It sets software AGC in the main unit to ON.

[:SOURce]:SAFEty:PRESet:AGC[:SOFTware]?
It queries if software AGC is ON or OFF.
Example: Input command **"SAFE:PRES:AGC?"**
Return message **"1"**
Description: Return message **"1"** means software AGC is ON.

[:SOURce]:SAFEty:PRESet:NUMber:PART < *string data* >
It sets part number of the product.

Example: Input command **"SAFE:PRES:NUM:PART 19032"**
Description: It sets part number of the product to 19032.

[:SOURce]:SAFEty:PRESet:NUMber:PART?
It queries part number of the product.
Example: Input command **"SAFE:PRES:NUM:PART?"**
Return message **"19032"**
Description: Return message **"19032"** means part number of the product is 19032.

[:SOURce]:SAFEty:PRESet:NUMber:LOT < *string data* >
It sets lot number of the product.
Example: Input command **"SAFE:PRES:NUM:LOT 0032"**
Description: It sets lot number of the product to 0032.

[:SOURce]:SAFEty:PRESet:NUMber:LOT?
It queries lot number of the product.
Example: Input command **"SAFE:PRES:NUM:LOT?"**
Return message **"0032"**
Description: Return message **"0032"** means lot number of the product is 0032.

[:SOURce]:SAFEty:PRESet:NUMber:SERIal < *string data* >
It sets serial number format of the product, denotes changeable character by *.
Example: Input command **"SAFE:PRES:NUM:SERI AAP190320***"**
Description: It sets serial number format of the product to AAP190320***.

[:SOURce]:SAFEty:PRESet:NUMber:SERIal?
It queries serial number format of the product.
Example: Input command **"SAFE:PRES:NUM:SERI?"**
Return message **"AAP190320***"**
Description: Return message **"AAP190320***"** means serial number format of the product is AAP190320***.

[:SOURce]:SAFEty:PRESet:IEC < *boolean* > | *ON* | *OFF*
It sets if IEC-601 is ON or OFF.
Example: Input command **"SAFE:PRES:IEC ON"**
Description: It sets IEC-601 to ON.

[:SOURce]:SAFEty:PRESet:IEC?
It queries if IEC-601 is ON or OFF.
Example: Input command **"SAFE:PRES:IEC?"**
Return message **"1"**
Description: Return message **"1"** means IEC-601 ON.

[:SOURce]:SAFEty:PRESet:RJUDgment< *boolean* > | *ON* | *OFF*
It sets Ramp Judg. ON or OFF.
Example: Input command **"SAFE:PRES:RJUD ON"**
Description: It sets Ramp Judg. ON for the main unit.

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

[:SOURce]:SAFEty:PRESet:GFI *ON|OFF|FLOAT*
It is used for GFI setting.
Example: Input command **"SAFE:PRES:GFI ON"**
Description: It means to set GFI ON.

[:SOURce]:SAFEty:PRESet:GFI?
It is used for querying GFI.
Example: Input command **"SAFE:PRES:GFI?"**
Return message "ON"
Description: It means GFI ON.

[:SOURce]:SAFEty:PRESet:SCREen< *boolean* > | *ON* | *OFF*
It sets if enable Screen.
Example: Input command **"SAFE:PRES:SCRE OFF".**
Description: It sets Screen of the analyzer to off.

[:SOURce]:SAFEty:PRESet:IMEAS <*OUTPUT|RETURN*>
It sets I MESA to OUTPUT or RETURN.
Example: Input command **"SAFE:PRES:IMEAS OUTPUT"**
Description: It means to set I MESA to OUTPUT.

[:SOURce]:SAFEty:PRESet:IMEAS?
It queries the setting of I MESA.
Example: Input command **"SAFE:PRES:IMEAS?"**
Return message "OUTPUT"
Description: It means I MEAS OUTPUT.

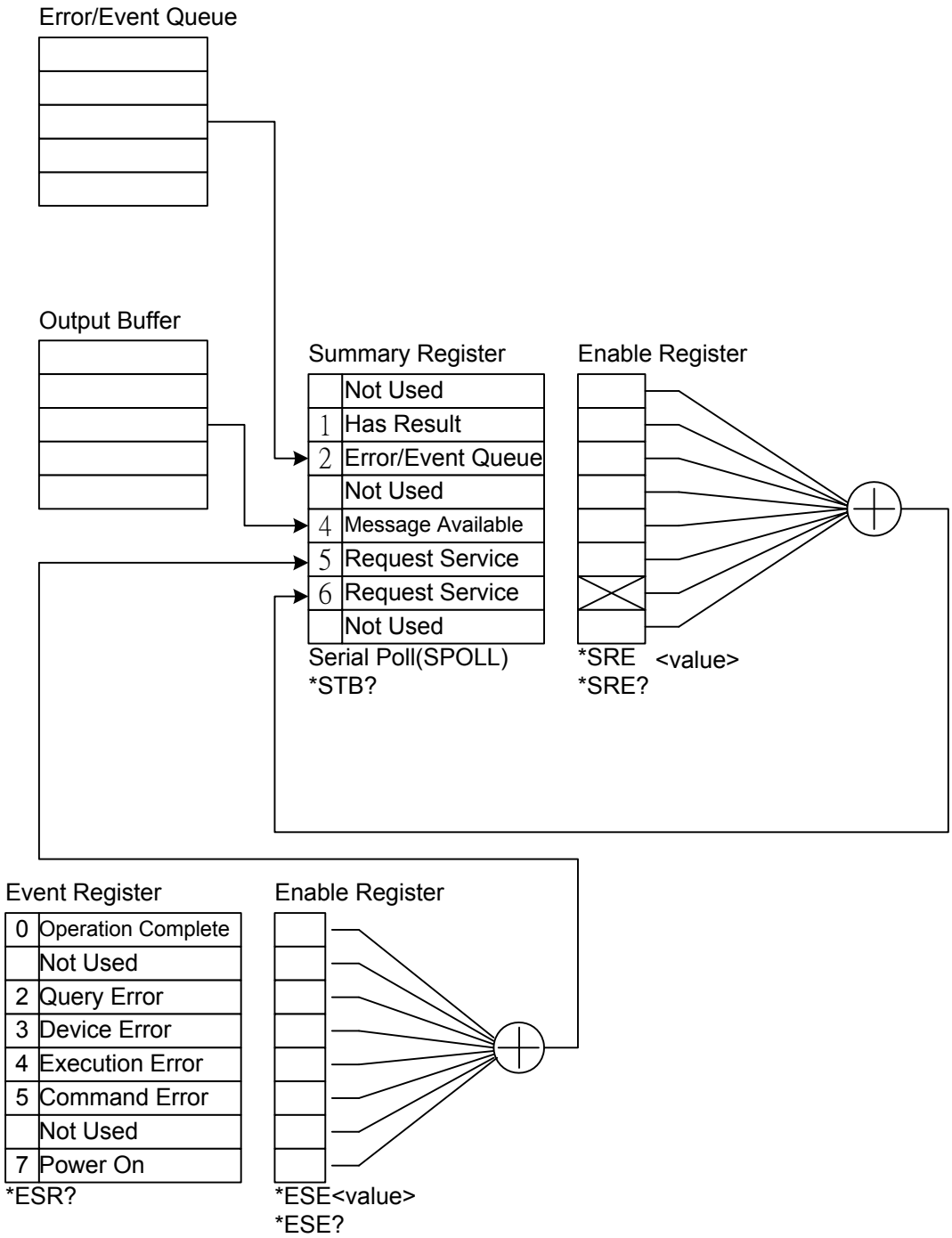
TRIGger:SOURce:EXTernal:STATe< *boolean* > | *ON* | *OFF*
It sets if START KEY being blocked under remote state.
START KEY won't be blocked under remote state when parameter is 1.
START KEY will be blocked under remote state when parameter is 0.
Example: Input command **"TRIG:SOUR:EXT:STAT 0"**
Description: It sets START KEY being blocked under remote state for the main unit.

TRIGger:SOURce:EXTernal:STATe?
It queries if START KEY being blocked under remote state.
Example: Input command **"TRIG:SOUR:EXT:STAT?"**
Return message **"0"**
Description: Return message **"0"** means START KEY will be blocked under remote state for the main unit.

5.4.3 Start Test by Serial No.

This device will start 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 test.

5.4.4 SCPI Status System



5.5 Error Message

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

-102 Syntax error
Syntax error usually includes not allowed character symbol in command.
-103 Invalid separator
Invalid separator characters are found in command string.
-108 Parameter not allowed
The device receives parameter is not allowed.
-109 Missing parameter
Parameter is missed
-112 Program mnemonic too long
The header contains more than twelve characters
-113 Undefined header
The device is received undefined 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 missing.
-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
Execute command 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 execute.
-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 received a query command, you don't read out the query result and then received a query command immediately. The query will be interrupted.

-420 Query UNTERMINATED

There is no data in queue, meanwhile read the command of output queue 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
```

■ **Save and recall 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:GB:LEVel 25"
PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP1:GB:LIMit:HIGH 0.02"

PRINT #1, "OUTPUT 3;SOURce:SAFEty:STEP2:AC:LEVel 500"
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 be warm up at least 30 minutes.

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

Voltage Calibration (See *section 6.2*)

ACV	5kV	Offset (500V)	;AC Voltage	OFFSET	point
ACV	5kV	Full (4kV)	;AC Voltage	FULL	point
DCV	6kV	Offset (500V)	;DC Voltage	OFFSET	point
DCV	6kV	Full (4kV)	;DC Voltage	FULL	point
IRV	1kV	Offset (500V)	;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
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

Grounding Mode Calibration (See *section 6.4*)

GBA	40A	Offset (3A)	;GB current	OFFSET	point
GBA	40A	Full (25A)	;GB current	FULL	point
GBV	8V	Offset (0.3V)	;GB voltage	OFFSET	point
GBV	8V	Full (3V)	;GB voltage	FULL	point

Withstand Voltage Mode Arcing Calibration (See *section 6.5*)

AC	ARC	40mA(5mA)	;AC Arcing	Calibration
DC	ARC	12mA(5mA)	;DC Arcing	Calibration

Insulation Resistance Mode Leakage Current Meter Calibration (See *section 6.6 & 6.7*)

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 Calibration

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 an 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 a 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 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 high potential terminal and input terminal of ammeter. Otherwise, the dangerous condition may be occurred.

6.3.1 AC Current Calibration

Connecting a 10MΩ load resistor in high potential terminal of withstand voltage tester, and series high potential terminal (HV1) of AC ammeter. However, connect low potential terminal (HV2) of withstand voltage tester to 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).
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 DC Current Calibration

Connecting a 10MΩ load resistor in high potential terminal of withstand volatge tester, and series high potential terminal of DC ammeter. However, connect low potential terminal of withstand voltage tester to low potential terminal of DC ammeter or connecting 9102 to select DCA MODE [10MΩ].

Press [△] key to display
Display DCA 0.3mA Offset (0.012mA); DCA 2.999uA range Offset point calibration.
Press [STOP] [START] ; Read out the ammeter value
; Example 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 connecting 9102 to select DCA MODE [500kΩ].
Press [△] key to display
Display DCA 3mAFULL (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 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 GBA/GBV Calibration

Connecting an ammeter is over 30Amp by four wires (±sense and ±driver) or connecting 9102 to select GRA MODE [>0Ω].

Press [△] key to display
Display GBA 40A Offset (3A) ; GRA offset point calibration.
Press [STOP] [START] ; Read out the ammeter value
; Example 2.897Amp
Press [2] [.] [8] [9] [7] [ENTER]
Press [STOP] ; Stop GBA offset point calibration
Press [△] key to display
Display GBA 40A FULL (25A) ; GRA full point calibration.
Press [STOP] [START] ; Read out the ammeter value
; Example 24.87Amp
Press [2] [4] [.] [8] [7] [ENTER]
Press [STOP] ; Stop GBA calibration.

Connecting 0.1Ω 200watts resistor and an ammeter is over 30Amp by four wires (±sense and ±driver) or connecting 9102 to select GRV MODE [0.1000Ω].

Press [△] key to display ; GRV offset point calibration

Display	GBV 8V offset (0.3V)	; 3.0Amp into 100mΩ (9102 select GRV [0.1000Ω])
Press	[STOP] [START]	; Read out GRV value ; Example 0.301 volts
Press	[0] [.] [3] [0] [1] [ENTER]	
Press	[STOP]	; Stop GBV offset point calibration.
Press	[△] key to display	; GRV full point calibration
Display	GBV 8V FULL (3V)	; 30Amp into 100mΩ.(9102 select GRV [0.1000Ω])
Press	[STOP] [START]	; Read out GRV value ; Example 3.002 volts
Press	[3] [.] [0] [0] [2] [ENTER]	
Press	[STOP]	; Stop GBV calibration

6.5 Withstand Voltage Mode Arc Calibration

CAUTION 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, and arcing 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 arcing sensitivity calibration.
Display	DC ARC 12mA (5mA)	; DC 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, and arcing 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.

6.6 Resistor Calibration for Insulation Resistance Mode

The standard load resistor is connecting between high potential terminal and 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

6.7 Complete Calibration

Press [EXIT]
[MENU]
Go to MAIN MENU

7. Maintenance

7.1 General

Our warranty (at the front of the manual) attests the quality of materials and workmanship in our products. If malfunction should be suspected, or other information be desired applications engineers are available for technical assistance. Application assistance is available in the Taiwan by calling 886-3-3279999 and asking for applications support. For support outside of the Taiwan please contact your local Chroma distributor.

7.2 Battery Replacement

Batteries are included in the instrument. Please contact the service center for battery replacement.

CAUTION 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 Chroma for service please call our Service Department at 886-3-3279688 for return material authorization. It will be necessary to include a purchase order number to insure expedient processing, although units found to be in warranty 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 packaging that is adequate to protect it from damage, i.e., equivalent to the original packaging and mark the box "Delicate Electronic Instrument". Return material should be sent freight prepaid, to:

Chroma Ate Inc.
66 Hwaya 1st Rd., Kueishan Hwaya Technology Park,
Taoyuan County 33383, Taiwan
Attention: Service Department

CAUTION This machine is overweight, please use wheelbarrow to avoid injuring.

CHROMA ATE INC.

致茂電子股份有限公司

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Kuei-shan Hwaya Technology Park

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