HIPOT Tester

19051/19052/19053/19054

User's Manual

Chroma

www.chromaate.com

HIPOT Tester
19051/19052/19053/19054
User's Manual

Version 2.1
December 2009
P/N A11 000893

Legal Notices

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

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CHROMA ATE INC.
No.66 Hwa-Ya 1st Rd., Hwa-Ya Technical Park, Kuei-Shan 33383, Taoyuan County, Taiwan

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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.

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CHROMA ATE INC.

No.66 Hwa-Ya 1st Rd., Hwa-Ya Technical Park,
Kuei-Shan 33383, Taoyuan County, Taiwan
Tel: 886-3-327-9999
Fax: 886-3-327-2886
http://www.chromaate.com

Material Contents Declaration

A regulatory requirement of The People's Republic of China defined by specification SJ/T 11364-2006 mandates that manufacturers provide material contents declaration of electronic products, and for Chroma products are as below:

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

QuieTek Corporation

EMC/Safety Test Laboratory

Accredited by DNV, Nemko and NVLAP

QTK No.: 047L046E

CE

Statement of Conformity

The certifies that the following designated product

Product	:	Hipot tester
Trade name	:	Chroma, TOADKK, QuadTech
Model Number	:	19051, 19052, 19053, 19054, WT-8751, WT-8752, WT-8753, Guardian 1010, Guardian 1030, Guardian 1030S, Guardian 1030S-4
Company Name	:	CHROMA ATE INC.

This product is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive (89/336/EEC).For the evaluation regarding EMC, the following standards were applied:

RFI Emission:

EN 61000-6-4:2001	: Generic emission standard
EN 61326:1997+A1:1998+A2:2001	: Product Family standard
EN 61000-3-2:2000	: Limits for harmonic current emission
EN 61000-3-3:1995+A1:2001	: Limitation of voltage fluctuation and flicker in low-voltage supply system

Immunity :

EN 61326:1997+A1:1998+A2:2001 Product Family standard

DNV NVLAP NEMKO

TEST LABORATORY

Gene Chang/ Manager

The verification is based on a single evaluation of one sample of above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab. Logo.

QuieTek Corporation / No. 5-22, Ruei-Shu Valley, Ruei-Ping Tsuen, Lin Kou Shiang, Taipei 244 Taiwan
Tel: 886-2-8601-3788, Fax: 886-2-8601-3789, E-mail: service@quietek.com

Safety Summary

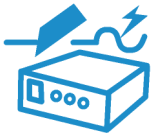
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the 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.
	**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.
⚠WARNING	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.
CAUTION	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.
Notice	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. If collision results in damages and defects of the quality and the performance, please contact us for prompt service.

19051 Standard Accessory

Item	Q'ty	Remark
USA-type power cord	1	90° elbow USA-type power cord, length 1.8m
Euro-type power cord	1	Euro-type power cord, length 1.8m
Power adapter	1	USA-type power cord 3P – 2P adapter
HV terminal used test cable	1	Alligator clip – cross HV head, red HV test cable, wire length 1m
LOW terminal used test cable	1	Alligator clip – banana plug, black HV test cable, wire length 1.2m
Test cable of grounding continue	1	Wire used in GC test, length 1.2m
5A fuse	2	For 5.0A SLOW 110VAC used
2.5A fuse	2	For 2.5A SLOW 240VAC used
Pamphlet	1	Chinese & English manual

19052 Standard Accessory

Item	Q'ty	Remark
USA-type power cord	1	90° elbow USA-type power cord, length 1.8m
Euro-type power cord	1	Euro-type power cord, length 1.8m
Power adapter	1	USA-type power cord 3P – 2P adapter
HV terminal used test cable	1	Alligator clip – cross HV head, red HV test cable, wire length 1m
LOW terminal used test cable	1	Alligator clip – banana plug, black HV test cable, wire length 1.2m
Test cable of grounding continue	1	Wire used in GC test, length 1.2m
5A fuse	2	For 5.0A SLOW 110VAC used
2.5A fuse	2	For 2.5A SLOW 240VAC used
Pamphlet	1	Chinese & English manual

19053 Standard Accessory

Item	Q'ty	Remark
USA-type power cord	1	90° elbow USA-type power cord, length 1.8m
Euro-type power cord	1	Euro-type power cord, length 1.8m
Power adapter	1	USA-type power cord 3P – 2P adapter
HV terminal used test cable #1	1	Alligator clip – cross HV head, red HV test cable, wire length 1m
LOW terminal used test cable	1	Alligator clip – banana plug, black HV test cable, wire length 1.2m
Test cable of grounding continue	1	Wire used in GC test, length 1.2m
HV terminal used test cable #2	8	Cross HV head, single head white HV test cable, wire length 1m
5A fuse	2	For 5.0A SLOW 110VAC used

2.5A fuse	2	For 2.5A SLOW 240VAC used
Pamphlet	1	Chinese & English manual

19054 Standard Accessory

Item	Q'ty	Remark
USA-type power cord	1	90° elbow USA-type power cord, length 1.8m
Euro-type power cord	1	Euro-type power cord, length 1.8m
Power adapter	1	USA-type power cord 3P – 2P adapter
HV terminal used test cable #1	1	Alligator clip – cross HV head, red HV test cable, wire length 1m
LOW terminal used test cable	1	Alligator clip – banana plug, black HV test cable, wire length 1.2m
Test cable of grounding continue	1	Wire used in GC test, length 1.2m
HV terminal used test cable #2	4	Cross HV head, single head white HV test cable, wire length 1m
5A fuse	2	For 5.0A SLOW 110VAC used
2.5A fuse	2	For 2.5A SLOW 240VAC used
Pamphlet	1	Chinese & English manual

Note: When order the accessory, just name the item.

The Danger of Operating

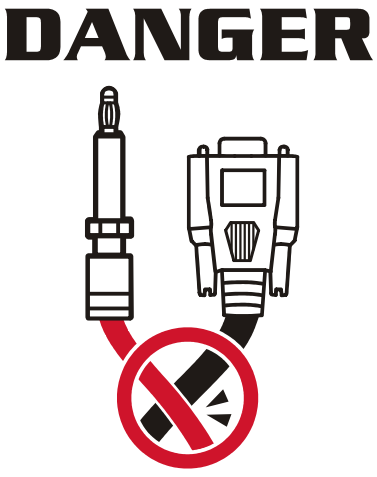
1. When the instrument is under output voltage, please don't touch test area or you may shock hazard and result in death.

   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.
   - Do not use insulation glove for testing.
   - 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 to 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 Don't tie HV cable, RS232, Handler, GPIB control cable and other low voltage cable together. Or it may cause product damaged or PC crashed.



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 uses qualified transportation as possible. And avoid heavy hitting etc to damage the device.

Maintenance
There is no maintenance operation for the general user. (Except for the note 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
Sep. 2003	1.0	Modify “Inspection and Examination” “Notice Items before Use” “Rear Panel Description” “Insulation Resistance Mode Resistor Calibration”
Oct. 2003	1.1	Modify “Specifications”
March 2004	1.2	Modify “The Danger of Operating” “Specifications” “Notice Items before Use” “Rear Panel Description” “Preset Parameter Setting”
Sep. 2004	1.3	Modify “Specifications” “Notice Items before Use” “Front Panel Description” “Rear Panel Description” “Preset Parameter Setting” “PROGRAM Setting” “How to Process Test” “Remote Command Summary” “Error Messages”
Dec. 2004	1.4	Modify “Introduction” “PROGRAM Setting” “How to Process Test” “Remote Command Summary” “Maintenance”
March 2005	1.5	– Add the note description to the displayed menu for switching in *OS Test Procedure* section.
Sep. 2005	1.6	– Add *“CE Certification”* – Modify the description of “RMT function key” in the section of *“Front Panel”*. – Modify the description of “SCPI command” in the section of *“Remote Command Summary”*.
March 2006	1.7	– Modify “PRESET Parameter Setting Menu” in the section of *“Preset Parameter Setting”*. – Modify “Testing preset parameter function table” in the section of *“Preset Parameter Setting”*. – Modify “Program Setting Menu” in the section of *“PROGRAM Setting”*. – Modify “Function Keys Menu” in the section of *“PROGRAM Setting”*. – Modify the description of second item of “Select Test Mode” in

		the section of *“PROGRAM Setting”*. – Modify “DC withstand voltage test mode” in the section of *“PROGRAM Setting”*. – Modify “Insulation resistance test mode menu” in the section of *“PROGRAM Setting”*. – Modify “SCPI command” in the section of *“Remote Command Summary”*. – Add “the description of DWLL” in the section of *“Each Parameter Setting Data Description”*. – Add “the description of RNG” in the section of *“Each Parameter Setting Data Description”* – Add “Pause Mode menu and description” in the section of *“Each Parameter Setting Data Description”*. – Add the section of *“Initial Inspection”*.
Aug. 2006	1.8	– Modify *“CE Statement of Conformity”* – Modify “the standard accessory of 19051/2/4” in *“Inspection and Examination”.*
Nov. 2006	1.9	– Modify the description of Disposal in *“Storage. Freight. Maintenance. Disposal”* – Modify “the descriptions of RS-232/GPIB commands” in the section of *“Remote Command Summary”.* – Modify the description of “Preface” in the chapter of *“Printer Function”.*
March 2007	2.0	Add *“Material Contents Declaration”* Delete the description of Disposal in *“Storage. Freight. Maintenance. Disposal”*
Dec. 2009	2.1	Modify the following sections: – Standard accessory description in *“Inspection and Examination”.* – “Hipot” item in the section of *“Specifications”*. – Description in the section *“Error Messages”*. – Add UL/TUV required descriptions.

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 and short/open circuit detection of electromechanical and electronic equipments.

The testing aspect of withstand voltage, the output power of the tester is AC: 150VA(5kV, 30mA), DC: 60VA(6kV, 10mA). Therefore, it is for withstand test of electronic and electromechanical and component.

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

In the testing aspect of short/open circuit detection, please test if test 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 listed on the display, it is unnecessary to remember any parameter status which be set.

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

1.2 Features

- AC / DC withstand voltage, insulation resistance test and short/open circuit detection four in one model.
- DC open circuit detection patent design.
- Reformation DC quick discharge patent design.
- Match TUV (19051/19052/19054), VDE and CE test request of safety rule.
- With 0.4ms cut off and 0.2sec discharge quickly.
- Keypad locked and material protection function.
- Seven kinds of judgment result indication window.
- Charge current low limit detection function.
- Combine 500 test procedures totally or 100 sets of memory function.
- GP-IB, RS-232, PRINTER interface optional.
- Full-function front panel calibration.
- The instrument is with [FALL] function, before ending test to change output test voltage. The needed time is from setting voltage value to zero.

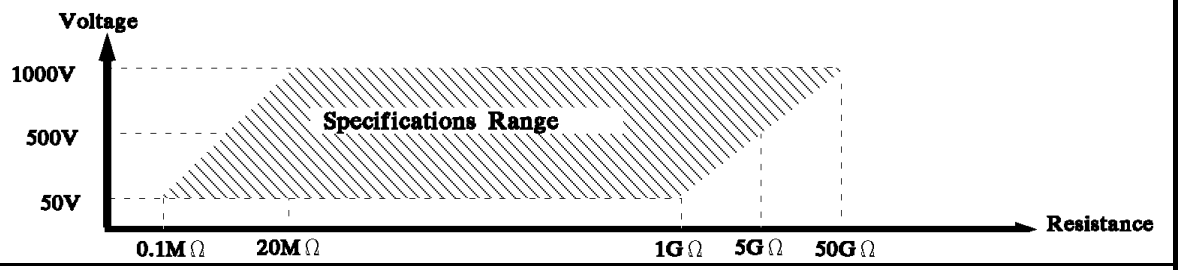
1.3 Initial Inspection

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.

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

❑ Scan Unit	8 ports, · ±phase (19053 only), 4 ports, · ±phase (19054 only)
❑ Withstanding Voltage Test	
❑ Test Voltage	AC: 0.05 ~ 5kV/ DC: 0.05 ~ 6kV Constant Voltage
❑ Voltage Regulation	≤ (1%+5V), Rated Load
❑ V-display Accuracy	± (1% of reading + 5 counts), 2V resolution
❑ Cutoff Current (Note 2)	AC: 0.1mA ~ 30mA (Note 1), DC: 0.01mA ~ 10mA (Note 1), 0.1uAdc resolution
❑ Current Accuracy (Note2)	± (1% of reading + 5 counts) Real Current ± (5% of total current + 20 counts) (Note2) WAC only
❑ Current Display	Hi limit setting Display Range < 300uA: 0.1uA~299.9uA (dc only) < 3mA: 0.001mA~2.999mA <30mAac (10mAdc): 0.01mA~30.00mAac (10mAdc)
❑ Output Frequency	50Hz, 60Hz
❑ Test Time (Note 3)	0.3 ~ 999 Sec, continue (Note 1) (0.2S for LCD off)
❑ Ramp Time	0.1 ~ 999 Sec, off (Note 1)
❑ Fall Time	0.1 ~ 999 Sec, off
❑ Judgment Delay (Wdc Only)	0.1 ~ 99.9 Sec. (Note 1)
❑ Arc Detection (Note 4)	
❑ Setting Mode	Programmable Setting
❑ Detection Current	AC: 1mA ~ 15mA, DC: 1mA ~ 10mA
❑ Min. pulse width	10us approx.
❑ GOOD/NO-GO Judgment Function	
❑ Judgment System	• Window comparator. • A NO-GO judgment is made when a current greater than the high limit value or smaller than the low limit value is detected. • When a NO-GO judgment is made, the output voltage is cut out and a NO-GO alarm signal is delivered. • If no abnormal state is detected during the test time a GOOD judgment is made and a GOOD signal is delivered.
❑ Insulation Resistance Test (19052, 19053, 19054 only)	
❑ Test Voltage	DC: 0.05kV ~ 1kV, Constant Voltage
❑ V-display Accuracy	± (1.5% of reading + 5 counts) (open voltage), 2V resolution
❑ Resistance Range	0.1 MΩ ~ 10 GΩ (19052 up to 50GΩ)
❑ Measuring Accuracy	≥ 500: 1 MΩ ~ 1GΩ: ± (5% of reading + 5 counts) 1GΩ ~ 10 GΩ: ± (10% of reading + 5 counts) 10GΩ ~50 GΩ: ± (15% of reading + 5 counts) (19052 only) < 500V: 0.1 MΩ ~ 1GΩ: ± (10% of reading + 5 counts)



❑ Secure Protection Function	
❑ Fast Output Cut-off	0.4mS typical after NG happen
❑ Fast Discharge	0.2S, Typical
❑ Ground Fault Interrupt	0.5mA ± 0.25mAac (ON), OFF
❑ Continuity Check	1Ω ± 0.2Ω, ON/OFF
❑ Panel Operation Lock	YES
❑ Memory Storage	
❑ Memories, Steps	99 steps or 99 groups for total 500 memory locations
❑ GO/NG Judgment Window	
❑ Indication, Alarm	GO: (Short Sound) NG: W-Arc, W-Hi, W-Lo, IR-Lo, IR-Hi, GFI, Continuity-fail (Long Sound)
❑ Remote Connector	
❑ Rear Panel 9 Pin D-type Connector	Input: Start, Stop, Interrupt (at 11 pin terminal block) Output: Under test, Pass, Fail
❑ TEST/RESET Control	Low - active control, (24V open voltage typical). Input requirements
	Input time duration: 20msec. approx. The above input circuits are not isolated from other internal circuits.
❑ Options	
❑ Interface Card	
❑ GP-IB Interface	Talk, Listen all function
❑ RS232 (standard option)	Baud rate: 300 ~ 19200, data bits: 8, stop bit: 1
❑ Ambient Temperature and Relative Humidity	
❑ Specifications range	18 to 28°C (64 to 82°F), ≤ 70% RH.
❑ Operable range	Maximum relative humidity 80% for temperature up to 31°C (88°F). Decreasing linearly to 50% relative humidity at 40° C (104°F) Altitude up to 2000m. Indoor use only. Pollution degree 2
❑ Storage range	-10 to 60°C (-14 to 140°F), ≤ 80% RH.
❑ Installation Category	CAT II
❑ Power Requirement	
❑ Line Voltage	AC 100V, 120V, 220V ± 10%, 240V +5 -10%
❑ Frequency	50 or 60 Hz
❑ Power	No load: < 100W
❑ Consumption	With rated load: 500W max.
❑ Dimension	320W x 105H x 400D mm
❑ Weight	19051, 19052: 14kg approx.

	19053, 19054: 15kg approx.
❑ Safety	
❑ Ground Bond	Less than 100mΩ at 25Amp, 10sec
❑ Hipot	Less than 10mA at Wac 1.5kV, 3sec
❑ Insulation Resistance	Over 20MΩ at 500V 10sec
❑ Line leakage current	Less than 3.5mA at 127V, 3sec, normal, reverse

Note 1: AC set over 100 VA, DC set over 40VA the maximum operating time is 60 seconds, and the same as rest time. If the period is 1/2 duty (TUV ON), for full rating output, the line input range is +10%, -0%.

Note 2: Refer 1.2kV resistance load only. With the standard test lead, to get best accuracy, please do not need to process OFFSET.
WAC mode is less than 500V add extra 3 counts error.
WAC scanners on, please add 10 counts/channel. WDC scanner on, add 2 counts/channel.

Note 3: The best test time is dependent on device under test (DUT).

Note 4: Validation point is 1.25kV with a 250kΩ resistor.

3. Notice Items 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 denotation.

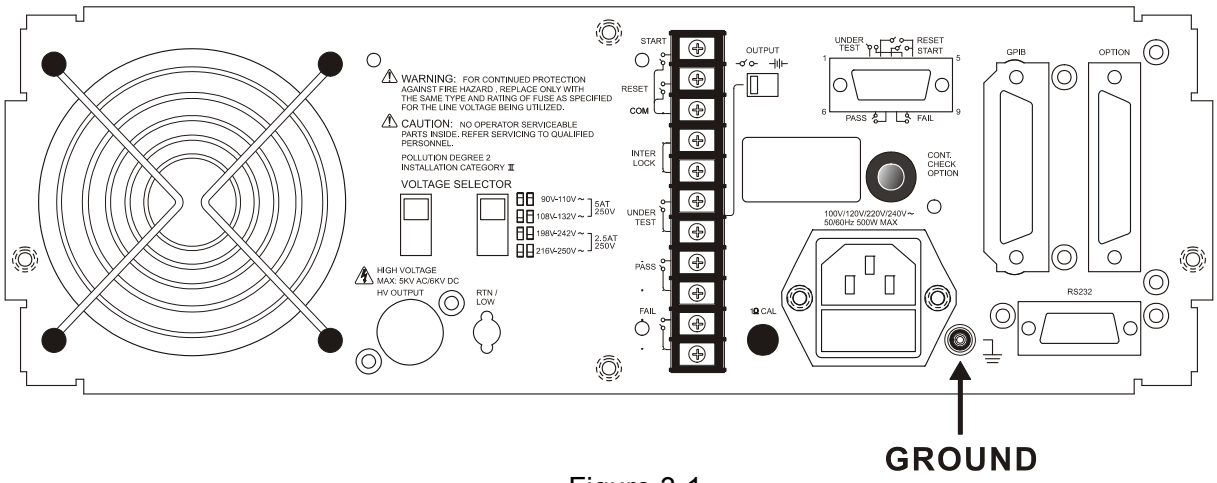


Figure 3-1

3. Connect test cable to RTN/LOW terminal

As figure 3-2 arrow denotation, connect test cable to RTN/LOW terminal. It is necessary to check if there is loosen or drop under operation condition at any time. If you want to connect DUT by testing cable, please connect test cable of RTN/LOW terminal to DUT. (RTN/LOW terminal, which has connected to the main unit) The uncompleted connection of test cable of RTN/LOW terminal or drop is very danger, as there is full of high voltage on DUT.

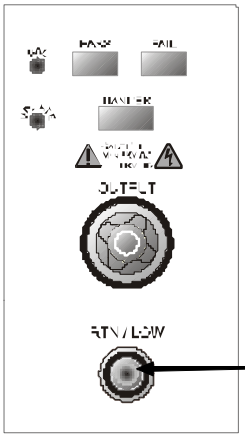


Figure 3-2

4. Connection test of high voltage output terminal

After the test cable of COMMON terminal has been connected. Then follows the below procedures to connect high voltage output cable.

- Press [STOP] key firstly.
- Confirm DANGER indication LED is not light.
- The test cable of COMMON terminal with high voltage output terminal is short, confirm there is no voltage output.
- Plug high voltage test cable in high voltage output terminal.
- Connect the test cable of COMMON terminal to DUT finally, and then 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 0 (that is turn off power). As figure 3-3.

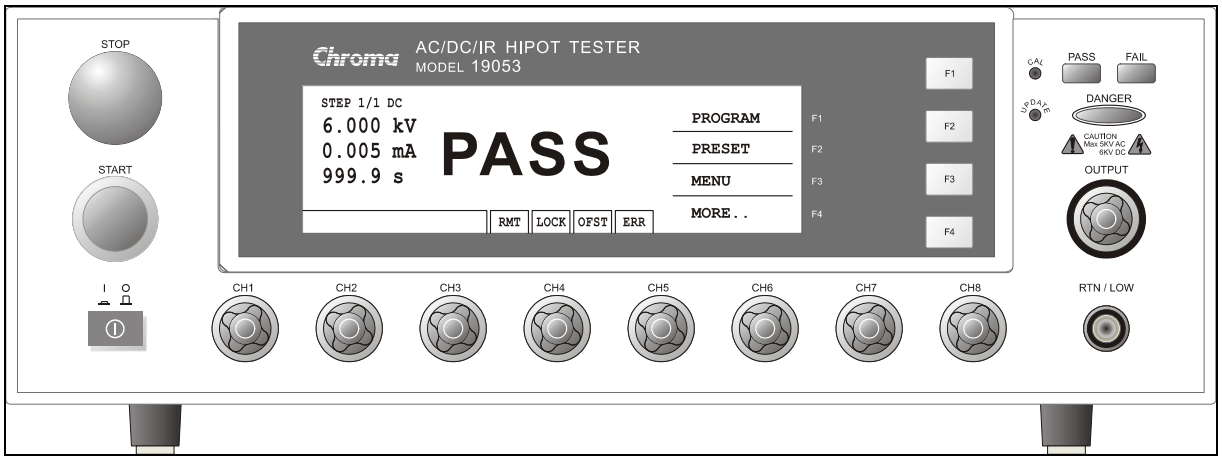


Figure 3-3

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 clipper on test cable. Because the insulation of plastic layer is not enough, touch it may cause hazard. As figure 3-4.

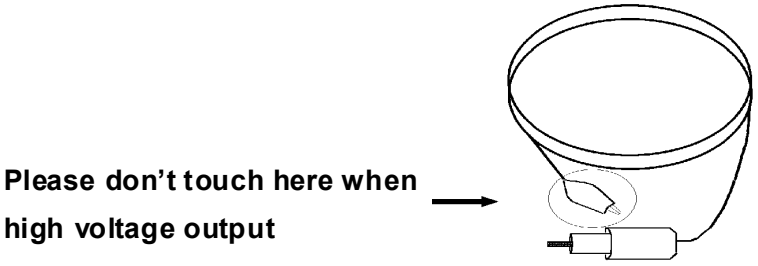


Figure 3-4

<<< 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.

As the insulation resistance test unit, 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 of this chapter. As the described procedures to execute.

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

8. Charge

When the insulation resistance is 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 obeys 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 is 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. When test voltage is 1000V, then after turned off power, the voltage which add on testing and DUT decrease to lower than 30V and 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 needed time of decreasing to below 30V by time constant. As figure 3-5.

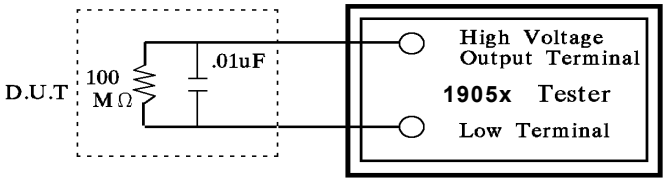


Figure 3-5

<Formula>

Test Voltage * $e^{-t/RC}$ = Residual Voltage

Ex.: 1000V * $e^{-t/RC}$ = 30V
ln $e^{-t/RC}$ = ln 0.03
- t / RC = -3.5
t = 3.5 sec

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.

11. Turn on or turn off power switch ※ *Note* ※

The product should be so positioned that the power switch can be easily reached by the operator during emergency. 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, which 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 tester is full of voltage. Please connect the cover of the tester to earth firstly when high voltage output terminal is short-circuited with COMMON terminal.

<<< Dangerous event >>>

13. The danger handling

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 tester needs long time using under normal operation. Please notice the following items.

If the high limit setting value is 20.00mA (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 tester includes four kinds of AC INPUT power. Please accord with local voltage turn the voltage selection switch on rear panel to the right position.

When you want to plug in power cable, be sure input AC power scale is the same as rear panel switch power. Also need to replace fuse, the following table is voltage and fuse which be used.

Scale	Nominal Value	Range	Fuse
90V ~ 110V	100V	90V ~ 110V	5A Slow/250V
108V ~ 132V	120V	108V ~ 132V	5A Slow/250V
198V ~ 242V	220V	198V ~ 242V	2.5A Slow/250V
216V ~ 250V	240V	216V ~ 250V	2.5A Slow/250V

Be sure used voltage when replace fuse. Only can replace fuse under power-disconnected status by flat type screwdriver.

⚠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 within selection voltage range, 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. The tester use power transformer is over 200VA. When DUT drawing mass current. Before deadline of no good 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, 75% RH. If over this range then function may malfunction. 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 tester are activated when the power switch is turned on. However, to attain the precision in the specification, please warm the instrument over 15 minutes.

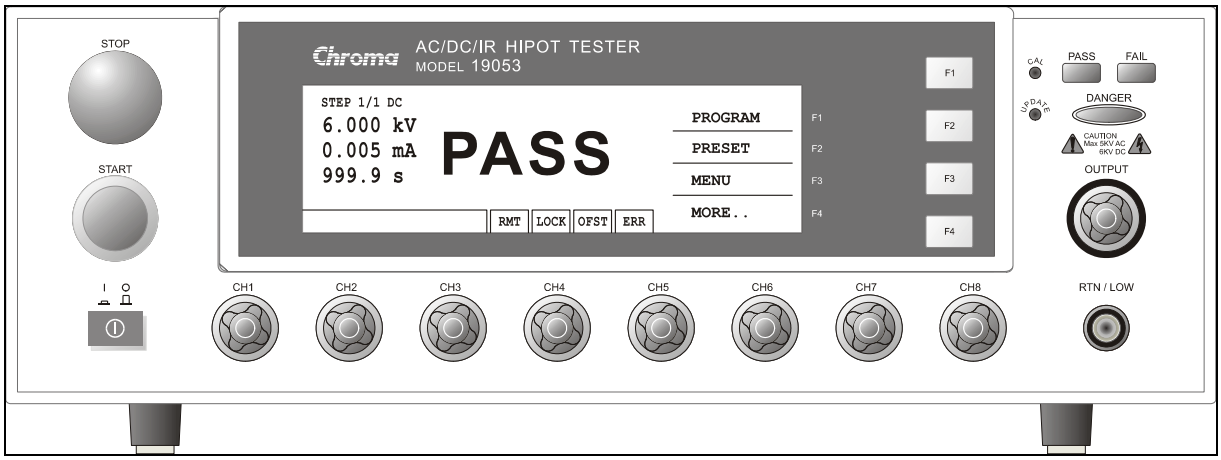
22. Warning signal of testing

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

4. Panel Description

4.1 Front Panel

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



■ **Display Area**

Function key display area: Under different display menus, there are different function descriptions. The right side of display has corresponding function keys (F1-F4). If the description is blank, it means corresponding function is invalid.

State list : This list indicates the setting mode, the range of setting value and displays no good state of testing result.

RMT : When this area is highlighted, it means the main unit is under Remote status. That is the main unit controlled by PC through GPIB/RS232 connecting cable. At the same time, all of keys are malfunction except for [STOP], [Local] and [MORE..] Keys.

Note: As connecting RS232, the word “RMT” on LCD will not be highlighted only when give the command of :SYSTem:LOCk:REQuest?. When the word “RMT” is not highlighted, all keys can be operated as usual.

LOCK : When this area is highlighted, it means the main unit is under setting parameter protected mode. The other mode can’t enter except for "MEMORY", "TEST" and "KEY LOCK" modes.

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

ERR : When this area is highlighted, it means there is unclear error in error queue.

Danger LED : The testing status indication LED. When LED is light, the tester is under testing status. There is high voltage or mass current on testing terminal. Don’t touch the testing terminal at the same time.

PASS LED : When this LED is light, it means DUT judge as PASS after testing.

FAIL LED : When this LED is light, it means DUT judge as FAIL after testing and then cutting off the main unit output immediately. This LED keeps on light until

the main unit be pressed [STOP] key.

- **Key Area**

Power Switch : The switch provides AC power source which the tester is needed.

STOP Key : Reset key, after pressing this key the main unit return to standby testing status immediately. That is cutting output and clear all of judgments simultaneously.

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

Cal-Enable : Calibration switch. This key is only for calibration before exiting factory. A non-professional personnel using this function is prohibited or may cause the product malfunction.

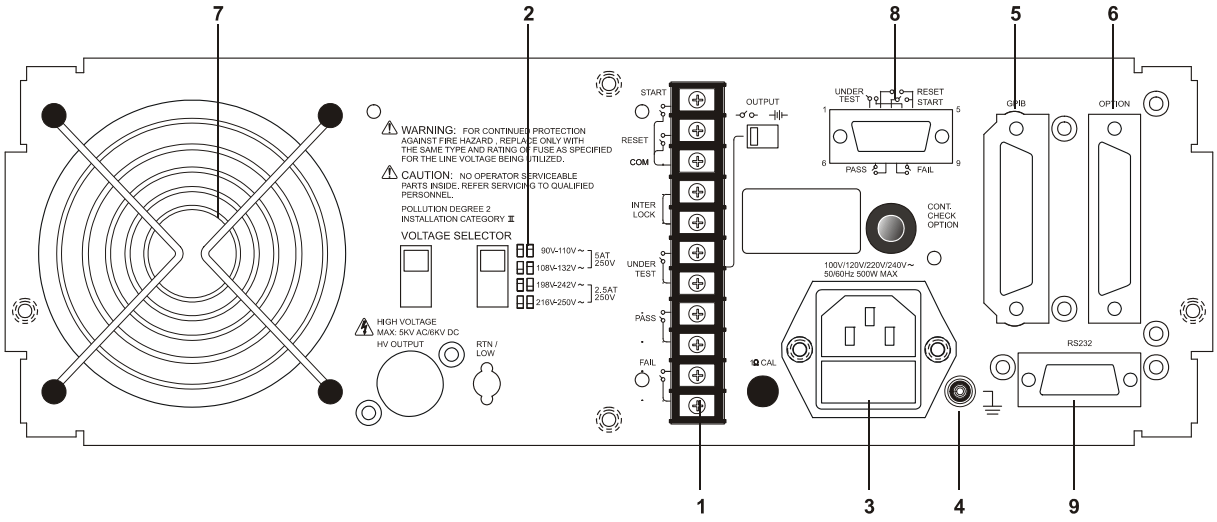
Function Keys: Function key. Under different display menus, there are different functions. The right side of display has corresponding function description. If the description is blank, it means corresponding function key is invalid.

- **Terminal Area**

OUTPUT : High electric potential terminal of high voltage output. This terminal is belong 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.

RTN / LOW : The common test terminal. It's a reference terminal when high voltage test, it also a low electric potential terminal. This terminal is almost equal to cover grounding terminal.

4.2 Rear Panel



1. **REMOTE I/O** : The test result signal output terminal.
   START : Start test signal input terminal.
   STOP : Stop test signal input terminal.
   INTER LOCK : Output only when this two terminals are short circuit and high voltage.
   UNDER TEST : When the tester is under test status, this output terminal will short circuit. Control external signal by using this short condition. The junction

specification 115V AC current is lower than 0.3A action time.
This tester is under testing status until STOP is stopped.

PASS : When the tester judge DUT is PASS, this output terminal is short circuit. Control external signal by using this short circuit condition. The junction specification 115V AC current is lower than 0.3A.
The action time is 0.2sec ~ 99.9sec. (Can be set)

FAIL : When the tester judge DUT is FAIL, this output terminal will be short circuit. Control external signal by using this short condition. The junction specification 115V AC current is lower than 0.3A.
The action time: From judging FAIL to STOP is stopped.

OUTPUT Switch: When toggles this switch to power symbol, UNDER TEST output terminal will be short circuited under test status. When toggles this switch to voltage symbol, UNDER TEST terminal outputs 24V under test status. This function can be used with 3002B or 3002D and is for controlling valve.

2. VOLTAGE SELECTOR Input Power Supply Range Switch
Changing the tester inputted AC power. Using AC power has four kinds as below.
a. 90 ~ 110V AC
b. 108 ~ 132V AC
c. 198 ~ 242V AC
d. 216 ~ 250V AC
Switching this power switch by applying AC power and notice the change of fuse.

3. AC LINE: AC power socket and fuse holder.
A tri-cord power and fuse holder. Input AC power, which the tester is needed from AC power socket. The detailed specification of using fuse please refers "Chapter 3 - Notice Items Before Using" or descriptions of rear panel in this manual.

4. GROUND: 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 tester may exist high voltage. This is very dangerous, anyone touch the tester under the above status may cause damage. Therefore, it is necessary to connect safety GND terminal to ground.

5. GPIB INTERFACE (Option)
This socket is for optional GIPB interface (IEEE-488-1978). The detailed descriptions, please refers "Chapter 5 - Description of GPIB Interface" in this manual.

6. OPTION: This socket is the option PRINTER interface for the tester. The detailed descriptions please refer chapter 8 of this manual.

7. FAN: The temperature control fan.
When the temperature reaches 50°C, fan opens automatically. When the temperature is lower than 45°C, fan stops automatically.

8. 9 Pin D Connector
All of 9 pin D-Sub connector functions are the same as (1) Remote I/O.

9. RS232 Interface
This socket is the standard RS232 interface for the tester. GPIB and RS232 interface can't use simultaneously.

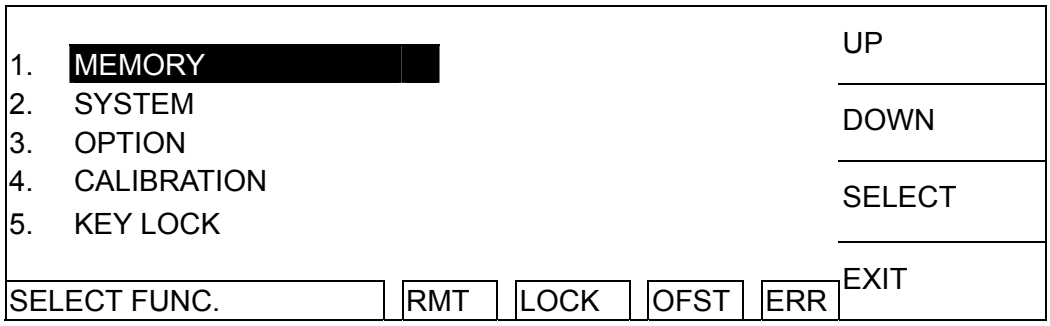
4.3 Notice Items and Procedures before Operation

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 - Notice Items Before Using" and remember it.
3. When turns on power, the tester will self-test. If there is abnormal condition, please turns off switch and pulls off power cord immediately.

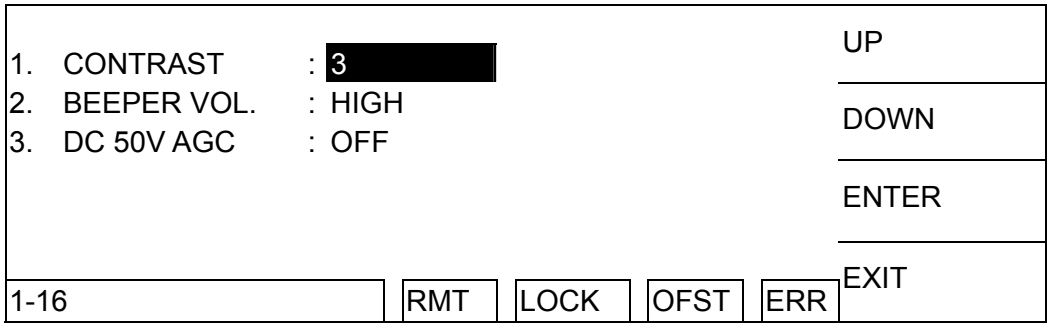
4.4 System Parameter Setting

4.4.1 How to Enter System Parameter Setting Menu

1. Under power on menu, press Function Key **MENU** the menu as the following:



2. Move the highlighted to "SYSTEM" by Function Key **UP**, **DOWN**. Press Function Key **SELECT** to enter system parameter setting menu is shown as the following:



4.4.2 Operation Methods

1. After entering system parameter setting menu, press Function Key **ENTER** to move the highlighted to the parameter item, which want to set.
2. Press Function Keys **UP**, **DOWN** to set this item parameter data.

Setting Item	Range	Initial Setting	Description
Contrast	1~16	7	Adjust LCD brightness
Beeper Vol.	LOW / MEDIUM / HIGH / OFF	HIGH	Adjust buzzer volume

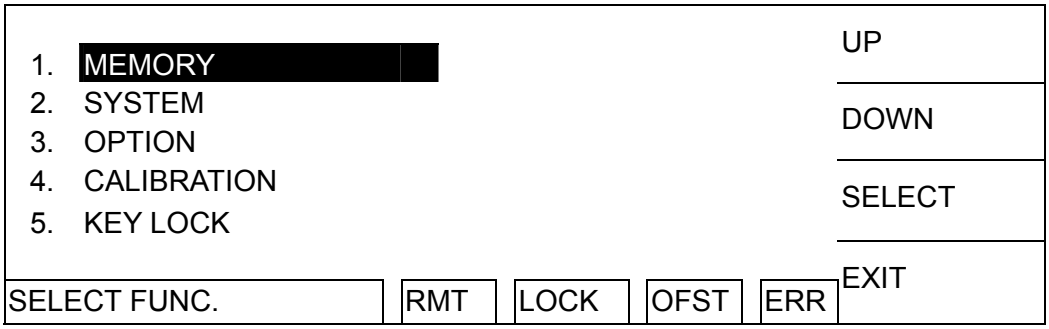
DC 50V AGC	ON/OFF	ON	When set above DC 50V, hardware automatic gain compensation function is open or not.

System parameter setting data description table

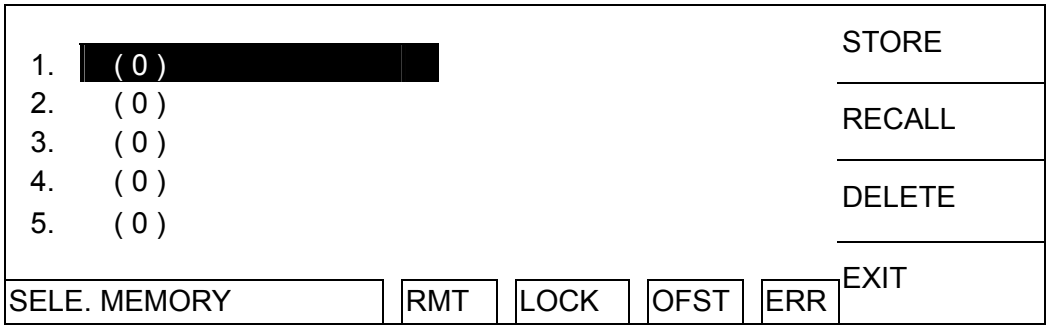
4.5 Test Parameter and Memory Management of Test Preset Parameter

4.5.1 How to Enter Memory Management Menu

1. Under power on menu, press Function Key **MENU** the menu as the following:



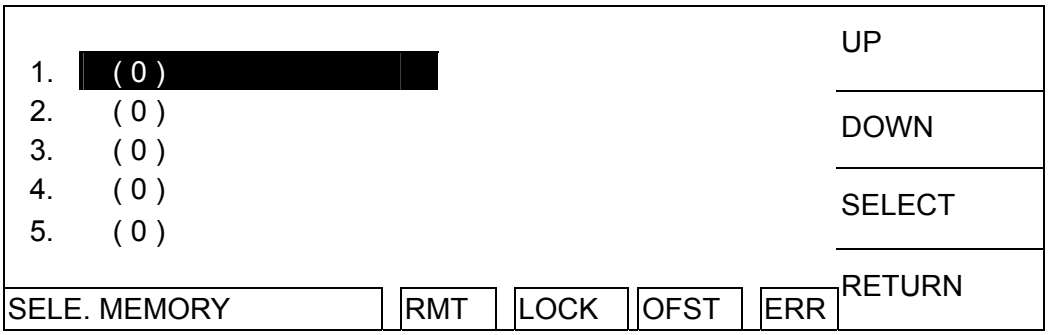
2. Move the highlight to "MEMORY" by Function Key **UP**, **DOWN**. Press Function Key **SELECT** to enter Memory management mode is shown as the following:



3. At this time, can read, store or delete this set memory by Function Key.
4. The value within ( ) means this set memory included test procedure number.

4.5.2 How to Select a Set of Memory

1. When the state list shows "SELECT MEMORY", move the highlighted to the memory which want to manage by Function Key **UP**, **DOWN**. Press Function Key **SELECT** is shown the following menu:



2. At this time, follows Function Key instructions to read, store or delete this set of memory.

4.5.3 Delete Memory

If you want to delete test parameter data which be stored in memory, please follow the below procedures to process.

1. Press Function Key **DELETE** when status bar shows [SELECT FUNC.].
2. Select the test parameter data of memory, which want to delete by using Function Key **UP**, **DOWN**. Press Function Key **DELETE** and then show delete confirm window.
3. Press Function Key **YES** to confirm or press Function Key **NO** to cancel.

4.5.4 Read Memory

If there are many sets of test parameter values which be saved in main memory. Follow the below procedures to recall test parameter.

1. Press Function Key **RECALL** when status bar shows [SELECT FUNC.].
2. Select the test parameter data of memory, which want to read by using Function Key **UP**, **DOWN**.
3. Press Function Key **SELECT** and then show confirm window.
4. Press Function Key **YES** to confirm or press Function Key **NO** to cancel.

4.5.5 Store Memory

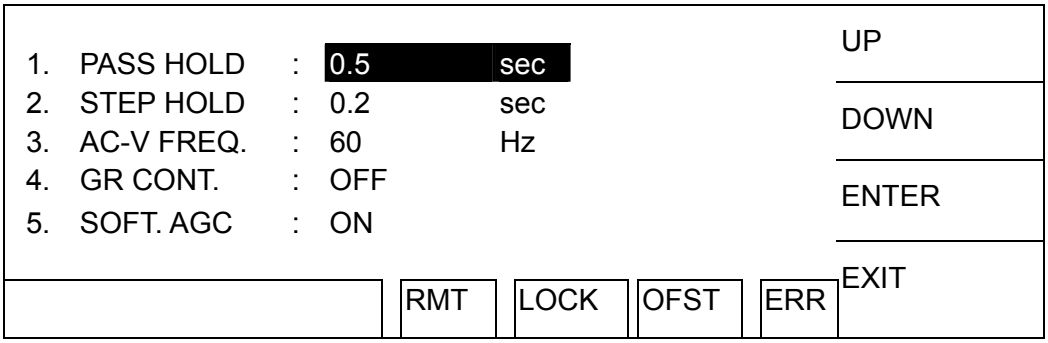
If you want to save test parameter data which be set in the memory. Please follows the below procedures to process.

1. When status bar shows [SELECT FUNC.], press Function Key **STORE**.
2. Selecting the memory want to store by using Function Key **UP**, **DOWN**. Press Function Key **SELECT**, the cursor become underscore blinking cursor.
3. At this time, input the memory name by using Function Key **UP**, **DOWN**.
4. By using Function Key **ENTER** to move the underscore blinking cursor to next character.
5. If press Function Key **ENTER** twice then will show a read confirmation window.
6. Press Function Key **YES** to confirm or press Function Key **NO** to cancel.
   (*Note*: If there is covered data in the memory name, please be careful to confirm before storing.)

4.6 Preset Parameter Setting

4.6.1 How to Enter Testing Preset Parameter Setting Menu

Under power on menu, press Function Key **PRESET** to enter testing preset parameter setting menu as the following.



4.6.2 Operation Methods

1. After entering test preset parameter setting menu, press **ENTER** key move the highlighted cursor to the parameter item, which want to set.
2. Press Function Keys **UP** or **DOWN** to set this item parameter data.

Testing preset parameter function description table:

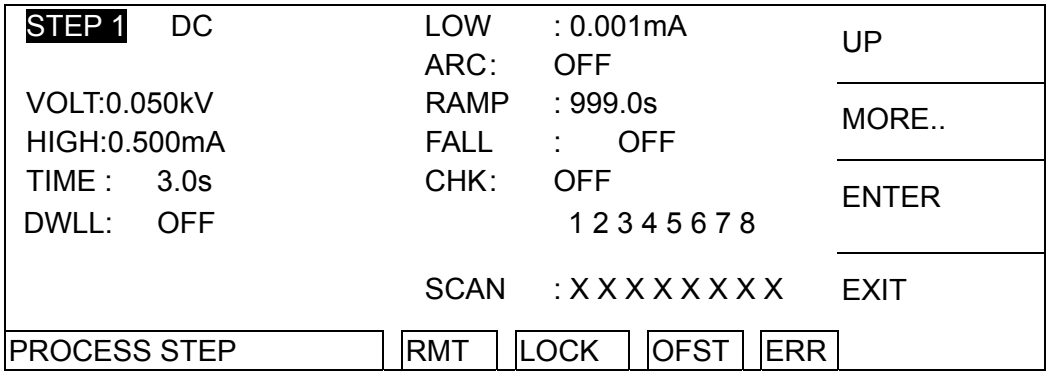
Setting Item	Range	Initial Setting	Description
Pass Hold	0.2 ~ 99.9	0.5	When the display shows PASS, the continuous time of buzzer beeps.
Step Hold	0.0 ~ 99.9 / KEY	0.2	Set interval time between test procedures. Key: Set test procedure is interrupted. (Please press [START] to continue when test stop.)
AC-V Freq.	50/60	60	Set AC-V FREQ. of HIPOT tester by inputting frequency of AC source.
GR CONT.	OFF/KEY/TIME (0.2sec~99.0sec)	OFF	Set grounding continue test no good function operation mode. 1. When set to OFF, it doesn't proceed grounding continue test. 2. When set to KEY, press START KEY to proceed grounding continue test. 3. When set to TIME, GR CONT operation modes are as below descriptions. (1) When users press START KEY, the program judge if DUT connected well by GR CONT. ON or OFF. (2) If CR CONT. judge DUT is connected well then proceed test automatically when set TIME is up. (3) After the test is ended, re-judge if

			CR CONT. is continue for the condition of proceeding test.
Soft. AGC	ON/OFF	ON	Set software automatic gain compensation function is open or not.
Auto Range	ON/OFF	OFF	Set withstand voltage auto-range function is open or not.
GFI	ON/OFF	ON	Set ground fail interrupt function
AFTER FAIL	STOP/CONTINUE/RESTART	STOP	After setting FAIL, it indicates if stop the test or continue to the next step or restart.
SCREEN	ON/OFF	ON	Set if show test screen.
SMART KEY	ON/OFF	OFF	Set if open parameter memory function.
RAMP JUDG.	ON/OFF	ON	When set this item to ON, it means during ramp time will judge high limit under DC mode. When set this item to OFF, it means during ramp time won't judge high limit under DC mode.
Part No.	Not over 13 characters	None	Set the product Part No.
Lot No.	Not over 13 characters	None	Set the product Lot No.
Serial No.	Not over 13 characters	None	Set the product serial no. format, * means changeable character.

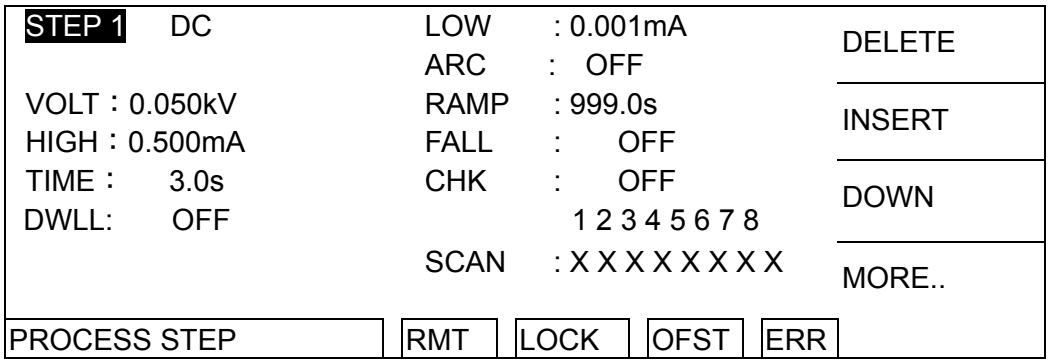
4.7 PROGRAM Setting

4.7.1 Test Procedure Setting

1. Under power on menu, press Function Key **PROGRAM** and then enter PROGRAM setting menu as the following:



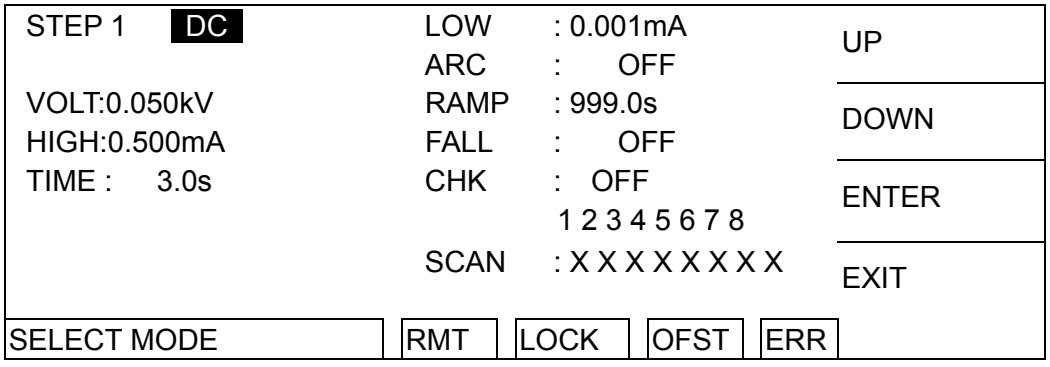
2. After entering PROGRAM setting menu, use Function Keys **UP** select the test procedure want to set, the range is 1~99.
3. Press **ENTER** key move the highlighted cursor to the parameter item, which want to set.
4. Press Function Key **MORE..** can switch to other setting menu as the following.



5. By using Function Keys **DOWN** to decrease test procedure which you want to set, the range is 1~99.
6. Press Function Keys **DELETE**, **INSERT** can delete, insert a test procedure.
7. Press Function Key **MORE..** can return to PROGRAM setting menu to continue setting others test parameter.

4.7.2 Select Test Mode

1. After entering PROGRAM setting menu, press **ENTER** key to move the highlighted cursor to the following position.



2. Use Function Key **UP**, **DOWN** to select test mode. There are AC / DC / IR / OS / PA test modes can be selected (19051 only AC / DC / OS / PA). Different test modes have different test parameters can be set.

4.7.3 SMART KEY Operation Methods

1. When starts SMART KEY function of PRESET parameter in each test, it records the test parameters. The test parameter includes: withstand test needed voltage, the high limit value of leakage current, needed test time, the low limit of leakage current, the high limit of electric arc, needed rise time to setting voltage, the high limit of real leakage current, scanning selection point. Each parameter can store ten sets of value.
2. After entering PROGRAM setting screen, press **ENTER** key continuous for one second then will show S-KEY word on the lower left side of screen. At this time, the adjustment function of **UP** and **DOWN** keys is disabled and read back the previous test parameter. If want to recover the adjustment function of **UP** and **DOWN** keys, press **ENTER** key continuous for one second until S-KEY word on the lower left side of screen is disappeared.

4.7.4 Each Parameter Setting Data Description

The following described parameter setting data of each test mode.

AC withstand voltage test mode

STEP 1 AC	LOW : 0.001mA		UP
	ARC : OFF		
VOLT:0.050kV	RAMP : 999.0s		DOWN
HIGH:0.500mA	FALL : OFF		
TIME : 3.0s	REAL : OFF		ENTER
	1 2 3 4 5 6 7 8		
	SCAN : X X X X X X X X		EXIT
SELECT MODE	RMT	LOCK OFST ERR	

VOLT : Setting withstand voltage test needed voltage.
HIGH : Setting leakage current high limit value.
TIME : Setting test needed time, input 0 means continuous test.
LOW : Setting leakage current low limit value, input 0 means OFF.
ARC : Setting arc high limit, input 0 means OFF.
RAMP : Step-up setting voltage needed time, input 0 means OFF.
FALL : The needed time is from setting voltage value to zero, 0 means OFF.
REAL : Setting real leakage current high limit value, input 0 means OFF.
SCAN : Setting scan test selection point.

DC withstand voltage test mode

STEP 1 DC	LOW : 0.001mA		UP
	ARC : OFF		
VOLT:0.050kV	RAMP : 999.0s		DOWN
HIGH:0.500mA	FALL : OFF		
TIME : 3.0s	CHK : OFF		ENTER
DWLL: OFF	1 2 3 4 5 6 7 8		
	SCAN : X X X X X X X X		EXIT
SELECT MODE	RMT	LOCK OFST ERR	

VOLT : Set withstand voltage test needed voltage.
HIGH : Set leakage current high limit value.
TIME : Set test needed time, input 0 means continuous test.
DWLL : Set DWELL needed time, 0 means OFF.
(During DWELL TIME action don't judge high and low limit value of leakage current but the limit don't over high limit of setting range.)
LOW : Set leakage current low limit value, input 0 means OFF.
ARC : Set arc high limit, input 0 means OFF.
RAMP : Step-up setting voltage needed time, input 0 means OFF.
FALL : The needed time is from setting voltage value to zero, 0 means OFF.
CHK : Select detect charge current over low (CHECK LOW)
SCAN : Set scan test selection point.

IR Insulation resistance test mode

STEP 1 IR	HIGH : OFF		UP
	RAMP : OFF		
VOLT : 0.050kV	FALL : OFF		DOWN
LOW : 1.0MΩ	RNG : AUTO		
TIME : 3.0s	1 2 3 4 5 6 7 8		ENTER
	SCAN : X X X X X X X X		
			EXIT
SELECT MODE	RMT	LOCK OFST ERR	

VOLT : Set insulation resistance test needed voltage.
LOW : Set insulation resistance low limit value.
TIME : Set test needed time, input 0 means continuous test.
HIGH : Set insulation resistance high limit value, input 0 means OFF
RAMP : Step-up setting voltage needed time, input 0 means OFF.
FALL : The needed time is from setting voltage value to zero, 0 means OFF.
RNG : Set the current test range of insulation resistance, AUTO means automatic switch range. The relation of current range and resistance measurement range is as below table shown.

Range	IR Display Value	
	Setting Voltage 50V ~ 250V	Setting Voltage 250V ~ 1000V
0mA(3~10mA)	0.1MΩ~0.1MΩ	0.1MΩ~1.0MΩ
3mA(0.3~3mA)	0.1MΩ~0.9MΩ	0.1MΩ~3.5MΩ
300uA(30~300uA)	0.1MΩ~9.0MΩ	0.1MΩ~29.9MΩ 25MΩ~35MΩ
30uA(3~30uA)	0.1MΩ~29.9MΩ 25MΩ~90MΩ	0.1MΩ~29.9MΩ 25MΩ~249MΩ 0.20GΩ~0.35GΩ
3uA(0.3~3uA)	0.1MΩ~29.9MΩ 25MΩ~249MΩ 0.20GΩ~0.90GΩ	0.1MΩ~29.9MΩ 25MΩ~249MΩ 0.20GΩ~3.33GΩ
300nA(20~300nA)	0.1MΩ~29.9MΩ 25MΩ~249MΩ 0.20GΩ~2.00GΩ	0.1MΩ~29.9MΩ 25MΩ~249MΩ 0.20GΩ~3.99GΩ 3.5GΩ~19.9GΩ 15GΩ~50GΩ

Note: Select IR suitable current range please follows test voltage and DUT insulation resistance for counting the quantity of current then follows it to select suitable current range.

SCAN : Set scan test selection point.

Short/Open Circuit detection test mode (OS)

STEP 1 OS								UP
								DOWN
								ENTER
								EXIT
SELECT MODE	RMT	LOCK	OFST	ERR				

OPEN CHK : 50%
SHORT CHK : 300%
1 2 3 4 5 6 7 8
SCAN : X X X X X X X X

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

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

SCAN : Set the scanning test selection point.

Pause Mode

STEP 1 PA								UP
								DOWN
								ENTER
								EXIT
SELECT MODE	RMT	LOCK	OFST	ERR				

MESSAGE : PAUSE MODE
UNDER TEST SIGNAL : OFF
TIME : CONT.

MESSAGE: Set the message shows on pause screen, the maximum input character is 15.

UNDER TEST SIGNAL: Set UNDER TEST signal on rear panel when pause and DANGER LED action.

(1) Set to ON: UNDER TEST terminal on rear panel is short circuit under pause mode. DANGER LED on panel is blinking.

(2) Set to OFF: UNDER TEST terminal on rear panel is open circuit under pause mode. DANGER LED on panel isn't blinking.

TIME: Set the method of PAUSE MODE.

(1) Set to CONT: Pause mode is ended until press START on panel or START signal re-triggered on rear panel.

(2) Set to 0.3~999sec: Pause mode is ended until setting time's up.

4.8 How to Process Test

4.8.1 Offset Value Calibration Confirmation of Test Cable

1. Under power on menu, press Function Key **MORE..** to enter multi sets of STEPS test menu.

2. Press Function Key **OFFSET**, the display will show a menu indicate the user open the output terminal.
3. After pressing **START** key, DANGER LED on front panel is light up. When test time is end and PASS indicator is light up, meanwhile Offset block is also highlighted. This means the tester zeroed the test cable and test lead.

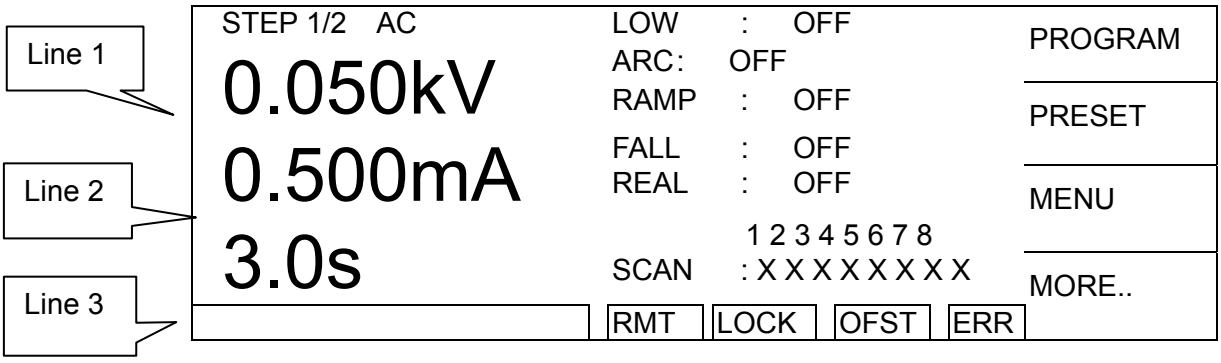
4.8.2 Connecting DUT Methods

Withstanding voltage / Insulation resistance test mode (AC / DC / IR / OS)
First of all, confirms there is no voltage output and DANGER LED isn't light. And then connecting test cable (black) of low electric potential to RTN / LOW terminal of the main unit and fix on the fixture. This test cable and high voltage output terminal short-circuited and confirms there is no high voltage output. At the same time, high voltage test cable (red or white) plug in high voltage output terminal OUTPUT. Connecting the test cable of low electric potential to DUT firstly, and then connecting the test cable of high electric potential to DUT.

4.8.3 Test Procedure (AC / DC / IR / OS)

4.8.3.1 AC / DC / IR Test Procedure

1. Connection is completed correctly by connecting DUT device method.
2. Under power on menu (as the following figure):



Schema:
STEP 1/2 means there are 2 test procedures in total and now executing the first test procedure. AC means test mode. "Line 1" means setting voltage value, "Line 2" means setting current high limit, "Line 3" means test time. The test results are shown on the status list.

3. Please press **STOP** key, ready for testing, the status list show "STANDBY".
4. Press **START** key to start test.
When press this key, start voltage output. At the same time, DANGER LED will be lighted, the status list shows "UNDER TEST". Warning: Now test status is with output voltage. "Line 1" will show output voltage output value; "Line 2" will show current reading. "Line 3" the timer is counting down simultaneously.
5. GOOD judgment
When all of test statuses have been tested and the result shows PASS, then the main unit is judged as GOOD and cut off output. The rear panel outputs PASS signal, the buzzer functions simultaneously.

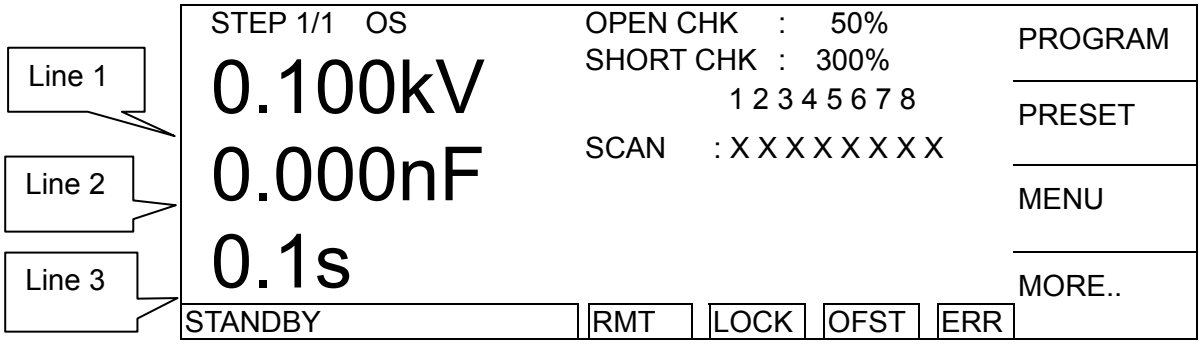
6. No good judgment
   If the measurement value is abnormal, the main unit is judged as FAIL and stop to output immediately. The rear panel outputs FAIL signal, the buzzer functions simultaneously. Keep on function until **STOP** key of the main unit be pressed. The test result will show no good status.

Test result	Meaning
HI	Measurement current / Resistance value over high limit
LO	Measurement current / Resistance value over low limit
ARC	Current arc over high limit
CHECK LOW	Charging current over low
ADV OVER	Voltage / current reading over hardware valid digit.
ADI OVER	Current / resistance reading over hardware valid digit.
GR CONT.	Grounding on test no good
GFI TRIP	Ground fail interrupt
AC REAL HI	Real current measurement value over high limit

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

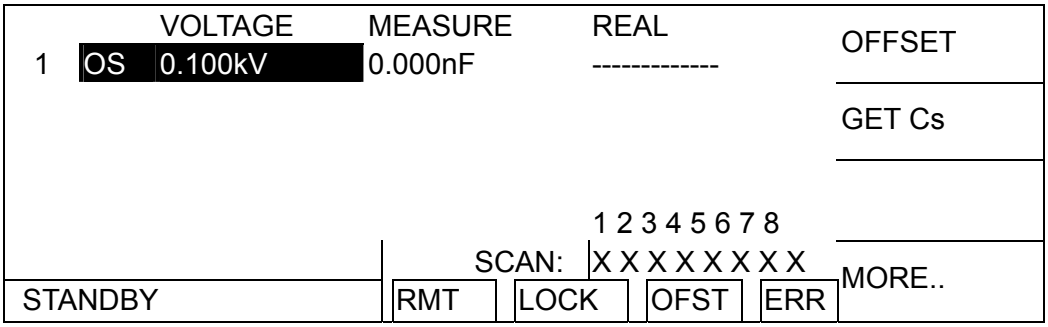
4.8.3.2 OS Test Procedure

1. Connection is completed correctly by connecting DUT device method under standby menu.
2. Under standby menu (as the following figure):



Schema:
OS means the test mode is short/open detection mode. "Site 1" means the setting voltage value, "Site 2" means the capacitance value which be read, "Site 3" means the test time. The test results are shown on the status list.

3. Please press **STOP** key, ready for testing, the status list shows "STANDBY".
4. Please press **F4** **MORE..** key to switch the menu which be displayed.



(1) Please press **F1** **OFFSET** to offset, it is necessary to offset wire or fixture at each time change to ensure the accuracy of the test.
(2) When test or change a new capacitance DUT, the testing capacitance standard sample
as DUT. Press **F2** GET Cs to read the standard capacitance value for testing.
(3) Please press **F4** **MORE..** key again to switch the menu which be displayed to standby.
(4) Press **START** key to begin the test. It will begin to output the voltage. The DANGER indicator lights up and the “Status Line” shows “UNDER TEST” to warn you that it is in test state and there is voltage output. "Line 1" will show the voltage output reading, "Line 2" will show the reading of capacitance, and "Line 3" performs timing and countdown work.

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.

5. GOOD judgment
When all of test statuses have been tested and the 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.
6. 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 test result will show no good status.

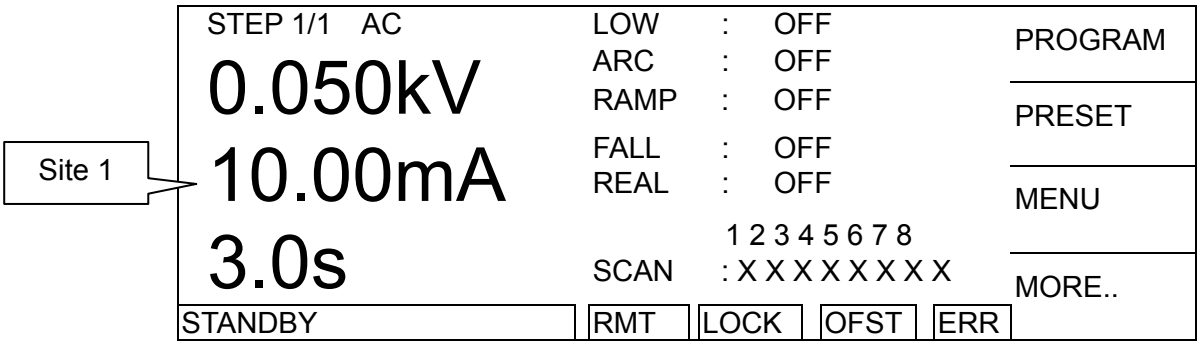
No good status

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

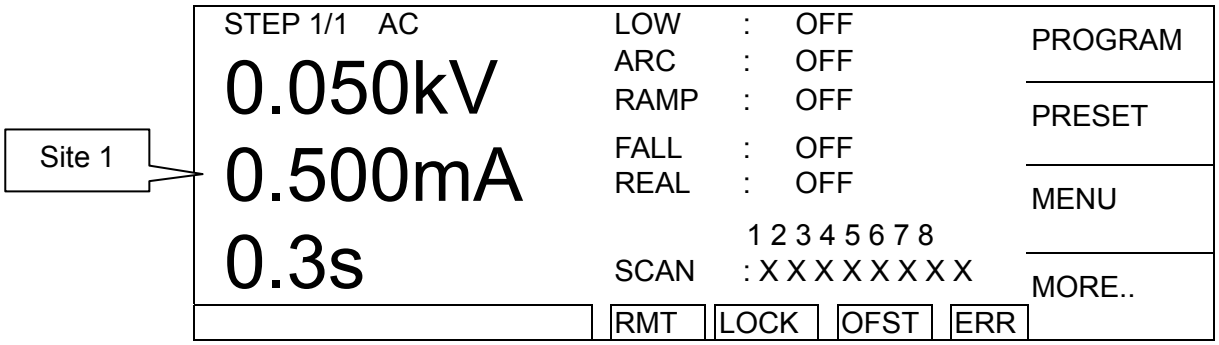
Under any circumstances only need to press **STOP** key if you want to stop the test output.

4.8.4 Auto Range

1. Set Auto Range as ON.
2. Set the range to high current as the Site 1 shown in the following menu.



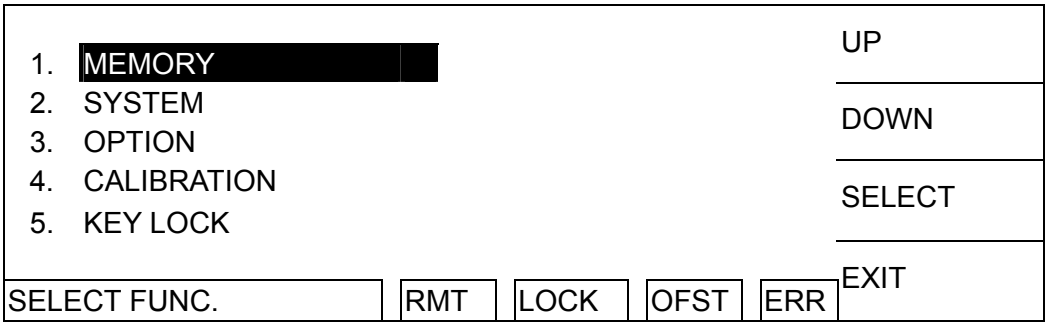
3. Before ending the test previous 0.6 sec., the tested current is shown and auto range to low current as the Site 1 in the following menu.



4.9 KEY LOCK Function

4.9.1 KEY LOCK Setting Method

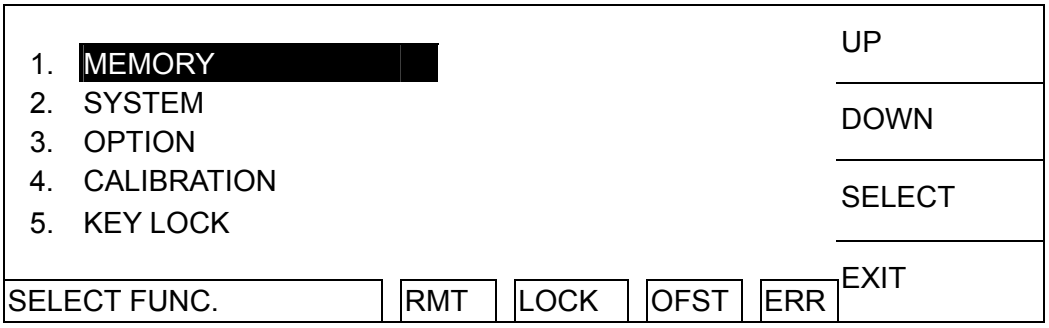
1. Under power on menu, if "LOCK" text block isn't highlighted then can set KEY LOCK function.
2. Press Function Key **MENU** then show the following menu:



3. Move the highlighted to "KEY LOCK " by using Function Keys **UP**, **DOWN**. Press Function Key **SELECT** to enter KEY LOCK setting menu.
4. Using Function Keys **A**, **B** to input PASSWORD (please input AAAA, when PASSWORD is not set).
5. Press **ENTER** key will show selection window, "LOCK" text block will show highlighted. The user can use Function Keys **YES**, **NO** to select whether LOCK MEMORY RECALL function together or not.
6. Press Function Keys **EXIT** to complete KEY LOCK function.

4.9.2 KEY LOCK Release Method

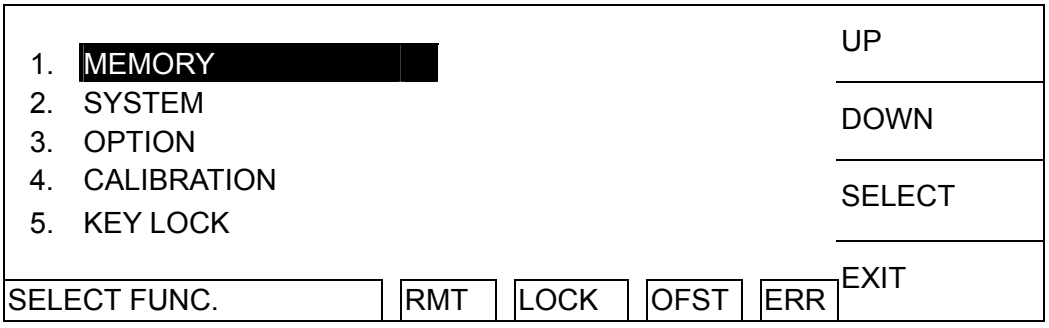
1. Under power on menu, if "LOCK" text block is highlighted then can release KEY LOCK function.
2. Press Function Key **MENU** then show the following menu:



3. Move the highlighted to "KEY LOCK" by using Function Keys **UP**, **DOWN**. Press Function Key **SELECT** to enter KEY LOCK release menu.
4. Using Function Keys **A**, **B** to input PASSWORD (please input AAAA, when PASSWORD is not set).
5. Press Function Key **ENTER** key, "LOCK" text block will release the highlighted. It means KEY LOCK function is released.

4.10 Setting User Password

1. Under power on menu, press Function Key **MENU** then show the following menu:



2. Move the highlighted to "CHANGE PASSWORD" by using Function Keys **UP**, **DOWN**. Press Function Key **ENTER** to enter password input menu.
3. Using Function Keys **A**, **B** to input PASSWORD (please input AAAA, when PASSWORD is not set). Press **ENTER** key will show "ENTER NEW PASSWORD" window.
4. Using Function Keys **A**, **B** to input NEW PASSWORD (not over ten characters), press **ENTER** key will shows “ENTER CONFIRM PASSWORD” window.
5. Using Function Keys **A**, **B** to input CONFIRM PASSWORD (the same as NEW PASSWORD), press **ENTER** key. At the same time, the setting has been done and can press **EXIT** to exit.

4.11 Remote Control

This tester has REMOTE socket of remote switch on rear panel. When you want to control this tester 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.
Users 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 want to control START single and STOP signal can refer to *figure 4-5*. As this figure described method connect to REMOTE position on front panel.

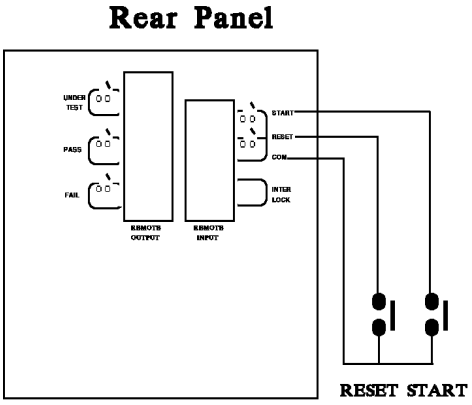


Figure 4-5

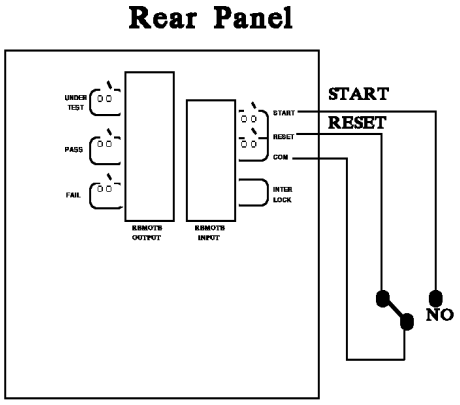


Figure 4-6

2. As figure 4-6, 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 4-7. The connecting signal and circuit as figure 4-7. Only the circuit includes the following statuses, it can control the main unit.
   (1) The signal of LOW flows current is 2mA or less.
   (2) The action time of inputting signal should over 20mS.

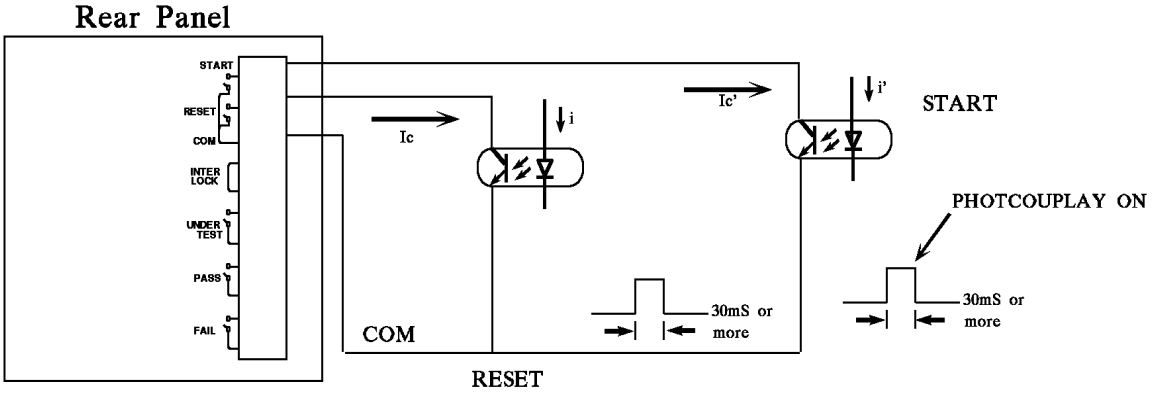


Figure 4-7

4. The relay switch control as figure 4-5 and photo-coupler control as figure 4-7 are controlled by component contact. It is effective to avoid error operation system cause 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 4-8. When you want to control by external, please remember this pin diagram.

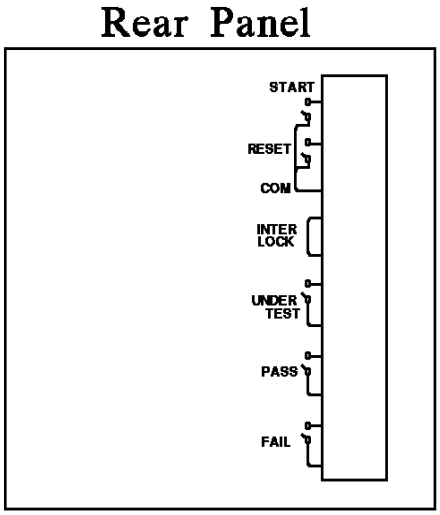


Figure 4-8

4.12 Output Signal

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

UNDER TEST : When the analyzer is under test, the output terminal will short circuit. Users can use this short condition to control external signal. The junction specification 115V AC current is lower than 0.3A.

PASS : When the tester judge DUT is good, the output terminal will short circuit. Can use this short circuit condition to control external signal. The junction specification 115V AC current is lower than 0.3A. The action time is 0.2sec ~ 99.9sec. can be set.

FAIL : When the tester judge DUT is no good, the output terminal will short circuit. Users can use this short circuit condition to control external signal. The junction specification 115V AC current is lower than 0.3A. The action time: from judge as no good to STOP is stopped.

4.13 Scan Test

The tester multipoint scans on DUT (only 19053/19054) for more faster and effective test.

Setting method:

1. Enter test parameter setting menu and setting test parameter in sequence.
2. When the highlighted position on “SCAN”, press Function Key **MOVE** can select the output channel want to set. (19053: 1 ~ 8 / 19054: 1 ~ 4)
3. At the same time, can use Function Key **CHANGE** to set the status of scanning test output terminal. Press this key will shows “H”, “L” and “X” in sequence, it means do output from High Channel; do output and don’t output from Low Channel.
4. Setting is completed, press Function Key **ENTER** to confirm and exit.

5. GPIB Operation Description (Option)

5.1 Guide

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

5.2 Interface Specification

5.2.1 Adaptable Standard

IEEE488-1978 standard

5.2.2 Interface Capability

Code	Meaning
SH1	Source Handshake Equipped with source handshake interface function
AH1	Acceptor Handshake Equipped with acceptor handshake interface function
T4	Basic Talker requirement Equipped with basic talker interface function
L4	Basic Listener requirement Equipped with basic listener interface function
SR1	Service request requirement Equipped with service request interface function
RL1	All remote/local requirement Equipped with remote/local interface function
PP0	No Parallel poll requirement No parallel poll interface function
DC1	All device clear requirement Equipped with device clear interface function
DT0	No Device trigger requirement No device trigger interface function
C0	No controller requirement No controller interface function

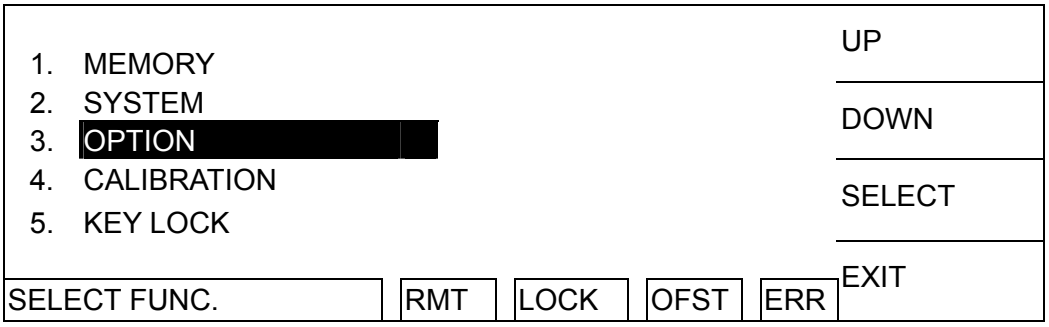
5.2.3 Using Code

ASCII code

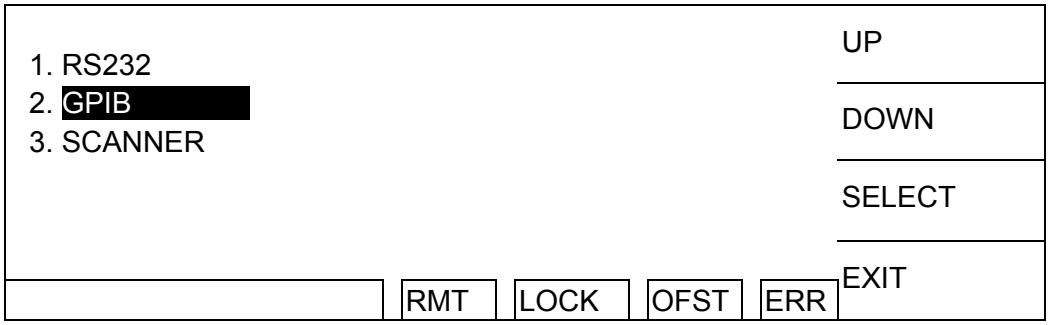
5.3 GPIB Related Panel Descriptions

5.3.1 Address Setting

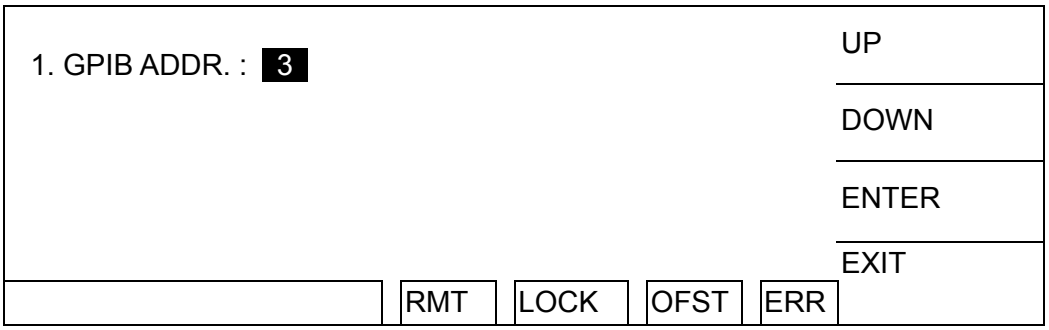
1. Under power on menu, press Function Key **MENU** as the following:



2. Move the highlight to "OPTION" by Function Key **UP**, **DOWN**. Press Function Key **SELECT** to enter OPTION select setting as the following:



3. Move the highlighted to "GPIB" by Function Key **UP**, **DOWN**. Press Function Key **SELECT** to enter GPIB setting menu as the following:



4. Then select GPIB Address by Function Key **UP**, **DOWN**.
5. The setting is completed, press Function Key **EXIT** to exit.

5.3.2 Remote / Local

1. The signal block Remote is highlighted, it means the analyzer is on Remote status.
2. On Remote status can use **LOCAL** key on panel switch the analyzer to Local status.
3. On Remote status, all of panel keys are malfunction except for Function Key **LOCAL** (switch to Local) **MENU**, **MORE..** and **STOP** (reset instrument) keys.
4. By using LLO [Local lockout] command of GPIB makes **LOCAL** key is malfunction.

5.4 Interface Message

The analyzer is capable of responding to the following messages

Signal	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

5.5 GPIB Control / Setting Command Descriptions

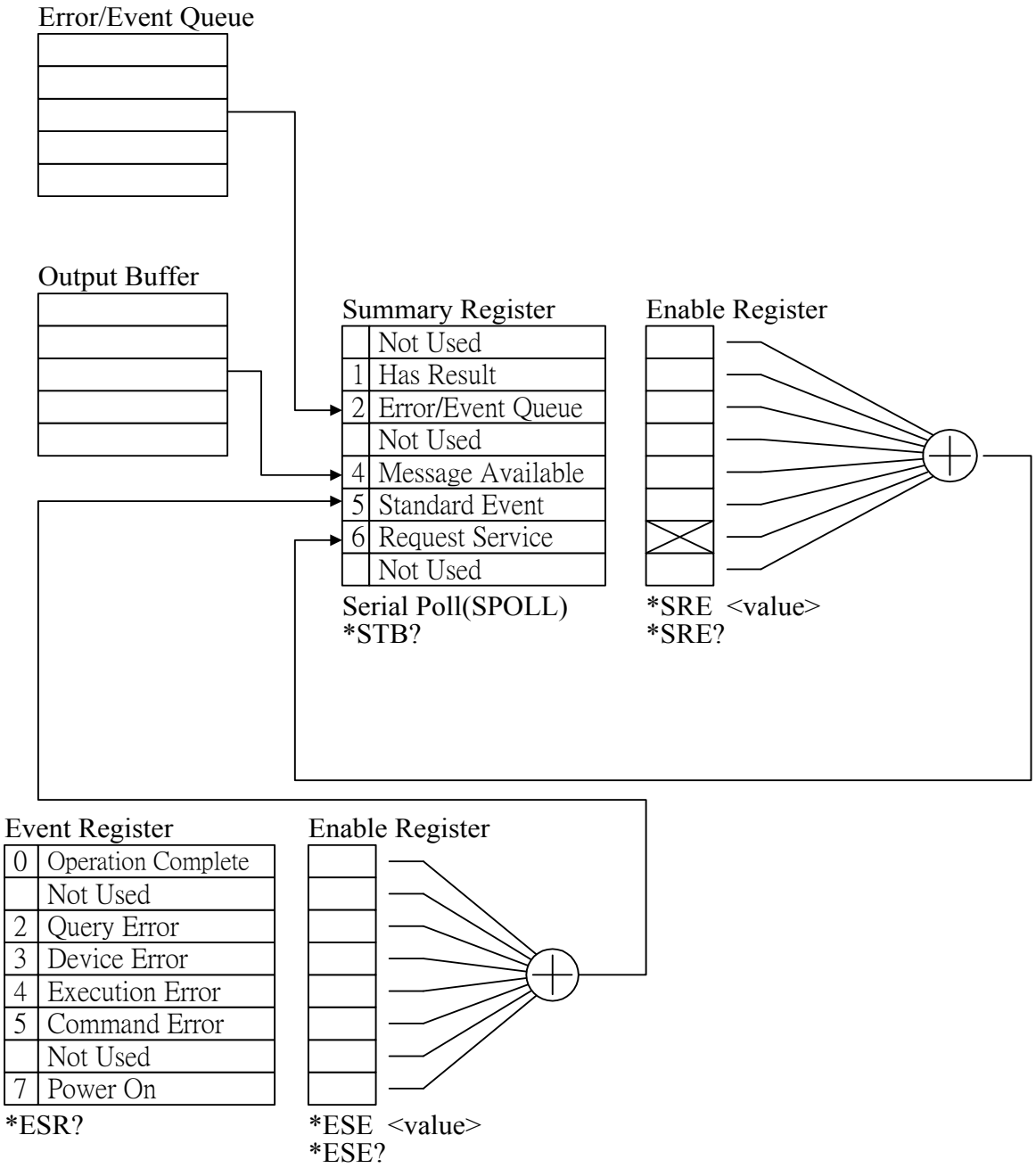
The analyzer GPIB function composed command string is inputted by ASCII code to attain functions of remote control and setting. The length of the command string is limited in 1024 characters (include end code) [Command + Parameter] compose a command. Two commands can be connected by semicolon and end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

End code

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

Status response command

✳CLS
✳ESE <*enable value*>
✳ESE?
✳ESR?
✳SRE <*enable value*>
✳SRE?
✳STB?
✳PSC 0|1
✳PSC?


Error/Event Queue
Output Buffer
Summary Register
Not Used
1 Has Result
2 Error/Event Queue
Not Used
4 Message Available
5 Standard Event
6 Request Service
Not Used
Enable Register
Serial Poll(SPOLL)
*STB?
*SRE <value>
*SRE?
Event Register
0 Operation Complete
Not Used
2 Query Error
3 Device Error
4 Execution Error
5 Command Error
Not Used
7 Power On
*ESR?
Enable Register
*ESE <value>
*ESE?

5.6 IEEE 488.2 Command

* CLS command

Clear status data configuration the following actions are needed.

Clear standard event status register.

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

* ESE <*metric system value*> Command

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

* ESE? Command

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

* ESR? Command

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

* SRE <metric system value> Command

Use for setting service request register value, its' <metric system value> value is 0 ~ 255.

* SRE? Command

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

* STB? Command

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

* OPC Command

Operation is completed command

* OPC? Command

Operation complete query command. The output format is ASCII character " 1 ".

* PSC 0|1 Command

Power on status clear command.

* PSC? Command

Power on status clear query command. The output format is ASCII character " 1 " or " 0 ".

* RST Command

The device reset command.

* IDN? Command

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

* SAV <metric system value> Command
  Save command.
  This command is save the current status to memory, its' metric system value range is 1 ~ 99.

* RCL <metric system value> Command
  Recall command.
  This command is recall the saved status, its' metric system value range is 1 ~ 99.

5.7 Remote Command Summary

SCPI command

The parameter syntax format of SCPI command includes the following.
Dual arrow symbol "< >" denote the defined parameter of SCPI command standard.
"< numeric _ value >" is metric system value, "< boolean >" is Boolean equation data and its' value is 0 or 1. Vertical line " | " denotes OR parameter.

: SYSTem
: ERRor
: [NEXT]?
: VERSion?
: KLOCk < boolean > | ON | OFF
: KLOCk?
: LOCK
: OWNer?
: REQuest?
: RELease

MEMory
: DELete
: LOCAtion < register number >
: FREE
: STEP?
: STATe?
: STATe
: DEFine < name >, < register number >
: DEFine? < name >
: LEAble? < register number >
: NSTAtes?
: SOURce
: SAFEty
: FETCh? ***[< item >] { , < item > }***
: STARt
[: ONCE]
: OFFSet GET|OFF
: OFFSet?
: CSTandard
: STOP
: STATus?

```
: RESult
      : ALL
            [: JUDGment]?
            : OMETerage?
            : MMETerage?
            : RMETerage?
            : TIME
                  [: ELAPsed]
                        [: TEST]?
                              : RAMP?
            : MODE?
      : COMPleted?
      : AREPort?   (RS232 Interface only)
            [: JUDGment]
                  [:MESsage]?
      : AREPort    (RS232 Interface only)
            [:JUDGment]
                  [:MESsage] <Boolean> |ON | OFF
            : OMETerage <Boolean> |ON | OFF
            : OMETerage?
            : MMETerage <Boolean> |ON | OFF
            : MMETerage?
            : RMETerage
            : RMETerage?
      [: LAST]
            [: JUDGment]?
            : OMETerage?
            : MMETerage?
            : RMETerage?
      :STEP<n>
            : JUDGment]?
            : OMETerage?
            : MMETerage?
            : RMETerage?

: SNUMber?
: STEP<n>
      : DELete
      : SET?
      : MODE?
      : AC
            [: LEVel] <numeric_value>
            [: LEVel]?
            : LIMit
                  [: HIGH]   <numeric_value>
                  [: HIGH]?
                  : LOW    <numeric_value>
                  : LOW?
                  : ARC
                              [: LEVel] <numeric_value>
                              [: LEVel]?
                  : REAL
                              [: HIGH]
                              [: HIGH]?
```

```
        : TIME
            : RAMP <numeric_value>
            : RAMP?
            [: TEST] <numeric_value>
            [: TEST]?
            : FALL <numeric_value>
            : FALL?
        : CHANnel
            [: HIGH] <channel_list>
            [: HIGH]?
            : LOW   <channel_list>
            : LOW?
: DC
    [: LEVel] <numeric_value>
    [: LEVel]?
    : LIMit
        [: HIGH]   <numeric_value>
        [: HIGH]?
        : LOW    <numeric_value>
        : LOW?
        : ARC
                [: LEVel] <numeric_value>
                [: LEVel]?
    : CLOW   <boolean>|ON|OFF
    : CLOW
    : TIME
        : DWELI <numeric_value>
        : DWELI?
        : RAMP <numeric_value>
        : RAMP?
        [: TEST] <numeric_value>
        [: TEST]?
        : FALL <numeric_value>
        : FALL?
    : CHANnel
        [: HIGH]   <channel_list>
        [: HIGH]?
        : LOW    <channel_list>
        : LOW?
: 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?
        : OSC
            : LIMit
                : OPEN   <numeric_value>
                : OPEN?
                : SHORt   <numeric_value>
                : SHORt?
            : CHANnel
                [: HIGH] <channel_list>
                [: HIGH]?
                : LOW   <channel_list>
                : LOW?
        : Pause
            : [:MESSage] <string data>
            : [:MESSage] ?
            : UTSIgnal   < boolean> | ON | OFF >
            : UTSIgnal?
            : TIME
               [:TEST] <numeric_value>
               [:TEST]?
: PRESet
        : TIME
            : PASS       <numeric_value>
            : PASS?
            : STEP       <numeric_value>|KEY
            : STEP?
            : RJUDgment <ON/OFF or boolean>
            : RJUDgment?
        : AC
            : FREQuency <numeric_value>
            : FREQuency?
        : WRANge
            [: AUTO]         <boolean>|ON|OFF
            [: AUTO]?
        : AGC
            [: SOFTware]     <boolean>|ON|OFF
            [: SOFTware]?
        : GFI
            [: SWITCH]       <boolean>|ON|OFF
            [: SWITCH]?
        : GR
            : CONTinue       <numeric_value>|ON|OFF
            : CONTinue?
```

: FAIL
: OPERation STOP|CONTinue|RESTart
: OPERation?
: SCREen <Boolean>|ON|OFF
: SCREen?
: KEYboard
: SMARt <Boolean>|ON|OFF
: SMARt?
: RJUDgment <Boolean>|ON|OFF
: RJUDgment?
: NUMber
: PART
: PART?
: LOT
: LOT?
: SERIal
: SERIal?

: SYSTem

: VERSion?

: 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.

: ERRor

: [NEXT]?

: SYSTem: ERRor: [NEXT]?

This command read message in Error Queue.

Returned message please refer to section 5.7 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.

: KLOCk < boolean > |ON |OFF

: SYSTem: KLOCk

This command locks or releases LOCAL key function but no switch of LOCAL or REMOTE.

Example: Input command "**SYST:KLOC ON"**

Description: It means LOCAL function key locked for setting panel.

: KLOCk?

:SYSTem: KLOCk?

This command queries if LOCAL key is being locked.

Example: Input command "**SYST:KLOC?"**

Return message "**1"**

Description: Return message **"1"** means LOCAL key is locked.

: **LOCk**

: OWNer?

: SYSTem:LOCk:OWNer?

This command queries if it is controlled by REMOTE terminal.
Return character data NONE|REMOTE.
Example: Input command "**SYST:OWN?"**
Return message "**REMOTE"**
Description: Return message **"REMOTE"** means the instrument is under the status of REMOTE terminal control.

: REQuest?
: SYSTem:LOCk:REQuest?
This command switches to REMOTE terminal control.
Example: Input command "**SYST:REQ?"**
Return message "**1"**
Description: Return message "**1"** means the instrument is already set to the status of REMOTE.

: RELease
: SYSTem:LOCk:RELease
This command switches to LOCAL terminal control.
Example: Input command "**SYST:REL"**
Description: It means the instrument is already set to the status of NONE.

: MEMory

: DELete

LOCAtion < *register number* >
: MEMory: DELete: LOCAtion
This command deletes the parameter data in the main memory.
Example: Input command "**MEM:DEL:LOCA 1"**
Description: It means to delete the first group of parameter data in the main memory.

: STATe

: DEFine < *name* >, < *register number* >
The command sets the name of the location of a certain memory in the main memory.
< *name* > The characters can be used are 0 ~ 9, A ~ Z, —.
Example: Input command "**MEM:STAT:DEF TEST,1"**
Description: It means to set the first group of parameter data name in the main memory is TEST.

: DEFine? < *name* >
The command queries the location in the main memory by the name of memory.
< *name* > The characters can be used are 0 ~ 9, A ~ Z, —.
Example : Input command "**MEM:STAT:DEF? TEST"**
Return message "**1"**
Description: Return message "**1"** means the parameter data location of TEST is at the first group.

: LABEl? < *register number* >
This command queries the name in the main memory is by the location of the memory.
Example: Input command "**MEM:STAT:LABEl? 1"**
Return message "**TEST"**
Description: Return message "**TEST"** means the first group parameter data name is TEST.

: NSTates?
This command queries the storage capacity in the main memory.
The storage capacity return to the main memory is the maximum value plus one.
Example : Input command "**MEM:NST?"**
Return message "**100"**
Description: Return message "**100"** means the storage capacity of the main memory is 99 groups (100-1).

: FREE
: STEP?
: 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 can be set is 497, there are 3 steps have been used.

: STATe?
: MEMory: FREE: STATe?
This command queries the rest parameter data number can be set 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 can be set is 97, there are 3 groups have been used.

[: SOURce]
: SAFEty
: STARt
[: ONCE]
: SOURce: SAFEty: STARt
This command starts the test.
Example: Input command "**SAFE:STAR"**
Description: It means to start the main unit test.

: OFFSet GET|OFF
: SOURce: SAFEty: STARt: OFFSet GET
This command gets offset value.
Example: Input command "**SAFE:STAR OFFS GET"**
Description: It means to start the function of getting offset value.

: SOURce: SAFEty: STARt: OFFSet OFF
This command is off offset function.
Example: Input command "**SAFE:STAR OFFS OFF"**
Description: It means to off the function of getting offset value.

: OFFSet?
: SOURce: SAFEty: STARt: OFFSet?
This command queries if do offset action or not.
Return 0, it means without doing zero action, 1 means zero action have been done, 2 means zero action processing.
Example: Input command "**SAFE:STAR OFFS?"**
Return message **"0"**

Description: Return message **"0"** means the main unit is without doing zero action.

: CSTandard
: SOURce: SAFEty: STARt: CSTandard
This command starts GET Cs function of short/open circuit detection mode.
Example: Input command "**SAFE:STAR:CST"**
Description: It means to start GET Cs function of short/open circuit detection mode.

: STOP
: SOURce: SAFEty: STOP
This command stops the test.
Example: Input command "**SAFE:STOP"**
Description: It means to stop the main unit test.

: STATus?
: 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.

: FETCh? [< item >] { , < item > }
The command queries the metered data. The < item > is character data.
The command responding the following data:

ITEM	Responding Data
STEP	The step number.
MODE	The test mode.
OMETerage	The value of output meter.
MMETerage	The value of measure meter.
RMETerage	The value of real meter.
RELApsed	The elapse time of ramp.
RLEFt	The left time of ramp.
TELApsed	The elapse time of test.
TLEFt	The left time of test.
FELApsed	The elapse time of fall.
FLEFt	The left time of fall.
DELApsed	The elapse time of dwell.
DLEFt	The left time of dwell.
CHANnel	The scan box status.

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.

: RESult
: ALL
[: JUDGment]?

: SOURce: SAFEty: RESult: ALL: JUDGment?
This command queries all STEP judgment results.
Example : Input command "**SAFE:RES:ALL?"**
Return message "**116"**
Description: Return message "**116"** means judgment results are PASS.

: OMETerage?
: SOURce: SAFEty: RESult: ALL: OMETerage?
This command queries all OUTPUT METER readings of STEP.
Example : Input command "**SAFE:RES:ALL:OMET"**
Return message "**5.100000E+01"**
Description: Return message "**5.100000E+01"** means query OUTPUT METER result is 0.051kV.

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

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

: TIME
[: TEST]?
: SOURce: SAFEty: RESult: ALL: TIME: TEST?
This command queries the needed time of all STEP tests.
Example : Input command "**SAFE:RES:ALL:TIME"**
Return message "**3.000000E+00"**
Description: Return message "**3.000000E+00"** means the test needed time being set to 3 seconds.

: RAMP?
: SOURce: SAFEty: RESult: ALL: TIME: RAMP?
This command queries the time of all STEP tests ramp to the setting voltage.
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 being set to 1 second.

:FALL?
: SOURce: SAFEty: RESult: ALL: TIME: FALL?
This command queries the time of all STEP tests from the setting voltage fall to zero.
Example : Input command "**SAFE:RES:ALL:TIME: FALL"**

Return message "**2.000000E+00"**
Description: Return message "**2.000000E+00"** means from the setting voltage fall to zero needed time being set to 2 seconds.

:DWELI?
: SOURce: SAFEty: RESult: ALL: TIME: DWELI?
This command queries dwell time of all STEP tests.
Example : Input command "**SAFE:RES:ALL:TIME: DWEL"**
Return message "**2.500000E+00"**
Description: Return message "**2.500000E+00"** means the test dwell time being set to 2.5 seconds.

:MODE?
: SOURce: SAFEty: RESult: ALL: MODE?
This command queries all STEP modes will return character data.
AC|DC|IR|OS|PA
Example : Input command "**SAFE:RES:ALL: MODE?"**
Return message "**DC"**
Description: Return message "**DC"** means MODE setting is DC MODE.

: COMPleted?
: SOURce: SAFEty: RESult: COMPlete?
This command queries if the device complete the execution action of all setting values.
Return 1 or 0 (1 means the execution action is completed, 0 means the execution action isn't completed).
Example : Input command "**SAFE:RES:COMP?"**
Return message "**1"**
Description: Return message "**1"** means execution actions of all setting values are completed.

: AREPort (RS232 Interface only)
[:JUDGment]
[:MESsage] <boolean>|ON|OFF
: SOURce: SAFEty: RESult: AREPort**:JUDGment:MESsage**
< boolean > | ON | OFF
This command sets if auto report the test result. When sets as ON or 1, the test is completed, return the string data of "PASS" or "FAIL". When sets as OFF or 0, it will not auto report the result.
Example : Input command "**SAFE:RES:AREP ON"**
Description: It means the main unit auto report test result after the test is completed.

:OMETerage
: SOURce: SAFEty: RESult: AREPort**:**OMETerage ***< boolean > | ON | OFF***
This command sets if OUTPUT METER auto reports the test result. When sets as ON or 1, the test is completed, return messages are OUTPUT VALUE of all STEPs. If some STEPs among don't be tested, it denotes these STEPs don't have OUTPUT VALUE, return +9.910000E+37. When set as OFF or 0, it will not auto report the test result.

Example : Input command "**SAFE:RES:AREP:OMET ON"**
Description : It means the main unit auto report the test result of OUTPUT METER after the test is completed.

:OMETerage ?
: SOURce: SAFEty: RESult: AREPort:OMETerage ?
This command queries if OUTPUT METER auto reports the test result. Return 1 or 0 (1 means OUTPUT METER will auto report the test result, 0 means OUTPUT METER will not auto report the test result).
Example : Input command "**SAFE:RES:AREP:OMET?"**
Return message "**1"**
Description: Return message "**1"** means the main unit will auto report OUTPUT METER result after the test is completed.

:MMETerage
: SOURce: SAFEty: RESult: AREPort**:**MMETerage **< *boolean* > | *ON* | *OFF***
This command sets if MEASURE METER auto report the test result. When sets as OFF or 1, the test is completed, return messages are MEASURE VALUE of all STEPs. If some STEPs among don't be tested, it denotes these STEPs don't have MEASURE VALUE, return +9.910000E+37. When set as OFF or 0, it will not auto report the test result.
Example : Input command "**SAFE:RES:AREP:MMET ON"**
Description: It means to set the main unit auto report MEASURE METER test result after the test is completed.

: MMETerage ?
: SOURce: SAFEty: RESult: AREPort: MMETerage ?
This command queries if MEASURE METER auto reports the test result. Return 1 or 0 (1 means MEASURE METER will auto reports the test result, 0 means MEASURE METER will not auto reports the test result).
Example: Input command "**SAFE:RES:AREP:MMET?"**
Return message "**1"**
Description: Return message "**1"** means the main unit will auto report MEASURE METER result after the test is completed.

:RMETerage
: SOURce: SAFEty: RESult: AREPort**:**RMETerage **< *boolean* > | *ON* | *OFF***
This command sets if REAL CURRENT METER auto reports the test result. When sets as OFF or 1, the test is completed, return messages are REAL CURRENT VALUE of all STEPs. If some STEPs among don't be tested, it denotes these STEPs don't have REAL CURRENT VALUE, return +9.910000E+37. When set as OFF or 0, it will not auto report the test result.
Example: Input command "**SAFE:RES:AREP:RMET ON"**
Description: It means to set the main unit auto report test result of REAL CURRENT METER after the test is completed.

:RMETerage ?
: SOURce: SAFEty: RESult: AREPort:RMETerage ?
This command queries if REAL CURRENT METER auto reports the test result. Return 1 or 0 (1 means REAL CURRENT METER will auto report the test result, 0 means REAL CURRENT METER will not auto report the

test result).
Example : Input command "**SAFE:RES:AREP:RMET?"**
Return message "**1"**
Description: Return message "**1"** means auto report the result of REAL CURRENT METER after the main unit test is completed.

[: LAST]?
[: JUDGment]?
: 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: Return message "**116"** means the judgment result of the last STEP is PASS.

: OMETerage?
: SOURce: SAFEty: RESult: LAST: OMETerage?
This command queries OUTPUT METER reading of the last STEP.
Example : Input command "**SAFE:RES:LAST:OMET"**
Return message "**5.100000E+01"**
Description: Return message "**5.100000E+01"** means OUTPUT METER reading of the last STEP is 0.051kV.

: MMETerage?
: SOURce: SAFEty: RESult: LAST: MMETerage?
This command queries MEASURE METER reading of the last STEP.
Example : Input command "**SAFE:RES:LAST:MMET"**
Return message "**2.000000E-07"**
Description: Return message "**2.000000E-07** means MEASURE METER reading of the last STEP is 2uA.

: RMETerage?
: SOURce: SAFEty: RESult: LAST: RMETerage?
This command queries REAL CURRENT METER reading of the last STEP.
Example : Input command "**SAFE:RES:LAST:RMET"**
Return message "**8.000000E-07"**
Description: Return message "**8.000000E-07"** means REAL CURRENT METER reading of the last STEP is 0.008mA.

: STEP<n>
: JUDGment?
: SOURce: SAFEty: RESult: STEP: JUDGment?
This command queries the judgment result code of selected STEP.
Example : Input command "**SAFE:RES:STEP2:JUDG?"**
Return message "**116"**
Description: Return message "**116"** means query the judgment result of the second STEP is PASS.

: OMETerage?
: SOURce: SAFEty: RESult: STEP: OMETerage?
This command queries OUTPUT METER reading of selected STEP.
Example : Input command "**SAFE:RES:STEP2:OMET?"**
Return message "**5.000000E+03"**

Description: Return message "**5.000000E+03"** means OUTPUT METER reading of the second STEP is 5000V.

: MMETerage?
: SOURce: SAFEty: RESult: STEP: MMETerage?
This command queries MEASURE METER reading of selected STEP.
Example : Input command "**SAFE:RES:STEP2:MMET?"**
Return message "**2.500000E-05"**
Description: Return message "**2.500000E-05"** means MEASURE METER reading of the second STEP is 0.025mA.

: RMETerage?
: SOURce: SAFEty: RESult: STEP: RMETerage?
This command queries REAL CURRENT METER reading of selected STEP.
Example : Input command "**SAFE:RES:STEP2:MMET?"**
Return message "**1.000000E-05"**
Description: Return message "**1.000000E-05"** means MEASURE METER reading of the second STEP is 0.010mA.

Common judgment result code list

Judgment Result	Code (HEX)	Code (metric system)
PASS	0×74	116
USER STOP	0×71	113
CAN NOT TEST	0×72	114
TESTING	0×73	115
STOP	0×70	112

Judgment result no good code list

	AC MODE		DC MODE		IR MODE	
	Hex	Dec	Hex	Dec	Hex	Dec
HI	11	17	21	33	31	49
LO	12	18	22	34	32	50
ARC	13	19	23	35	33	----
IO	14	20	24	36	34	52
CHECK LOW	----	----	25	37	----	----
ADV OVER	16	22	26	38	36	54
ADI OVER	17	23	27	39	37	55
REAL HIGH	1a	26	----	----	----	----
GR CONT.	78	120	78	120	78	120
TRIPPED	79	121	79	121	79	121
IO-F	16	27	26	43	----	----

: SNUMber?
: SOURce: SAFEty: SNUMber?
This command queries STEP number being set in the memory.
Example : Input command "**SAFE:SNUM?"**

Return message "**+2"**
Description : Return message "**+2"** means 2 steps have been set in the memory.

: STEP<n>

: DELete
: SOURce: SAFEty: STEP: DELete
This command clears all setting value in selected Step to initial value.
<n> The metric system value is 1 ~99 (included).
Example : Input command "**SAFE:STEP 1:DEL"**
Description : This command means deleting STEP1 setting value in the memory.

: SET?
: SOURce: SAFEty: STEP: SET?
This command queries all setting values in 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, 3.000000E+00, 1.000000E+00, 2.000000E+00, 4.000000E-04, (@(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, TIME: 3.0s, RAMP: 1.0s, FALL: 2.0s, REAL: 0.400mA, SCAN HI: 0, SCAN LOW: 0.

: MODE?
: SOURce: SAFEty: STEP: MODE?
This command queries MODE in selected STEP.
Return character data AC | DC | IR | OS | PA
Example : Input command "**SAFE:STEP 1:MODE?"**
Return message "**AC"**
Description: Return message "**AC"** means STEP 1 set to AC MODE.

: AC
[: LEVel] <numeric_value>
: SOURce: SAFEty: STEP: AC: LEVel
This command sets selected Step which AC withstand voltage test needed voltage value.
<numeric_value> is 50 ~5000 (included), the unit is volt.
Example : Input command "**SAFE:STEP 1:AC 3000"**
Description: This command means STEP1 AC withstand voltage test needed voltage value is 3000V.

[: LEVel]?
: SOURce: SAFEty: STEP: AC: LEVel?
This command queries selected STEP which AC withstand voltage test needed voltage value.
Return value is 50 ~ 5000 (included), the unit is volt.
Example : Input command "**SAFE:STEP 1:AC?"**
Return message "**3.000000E+03"**
Description: Return message "**3.000000E+03"** means voltage value set to 3000V when testing STEP1 AC withstand voltage.

: LIMit

[: HIGH] <numeric_value>

: SOURce: SAFEty: STEP: AC: LIMit: HIGH

This command sets selected STEP which AC withstand voltage leakage current high limit.

Example : Input command "**SAFE:STEP 1:AC:LIM 0.01"**

Description: This command sets AC withstand voltage leakage current high limit value of the main unit STEP1 is 10mA.

[: HIGH]?

: SOURce: SAFEty: STEP: AC: LIMit: HIGH?

This command queries selected STEP which AC withstand voltage leakage current high limit.

Example : Input command "**SAFE:STEP 1: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 STEP1 is set to 10mA.

: LOW <numeric_value>

: SOURce: SAFEty: STEP: AC: LIMit: LOW

This command sets selected STEP which AC withstand voltage leakage current low limit.

Example : Input command "**SAFE:STEP 1:AC:LIM:LOW 0.00001"**

Description: This command sets AC withstand voltage leakage current low limit value of the main unit STEP1 is 0.01mA.

: LOW?

: SOURce: SAFEty: STEP: AC: LIMit: LOW?

This command queries selected STEP which AC withstand voltage leakage current low limit.

Example : Input command "**SAFE:STEP 1: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 1 is set to 0.01mA.

: ARC

[: LEVel] <numeric_value>

: SOURce: SAFEty: STEP: AC: LIMit: ARC: LEVel

This command sets selected STEP which ARC checking value.

Example : Input command "**SAFE:STEP 1:AC:LIM:ARC 0.004"**

Description: This command means ARC checking value of the main unit STEP1 is set to 4mA.

[: LEVel]?

: SOURce: SAFEty: STEP: AC: LIMit: ARC: LEVel?

This command queries selected STEP which ARC checking value.

Example : Input command "**SAFE:STEP 1:AC:LIM:ARC?"**
Return message "**4.000000E-03"**

Description: Return message "**4.000000E-03"** means ARC checking value of the main unit STEP 1 is set to 4.0mA.

: REAL

[: HIGH]
: SOURce: SAFEty: STEP: AC: LIMit: REAL: HIGH
This command sets selected STEP which AC withstand voltage real current high limit value.
Example : Input command "**SAFE:STEP 1:AC:LIM:REAL 0.0001"**
Description: This command means AC withstand voltage real current high limit value of the main unit STEP1 is 0.10mA.

[: HIGH]?
: SOURce: SAFEty: STEP: AC: LIMit: REAL: HIGH?
This command queries selected STEP which AC withstand voltage real current high limit value.
Example : Input command "**SAFE:STEP 1:AC:LIM:REAL?"**
Return message "**1.000000E-04"**
Description: Return message "**1.000000E-04"** means ARC checking value of the main unit STEP 1 is set to 0.10mA.

: TIME

: RAMP <numeric_value>
: SOURce: SAFEty: STEP: AC: TIME: RAMP
This command sets selected STEP which test ramps to setting voltage needed time.
Example : Input command "**SAFE:STEP 1:AC:TIME:RAMP 5"**
Description: This command means test ramps to setting voltage needed time of the main unit STEP 1 is 5.0sec.

: RAMP?
: SOURce: SAFEty: STEP: AC: TIME: RAMP?
This command queries selected STEP which test ramps to setting voltage needed time.
Example : Input command "**SAFE:STEP 1: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 1 is set to 5.0sec.

[: TEST] <numeric_value>
: SOURce: SAFEty: STEP: AC: TIME: TEST
This command sets selected STEP which test needed time.
Example : Input command "**SAFE:STEP 1:AC:TIME 10"**
Description: This command means test needed time of the main unit STEP 1 is 10.0sec.

[: TEST]?
: SOURce: SAFEty: STEP: AC: TIME: TEST?
This command queries selected STEP which test needed time.
Example : Input command "**SAFE:STEP 1:AC:TIME?"**
Return message "**1.000000E+01"**
Description: Return message "**1.000000E+01"** means test needed time of the main unit STEP 1 is set to 5sec.

: FALL <numeric_value>
: SOURce: SAFEty: STEP: AC: TIME: FALL
This command sets selected STEP which setting voltage value fall to

zero needed time.
Example : Input command "**SAFE:STEP 1:AC:TIME:FALL 4"**
Description: This command means setting voltage value of the main unit STEP 1 fall to zero needed time is 5.0 sec.

: FALL?
: SOURce: SAFEty: STEP: AC: TIME: FALL?
This command queries selected STEP which setting voltage value fall to zero needed time.
Example : Input command "**SAFE:STEP 1:AC:TIME:FALL?"**
Return message "**4.000000E+00"**
Description : Return message "**4.000000E+00"** means setting voltage value of the main unit STEP 1 fall to zero needed time is 4 sec.

: CHANnel
[: HIGH] <channel_list>
: SOURce: SAFEty: STEP: AC: CHANnel: HIGH
This command sets output channel status of scanning test high voltage.
Example : Input command "SAFE:STEP 1:AC:CHAN(@(1,3))"
Description: This command means output channel of scanning test of the main unit STEP 1 is set to channel 1 and 3 HIGH output.

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

[: HIGH]?
: SOURce: SAFEty: STEP: AC: CHANnel: HIGH?
This command queries output channel status of scanning test high voltage.
Example : Input command "**SAFE:STEP 1:AC:CHAN?"**
Return message "**(@(1,3))"**
Description: Return message "**(@(1,3))"** means output channel status of scanning test of the main unit STEP 1 is channel 1 and 3 HIGH output.

: LOW <channel_list>
: SOURce: SAFEty: STEP: AC: CHANnel: LOW
This command sets output status of scanning common test channel (RTN/LOW).
Example : Input command "**SAFE:STEP 1:AC:CHAN:LOW (@(2,4))"**
Description: This command means output channel of scanning test of the main unit STEP 1 is set to channel 2 and 4 LOW output.
Example : Input command "**SAFE:STEP 3:AC:CHAN:LOW (@(0))"**
Description: This command means LOW output channel of scanning test of the main unit STEP 1 is set to OFF.

: LOW?
: SOURce: SAFEty: STEP: AC: CHANnel: LOW?
This command queries output status of scanning common test channel (RTN/LOW).
Example : Input command "**SAFE:STEP 1:AC:CHAN:LOW?"**
Return message "**(@(2,4))"**

Description: Return message "**(@(2,4))"** means output channel status of scanning test of the main unit STEP 1 is channel 2 and 4 LOW output.

: DC

[: LEVel] <numeric_value>

: SOURce: SAFEty: STEP: DC: LEVel

This command sets selected STEP which DC withstand voltage test needed voltage value.

<numeric_value> is 50-6000 (included), the unit is volt.

Example : Input command "**SAFE:STEP 2:DC 4000"**

Description : This command means DC withstand voltage test needed voltage value of the main unit STEP 2 is set to 4000V.

[: LEVel]?

: SOURce: SAFEty: STEP: DC: LEVel?

This command queries selected STEP which DC withstand voltage test needed voltage value.

Return value is 50-6000(included), the unit is volt.

Example : Input command "**SAFE:STEP 2:DC?"**

Return message "**4.000000E+03"**

Description: Return message "**4.000000E+03"** means DC withstand voltage test setting voltage value of the main unit STEP 2 is 4000V.

: LIMit

[: HIGH] <numeric_value>

: SOURce: SAFEty: STEP: DC: LIMit: HIGH

This command sets selected STEP which DC withstand voltage leakage current high limit.

Example : Input command "**SAFE:STEP 2:DC:LIM 0.002999"**

Description: This command means DC withstand voltage leakage current high limit of the main unit STEP 2 is set to 2.999mA.

[: HIGH]?

: SOURce: SAFEty: STEP: DC: LIMit: HIGH?

This command queries selected STEP which DC withstand voltage leakage current high limit value.

Example : Input command "**SAFE:STEP 2: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 2 is 2.999mA.

: LOW <numeric_value>

: SOURce: SAFEty: STEP: DC: LIMit: LOW

This command sets selected STEP which DC withstand voltage leakage current low limit.

Example : Input command "**SAFE:STEP 2:DC:LIM:LOW 0.000001"**

Description: This command means DC withstand voltage leakage current low limit of the main unit STEP 2 is set to 0.001mA.

: LOW?

: SOURce: SAFEty: STEP: DC: LIMit: LOW?

This command queries selected STEP which DC withstand voltage leakage current low limit.
Example : Input command "**SAFE:STEP 2: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 2 is 0.001mA.

: ARC
[: LEVel] <numeric_value>
: SOURce: SAFEty: STEP: DC: LIMit: ARC: LEVel
This command sets selected STEP which ARC checking value.
Example : Input command "**SAFE:STEP 2:DC:LIM:ARC 0.0025"**
Description: This command means ARC checking value of the main unit STEP 2 is set to 2.5mA.

[: LEVel]?
: SOURce: SAFEty: STEP: DC: LIMit: ARC: LEVel?
This command queries selected STEP which ARC checking value.
Example : Input command "**SAFE:STEP 2:DC:LIM:ARC?"**
Return message "**2.500000E-03"**
Description: Return message "**2.500000E-03"** means ARC checking value of the main unit STEP 2 is 2.5mA.

: CLOW <boolean>|ON|OFF
: SOURce: SAFEty: STEP: DC: CLOW
This command sets selected STEP detect if charge current over low or not.
Example : Input command "**SAFE:STEP 2:DC:CLOW ON"**
Description: This command means detection charge current over low function of the main unit STEP 2 is set to ON.

: CLOW?
: SOURce: SAFEty: STEP: DC: CLOW?
This command queries selected STEP detect if charge current over low or not.
Example : Input command "**SAFE:STEP 2:DC:CLOW?"**
Return message "**1"**
Description: Return message "**1"** means detection charge current over low function of the main unit STEP 2 is ON.

: TIME
: RAMP <numeric_value>
: SOURce: SAFEty: STEP: DC: TIME: RAMP
This command sets selected STEP which test ramps to setting voltage needed time.
Example : Input command "**SAFE: STEP 2: DC: TIME: RAMP 2"**
Description: This command means test ramps to setting voltage needed time of the main unit STEP 2 is set to 2.0 sec.

: RAMP?
: SOURce: SAFEty: STEP: DC: TIME: RAMP?
This command queries selected STEP which test ramps to setting voltage needed time.

Example : Input command "**SAFE: STEP 2: DC: TIME: RAMP?"**
Return message "**2.000000E+00"**
Description: Return message "**2.000000E+00"** means test ramps to setting voltage needed time of the main unit STEP 2 is 2.0 sec.

[: TEST] <numeric_value>
: SOURce: SAFEty: STEP: DC: TIME: TEST
This command sets selected STEP which test needed time.
Example : Input command "**SAFE:STEP 2:DC:TIME 1"**
Description : This command means test needed time of the main unit STEP 2 is set to 1.0 sec.

[: TEST]?
: SOURce: SAFEty: STEP: DC: TIME: TEST?
This command queries selected STEP which test needed time.
Example : Input command "**SAFE:STEP 2:DC:TIME?"**
Return message "**1.000000E+00"**
Description: Return message "**1.000000E+00"** means test needed time of the main unit STEP 2 is 1 sec.

: FALL <numeric_value>
: SOURce: SAFEty: STEP: DC: TIME: FALL
This command sets selected STEP which setting voltage value fall to zero needed time.
Example : Input command "**SAFE: STEP 2: DC: TIME: FALL 1.5"**
Description: This command means setting voltage value fall to zero needed time of the main unit STEP 2 is set to 1.5 sec.

: FALL?
: SOURce: SAFEty: STEP: DC: TIME: FALL?
This command queries selected STEP which setting voltage value fall to zero needed time.
Example : Input command "**SAFE: STEP 2: DC: TIME: FALL?"**
Return message "**1.500000E+00"**
Description: Return message "**1.500000E+00"** means voltage value fall to zero needed time of the main unit STEP 2 is 1.5 sec.

: DWELI <numeric_value>
: SOURce: SAFEty: STEP: DC: TIME: DWELI
This command sets selected STEP which dwell needed time.
Example : Input command "**SAFE: STEP 2: DC: TIME: DWEL 2.5"**
Description: This command means dwell needed time of the main unit STEP 2 is set to 2.5 sec.

: DWELI?
: SOURce: SAFEty: STEP: DC: TIME: DWELI?
This command queries selected STEP which setting dwell time.
Example : Input command "**SAFE: STEP 2: DC: TIME: DWEL?"**
Return message "**2.500000E+00"**
Description: Return message "**2.500000E+00"** means dwell time of the main unit STEP 2 is 2.5 sec.

: CHANnel

[: HIGH] <channel_list>

: SOURce: SAFEty: STEP: DC: CHANnel: HIGH

This command sets the status of scanning test high voltage output channel.

Example : Input command "**SAFE: STEP 2: DC: CHAN(@(1,3))"**

Description : This command means output channel of scanning test of the main unit STEP 2 is set to channel 1 and 3 HIGH output.

Example : Input command "**SAFE: STEP 2: DC: CHAN(@(0))"**

Description : This command means HIGH output channel of scanning test of the main unit STEP 2 is set to OFF.

[: HIGH]?

: SOURce: SAFEty: STEP: DC: CHANnel: HIGH?

This command queries the status of scanning test high voltage output channel.

Example : Input command "**SAFE:STEP 2:DC:CHAN?"**

Return message "**(@(1,3))"**

Description: Return message "**(@(1,3))"** means output channel status of scanning test of the main unit STEP 2 is channel 1 and 3 HIGH output.

: LOW <channel_list>

: SOURce: SAFEty: STEP: DC: CHANnel: LOW

This command sets output status of scanning common test channel (RTN/LOW).

Example : Input command "**SAFE:STEP 2:DC:CHAN:LOW (@(2,4))"**

Description: This command means output channel of scanning test of the main unit STEP 2 is set to channel 2 and 4 LOW output.

Example : Input command "**SAFE:STEP 2:DC:CHAN:LOW (@(0))"**

Description : This command means LOW output channel of scanning test of the main unit STEP 2 is set to OFF.

: LOW?

: SOURce: SAFEty: STEP: DC: CHANnel: LOW?

This command queries output status of scanning common test channel (RTN/LOW).

Example : Input command "**SAFE: STEP 2: DC: CHAN: LOW?"**

Return message "**(@(2,4))"**

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

: IR

[: LEVel] <numeric_value>

: SOURce: SAFEty: STEP: IR: LEVel

This command sets selected STEP which IR test needed voltage value.

<numeric_value> is 50-1000 (included), the unit is volt.

Example : Input command "**SAFE:STEP 3:IR 1000"**

Description : This command means IR test needed voltage value of the main unit STEP 3 is set to 1000V.

[: LEVel]?
: SOURce: SAFEty: STEP: IR: LEVel?
This command sets selected STEP which IR test needed voltage value.
Return value is 50-1000 (included), the unit is volt.
Example : Input command "**SAFE:STEP 3:IR?"**
Return message "**1.000000E+03"**
Description: Return message "**1.000000E+03"** means IR test needed voltage value of the main unit STEP 3 is 1000V.

: LIMit
: HIGH <numeric_value>
: SOURce: SAFEty: STEP: IR: LIMit: HIGH
This command sets selected STEP which IR high limit.
Example : Input command "**SAFE:STEP 3:IR:LIM:HIGH 50000000000"**
Description : This command means IR high limit of the main unit STEP 3 is set to 50GΩ.

: HIGH?
: SOURce: SAFEty: STEP: IR: LIMit: HIGH?
This command queries selected STEP which IR high limit.
Example : Input command "**SAFE:STEP 3:IR:LIM:HIGH?"**
Return message "**5.000000E+10"**
Description: Return message "**5.000000E+10"** means IR high limit of the main unit STEP 3 is 50GΩ.

[: LOW] <numeric_value>
: SOURce: SAFEty: STEP: IR: LIMit: LOW
This command sets selected STEP which IR low limit.
Example : Input command "**SAFE:STEP 3:IR:LIM:100000"**
Description : This command means IR low limit of the main unit STEP 3 is set to 0.1 MΩ.

[: LOW]?
: SOURce: SAFEty: STEP: IR: LIMit: LOW?
This command queries selected STEP which IR low limit.
Example : Input command "**SAFE:STEP 3:IR:LIM?"**
Return message "**1.000000E+05"**
Description: Return message "**1.000000E+05"** means IR low limit of the main unit STEP 3 is 0.1MΩ.

: TIME
: RAMP <numeric_value>
: SOURce: SAFEty: STEP: IR: TIME: RAMP
This command sets selected STEP which test ramp to setting voltage needed time.
Example : Input command "**SAFE: STEP 3: IR: TIME: RAMP 0.5"**
Description : This command means test ramp to setting voltage needed time of the main unit STEP 3 be set to 0.5 sec.

: RAMP?
: SOURce: SAFEty: STEP: IR: TIME: RAMP?
This command queries selected STEP which test ramp to setting voltage needed time.
Example : Input command "**SAFE: STEP 3: 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 3 is 0.5 sec.

[: TEST] <numeric_value>
: SOURce: SAFEty: STEP: IR: TIME: TEST
This command sets selected STEP which test needed time.
Example : Input command "**SAFE:STEP 3:IR:TIME 1"**
Description: This command means test needed time of the main unit STEP 3 is set to 1.0 sec.

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

: FALL <numeric_value>
: SOURce: SAFEty: STEP: AC: TIME: FALL
This command sets selected STEP which setting voltage value of falling to zero needed time.
Example : Input command "**SAFE: STEP 3: IR: TIME: FALL 0.3"**
Description: This command means setting voltage value of the main unit STEP 3 fall to zero needed time is set to 0.3 sec.

: FALL?
: SOURce: SAFEty: STEP: AC: TIME: FALL?
This command queries selected STEP which setting voltage value of falling to zero needed time.
Example : Input command "**SAFE: STEP 3: IR: TIME: FALL?"**
Return message "**3.000000E-01"**
Description: Return message "**3.000000E-01"** means setting voltage value of the main unit STEP 3 fall to zero needed time is 0.3 sec.

: RANGe
[:UPPer] <numeric_value>
: SOURce: SAFEty: STEP: IR: RANGe: UPPer
This command is in accordance with users' input current value to select the range which upper than the current can be measured.
Example : Input command "**SAFE: STEP 3: IR: RANG 0.0003"**
Description : This command means IR measured current value of the main unit STEP 3 is set to 300uA. Thus, meanwhile the selected IR range upper than the current can be measured is 3mA.

[:UPPer]?
: SOURce: SAFEty: STEP: IR: RANGe: UPPer?
This command queries the range is set.
Example : Input command "**SAFE:STEP 3:IR:RANG?"**
Return message "**3.000000E-03"**
Description: Return message "**3.000000E-03"** means setting range of the main unit STEP 3 is 3mA.

:LOWer <numeric_value>
: SOURce: SAFEty: STEP: IR: RANGe: LOWer
This command is in accordance with users' input current value to select the range lower than the current can be measured.
Example : Input command "**SAFE: STEP 3: IR: RANG: LOW 0.0003"**
Description: This command means IR measured current value of the main unit STEP 3 is set to 300uA. Thus, meanwhile the selected IR range lower than the current can be measured is 300uA.

:LOWer?
: SOURce: SAFEty: STEP: IR: RANGe: LOWer?
This command queries the range is set.
Example : Input command "**SAFE: STEP 3: IR: RANG: LOW?"**
Return message "**3.000000E-04"**
Description: Return message "**3.000000E-04"** means setting range of the main unit STEP 3 is 300uA.

: AUTO <ON/OFF or boolean >
: SOURce: SAFEty: STEP: IR: RANGe: AUTO
This command sets if IR range switch to AUTO.
Parameter ON or 1 indicates AUTO on.
Parameter OFF or 0 indicates AUTO off.
Note: When users don't set AUTO and give OFF parameter, it will remain the previous setting range. When users set AUTO and give OFF parameter then it will set to 10mA range.
Example : Input command "**SAFE: STEP 3: IR: RANG: AUTO ON"**
Description: This command means IR measured current range of the main unit STEP 3 is AUTO.

: AUTO?
: SOURce: SAFEty: STEP: IR: RANGe: AUTO?
This command queries if IR range switch to AUTO.
Return 1 indicates the setting is AUTO status.
Return 0 indicates the setting is AUTO status off.
Example : Input command "**SAFE: STEP 3: IR: RANG: AUTO?"**
Return message "**1"**
Description: Return message "**1"** means setting range of the main unit STEP 3 is AUTO.

: CHANnel
[: HIGH] <channel_list>
: SOURce: SAFEty: STEP: IR: CHANnel: HIGH
This command sets the status of scanning test high voltage output channel.

Example : Input command "**SAFE: STEP 3: IR: CHAN(@(1,3))"**
Description: This command means output channel of scanning test of the main unit STEP 3 is set to channel 1 and 3 HIGH output.

Example : Input command "**SAFE: STEP 3: IR: CHAN(@(0))"**
Description: This command means HIGH output channel of scanning test of the main unit STEP 3 is set to OFF.

[: HIGH]?
: SOURce: SAFEty: STEP: IR: CHANnel: HIGH?
This command queries the status of scanning test high voltage output channel.
Example : Input command "**SAFE:STEP 3:IR:CHAN?"**
Return message "**(@(1,3))"**
Description: Return message "**(@(1,3))"** means output channel status of scanning test of the main unit STEP 3 is channel 1 and 3 HIGH output.

: LOW <channel_list>
: SOURce: SAFEty: STEP: IR: CHANnel: LOW
This command sets output status of scanning common test channel (RTN/LOW).
Example : Input command "**SAFE:STEP 3:IR:CHAN:LOW (@(2,4))"**
Description: This command means output channel of scanning test of the main unit STEP 3 is set to channel 2 and 4 LOW output.

Example : Input command "**SAFE:STEP 3:DC:CHAN:LOW (@(0))"**
Description: This command means LOW output channel of scanning test of the main unit STEP 3 is set to OFF.

: LOW?
: SOURce: SAFEty: STEP: IR: CHANnel: LOW?
This command queries output status of scanning common test channel (RTN/LOW).
Example : Input command "**SAFE: STEP 3: DC: CHAN: LOW?"**
Return message "**(@(2,4))"**
Description: Return message "**(@(2,4))"** means output channel status of scanning test of the main unit STEP 3 is channel 2 and 4 LOW output.

: OSC
: LIMit
: OPEN <numeric_value>
: SOURce: SAFEty: STEP: OSC: LIMit: OPEN
This command sets selected STEP which setting percentage is judged by open circuit as detecting short/open circuit.
Example : Input command "**SAFE: STEP 4: OSC: LIM: OPEN 0.3"**
Description: This command means open circuit judgment percentage of the main unit STEP 4 as detecting short/open circuit is set to 30%.

: OPEN?
: SOURce: SAFEty: STEP: OSC: LIMit: OPEN?
This command queries selected STEP which setting percentage is judged by open circuit as detecting short/open circuit.
Example : Input command "**SAFE: STEP 4: OSC: LIM: OPEN?"**
Return message "**3.000000E-01**"
Description: Return message "**3.000000E-01**" means open circuit judgment percentage of the main unit STEP 4 as detecting short/open circuit is 30%.

:SHORt <numeric_value>
: SOURce: SAFEty: STEP: OSC: LIMit: SHORt
This command sets selected STEP which setting percentage is judged by short circuit as detecting short/open circuit.
Example : Input command "**SAFE: STEP 4: OSC: LIM: SHOR 3"**
Description : This command means short circuit judgment percentage of the main unit STEP 4 as detecting short/open circuit is set to 300%.

SHORt?
: SOURce: SAFEty: STEP: OSC: LIMit: SHORt?
This command queries selected STEP which setting percentage is judged by short circuit as detecting short/open circuit.
Example : Input command "**SAFE: STEP 4: OSC: LIM: SHORt?"**
Return message "3.000000E+00"
Description: Return message "3.000000E+00" means short circuit judgment percentage of the main unit STEP 4 as detecting short/open circuit is 300%.

: CHANnel
[: HIGH] <channel_list>
: SOURce: SAFEty: STEP: OSC: CHANnel: HIGH
This command sets the status of scanning test high voltage output channel.
Example : Input command "**SAFE: STEP 4: OSC: CHAN(@(1,3))"**
Description: This command means output channel of scanning test of the main unit STEP 4 is set to channel 1 and 3 HIGH output.

Example : Input command "**SAFE: STEP 4: OSC: CHAN(@(0))"**
Description: This command means output channel of scanning test of the main unit STEP 4 is set to OFF.

[: HIGH]?
: SOURce: SAFEty: STEP: OSC: CHANnel: HIGH?
This command queries the status of scanning test high voltage output channel.
Example : Input command "**SAFE: STEP 4: OSC: CHAN?"**
Return message "**(@(1,3))"**
Description: Return message "**(@(1,3))"** means output channel status of scanning test of the main unit STEP 4 is channel 1 and 3 HIGH output.

: LOW <channel_list>

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

Example : Input command "**SAFE:STEP 4:DC:CHAN:LOW (@(0))"**
Description: This command means output channel of scanning test of the main unit STEP 4 is set to OFF.

: LOW?
: SOURce: SAFEty: STEP: OSC: CHANnel: LOW?
This command queries the status of scanning common test channel (RTN/LOW) output.
Example : Input command "**SAFE: STEP 4: OSC: CHAN: LOW?"**
Return message "**(@(2,4))"**
Description: Return message "**(@(2,4))"** means output channel status of scanning test of the main unit STEP 4 is channel 2 and 4 LOW output.

: PAuse

: [:MESSage] <string>
: SOURce:SAFEty:STEP:PAuse:MESSage
This command sets the string of message.
Example : Input command "**SAFE: STEP 5: PA: MESS CHROMA"**
Description : This command means message string of the main unit STEP 5 is set to CHROMA.

: [:MESSage] ?
: SOURce:SAFEty:STEP:PAuse:MESSage?
This command 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 the main unit STEP 5 is "CHROMA".

: UTSIgnal < boolean > | ON | OFF >
: SOURce:SAFEty:STEP:PAuse:UTSIgnal
This command 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: This command means the status of UNDER TEST SIGNAL of the main unit STEP 5 is set to ON.

: UTSIgnal?
: SOURce:SAFEty:STEP:PAuse:UTSIgnal?
This command 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 the main unit STEP 5 is ON.

: TIME
[:TEST] <numeric_value>
: SOURce: SAFEty: STEP: PAuse: TIME: TEST
This command sets selected STEP which test needed time.
Example : Input command "**SAFE: STEP 5: PA:TIME 5"**
Description: This command means test needed time of the main unit STEP 5 is set to 5.0 sec.

[:TEST]?
: SOURce:SAFEty:STEP :PA:TIME:TEST?
This command queries selected STEP which test needed time.
Example : Input command "**SAFE: STEP 5: PA:TIME?"**
Return message "**5.000000E+00"**
Description : Return message "**5.000000E+00"** means test needed time of the main unit STEP 5 is 5.0 sec.

: PRESet
: TIME
: PASS <numeric_value>
: SOURce: SAFEty: PRESet: TIME: PASS
This command sets the buzzer sound continuous time when pass.
<numeric_value> is 0.2-99.9(included).
Example : Input command "**SAFE: PRES: TIME: PASS 1"**
Description: This command means buzzer sound continuous time when pass is set to 1 sec.

: PASS?
: SOURce: SAFEty: PRESet: TIME: PASS?
This command queries buzzer sound output continuous time when pass.
Return value is 0.2-99.9(included).
Example : Input command "**SAFE: PRES: TIME: PASS?"**
Return message "**1.000000E+00"**
Description: Return message "**1.000000E+00"** means buzzer sound continuous time when pass is 1 sec.

: STEP <numeric_value>|KEY
: SOURce: SAFEty: PRESet: TIME: STEP
This command sets the interval time between STEP and STEP.
<numeric_value> is a value or character KEY from 0.1 to 99.9 (included).
Example : Input command "**SAFE: PRES: TIME: STEP 0.5"**
Description : This command means the interval time between STEP and STEP is set to 1 sec.

: STEP?
: SOURce: SAFEty: PRESet: TIME: STEP?
This command queries the interval time between STEP and STEP, or the next start command to execute the next STEP.

Return value is 0.1-99.9 (included).
Example : Input command "**SAFE: PRES: TIME: STEP?"**
Return message "**5.000000E-01"**
Description: Return message "**5.000000E-01"** means the interval time between STEP and STEP is 0.5 sec.

: RJUDgment <Boolean> |ON|OFF
: SOURce: SAFEty: PRESet: RJUDgment
This command sets the status of RAMP JUDGMENT.
Parameter is ON or 1 indicates the setting ON.
Parameter is OFF or 0 indicates the setting OFF.
Example : Input command "**SAFE:PRES:RJUD ON"**
Description: This command means the status of RAMP JUDGMENT is set to ON.

: RJUDgment?
: SOURce: SAFEty: PRESet: RJUDgment?
This command queries the status of RJUDGMENT.
Return 1 indicates the setting ON.
Return 0 indicates the setting OFF.
Example : Input command "**SAFE: PRES: RJUD?"**
Return message "**1"**
Description: This command means the queried setting result of RAMP JUDGMENT is ON.

: AC
: FREQuency <numeric_value>
: SOURce: SAFEty: PRESet: AC: FREQuency
This command sets the output voltage frequency when testing AC withstand voltage.
<numeric_value> is the value of 50 or 60.
Example : Input command **"SAFE: PRES: AC: FREQ 60"**
Description: This command means the output voltage frequency when testing AC withstand voltage is set to 60Hz.

: FREQuency?
: SOURce: SAFEty: PRESet: AC: FREQuency?
This command queries the output voltage frequency when testing AC withstand voltage.
Return value is 50 or 60.
Example : Input command "**SAFE: PRES: AC: FREQ?"**
Return message "**6.000000E+01"**
Description: Return message "**6.000000E+01"** means the output voltage frequency when testing AC withstand voltage is 60Hz.

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

[: AUTO]?

: SOURce: SAFEty: PRESet: WRANge: AUTO?
This command queries withstand voltage auto range function is ON or OFF.
Return 1 or 0 (0 means withstand voltage auto range function is OFF, 1 means withstand voltage auto range function is ON).
Example : Input command "**SAFE: PRES: WRNG?"**
Return message "**0"**
Description : Return message "**0"** means withstand voltage auto range function is OFF.

: AGC
[: SOFTware] <boolean>|ON|OFF
: SOURce: SAFEty: PRESet: AGC: SOFTware
This command sets software AGC is ON or OFF.
Example : Input command "**SAFE: PRES: AGC ON"**
Description: This command means software AGC function is set to ON.

[: SOFTware]?
: SOURce: SAFEty: PRESet: AGC: SOFTware?
This command queries software AGC is ON or OFF.
Return 1 or 0 (0 means AGC is OFF, 1 means AGC is ON).
Example : Input command "**SAFE: PRES: AGC?"**
Return message "**1"**
Description: Return message "**1"** means software AGC function is ON.

: GCONtinuity <numeric_value>|ON|OFF
: SOURce: SAFEty: PRESet: GCONtinuity
This command sets GR CONT. parameter of PRESET.
Parameter 0 or OFF indicates OFF, parameter 0.1 or ON indicates KEY and parameter 0.2-99.9 sec indicates start.
Note: "start" is the count down second you need under the stage of detecting DUT connection.
Example : Input command "**SAFE: PRES: GCON ON"**
Description: This command means GR CONT. function is set to ON.

: GCONtinuity?
: SOURce: SAFEty: PRESet: GCONtinuity?
This command queries if grounding resistance test ON or OFF, or enters the status of SMART START.
Return OFF or ON or setting time (OFF indicates grounding resistance don't open, ON indicates grounding resistance open. When the time is responded, it indicates to enter the status of SMART START.
Example : Input command "**SAFE: PRES: GCON?"**
Return message "**1"**
Description : Return message "**1"** means GR CONT. function is ON.

: GFI
[: SWITCH] <Boolean>|ON|OFF
: SOURce: SAFEty: PRESet: GFI: SWITCH
This command sets GFI switch is ON or OFF.
Example : Input command "**SAFE: PRES: GFI OFF"**
Description : This command means GFI function is set to OFF.

[: SWITCH]?

: SOURce: SAFEty: PRESet: GFI: SWITCH?
This command queries GFI switch is ON or OFF.
Return 1 or 0 (0 means GFI is OFF, 1 means GFI is ON).
Example : Input command **"SAFE: PRES: GFI?"**
Return message "**0"**
Description: Return message "**0"** means GFI function is OFF.

: FAIL
:OPERation STOP|CONTinue|RESTart
: SOURce: SAFEty: PRESet: FAIL: OPERation
This command sets AFTER FAIL parameter of PRESET.
Parameter STOP is to stop the test.
Parameter CONTinue is to continue the test.
Parameter RESTart is FAIL occurred then press START to retest.
Example : Input command "**SAFE: PRES: FAIL: OPER CONT"**
Description: This command means the function of AFTER FAIL is set to CONTINUE.

:OPERation?
This command queries the setting status of AFTER FAIL.
Response value is the same as setting value is STOP or CONTINUE or RESTART.
Example : Input command "**SAFE: PRES: FAIL: OPER?"**
Return message "**CONTINUE"**
Description: Return message "**CONTINUE"** means the setting status of AFTER FAIL is CONTINUE.

:SCREen <Boolean>|ON|OFF
: SOURce: SAFEty: PRESet: SCREen
This command sets if display test screen.
Example : Input command **SAFE: PRES: SCRE ON**
Description: This command means if display the function of test screen is set to ON.

:SCREen ?
: SOURce: SAFEty: PRESet: SCREen?
This command queries if display test screen.
Example : Input command "**SAFE: PRES: SCRE?"**
Return message "**1"**
Description: Return message "**1"** means test screen is displayed.

: KEYboard
:SMARt <Boolean>|ON|OFF
: SOURce: SAFEty: PRESet: KEYboard: SMARt
This command sets if SMART KEY is ON or OFF.
Example : Input command "**SAFE: PRES: KEY: SMAR ON"**
Description: This command means the function of SMART KEY is set to ON.

:SMARt?
: SOURce: SAFEty: PRESet: KEYboard: SMARt?
This command queries if SMART KEY is ON or OFF.
Return character 0 or 1 (0 indicates SMART KEY don't open, 1 indicates SMART KEY opened).

Example : Input command "**SAFE: PRES: KEY: SMRT?"**
Return message "**1"**
Description: Return message "**1"** means the setting status of SMART KEY is ON.

: NUMber

: PART

: SOURce: SAFEty: PRESet: NUMber: PART
This command sets part number of the product.
Example: Input command "**SAFE: PRES: NUM: PART 19054"**
Description: This command means part number of the product is set to 19054.

: PART?

SOURce: SAFEty: PRESet: NUMber: PART?
This command queries part number of the product.
Example: Input command "**SAFE: PRES: NUM: PART?"**
Return message "**19054"**
Description: Return message "**19054"** means part number of the product is 19054.

LOT

: SOURce: SAFEty: PRESet: NUMber: LOT
This command sets lot number of the product.
Example: Input command "**SAFE: PRES: NUM: LOT 0054"**
Description: This command means lot number of the product is set to 0054.

LOT?

: SOURce: SAFEty: PRESet: NUMber: LOT?
This command queries lot number of the product.
Example : Input command "**SAFE: PRES: NUM: LOT?"**
Return message "**0054"**
Description: Return message "**0054"** means lot number of the product is 0054.

SERIal

: SOURce: SAFEty: PRESet: NUMber: SERIal
This command sets serial number format of the product, denoted changeable character by *.
Example: Input command "**SAFE: PRES: NUM: SERI AAP190540*****"**
Description: This command means serial number format of the product is set to "AAP190540***".

SERIal?

: SOURce: SAFEty: PRESet: NUMber: SERIal?
This command queries serial number format of the product.
Example: Input command "**SAFE: PRES: NUM: SERI?"**
Return message "**AAP190540*****"**

Description: Return message "**AAP190540*****"** means serial number of the product is AAP190540***.

5.8 Error Messages

- Error messages are saved in error queue which accessed by FIFO method. The return first 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, 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 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
Simple command program header is over 12 characters.

-113 Undefined header
The device is received undefined header.

-114 Header suffix out of range
Variable is out of range.

-120 Numeric data error
Numerical parameter error

-140 Character data error
Inputted character data error

-151 Invalid string data
Invalid string data is usually missing double quotation.

-158 String data not allowed
The device is received disallowed string data.

-170 Expression error
The device is received uncompleted parameter data, such as missing the right parenthesis.

-200 Execution error
Command executing error

-203 Command protected
The device does not receive this command.

-221 Settings conflict
The device does not receive this command.

-222 Data out of range
The data is out of range.

-223 Too much data
Received string length is over, can't execute.

-290 Memory use error
Store or read the memory is error.

-291 Out of memory

The value is out of memory.

-292 Referenced name does not exist
Referenced name does not exist.

-293 Referenced name already exist
Referenced name is already existed.

-350 Queue overflow
The error message, which saved number in queue over 30.

-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 device is received over 1024 characters.

-400 Queue error
The output queue data is over 256 characters.

-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 received the command of reading output queue data.

5.9 GPIB Operation Using Basic

```
REM-----------------------------------------------------------------------
REM       Please run the ULI file before this program.
REM       This program is that input data through GPIB to 1905X.
REM       1905X's    GPIB address is 3
REM-----------------------------------------------------------------------

CLS
PRINT "Program is running"
OPEN "gpib0" FOR OUTPUT AS #1
OPEN "gpib0" FOR INPUT AS #2
PRINT #1, "abort"
PRINT #1, "GPIBEOS IN LF"

PRINT #1, "output 3; SOURce: SAFEty: STOP"
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

PRINT "set steps"

PRINT #1, "output 3; SOURce: SAFEty: STEP 1: DC 1000"
PRINT #1, "output 3; SOURce: SAFEty: STEP 1: DC: LIMit 0.0004"
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 0.0002"
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"

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
```

```
REM-------------------------------------------------------------------------------
REM       Please run the ULI file before this program.
REM       This program is that getting results
REM            through GPIB from the 1905X.
REM        1905X's GPIB address is 3
REM-------------------------------------------------------------------------------
REM CLS
PRINT "Program is running."
OPEN "gpib0" FOR OUTPUT AS #1              'set the talker
OPEN "gpib0" 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"

PRINT #1, "GPIBEOS IN LF"                  ' set the end code
REM PRINT "waiting for SRQ from 1905X"
PRINT #1, "output 3; SOURce: SAFEty: STOP"      ' STOP the instrument

PRINT #1, "output 3; *SRE 2"               'set status enable register
PRINT #1, "output 3; *ESE 60"              'set standard enable register

PRINT #1, "output 3; SOURce: SAFEty: STARt"

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;*STB?"
    PRINT #1, "enter 3"
    INPUT #2, Q$                              'get the questionable state
    PRINT Q$

    RES = CVI (Q$)

                                      IF RES AND 2 = 2 THEN
        PRINT "HAS RESULT!"
    END IF                                    'End of SRQ interrupt

END1:
        PRINT #1, "output 3; SOURce: SAFEty: RESult: LAST: JUDGment?"
        PRINT #1, "enter 3"
        INPUT #2, S$                            ' get the questionable state
        PRINT S$

     PRINT #1, "output 3;*STB?"
     PRINT #1, "enter 3"
     INPUT #2, Q$                               ' get the questionable state
    PRINT Q$

CLOSE :   SYSTEM
```

```
REM ------------------------------------------------------------
        'Please run the ULI file before this program
        '1905X GPIB address is 3
REM ------------------------------------------------------------

OPEN "gpib0" FOR OUTPUT AS #1
                                OPEN "gpib0" FOR INPUT AS #2

PRINT #1, "abort"
PRINT #1, "GPIBEOS IN LF"
PRINT #1, "output 3; SOURce: SAFEty: STOP"
PRINT #1, "output 3; SOURce: SAFEty: STEP1: AC: LEVel 600"
         PRINT #1, "output 3; SOURce: SAFEty: STEP1: AC: LIMit: HIGH 0.0004"

PRINT #1, "output 3; SOURce: SAFEty: STEP2: AC: LEVel 500"
         PRINT #1, "output 3; SOURce: SAFEty: STEP2: AC: LIMit: HIGH 0.0003"

'Work memory were stored in memory AAA.
PRINT #1, "output 3; *SAV 1"
PRINT #1, "output 3; MEMory: STATe: DEFine AAA,1"
'Work memory were stored in memory 1.

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"
PRINT #1, "output 3; MEMory: STATe: DEFine BBB, 3"
'Work memory were stored in memory 3.

'PRINT #1, "output 3; MEMory: STORe: NAME BBB"
'Work memory were stored in memory BBB.

PRINT #1, "output 3; *RCL 1"    'Recall the memory 1
'PRINT #1, "output 3; MEMory: RECAll: NAME AAA"    'Recall the memory AAA

CLOSE:    SYSTEM
```

6. RS232 Interface

6.1 Guide

The user can use computer by RS232 interface to remote control and data transfer.

6.2 Interface Specification

It's a standard RS232 interface, the setting value as the following:
BAUD RATE : 300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200
PARITY : NONE / ODD / EVEN
FLOW CTRL. : NONE / SOFTWARE

6.3 Command Format

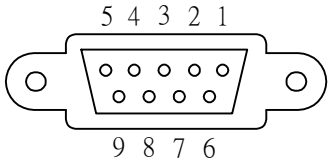
The analyzer RS232 interface function composed command string is inputted by ASCII code to attain functions of remote control and setting. The length of the command string is limited in 1024 characters (include end code) [Command + Parameter] compose a command. Two commands can be connected by semicolon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

End code

LF
CR + LF

6.4 Connector

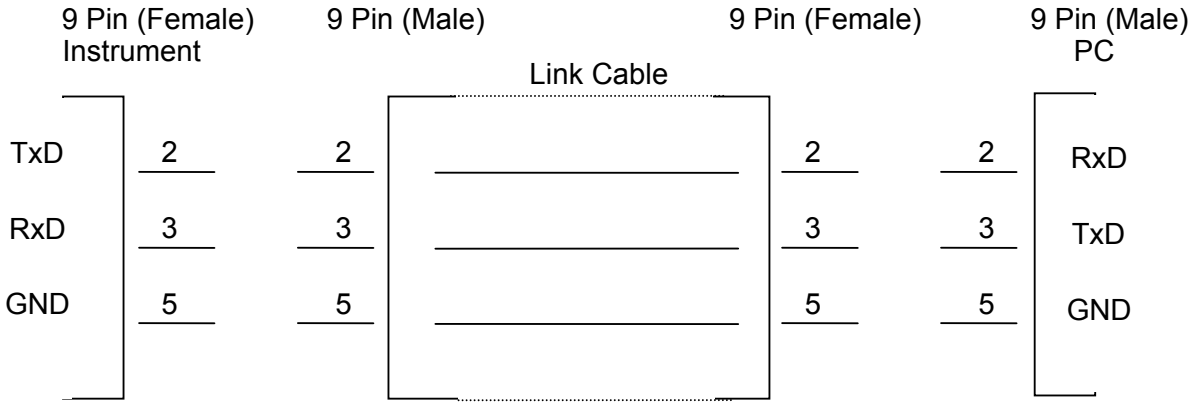
The analyzer RS232 connecter is a 9-pin D-Sub connector.



Pin Number		Description
1	*	Don't use
2	TxD	Send data
3	RxD	Receive data
4	*	Don't use
5	GND	Ground
6	*	Don't use
7	*	Don't use
8	*	Don't use
9	*	Don't use

6.5 Method of Connecting

The connection as the following:



6.6 RS232 Operation Using Basic

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

REM open serial port as device 1
OPEN "COM2: 9600,N, 8,1,RS, CS, DS, CD, LF" FOR RANDOM AS #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
        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 0.0003"
PRINT #1, "SOURce: SAFEty: STEP1: AC: TIME: TEST 3"

PRINT #1, "SOURce: SAFEty: STEP2: DC: LEVel 500"
PRINT #1, "SOURce: SAFEty: STEP2: DC: LIMIT 0.0003"
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

WHILE status$ <> "STOPPED"
      PRINT #1, "SOURce: SAFEty: STATUS?"
      INPUT #1, status$                              'read status

      IF status$ = "STOPPED" THEN                    'if status not=TEST
          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
```

7. Bar Code Scan Test (Option)

7.1 Guide

The user can use bar code scanner by RS232 interface to remote control and automatic test.

7.2 Interface Specification

The standard RS232 interface.

7.3 Method of Connecting

Please see the Description of *RS232 Interface*.

7.4 Method of Using

Set the product serial number under PRESET menu screen.

1. The setting characters of product serial number are 5 ~ 13.
2. The character can be set are 0 ~ 9, A ~ Z, —, *
3. * means changeable character.
4. There is at least a non " * " character in string of product serial number.
5. The setting string number of product serial number is the same as the string number of bar code.

   Ex.1: Bar code string 9789572218488
   Product serial number can be set as: 9**********
   or *******2*****
   or **********8

   Ex. 2: Bar code string C12345
   Product serial number can be set as: C*****
   or *****5

   Ex. 3: Bar code string 12–34–56
   Product serial number can be set as: 1*******
   or **–*****

If the string scanned from bar code is the same as the product serial number, then will start test automatically

8. Printer Function

Preface
The user can connect printer to print test parameter setting value or test result report.

Note: The printer interface card of the tester support the print in text mode only. We suggest you to use LQ or STYUS series of EPSON printers, however the whole series of HP printers support the print in graphic mode only so they can't be used.

How to print test parameter setting value?
1. Under power-on screen, press Function Key F3 **MENU** then move cursor to 8. PRINT PROGRAM.
2. Press Function Key F3 **SELECT** , connect correct printer then will auto print test parameter setting value in memory.

How to print test result report?
After setting printer print parameter, follow normal test procedures to test. When test is completed according to the user setting, connect correct printer to print out test result report.

Enter printer print parameter setting screen.
1. Under power-on screen, press Function Key **MENU** then move cursor to 3. OPTION.
2. Press Function Key **SELECT** , then move cursor to 3. PRINT.
3. Press Function Key F3 **SELECT** , then start to set print parameter.

How to set printer print parameter?
1. By using Function Keys **UP**, **DOWN** to set every parameter data.
2. By using Function Key **ENTER** to move cursor.
3. By using Function Key **EXIT** to exit this screen.

Print parameter description
A. AUTO PRINT -- includes the following two parameters for setting print test result report timing.
   1. PASS : OFF -- When setting is ON, test result is PASS will print test result report.
   2. FAIL : OFF- - When setting is ON, test result is FAIL will print test result report.
   3. F .FEED : OFF -- When setting is ON, end the print and printing paper will skip another page.

B. PRINT DATA - - Includes the following five parameters for setting print test result report included data.
   1. PART NO. : OFF- - When setting is ON, test result report will print PART NUMBER.
   2. LOT NO. : OFF- - When setting is ON, test result report will print LOT NUMBER.
   3. SERIAL NO. : OFF- - When setting is ON, test result report will print SERIAL NUMBER.
   4. TEST DATA : OFF- - When setting is ON, test result report will print test voltage, current / resistance value.
   5. RESULT : OFF- - When setting is ON, test result report will print test result is PASS or FAIL.

9. Calibration Procedure

Before process this section the HI-POT tester be warm up at least 30 minutes. Take off the calibration front panel. Press the lock switch, this is a hardware data backup protection circuit, to avoid calibration data loss.

The following items are need to calibration.

Voltage Calibration (See 9.2)

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

Current Calibration (See 9.3)

ACA 3mA Offset (0.12mA)	; AC total current 2.99mA range OFFSET point
ACA 3mA Full (2.5mA)	; AC total current 2.99mA range FULL point
ACA30mA Offset (2.5mA)	; AC total current 30mA range OFFSET point
ACA 30mA Full (25mA)	; AC total current 30mA range FULL point
RACA 3mA Offset (0.12mA)	; AC real current 2.99mA range OFFSET point
RACA 3mA Full (2.5mA)	; AC real current 2.99mA range FULL point
RACA 30mA Offset (2.5mA)	; AC real current 30mA range OFFSET point
RACA 30mA Full (25mA)	; AC real current 30mA 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 10mA Offset (2.5mA)	; DC 10mA range OFFSET point
DCA 10mA Full (8mA)	; DC 10mA range FULL point

Withstanding Voltage Mode ARCing Calibration (See 9.4)

AC ARC 15mA (5mA)	; AC ARCing calibration
DC ARC 10mA (5mA)	; DC ARCing calibration

Insulation Resistance Mode Leakage Current Meter Calibration (See 9.5)

IRR Range1 (1GΩ)	; IR Resistor range 1 Calibration
IRR Range2 (100MΩ)	; IR Resistor range 2 Calibration
IRR Range3 (10MΩ)	; IR Resistor range 3 Calibration
IRR Range4 (10MΩ)	; IR Resistor range 4 Calibration

Ground Continue Calibration (See 9.6)

Contrast Calibration (See 9.7)

9.1 Calibration

press [MENU] [DOWN] [DOWN] [DOWN]
display CALIBRATION
press [ENTER]
display password
press [A] [A] [A] [B] [ENTER]

9.2 Voltage Calibration

9.2.1 ACV Calibration

Connect an ACV HI voltage meter to HI-POT tester.

press [UP] or [DOWN] key times to display
display ACV 5kv Offset (100V) ; ACV Voltage Offset calibration
press [STOP] [START] ; read out HV meter value
; example 0. 105kV
press [UP] or [DOWN] key until display 0. 105 kV
press [ENTER] for saving calibration value.
press [STOP] ; stop ACV voltage offset calibration
press [UP] key
display ACV 5kV Full (4kV) ; ACV Voltage full scale calibration
press [STOP] [START] ; read out the HV meter value
; example 4.152kV
press [UP] or [DOWN] key until display 4.152 kV
press [ENTER] for saving calibration value.
press [STOP] ; stop ACV voltage full scale calibration

9.2.2 DCV Calibration

Connect a DCV HI voltage meter to HI-POT tester.

press [UP] key
display DCV 6kV Offset (100V) ; DCV voltage Offset calibration
press [STOP] [START] ; read out HV meter value
; example 0.105kV
press [UP] or [DOWN] key until display 0. 105 kV
press [ENTER] for saving calibration value.
press [STOP] ; stop DCV voltage offset calibration
press [UP] key
display DCV 6kV Full (4kV) ; DCV Voltage full scale calibration
press [STOP] [START] ; read out HV meter value
; example 4.152kV
press [UP] or [DOWN] key until display 4.152 kV
press [ENTER] for saving calibration value.
press [STOP] ; stop DCV voltage full scale calibration

9.2.3 IR Voltage Calibration

Connect a DCV HI voltage meter to HI-POT tester.

press	[UP] key	
display	IRV 1kV Offset (100V)	; IR voltage Offset calibration
press	[STOP] [START]	; read out HV meter value ; example 0. 105kV
press	[UP] or [DOWN] key until display 0. 105 kV	
press	[ENTER] for saving calibration value.	
press	[STOP]	; stop IR voltage Offset calibration
press	[UP] key to display	
display	IRV 1kV Full (1kV)	; IR voltage full scale calibration
press	[STOP] [START]	; read out HV meter value ; example 1.052kV
press	[UP] or [DOWN] key until display 1.052 kV	
press	[ENTER] for saving calibration value.	
press	[STOP]	; stop IR voltage full scale calibration

9.3 Current Calibration

Caution! The dummy load must be between HI terminal and ammeter input terminal. Or, dangerous may be happened.

9.3.1 AC Current Calibration

Connect a dummy load resistor 10MΩ between HI-POT testers. Connect HI terminal to AC ammeter input HI terminal, connect LO terminal of HI-POT tester to input LO terminal of AC ammeter.

press	[UP] key	
display	ACA 3mA offset (0.12mA)	; ACA 2.99mA range Offset calibration
press	[STOP] [START]	; read out the ammeter value ; example 0.124mA
press	[UP] or [DOWN] key until display 0. 124mA	
press	[ENTER] for saving calibration value.	
press	[STOP]	; stop ACA 2.999mA range Offset calibration

Change the dummy load resistor to 500kohm 50watt or higher.

press	[UP]	
display	ACA 3mA Full (2.5mA)	; ACA 2.999mA range full scale calibration
press	[STOP] [START]	; read out the ammeter value ; example 2.503mA]
press	[UP] or [DOWN] key until display 2.503mA	
press	[ENTER] for saving calibration value.	
press	[STOP]	; stop ACA 2.99mA range full scale calibration

press [UP]
display ACA 30mA offset (2.5mA) ; ACA 30.00mA range Offset calibration
press [STOP] [START] ; read out the ammeter value ; example 2.503mA
press [UP] or [DOWN] key until display 2.503mA
press [ENTER] for saving calibration value.
press [STOP] ; stop ACA 30.00mA range Offset calibration

Change the dummy load resistor to 50kΩ 200watt or higher.
press [UP]
display ACA 30mA full (25mA) ; ACA 30.00mA range full scale calibration
press [STOP] [START] ; read out the ammeter value ; example 24.50mA
press [UP] or [DOWN] key until display 24.50mA
press [ENTER] ; stop ACA 30.00mA range full scale calibration

9.3.2 AC Real Current Calibration

Connect a dummy load resistor 10MΩ between HI-POT testers. Connect HI terminal of HI-POT tester to input HI terminal of AC ammeter, connect LO terminal of HI-POT tester to input LO terminal of AC ammeter.

press [UP] key
display RACA 3mA offset (0.12mA) ; RACA 2.999mA range Offset calibration
press [STOP] [START] ; read out the ammeter value ; example 0.124mA
press [UP] or [DOWN] key until display 0. 124mA
press [ENTER] for saving calibration value.
press [STOP] ; stop RACA 2.999mA range Offset calibration

Change the dummy load resistor to 500kΩ 50watt or higher.
press [UP] to display
display RACA 3mA Full (2.5mA) ; RACA 2.999mA range full scale calibration
press [STOP] [START] ; read out the ammeter value ; example 2.503mA
press [UP] or [DOWN] key until display 2.503mA
press [ENTER] for saving calibration value.
press [STOP] ; stop RACA 2.999mA range full scale calibration

press [UP]
display RACA 30mA offset (2.5mA) ; RACA 30mA range Offset calibration
press [STOP] [START] ; read out the ammeter value ; example 2.503mA
press [UP] or [DOWN] key until display 2.503mA
press [ENTER] for saving calibration value.

press [STOP] ; stop RACA 30.00mA range Offset calibration

Change the dummy load resistor to 50kΩ 200watt or higher.
press [UP]
display RACA 30mA full 2.50mA (25mA) ; RACA 30mA range full scale.
press [STOP] [START] ; read our the ammeter value
; example 24.50mA
press [UP] or [DOWN] key until display 24.50mA
press [STOP] ; stop RACA 30mA range full scale
; calibration

9.3.3 DC Current Calibration

Connect a dummy load resistor 10MΩ between HI-POT testers. Connect HI terminal of HI-POT tester to input HI terminal of DC ammeter, connect LO terminal of HI-POT tester to input LO terminal of DC ammeter.

press [UP] key
display DCA 3mA offset (0.12mA) ; DCA 2.999mA range Offset calibration
press [STOP] [START] ; read out the ammeter value
; example 0.124mA
press [UP] or [DOWN] key until display 0.124mA
press [ENTER] for saving calibration value.
press [STOP] ; stop DCA 2.999mA range Offset calibration

Change the dummy load resistor to 500kΩ 50watt or higher.
press [UP] key
display DCA 3mA Full (2.5mA) ; DCA 2.999mA range full scale calibration.
press [STOP] [START] ; read out the ammeter value
; example 2.503mA
press [UP] or [DOWN] key until display 2.503mA
press [ENTER] for saving calibration value.
press [STOP] ; stop DCA 2.999mA range full scale calibration.
press [UP] key
display DCA 10mA offset (2.5mA) ; DCA 10.00mA range Offset calibration.
press [STOP] [START] ; read out the ammeter value
; example 2.503mA
press [UP] or [DOWN] key until display 2.503mA
press [ENTER] for saving calibration value.
press [STOP] ; stop DCA 10.00mA range Offset calibration.

Change the dummy load resistor to150kΩ 100watt or higher.
press [UP] key to display
display DCA 10mA full (8mA) ; DCA 10.00mA range full scale calibration.

press	[STOP] [START]	; read out the ammeter value ; example 8.02mA
press	[UP] or [DOWN] key until display 8.02mA	
press	[ENTER] for saving calibration value.	
press	[STOP]	; stop DCA 10.00mA range full scale calibration.

9.4 Withstanding Voltage Mode ARCing Calibration

CAUTION

1. ARCing calibration is very special, the high voltage terminal are on outside.
2. Please contact your local agent for more detailed descriptions.

press	[UP] key	; AC arcing sensitivity calibration.
display	AC ARC 15mA (5mA)	; AC hipot ARCing.
press	[STOP] [START]	; Using two HV cables, HV output terminal series 250kΩ 5watt resistance. Another HV cable (ground wire RTN/LOW) is as possible as close to the first one cable but do not contact each other. Then press [STOP] [START] to generate ARCing.
press	[UP] or [DOWN] key until ARC NG high limit value is a critical point of generating ARC NG and non-generating ARC NG.	
press	[STOP]	; stop AC ARCing calibration.

press	[UP] key	; DC ARCing sensitivity calibration
display	DC ARC 10mA (5mA)	; DC hipot ARCing.
press	[STOP] [START]	; Using two HV cables, HV output terminal series 250kΩ 5watt resistance. Another HV cable (ground wire RTN/LOW) is as possible as close to the first one cable but do not contact each other. Then press [STOP] [START] to generate ARCing.
press	[UP] or [DOWN] key until ARC FAIL high limit value is a critical point of generating ARC FAIL and non-generating ARC NG.	
press	[STOP]	; stop DC ARCing calibration.

9.5 Insulation Resistance Mode Resistor Calibration

Connecting a standard dummy load resistor between the high voltage output terminal and low potential terminal of the Hi-Pot tester.

IRR Range1 (1GΩ) ; resistor of IR to 1GΩ

IRR Range2 (100MΩ) ; resistor of IR to 100.0Ω
IRR Range3 (10MΩ) ; resistor of IR to 10.0MΩ
IRR Range4 (10MΩ) ; resistor of IR to 10.0MΩ

Change the dummy load resistor to 1GΩ.
press [UP] key
display IRR Range1 (1GΩ) ; resistor of IR to 1GΩ
press [STOP] [START] ; read the IRR value
; example 1GΩ
press [UP] or [DOWN] key until display 1000MΩ
press [STOP] ; stop IRR Range1 calibration.

Change the dummy load resistor to 100MΩ.
press [UP] key
display IRR Range2 (100MΩ) ; resistor of IR to 100MΩ
press [STOP] [START] ; read the IRR value
; example 100.0MΩ
press [UP] or [DOWN] key until display 100.0MΩ
press [ENTER] for saving calibration value.
press [STOP] ; stop IRR Range2 calibration.

Change the dummy load resistor to 10MΩ.
press [UP] key
display IRR Range3 (10MΩ) ; resistor of IR to 10MΩ
press [STOP] [START] ; read the IRR value
; example 10MΩ
press [UP] or [DOWN] key until display 10.00MΩ
press [STOP] ; stop IRR Range3 calibration.

Change the dummy load resistor to 10MΩ.
press [UP] key
display IRR Range4 (10MΩ) ; resistor of IR to 10MΩ
press [STOP] [START] ; read the IRR value
press [UP] or [DOWN] key until display 10.00MΩ
press [ENTER] for saving calibration value.
press [STOP] ; stop IRR Range4 calibration.

9.6 Ground Continue Calibration

1. Press [UP] key.
2. Connect resistance (0.8 ohm) to CONT. CHECK OPTION of rear panel and grounding terminal. Press [STOP] [START] to adjust 1 ohm in rear panel, calibrate VR to critical point of PASS and FAIL.
3. Press [STOP] twice.

9.7 Contrast Calibration

1. Press [UP] key.
2. Press [SETUP] key.

3. Press [UP] or [DOWN] until LCD contrast brightness is appropriate.

9.8 Finish Calibration

press	[EXIT] [DOWN] [DOWN] [DOWN] [ENTER]
display	PASSWORD:
press	[A] [A] [A] [A] [ENTER]
display	CALIBRATION IS OFF or CALIBRATION IS ON; choose CALIBRATION IS ON, if shows CALIBRATION IS OFF.
press	[A] [A] [A] [A] [ENTER]
display	CALIBRATION IS ON
press	[EXIT] to complete calibration steps.

9.9 Remote Calibration Command

9.9.1 Command List

```
CALibration
        :STATe <Boolean>
        :REQuest?
        :VALue <Numeric Value>
        :SAFEty
                :STARt
                :STOP
                :AC
                        :VRANge? MAXimum|MINimum
                        :VOLTage ( range)
                                :OFFSet
                                        [:SOURce]
                                                [:VOLTage]   [<Numeric Value>]
                                                [:VOLTage] ?
                                        :BEST?
                                :FULL
                                        [:SOURce]
                                                [:VOLTage]   [<Numeric Value>]
                                                [:VOLTage] ?
                                        :BEST?
                        :CRANge? MAXimum|MINimum
                        :CURRent ( range)
                                :OFFSet
                                        [:SOURce]
                                                [:VOLTage]   [<Numeric Value>]
                                                [:VOLTage] ?
                                        :BEST?
                                :FULL
                                        [:SOURce]
                                                [:VOLTage]   [<Numeric Value>]
                                                [:VOLTage] ?
                                        :BEST?
                        :RCRANge? MAXimum|MINimum
                        :RCURrent ( range)
                                :OFFSet
                                        [:SOURce]
                                                [:VOLTage]   [<Numeric Value>]
                                                [:VOLTage] ?
                                        :BEST?
                                :FULL
                                        [:SOURce]
```

```
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
        :ARANge? MAXimum|MINimum
        :ARC ( range)
            :SLOPe
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :LEVel [<Numeric Value>]
                :LEVel?
                :BEST?
:DC
        :VRANge? MAXimum|MINimum
        :VOLTage ( range)
            :OFFSet
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
            :FULL
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
        :CRANge? MAXimum|MINimum
        :CURRent ( range)
            :OFFSet
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
            :FULL
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
        :ARANge? MAXimum|MINimum
        :ARC ( range)
            :SLOPe
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :LEVel [<Numeric Value>]
                :LEVel?
                :BEST?
:IR
        :VRANge? MAXimum|MINimum
        :VOLTage ( range)
            :OFFSet
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
            :FULL
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
        :RRANge? MAXimum|MINimum
        :RESistance ( range)
            :SLOPe
                [:SOURce]
                    [:VOLTage]   [<Numeric Value>]
                    [:VOLTage] ?
                :BEST?
```

9.9.2 Commands Summary

- **:CALibration:STATe <Boolean>**

The command is used to select if the calibration data applying (1) or (0).

At *RST, the state is set to ON.

- **:CALibration:REQuest?**

The event attempts to attain the calibrating this device and returns 1 if succeed and 0 if it fails.

- **:CALibration:VALue <Numeric_Value>**

Enters the value of calibration. If the state is not calibration or output on, an error –203 will be generated in addition to the execution error.

- **:CALibration:SAFEty:STARt**

Start output the source, and can enter the value of calibration. When the state is not calibration, an error –203 will be generated as executing this command.

- **:CALibration:SAFEty:STOP**

Stop output the source.

- **:CALibration:SAFEty:AC:VRANge? {MAXimum, MINimum }**

Query the maximum and minimum of the range of the voltage source and meter of the AC mode.

- **:CALibration:SAFEty:AC:VOLTage (range):OFFSet[:SOURce] [:VOLTage] [<Numeric Value>]**

Changing to the offset item of the voltage source and voltage meter of AC mode, and set the output voltage value that is used in the calibration.

- **:CALibration:SAFEty:AC:VOLTage (range):OFFSet[:SOURce] [:VOLTage] ?**

Change to the offset item of the voltage source and voltage meter of AC mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:AC:VOLTage (range):OFFSet:BEST?**

Change to the offset item of voltage source and voltage meter of AC mode, and returns the best value that is selected by device.

- **:CALibration:SAFEty:AC:VOLTage (range):FULL[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the offset item of voltage source and voltage meter of AC mode, and set the output voltage value that is used in the calibration.

- **:CALibration:SAFEty:AC:VOLTage (range):FULL[:SOURce] [:VOLTage] ?**

Change to the offset item of voltage source and voltage meter of AC mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:AC:VOLTage (range):FULL:BEST?**

Change to the offset item of voltage source and voltage meter of AC mode, and returns the best value that is selected by device.

- **:CALibration:SAFEty:AC:CRANge? { MAXimum, MINimum }**

Query the maximum and minimum of the range of the current meter of the AC mode.

■ **:CALibration:SAFEty:AC:CURRent (range):OFFSet[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the offset item of current meter of AC mode, and set the output voltage value that is used in the calibration. The header suffix (range) is selected the range of current.

■ **:CALibration:SAFEty:AC:CURRent (range):OFFSet[:SOURce] [:VOLTage] ?**

Change to the offset item of current meter of AC mode, and returns the output voltage value which is used in the calibration.

■ **:CALibration:SAFEty:AC:CURRent (range):OFFSet:BEST?**

Change to the offset item of current meter of AC mode, and returns the best value that is selected by device.

■ **:CALibration:SAFEty:AC:CURRent (range):FULL[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the full item of current meter of AC mode, and set the output voltage value that is used in the calibration.

■ **:CALibration:SAFEty:AC:CURRent (range):FULL[:SOURce] [:VOLTage] ?**

Change to the full item of current meter of AC mode, and returns the output voltage value which is used in the calibration.

■ **:CALibration:SAFEty:AC:CURRent (range):FULL:BEST?**

Change to the full item of current meter of AC mode, and returns the best value that is selected by device.

■ **:CALibration:SAFEty:AC:RCRAnge? { MAXimum, MINimum }**

Query the maximum and minimum of the range of the real current meter of the AC mode.

■ **:CALibration:SAFEty:AC:RCURrent (range):OFFSet[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the offset item of the real current meter of AC mode, and set the output voltage value that is used in the calibration. The header suffix (range) is selected the range of current

■ **:CALibration:SAFEty:AC:RCURrent (range):OFFSet[:SOURce] [:VOLTage] ?**

Change to the offset item of the real current meter of AC mode, and returns the output voltage value which is used in the calibration.

■ **:CALibration:SAFEty:AC:RCURrent (range):OFFSet:BEST?**

Change to the offset item of real current meter of AC mode, and returns the best value that is selected by device.

■ **:CALibration:SAFEty:AC:RCURrent (range):FULL[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the full item of the real current meter of AC mode, and set the output voltage value that is used in the calibration.

■ **:CALibration:SAFEty:AC:RCURrent (range):FULL[:SOURce] [:VOLTage] ?**

Change to the full item of the real current meter of AC mode, and returns the output voltage value which is used in the calibration.

■ **:CALibration:SAFEty:AC:RCURrent (range):FULL:BEST?**
Change to the full item of real current meter of AC mode, and returns the best value that is selected by device.

■ **:CALibration:SAFEty:AC:ARANge? {MAXimum, MINimum }**
Query the maximum and minimum of the range of the arc meter of the AC mode.

■ **:CALibration:SAFEty:AC:ARC (range):SLOPe[:SOURce] [:VOLTage] [<Numeric Value>]**
Change to the arc item of AC mode, and set the output voltage value that is used in the calibration.

■ **:CALibration:SAFEty:AC:ARC (range):SLOPe[:SOURce] [:VOLTage] ?**
Change to the arc item of AC mode, and returns the output voltage value which is used in the calibration.

■ **:CALibration:SAFEty:AC:ARC (range):SLOPe:LEVel [<Numeric Value>]**
Change to the arc item of AC mode, and set the arc limit value.

■ **:CALibration:SAFEty:AC:ARC (range):SLOPe:LEVel?**
Change to the arc item of AC mode, and returns the arc limit value.

■ **:CALibration:SAFEty:AC:ARC (range):SLOPe:BEST?**
Change to the arc item of AC mode, and returns the best arc limit value that is selected by device.

■ **:CALibration:SAFEty:DC:VRANge? {MAXimum, MINimum}**
Query the maximum and minimum of the range of the voltage source and meter of the DC mode.

■ **:CALibration:SAFEty:DC:VOLTage (range):OFFSet[:SOURce] [:VOLTage] [<Numeric Value>]**
Change to the offset item of the voltage source and voltage meter of DC mode, and set the output voltage value that is used in the calibration.

■ **:CALibration:SAFEty:DC:VOLTage (range):OFFSet[:SOURce] [:VOLTage] ?**
Change to the offset item of the voltage source and voltage meter of DC mode, and returns the output voltage value which is used in the calibration.

■ **:CALibration:SAFEty:DC:VOLTage (range):OFFSet:BEST?**
Change to the offset item of voltage source and voltage meter of DC mode, and returns the best value that is selected by device.

■ **:CALibration:SAFEty:DC:VOLTage (range):FULL[:SOURce] [:VOLTage] [<Numeric Value>]**
Change to the offset item of voltage source and voltage meter of DC mode, and set the output voltage value that is used in the calibration.

■ **:CALibration:SAFEty:DC:VOLTage (range):FULL[:SOURce] [:VOLTage] ?**
Change to the offset item of voltage source and voltage meter of DC mode, and returns the output voltage value which is used in the calibration.

■ **:CALibration:SAFEty:DC:VOLTage (range):FULL:BEST?**
Change to the offset item of voltage source and voltage meter of DC mode, and returns the

best value that is selected by device.

- **:CALibration:SAFEty:DC:CRANge? { MAXimum, MINimum }**

Query the maximum and minimum of the range of the current meter of the DC mode.

- **:CALibration:SAFEty:DC:CURRent (range):OFFSet[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the offset item of current meter of DC mode, and set the output voltage value that is used in the calibration. The header suffix (range) is selected the range of current

- **:CALibration:SAFEty:DC:CURRent (range):OFFSet[:SOURce] [:VOLTage] ?**

Change to the offset item of current meter of DC mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:DC:CURRent (range):OFFSet:BEST?**

Change to the offset item of current meter of DC mode, and returns the best value that is selected by device.

- **:CALibration:SAFEty:DC:CURRent (range):FULL[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the full item of current meter of DC mode, and set the output voltage value that is used in the calibration.

- **:CALibration:SAFEty:DC:CURRent (range):FULL[:SOURce] [:VOLTage] ?**

Change to the full item of current meter of DC mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:DC:CURRent (range):FULL:BEST?**

Change to the full item of current meter of DC mode, and returns the best value that is selected by device.

- **:CALibration:SAFEty:DC:ARANge? {MAXimum, MINimum }**

Query the maximum and minimum of the range of the arc meter of the DC mode.

- **:CALibration:SAFEty:DC:ARC (range):SLOPe[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the arc item of DC mode, and set the output voltage value that is used in the calibration.

- **:CALibration:SAFEty:DC:ARC (range):SLOPe[:SOURce] [:VOLTage] ?**

Change to the arc item of DC mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:DC:ARC (range):SLOPe:LEVel [<Numeric Value>]**

Change to the arc item of DC mode, and set the arc limit value.

- **:CALibration:SAFEty:DC:ARC (range):SLOPe:LEVel?**

Change to the arc item of DC mode, and returns the arc limit value.

- **:CALibration:SAFEty:DC:ARC (range):SLOPe:BEST?**

Changing to the arc item of DC mode, and returns the best arc limit value that is selected by device.

- **:CALibration:SAFEty:IR:VRANge? {MAXimum, MINimum }**

Query the maximum and minimum of the range of the voltage source and meter of the IR

mode.

- **:CALibration:SAFEty:IR:VOLTage (range):OFFSet[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the offset item of the voltage source and voltage meter of IR mode, and set the output voltage value that is used in the calibration.

- **:CALibration:SAFEty:IR:VOLTage (range):OFFSet[:SOURce] [:VOLTage] ?**

Change to the offset item of the voltage source and voltage meter of IR mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:IR:VOLTage (range):OFFSet:BEST?**

Change to the offset item of voltage source and voltage meter of IR mode, and returns the best value that is selected by device.

- **:CALibration:SAFEty:IR:VOLTage (range):FULL[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the full item of voltage source and voltage meter of IR mode, and set the output voltage value that is used in the calibration.

- **:CALibration:SAFEty:IR:VOLTage (range):FULL[:SOURce] [:VOLTage] ?**

Change to the full item of voltage source and voltage meter of IR mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:IR:VOLTage (range):FULL:BEST?**

Change to the full item of voltage source and voltage meter of IR mode, and returns the best value that is selected by device.

- **:CALibration:SAFEty:IR:RRANge? { MAXimum, MINimum }**

Query the maximum and minimum of the range of the resistance meter of the IR mode.

- **:CALibration:SAFEty:IR:RESistance (range):SLOPe[:SOURce] [:VOLTage] [<Numeric Value>]**

Change to the resistance item of IR mode, and set the output voltage value that is used in the calibration.

- **:CALibration:SAFEty:IR:RESistance (range):SLOPe[:SOURce] [:VOLTage] ?**

Change to the resistance item of IR mode, and returns the output voltage value which is used in the calibration.

- **:CALibration:SAFEty:IR:RESistance (range):SLOPe:BEST?**

Change to the resistance item of IR mode, and returns the best value that is selected by device.

10. Maintenance

10.1 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.

10.2 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.
No. 66 Hwa-Ya 1st Rd., Hwa-Ya Technical Park,
Kuei-Shan 33383, Taoyuan County, Taiwan
Attention: Service Department

Headquarters 總公司

CHROMA ATE INC. 致茂電子股份有限公司

66, Hwa-ya 1st Rd., Hwaya Technology Park,

Kuei-shan 33383, Taoyuan, Taiwan

台灣桃園縣33383龜山鄉華亞科技園區華亞一路 66 號

TEL: + 886 - 3 - 327 - 9999

FAX: + 886 - 3 - 327 - 8898

e-mail: chroma@chroma.com.tw

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