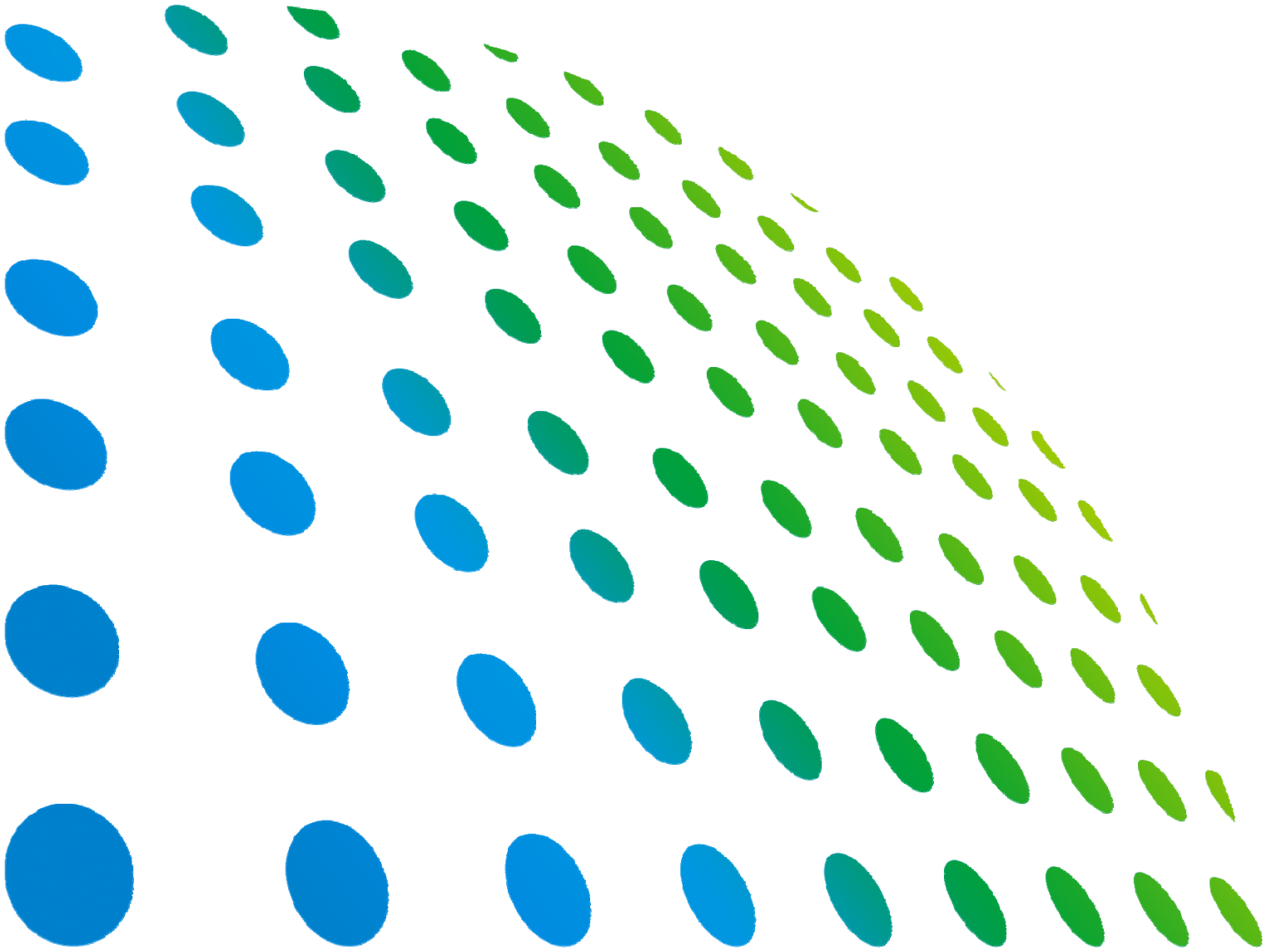
Chroma

Multi-Channel Sync Hipot Tester

19020/19020-4/19021/19022/19022-4

User's Manual



Multi-Channel Sync Hipot Tester
19020/19020-4/19021/19022/19022-4
User's Manual

Version 1.9
October 2014

Legal Notices

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CHROMA ATE INC.
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Warranty

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Material Contents Declaration

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


: See **<Table 1>**.

: See **<Table 2>**.

<Table 1>

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

“O” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

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

Disposal

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

<Table 2>

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

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

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

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

Disposal

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

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Declaration of Conformity

For the following equipment :

Multi-Channel Hipot Tester

(Product Name/ Trade Name)

19020, 19021, 19022, 19020-4, 19022-4

(Model Designation)

CHROMA ATE INC.

(Manufacturer Name)

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

(Manufacturer Address)

Is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility (2004/108/EC) and Low Voltage Directive (2006/95/EC). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1:2006

EN 55011:1998/A1:1999/A2:2002 Class A, EN 61000-3-2:2006,

EN61000-3-3:1995/A1:2001/A2:2005, IEC 61000-4-2:1995/A1:1998/A2:2000,

IEC 61000-4-3:2002, IEC 61000-4-4:2004, IEC 61000-4-5:1995/A1:2000,

IEC 61000-4-6:2003, IEC 61000-4-8:1993/A1:2000, IEC 61000-4-11:2004

EN 61010-1:2010 and EN 61010-2-030:2010

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

CHROMA ATE INC.

(Company Name)

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

(Company Address)

Person responsible for this declaration:

Mr. Benjamin Huang

(Name, Surname)

T&M BU Vice President

(Position/Title)

Taiwan	**2012.11.26**	Benjamin Huang
(Place)	(Date)	(Legal Signature)

Unpacking for Check & Inspection

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

Standard Package

Item Name	Qty	Description
US Power Cord	1	USA standard 180 degree straight head power cord with the length 1.8 meter, 15A
15A Fuse	2	15A SLOW
CANBUS Cable	1	PHONE CABLE 6P6C to connect multiple devices, length 1 meter
D-SUB Cable	1	D-SUB-25P-MALE*2 to connection multiple devices, length 1 meter
High Voltage Cable	**Note 2**	Single head high voltage terminal + 20kV high voltage cable, length 3.1 meters
RTN/LOW Cable	**Note 2**	Single head BNC(MALE)+RG-174, length 3 meters
Quick Start Guide	2	One English version and one Traditional Chinese version.
User's Manual CD	1	CD for user's manuals in English and Traditional Chinese

Note

1. When additional item is required, just inform Chroma the item name.
2. The cable quantity is varied with the output channel configured, for instance, the cable quantity for 10CH model is 10 sets and for 4CH mode is 4 sets.

Hazard Operation Methods

1. Do not touch the testing area when this Hipot Tester is outputting voltage or you may get electric shock and it may cause death.

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

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

CAUTION Please see *Chapter 3 Precaution before Use* in this manual for detail descriptions of usage notices and operation hazards.

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

Storage, Freight, Maintenance & Cleaning

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

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

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

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

Regular check and calibration is required to ensure the device meets the product specification. The suggested calibration period every 12 months.

Cleaning
Remove all connected wires and cables on the instrument before cleaning. Use a brush 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
Nov. 2008	1.0	Complete this manual.
June 2009	1.1	Add "*ACA MEAS.*" in the section of "*Setting SYSTEM CONFIG*" under the chapter of "*Operation*." Update the commands in the chapter of "*GPIB/RS232 Interface (IEEE-488.2)*."
Nov. 2009	1.2	Update the values in "*Specification*" chapter and the figures of "*Example of Using Internal Power Supply*" as well as of "*Example of Using External Power Supply*" in "*Example of External Control Circuit*" section.
June 2010	1.3	Add two new items in the chapter of "*Precaution before Use*".
Dec. 2010	1.4	Update "*Material Contents Declaration*."
May 2011	1.5	Add descriptions of 19020-4 & 19022-4 two new models.
Sep. 2011	1.6	Update "*Standard Package*" and its Note in "*Unpacking for Check & Inspection*".
Dec. 2012	1.7	Add "*CE Declaration of Comformity*". Update "*Pin Assignment*" in the chapter of "*HANDLER Interface*".
Aug. 2013	1.8	Update the following: – "*Setting TEST CONTROL*", "*Setting SYSTEM CONFIG*" and "*Selecting Test Mode*" sections in the chapter of "Operation" – "*Commands Summary*" and "*Command Description*" in the chapter of "*GPIB/RS232 Interface*"
Oct. 2014	1.9	Add PSC Mode to DC, IR and OSC tests procedures and commands.

Table of Contents

1. Preface

1.1 Product Overview

The 19020/19021/19022 Multi-Channel Sync Hipot Testers are high quality devices specially designed to test the hipot leakage current and insulation resistance automatically for electrical and electronic equipment.

For withstand voltage test, the output power of each channel for 19020/19020-4 is AC: 50VA(5kV, 10mA) /DC: 30VA(6kV, 5mA), for 19021 is AC: 48VA(6kV, 8mA) and for 19022/19022-4 is DC: 28VA(8kV, 3.5mA). Thus they can be used to perform withstand voltage tests on electronic, electrical equipment as well as on components.

For insulation resistance test, the range it can show is 0.1MΩ ~ 50GΩ and the test voltage is 50V~1000V that can be set as desired. (Note: Only 19021 can conduct AC withstand voltage test.)

The Hipot Tester uses a clear display to show all settings, time, current, voltage, resistance and memory channel no., etc without the need to memorize the parameters set previously.

The Hipot Tester has equipped the device to identify pass or fail products as well as to output signals of test result and to remote control other devices. It has GPIB, HANDLER and RS232 interfaces that are of advantage to automatic test system. This Tester equipped with assorted devices mentioned above is capable of performing highly efficient and accurate tests for electrical, electronics equipment and components.

1.2 Features

- **Sync Withstand Voltage Test**
  The testers have the world's first sync withstand voltage test function that a single device can have 10 channels to output and test simultaneously and maximum 10 devices can be controlled (master & slave) for 100 channels. They can be grouped for output to avoid voltage difference from generation due to adjacent test and furthermore to improve the production efficiency.

- **Multiple Tests**
  The testers are able to select single test function such as AC withstand voltage test, DC withstand voltage test, Insulation Resistance (IR) test and Open/Short Check (OSC) test

- **OSC (Open/Short Check)**
  The testers have built-in OSC function to check if there is any Open (bad connection) or Short (UUT shorted) occurred during test. It may cause the Fail product to be identified as Pass if Open occurs. If Short is detected and resolved early when occurred, it can reduce the damage to fixture and save the test cost.

- **Clear Display**
  The testers have a clearest design for display. All programs for settings such as test voltage, current state, test readings, test steps and test states are able to be viewed from the LED display directly.

- **High/Low Limit Comparison for Pass/Fail Products**
  The testers have been designed to do High/Low Limit comparison for the Unit Under Test (UUT.) This function is available in Withstand Voltage test or Insulation Resistance test. The low limit comparison for hipot and high limit comparison for insulation are used to test if there's any bad connection or loose test wire that causes misjudgment.

- **Remote Control**
  The HANDLER of the testers is able to extend the control signals for controlling externally. It usually connects to the control box of automated devices.

- **Change Voltage Ramp Time**
  These testers have a [RAMP] function that can set the time required for voltage rises from zero to set value.

- **Change Voltage Fall Time**
  These testers have a [FALL] function that can set the time required for voltage falls from set value to low when the test time ends.

- **Auto Switch Low Current Range**
  The current meter ranges for withstand voltage test in the testers have two ranges, one is low AC range 0~2.999mA and the other is 3.00 mA ~ maximum AC. There are three ranges for DC: 0~299.9uA low current range, 0.300mA ~2.999mA current range and 3.00~ maximum AC. If the tested current is low, software can be used to switch the current range to low range automatically for resolution improvement before the test ends as need.

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

Maximum/Model	19020	19020-4	19021	19022	19022-4
Output Channels	10CH	4CH	10CH	10CH	4CH
AC	5kV,10mA		6kV,8mA	-------	
DC	6kV,5mA		-------	8kV,3.5mA	
IR	1kV		-------	1kV	

❑ Multi-Hipot Unit	Output channels are defined by model, independent output
❑ Frame Number	Master fixed the frame number on 0 Slave need to select frame number (1~9)
❑ Withstanding Voltage Test	
Output Voltage:	AC: 0.05-Maximum, steps 0.001kV, 50Hz/60Hz ± 0.1%, sine wave. DC: 0.05-Maximum, steps 0.001kV. Load Regulation: ≤ (1% of setting + 0.1% of full scale), Rated load, AGC ON Voltage Accuracy: ± (1% of setting + 0.1% of full scale) **<Note1>**
Output Voltage Monitor	V-monitor: ± (1% of reading + 0.1% of full scale), 2V resolution
Cutoff Current	AC:0.01mA~10mA, 0.001mAdc resolution DC:0.001mA~5mA, 0.1uAdc resolution
Leakage Current Meter	AC current: 3mA range: 0.001mA – 2.999mA 10mA range: 0.01mA -- Maximum; Measurement Accuracy: ± (1% of setting +0.5% of full scale) DC current: 300uA: 0.1uA– 299.9uA 3mA range: 0.001mA – 2.999mA 5mA range: 0.01mA –Maximum Measurement Accuracy: ± (1% of setting +0.5% of full scale)
❑ Flashover (ARC) Detection **<Note2>**	AC: 1mA –20mA, DC: 1mA –10mA, step 0.1mA
❑ Insulation Resistance Measurement	
Output Voltage	DC: 0.05-1.0 kV, steps 0.001kV Voltage Accuracy: ± (2% of setting + 0.5% of full scale)
Output Voltage Monitor	V-monitor: ± (1% of reading + 0.5% of full scale), 2V resolution
Measurement Accuracy (RH ≤ 60%)	≥500V: 1MΩ~1GΩ: ± (3% of reading + 0.1% of full scale) 1GΩ~10GΩ: ± (7% of reading + 2% of full scale) 10GΩ~50GΩ: ± (10% of reading + 1% of full scale) < 500V: 1MΩ~1GΩ: ± [3% of reading + (0.2 x 500V /Vs)% of full scale]
Test Time	0.03 – 999.9 sec., and Continuous (IR: 0.3 – 999.9 sec.)
Ramp Time	0.1– 999.9 sec., and OFF
Fall Time	0.1– 999.9 sec., and OFF
❑ OSC – Contact Check	
Test Voltage Level	Less than ac 100V
Test Frequency	600Hz

No Contact Judge	Measured capacitance comparison.
❑ Other Functions	
Display:	320 x 240 dot matrix, blue, CCFL back light.
❑ Compensation (Correct)	
Open Circuit:	Leakage current offset compensation for WVAC, WVDC, and IR testing
❑ PASS/FAIL System	
Indication, Alarm	PASS : (Short Sound) FAIL : High/Low Fail (WV, IR) ARC Fail (WV) Open/Short Fail (OSC) System Error
❑ Memory Storage	
Save/Recall	30 instrument setups with up to 10 test steps can be stored into and recalled from the internal memory.
Key Lock	Front panel keys can be locked to prevent undesired operation.
❑ Interface	
GPIB (Optional)	Complies with tested values and comparator decision results can be stored and output.
RS232 (Standard)	Standard: RS232, The programming language is SCPI. Data buffer: One set of tested IEEE488.1 and 488.2. The programming language is SCPI. Data buffer: One set of values and comparator decision results can be stored and output.
❑ Handler interface (Standard)	
Judge Result (O/P)	Output channels Pass/Fail, Total Pass/Fail (Lo: Pass , Hi: Fail) nEOT: Low active
Control Signal	Start trigger (I/P): Falling edge trigger. Stop Testing (I/P): Falling edge trigger. Memory recall(I/P): 7 sets
Power Supply	Internal +Vint: 5V, 40~60mA limit current. Common Int. External +Vext: +3V~+26V allowable. Common Ext.
❑ Indication, Alarm	PASS(short Sound) FAIL: High, Low, ARC, System Error(Long Sound)
❑ Interlock	2 pins connector, pin1 pull-up to digital +V source with 4.7kohm resistor, and pin 2 tied to digital GND.
❑ Ambient Temperature and Relative Humidity	
❑ Specifications Range	18 to 28°C (64 to 82°F), ≤ 70% RH.
❑ Operable Range	0°C to 45°C, 15% to 95% RH@ ≤ 40°C and no condensation.
❑ Storage Range	-10 to 60°C (-14 to 140°F), ≤ 80% RH.
❑ Power Requirement	
❑ Line Voltage	AC 100V~240V±10%
❑ Frequency	47~63 Hz
❑ Power Consumption	Standby: < 250W
	With rated load: <1100W

❑ Dimension	428 W x 174 H x 600 D mm
❑ Weight	Approx. 40kg
❑ Safety	
❑ Ground Bond	Less than 100mΩ at 25Amp, 2sec
❑ Hi-Pot L + N to Earth	Less than 10mA at WVAC 1.5kV, 60Hz, 3sec no flashover happen (ARC level < 8mA, tested by Chroma 19032)
❑ Insulation L + N to Earth	Greater than 20MΩ at 500V dc, 2 sec.
❑ Line Leakage Current	Less than 3.5mA at Vin max (132V at 120V selected voltage), normal and reverse.

Note

1. When the testing time is less than 0.3 second, the output voltage specification is ±(4% of setting + 0.2% of full scale)
   It is necessary to calibrate again when the high voltage module on the rear panel is replaced.
2. AC ARC Validation point is 2.5kV with a 500kΩ resistor.
   DC ARC Validation point is 1.5kV with a 500kΩ resistor.

3. Precaution before Use

The Hipot Tester can output up to 8kV high voltage for external test. Accidents may occur or even cause death if using this Tester incorrectly or in the wrong way. Thus for safety sake, be sure to read the precautions in this chapter to avoid any accidents from happening.

1. **High voltage module replacement**
   If users replace or switch the high voltage modules on the rear panel, to ensure the Tester output is still within the specification, users need to recalibrate the Tester and ensure the specification.

2. **Electric shock**
   To prevent the incident of electric shock from occurring, it is suggested to wear the insulated rubber gloves before using the Hipot Tester for electricity related tasks.

3. **Grounding**
   A safety ground terminal is located at the rear of the Tester chassis; please use a proper tool to ensure it is grounded accurately. If not it would be very dangerous when the power circuit or the connection cable of any device shorts with ground terminal as the chassis may contain high voltage. Anyone who touches the device in this case may cause electric shock. Therefore, it is necessary to connect the safety ground terminal to earth properly as the arrow shows in Figure 3-1.

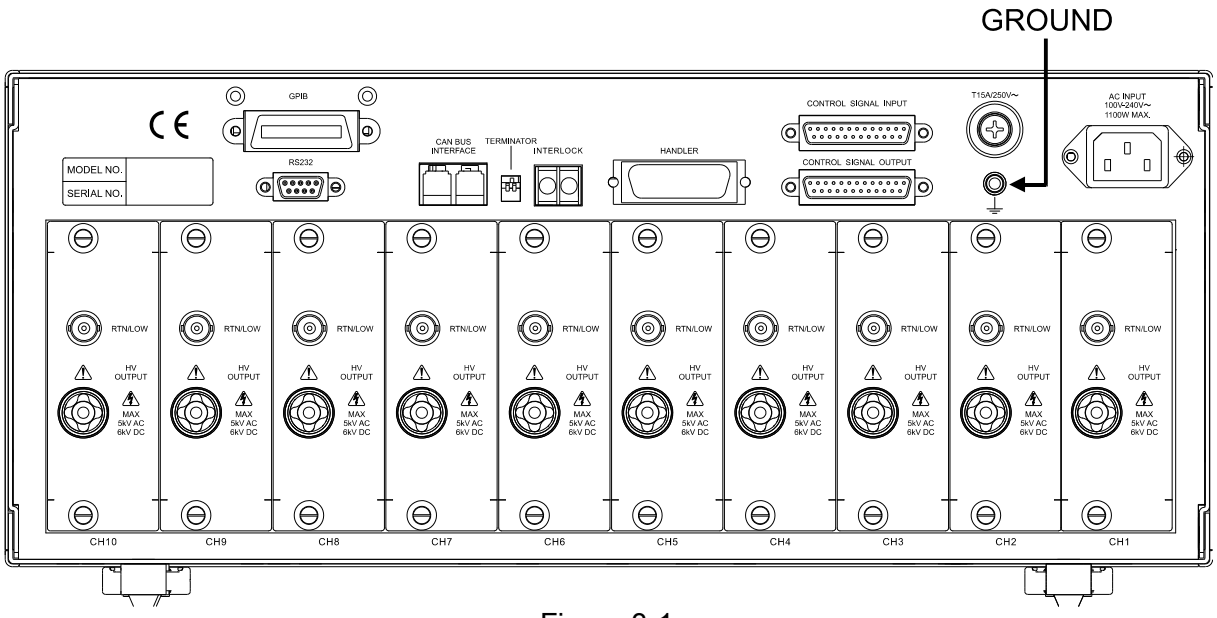


Figure 3-1

4. **Connecting test cable to LOW terminal**
   It is necessary to check if the test cable is connected all the time when the Tester is in use. When connecting a test unit with test cable, connect the RTN/LOW test cable to the UUT first. When the host RTN/LOW terminal is connected, it is very dangerous if the test cable on RTN/LOW terminal is not connected correctly or falls as the entire UUT may full of high voltage.

5. **Connecting the test cable to high voltage output terminal**
   When the RTN/LOW test cable is connected, follow the steps below to connect the high voltage output cable.

- Press **STOP**.
- Ensure the DANGER indicator is off.
- Short the test cable of RTN/LOW and high voltage output to make sure there is no voltage output.
- Plug in the high voltage test cable to high voltage output terminal.
- Last connect the RTN/LOW test cable to the unit under test and then connect high voltage test cable.

6. End the test

When the test is end or the Tester is not in use or is in use but needs to leave it unattended for a while, it is necessary to toggle the power switch to O (i.e. to shut off the power) as Figure 3-2 shows.

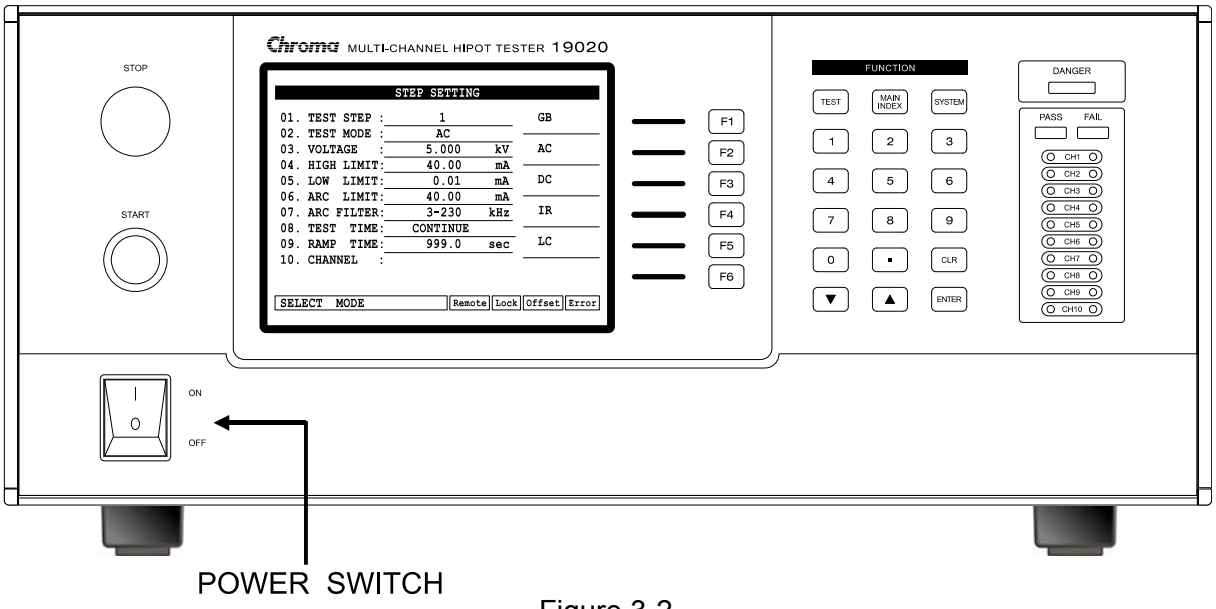


Figure 3-2

7. Do not touch the hazard areas when the Tester is in test mode

When the Tester is in use, touching the object with high voltage such as UUT, test cable, probe and output terminal is very dangerous.

8. Ensure the test is done

Sometimes users might need to touch the high voltage objects such as UUT, high voltage test cable or output terminal etc. due to configuration or test required change. In that case, please ensure the following:

- **The power switch is turned off.**
- **The UUT may full of high voltage when completing the Insulation Resistance test; thus it is necessary to follow the description of item 9 and 10 for execution.**

<<< Warning! Charging when doing insulation resistance test >>>

9. Charging

When doing insulation resistance test, the UUT, capacitor, test cable, probe and output terminal, even the Tester itself may full of high voltage. The charged voltage may need some time to discharge completely after turning off the power switch. It is

necessary to follow the instruction described above for actions. Do not touch any area that may cause electric shock especially when the power is just turned off.

10. Ensure the charged voltage is fully discharged

The time required for fully discharging the voltage depends on the test voltage applied and the features of UUT. Assuming the high voltage added on the UUT equals the high voltage added to a 0.01uF capacitor and paralleled to a 100MΩ resistance circuit. When the test voltage is 1000V, then it requires approximately 3.5 seconds for the voltage that added to test and on UUT to fall to 30V under after turned off the power. For 500V test voltage, it requires about 2.8 seconds. Assuming the time constant of a UUT is already known, the way described above can be used to calculate the time required for voltage falling to 30V under after powered off by timing the time constant multiple to the time decreased to 30V under as Figure 3-3 shows.

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

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

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

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

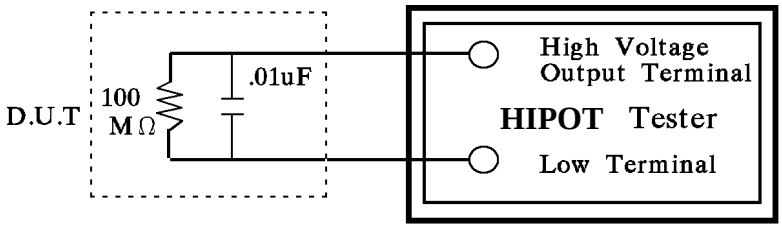


Figure 3-3

11. Remote controlling the Tester

The Hipot Tester can be remote controlled generally for high voltage output via external control signal. When performing it, it is necessary to follow the control guidelines for safety and precautions.

- **Do not allow any accidental high voltage output that may cause hazard.**
- **When there is high voltage output from the Tester, do not allow any operator or other personnel to touch the UUT, test cable or probe output and etc.**

12. Turning on or off the power switch

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

13. Other notices

Do not short-circuit the output line, grounding wire, communication cable or other device's grounding wire or AC power to avoid charging the entire Tester to dangerous voltage. To short-circuit the terminal of high voltage output and LOW, it is necessary to ground the Tester chassis to earth properly.

<<< Emergency Case >>>

14. Process for emergency case

To avoid causing bigger hazard when in emergency situations like electric shock, UUT or Tester burnout, please perform the steps below:

* **First cutoff the power switch.**
* **Second unplug the power cord.**

<<< Resolving Problems>>>

15. Problems occurred

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

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

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

16. DANGER Indicator failure

When pressing the **START** key the voltage meter has readings but the DANGER LED indicator is still off, it means the indicator may be broken. Please power off the hardware and replace it with another device, then send the broken one back to Chroma or its distributor for repair service.

17. AC INPUT used by the Tester is 100V~240V auto switch and the fuse specification is **15A Slow/250V**. Also to avoid electric shock the fuse should be changed when the power cord is not plugged in. Whe replacing, use a flat screwdriver to pry the fuse holder inside the power socket and remove the fuse to replace with a new one by pushing it in gently, and then push the power socket back to its position.

CAUTION Be sure to use the fuse with correct specification or it may cause hazard.

18. Tester is normally operated under AC power

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

19. Tester uses a power transformer with 1100VA or above

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

20. Storage

The temperature and humidity for the Tester is 5°C~35°C, 70% RH in normal. The operation may malfunction if exceeding the range. Do not mount the Tester to a fixed place in case it needs to be removed. The storage temperature for the Tester is from

-10°C to 60°C, ≤ 80% RH. If it is not in use for a long time, please pack it with its original package for storage. For proper test and safety measures, do not place the Tester under direct sunlight, high temperature, trembling, humid or dusty area.

21. Warming up

The Tester is activated when power is on; however, in order to meet the specifications for accuracy please warm it up for 15 minutes or above.

22. Safety symbols

The terminal may output lethal voltage. Please read all precautions clearly.

There are detail descriptions in the User's Manual. Please read it to get detail information.

The protection ground terminal to prevent electric shock due to leakage to chassis. It is necessary to connect this ground terminal to earth before using the Scanner.

⚠WARNING A waning label to avoid any improper use due to procedure, application or other reasons that may cause injury or death to human.

⚡ CAUTION A caution label to avoid any improper use due to procedure, application or other reasons that may cause damage or bad result to the Scanner or the unit under test.

Notice A notice label for important information on procedure, application or other areas. Please read it clearly.

23. Warning label during test

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

24. Common Environment Conditions

(1) Indoor use
(2) Altitude: 2000 m
(3) Temperature: 5°C to 45°C
(4) Humidity: Maximum 80%RH at 31°C decreasing to 50%RH at 40°C
(5) Transient Overvoltage at Mains Supply: 2500V
(6) Pollution Degree: 2

25. Keep test cable away from the panel

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

26. Notices for connecting automated device

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

4. Operation

4.1 Front Panel

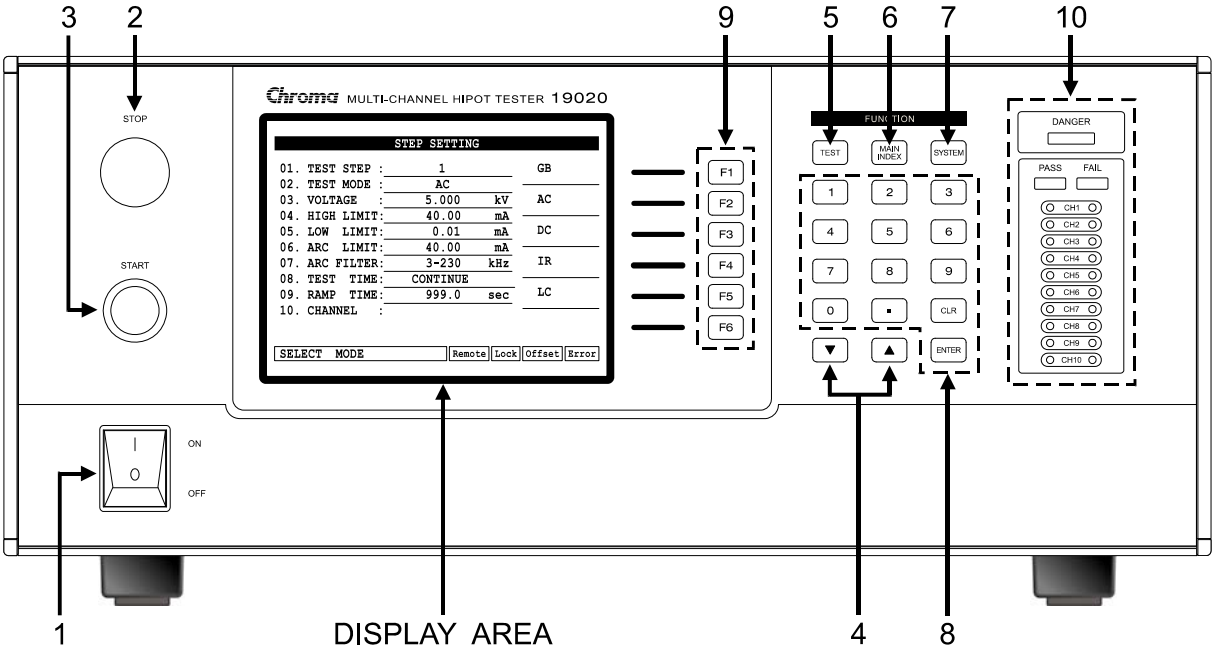
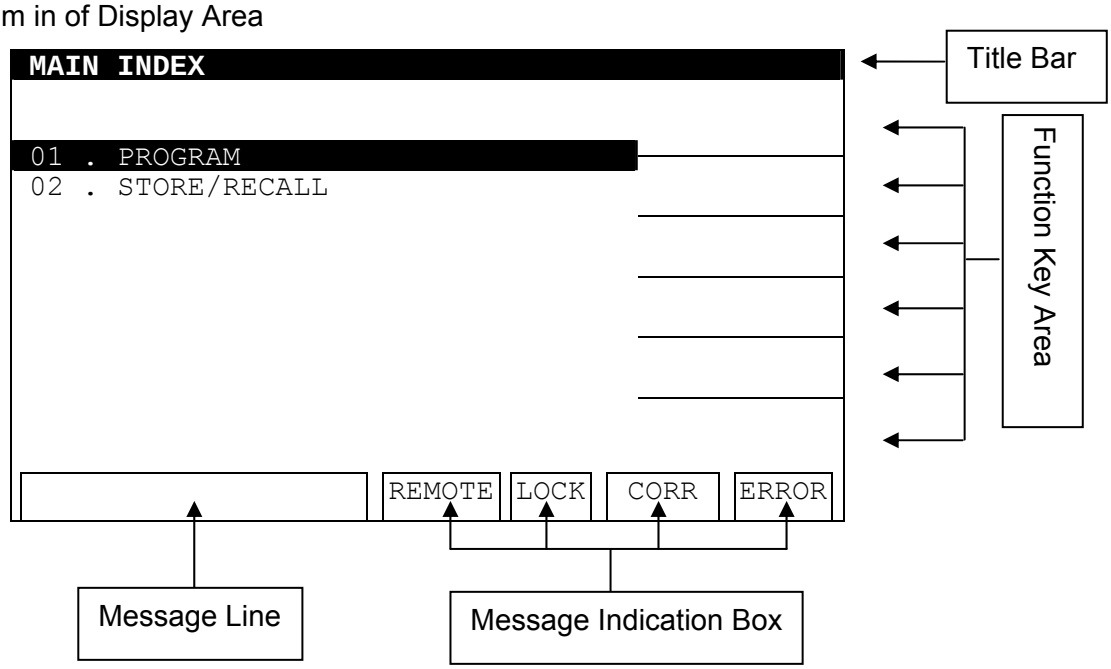


Figure 4-1

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

■ Zoom in of Display Area



Display Area

Title Bar: This line of text indicate the setting or test mode at present of the Tester.

Function Key Area: Different function key descriptions will appear in different screen and the mapping function keys are at the right of LCD. If the description is blank, it indicates the mapping function key is invalid.

Message Line: This line of text instructs the setting method and range also test time.

Message Indication Box

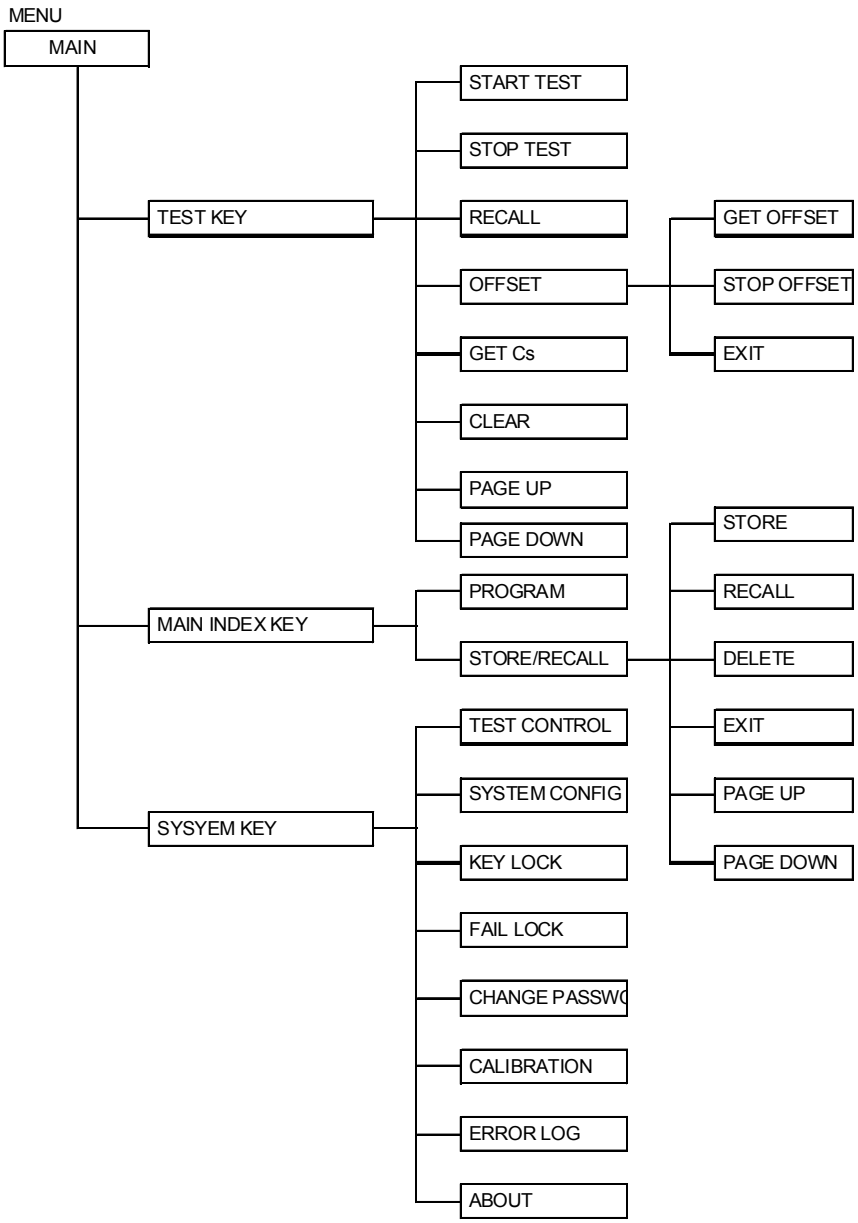
REMOTE: When this box is reversed it indicates the Tester is in Remote state which means it is controlled by PC via GPIB/RS232 cable. At this time all buttons are invalid except **STOP** and **ENTER** keys.

LOCK: When this box is reversed it indicates the Tester is in parameter protection mode. Except "TEST", "RECALL" and "KEY LOCK" 3 modes, all other keys are invalid.

CORR: When this box is reversed it indicates the Tester has offset the leakage current of test wires and leads or completed the actions of GET Cs.

ERROR: When this box is reversed it indicates error messages are generated for RS232 or GPIB interface.

Simple Function Flow Chart



Buttons

(1) Power Switch : It is the AC power switch for this Hipot Tester. Read *Chapter 3 Precaution before Use* in this manual carefully before using this switch.

(2) STOP Key : It is the reset key. When pressed the Hipot Tester will cutoff output immediately or return to ready-to-test state and clear all judgments.

(3) START Key : It is the test activation key. When pressed, the Hipot Tester is in test state, which means there is output on test terminal and the judging functions are activated at the same time.

(4) Cursor Keys : ▲ and ▼ keys are used to move the reserved cursor.

(5) TEST Key : Press this key under each major display mode can return to the "TEST" main screen.

(6) MAIN INDEX Key: Press this key under each major display mode can return to the "MAIN INDEX" main screen.

(7) SYSTEM Key : Press this key under each major display mode can return to the "SYSTEM" main screen.

(8) Data Entry Keys/Program Keys

0 . ～ 9 : They are numeric/character keys for inputting test parameter data (value or English letters.)

ENTER : It is the input confirmation key for setting test parameters.

CLR : It is the cancel key for clearing the inputted test parameters when error occurs and entering the new data again.

(9) Function Keys : Different function key descriptions will appear in different screen and the mapping function keys are at the right of LCD. If the description is blank, it indicates the mapping function key is invalid.

(10) Indicators

DANGER LED : It is the indicator of test status. When on it means the Tester is performing test when on. Do not touch the test terminals as they may contain high voltage output.

PASS LED : It is the indicator for pass items. CH1~CH10 indicators stand for the test results of CH1~CH10. The rectangular PASS LED is on only when the test results of CH1~CH10 are all good.

FAIL LED : It is the indicator for fail items. CH1~CH10 indicators stand for the test results of CH1~CH10. The rectangular FAIL LED is on when one of the CH1~CH10 test results is bad and will keep on until STOP is pressed.

Notice The indicator shows the test result in the channel numbers specified by the model, for instance, the 19020 shows the test result of CH1~CH10 and 19020-4 shows the test result of CH1~CH4.

4.2 Rear Panel

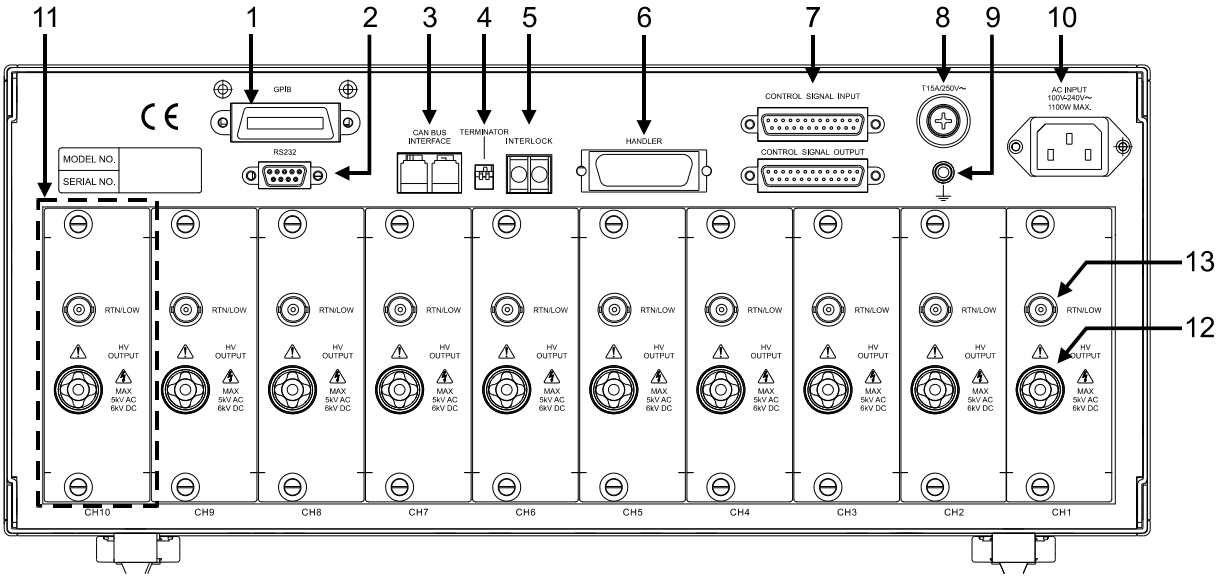


Figure 4-2

(1) GPIB Interface (option):
This is the connector of optional GPIB interface card under IEEE-488-1978 standard. See *Chapter 6 GPIB/RS232 Interface (IEEE-488.2)* for detail usage description.

(2) RS232 Interface:
This is the connector of optional RS232 interface card. GPIB and RS232 cannot be used at the same time.

(3) CAN BUS Interface:
This connector is used for data communication between MASTER and SLAVE.

(4) Terminal Resistance Selector:
This DIP switch is used to set the terminal resistance for CAN BUS interface. It is necessary to set the DIP switch to ON for the first and last Testers on the CAN BUS transmission path.

(5) INTER LOCK: High voltage can only be outputted when these two terminals are short-circuited.

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

(7) Internal Communication Interface:
This connector is used for control signal transmission between MASTER and SLAVE.

(8) Fuse Holder:
See *Chapter 3 Precaution before Use* for detail specification or the label mark on the rear panel.

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

(10) AC Input:
It contains a three-wire AC power socket. The AC power required by the Tester is supplied by this power socket. The power socket or connecting cable can be interrupt device.

(11) High Voltage Module:
It is the combination of high voltage output circuits. Be sure the anchor screws are secured.

(12) High Voltage Output Channel:
It is the high potential terminal for high voltage output. The output terminal that belongs to high potential output terminal usually has high voltage output. Thus, it is very dangerous. Do not touch it especially when the DANGER LED is on with high voltage output.

(13) RTN/LOW Channel:
It is the common test terminal that is the reference terminal for high voltage test. It is the low potential terminal that almost equals to chassis grounding terminal.

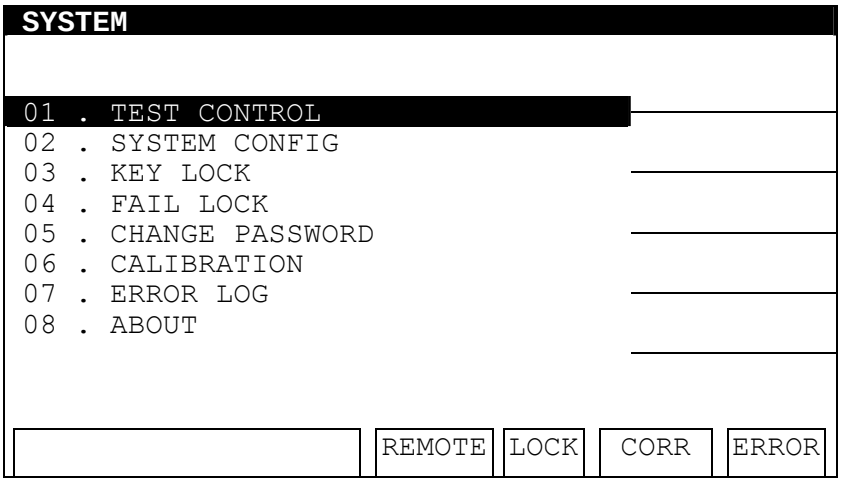
4.3 Notices before Using & Procedure

1. Before plugging in the AC power cord, make sure the power in use matches the power indicated on the rear panel and the switch is OFF.
2. Read the precautions described in *Chapter 3* carefully and keep them in mind before power-on the Tester.
3. Once the Tester is powered on, it will start self-test. If any abnormal occurs, turn off the power switch immediately and unplug the power cord.

4.4 Setting SYSTEM Parameters

4.4.1 Entering SYSTEM Setting Screen

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



Procedure

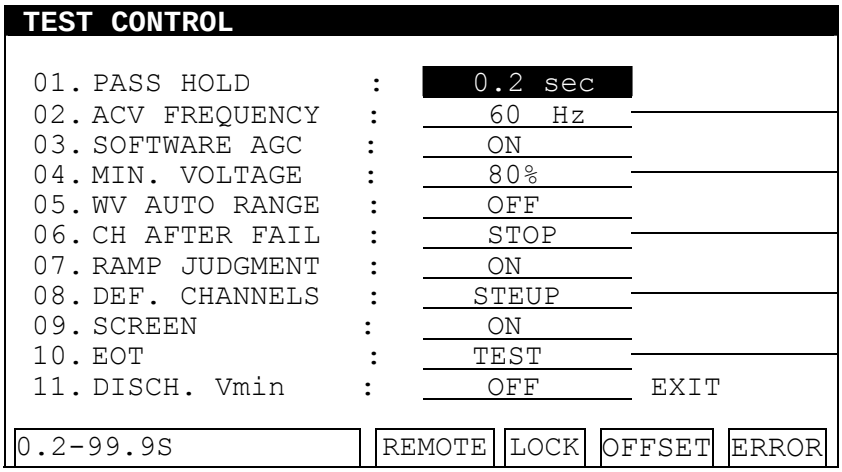
1. When title bar shows “SYSTEM”, press ▲, ▼ to move the highlight to the item to be set.
2. Press **ENTER** to go the sub menu or set the parameter data.
3. Press numeric/character keys or Function Keys to set the parameter data.
4. When error occurs during data input, press **CLR** to clear it and re-enter. At last, press **ENTER** to confirm the parameter data.

The following table lists the setting items of System and their descriptions.

Setting Items	Description
TEST CONTROL	It sets the related parameters for test. See section 4.4.2 for details.
SYSTEM CONFIG	It sets the system related parameters. See section 4.4.3 for details.
KEY LOCK	It sets the keyboard lock function. See section 4.4.4 for details.
FAIL LOCK	It sets the fail lock function on keyboard. See section 4.4.5 for details.
CHANGE PASSWORD	It changes the user’s password. See section 4.4.6 for details.
CALIBRATION	It sets the calibration related function. See section 4.4.7 for details.
ERROR LOG	It logs the errors messages generated when connecting with PC. See section 4.4.8 for details.
ABOUT	It shows the firmware version related description.

4.4.2 Setting TEST CONTROL

In SYSTEM screen, move the highlight to TEST CONTROL and press **ENTER** to go to TEST CONTROL setting screen as shown below:



When in TEST CONTROL screen, press ▲, ▼ to move the highlight to the item to be set for related setting.

The following table lists the setting items of TEST CONTROL and their descriptions.

No.	Setting Items	Range	Default	Description
01	PASS HOLD	0.2~99.9sec	0.2sec	It sets the time duration the beeper sounds for PASS.
02	AC FREQUENCY	50, 60Hz	60	It sets the frequency of output voltage when doing AC withstand voltage test.
08	SOFTWARE AGC	ON/OFF	ON	It sets the software AGC function to be on or off.
04	MIN. VOLTAGE	OFF,50~95%	80%	It sets the percentage for the output voltage to reach the set voltage.
05	WV AUTO RANGE	ON/OFF	OFF	It sets the range auto change function for withstand voltage test to be on or off.
06	CH AFTER FAIL	STOP/ CONTINUE	STOP	It sets if the channel stops testing when FAIL occurs during test.
07	RAMP JUDGMENT	ON / OFF	ON	When it is set to ON, it will judge if the current readings exceed the high limit during ramp time execution. When it is set to OFF, it won't judge if the current readings exceed the high limit during ramp time execution.
08	DEF. CHANNELS	----------	Output channel of Frame 0 are ON	It sets the default channel to be on. The settings here will become the default of PROGRAM channel. Detail please see *Setting DEF. CHANNELS*.
09	SCREEN	ON/OFF	ON	It sets the LCD screen to be on or off during test.
10	EOT	TIMER / TEST	TEST	1. When EOT set to TIMER, it means nEOT and PASS_FAIL signals act

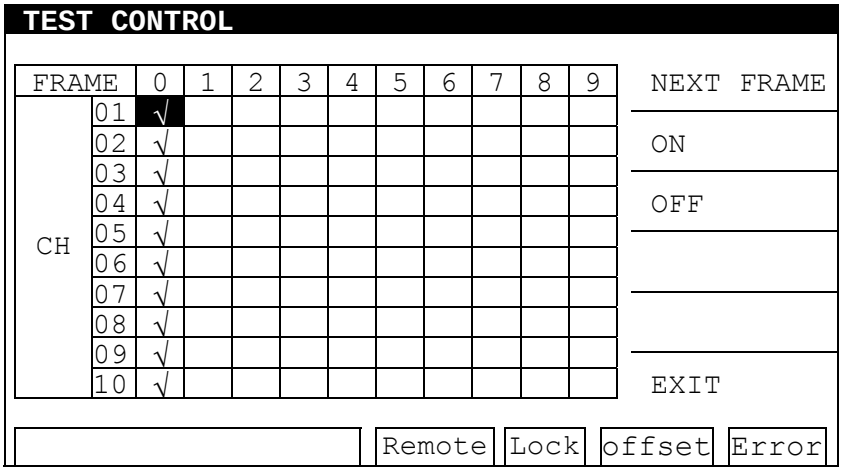
				immediately after test time ends without waiting for the high voltage discharge to end. 2. When EOT set to TEST, it means nEOT and PASS_FAIL signals act after the high voltage discharge ends.
11	DISCH. Vmin	ON/OFF	OFF	When set to ON, the discharge circuit will discharge to the voltage lower than safe voltage. When set to OFF, the discharge circuit will discharge to safe voltage.

Notice

The DISCH. Vmin setting is only valid when the EOT is set to TEST. When EOT is set to TIME, the tester will end the testing without discharge, thus the DISCH. Vmin is invalid.

Setting DEF. CHANNELS:

Move the highlight to DEF. CHANNELS and press Function Key [SETUP] to go to DEF. CHANNELS setting screen as shown below:



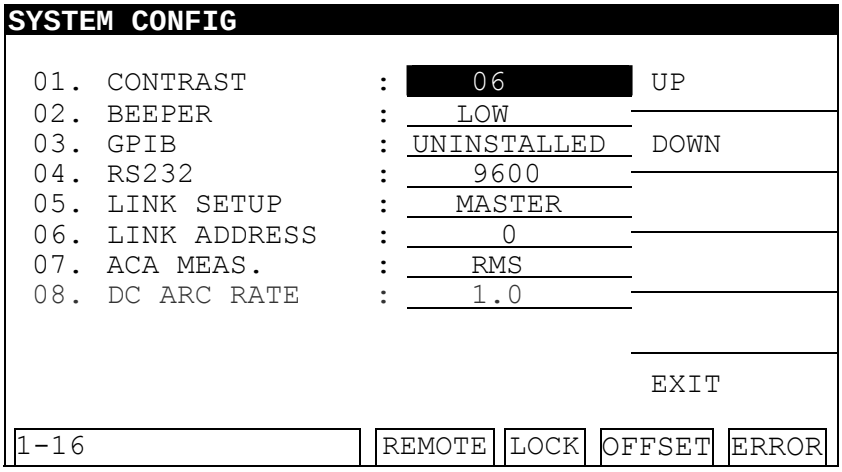
Press ▲, ▼ move the highlight to channel to be set and press Function Key [ON] [OFF] to enable or disable it. Use Function Key [NEXT FRAME] to move the highlight to next FRAME.

Notice

Please follow the model to set the output channel, for instance, the 19020 can set the output channel to CH1~CH10 while the 19020-4 can only set the channel to CH1~CH4. The message line on the test screen will show ”Module Fail” if set otherwise and the test is unable to start.

4.4.3 Setting SYSTEM CONFIG

In SYSTEM screen, move the highlight to SYSYEM CONFIG and **ENTER** to go to SYSYEM CONFIG setting screen as shown below:



When in SYSTEM CONFIG screen, press ▲, ▼ to move the highlight to the item desired for setting the related function.

The following table lists the setting items of SYSYTEM CONFIG and their descriptions.

Setting Items	Range	Default	Description
CONTRAST	1 - 16	06	It adjusts the LCD brightness.
BEEPER	HIGH / LOW / OFF	LOW	It adjusts the beeper volume.
GPIB	UNINSTALLED / ADDRESS = 0~30	03	It sets the GPIB interface address. It shows UNINSTALLED if GPIB card is not installed.
RS232	9600 / 19200 / 38400	9600	It sets the transmission baud rate of RS232 interface.
LINK SETUP	MASTER/SLAVE/SCANNER	MASTER	It sets the tester to be MASTER or SLAVE when linked for test. Be sure to set it to SCANNER when connecting to A190201/A190202.
LINK ADDRESS	1~9	0	It sets the tester address when linked for test. **Note:** The tester address is fixed to 0 when set to MASTER.
ACA MEAS	RMS/GENERAL	RMS	It sets the AC current measurement.
DC ARC RATE	1.0~10.0	1.0	The ARC LIMIT setting will multiply this rate for RAMP, DWELL time during DC MODE test.

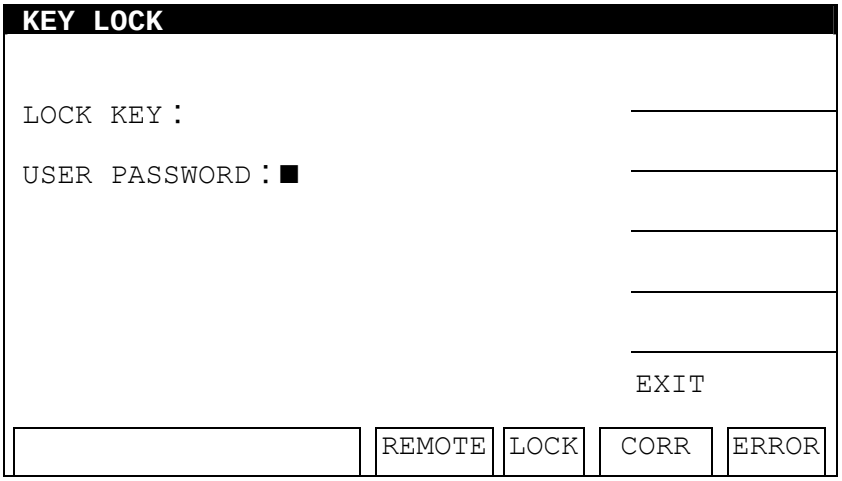
Notice

1. When LINK SETUP is set to SLAVE, besides the items "02. SYSTEM CONFIG", "05. CHANGE PASSWORD", "06. CALIBRATION", "07. ERROR LOG" and "08. ABOUT" in the SYSTEM screen, the rest items are all invalid.
2. Only the 19020/19020-04 LINK SETUP settings has SCANNER selection.

4.4.4 Setting KEY LOCK

The way to set KEY LOCK:

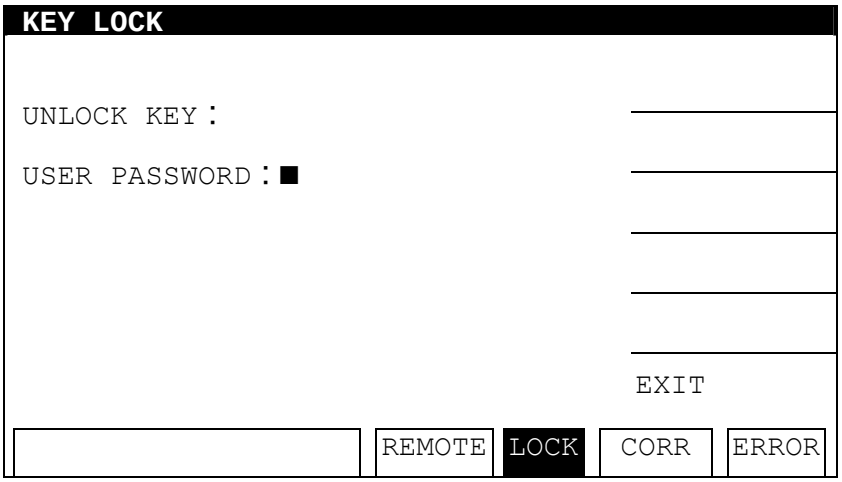
In SYSTEM screen, move the highlight to KEY LOCK and press **ENTER** to go to KEY LOCK setting screen as shown below:



1. Enter the PASSWORD when in KEY LOCK screen. (The default is 0 0 0 0.)
2. Press **ENTER** will prompt a selection window to select if to lock RECALL MEMORY. Users can use Function Keys [YES], [NO] to select if locking the function of MEMORY RECALL as well.
3. When KEY LOCK is ON, the LOCK text is reversed to indicate the host is in parameter protection mode. The “OFFSET”, “GET Cs”, “CLEAR” in [TEST] and “PROGRAM”, “STORE” in [MAIN INDEX] as well as the “TEST CONTROL”, “SYSTEM CONFIG”, “FAIL LOCK”, “CHANGE PASSWORD” and “CALIBRATION” in [SYSTEM] are all invalid for setting.
4. When setting KEY LOCK, if RECALL LOCK ON is selected, the MEMORY RECALL function is also invalid.

The way to release KEY LOCK:

If the LOCK box is reversed in power on screen, the KEY LOCK function can be released. Press **SYSTEM** to select KEY LOCK as shown below:

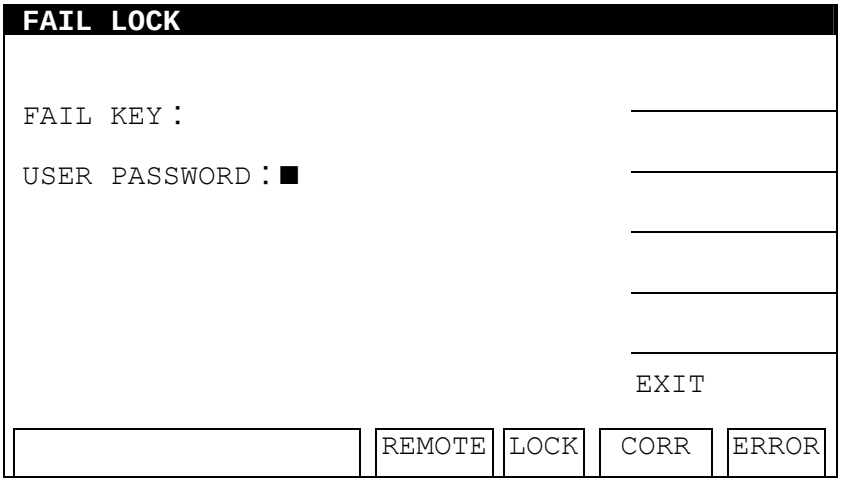


Enter the PASSWORD and press **ENTER**, the LOCK box returns to normal indicating the KEY LOCK is cancelled.

4.4.5 Setting FAIL LOCK

The way to set FAIL LOCK:

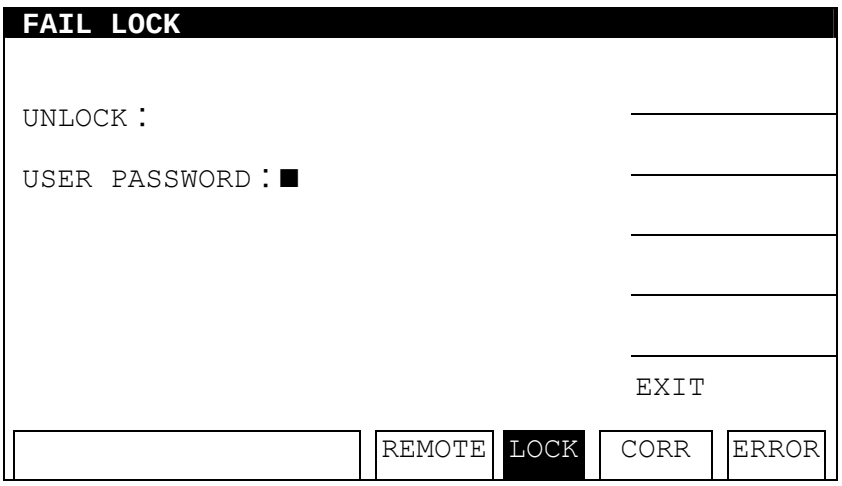
In SYSTEM screen, move the highlight to FAIL LOCK and press **ENTER** to go to FAIL LOCK setting screen as shown below:



1. Enter the PASSWORD when in FAIL LOCK screen.
2. When FAIL LOCK is ON, the LOCK text is reversed to indicate the host is in parameter FAIL LOCK mode. The "RECALL", "OFFSET", "GET Cs" in [TEST] and "PROGRAM", "STORE/RECALL" in [MAIN INDEX] as well as the "TEST CONTROL", "SYSTEM CONFIG", "KEY LOCK", "CHANGE PASSWORD" and "CALIBRATION" in [SYSTEM] are all invalid for setting.
3. When FAIL LOCK is set and the test result is FAIL, all keys are invalid except the Function Key [CLEAR] and **STOP** in TEST screen. It is necessary to press the Function Key [CLEAR] to enter the FAIL LOCK password to continue the test.

The way to release FAIL LOCK:

If the LOCK box is reversed in power on screen, the FAIL LOCK function can be released. Press **SYSTEM** to select FAIL LOCK as shown below:

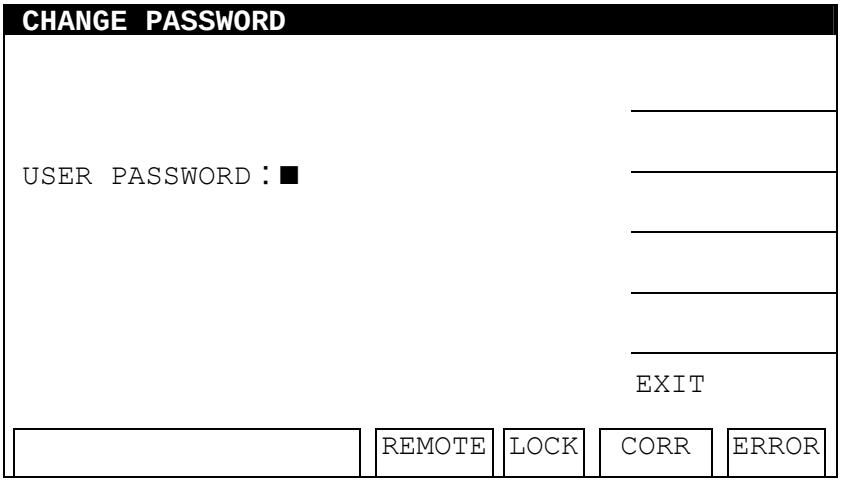


Enter the PASSWORD and press **ENTER**, the LOCK box returns to normal indicating the FAIL LOCK is cancelled.

4.4.6 Changing PASSWORD

Setting password for KEY LOCK:

In SYSTEM screen, move the highlight to CHANGE PASSWORD and press **ENTER** to go to CHANGE PASSWORD setting screen as shown below:



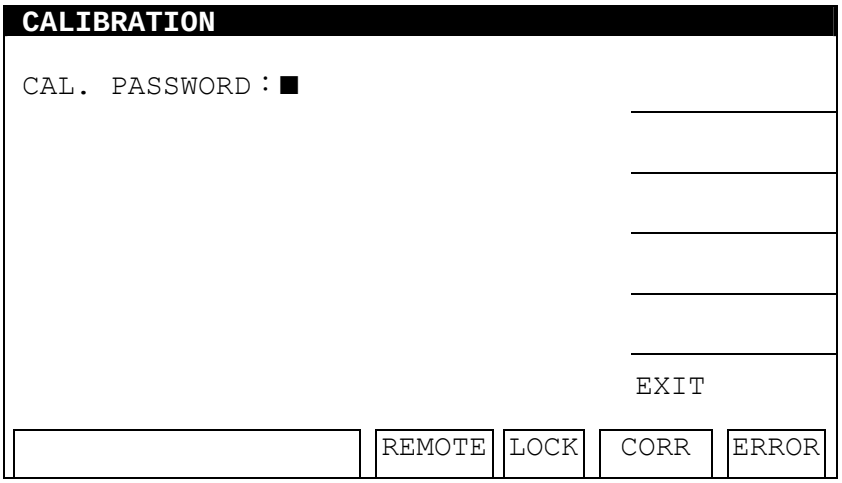
1. Enter the PASSWORD (enter 0000 if it hasn't been set) and press **ENTER** will prompt a "NEW PASSWORD" window.
2. Enter the NEW PASSWORD (maximum 10 characters) and press **ENTER** will prompt a "CONFIRM PASSWORD" window.
3. Enter the same password again and press **ENTER**. A message "*CHANGE PASSWORD OK!*" will appear to indicate the password has been changed. Press Function Key [EXIT] to quit the Setting Screen.

Notice

If the memory has been cleared following the description of "Clear the settings and test procedures in memory" in section 4.4.7, the PASSWORD will return to initial that is 0000.

4.4.7 Setting CALIBRATION

In SYSTEM screen, move the highlight to CALIBRATION and press **ENTER** to go to CALIBRATION setting screen as shown below:



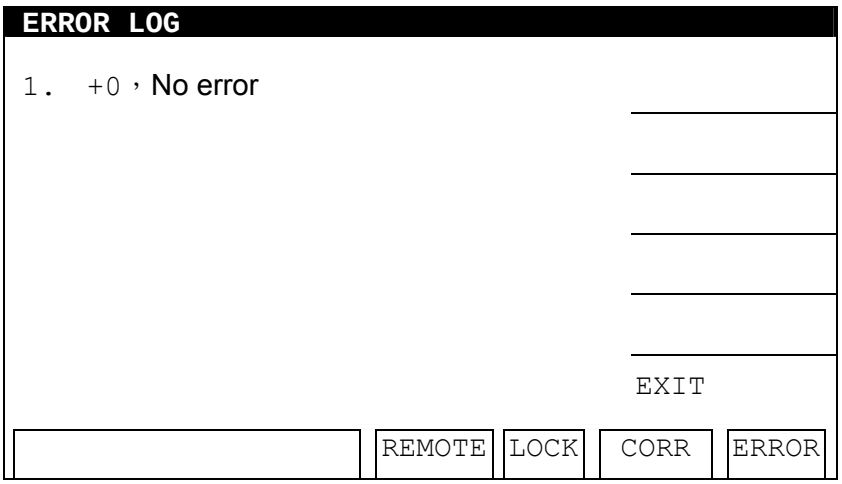
When in CALIBRATION screen, press keys to set the related functions.

The following table lists the setting items of CALIBRATION and their descriptions.

Setting Items	Password	Description
Enter into Calibration Mode	7931	Please refer to Chapter 7 *Calibration Procedure* for related info.
Clear the settings and test procedures in memory	85246	This function will clear all settings and test procedures in memory and return to factory default.

4.4.8 Setting ERROR LOG

In SYSTEM SETUP screen, move the highlight to ERROR LOG and press **ENTER** to go to ERROR LOG screen as shown below:

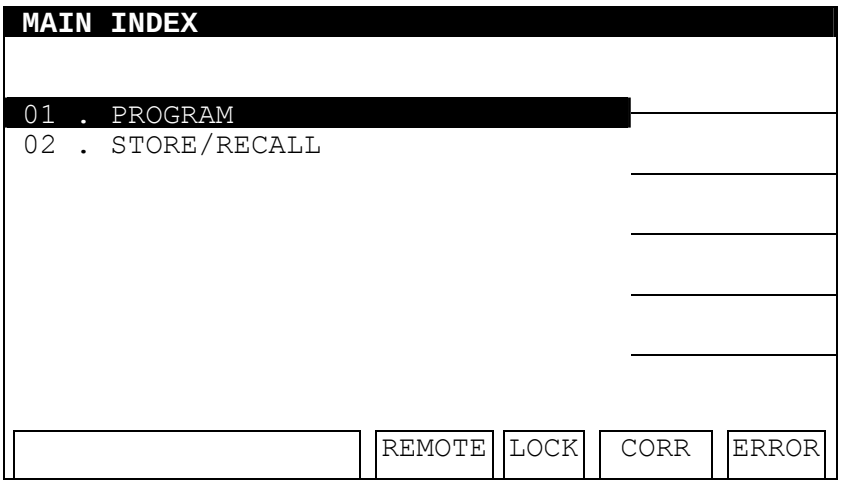


When in ERROR LOG screen it will show the error message generated during connection. The ERR box will return to normal without reverse when in ERROR LOG screen.

4.5 Setting PROGRAM

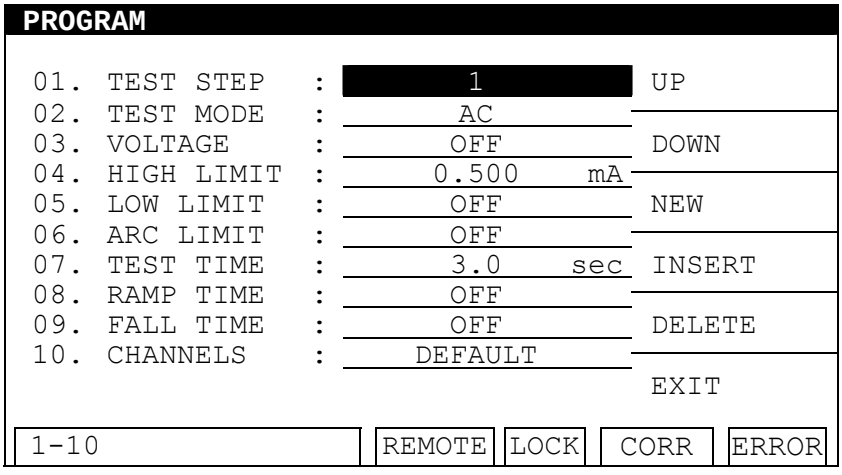
4.5.1 How to Get in PROGRAM Setting Screen

Press **MAIN INDEX** in any screen will show the following:



4.5.2 Setting Program Procedure

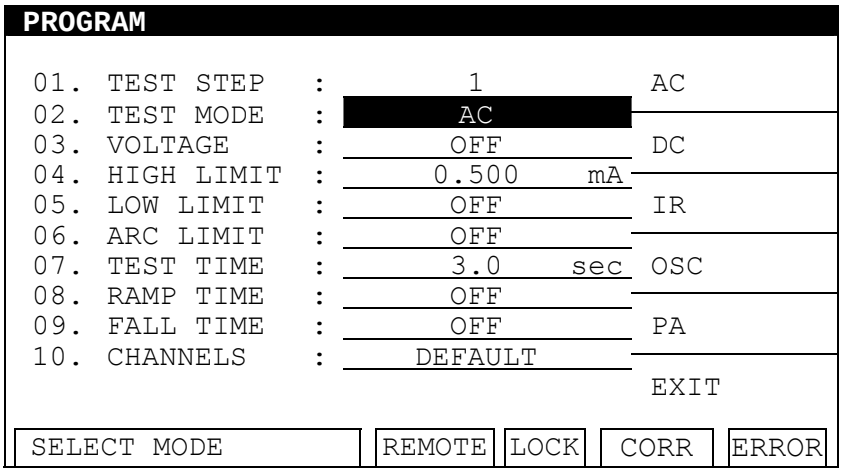
1. In MAIN INDEX screen, press ▲, ▼ to move the highlight to [PROGRAM] and press **ENTER** to enter into the program setting screen as shown below:



2. When in PROGRAM screen, use Function Keys [NEW] to add new test steps from 1 to 10.
3. Use Function Keys [UP] and [DOWN] to switch to previous or next test step.
4. Press ▲, ▼ to move the highlight to the item to be set and press **ENTER** to confirm it.

4.5.3 Selecting Test Mode

1. When in PROGRAM screen, press ▼ to move the highlight to the following position.

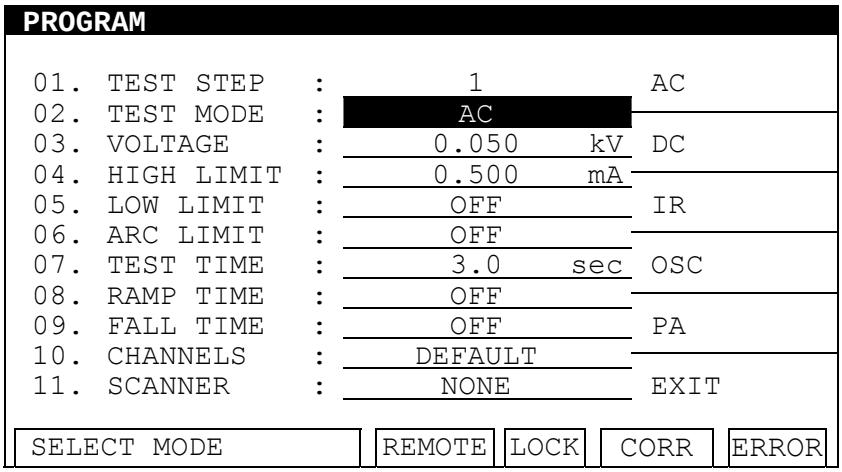


2. Use Function Key [AC], [DC], [IR], [OSC] and [PA] to select the test mode. There are AC / DC / IR / OSC /PA available for selection. Different test mode and model number has different programs for setting.

4.5.4 Description of Parameters

Following explains the parameters set in each test mode.

AC Withstand Voltage (AC) Test Mode (for Model 19020/19020-4/19021)



VOLTAGE : It sets the voltage required for AC withstand voltage test.
HIGH LIMIT : It sets the high limit of leakage current.
LOW LIMIT : It sets the low limit of leakage current. The range is smaller than the high limit of leakage current or OFF.
ARC LIMIT : It sets the ARC limit, 0 means OFF.
TEST TIME : It sets the time test required, 0 means continue test.
RAMP TIME : It sets the time required for ramping to the set voltage, 0 means OFF.
FALL TIME : It sets the time required for falling to low voltage from set, 0 means OFF.

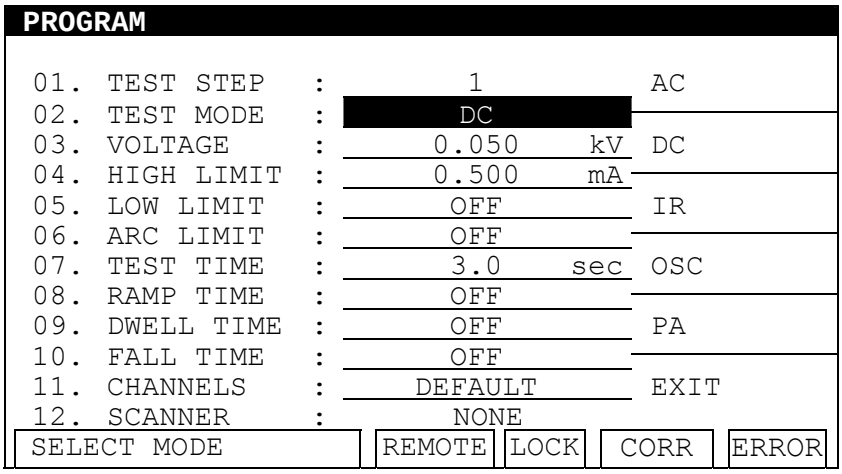
CHANNELS : It sets the high voltage channel for output. Select Function Key [DEFAULT] means to use the “DEF. CHANNELS” settings in “TEST CONTROL.” Select Function Key [SETUP] means to reset the high voltage channel for output.

SCANNER : It sets the output mode of A190201/A190202 SCANNER. It can select [P→S], [P→C], [S→C], [P+S→C] and [P→S+C]. It is only valid when the LINK SETUP in the SYSTEM of 19020/19020-4 is set to SCANNER.

Notice

Please follow the model to set the output channel, for instance, the 19020 can set the output channel to CH1~CH10 while the 19020-4 can only set the channel to CH1~CH4. The message line on the test screen will show ”Module Fail” if set otherwise and the test is unable to start.

DC Withstand Voltage Test Mode (DC) (for Model 19020/19020-4/19022/19022-4)



VOLTAGE : It sets the voltage required for DC withstand voltage test.

HIGH LIMIT : It sets the high limit of leakage current.

LOW LIMIT : It sets the low limit of leakage current. The range is smaller than the high limit of leakage current or OFF.

ARC LIMIT : It sets the ARC limit, 0 means OFF.

TEST TIME : It sets the time test required, 0 means continue test.

RAMP TIME : It sets the time required for ramping to the set voltage, 0 means OFF.

DWELL TIME : It sets the time required for DWELL, 0 means OFF. (It does not judge the high and low limit of leakage current during DWELL TIME but only when the set range is within the high limit.)

FALL TIME : It sets the time required for falling to low voltage from set, 0 means OFF.

CHANNELS : It sets the high voltage channel for output. Select Function Key [DEFAULT] means to use the “DEF. CHANNELS” settings in “TEST CONTROL.” Select Function Key [SETUP] means to reset the high voltage channel for output.

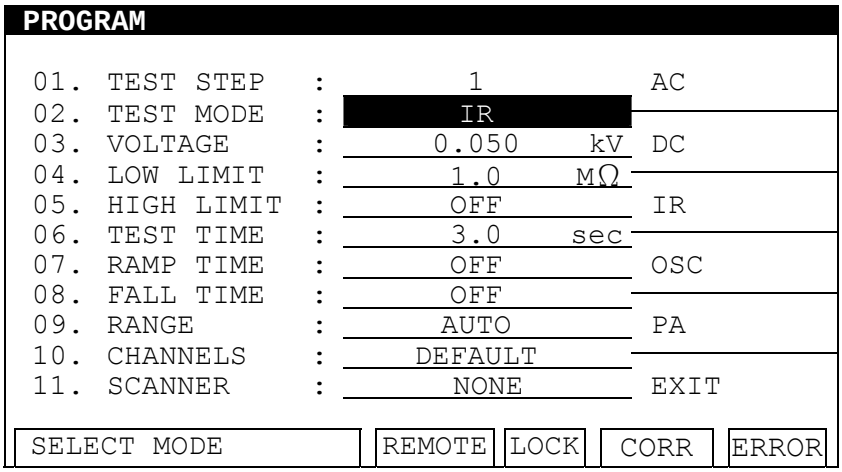
SCANNER : It sets the output mode of A190201/A190202 SCANNER. It can select [P→S], [P→C], [S→C], [P+S→C] and [P→S+C]. It is only valid when the LINK SETUP in the SYSTEM of 19020/19020-4 is set to SCANNER.

Notice

Please follow the model to set the output channel, for instance, the 19020 can set the output channel to CH1~CH10 while the 19020-4 can only set the channel to CH1~CH4. The message line on the test screen

will show "Module Fail" if set otherwise and the test is unable to start.

Insulation Resistance Test Mode (IR) (for Model 19020/19020-4/19022/19022-4)



VOLTAGE : It sets the voltage required for insulation resistance test.
LOW LIMIT : It sets the low limit of insulation resistance.
HIGH LIMIT : It sets the high limit of insulation resistance. The range is larger than the low limit of insulation resistance or OFF.
TEST TIME : It sets the time test required, 0 means continue test.
RAMP TIME : It sets the time required for ramping to the set voltage, 0 means OFF.
FALL TIME : It sets the time required for falling to low voltage from set, 0 means OFF.
RANGE : It sets the current test range for insulation resistance, AUTO means switching the range automatically. The table below lists the relationship between current range and resistance measurement range.

Range	IR Display	
	Set voltage to 50V~499V	**Set voltage to500V~1000V**
5mA(2.7~5mA)	0.1MΩ~2.4MΩ	0.1MΩ~7.7MΩ
3mA (0.27~3mA)	0.1MΩ~7.7MΩ	0.1MΩ~24.5MΩ
300uA(27~300uA)	0.1MΩ~24.5MΩ	0.1MΩ~49.9MΩ 50MΩ~245MΩ
30uA(2.7~30uA)	0.1MΩ~49.9MΩ 50MΩ~245MΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ
3uA(0.27~3uA)	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ
300nA(27~300nA)	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ 50GΩ~60GΩ
30nA(1~30nA)	----------	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ 50GΩ~60GΩ

Notice

To select an appropriate IR current range please calculate the current by test voltage and UUT's insulation impedance, and then select the proper current range. It will show UUUUU if the IR display exceeds 60GΩ.

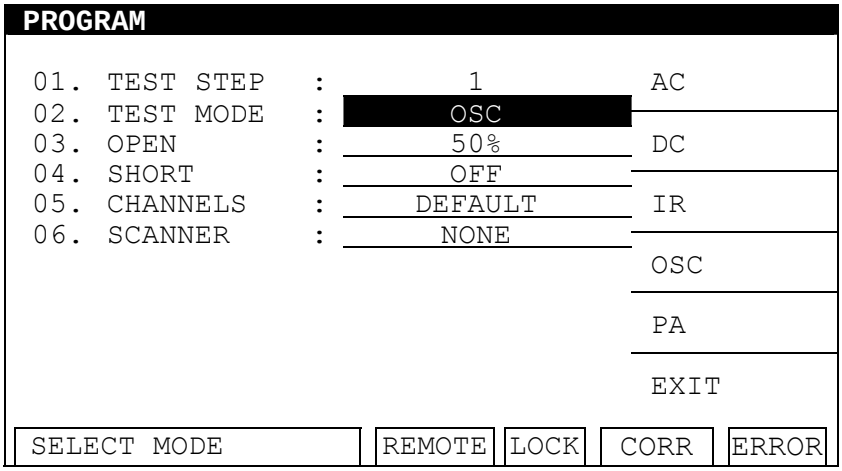
CHANNELS : It sets the high voltage channel for output. Select Function Key [DEFAULT] means to use the "DEF. CHANNELS" settings in "TEST CONTROL." Select Function Key [SETUP] means to reset the high voltage channel for output.

SCANNER : It sets the output mode of A190201/A190202 SCANNER. It can select [P→S], [P→C], [S→C], [P+S→C] and [P→S+C]. It is only valid when the LINK SETUP in the SYSTEM of 19020/19020-4 is set to SCANNER.

Notice

Please follow the model to set the output channel, for instance, the 19020 can set the output channel to CH1~CH10 while the 19020-4 can only set the channel to CH1~CH4. The message line on the test screen will show "Module Fail" if set otherwise and the test is unable to start.

Open/Short Check (OSC) Test Mode (for Model 19020/19020-4/19021/19022/19022-4)



OPEN : It sets the OPEN condition for test result judgment. (Compare it with the test reading and the read standard capacitance [Cs].)

SHORT : It sets the SHORT condition for test result judgment. (Compare it with the test reading and the read standard capacitance [Cs].)

CHANNELS : It sets the high voltage channel for output. Select Function Key [DEFAULT] means to use the "DEF. CHANNELS" settings in "TEST CONTROL." Select Function Key [SETUP] means to reset the high voltage channel for output.

SCANNER : It sets the output mode of A190201/A190202 SCANNER. It can select [P→S], [P→C], [S→C], [P+S→C] and [P→S+C]. It is only valid when the LINK SETUP in the SYSTEM of 19020/19020-4 is set to SCANNER.

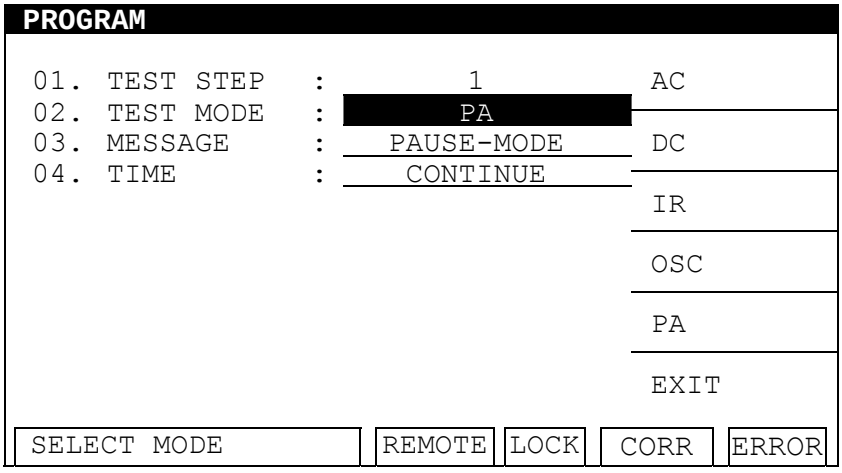
Notice

1. Before conducting the test or testing the new capacitance UUT or replacing the capacitance UUT in OSC Mode, the action of reading standard capacitance (GET Cs) has to be done first.
2. Before reading standard capacitance (GET Cs), press Function Key [OFFSET] first to conduct OFFSET. OFFSET needs to be done

every time the cable or fixture is changed to ensure the test accuracy.

3. When conducting tests in OSC Mode, the test condition for judging OPEN/SHORT is the reading of GET Cs.
4. Please follow the model to set the output channel, for instance, the 19020 can set the output channel to CH1~CH10 while the 19020-4 can only set the channel to CH1~CH4. The message line on the test screen will show "Module Fail" if set otherwise and the test is unable to start.

Pause Mode (PA) (for Model 19020/19020-4/19021/19022/19022-4)

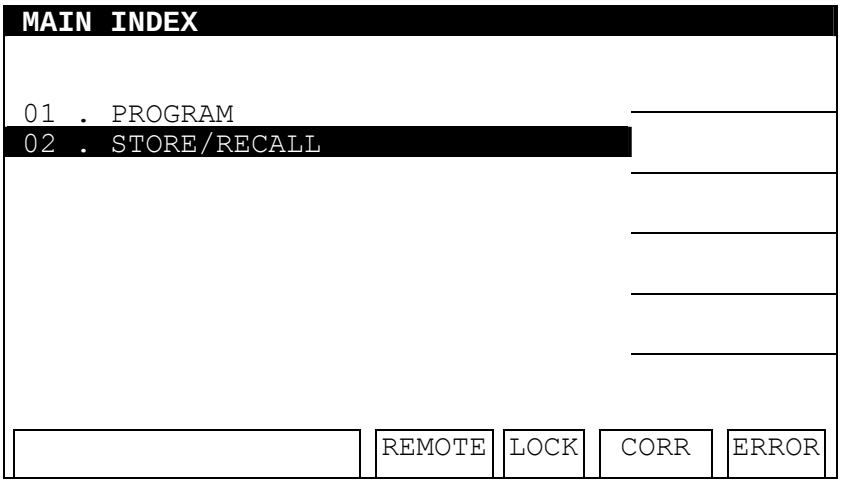


MESSAGE : It sets the message for pause screen, maximum 13 characters for input.
TIME : It sets the action of PAUSE MODE.
(1) CONTINUE : The pause mode only ends when **START** on the panel is pressed or START signal on the HANDLER card is triggered again.
(2) 0.1~999.9sec : The pause mode ends when it reaches the time set.

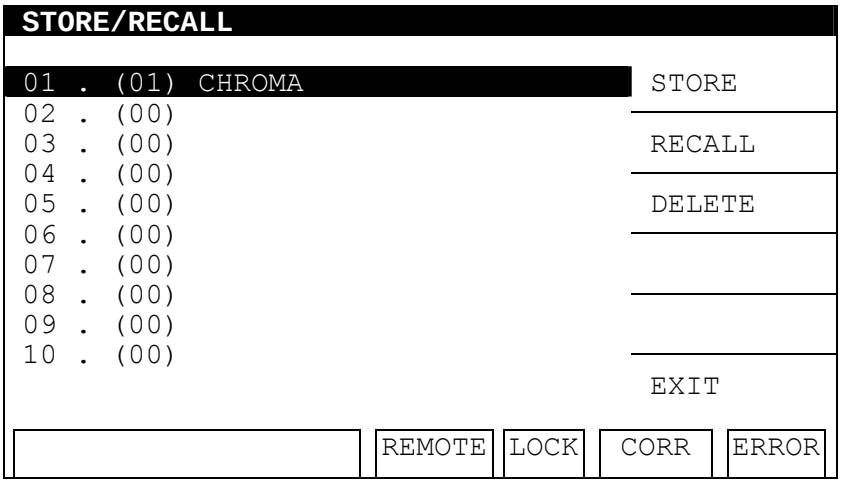
4.6 Managing Memory for Programs

4.6.1 Entering Memory Screen

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



2. When “MAIN INDEX” shows on the title bar, press ▲, ▼ to move the highlight to [STORE/RECALL] and press **ENTER** to go to the setting screen as shown below:

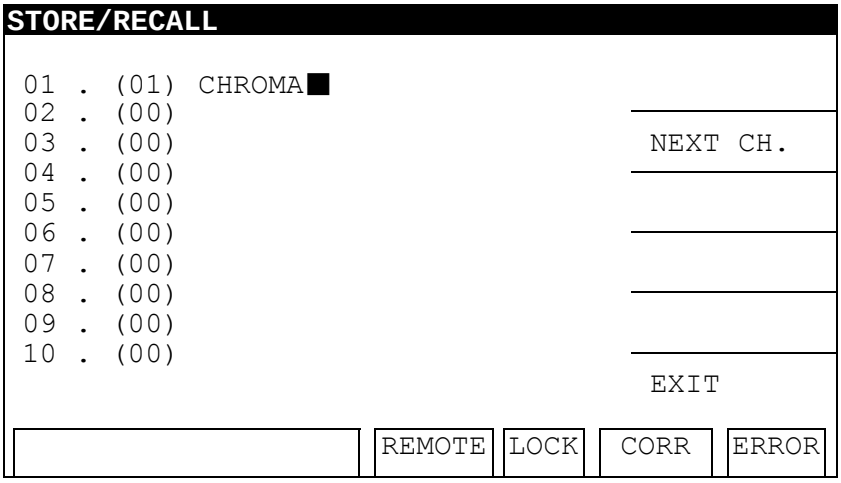


3. Use ▲, ▼ to move the highlight to the memory to be processed and follow the instruction of Function Key to read, save or erase that memory.
4. The number in parentheses means the test steps contained in the memory.

4.6.2 Saving Memory

Follow the steps below to save the set program data to memory:

1. Use ▲, ▼ to move the highlight to the memory to be saved and press Function Key [STORE].



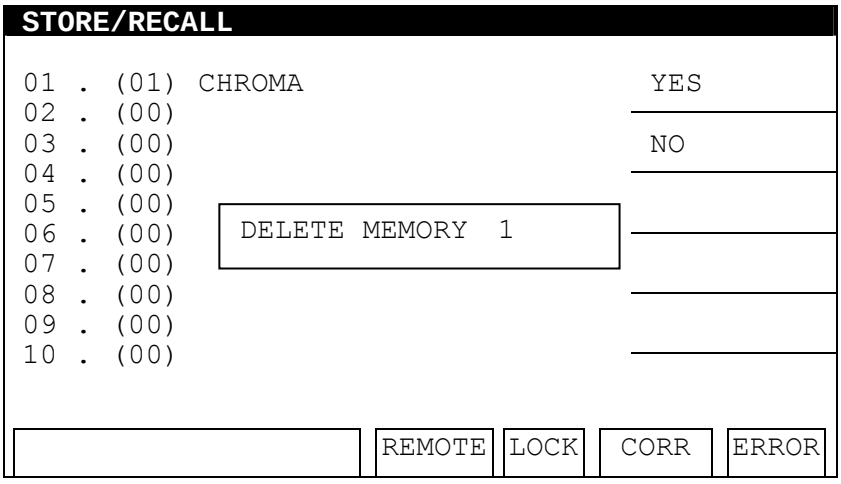
2. Use 1 2 3 4 4 5 6 7 8 9 0 to select the character for entering the memory name. Then use the numeric/character keys to enter the memory name. Press one numeric/character key repeatedly can switch the number and English letter display in cycle. Pressing Function Key [NEXT CHAR] to move the cursor to the next character position can use the same number/character key to enter the name in sequence.
3. Press ENTER, a confirmation dialog box will appear for save.
4. Press Function Key [YES] to confirm it or press Function Key [NO] to cancel it.

Notice If there is data in the memory, it will be overwritten when save. Make sure it is ok to do so before save.

4.6.3 Deleting Memory

Follow the steps below to delete the programs from memory:

1. Use ▲, ▼ to move the highlight to the memory to be deleted and press Function Key [DELETE].

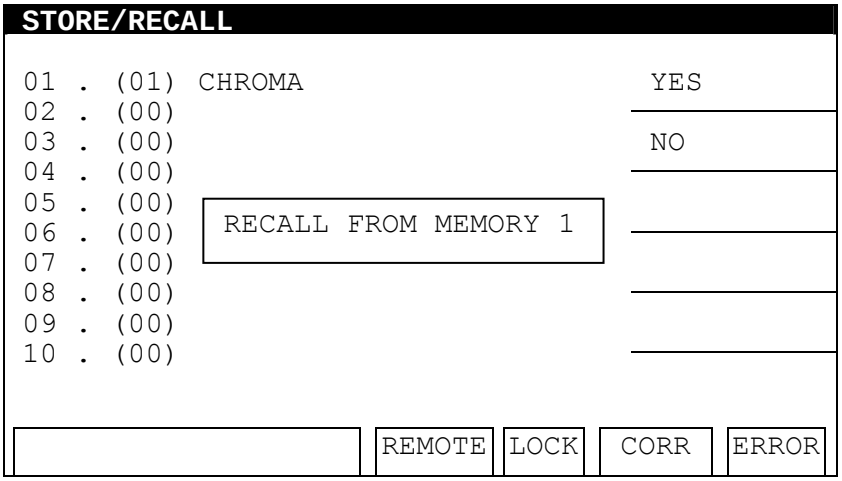


2. A delete confirmation dialog box is prompted. Press Function Key [YES] to confirm it or press Function Key [NO] to cancel it.

4.6.4 Recalling Memory

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

1. Use ▲, ▼ to move the highlight to memory to be recalled and press Function Key [RECALL].

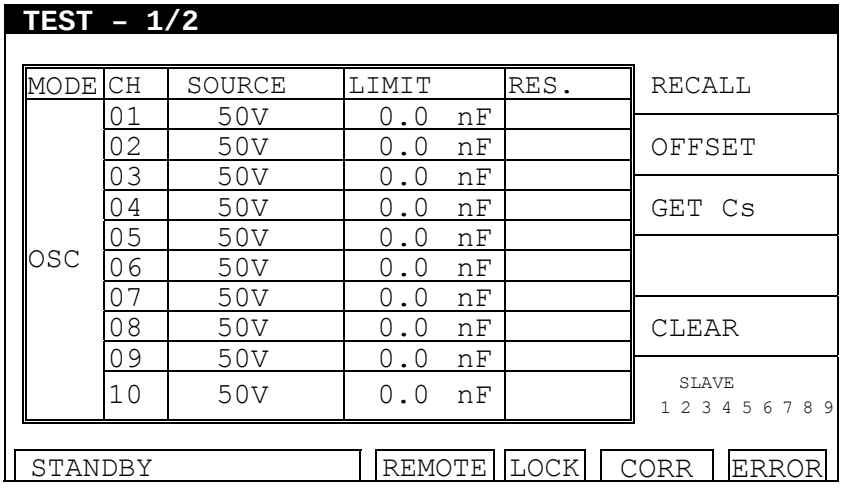


2. A recall confirmation dialog box is prompted. Press Function Key [YES] to confirm it or press Function Key [NO] to cancel it.

4.7 Using OFFSET or GET Cs

4.7.1 How to Get in OFFSET or GET Cs Screen

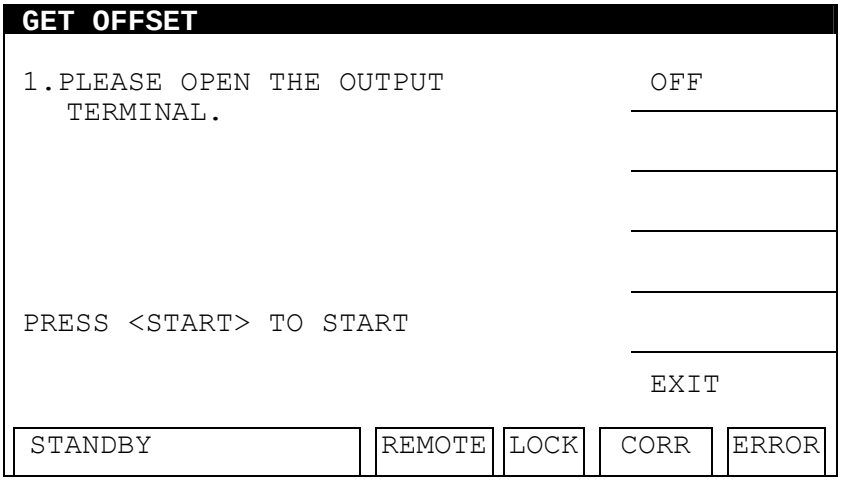
1. Select OFFSET or GET Cs operation in TEST screen as shown below:



2. Press Function Keys [OFFSET] or [GET Cs] to select the desired function. If these two keys are grayed out, it means they are invalid here.

4.7.2 Using GET OFFSET

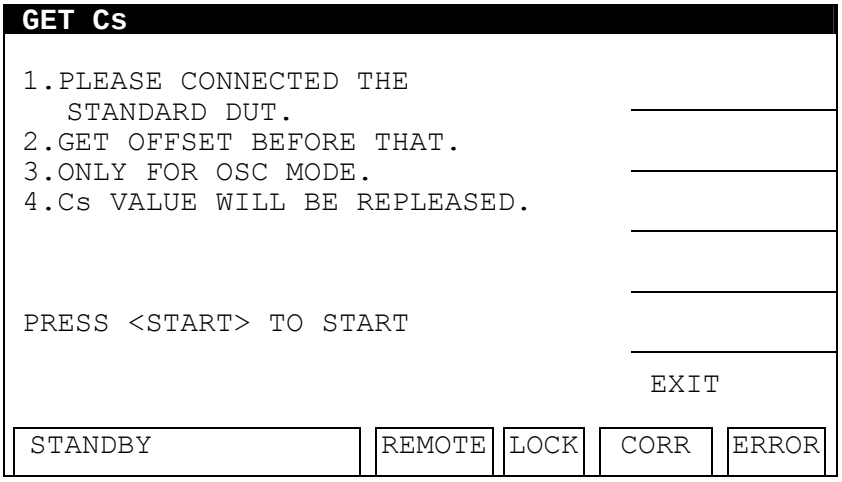
1. Press Function Key [OFFSET] in TEST screen to go to GET OFFSET screen as shown below:



2. GET OFFSET is to offset the leakage current of AC / DC / IR MODE test leads and fixture as well as the stray capacitance of OSC MODE.
3. Remove the UUT from fixture and press **START** to offset the leakage current or leakage capacitance.
4. The message box [CORR] will be reserved when the test time ends.
5. Press Function Keys [OFF] can cancel OFFSET.

4.7.3 Using GET Cs

1. Press Function Key [GET Cs] in TEST screen to go to GET Cs screen as shown below:



2. Use the standard sample under capacitance test as the UUT and connect it to the 1st channel opened by OSC (this CHANNEL has to be the Master CHANNEL). Press **START** to get the standard capacitance (GET Cs).

4.8 Conducting the Test

4.8.1 Connecting the UUT

First ensure there is no voltage output and the DANGER LED is off. Connect the low potential test cable (black) to the Tester RTN/LOW terminal. Short-circuit the test cable and high voltage output terminal and ensure there is no high voltage output. Next, plug in the high voltage test cable (red or white) to high voltage output terminal. Then connect the low potential test cable to UUT and the high potential test cable to UUT.

4.8.2 Procedure for AC/DC Test

1. Connect the UUT properly following the connection method.
2. In the power on screen shown below:

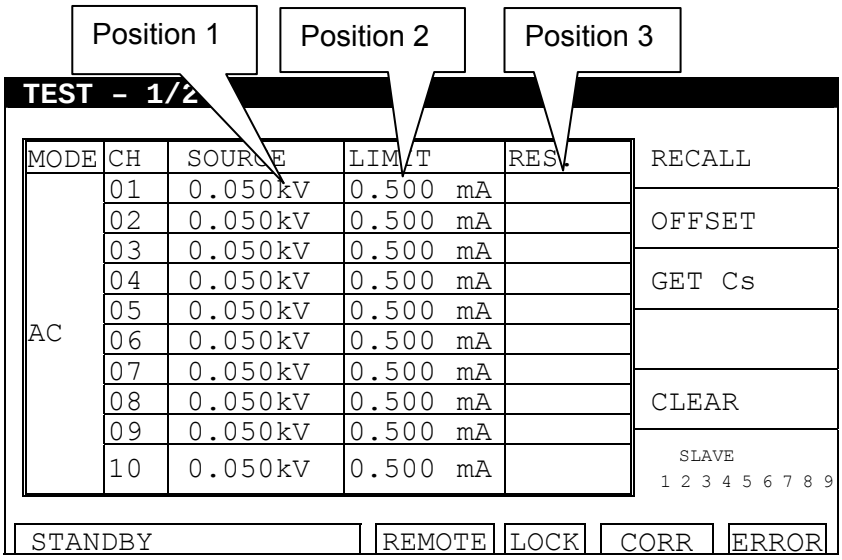


Illustration:
TEST 1/2 means there are 2 test steps and it is running the 1st test step at present. AC indicates the test mode. “Position 1” indicates the set voltage, “Position 2” is the high limit set for current, while “Position 3” is the test result.

3. Press **STOP** to prepare for test. The status line shows “STANDBY”.

4. Press **START** to activate the test
When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows a counter to count down. “Position 1” will show the output voltage value, “Position 2” will show the current readings and “Position 3” will show the test result.

5. GOOD Judgment
When all tests are done and the results show PASS, the Tester will see the UUT as a GOOD product and cutoff the output. The HANDLER interface outputs PASS signal and the beeper acts at the same time.

6. NO GOOD Judgment
   If the test value is abnormal, the Tester judges it as FAIL and cutoff the output immediately. The HANDLER outputs FAIL signal and the beeper acts at the same time until the **STOP** key on the Tester is pressed. The test result will show FAIL state.

   FAIL State:

Test Result Display	Meaning
FAIL	The current measured exceeds the range or the set high/low limit.
ARC	The ARC measured exceeds the set high limit.

   To stop test output in any condition, just press **STOP**.

4.8.3 Procedure for IR Test

1. Connect the UUT properly following the connection method.
2. In the power on screen shown below:

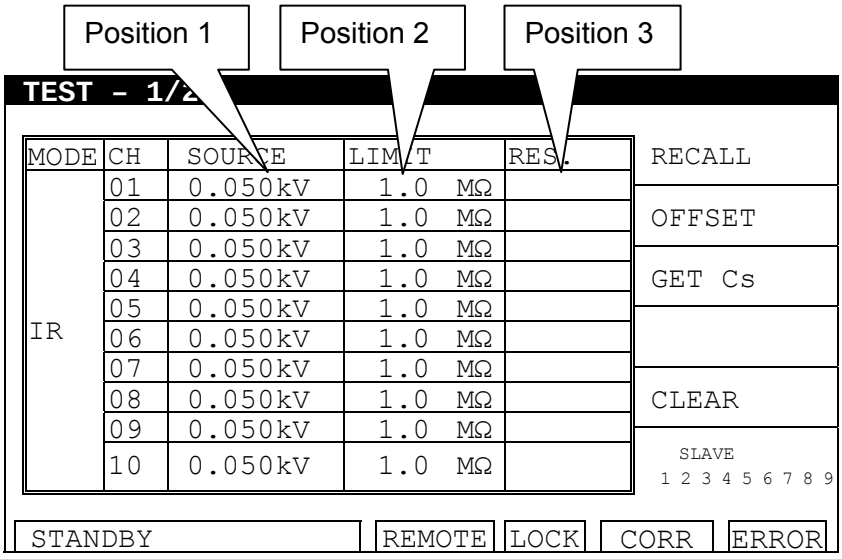


   Illustration:
   TEST 1/2 means there are 2 test steps and it is running the 1st test step at present. IR indicates the test mode. "Position 1" indicates the set voltage, "Position 2" is the low limit set for insulation impedance, while "Position 3" is the test result.

3. Press **STOP** to prepare for test. The status line shows "STANDBY".

4. Press **START** to activate the test
   When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows a counter to count down. "Position 1" will show the output voltage value, "Position 2" will show the current readings and "Position 3" will show the test result.

5. GOOD Judgment
   When all tests are done and the results show PASS, the Tester will see the UUT as a GOOD product and cutoff the output. The HANDLER interface outputs PASS signal and the beeper acts at the same time.

6. NO GOOD Judgment
   If the test value is abnormal, the Tester judges it as FAIL and cutoff the output immediately. The HANDLER outputs FAIL signal and the beeper acts at the same time until the **STOP** key on the Tester is pressed. The test result will show FAIL state.

   FAIL State:

Test Result Display	Meaning
FAIL	The resistance measured exceeds the range or the set high/low limit.

   To stop test output in any condition, just press **STOP**.

4.8.4 Procedure for OSC Test

1. Connect the UUT properly following the connection method.
2. In the power on screen shown below:

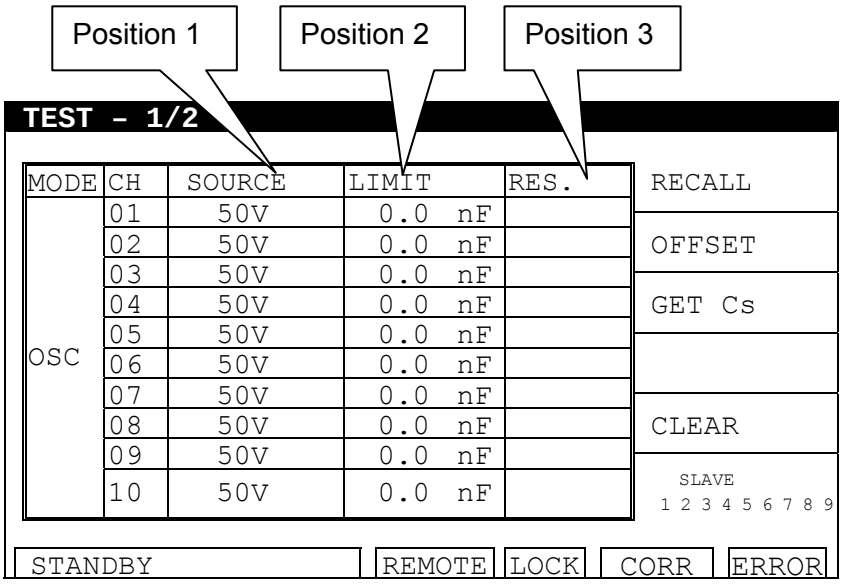


   Illustration:
   OSC means it is in Open Short Check mode. “Position 1” is the setting voltage and “Position 2” is the standard capacitance (Cs) while “Position 3” shows the test result.

3. Press **STOP** to prepare for test. The status line shows “STANDBY”.

4. Press **START** to activate the test
   When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows a counter to count down. “Position 1” will show the output voltage value, “Position 2” will show the current readings and “Position 3” will show the test result.

5. GOOD Judgment
   When all tests are done and the results show PASS, the Tester will see the UUT as a GOOD product and cutoff the output. The HANDLER interface outputs PASS signal and the beeper acts at the same time.

6. NO GOOD Judgment
   If the test value is abnormal, the Tester judges it as FAIL and cutoff the output immediately. The HANDLER outputs FAIL signal and the beeper acts at the same time until the **STOP** key on the Tester is pressed. The test result will show FAIL state.

   FAIL State:

Test Result Display	Meaning
FAIL	The Open/Short Capacitance reading exceeds the OPEN/ SHORT setting.

   To stop test output in any condition, just press **STOP**.

Notice

1. Every time the cable or fixture is changed for OSC, be sure to run OFFFSET in advance to ensure the test accuracy.
2. It is necessary to run GET Cs when testing a new UUT or replacing a UUT for OSC test. Read the standard capacitance from the test sample as the standard value.
3. For using OSC GET CS, see section *4.7.3* for detail information.

4.8.5 Test Procedure for PA Test

1. Connect the UUT properly following the connection method.
2. In the power on screen shown below:

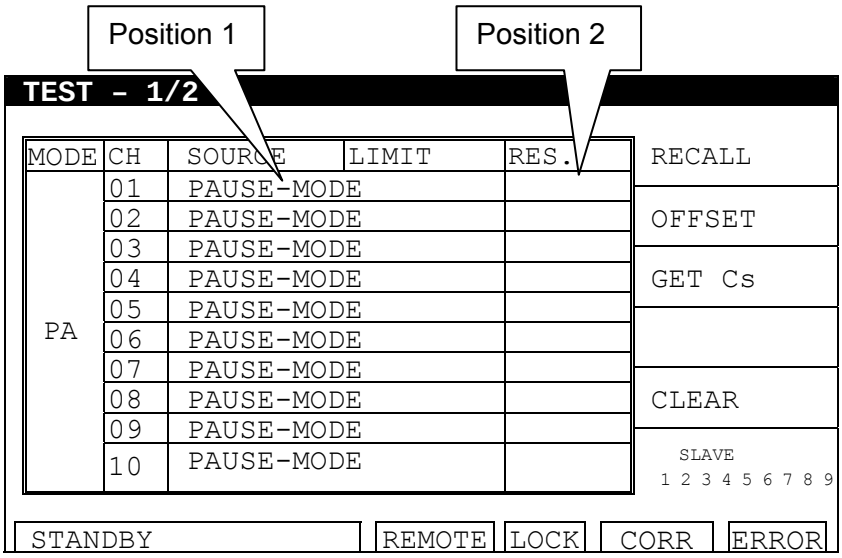


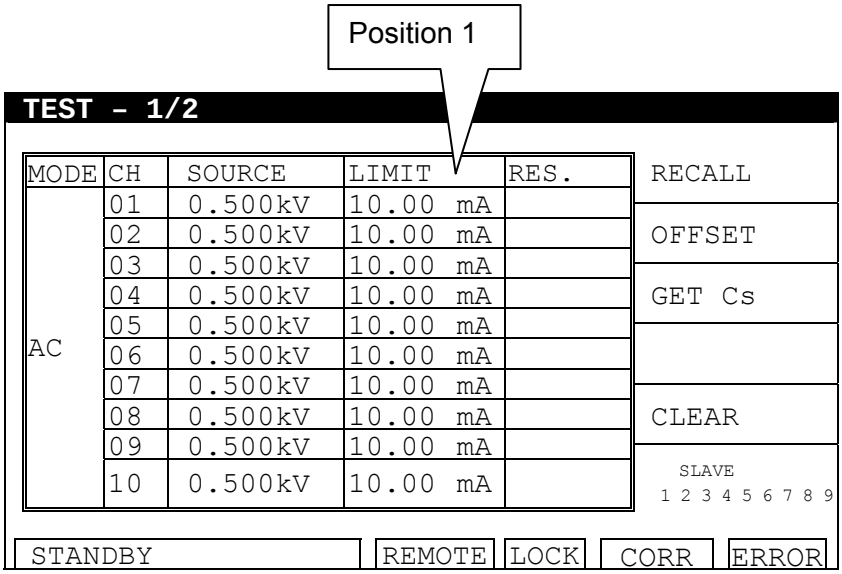
   Illustration:
   PA means it is in pause mode. "Position 1" is the message set to display and "Position 2" is the test result.

3. Press **STOP** to prepare for test. The status line shows "STANDBY".

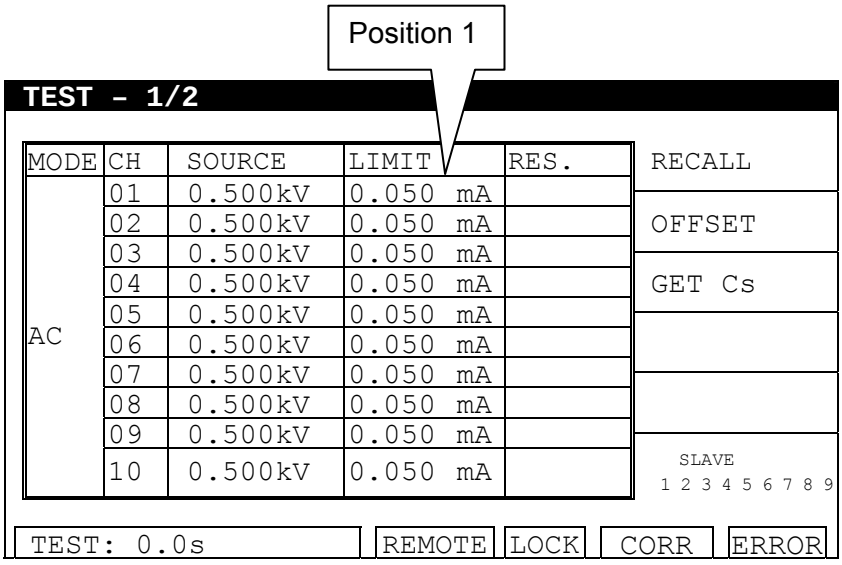
4. Press **START** to activate the test
   When this key is pressed it starts PA MODE. If action time is set for PA MODE, the status line will show a counter to count down. If the test time is set to CONTINUE, the status line will show PAUSE and wait for the input of START signal to end PA MODE.

4.8.6 Auto Range

1. Set **Auto Range** to **ON**.
2. As Position 1 shows in the figure below setting it to high current range.



3. If the tested current can be displayed by low current range 0.6 seconds before the test ends, the current range will change the range to low current range automatically as Position 1 shows in the figure below.

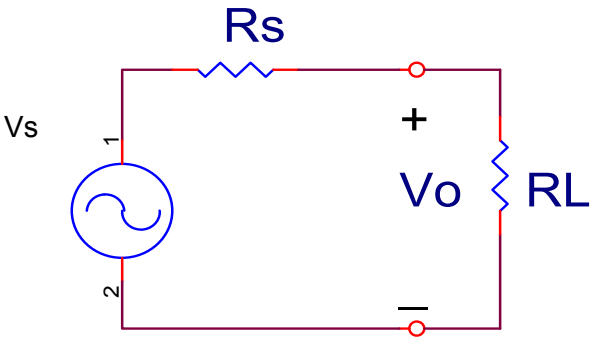


4.8.7 Hardware/Software AGC

AGC function is used due to load effect (the output voltage changes when the Load changes.)

ACV : H/W AGC always ON, S/W AGC default is ON but can be set to OFF.
DCV : H/W AGC always ON, S/W AGC default is ON but can be set to OFF.
IR : No H/W AGC, S/W AGC is ON but can be set to OFF.
OSC : No H/W AGC, S/W AGC is OFF.

Notice When the ACV/DCV test time is less than 0.29 second, the H/W AGC is OFF.



Vo / Vs = RL / (Rs + RL)

1. H/W AGC: Since the load effect caused Vo<Vs, the hardware comparator circuit is used to make Vo compensate voltage to be the same as within Vs within 0.1sec.
2. S/W AGC: This tester uses software AGC only in IR MODE. Since the software compensation is slow, it would not cause transient voltage shock to DUT and the common IR impedance (RL) is much larger than the output impedance (Rs) of this tester, thus Vo≒Vs.

5. HANDLER Interface

5.1 Introduction

The HANDLER interface socket can be purchased for the Tester rear panel. When it is desired to control the Tester output via external signal or to send the signal outside, the HANDLER card can be inserted for external control.

5.2 Specification

5.2.1 Driving Capability

Internal Signal Output Specification: DC 5V, 40~60mA
External Signal Output Specification: DC 3V~26V (HIGH), 10mA± 4mA, current limit is 10mA± 4mA for every circuit.

5.2.2 Pin Assignment

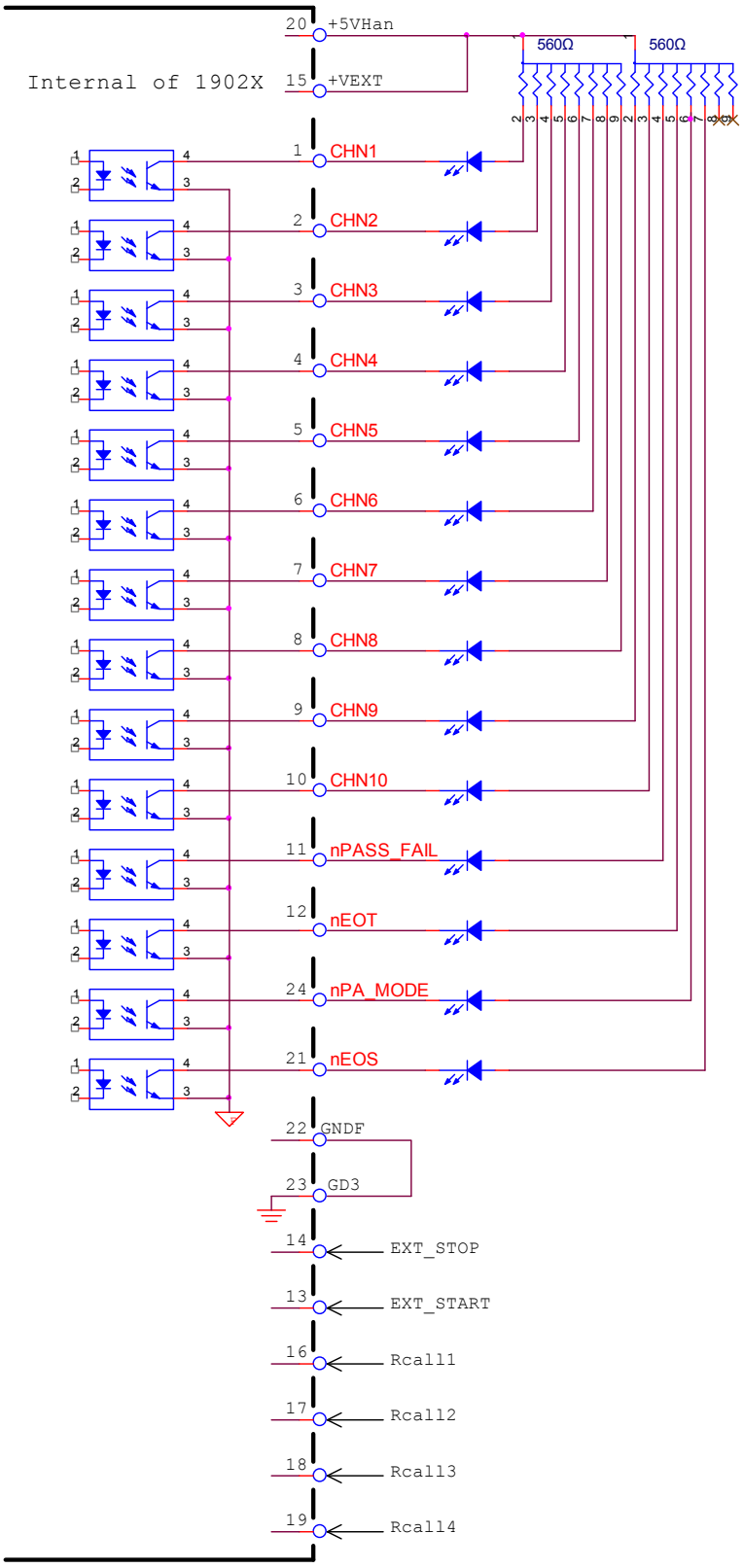
The each pin assignment of HANDLER is listed in the table below:

Pin No.	Signal	Input/Output	Description
1	CHN1	Output	The output signals of CHN1~10 indicate the test results of CH1~10. Lo: PASS, Hi: FAIL.
2	CHN2		
3	CHN3		
4	CHN4		
5	CHN5		
6	CHN6		
7	CHN7		
8	CHN8		
9	CHN9		
10	CHN10		
11	PASS_FAIL	Output	The output signal of PASS_FAIL indicates the test result of all channels when each Step ends. Lo: TOTAL PASS, Hi: TOTAL FAIL.
12	nEOT	Output	The output signal of nEOT shows if the test procedure is ended. When the signal is HIGH, it means the test procedure is under execution. When the signal is LOW, it means the test procedure has been ended or the tester is standby.
13	nEXT_START	Input	It is the external START signal input that starts when LOW.
14	nEXT_STOP	Input	It is the external STOP signal input that stops when LOW.

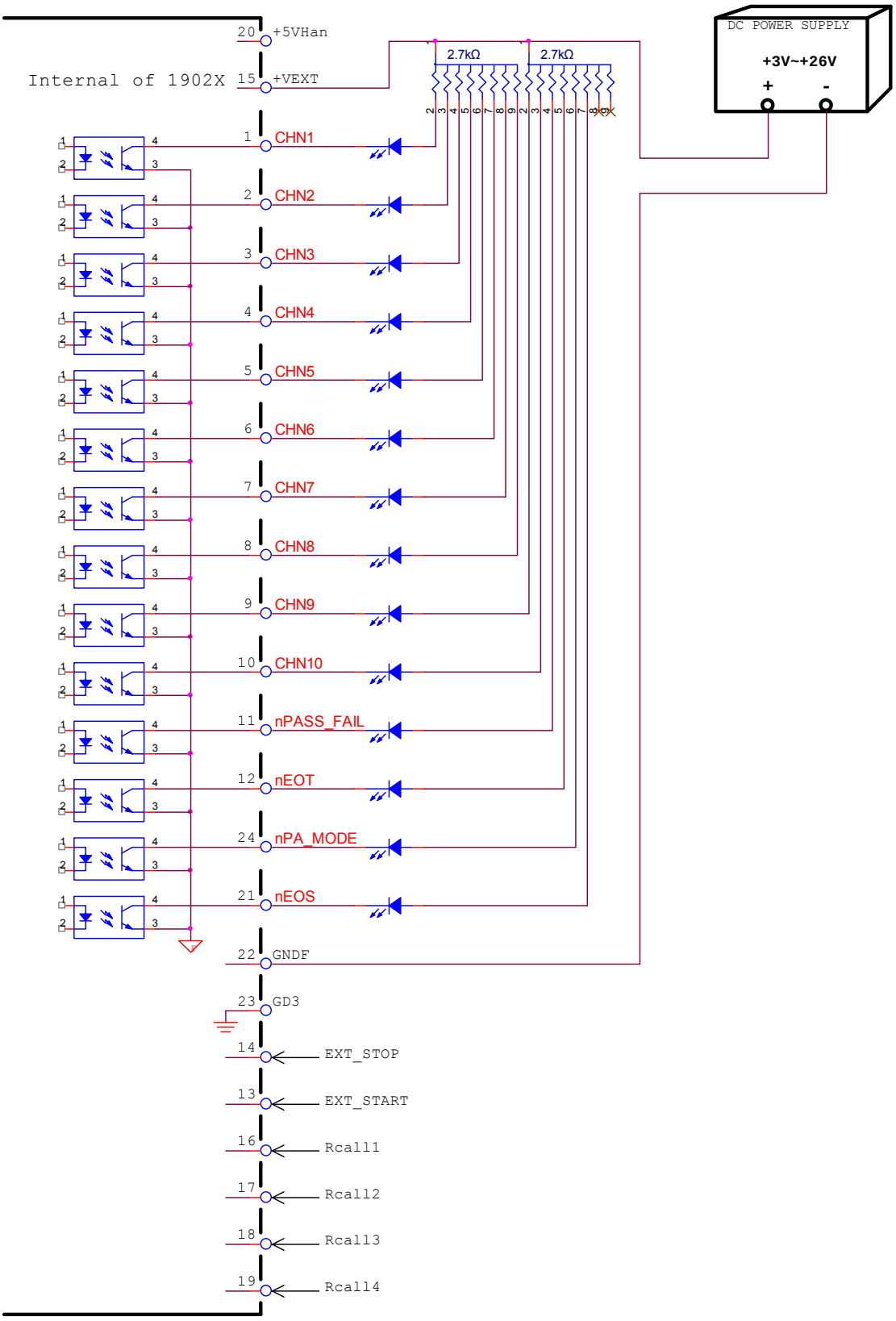
15	+VEXT	—	It is the external DC voltage input. The input voltage range is between +3V~+26V.
16	nRecall1	Input	nRecall1~nRecall3 signals indicate the memory position to be read. It uses 3 bits to present 7 test steps. The input format is binary code (001~011) (nRecall1 is the low bit, while nRecall3 is the high bit.) 001 means to recall memory 1 111 means to recall memory 7 nRecall4 signal is the switch for reading memory. When nRecall4 inputs a LOW level signal, the memory data can be retrieved.
17	nRecall2		
18	nRecall3		
19	nRecall4		
20	+5VHan	—	It is the internal DC voltage output.
21	nEOS	Output	The output signal of nEOS indicates if the test is ended. When the signal is HIGH, it means the test is undergoing. When the signal is LOW, it means the test is ended or standby.
22	GNDF	—	It is the external DC voltage input and the low voltage terminal for input/output signal.
23	GD3	—	It is the low voltage terminal for internal voltage output.
24	nPA_MODE	Output	This signal will change once when running PA Mode.

5.3 Example of External Control Circuit

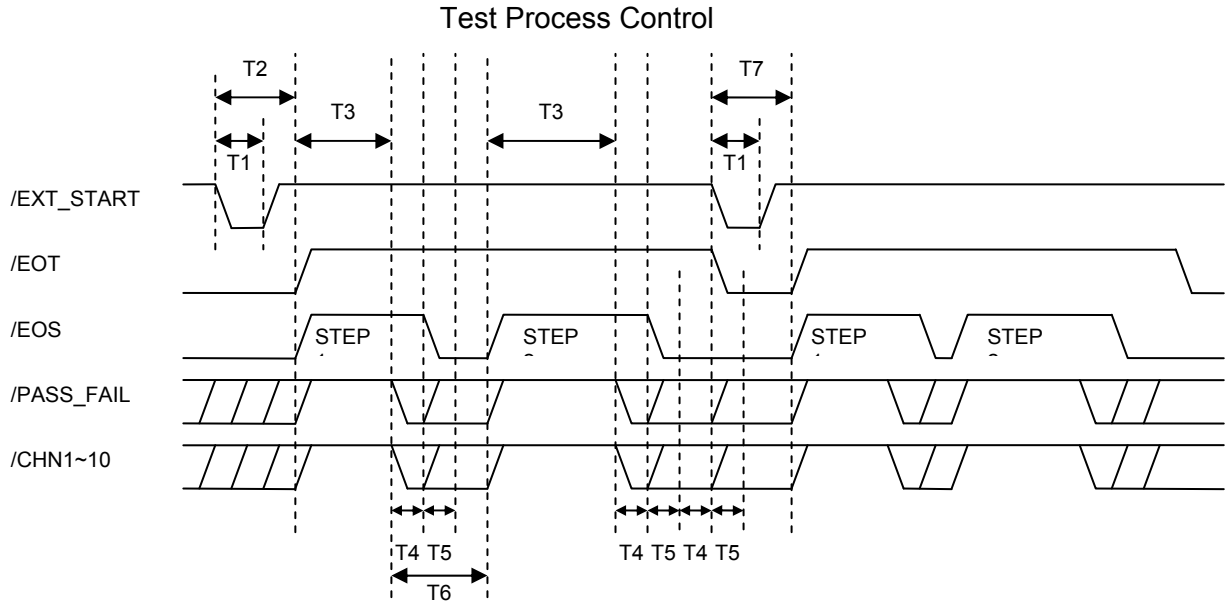
5.3.1 Example of Using Internal Power Supply



5.3.2 Example of Using External Power Supply



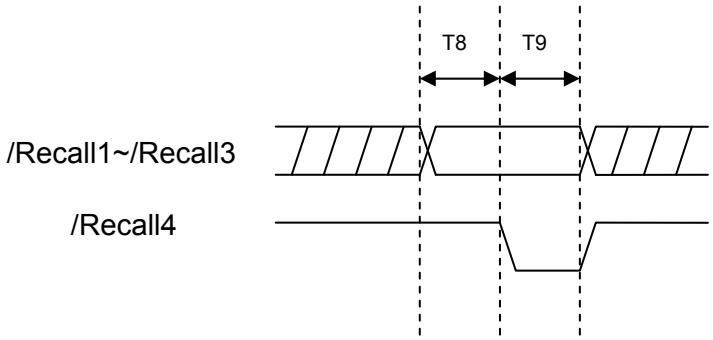
5.4 Timing Diagram



Time	Limit	Description
T1	> 10mS	It sets the time required for external trigger signal (/EXT_START) to sustain.
T2	< 20mS	It sets the time for clear from external trigger signal (/EXT_START) to /EOT signal.
T3	-	It sets the time required for test.
T4	> 5mS	It sets the waiting time for /PASS_FAIL signal to be stable.
T5	> 5mS	It sets the waiting time for /EOT and /EOS signals to be stable.
T6	**Note**	It is the time spent to switch step.
T7	**Note**	It is the time spent for starting 2nd test.

Note The value is varied by conditions. For instance, the T6 under the condition of Screen On is about 320mS and under the condition of Screen Off is about 40mS, while the T7 under the condition of Screen On is about 280mS and under the condition of Screen Off is about 60mS. (The values mentioned here are estimated, the exact values shall base on the actual measurement.)

Control for Recalling Saved Parameter



Time	Limit	Description
T8	> 5mS	It sets the time for /Recall1~/Recall3 signal to sustain.
T9	> 5mS	It sets the time for /Recall4 signal to sustain.

6. GPIB/RS232 Interface (IEEE-488.2)

6.1 Introduction

The Tester can be controlled remotely by PC for data transmission through RS232 or GPIB (IEEE 488-1978) interface.

6.2 GPIB Interface (Option)

6.2.1 Applied Standard

The tester applies the IEEE488-1978 standard.

6.2.2 Interface Capability

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

6.2.3 Interface Message

The table below lists the Tester's reaction to the following interface messages:

Interface Message	Meaning	Reaction
GTL	Go To Local	It switches the Tester to Local mode.
SDC	Selected Device Clear	It clears the selected device.
LLO	Local Lockout	It is prohibited to use **ENTER** to switch to Local mode.
IFC	Interface Clear	It clears the GPIB interface.

6.2.4 Command Format

The function of GPIB interface is to input the ASCII code composed commands in order to do remote control and setting. The command string is formed by [command+parameter]. Semicolon ";" can be used to connect any two commands with end code at last. The End Code is in one of the following formats which can be identified by the Tester itself:

End Code

LF
CR＋LF
EOI
LF＋EOI
CR＋LF＋EOI

6.2.5 Panel Description

1. **Setting Address**
   - When "SYSTEM" appears on the title bar, press ▲, ▼ to move the highlight to [SYSTEM CONFIG] and press **ENTER** to go to SYSTEM CONFIG screen.
   - Press ▲, ▼ again to move the highlight to [GPIB] and use the Function Keys [UP] and [DOWN] to select the GPIB Address.
   - When the setting is done, press Function Key [EXIT] to end the setting.

2. **Remote & Panel Control**
   - When the message box "Remote" is reversed it indicates the Tester is in remote control state.
   - When in remote control state, it can use the **ENTER** key on panel to switch the Tester to panel control state.
   - When in remote control state, all keys are invalid except **ENTER** (switch to panel control state) and **STOP** (reset the Tester) keys.
   - The GPIB LLO [Local Lockout] command can be used to make **ENTER** key invalid.

6.3 RS232 Specification

6.3.1 Data Format

Baud Rate: 9600⁄19200⁄38400
Transmission Bit: 1 start bit + 8 data bits + 1 stop bit

6.3.2 Command Format

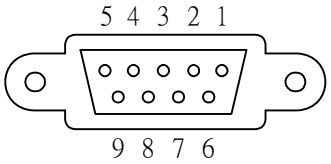
The function of RS232 interface is to input the ASCII code composed commands in order to do remote control and setting. The command string is formed by [command+parameter]. Semicolon ";" can be used to connect any two commands with end code at last. The End Code one of the following formats:

End Code

LF
CR＋LF

6.3.3 Connector

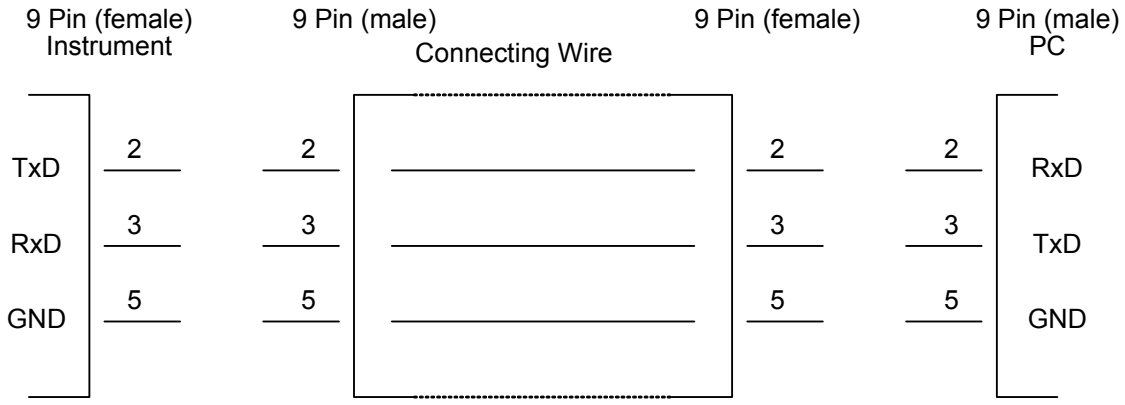
The RS232 connector of the Tester is a female 9-pin connector.



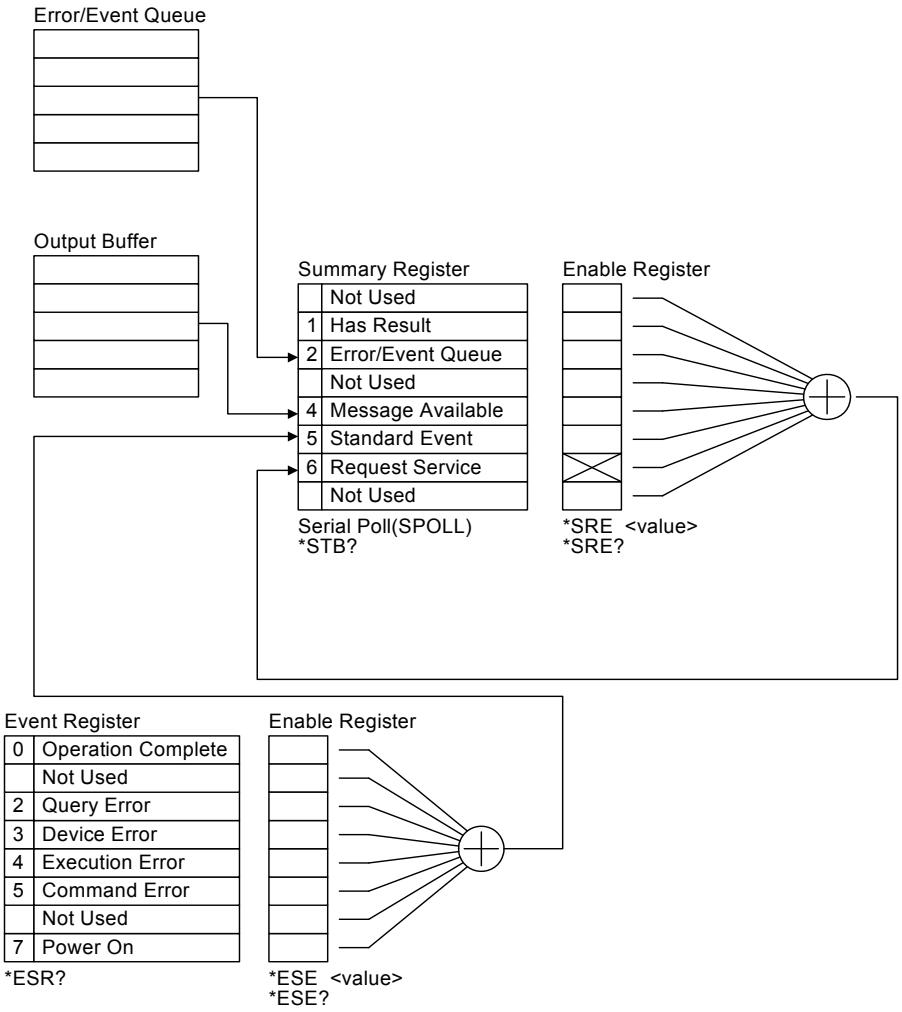
Pin No.		Description
1	*	Unused
2	TxD	Sending data
3	RxD	Receiving data
4	*	Unused
5	GND	Grounding signal
6	*	Unused
7	*	Unused
8	*	Unused
9	*	Unused

6.3.4 Connection

The RS232 connector of the Tester is a female 9-pin connector.



6.4 Structure of Remote Interface



6.5 Commands for Remote Interface

6.5.1 Commands Summary

- **IEEE 488.2 Command**

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

```
*SRE?
*STB?
```

The parameter syntax of SCPI command includes:
(1) Use “< >” to indicate the defined parameter format of standard SCPI command.
(2) “< numeric value >” is a decimal data while “< boolean >” is Boolean program data with value 0 or 1.
(3) Use vertical bar “|” to indicate parameter OR.
(4) “< channel list >” indicates the Channel status and expression is: (@C1, C2…) where C1, C2… indicates Channel number. The format of this model’s Channel number is 3 digits, the first digit is Frame index and the last two seconds are Channel index, for example, the Channel number of Master (Frame 0) Channel 4 (04) is 004.

- **SCPI Command**

```
:MEMory
|   :DELete
|   |   [:NAME] <name>
|   |   :LOCation <register number>
|   :STATe
|   |   :DEFine <name>,<register number>
|   |   :DEFine? <name>
|   :FREE
|   |   :STATe?
|   :NSTates?
[:SOURce]
|   :SAFety
|   |   [:CHANnel]<n>
|   |   |   :FETCh? [<item>][,<item>]
|   |   |   :RESult
|   |   |   |   :ALL
|   |   |   |   |   [:JUDGment]?
|   |   |   |   |   :MMETerage?
|   |   |   |   |   :MODE?
|   |   |   |   |   :OMETerage?
|   |   |   |   |   :TIME
|   |   |   |   |   |   [:ELAPsed]
|   |   |   |   |   |   |   :DWELl?
|   |   |   |   |   |   |   :FALL?
|   |   |   |   |   |   |   :RAMP?
|   |   |   |   |   |   |   [:TEST]?
|   |   |   |   :AREPort <boolean> | ON | OFF    (RS232 only)
|   |   |   |   :AREPort?                         (RS232 only)
|   |   |   |   :COMPleted?
|   |   |   |   :STEP<n>
|   |   |   |   |   [:JUDGment]?
|   |   |   |   |   :MMETerage?
|   |   |   |   |   :OMETerage?
|   |   |   |   |   :TIME
|   |   |   |   |   |   [:ELAPsed]
|   |   |   |   |   |   |   :DWELl?
|   |   |   |   |   |   |   :FALL?
|   |   |   |   |   |   |   :RAMP?
|   |   |   |   |   |   |   [:TEST]?
|   |   :FRAMe<f>
|   |   |   :RESult
|   |   |   |   :STEP<n>
|   |   |   |   |   [:JUDGment]?
```

```
|   |   |   |   |   :MMETerage?
|   |   |   |   |   :OMETerage?
|   |   |   |   |   :TIME
|   |   |   |   |   |   [:ELAPsed]
|   |   |   |   |   |   |   :DWELl?
|   |   |   |   |   |   |   :FALL?
|   |   |   |   |   |   |   :RAMP?
|   |   |   |   |   |   |   [:TEST]?
|   |   |   :STARt
|   |   |   |   [:ONCE]
|   |   |   |   :CORRection
|   |   |   |   |   :OPEN GET | OFF
|   |   |   |   |   :OPEN?
|   |   |   |   |   :SAMPle GET
|   |   |   |   |   :SAMPle?
|   |   |   :STATus?
|   |   |   :STEP<n>
|   |   |   |   :AC
|   |   |   |   |   :CHANnel
|   |   |   |   |   |   [:CLOSe] <channel list>
|   |   |   |   |   |   [:CLOSe]?
|   |   |   |   |   |   :DEFault
|   |   |   |   |   |   |   :ON
|   |   |   |   |   |   |   :STATe?
|   |   |   |   |   |   :PSC  P | S | PS, S | C | SC
|   |   |   |   |   |   :PSC?
|   |   |   |   |   [:LEVel] <number value>
|   |   |   |   |   [:LEVel]?
|   |   |   |   |   :LIMit
|   |   |   |   |   |   :ARC <number value>
|   |   |   |   |   |   :ARC?
|   |   |   |   |   |   [:HIGH] <number value>
|   |   |   |   |   |   [:HIGH]?
|   |   |   |   |   |   :LOW <number value>
|   |   |   |   |   |   :LOW?
|   |   |   |   |   :TIME
|   |   |   |   |   |   :FALL <number value>
|   |   |   |   |   |   :FALL?
|   |   |   |   |   |   :RAMP <number value>
|   |   |   |   |   |   :RAMP?
|   |   |   |   |   |   [:TEST] <number value>
|   |   |   |   |   |   [:TEST]?
|   |   |   |   :DC
|   |   |   |   |   :CHANnel
|   |   |   |   |   |   [:CLOSe] <channel list>
|   |   |   |   |   |   [:CLOSe]?
|   |   |   |   |   |   :DEFault
|   |   |   |   |   |   |   :ON
|   |   |   |   |   |   |   :STATe?
|   |   |   |   |   |   :PSC  P | S | PS, S | C | SC
|   |   |   |   |   |   :PSC?
|   |   |   |   |   [:LEVel] <number value>
|   |   |   |   |   [:LEVel]?
|   |   |   |   |   :LIMit
|   |   |   |   |   |   :ARC <number value>
|   |   |   |   |   |   :ARC?
|   |   |   |   |   |   [:HIGH] <number value>
|   |   |   |   |   |   [:HIGH]?
|   |   |   |   |   |   :LOW <number value>
|   |   |   |   |   |   :LOW?
```

```
|   |   |   |   :TIME
|   |   |   |   |   :DWELl <number value>
|   |   |   |   |   :DWELl?
|   |   |   |   |   :FALL <number value>
|   |   |   |   |   :FALL?
|   |   |   |   |   :RAMP <number value>
|   |   |   |   |   :RAMP?
|   |   |   |   |   [:TEST] <number value>
|   |   |   |   |   [:TEST]?
|   |   |   :DELete
|   |   |   :IR
|   |   |   |   :CHANnel
|   |   |   |   |   [:CLOSe] <channel list>
|   |   |   |   |   [:CLOSe]?
|   |   |   |   |   :DEFault
|   |   |   |   |   |   :ON
|   |   |   |   |   |   :STATe?
|   |   |   |   |   :PSC  P | S | PS, S | C | SC
|   |   |   |   |   :PSC?
|   |   |   |   [:LEVel] <number value>
|   |   |   |   [:LEVel]?
|   |   |   |   :LIMit
|   |   |   |   |   :HIGH <number value>
|   |   |   |   |   :HIGH?
|   |   |   |   |   [:LOW] <number value>
|   |   |   |   |   [:LOW]?
|   |   |   |   :RANGe
|   |   |   |   |   :UPPer <number value>
|   |   |   |   |   :UPPer?
|   |   |   |   |   [:LOWer] <number value>
|   |   |   |   |   [:LOWer]?
|   |   |   |   |   :AUTO <boolean> | ON | OFF
|   |   |   |   |   :AUTO?
|   |   |   |   :TIME
|   |   |   |   |   :FALL <number value>
|   |   |   |   |   :FALL?
|   |   |   |   |   :RAMP <number value>
|   |   |   |   |   :RAMP?
|   |   |   |   |   [:TEST] <number value>
|   |   |   |   |   [:TEST]?
|   |   |   :OSC
|   |   |   |   :CHANnel
|   |   |   |   |   [:CLOSe] <channel list>
|   |   |   |   |   [:CLOSe]?
|   |   |   |   |   :DEFault
|   |   |   |   |   |   :ON
|   |   |   |   |   |   :STATe?
|   |   |   |   |   :PSC  P | S | PS, S | C | SC
|   |   |   |   |   :PSC?
|   |   |   |   :LIMit
|   |   |   |   |   [:OPEN] <number value>
|   |   |   |   |   [:OPEN]?
|   |   |   |   |   :SHORt <number value>
|   |   |   |   |   :SHORt?
|   |   |   :PAuse
|   |   |   |   [:MESSage] <string data>
|   |   |   |   [:MESSage]?
|   |   |   |   :TIME
|   |   |   |   |   [:TEST] <number value>
|   |   |   |   |   [:TEST]?
```

```
|   |   |   :MODE?
|   |   |   :SET?
|   |   :STOP
:SYSTem
|   :ERRor
|   |   [:NEXT]?
|   :KLOCk <boolean> | ON | OFF            (RS232 only)
|   :KLOCk?
|   :LINK
|   |   :ADDRess?
|   |   :MASTer?
|   :LOCK
|   |   :OWNer?
|   |   :RELease                           (RS232 only)
|   |   :REQuest?                          (RS232 only)
|   :TCONtrol
|   |   :AGC
|   |   |   [:SOFTware] <boolean> | ON | OFF
|   |   |   [:SOFTware]?
|   |   :CHANnel
|   |   |   [:DEFault]
|   |   |   |   [:CLOSe] <channel list>
|   |   |   |   [:CLOSe]?
|   |   :DISCharge
|   |   |   :VMINimum  ON | OFF | <boolean>
|   |   |   :VMINimum?
|   |   :EOT TIMer | TEST
|   |   :EOT?
|   |   :FAIL
|   |   |   :OPERation STOP | CONTinue
|   |   |   :OPERation?
|   |   :RJUDgment <boolean> | ON | OFF
|   |   :RJUDgment?
|   |   :SCReen <boolean> | ON | OFF
|   |   :SCReen?
|   |   :TIME
|   |   |   :PASS
|   |   |   |   [:HOLD] <number value>
|   |   |   |   [:HOLD]?
|   |   :VPERcent
|   |   |   [:MINimum] <number value> |OFF
|   |   |   [:MINimum]?
|   |   :WRANge
|   |   |   [:AUTO] <boolean> | ON | OFF
|   |   |   [:AUTO]?
|   |   :WVAC
|   |   |   :FREQuency <number value>
|   |   |   :FREQuency?
|   :VERSion?
```

6.5.2 Command Description

- **IEEE 488.2 Command**

  ***CLS**
  It clears the data structure of status in the following actions:
  Clear the standard event register.

Clear the byte register except MAV bit (bit 4).

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

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

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

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

***OPC**
It completes the operation.

***OPC?**
It queries the operation for completeness. An ASCII character “1” is output when done.

PSC *0* | *1
It clears the power on state.

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

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

***RCL <*decimal data*>**
It is a read back command.
This command reads back the settings saved in the memory of the device. The range of < *decimal data* > is between 1~30. (This command is invalid when the value is 0.)

***SAV <*decimal data*>**
It is a save command.
This command is to save the settings at present of the device to memory. The range of < *decimal data* > is between 1~30. (This command is invalid when the value is 0.)

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

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

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

- **SCPI Command**

:MEMory:DELete[:NAME] <*name*>
It deletes the parameter data specified by <name> in main memory. <name> is a string with maximum 13 characters. .

Example: Input the command "MEM:DEL 123".
Description: It deletes the parameter data named 123 in main memory.

:MEMory:DELete:LOCation <*register number*>
It deletes the parameter data specified by <register number> in main memory. <register number> is an integer with the range between 0~30 where 0 means to clear the memory.

Example: Input the command **"MEM:DEL:LOC 1".**
Description: It deletes the parameter data number 1 in main memory.

:MEMory:STATe:DEFine <*name*>, <*register number*>
It sets a name for memory specified by <register number>. <register number> is an integer with the range between 1~30.

Example: Input the command "MEM:STAT:DEF TEST,1".
Description: It defines the parameter data named TEST of the 1st memory set in main memory.

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

Example: Input the command "MEM:STAT:DEF? TEST".
The Tester returns "1".
Description: The returned value "1**"** indicates the parameter data named TEST is located at the 1st set.

:MEMory:FREE:STATe?
It queries the unused capacity in main memory.

Example: Input the command "MEM:FREE:STAT?**"**.
The Tester returns "27".
Description: The returned value "27" indicates the remaining data parameters for set.

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

Example: Input the command "MEM:NST?".
The Tester returns "31".
Description: The returned value "31" indicates the storage capacity of main memory is 30 sets (1-30).

[:SOURce]:SAFety[:CHANnel]<m>:FETCh? ***[< item >] [, < item >]***
It queries the host for the measured result when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master. <item> is string as listed below:

String	Returned Data
STEP	The present STEP No.
MODE	The present MODE
OMETerage	The present reading of output meter
MMETerage	The present reading of measure meter
RELapsed	The time executed for RAMP
RLEave	The time remained for RAMP
DELapsed	The time executed for DWELL
DLEave	The time remained for DWELL
TELapsed	The time executed for TEST When the Test Time is limited it responds the time remained. When the Test Time is set to CONT, it responds 9.9000001E+37.
TLEave	The time remained for TEST When the Test Time is limited it responds the time remained. When the Test Time is set to CONT, it responds 9.9000001E+37.
FELapsed	The time executed for FALL
FLEave	The time remained for FALL

Example: Input the command **SAF:CHAN003:FETH? STEP,MODE,OMET**
The Tester returns 1,AC,+5.000000E+02.
Description: The returned string **1,AC,+5.000000E+02** indicates the result of STEP, MODE and output result for CH3 of Address 0 host is STEP1, AC MODE, 0.500kV.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL[:JUDGment]?
It queries all judgment results when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master. The return format is First Step Result, Second Step Result, ..., Last Step Result. The meaning of Code is listed as below:

Code of Test Result

Mode	AC		DC		IR		OSC		ALL	
Code	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
STOP									70	112
TESTING									73	115
PASS									74	116
HIGH FAIL	21	33	31	49	41	65				
LOW FAIL	22	34	32	50	42	66				
ARC FAIL	23	35	33	51						
OCP	24	36	34	52	44	68	64	100		
SHORT FAIL							61	97		
OPEN FAIL							62	98		

Example: Input the command SAF:CHAN003:RES:ALL?
The Tester returns 116,116,116,116,116,116,116,116,116,116.
Description: The returned string is the judgment result of CH3 STEP1~STEP10 for Address 0 host, that is PASS, PASS, PASS, PASS, PASS, PASS,P ASS, PASS, PASS, PASS.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:MMETerage?
It queries the readings of MEASURE METER in all STEPs when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN004:RES:ALL:MMET?
The Tester returns 7.000000E-05, 5.000000E-05, 4.000000E-05, 3.000000E-05, 2.000000E-05, 1.000000E-05, 2.000000E-04, 7.000000E-05, 5.000000E-04, 3.000000E-04.
Description: The returned string is the result queried for MEASURE METER by CH4 STEP1~STEP10 from Address 0 host, that is 0.07mA, 0,05mA, 0.04mA, 0.03mA, 0.02mA, 0.01mA, 0.20mA, 0.07mA, 0.50mA, 0.30mA.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:MODE?
It queries the MODE of all STEPs when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master. The returned string is AC|DC|IR|OSC|PA.

Example: Input the command SAF:CHAN005:RES:ALL:MODE?
The Tester returns OSC,AC,AC,PA,DC,DC,DC,PA,IR,IR.
Description: The returned string is the MODE setting of Address 0 host for CH5 STEP1~STEP10, that is OSC Mode, AC Mode, AC Mode, PA Mode, DC Mode, DC Mode, DC Mode, PA Mode, IR Mode, IR Mode.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:OMETerage?
It queries the readings of OUTPUT METER in all STEPs when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN101:RES:ALL:OMET?
The Tester returns 5.100000E+01, 5.000000E+02, 1.000000E+02, 2.000000E+02, 3.000000E+02, 4.000000E+02, 5.100000E+02, 6.000000E+02, 7.000000E+02, 8.000000E+02.
Description: The returned string is the result queried for OUTPUT METER by CH1 STEP1~STEP10 from Address 1 host, that is 0.051kV, 0.500kV, 0.100kV, 0.200kV, 0.300kV, 0.400kV, 0.510kV, 0.600kV, 0.700kV, 0.800kV.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:TIME[:ELAPsed]:DWELl?
It queries the DWELL time of all STEPs for test when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the

range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04 (19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:ALL:TIME:DWEL?
The Tester returns 5.000000E+00, 5.000000E+00, 5.000000E+00, 1.000000E+00, 1.000000E+00, 1.000000E+00, 1.000000E+00, 2.000000E+00, 2.000000E+00, 2.000000E+00.
Description: The returned string is the dwell time tested of Address 0 host for CH5 STEP1~STEP10, that is 5.0sec, 5.0sec, 5.0sec, 1.0sec,1.0sec, 1.0sec, 1.0sec, 2.0sec, 2.0sec, 2.0sec.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:TIME[:ELAPsed]:FALL?
It queries the time of voltage fall for all STEPs when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04 (19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:ALL:TIME:FALL?
The Tester returns 1.500000E+00, 1.500000E+00, 1.500000E+00, 2.000000E+00, 2.000000E+00, 2.000000E+00, 5.000000E-01, 5.000000E-01, 5.000000E-01, 5.000000E-01.
Description: The returned string is the voltage fall time tested of Address 0 host for CH5 STEP1~STEP10, that is 1.5sec, 1.5sec, 1.5sec, 2.0sec,2.0sec, 2.0sec, 0.5sec, 0.5sec, 0.5sec, 0.5sec.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:TIME[:ELAPsed]:RAMP?
It queries the time required for voltage to ramp up of all STEPs when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04 (19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:ALL:TIME:RAMP?
The Tester returns 5.000000E+00, 5.000000E+00, 5.000000E+00, 1.000000E+00, 1.000000E+00, 1.000000E+00, 2.000000E+00, 2.000000E+00, 2.000000E+00, 2.000000E+00
Description: The returned string is the time required for voltage to ramp up to the set in CH5 STEP1~STEP10 on Address 0 host, that is 0.5sec, 0.5sec, 0.5sec, 1.0sec,1.0sec, 1.0sec, 2.0sec, 2.0sec, 2.0sec, 2.0sec.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:TIME[:ELAPsed] [:TEST]?
It queries the test time of all STEPs when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04 (19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:ALL:TIME?
The Tester returns 3.000000E+00, 3.000000E+00, 1.000000E+00, 2.500000E+00, 2.500000E+00, 1.000000E+00, 1.000000E+00,

0.500000E+00, 3.000000E+00, 1.000000E+00.
Description: The returned string is the time required for testing for CH5 STEP1~STEP10 of Address 0 host, that is 3.0sec, 3.0sec, 1.0sec, 2.5sec,2.5sec, 1.0sec, 1.0sec, 0.5sec, 3.0sec, 1.0sec.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:AREPort < *boolean* > | *ON* | *OFF*
It sets if reporting the test result automatically (only valid for RS232 interface.) This command is only valid for this Tester, so the Address 0 host <m> can use 001, Address 1 host <m> can use 101 and so forth. The Address 9 host <m> can use 901. The returned data is Total Pass/Fail state and its format is string in "PASS" or "FAIL".

Example: Input the command SAF001:RES:AREP ON
Description: It means to set the Address 0 host to return the test result automatically after the test is done. If the test result of all channels of Address 0 host is PASS, it returns "PASS" or "FAIL" will be returned.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:AREPort?
It queries the device if reporting the test result automatically. The return is 1 or 0. (Applicable for RS232 interface only.)

Example: Input the command SAF001:RES:AREP?
The Tester returns 1.
Description: The returned 1 means Address 0 host will report the test result automatically once the test is done.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:COMPleted?
It queries the device if all settings are executed completely. The return is 1 or 0.

Example: Input the command SAF001:RES:COMP?
The Tester returns 1.
Description: The returned 1 means Address 0 host has completed the execution of all settings.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>[:JUDGment]?
It queries the judgment of specified STEP when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master. Return format: First Step Result, Second Step Result, ..., Last Step Result. The table below lists the definition of Code:

Code of Test Result

Mode	AC		DC		IR		OSC		ALL	
Code	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
STOP									70	112
TESTING									73	115
PASS									74	116
HIGH FAIL	21	33	31	49	41	65				
LOW FAIL	22	34	32	50	42	66				
ARC FAIL	23	35	33	51						
OCP	24	36	34	52	44	68	64	100		
SHORT FAIL							61	97		
OPEN FAIL							62	98		

Example: Input the command SAF:CHAN003:RES:STEP3?
The Tester returns 116.
Description: The returned result indicates the judgment of CH3 STEP 3 for Address 0 host is PASS.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:MMETerage?
It queries the MEASURE METER reading of specified STEP when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN004:RES:STEP3:MMET?
The Tester returns 4.000000E-05.
Description: The returned result indicates the MEASURE METER reading of CH4 STEP 3 for Address 0 host is 0.04mA.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:OMETerage?
It queries the OUTPUT METER reading of specified STEP when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN001:RES:STEP3:OMET?
The Tester returns 1.000000E+02.
Description: The returned result indicates the OUTPUT METER reading of CH1 STEP 3 for Address 0 host is 0.100kV.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed]: DWELl?
It queries the DWELL time tested by specified STEP when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:STEP1:TIME:DWEL?
The Tester returns 5.000000E-01
Description: The returned result indicates the DWELL tested by CH5 STEP 1 for Address 0 host is 0.5sec.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed]: FALL?
It queries the time of voltage fall in specified STEP when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:STEP4:TIME:FALL?
The Tester returns 2.000000E+00.
Description: The returned result indicates the time of voltage fall in CH5 STEP 4 for Address 0 host is 2.0sec.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed]: RAMP?
It queries the time of voltage ramp in specified STEP when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:STEP1:TIME:RAMP?
The Tester returns 5.000000E-01.
Description: The returned result indicates the time of voltage ramp in CH5 STEP 1 for Address 0 host is 0.5sec.

[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed] [:TEST]?
It queries the test time of specified STEP when the Screen sets to On. The format of variable <m> at the end of [:CHANnel] is 3 digits. The first digit is Frame index in the range of 0~9 and the last two digits are Channel index in the range of 01~10 (19020/19021/19022) or 01~04(19020-4/19022-4). When the variable is ignored it is 001 to indicate Channel 1 of the Master.

Example: Input the command SAF:CHAN005:RES:STEP2:TIME?
The Tester returns 3.000000E+00.
Description: The returned result indicates the test time required in CH5 STEP 2 for Address 0 host is 3.0sec.

[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>[:JUDGment]?
It queries the judgment of specified STEP for all channels of a Frame when the Screen sets to On. The range of variable <f> at the end of FRAMe<f> command is 0~9 that indicates the Frame address. When <f> is ignored the default is 1 it indicates to query the judgment results of all channels for Slave 1. Return format: Ch1 Result, Ch2 Result, ..., Ch10 Result. The table below lists the definition of Code:

Code of Test Result

Mode	AC		DC		IR		OSC		ALL	
Code	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
STOP									70	112
TESTING									73	115
PASS									74	116
HIGH FAIL	21	33	31	49	41	65				
LOW FAIL	22	34	32	50	42	66				
ARC FAIL	23	35	33	51						
OCP	24	36	34	52	44	68	64	100		
SHORT FAIL							61	97		
OPEN FAIL							62	98		

Example: Input the command SAF:FRAM0:RES:STEP3?
The Tester returns 116,116,116,116,116,116,116,116,116,116.
Description: The returned result indicates the judgment result of STEP 3 for all Channels of Address 0 host is PASS.

[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:MMETerage?
It queries the MEASURE METER readings of specified STEP for all channels of a Frame when the Screen sets to On. The range of variable <f> at the end of FRAMe<f>

command is 0~9 that indicates the Frame address. When <f> is ignored the default is 1 it indicates to query the MEASURE METER readings of all channels for Slave 1.

Example: Input the command SAF:FRAME0:RES:STEP3:MMET?
The Tester returns 7.000000E-05, 5.000000E-05, 4.000000E-05, 3.000000E-05, 2.000000E-05, 1.000000E-05, 2.000000E-04, 7.000000E-05, 5.000000E-04, 3.000000E-04.
Description: The returned result indicates the queried MEASURE METER readings for all channels STEP3 of Address 0 host is 0.07mA, 0,05mA, 0.04mA, 0.03mA, 0.02mA, 0.01mA, 0.20mA, 0.07mA, 0.50mA, 0.30mA.

[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:OMETerage?
It queries the OUTPUT METER readings of specified STEP for all channels of a Frame when the Screen sets to On. The range of variable <f> at the end of FRAMe<f> command is 0~9 that indicates the Frame address. When <f> is ignored the default is 1 it indicates to query the OUTPUT METER readings of all channels for Slave 1.

Example: Input the command SAF:FRAM1:RES:STEP3:OMET?
The Tester returns 5.100000E+01, 5.000000E+01, 5.000000E+01, 5.200000E+01, 5.000000E+01, 4.900000E+01, 5.100000E+01, 4.900000E+01, 5.000000E+01, 4.900000E+01.
Description: The returned result indicates the queried OUTPUT METER readings for all channels STEP3 of Address 1 host is 0.051kV, 0.050kV, 0.050kV, 0.052kV, 0.050kV, 0.049kV, 0.051kV, 0.049kV, 0.050kV, 0.049kV.

[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:TIME[:ELAPsed]:DWELI?
It queries the DWELL time tested by specified STEP for all channels of a Frame when the Screen sets to On. The range of variable <f> at the end of FRAMe<f> command is 0~9 that indicates the Frame address. When <f> is ignored the default is 1 it indicates to query the DWELL time of all channels for Slave 1.

Example: Input the command SAF:FRAM0:RES:STEP1:TIME:DWEL?
The Tester returns 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00.
Description: The returned result indicates the queried DWELL times tested by STEP 1 for all channels of Address 0 host are 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:TIME[:ELAPsed]:FALL?
It queries the time voltage fall elapsed of a specified STEP for all channels of a Frame when the Screen sets to On. The range of variable <f> at the end of FRAMe<f> command is 0~9 that indicates the Frame address. When <f> is ignored the default is 1 it indicates to query the time elapsed for voltage fall of all channels for Slave 1.

Example: Input the command SAF:FRAM0:RES:STEP4:TIME:FALL?
The Tester returns 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00.
Description: The returned result indicates the tested voltage fall times of STEP 4 for all channels of Address 0 host are 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:TIME[:ELAPsed]:RAMP?
It queries the time voltage ramp elapsed of a specified STEP for all channels of a Frame when the Screen sets to On. The range of variable <f> at the end of FRAMe<f> command is 0~9 that indicates the Frame address. When <f> is ignored the default is 1 it indicates to query the time elapsed for voltage ramp of all channels for Slave 1.

Example: Input the command SAF:FRAM0:RES:STEP1:TIME:RAMP?
The Tester returns 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00.
Description: The returned result indicates the time required for voltage to ramp up to the set in STEP 1 for all channels of Address 0 host are 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:TIME[:ELAPsed][:TEST]?
It queries the test time of a specified STEP for all channels of a Frame when the Screen sets to On. The range of variable <f> at the end of FRAMe<f> command is 0~9 that indicates the Frame address. When <f> is ignored the default is 1 it indicates to query the test time of all channels for Slave 1.

Example: Input the command SAF:FRAM0:RES:STEP2:TIME?
The Tester returns 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00, 3.000000E+00.
Description: The returned result indicates the test time required for STEP 2 of all channels for Address 0 host is 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

[:SOURce]:SAFety:STARt[:ONCE]
It starts the test.

Example: Input the command SAF:STAR
Description: It means to start the host test.

[:SOURce]:SAFety:STARt:CORRection:OPEN ***GET*** **|** ***OFF***
When the parameter is set to GET, it gets the correction value, the host may output high voltage. When the parameter is set to OFF, correction is disabled.

Example: Input the command SAF:STAR:CORR:OPEN GET
Description: It means to start the function of getting correction value.

[:SOURce]:SAFety:STARt:CORRection:OPEN?
It queries if correction has been done.

Example: Input the command SAF:STAR:CORR:OPEN?
The Tester returns 0.
Description: The returned 0 means the correction hasn't been done on the host.

[:SOURce]:SAFety:STARt:CORRection:SAMPle ***GET***
It starts the GET Cs function in Open Short Check mode.

Example: Input the command SAF:STAR:CORR:SAMP GET
Description: It means to start the GET Cs function in Open Short Check mode.

[:SOURce]:SAFety:STARt:CORRection:SAMPle?
It queries if the GET Cs function is started in Open Short Check mode.

Example: Input the command SAF:STAR:CORR:SAMP ?
The Tester returns 1
Description: The returned 1 means the GET Cs function has been started in Open Short Check mode.

[:SOURce]:SAFety:STATus?
It queries the execution status of present device. The string returned is RUNNING| STOPPED.

Example: Input the command SAF:STAT?
The Tester returns RUNNING.
Description: The returned RUNNING means the host is conduction tests at present.

[:SOURce]:SAFety:STEP<n>:AC:CHANnel[:CLOSe] <*channel_list*>
It sets the status of high voltage output channel in selected STEP.

Example: Input the command SAF:STEP1:AC:CHAN (@001,002,201:210)
Description: It means to start the high voltage output channel CH1, CH2 in STEP 1 for Address 0 host, also start the high voltage output channel CH1~CH10 of Address 2 host.

[:SOURce]:SAFety:STEP<n>:AC:CHANnel[:CLOSe]?
It queries the status of high voltage output channel for selected STEP.

Example: Input the command SAF:STEP1:AC:CHAN?
The Tester returns (@001,002,201:210).
Description: The returned result indicates the high voltage output channels CH1 and CH2 of Address 0 host and the channels CH1~CH10 of Address 2 host in STEP 1 are started.

[:SOURce]:SAFety:STEP<n>:AC:CHANnel:DEFault:ON
It sets the selected STEP to use the option of DEF. CHANNELS in TEST CONTROL for setting high voltage output channel.

Example: Input the command SAF:STEP1:AC:CHAN:DEF:ON
Description: It means to set STEP 1 using the option of DEF. CHANNELS in TEST CONTROL for setting high voltage output channel.

[:SOURce]:SAFety:STEP<n>:AC:CHANnel:DEFault:STATe?
It queries if the selected STEP is using the option of DEF. CHANNELS in TEST CONTROL for setting high voltage output channel.

Example: Input the command SAF:STEP1:AC:CHAN:DEF:STAT?
The Tester returns 1.
Description: The returned 1 means STEP 1 is using the option of DEF. CHANNELS in TEST CONTROL for setting high voltage output channel.

[:SOURce]:SAFety:STEP<n>:AC:CHANnel:PSC *P* | *S* | *PS, S* | *C* | *SC*
It sets the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:AC:CHAN:PSC P,S
Description: It means to set the scan channel of STEP 1 to P→S.

[:SOURce]:SAFety:STEP<n>:AC:CHANnel:PSC?
It queries the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:AC:CHAN:PSC?
The Tester returns P,S.
Description: It means the scan channel of STEP 1 is set to P→S.

[:SOURce]:SAFety:STEP<n>:AC[:LEVel] < *numeric value* >
It sets the voltage required for AC withstand voltage test for selected STEP. The unit is Volt (V).

Range: The range of 19020 is 50~5000 and the range of 19021 is 50~6000.
Example: Input the command SAF:STEP1:AC 3000.
Description: It means to set the voltage required by AC withstand voltage test for the host STEP 1 is 3kV.

[:SOURce]:SAFety:STEP<n>:AC[:LEVel]?
It queries the voltage required for AC withstand voltage test for selected STEP.

Example: Input the command SAF:STEP1:AC?
The Tester returns 3.000000E+03.
Description: The returned 3.000000E+03 means the voltage required by AC withstand voltage test for the host STEP 1 is 3kV.

[:SOURce]:SAFety:STEP<n>:AC:LIMit:ARC < *numeric value* >
It sets the ARC test value for selected STEP. The unit is Ampere (A).

Range: 0 or 0.001~0.020, 0 is OFF.
Example: Input the command SAF:STEP1:AC:LIM:ARC 0.004.
Description: It means the ARC test value in AC Mode for the host STEP 1 is 4mA.

[:SOURce]:SAFety:STEP<n>:AC:LIMit:ARC?
It queries the ARC test value for selected STEP.

Example: Input the command SAF:STEP1:AC:LIM:ARC?
The Tester returns 4.000000E-03.
Description: The returned 4.000000E-03 means the ARC test value for the host STEP 1 is 4mA.

[:SOURce]:SAFety:STEP<n>:AC:LIMit[:HIGH] < *numeric value* >
It sets the high limit of AC withstand leakage current for selected STEP. The unit is Ampere (A).

Range: The range of 19020 is 0.000001~0.01 and the range of 19021 is 0.000001~0.008.
Example: Input the command SAF:STEP1:AC:LIM 0.01.
Description: It means the high limit of AC withstand leakage current for the host STEP 1 is 10mA.

[:SOURce]:SAFEty:STEP<n>:AC:LIMit[:HIGH]?
It queries the high limit of AC withstand leakage current for selected STEP.

Example: Input the command SAF:STEP1:AC:LIM?
The Tester returns 1.000000E-02.
Description: The returned 1.000000E-02 means the high limit of AC withstand leakage current for the host STEP 1 is 10mA.

[:SOURce]:SAFety:STEP<n>:AC:LIMit:LOW < *numeric value* >
It sets the low limit of AC withstand leakage current for selected STEP. The unit is Ampere (A).

Range: The range of 19020 is 0.000001~0.01 and the 19021 range is 0.000001~0.008 (the low limit of leakage current ≤ the set high limit.)
Example: Input the command SAF:STEP1:AC:LIM:LOW 0.00001.
Description: It means the low limit of AC withstand leakage current for the host STEP 1 is 0.01mA.

[:SOURce]:SAFety:STEP<n>:AC:LIMit:LOW?
It queries the low limit of AC withstand leakage current for selected STEP.

Example: Input the command SAF:STEP2:AC:LIM:LOW?
The Tester returns 1.000000E-05.
Description: The returned 1.000000E-05 means the low limit of AC withstand leakage current for the host STEP 2 is 0.01mA.

[:SOURce]:SAFety:STEP<n>:AC:TIME:FALL < *numeric value* >
It sets the time required for the voltage to fall to 0 in selected STEP. The unit is second (s).

Range: 0 or 0.1~999.9, 0 is OFF.
Example: Input the command SAF:STEP1:AC:TIME:FALL 3
Description: It means the time required for set voltage to fall to 0 in the host STEP 1 is 3.0sec.

[:SOURce]:SAFEty:STEP<n>:AC:TIME:FALL?
It queries the time required for the voltage to fall to 0 in selected STEP.

Example: Input the command SAF:STEP1:AC:TIME:FALL?
The Tester returns 3.000000E+00.
Description: The returned 3.000000E+00 means the time required for the set voltage to fall to 0 in the host STEP 1 is 3.0sec.

[:SOURce]:SAFety:STEP<n>:AC:TIME:RAMP < *numeric value* >
It sets the time required for the voltage to ramp up to the set for selected STEP. The unit second (s).

Range: 0 or 0.1~999.9, 0 is OFF.
Example: Input the command SAF:STEP1:AC:TIME:RAMP 5.
Description: It means the time required for testing the voltage to ramp up to set for the host STEP 1 is 5.0sec.

[:SOURce]:SAFety:STEP<n>:AC:TIME:RAMP?
It queries the time required for the voltage to ramp to the set for selected STEP.

Example: Input the command SAF:STEP1:AC:TIME:RAMP?
The Tester returns 5.000000E+00.
Description: The returned 5.000000E+00 means the time required for the voltage to ramp up to the set for the host STEP 1 is 5.0sec.

[:SOURce]:SAFety:STEP<n>:AC:TIME[:TEST] < *numeric value* >
It sets the time required for test for selected STEP. The unit is second (s).

Range: 0 or 0.03~999.9, 0 is CONTINUE.
Example: Input the command SAF:STEP1:AC:TIME 10.
Description: It means the time required for test in host STEP 1 is 10.0sec.

[:SOURce]:SAFety:STEP<n>:AC:TIME[:TEST]?
It queries the time required for test for selected STEP.

Example: Input the command SAF:STEP1:AC:TIME?
The Tester returns 1.000000E+01.
Description: The returned 1.000000E+01 means the time required for test in the host STEP 1 is 10.0sec.

[:SOURce]:SAFety:STEP<n>:DC:CHANnel[:CLOSe] <*channel_list*>
It sets the high voltage output channel status of selected STEP.

Example: Input the command SAF:STEP2:DC:CHAN (@001,002,201:210).
Description: It means the high voltage output channels CH1 & CH2 of Address 0 host in STEP 2 are enabled and the high voltage output channels CH1~CH10 of Address 2 host are enabled as well.

[:SOURce]:SAFety:STEP<n>:DC:CHANnel[:CLOSe]?
It queries the high voltage output channel status of selected STEP.

Example: Input the command SAF:STEP2:DC:CHAN?
The Tester returns (@001,002,201:210).
Description: The returned result indicates the high voltage output channels CH1 & CH2 of Address 0 host in STEP 2 are enabled and the high voltage output channels CH1~CH10 of Address 2 host are enabled as well.

[:SOURce]:SAFety:STEP<n>:DC:CHANnel:DEFault:ON
It sets the high voltage channel settings in DEF. CHANNELS options under TEST CONTROL for selected STEP.

Example: Input the command SAF:STEP2:DC:CHAN:DEF:ON
Description: It means to set STEP 2 with high voltage channel settings in DEF. CHANNELS options under TEST CONTROL.

[:SOURce]:SAFety:STEP<n>:DC:CHANnel:DEFault:STATe?
It queries the high voltage channel settings set by DEF. CHANNELS options in TEST CONTROL for selected STEP.

Example: Input the command SAF:STEP2:DC:CHAN:DEF:STAT?
The Tester returns 1.

Description: The returned 1 means STEP 2 is using the high voltage channel settings in DEF. CHANNELS options under TEST CONTROL.

[:SOURce]:SAFety:STEP<n>:DC:CHANnel:PSC *P | S | PS, S | C | SC*
It sets the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:DC:CHAN:PSC P,S
Description: It means to set the scan channel of STEP 1 to P→S.

[:SOURce]:SAFety:STEP<n>:DC:CHANnel:PSC?
It queries the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:DC:CHAN:PSC?
The Tester returns P,S.
Description: It means the scan channel of STEP 1 is set to P→S.

[:SOURce]:SAFety:STEP<n>:DC[:LEVel] < *numeric value* >
It sets the voltage required for DC withstand voltage test for selected STEP. The unit is Volt (V).

Range: 50~6000 for 19020, 50~8000 for 19022.
Example: Input the command SAF:STEP2:DC 4000.
Description: It means the voltage set for the DC withstand voltage test for the host STEP 2 is 4kV.

[:SOURce]:SAFety:STEP<n>:DC[:LEVel]?
It queries the voltage required for DC withstand voltage test for selected STEP

Example: Input the command SAF:STEP2:DC?
The Tester returns 4.000000E+03.
Description: The returned 4.000000E+03 means the voltage required for DC withstand voltage test for STEP 2 is 4kV.

[:SOURce]:SAFety:STEP<n>:DC:LIMit:ARC < *numeric value* >
It sets the ARC test value for selected STEP. The unit is Ampere (A).

Range: 0 or 0.001~0.010, 0 is OFF.
Example: Input the command SAF:STEP2:DC:LIM:ARC 0.0025.
Description: It means the ACR test value is set to 2.5mA for the host STEP 2.

[:SOURce]:SAFEty:STEP<n>:DC:LIMit:ARC?
It queries the ARC test value for selected STEP.

Example: Input the command SAF:STEP2:DC:LIM:ARC?
The Tester returns 2.500000E-03.
Description: The returned 2.500000E-03 means the ARC test value is set to 2.5mA for the host STEP 2.

[:SOURce:]SAFety:STEP<n>:DC:LIMit[:HIGH] < *numeric value* >
It sets the high limit of DC withstand voltage leakage current for selected STEP. The unit is Ampere (A).

Range: 0.000001~0.005 for 19020, 0.000001~0.0035 for 19022.

Example: Input the command SAFE:STEP2:DC:LIM 0.002999.
Description: It means the high limit of DC withstand voltage leakage current is set to 2.999mA for the host STEP 2.

[:SOURce:]SAFety:STEP<n>:DC:LIMit[:HIGH]?
It queries the high limit of DC withstand voltage leakage current for selected STEP.

Example: Input the command SAFE:STEP2:DC:LIM?
The Tester returns 2.999000E-03.
Description: The returned 2.999000E-03 means the high limit of DC withstand voltage leakage current is set to 2.999mA for the host STEP 2.

[:SOURce:]SAFety:STEP<n>:DC:LIMit:LOW < *numeric value* >
It sets the low limit of DC withstand voltage leakage current for select STEP. The unit is Ampere (A).

Range: 0.000001~0.005 for 19020, 0.000001~0.0035 for 19022.
(Low limit of leakage current ≤ set high limit.)
Example: Input the command SAF:STEP2:DC:LIM:LOW 0.000001.
Description: It means the low limit of DC withstand voltage leakage current is set to 0.001mA for the host STEP 2.

[:SOURce:]SAFety:STEP<n>:DC:LIMit:LOW?
It queries the low limit of DC withstand voltage leakage current for selected STEP.

Example: Input the command SAF:STEP2:DC:LIM:LOW?
The Tester returns 1.000000E-06.
Description: The returned 1.000000E-06 means the low limit of DC withstand voltage leakage current is set to 0.001mA for the host STEP 2.

[:SOURce]:SAFety:STEP<n>:DC:TIME:DWELl < *numeric value* >
It sets the time required for DWELL for selected STEP. The unit is second (s).

Range: 0 or 0.1~999.9, 0 is OFF.
Example: Input the command SAF:STEP2:DC:TIME:DWEL 2.5.
Description: It means the time required for DWELL for the host STEP 2 is 2.5sec.

[:SOURce]:SAFety:STEP<n>:DC:TIME:DWELl?
It queries the time required for DWELL for selected STEP.

Example: Input the command SAFE:STEP2:DC:TIME:DWEL?
The Tester returns 2.500000E+00.
Description: The returned 2.500000E+00 means the DWELL time is set to 2.5sec for the host STEP2.

[:SOURce]:SAFety:STEP<n>:DC:TIME:FALL < *numeric value* >
It sets the time required for set voltage to fall to 0 for selected STEP. The unit is second (s).

Range: 0 or 0.1~999.9, 0 is OFF.
Example: Input the command SAF:STEP2:DC:TIME:FALL 3.
Description: It means the time required for set voltage to fall to 0 for selected STEP is 3.0sec.

[:SOURce]:SAFety:STEP<n>:DC:TIME:FALL?
It queries the time required for set voltage to fall to 0 for selected STEP.

Example: Input the command SAF:STEP2:DC:TIME:FALL?
The Tester returns 3.000000E+00.
Description: The returned 3.000000E+00 means the time required for set voltage to fall to 0 for the host STEP 2 is 3.0sec.

[:SOURce]:SAFety:STEP<n>:DC:TIME:RAMP < *numeric value* >
It sets the time required for selected STEP to ramp up to the set voltage. The unit is second (s).

Range: 0 or 0.1~999.9, 0 is OFF.
Example: Input the command SAF:STEP2:DC:TIME:RAMP 2.
Description: It means the time required for the host STEP 2 to ramp up to the set voltage is 2.0sec.

[:SOURce]:SAFety:STEP<n>:DC:TIME:RAMP?
It queries the time required for selected STEP to ramp up to the set voltage.

Example: Input the command SAF:STEP3:DC:TIME:RAMP?
The Tester returns 2.000000E+00.
Description: The returned 2.000000E+00 means the time required for selected STEP 2 to ramp up to the set voltage is 2.0sec.

[:SOURce]:SAFety:STEP<n>:DC:TIME[:TEST] < *numeric value* >
It sets the time required for test for selected STEP. The unit is second (s).

Example: Input the command SAF:STEP2:DC:TIME 1.
Range: 0 or 0.1~999.9, 0 is CONTINUE.
Description: It means the time required for test for the host STEP 2 is 1.0sec.

[:SOURce]:SAFety:STEP<n>:DC:TIME[:TEST]?
It queries the time required for test for selected STEP.

Example: Input the command SAFE:STEP2:DC:TIME?
The Tester returns 1.000000E+00.
Description: The returned 1.000000E+00 means the time required for STEP 2 test is 1.0sec.

[:SOURce]:SAFety:STEP<n>:DELete
It removes the STEP of <n> and the subsequent STEP moves forward.

Example: Input the command SAF:STEP1:DEL.
Description: It means to clear the settings of STEP in the working memory.

[:SOURce]:SAFety:STEP<n>:IR:CHANnel[:CLOSe] <*channel_list*>
It sets the high voltage output channel status for selected STEP.

Example: Input the command SAF:STEP3:IR:CHAN (@001,002,201:210).
Description: It means the high voltage output channels CH1 & CH2 of Address 0 host in STEP 3 are enabled and the high voltage output channels CH1~CH10 of Address 2 host are enabled as well.

[:SOURce]:SAFety:STEP<n>:IR:CHANnel[:CLOSe]?
It queries the high voltage output channel status of selected STEP.

Example: Input the command SAF:STEP3:IR:CHAN?
The Tester returns (@001,002,201:210).
Description: The returned result means the high voltage output channels CH1 & CH2 of Address 0 host in STEP 3 are enabled and the high voltage output channels CH1~CH10 of Address 2 host are enabled as well.

[:SOURce]:SAFety:STEP<n>:IR:CHANnel:DEFault:ON
It sets the high voltage output channel using the options in DEF. CHANNELS under TEST CONTROL for selected STEP.

Example: Input the command SAF:STEP3:IR:CHAN:DEF:ON.
Description: It means the high voltage output channel is set using the options in DEF. CHANNELS under TEST CONTROL for STEP 3.

[:SOURce]:SAFety:STEP<n>:IR:CHANnel:DEFault:STATe?
It queries if the high voltage output channel uses the options in DEF. CHANNELS under TEST CONTROL for selected STEP.

Example: Input the command SAF:STEP3:IR:CHAN:DEF:STAT?
The Tester returns 1.
Description: The returned 1 means the high voltage output channel are set using the options in DEF. CHANNELS under TEST CONTROL for STEP 3.

[:SOURce]:SAFety:STEP<n>:IR:CHANnel:PSC *P* | *S* | *PS, S* | *C* | *SC*
It sets the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:IR:CHAN:PSC P,S
Description: It means to set the scan channel of STEP 1 to P→S.

[:SOURce]:SAFety:STEP<n>:IR:CHANnel:PSC?
It queries the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:IR:CHAN:PSC?
The Tester returns P,S.
Description: It means the scan channel of STEP 1 is set to P→S.

[:SOURce]:SAFety:STEP<n>:IR[:LEVel] < *numeric value* >
It sets the voltage required for insulation resistance test for selected STEP. The unit is Volt (V).

Range: 50~1000
Example: Input the command SAF:STEP3:IR 1000.
Description: It means the voltage required for insulation resistance test for the host STEP3 is 1kV.

[:SOURce]:SAFety:STEP<n>:IR[:LEVel]?
It queries the voltage required for insulation resistance test for selected STEP.

Example: Input the command SAFE:STEP3:IR?
The Tester returns 1.000000E+03.

Description: The returned 1.000000E+03 means the voltage required for insulation resistance test for the host STEP 3 is set to 1kV.

[:SOURce]:SAFety:STEP<n>:IR:LIMit:HIGH < *numeric value* >
It sets the high limit of insulation resistance for selected STEP. The unit is ohm.

Range: 100000~50000000000
Example: Input the command SAF:STEP3:IR:LIM:HIGH 50000000000.
Description: It means the high limit of insulation resistance for the host STEP 3 is 50GΩ.

[:SOURce]:SAFety:STEP<n>:IR:LIMit:HIGH?
It queries the high limit of insulation resistance for selected STEP.

Example: Input the command SAF:STEP3:IR:LIM:HIGH?
The Tester returns 5.000000E+10
Description: The returned 5.000000E+10 queries the high limit of insulation resistance for selected STEP. 50GΩ.

[:SOURce]:SAFety:STEP<n>:IR:LIMit[:LOW] < *numeric value* >
It sets the low limit of insulation resistance for selected STEP. The unit is ohm.

Range: 100000~50000000000 (low limit of insulation resistance ≤ set high limit.)
Example: Input the command SAFE:STEP3:IR:LIM 100000.
Description: It means the low limit of insulation resistance for the host STEP 3 is 0.1MΩ.

[:SOURce]:SAFety:STEP<n>:IR:LIMit[:LOW]?
It queries the low limit of insulation resistance for selected STEP.

Example: Input the command SAFE:STEP3:IR:LIM?
The Tester returns 1.000000E+05.
Description: The returned 1.000000E+05 queries the high limit of insulation resistance for selected STEP. 0.1MΩ.

[:SOURce]:SAFety:STEP<n>:IR:RANGe:UPPer < *numeric value* >
It selects the upper current range for measurement based on the inputted current. The unit is Ampere (A).

Example: Input the command SAF:STEP3:IR:RANG 0.0003.
Range: 0.000000001~0.005 for 19020, 0.000000001~0.0035 for 19022.
Description: It means the current for IR measurement in the host STEP 3 is 300uA, so the upper current range selected for IR measurement is 3mA.

[:SOURce]:SAFety:STEP<n>:IR:RANGe:UPPer?
It queries the upper range set.

Example: Input the command SAF:STEP3:IR:RANG?
The Tester returns 3.000000E-03.
Description: The returned 3.000000E-03 means the range set for the host STEP 3 is 3mA.

[:SOURce]:SAFety:STEP<n>:IR:RANGe[:LOWer] < *numeric value* >
It selects the lower current range for measurement based on the inputted current. The unit is Ampere (A).

Range: 0.000000001~0.005 for 19020, 0.000000001~0.0035 for 19022.
Example: Input the command SAF:STEP3:IR:RANG:LOW 0.0003
Description: It means the current for IR measurement in the host STEP 3 is 300uA, so the lower current range selected for IR measurement is 300uA.

[:SOURce]:SAFety:STEP<n>:IR:RANGe[:LOWer]?
It queries the lower range set.

Example: Input the command SAF:STEP3:IR:RANG:LOW?
The Tester returns 3.000000E-04.
Description: The returned 3.000000E-04 means the range set for the host STEP 3 is 300uA.

[:SOURce]:SAFety:STEP<n>:IR:RANGe: AUTO < *boolean* > | *ON* | *OFF*
It sets if IR range switches to AUTO. Parameter ON or 1 means AUTO while OFF or 0 means AUTO is disabled.
Note: When AUTO is not set, giving the parameter OFF will remain the original set range. When AUTO is set, giving the parameter OFF will set the range to 5mA.

Example: Input the command SAF:STEP3:IR:RANG:AUTO ON.
Description: It means the current range for the host STEP 3 IR measurement is AUTO.

[:SOURce]:SAFety:STEP<n>:IR:RANGe:AUTO?
It queries if IR range switches to AUTO. 1 means it is set to AUTO while 0 means AUTO is disabled.

Example: Input the command SAF:STEP3:IR:AUTO?
The Tester returns 1.
Description: The returned 1 means the range is set to AUTO for the host STEP 3.

[:SOURce]:SAFety:STEP<n>:IR:TIME:FALL < *numeric value* >
It sets the time required for set voltage to fall to 0 for selected STEP. The unit is second (s).

Range: 0 or 0.1~999.9, 0 is OFF.
Example: Input the command SAF:STEP3:IR:TIME:FALL 3.
Description: It means the time required for set voltage to fall to 0 for the host STEP 3 is 3.0sec.

[:SOURce]:SAFety:STEP<n>:IR:TIME:FALL?
It queries the time required for set voltage to fall to 0 for selected STEP. The unit is second (s).

Example: Input the command SAF:STEP3:IR:TIME:FALL?
The Tester returns 3.000000E+00.
Description: The returned 3.000000E+00 indicates the time required for set voltage to fall to 0 is 3.0sec.

[:SOURce]:SAFety:STEP<n>:IR:TIME:RAMP < *numeric value* >
It sets the time required for selected STEP to ramp up to the set voltage. The unit is second (s).

Range: 0 or 0.1~999.9, 0 is OFF.
Example: Input the command SAF:STEP3:IR:TIME:RAMP 0.5.
Description: It means the time required for the host STEP 3 to ramp up to the set voltage is 0.5sec.

[:SOURce]:SAFety:STEP<n>:IR:TIME:RAMP?
It queries the time required for selected STEP to ramp up to the set voltage.

Example: Input the command SAF:STEP3:IR:TIME:RAMP?
The Tester returns 5.000000E-01.
Description: The returned 5.000000E-01 means the time required for the host STEP 3 to ramp up to the set voltage is 0.5sec.

[:SOURce]:SAFety:STEP<n>:IR:TIME[:TEST] < *numeric value* >
It sets the time required for test for selected STEP. The unit is second (s).

Range: 0 or 0.3~999.9, 0 is CONTINUE.
Example: Input the command SAFE:STEP3:IR:TIME 1.
Description: It means the time required for test for the host STEP 3 is 1.0sec.

[:SOURce]:SAFety:STEP<n>:IR:TIME[:TEST]?
It queries the time required for test for selected STEP.

Example: Input the command SAFE:STEP3:IR:TIME?
The Tester returns 1.000000E+00.
Description: The returned 1.000000E+00 means the time required for test in STEP 3 is 1sec.

[:SOURce]:SAFety:STEP<n>:OSC:CHANnel[:CLOSe] <*channel_list*>
It sets the high voltage output channel status for selected STEP.

Example: Input the command SAF:STEP4:OSC:CHAN (@001,002,201:210)
Description: It means the high voltage output channels CH1 & CH2 of Address 0 host in STEP 4 are enabled and the high voltage output channels CH1~CH10 of Address 2 host are enabled as well.

[:SOURce]:SAFety:STEP<n>:OSC:CHANnel[:CLOSe]?
It queries the high voltage output channel status of selected STEP.

Example: Input the command SAF:STEP4:OSC:CHAN?
The Tester returns (@001,002,201:210).
Description: The returned result means the high voltage output channels CH1 & CH2 of Address 0 host in STEP 4 are enabled and the high voltage output channels CH1~CH10 of Address 2 host are enabled as well.

[:SOURce]:SAFety:STEP<n>:OSC:CHANnel:DEFault:ON
It sets the high voltage output channel using the options in DEF. CHANNELS under TEST CONTROL for selected STEP.

Example: Input the command SAF:STEP4:OSC:CHAN:DEF:ON.

Description: It means the high voltage output channel is set using the options in DEF. CHANNELS under TEST CONTROL for STEP 4.

[:SOURce]:SAFety:STEP<n>:OSC:CHANnel:DEFault:STATe?
It queries if the high voltage output channel uses the options in DEF. CHANNELS under TEST CONTROL for selected STEP.

Example: Input the command SAF:STEP4:OSC:CHAN:DEF:STAT?
The Tester returns 1.
Description: The returned 1 means the high voltage output channel are set using the options in DEF. CHANNELS under TEST CONTROL for STEP 4.

[:SOURce]:SAFety:STEP<n>:OSC:CHANnel:PSC *P* | *S* | *PS, S* | *C* | *SC*
It sets the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:OSC:CHAN:PSC P,S
Description: It means to set the scan channel of STEP 1 to P→S.

[:SOURce]:SAFety:STEP<n>:OSC:CHANnel:PSC?
It queries the scan channel status for selected STEP.

Example: Input the command SAF:STEP1:OSC:CHAN:PSC?
The Tester returns P,S.
Description: It means the scan channel of STEP 1 is set to P→S.

[:SOURce]:SAFety:STEP<n>:OSC:LIMit[:OPEN] < *numeric value* >
It sets the percentage of open check when doing OSC for selected STEP. The unit is 100%.

Range: 0.1~1.0
Example: Input the command SAF:STEP4:OSC:LIM 0.3.
Description: It means the percentage of open check when doing OSC for the host STEP 4 is 30%.

[:SOURce]:SAFety:STEP<n>:OSC:LIMit[:OPEN]?
It queries the percentage of open check when doing OSC for selected STEP.

Example: Input the command SAF:STEP4:OSC:LIM?
The Tester returns 3.000000E-01.
Description: The returned 3.000000E-01 means the percentage of open check when doing OSC for the host STEP 4 is 30%.

[:SOURce]:SAFety:STEP<n>:OSC:LIMit: SHORt < *numeric value* >
It sets the percentage of short check when doing OSC for selected STEP. The unit is 100%.

Range: 0 or 1~5, 0 is OFF.
Example: Input the command SAF:STEP4:OSC:LIM:SHOR 3.
Description: It means the percentage of short check when doing OSC for the host STEP 4 is 300%.

[:SOURce]:SAFety:STEP<n>:OSC:LIMit: SHORt?
It queries the percentage of short check when doing OSC for selected STEP.

Example: Input the command SAF:STEP4:OSC:LIM:SHOR?
The Tester returns 3.000000E+00.
Description: The returned 3.000000E+00 means the percentage of short check when doing OSC for the host STEP 4 is 300%.

[: SOURce]:SAFety:STEP<n>:PAuse[:MESSage] <*string data* >
It sets the message prompt string for PAUSE mode.

Example: Input the command SAF:STEP5:PA “WAIT”.
Description: It means the message string is WAIT for the host STEPS 5.

[: SOURce]:SAFety:STEP<n>:PAuse[:MESSage]?
It queries the message prompt string set.

Example: Input the command SAF:STEP5:PA.
The Tester returns “WAIT”.
Description: The returned “WAIT” means the message is “WAIT” for the host STEP 5.

[: SOURce]:SAFety:STEP<n>:PAuse:TIME[:TEST] <*numeric_value*>
It sets the time required for PA mode test for selected STEP.

Example: Input the command SAF:STEP5:PA:TIME 5.
Description: It means the time required for test for the host STEP 5 is 5.0sec.

[: SOURce]:SAFety:STEP<n>:PAuse:TIME[:TEST]?
It queries the time required for PA mode for selected STEP.

Example: Input the command SAF:STEP5:PA:TIME ?
The Tester returns 5.000000E+00.
Description: The returned 5.000000E+00 means the time required for test for the host STEP 5 is 5.0sec.

[:SOURce]:SAFety:STEP<n>:MODE?
It queries the MODE of selected STEP and returns the string data including AC, DC, IR, OSC or PA.

Example: Input the command SAF:STEP5:MODE?
The Tester returns PA.
Description: The returned PA means STEP 5 is in PA Mode.

[:SOURce]:SAFety:STEP<n>:SET?
It queries all of the settings of selected STEP.

Example: Input the command SAF:STEP1:SET?
The Tester returns 101,1, AC, +5.000000E+01, +5.000000E-04, +0.000000E+00, +0.000000E+00, +1.000000E+00, +3.000000E+00, +5.000000E-01, 1, (@001:010).
Description: It means the STEP1 settings in the working memory of host is “Data format version 101, STEP1, AC Mode, VOLT:0.050kV, HIGH:0.500mA, LOW:OFF, ARC:OFF, RAMP:1.0s, TIME:3.0s, FALL:0.5s, CHANNELS:DEFAULT, Address 0 of CH1~CH10 is set to ON”.

[:SOURce]:SAFety:STOP
It stops the test.

Example: Input the command SAF:STOP
Description: It means to stop the test on host.

:SYSTem:ERRor[:NEXT]?
It reads the message in Error Queue. See *6.6 Error Messages* for the error message returned.

Example: Input the command SYST:ERR?
The Tester returns 0, "No error".
Description: The returned 0,"No error" means there is no message in the error queue.

:SYSTem:KLOCk < *boolean* > | *ON* | *OFF* (RS232 only)
It controls the key to lock the panel from returning. The function is the same as the GPIB LLO command. However, it does not affect the Remote/Local state of GPIB.

Example: Input the command SYST:KLOC ON.
Description: It means the key is enabled to lock the panel from returning.

:SYSTem:KLOCk?
It queries if the panel has been locked.

Example: Input the command SYST:KLOC?
The Tester returns 1.
Description: The returned 1 means the host panel is locked at present.

:SYSTem:LINK:ADDRess?
It queries the address set for the system connection.

Example: Input the command SYST:LINK:ADDR?
The Tester returns 1.
Description: The returned 1 means the address of present system connection is 1.

:SYSTem:LINK:MASTer?
It queries if the system connection is set to Master.

Example: Input the command SYSTem:LINK:MAST?
The Tester returns 1.
Description: The returned 1 means the present system connection is set to Master.

:SYSTem:LOCK:OWNer?
It queries the system is in LOCAL or REMOTE state.

Example: Input the command SYSTem:LOCK:OWN?
The Tester returns LOCal.
Description: The returned LOCal means the system is in panel control state.

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

Example: Input the command SYSTem:LOCK:REL.
Description: It means to switch the system to panel control state.

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

Example: Input the command SYSTem:LOCK:REQ?
The Tester returns 1.
Description: The returned 1 means it is successful to switch from local to remote state.

:SYSTem:TCONtrol:AGC[:SOFTware] < *boolean* > | *ON* | *OFF*
It sets if enable the software AGC function.

Example: Input the command SYST:TCON:AGC ON.
Description: It means the software AGC function is enabled.

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

Example: Input the command SYST:TCON:AGC?
The Tester returns 1.
Description: The returned 1 means the software AGC function is enabled.

:SYSTem:TCONtrol:CHANnel[:DEFault][:CLOSe] <*channel_list*>
It sets the default of high voltage channel to close.

Example: Input the command SYST:TCON:CHAN (@001:003).
Description: It means the default of high voltage channel is set to close for CH1~CH3 of host Address 0.

:SYSTem:TCONtrol:CHANnel[:DEFault][:CLOSe]?
It queries the default of high voltage channel to close.

Example: Input the command SYST:TCON:CHAN?
The Tester returns (@001:003).
Description: It means the default of host high voltage channel is set to close for CH1~CH3 Address 0.

:SYSTem:TCONtrol:DISCharge:VMINimum *ON* | *OFF* | <*boolean*>
It sets the total discharge function to ON or OFF.

Example: Input the command SYST:TCON:DISC:VMIN ON
Description: It means to turn on the total discharge function.

:SYSTem:TCONtrol:DISCharge:VMINimum?
It queries if the total discharge is turned on.

Example: Input the command SYST:TCON:DISC:VMIN?
The Tester retuns 1.
Description: It means the total discharge function is turned on.

:SYSTem:TCONtrol:EOT TIMer | TEST
It sets the EOT signal to be End Of Test or End Of Timer.

Example: Input the command **SYST:TCON:EOT TIM**
Description: It means to set the host in End Of Timer state.

:SYSTem:TCONtrol:EOT*?*
It queries the meaning of EOT.

Example: Input the command **SYST:TCON:EOT?**
The Tester returns TIMer.
Description: The returned TIMer means the host is in End Of Timer state.

:SYSTem:TCONtrol:FAIL:OPERation *STOP* | *CONTinue*
It sets if continue to test the next step when the present test is judged FAIL.

Example: Input the command SYST:TCON:FAIL:OPER CONT.
Description: It means the test continues when the present test is judged FAIL.

:SYSTem:TCONtrol:FAIL:OPERation*?*
It queries if continue to test the next step when the present test is judged FAIL.

Example: Input the command SYST:TCON:FAIL:OPER?
The Tester returns CONTinue.
Description: The returned CONTinue means to carry on next test step.

:SYSTem:TCONtrol:RJUDgment < *boolean* > | *ON* | *OFF*
It sets the RAMP JUDGMENT to be on or off.

Example: Input the command SYST:TCON:RJUD ON.
Description: It means the RAMP JUDGMENT is set to on.

:SYSTem:TCONtrol:RJUDgment?
It queries the RAMP JUDGMENT is on or off.

Example: Input the command SYST:TCON:RJUD?
The Tester returns 1.
Description: The returned 1 means the RAMP JUDGMENT is on.

:SYSTem:TCONtrol:SCReen < *boolean* > | *ON* | *OFF*
It sets if the SCREEN is on or off.

Example: Input the command SYST:TCON:SCR ON.
Description: It means the SCREEN is set to on.

:SYSTem:TCONtrol:SCReen?
It queries if the SCREEN is on or off.

Example: Input the command SYST:TCON:SCR?
The Tester returns 1.
Description: The returned 1 means the SCREEN is set to on.

:SYSTem:TCONtrol:TIME:PASS[:HOLD] < *number value* >
It sets the action time for PASS HOLD. The unit is second (s).

Range: 0.2~99.9
Example: Input the command SYST:TCON:TIME:PASS 0.5.
Description: It means time set for PASS HOLD is 0.5sec.

:SYSTem:TCONtrol:TIME:PASS[:HOLD]?
It queries the action time for PASS HOLD.

Example: Input the command SYST:TCON:TIME:PASS?
The Tester returns 5.000000E-01.
Description: The returned 5.000000E-01 means the time set for PASS HOLD is 0.5sec.

:SYSTem:TCONtrol:VPERcent[:MINimum] < *number value* >
It sets the ratio of MIN. VOLTAGE. The unit is 100%.

Range: 0.0.5~0.95, 0 is OFF.
Example: Input the command SYST:TCON:VPER 0.6.
Description: It means the MIN. VOLTAG ratio is set to 60%.

:SYSTem:TCONtrol:VPERcent[:MINimum]*?*
It queries the ratio set for MIN. VOLTAGE.

Example: Input the command SYST:TCON:VPER?
The Tester returns 6.000000E-01.
Description: The returned 6.000000E-01 means the ration set for MIN. VOLTAGE is 60%.

:SYSTem:TCONtrol:WRANge[:AUTO] < *boolean* > | *ON* | *OFF*
It sets the WV mode to enable or disable auto range function.

Example: Input the command SYST:TCON:WRAN ON
Description: It means the WV auto range function is enabled.

:SYSTem:TCONtrol:WRANge[:AUTO]?
It queries the WV mode if auto range is enabled.

Example: Input the command SYST:TCON:WRAN?
Description: The returned 1 means auto range is enabled.

:SYSTem:TCONtrol:WVAC:FREQuency < *number value* >
It sets the ACV FREQUENCY. The unit is Hz.

Range: 50/60
Example: Input the command SYST:TCON:WVAC:FREQ 50.
Description: It means the ACV FREQUENCY is set to 50Hz.

:SYSTem:TCONtrol:WVAC:FREQuency?
It queries the setting of ACV FREQUENCY.

Example: Input the command SYST:TCON:WVAC:FREQ?
The Tester returns 5.000000E+01.

Description: The returned 5.000000E+01 means the setting of ACV FREQUENCY is 50Hz

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

Example: Input the command SYST:VERS?
The Tester returns 1990.0.
Description: The returned 1990.0 means the SCPI version supported by this device is 1990.0.

6.6 Error Messages

- The error messages stored in error queue will be returned in the way of first in first out (FIFO) which means the first error message returned is the first one being saved.
- When error messages exceed 30, the last one be stored in the error queue will be –350 "Queue overflow". It means the error queue is unable to store another error message until the error messages are extracted.
- If no error is generated, +0 "No error" will be stored in the first position of error queue.

-101 Invalid character
There is invalid character in the command.
-102 Syntax error
The syntax is error due to wrong character is used when piping the command.
-103 Invalid separator
There is invalid separator in the command string.
-104 Data type error
The parameter format is incorrect.
-108 Parameter not allowed
The device receives unallowable parameter.
-109 Missing parameter
The parameter is missing.
-111 Header separator error
The command header separator is incorrect.
-112 Program mnemonic too long
The simple command program header exceeds 12 characters.
-113 Undefined header
The device receives undefined command header.
-114 Header suffix out of range
The command header suffix variable is out of range.
-120 Numeric data error
The numeric parameter is incorrect.
-141 Invalid character data
The device receives invalid character data.
-151 Invalid string data
The device receives invalid string data usually the missing double quote.
-158 String data not allowed
The device receives unallowable string parameter.
-168 Block data not allowed
The device receives unallowable block parameter.
-171 Invalid expression error
The device receives invalid parameter of math expression.

-178 Expression data not allowed
The device receives unallowable parameter of math expression.
-200 Execution error
Error occurs when executing a command.
-203 Command protected
The device does not accept the command.
-221 Settings conflict
The command is conflict with the device at present and is unable to execute.
-222 Data out of range
The parameter value exceeds the tolerance.
-241 Hardware missing
The hardware does not exist.
-292 Referenced name does not exist
The name specified does not exist.
-293 Referenced name already exist
The name specified existed already.
-350 Queue overflow
The error message is overflow.
-363 Input buffer overrun
The device receives the characters more than the queue allowed.
-410 Query INTERRUPTED
The query is interrupted due another query is received before the result of previous query has been read.
-420 Query UNTERMINATED
When command is received to read the output queue data but there is none.

7. Calibration Procedure

Attention! Before performing the calibration procedure listed in this chapter, the Tester should be warm up for at least 30 minutes.

A/D REFERENCE Calibration (see Section 7.3)

A/D REFERENCE	; A/D Reference Calibration

Voltage Calibration (see Section 7.4)

19020/19020-4

ACV 5kV AGC OFFSET (0.1kV)	; AC Voltage AGC OFFSET point
ACV 5kV AGC FULL (4kV)	; AC Voltage AGC FULL point
ACV 5kV 50Hz OFFSET (0.1kV)	; AC Voltage 50Hz OFFSET point
ACV 5kV 50Hz FULL (4kV)	; AC Voltage 50Hz FULL point
ACV 5kV 60Hz OFFSET (0.1kV)	; AC Voltage 60Hz OFFSET point
ACV 5kV 60Hz FULL (4kV)	; AC Voltage 60Hz FULL point
DCV 6kV AGC OFFSET (0.1kV)	; DC Voltage AGC OFFSET point
DCV 6kV AGC FULL (4kV)	; DC Voltage AGC FULL point
DCV 6kV OFFST (0.1kV)	; DC Voltage OFFSET point
DCV 6kV FULL (4kV)	; DC Voltage FULL point
OSC 100V OFFST (50V)	; OSC Voltage OFFSET point
OSC 100V FULL (100V)	; OSC Voltage FULL point

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ACV 6kV AGC OFFSET (0.1kV)	; AC Voltage AGC OFFSET point
ACV 6kV AGC FULL (4kV)	; AC Voltage AGC FULL point
ACV 6kV 50Hz OFFSET (0.1kV)	; AC Voltage 50Hz OFFSET point
ACV 6kV 50Hz FULL (4kV)	; AC Voltage 50Hz FULL point
ACV 6kV 60Hz OFFSET (0.1kV)	; AC Voltage 60Hz OFFSET point
ACV 6kV 60Hz FULL(4kV)	; AC Voltage 60Hz FULL point
OSC 100V OFFST (50V)	; OSC Voltage OFFSET point
OSC 100V FULL (100V)	; OSC Voltage FULL point

19022/19022-4

DCV 8kV AGC OFFSET (0.1kV)	; DC Voltage AGC OFFSET point
DCV 8kV AGC FULL (4kV)	; DC Voltage AGC FULL point
DCV 8kV OFFST (0.1kV)	; DC Voltage OFFSET point
DCV 8kV FULL (7kV)	; DC Voltage FULL point
OSC 100V OFFST (50V)	; OSC Voltage OFFSET point
OSC 100V FULL (100V)	; OSC Voltage FULL point

Current Calibration (see Section 7.5)

19020/19020-4

ACA 3mA OFFSET (0.12mA)	; AC current 3mA range OFFSET point
ACA 3mA FULL (2.4mA)	; AC current 3mA range FULL point
ACA 10mA OFFSET (2.4mA)	; AC current 10mA range OFFSET point
ACA 10mA FULL (4.8mA)	; AC current 10mA range FULL point
DCA 3mA OFFSET (0.12mA)	; DC 3mA range OFFSET point
DCA 3mA FULL (2.4mA)	; DC 3mA range FULL point
DCA 5mA OFFSET (2.4mA)	; DC 5mA range OFFSET point

```
   DCA 5mA FULL (4.8mA)          ; DC 5mA range FULL point

19021
   ACA 3mA OFFSET (0.12mA)       ; AC current 3mA range OFFSET point
   ACA 3mA FULL (2.4mA)          ; AC current 3mA range FULL point
   ACA 8mA OFFSET (2.4mA)        ; AC current 8mA range OFFSET point
   ACA 8mA FULL (4.8mA)          ; AC current 8mA range FULL point

19022/19022-4
   DCA 3mA OFFSET (0.12mA)       ; DC 3mA range OFFSET point
   DCA 3mA FULL (2.4mA)          ; DC 3mA range FULL point
   DCA 3.5mA OFFSET (2.4mA)      ; DC 3.5mA range OFFSET point
   DCA 3.5mA FULL (4.8mA)        ; DC 3.5mA range FULL point
```

Insulation Resistance Calibration (see Section 7.6)

```
19020/19020-4/19022/19022-4
   IRR 200MΩ OFFSET (4MΩ)        ; IR Resistor 200MΩ OFFSET point
   IRR 200MΩ FULL (20MΩ)         ; IR Resistor 200MΩ FULL point
   IRR 2GΩ OFFSET (40MΩ)         ; IR Resistor 2GΩ OFFSET point
   IRR 2GΩ FULL (200MΩ)          ; IR Resistor 2GΩ FULL point
   IRR 20GΩ OFFSET (400MΩ)       ; IR Resistor 20GΩ OFFSET point
   IRR 20GΩ FULL (2GΩ)           ; IR Resistor 20GΩ FULL point
   IRR 200GΩ OFFSET (4GΩ)        ; IR Resistor 200GΩ OFFSET point
   IRR 200GΩ FULL (20GΩ)         ; IR Resistor 200GΩ FULL point
   IRR 550GΩ OFFSET (40GΩ)       ; IR Resistor 550GΩ OFFSET point
   IRR 550GΩ FULL (200GΩ)        ; IR Resistor 550GΩ FULL point
```

Note 19021 has no IRR related calibration.

ARC Calibration (see Section 7.7)

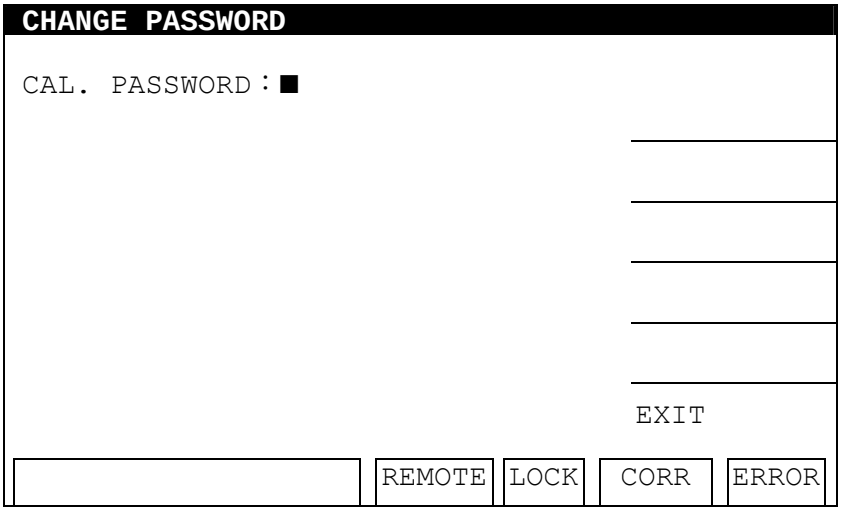
```
19020/19020-4
   AC ARC 15mA (7mA)             ; AC ARCing Calibration
   DC ARC 5mA (3mA)              ; DC ARCing Calibration

19021
   AC ARC 15mA (7mA)             ; AC ARCing Calibration

19022/19022-4
   DC ARC 5mA (3mA)              ; DC ARCing Calibration
```

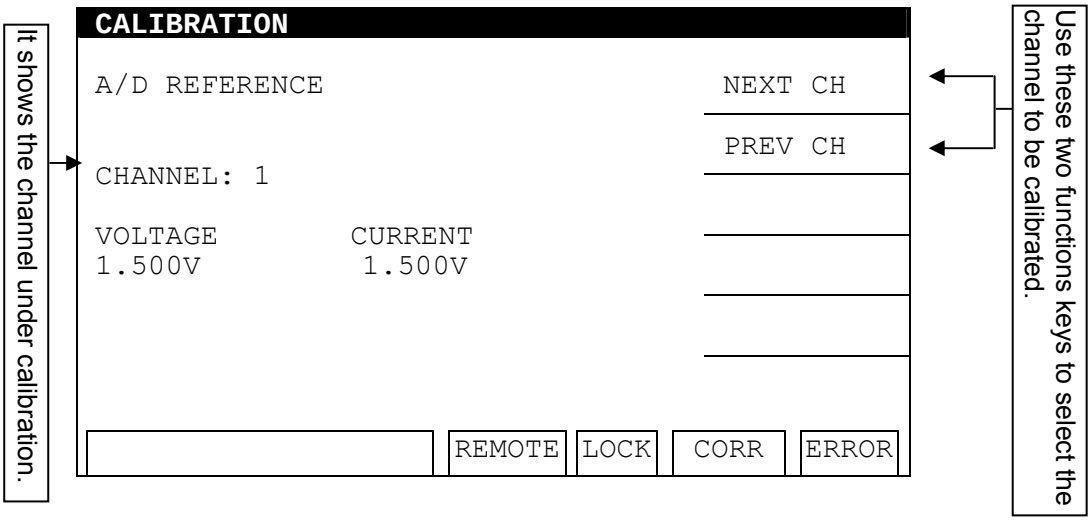
7.1 Entering Calibration Screen

When in SYSTEM screen, move the highlight to CALIBRATION and press **ENTER** to go to CALIBRATION setting screen as shown below:



Key-in the calibration password **7** **9** **3** **1** to enter into the calibration mode.

7.2 Selecting the Channel for Calibration

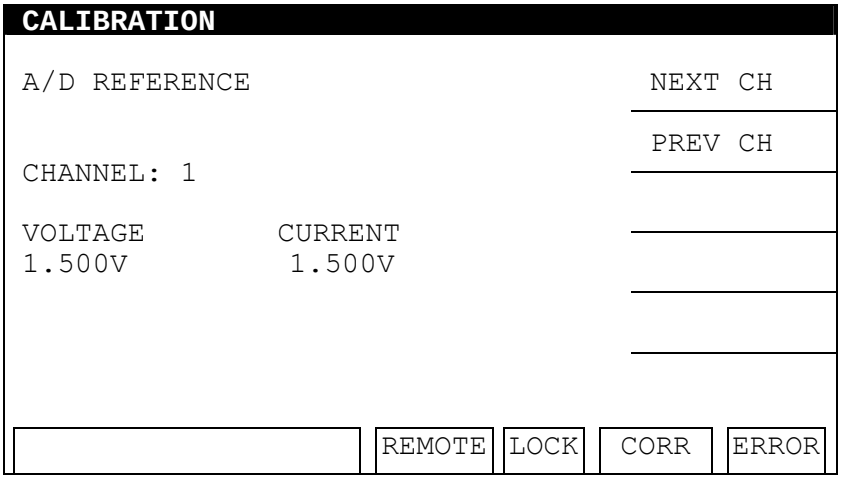


As the figure shown above, use Function Key [NEXT CH] and [PREV CH] to select the channel to be calibrated and the screen will show the channel under calibration.

7.3 A/D REFERENCE Calibration

■ **To calibrate the HV OUTPUT and RTN/LOW terminals of a CH, conduct the following calibration procedure without any DUT or cables connected.**

A/D REFERENCE Calibration Screen:



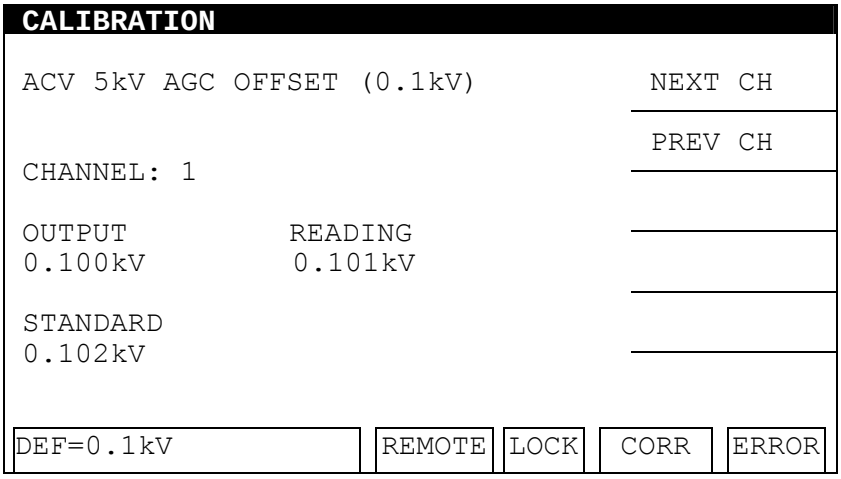
1. Press **START** to do A/D REFERENCE.
2. A/D REFERENCE calibration is done when the status indicator shows PASS.
3. Press ▼ to go to ACV 5kV AGC OFFSET (0.1kV) calibration.

7.4 Voltage Calibration

7.4.1 ACV Calibration

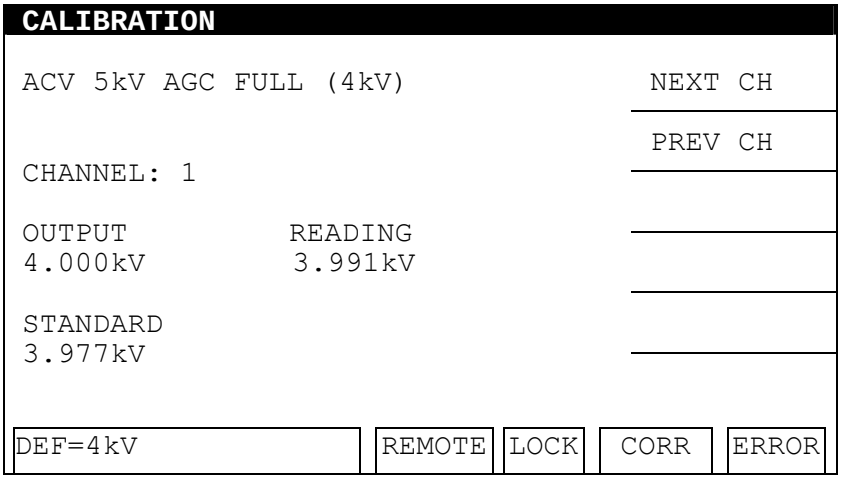
■ **Connect an ACV high voltage meter to the Tester with high voltage terminal connected to HV OUTPUT and low voltage terminal connected to RTN/LOW of the channel to be calibrated.**

ACV 5kV OFFSET (0.1kV) Calibration Screen:



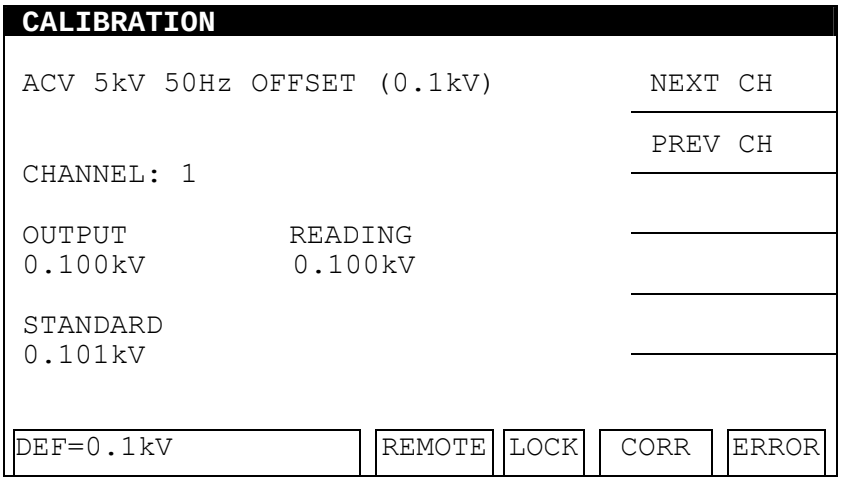
1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACV 5kV AGC FULL (4kV) calibration.

ACV 5kV AGC FULL (4kV) Calibration Screen:



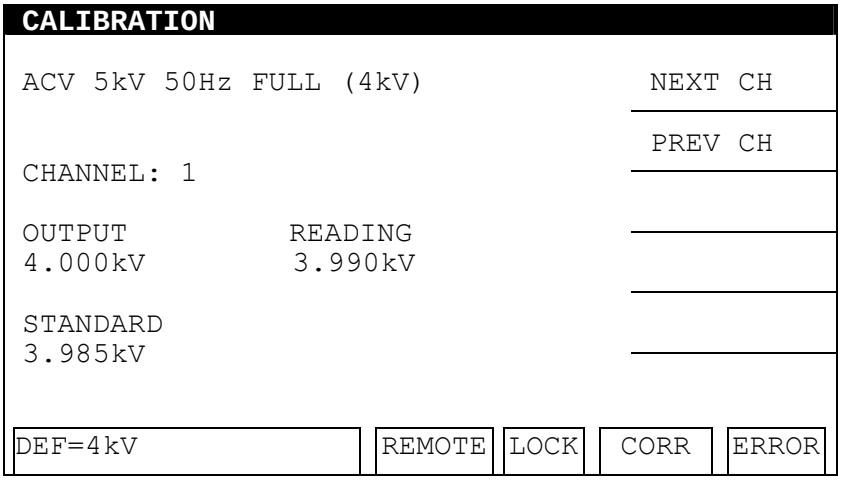
1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACV 5kV 50Hz OFFSET (0.1kV) calibration.

ACV 5kV 50Hz OFFSET(0.1kV) Calibration Screen:



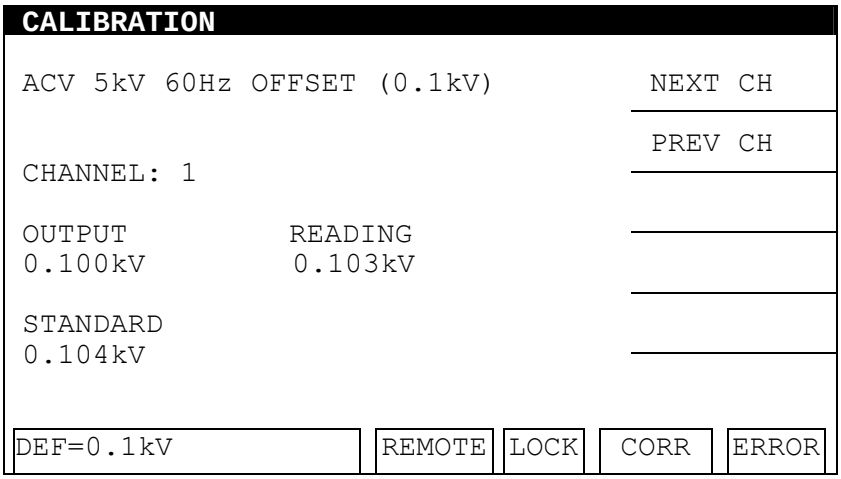
1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACV 5kV 50Hz FULL (4kV) calibration.

ACV 5kV 50Hz FULL (4kV) Calibration Screen:



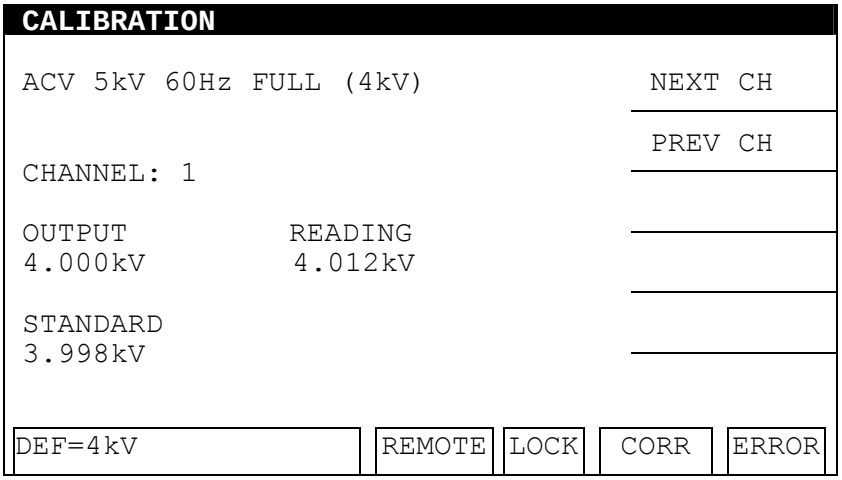
1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** **~** **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACV 5kV 60Hz OFFSET (0.1kV) calibration.

ACV 5kV 60Hz OFFSET(0.1kV) Calibration Screen:



1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** **~** **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACV 5kV 60Hz FULL (4kV) calibration.

ACV 5kV 60Hz FULL (4kV) Calibration Screen:

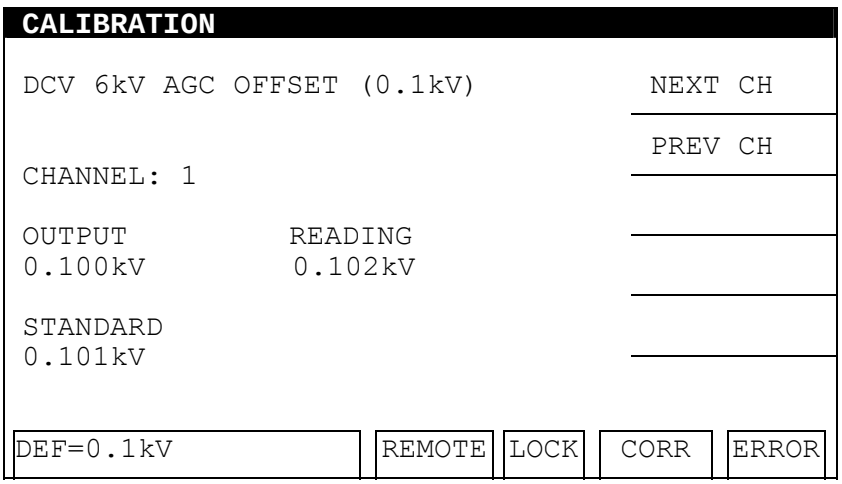


1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCV 6kV AGC OFFSET (0.1kV) calibration.

7.4.2 DCV Calibration

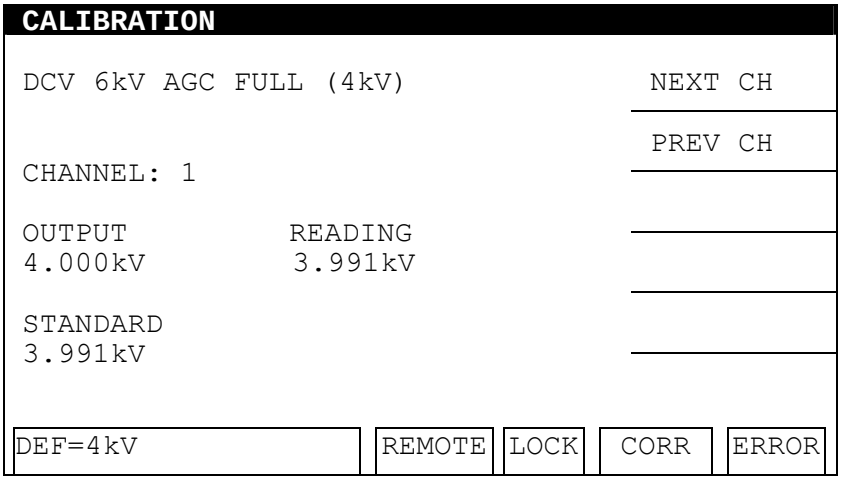
■ **Connect a DCV high voltage meter to the Tester with high voltage terminal connected to HV OUTPUT and low voltage terminal connected to RTN/LOW of the channel to be calibrated.**

DCV 6kV AGC OFFSET(0.1kV) Calibration Screen:



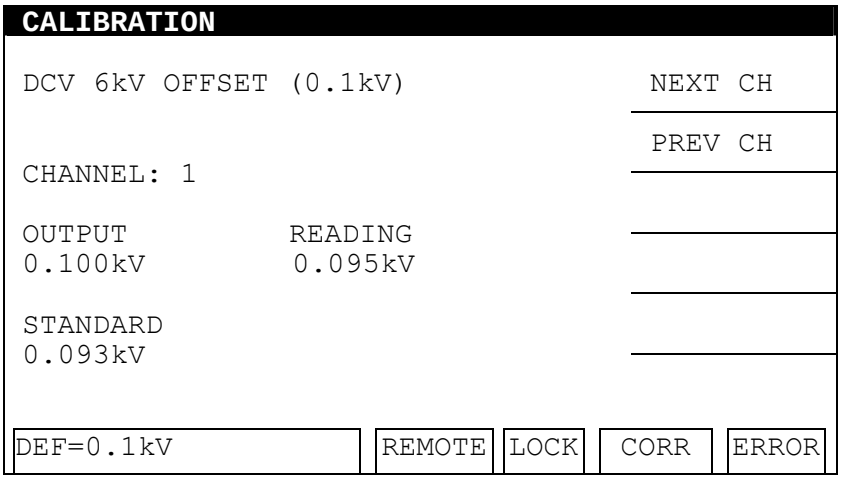
1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCV 6kV AGC FULL (4kV) calibration.

DCV 6kV AGC FULL (4kV) Calibration Screen:



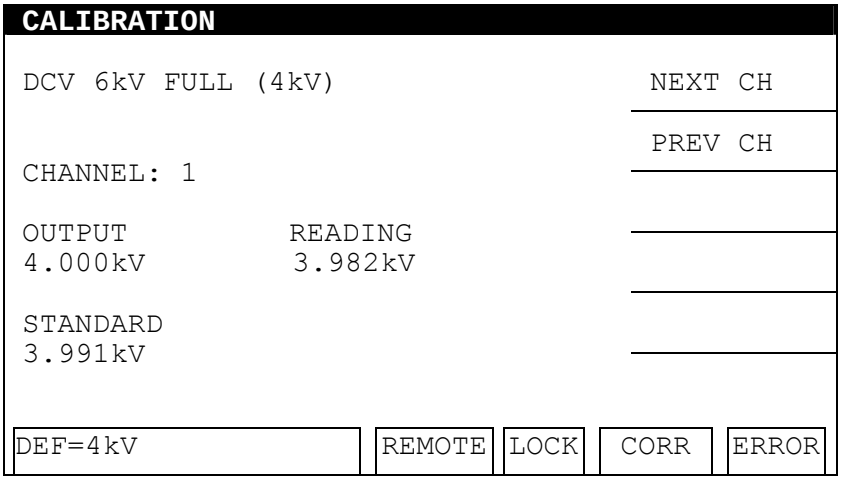
1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCV 6kV OFFSET (0.1kV) calibration.

DCV 6kV OFFSET(0.1kV) Calibration Screen:



1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCV 6kV FULL (4kV) calibration.

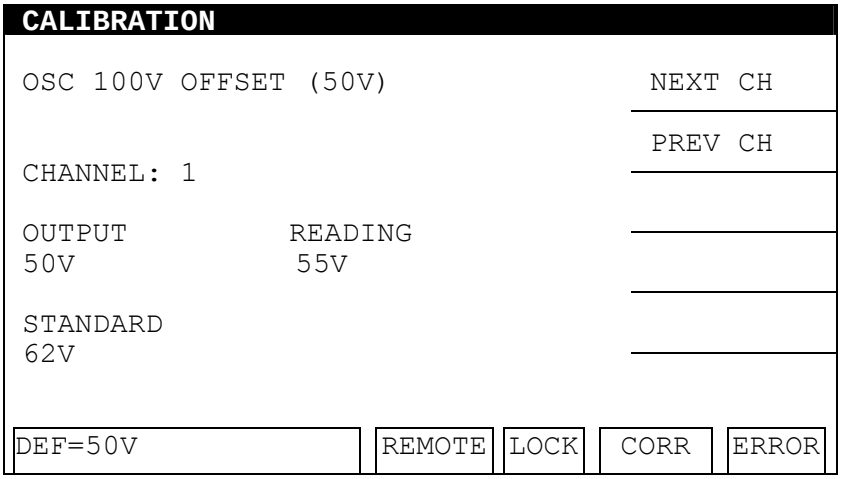
DCV 6kV FULL (4kV) Calibration Screen:



1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to OSC 100V OFFSET (50V) calibration.

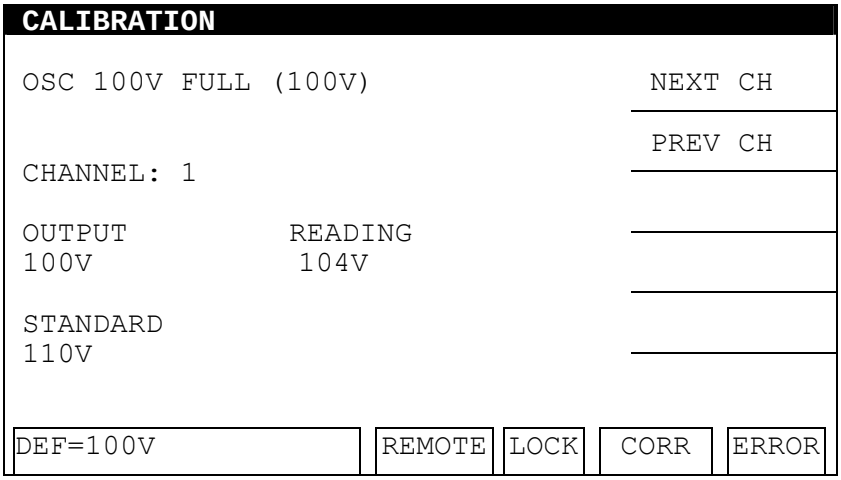
7.4.3 OSCV Calibration

OSC 100V OFFSET(50V) Calibration Screen:



1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to OSC 100V FULL (100V) calibration.

OSC 100V FULL (100V) Calibration Screen:



1. Press **START** to output voltage and read the data from the high voltage meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of high voltage meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACA 3mA OFFSET (0.12mA) calibration.

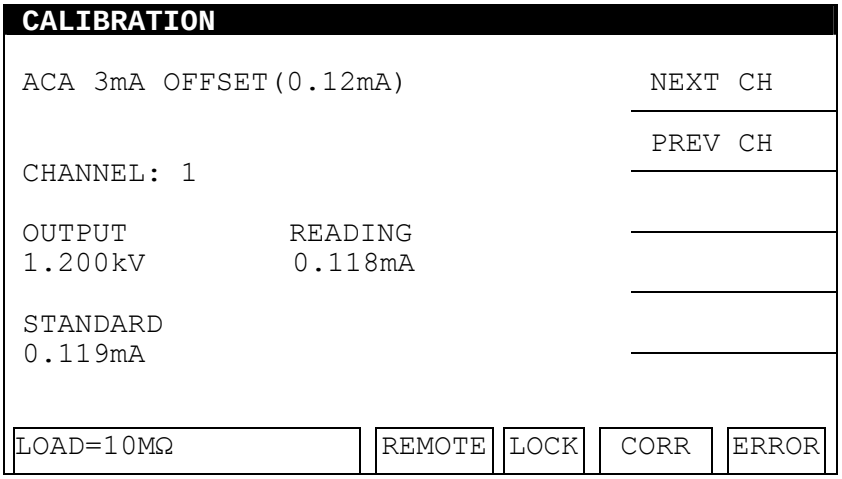
7.5 Current Calibration

CAUTION The virtual load has to be in between high potential terminal and ammeter input terminal, or it may cause hazard.

7.5.1 ACA Current Calibration

■ **Connect a 10MΩ 0.5 Watt or high power simulated load resistance in between the high voltage output terminal (HV OUTPUT) of the channel to be calibrated on this Tester and the high potential terminal of AC meter, also connect the low potential terminal (RTN/LOW) of the channel to be calibrated on this Tester to the low potential terminal of AC meter.**

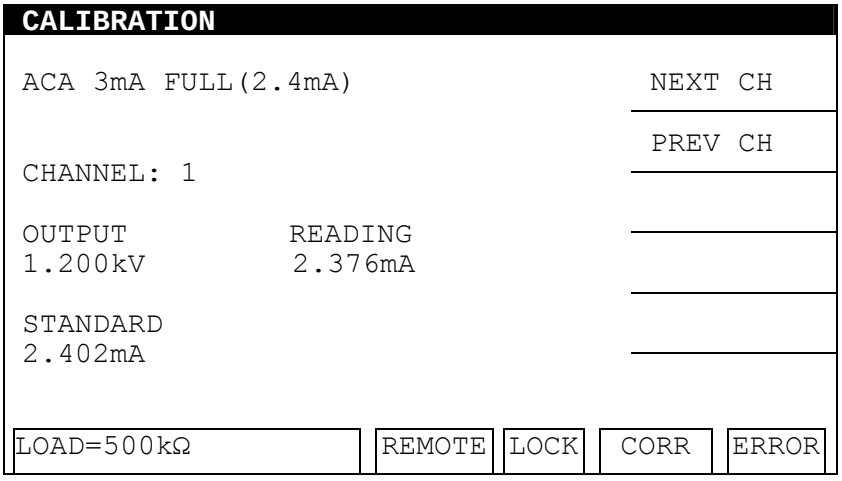
ACA 3mA OFFSET(0.12mA) Calibration Screen:



1. Press **START** to output voltage and read the data from the AC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of AC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACA 3mA FULL (2.4mA) calibration.

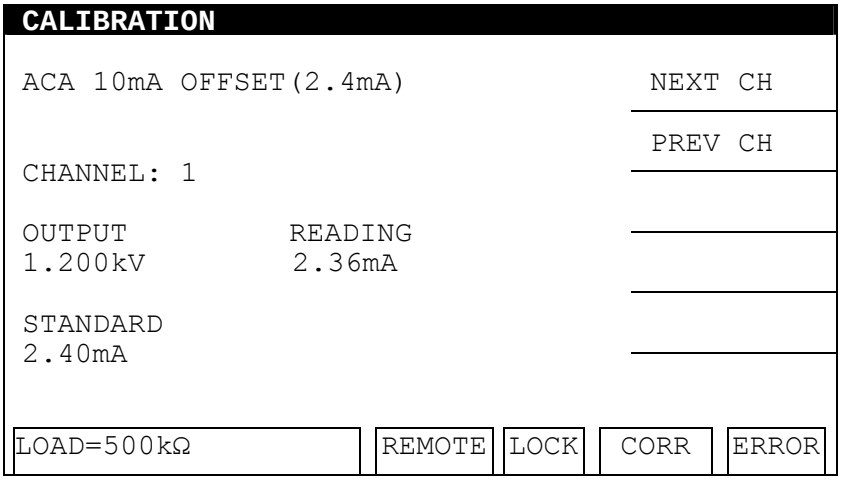
■ **Change the simulated load resistance to 500kΩ 10watt or higher power.**

ACA 3mA FULL(2.4mA) Calibration Screen:



1. Press **START** to output voltage and read the data from the AC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of AC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACA 10mA OFFSET (2.4mA) calibration.

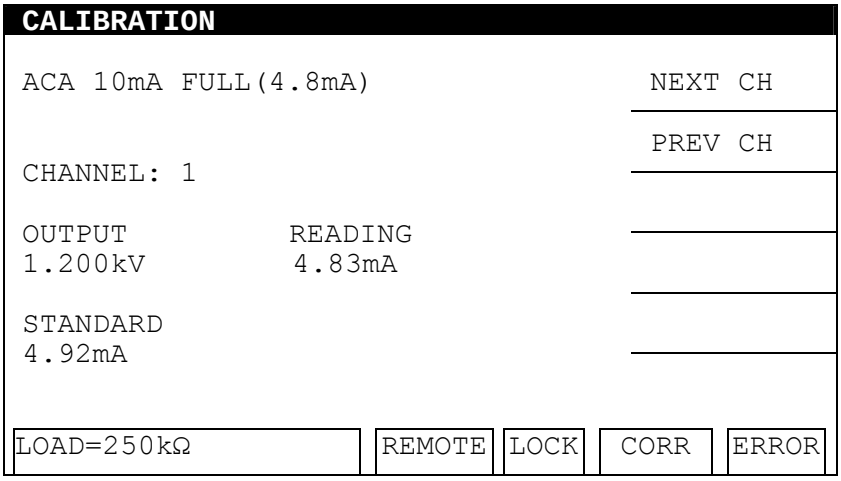
ACA 10mA OFFSET(2.4mA) Calibration Screen:



1. Press **START** to output voltage and read the data from the AC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of AC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to ACA 10mA FULL (4.8mA) calibration.

■ **Change the simulated load resistance to 250kΩ 20 Watts or higher power.**

ACA 10mA FULL(4.8mA) Calibration Screen:

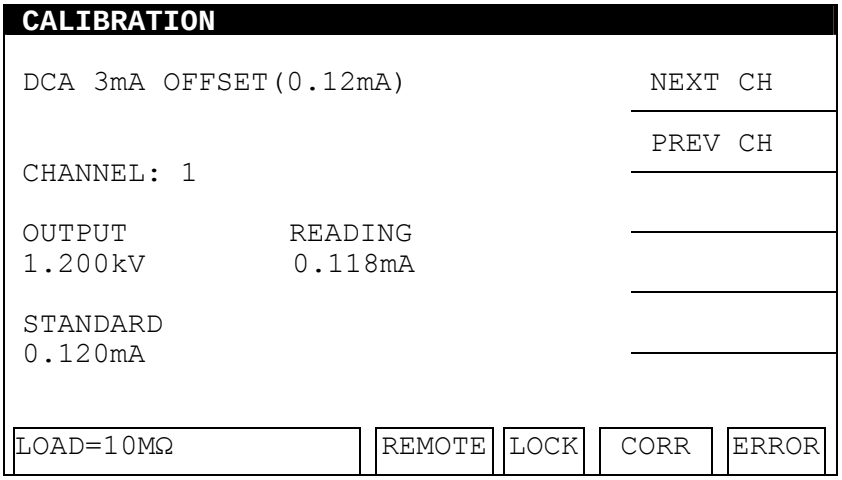


1. Press **START** to output voltage and read the data from the AC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of AC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCA 3mA OFFSET (0.12mA) calibration.

7.5.2 DCA Current Calibration

■ **Connect a 10MΩ 0.5 Watt or high power simulated load resistance in between the high voltage output terminal (HV OUTPUT) of the channel to be calibrated on this Tester and the high potential terminal of AC meter, also connect the low potential terminal (RTN/LOW) of the channel to be calibrated on this Tester to the low potential terminal of AC meter.**

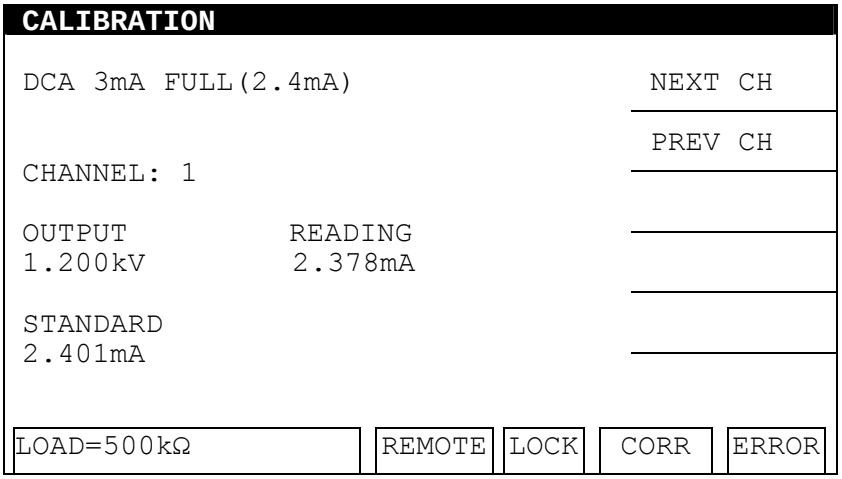
DCA 3mA OFFSET(0.12mA) Calibration Screen:



1. Press **START** to output voltage and read the data from the DC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of DC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCA 3mA FULL (2.4mA) calibration.

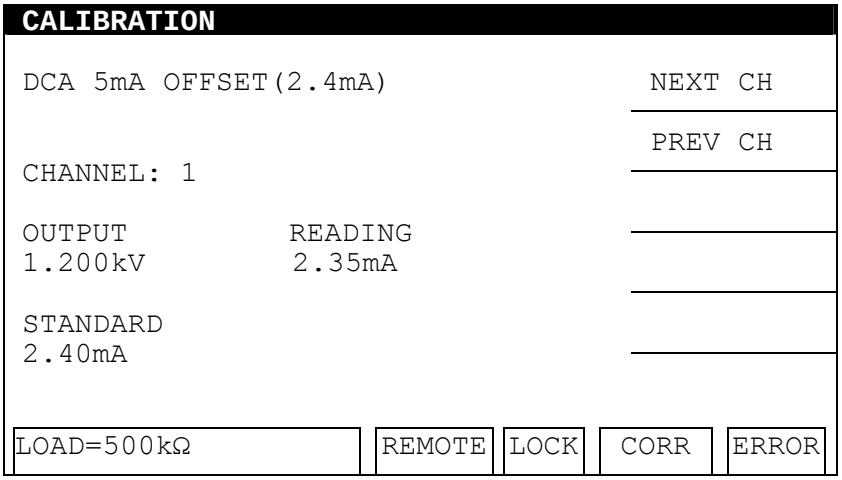
■ **Change the simulated load resistance to 500kΩ 10watt or higher power.**

DCA 3mA FULL(2.4mA) Calibration Screen:



1. Press **START** to output voltage and read the data from the DC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of DC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCA 5mA OFFSET (2.4mA) calibration.

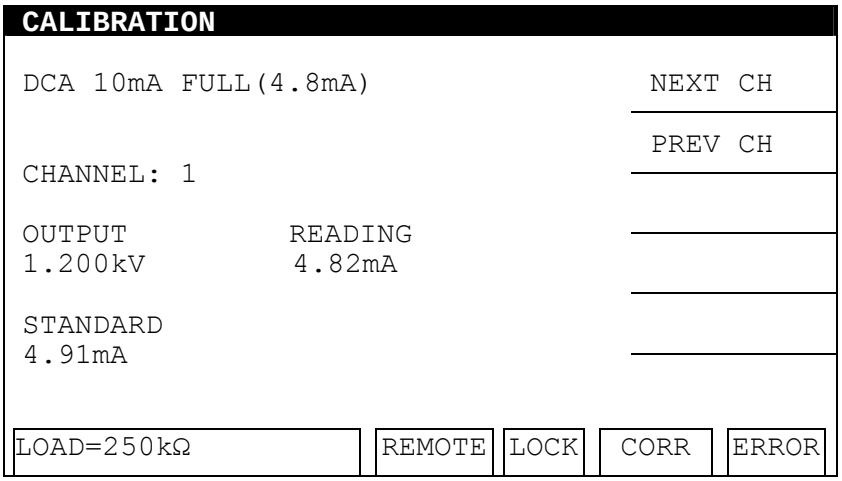
DCA 5mA OFFSET(2.4mA) Calibration Screen:



1. Press **START** to output voltage and read the data from the DC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of DC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to DCA 5mA FULL (4.8mA) calibration.

■ **Change the simulated load resistance to 250kΩ 20 Watts or higher power.**

DCA 5mA FULL(4.8mA) Calibration Screen:

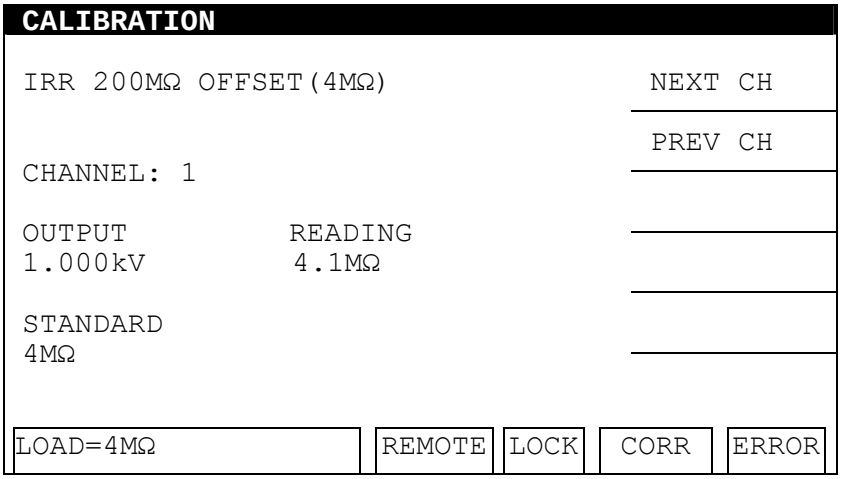


1. Press **START** to output voltage and read the data from the DC meter.
2. Press numeric key **0** **.** ~ **9** to input the reading of DC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 200MΩ OFFSET (4MΩ) calibration.

7.6 Insulation Resistance (IR) Calibration

■ **Connect a 4MΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

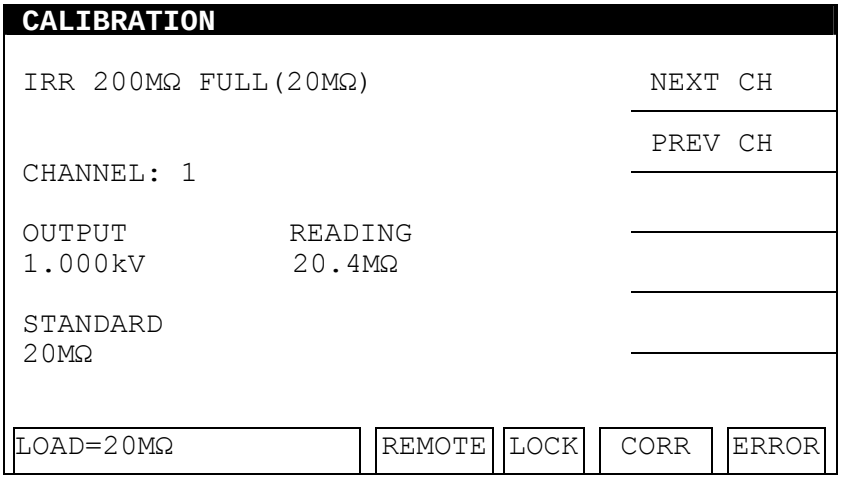
IRR 200MΩ OFFSET (4MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 200MΩ FULL(20MΩ) calibration.

■ **Connect a 20MΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

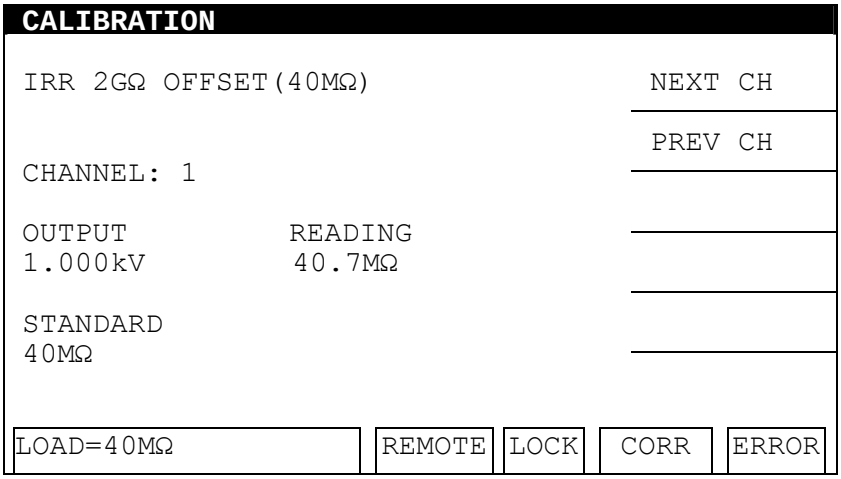
IRR 200MΩ FULL (20MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 2GΩ OFFSET (40MΩ) calibration.

■ **Connect a 40MΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

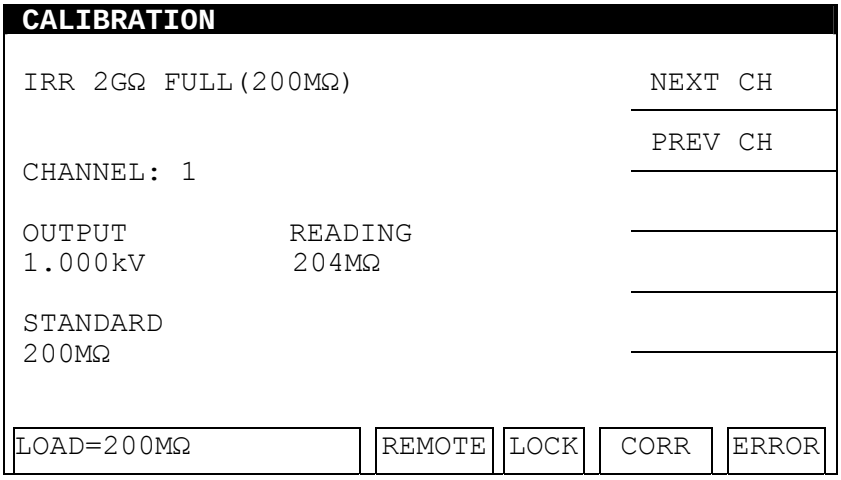
IRR 2GΩ OFFSET (40MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 2GΩ FULL (200MΩ) calibration.

■ **Connect a 200MΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

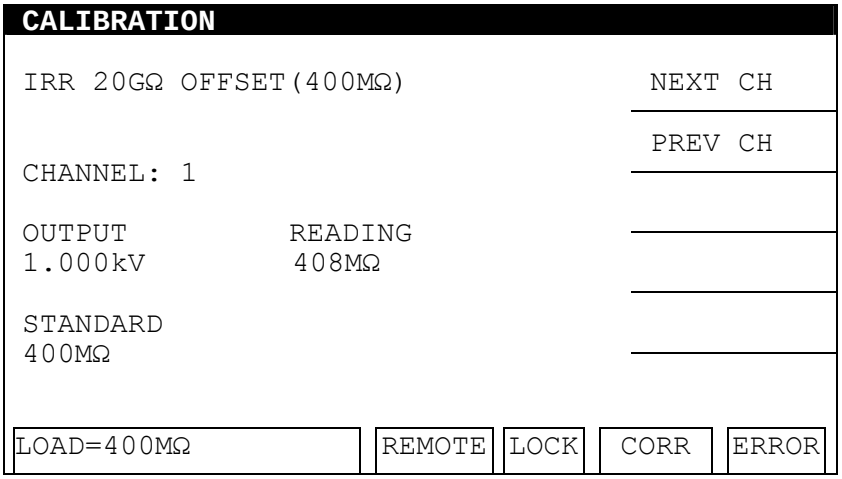
IRR 2GΩ FULL (200MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 20GΩ OFFSET (400MΩ) calibration.

■ **Connect a 400MΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

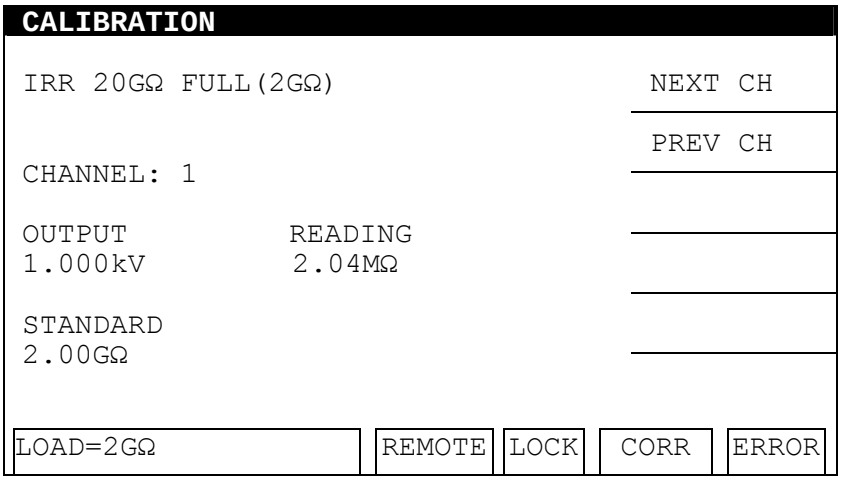
IRR 20GΩ OFFSET (400MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 20GΩ FULL (2GΩ) calibration.

■ **Connect a 2GΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

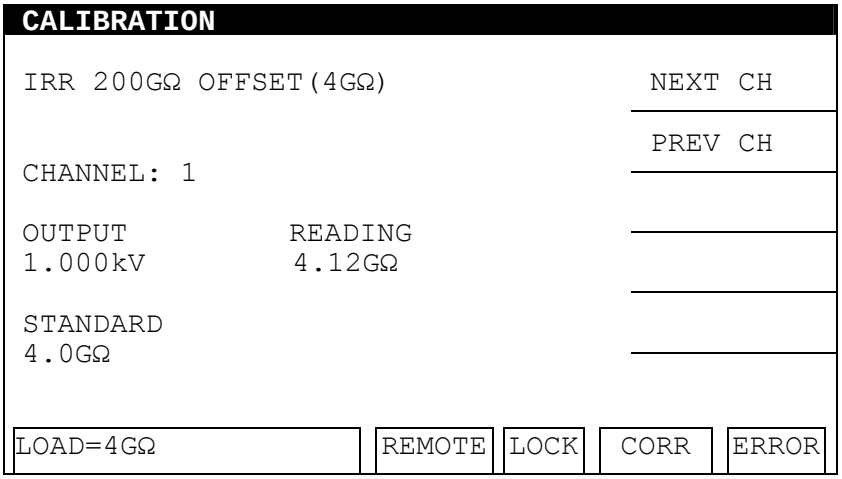
IRR 20GΩ FULL (2GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 200GΩ OFFSET (4GΩ) calibration.

■ **Connect a 4GΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

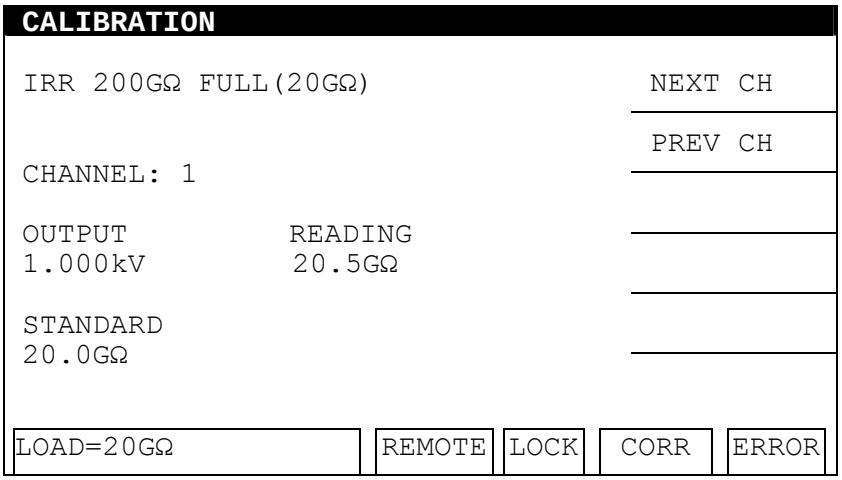
IRR 200GΩ OFFSET (4GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** **~** **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 200GΩ FULL (20GΩ) calibration.

■ **Connect a 20GΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

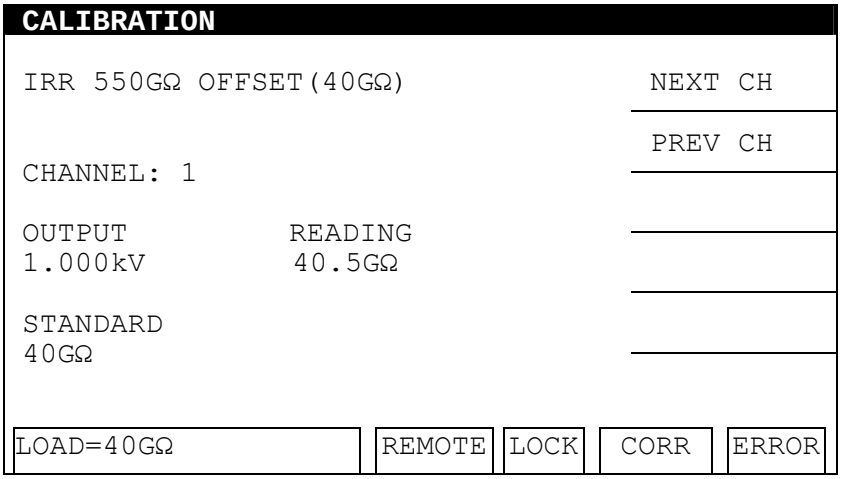
IRR 200GΩ FULL (20GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** **~** **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 550GΩ OFFSET (40GΩ) calibration.

■ **Connect a 40GΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

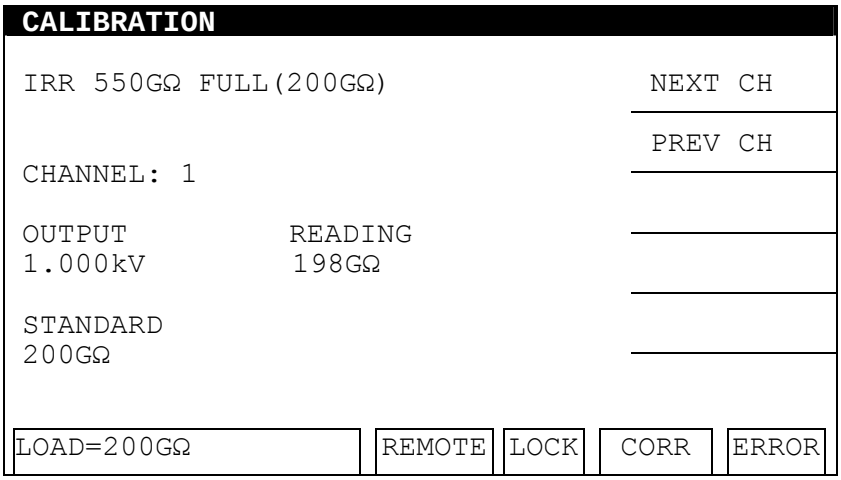
IRR 550GΩ OFFSET (40GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to IRR 550GΩ FULL (200GΩ) calibration.

■ **Connect a 200GΩ standard resistance in between the high voltage output terminal (HV OUTPUT) and low potential terminal (RTN/LOW) of the channel to be calibrated on the Tester.**

IRR 550GΩ FULL (200GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press numeric key **0** **.** ~ **9** to input actual resistance.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop high voltage output.
5. Press **▼** to go to AC ARC 15mA (7mA) calibration.

7.7 ARC Calibration

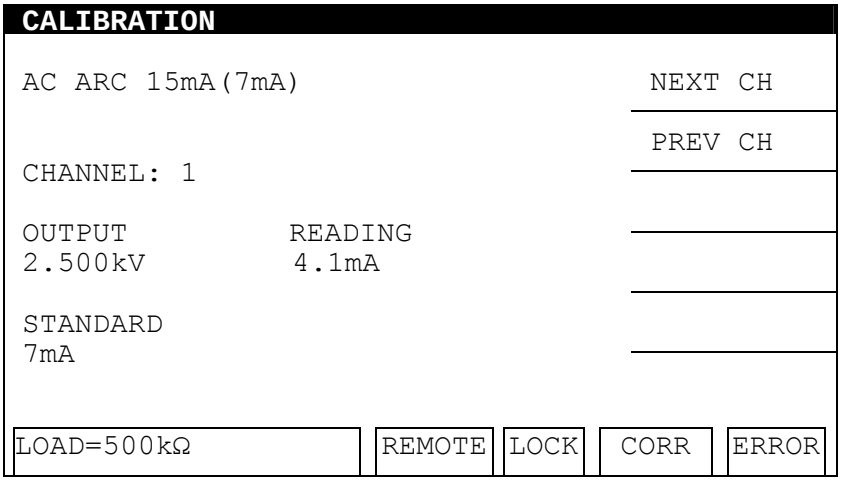
⚠WARNING

1. ARC calibration is special task as the high voltage is exposed outside the terminal. Please be careful as it may cause hazard.
2. For detail information, please contact Chroma or its local distributors.

7.7.1 AC ARC Calibration

■ **Connect one end of 500kΩ 10Watt or high power simulated load resistance to the high voltage output terminal (HV OUTPUT) of the channel to be calibrated on this Tester, and move the other end close to the low potential terminal (RTN/LOW) of the channel to be calibrated without physical connection in order to create sparks.**

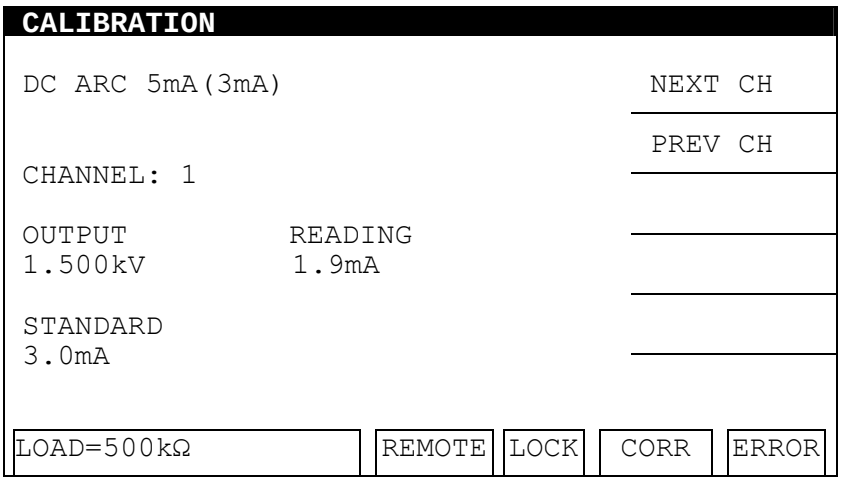
AC ARC 15mA (7mA) Calibration Screen:



1. Press **START** to output voltage.
2. When the status indicator shows PASS, it means the device has grabbed the ARC value correctly and stopped the high voltage output.
3. Press ▼ to go to DC ARC 5mA (3mA) calibration.

7.7.2 DC ARC Calibration

DC ARC 5mA (3mA) Calibration Screen:



1. Press **START** to output voltage.
2. When the status indicator shows PASS, it means the device has grabbed the ARC value correctly and stopped the high voltage output.

7.8 When Calibration is Done

1. Press **SYSTEM** to exit calibration mode or press ▼ to return to A/D REFERENCE calibration screen.

2. To calibrate other channels, press Function Key [NEXT CH][PREV CH] to select another channel for calibration.

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