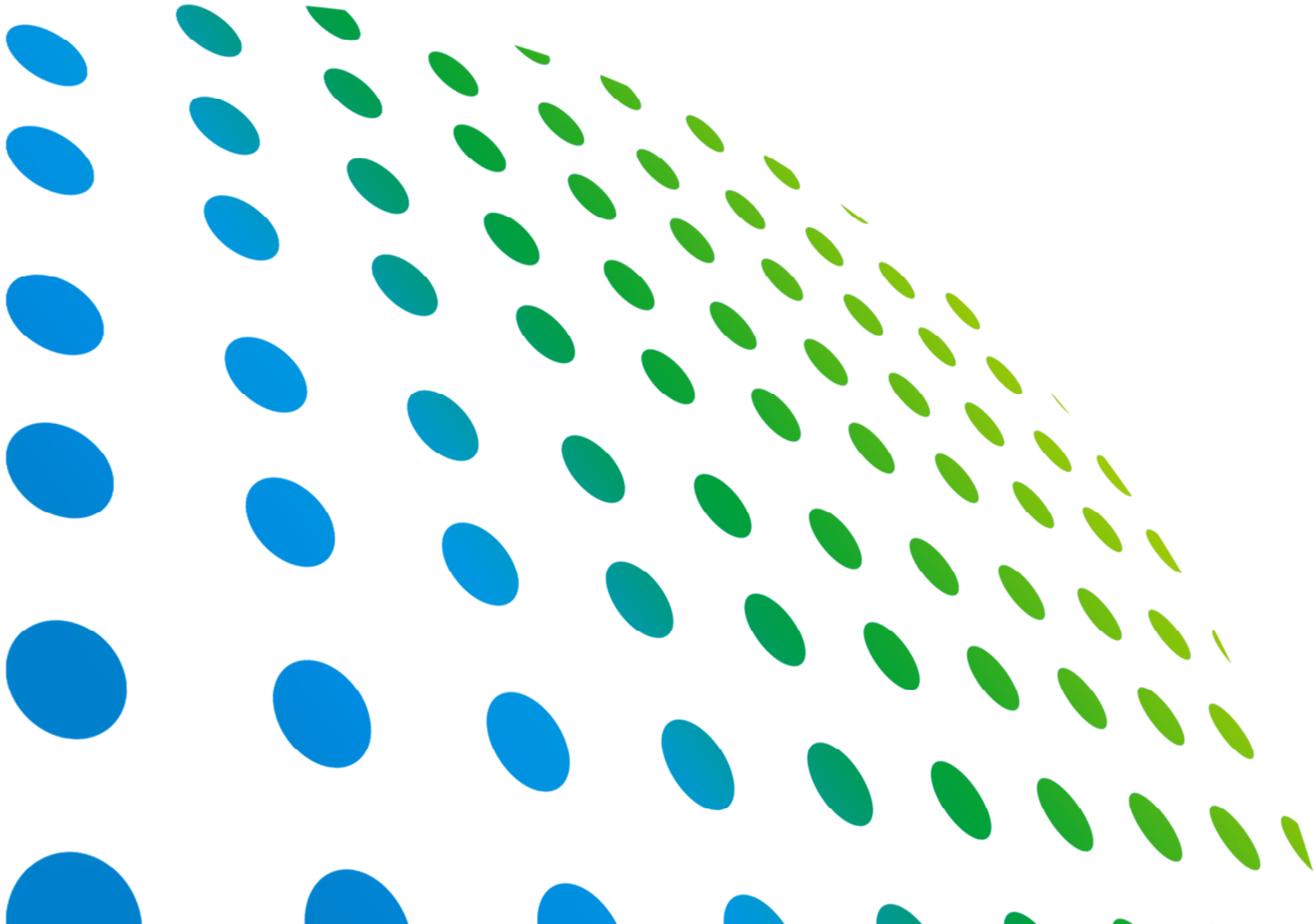




**Multi-Channel Sync Hipot Tester**  
**19020/19020-4/19021/19021-4/  
19022/19022-4**  
**User's Manual**





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



Version 2.4  
October 2017

# Legal Notices

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

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

## **CHROMA ATE INC.**

66 Huaya 1st Road, Guishan, Taoyuan 33383, Taiwan

Copyright Notices. Copyright 2008 Chroma ATE INC., all rights reserved. Reproduction, adaptation, or translation of this document without prior written permission is prohibited, except as allowed under the copyright laws.

# Warranty

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

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

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

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

**CHROMA ATE INC.**

66 Huaya 1st Road, Guishan,  
Taoyuan 33383, Taiwan  
Tel: 886-3-327-9999  
Fax: 886-3-327-8898  
e-mail: [info@chromaate.com](mailto:info@chromaate.com)

<http://www.chromaate.com>

# Material Contents Declaration

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



: See <Table 1>.



: See <Table 2>.

<Table 1>

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

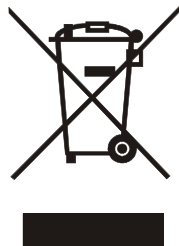
“○” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 and EU Directive 2011/65/EU.

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

Remarks: The CE marking on product is a declaration of product compliance with EU Directive 2011/65/EU.

## 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 ones, the retailer is legally obligated to take back the old appliances for disposal free of charge.



<Table 2>

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

“○” 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 Directive 2011/65/EU..

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

1. Chroma has not fully transitioned to lead-free solder assembly at this time; 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 ones, the retailer is legally obligated to take back the old appliances for disposal free of charge.





# Declaration of Conformity

For the following equipment :

**Multi-Channel Hipot Tester**

(Product Name/ Trade Name)

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

(Model Designation)

**CHROMA ATE INC.**

(Manufacturer Name)

**66 Huaya 1<sup>st</sup> Road, Guishan, Taoyuan 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 (2014/30/EU) and Low Voltage Directive (2014/35/EU). For the evaluation regarding the Directives, the following standards were applied :

**EN 61326-1:2013**

EN 55011:2009+A1:2010 Class A, EN 61000-3-2:2014, EN 61000-3-3:2013,

IEC 61000-4-2 Edition 2.0 2008-12, IEC 61000-4-3 Edition 3.2 2010-04,

IEC 61000-4-4 Edition 3.0 2012-04, IEC 61000-4-5 Edition 2.0 2005-11,

IEC 61000-4-6 Edition 3.0 2008-10, IEC 61000-4-8 Edition 2.0 2009-09,

IEC 61000-4-11 Edition 2.0 2004-03

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

The equipment describe above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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

**CHROMA ATE INC.**

(Company Name)

**66 Huaya 1<sup>st</sup> Road, Guishan, Taoyuan 33383, Taiwan**

(Company Address)

Person responsible for this declaration:

**Mr. Vincent Wu**

(Name, Surname)

**T&M BU Vice President**

(Position/Title)

**Taiwan**

(Place)

**2017.02.21**

(Date)

(Legal Signature)



# Unpacking Inspection

This instrument was inspected before shipment 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, file a claim with the 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 (1.8 meters, 15A)
15A Fuse	2	15A SLOW BLOW
CANBUS Cable	1	PHONE CABLE 6P6C to connect multiple devices (1 meter)
D-SUB Cable	1	D-SUB-25P-MALE*2 to connection multiple devices (1 meter)
High Voltage Cable	<b>Note 2</b>	Single head high voltage terminal + 20kV high voltage cable (3.1 meters)
RTN/LOW Cable	<b>Note 2</b>	Single head BNC(MALE)+RG-174 (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. If additional items are required, contact Chroma with the item's description.
2. The cable quantity may vary with the output channel configuration. For example, the cable quantity for the 10CH model is 10 sets, while the quantity for the 4CH model is 4 sets.

# Hazardous Operating Conditions

1. Do not touch the test area when the tester's output is enabled. Electrical shock could result in physical injury or death.

Be sure to observe the following rules:

- Use a standard three prong (grounded) power cord.
  - Insure the earth ground is properly connected.
  - Do not touch the output terminal.
  - Do not touch the test wire that is connected to the terminal under test.
  - Do not touch any Unit Under Test (UUT).
  - Do not touch any component that is connected to the output terminal for charging.
  - Do not touch the test unit right after the test has ended or when the output has just been turned off. It can take several seconds for the high voltage to bleed off.
2. Shock accidents usually occur under the following conditions:
    - The earth terminal of the Hipot Tester is not properly connected.
    - Insulating gloves are not used during testing.
    - Touching the test unit immediately after the test is done.



**WARNING**

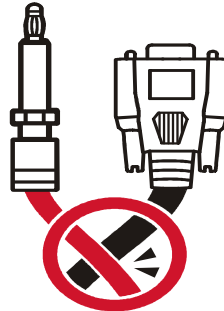
See Chapter 3 – “*Safety Precautions*” for safety notes on the proper setup and use of the tester.



**CAUTION**

Do not bundle or cross the high voltage cable with the RS-232, Handler, GPIB control cables, or other low voltage side wires. It could damage the product or PC controller.

## DANGER



# Storage, Freight, Maintenance & Cleaning

## **Storage**

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

## **Freight**

Pack the device carefully before moving it. If any of the original packing material is missing, use suitable alternative material and mark it “fragile” and “keep away from water” to avoid damaging the product. This product is a piece of precision test equipment; do not drop or strike it.

## **Maintenance**

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

The instrument should be calibrated every 12 months.

## **Cleaning**

Be sure to unplug the input power cord from the device and remove all other connected wires before cleaning. Use a brush to clean the dust off the machine surface and a low pressure air gun to clean the dust inside the device or send it to your local distributor for cleaning.

# Revision History

The following lists the additions, deletions and modifications in this manual for 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 for 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 Conformity".
Aug. 2013	1.8	Update "Pin Assignment" in the chapter of "HANDLER Interface". Update the following: <ul style="list-style-type: none"> <li>– "Setting TEST CONTROL", "Setting SYSTEM CONFIG" and "Selecting Test Mode" sections in the chapter of "Operation"</li> <li>– "Commands Summary" and "Command Description" in the chapter of "GPIB/RS232 Interface"</li> </ul>
Oct. 2014	1.9	Add PSC Mode to DC, IR and OSC tests procedures and commands.
Aug. 2015	2.0	Add descriptions for new model 19021-4.
Mar. 2016	2.1	Modify the following sections: <ul style="list-style-type: none"> <li>– "Features" in the chapter of "Preface."</li> <li>– Leakage current meter spec. and note description in the chapter of "Specification."</li> <li>– "Front Panel", "Rear Panel" and "Setting TEST CONTROL" in the chapter of "Operation."</li> <li>– "Commands Summary" and "Command Description" in the chapter of "GPIB/RS232 Interface."</li> <li>– "ACA Current Calibration" and "AC ARC Calibration" in the chapter of "Calibration Procedure."</li> </ul>
Aug. 2016	2.2	Update "CE Declaration of Conformity".
Apr. 2017	2.3	Update "Material Contents Declaration" and "CE Declaration of Conformity".
Oct. 2017	2.4	Revised text throughout manual.

# Table of Contents

<b>1.</b>	<b>Preface.....</b>	<b>1-1</b>
1.1	Product Overview.....	1-1
1.2	Features.....	1-1
<b>2.</b>	<b>Specifications (18°C ~ 28°C RH ≤ 70%) .....</b>	<b>2-1</b>
<b>3.</b>	<b>Safety Precautions.....</b>	<b>3-1</b>
<b>4.</b>	<b>Operation.....</b>	<b>4-1</b>
4.1	Front Panel .....	4-1
4.2	Rear Panel.....	4-5
4.3	Notes and Procedures before Operating.....	4-6
4.4	Setting SYSTEM Parameters.....	4-7
4.4.1	Entering SYSTEM Setting Screen.....	4-7
4.4.2	Setting TEST CONTROL .....	4-8
4.4.3	Setting SYSTEM CONFIG .....	4-10
4.4.4	Setting KEY LOCK.....	4-11
4.4.5	Setting FAIL LOCK .....	4-12
4.4.6	Changing PASSWORD.....	4-13
4.4.7	Setting CALIBRATION .....	4-14
4.4.8	Viewing the ERROR LOG .....	4-14
4.5	Setting PROGRAM .....	4-15
4.5.1	How to Get in PROGRAM Setting Screen.....	4-15
4.5.2	Setting Program Procedure.....	4-15
4.5.3	Selecting Test Mode .....	4-16
4.5.4	Description of Parameters.....	4-16
4.6	Managing Memory for Programs.....	4-21
4.6.1	Entering Memory Screen .....	4-21
4.6.2	Saving Memory.....	4-21
4.6.3	Deleting Memory.....	4-22
4.6.4	Recalling Memory .....	4-23
4.7	Using OFFSET or GET Cs.....	4-23
4.7.1	How to Get in OFFSET or GET Cs Screen .....	4-23
4.7.2	Using GET OFFSET .....	4-24
4.7.3	Using GET Cs.....	4-24
4.8	Conducting the Test.....	4-25
4.8.1	Connecting the UUT .....	4-25
4.8.2	Procedure for AC/DC Test .....	4-25
4.8.3	Procedure for IR Test.....	4-26
4.8.4	Procedure for OSC Test.....	4-27
4.8.5	Test Procedure for PA Test.....	4-28
4.8.6	Auto Range.....	4-29
4.8.7	Hardware/Software AGC.....	4-29
<b>5.</b>	<b>HANDLER Interface .....</b>	<b>5-1</b>
5.1	Introduction .....	5-1
5.2	Specifications.....	5-1
5.2.1	Driving Capability .....	5-1
5.2.2	Pin Assignment.....	5-1
5.3	Example of External Control Circuit.....	5-3
5.3.1	Example of Using Internal Power Supply .....	5-3
5.3.2	Example of Using External Power Supply .....	5-4
5.4	Timing Diagram.....	5-5



# 1. Preface

## 1.1 Product Overview

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

The output power of each channel for these instruments is listed below. These instruments are excellent for voltage testing of not only power electrical equipment, but for electrical component tests as well. Insulation resistance testing is only supported on the 19020/19020-4 and the 19022/19022-4 models.

19020/19020-4	19021/19021-4	19022/19022-4
AC: 50VA (5kV, 10mA)	AC: 48VA (6kV, 8mA)	DC: 28VA (8kV, 3.5mA)
DC: 30VA (6kV, 5mA)		

Chroma Hipot Testers use a clear display to show all settings, time, current, voltage, resistance and memory channel information. They will identify pass or fail of equipment under test, and output test result signals to remote devices for control and synchronization.

These instruments support GPIB, HANDLER and RS232 interfaces so they can be easily added to an automated test suite or test system, making the Chroma Hipot testers excellent for performing highly efficient and accurate tests of electrical and electronic equipment and electrical components.

## 1.2 Features

### ■ Sync Withstand Voltage Test

Chroma Hipot testers have the world's first sync withstand voltage test function. With it, a single device can have 10 simultaneous output channels, and up to 10 devices can be controlled (master & slave), providing a maximum of 100 channels. The devices can be grouped by different outputs to avoid voltage differences per output set, so that production efficiency can be achieved via multiple channels and outputs.

### ■ Multiple Tests

These testers also provide single test functions such as the 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 a built-in OSC function to check if there are any Open or Shorted connections during a test sequence. This situation may cause a false pass condition if not identified and corrected. Additionally, shorts can cause damage to a UUT, as well as invalidate the test.

- **Instrument Display**

The testers have clear and easy to see and understand displays. All program functions for settings and viewing such items as test voltage, current state, test readings, test steps and test states are easily seen and identifiable.

- **High/Low Limit Comparison for Pass/Fail Products**

The hipot testers have been designed to do High/Low Limit comparison tests. This function is available with Withstand Voltage tests or Insulation Resistance tests. The low limit comparison for hipot and high limit comparison for insulation are generally used to check if there are any bad connections or loose test wires, which can result in intermittent or invalid readings and tests.

- **Remote Control**

The HANDLER function of the tester extends the control signals for remotely controlling a test. In normal cases, the HANDLER usually connects to the control box of a remote automated device.

- **Change Voltage Ramp Time**

These testers have a RAMP function for setting a voltage rise time from zero to a preset value.

- **Change Voltage Fall Time**

These testers also have a FALL function that is the opposite of the RAMP time. This function allows setting a voltage fall time from a preset value to zero.

- **Auto Switch Low Current Range**

The current meter ranges for withstand voltage tests for the testers have two ranges: 0 - 2.999mA and 3.00 mA - maximum AC.

There are three ranges for DC: 0 - 299.9uA, 0.300mA - 2.999mA, and 3.00mA - maximum. If the test current is low, the instrument can be set to switch the current range to the low range automatically for better resolution.

The 19021 and 19021-4 hipot testers have 4 AC ranges: 30uA, 300uA, 3.000mA and 8.0mA. If the test current is low, the instrument can be set to switch the current range to the low range automatically for better resolution.



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

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

<input type="checkbox"/> Multi-hipot unit	Output channels are defined by model, independent output
<input type="checkbox"/> Frame number	Master frame number fixed at 0 Slave frame number can be set from 1 - 9
<input type="checkbox"/> 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: (30uA and 300uA are only for 19021 and 19021-4) 30uA range: 0.01uA – 29.99uA <Note 2> Measurement Accuracy: ±(1% of Reading +2% of full scale) 300uA range: 0.1uA – 299.9uA Measurement Accuracy: ±(1% of Reading +2% of full scale) 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)
<input type="checkbox"/> Flashover (ARC) detection <Note2>	AC: 1mA –20mA, DC: 1mA –10mA, step 0.1mA
<input type="checkbox"/> 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
<input type="checkbox"/> OSC – Contact Check	
Test voltage level	Less than 100V AC
Test frequency	600Hz
No contact judge	Measured capacitance comparison.
<input type="checkbox"/> Other functions	
Display	320 x 240 dot matrix, blue, LED back light.
<input type="checkbox"/> Compensation (Correct)	
Open circuit	Leakage current offset compensation for WVAC, WVDC, and IR testing
<input type="checkbox"/> PASS/FAIL System	
Indication, alarm	PASS : (Short Sound) FAIL : High/Low Fail (WV, IR) ARC Fail (WV) Open/Short Fail (OSC) System Error
<input type="checkbox"/> 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.
<input type="checkbox"/> Interface	
GPIB (Standard)	Complies with tested values and comparator decision results can be stored and output.
RS232 (Standard)	Standard: RS232. 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.
<input type="checkbox"/> 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.
<input type="checkbox"/> Indication, alarm	PASS(short Sound) FAIL: High, Low, ARC, System Error(Long Sound)

□ Interlock	2 pins connector: pin1 pulled 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. The output voltage specification is ±(4% of setting + 0.2% of full scale) when the testing time is less than 0.3 seconds
2. The unit must be recalibrated when the high voltage module on the rear panel is replaced.
3. The accuracy of the 30uA range is only valid for a capacitive load.
4. AC ARC Validation point is 1.25kV with a 250kΩ resistor.  
DC ARC Validation point is 1.50kV with a 500kΩ resistor.



## 3. Safety Precautions

The Hipot Tester can output up to 8kV high voltage for external tests. Incorrect use of this tester may cause serious injury or death. Read the precautions in this chapter to prevent any accident or injury.

### 1. High voltage module replacement

If the optional high voltage module in the back of the unit is replaced, the hipot tester unit must be recalibrated.

### 2. Electric shock

To prevent electric shock, wear insulated rubber gloves while using the Hipot Tester.

### 3. Grounding

A safety ground terminal is located on the rear of the tester chassis; ensure it is securely grounded before use. A very dangerous situation may arise if the power circuit or the connecting cables of any device shorts to the ground terminal as the chassis may contain high voltage. Anyone who touches the device in this situation may experience an electric shock. Connect the safety ground terminal to earth as shown in Figure 3-1.

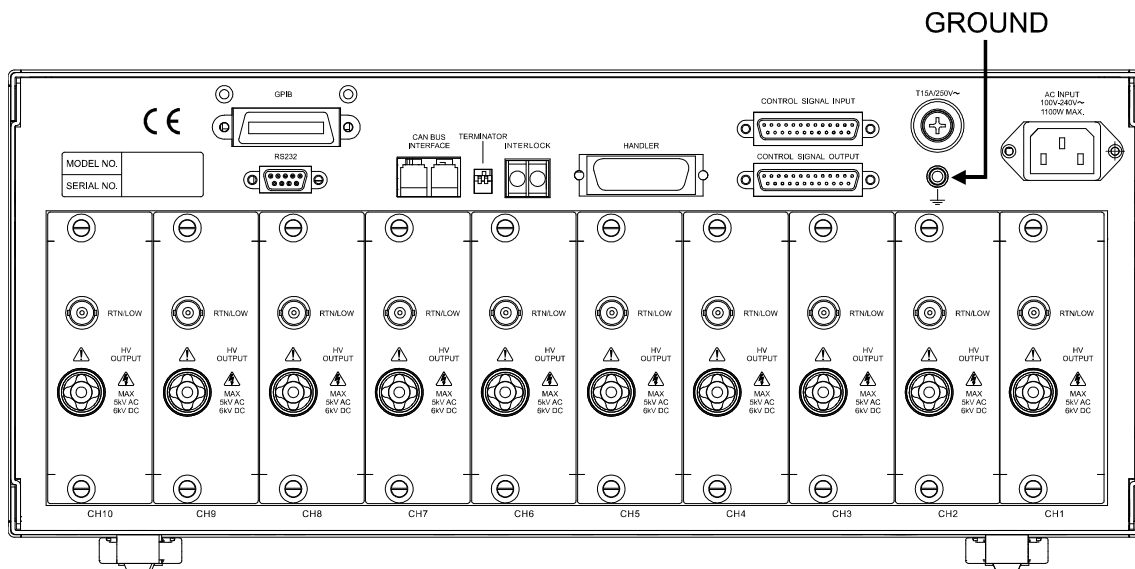


Figure 3-1

### 4. Connecting test cable to LOW terminal

Ensure the test cable is always connected when the tester is in use. When connecting a test unit with a test cable, connect the RTN/LOW test cable to the UUT first. It is very dangerous if the test cable on the RTN/LOW terminal is not already connected correctly before the high voltage terminal is connected as the entire UUT may be a shock hazard.

### 5. Connecting the test cable to high voltage output terminal

After 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 RTN/LOW test cable and high voltage output to make sure there is no residual voltage output.
- Plug in the high voltage test cable to the high voltage output terminal.
- Connect the RTN/LOW test cable to the unit under test and then connect the high voltage test cable.

## 6. End the test

When a test is completed or the tester is not in use, toggle the power switch to O (i.e. to shut off the power) as shown in Figure 3-2.

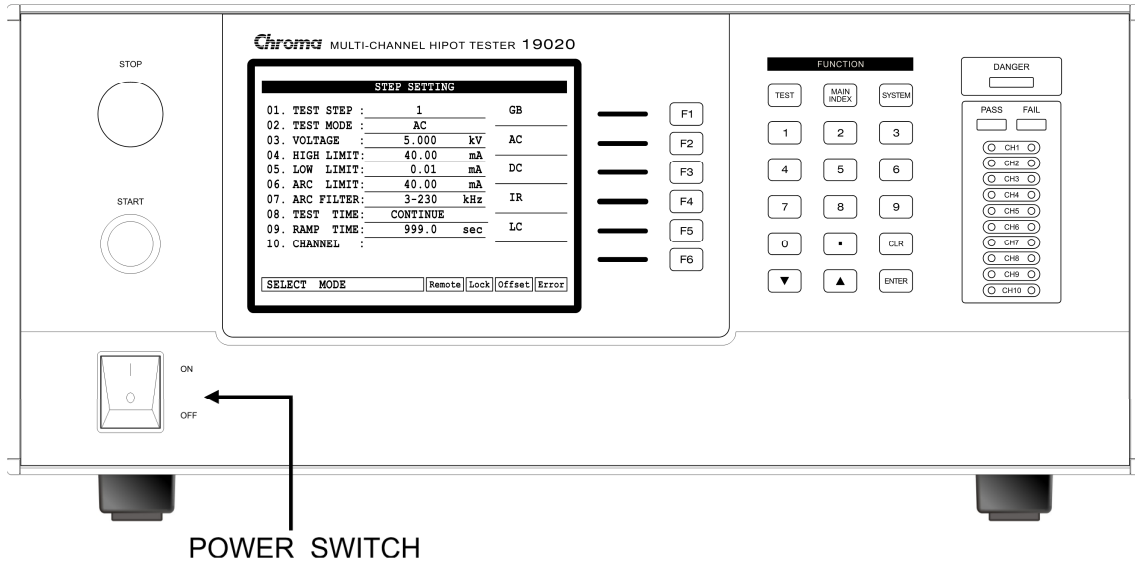


Figure 3-2

## 7. Do not touch any hazardous areas when the tester is in test mode

When the tester is in use, touching any object with high voltage such as the UUT, test cable, probe or output terminal is very dangerous due to the potential for electrical shock.

## 8. Ensure the test is done

Follow the steps below BEFORE touching the UUT, high voltage test cable, or output terminal areas when modifying the circuit under test conditions or upon test completion:

- \* **Insure the power switch is turned off.**
- \* **The UUT will have high voltage on it when the insulation resistance test is run.**

**Be sure to follow the steps in items 9 and 10.**

### **⚠ WARNING**

- \* **High Voltage is present when testing insulation resistance.**

## 9. Charge on UUT during insulation resistance test

When the insulation resistance test is run, the UUT, capacitor, test cable, probe, and output terminal have high voltage on them. After turning off the power switch, the test system needs a period of time to discharge. DO NOT touch any test area that may cause shock immediately after the power has been turned off.

**10. Ensure charging voltage has been completely discharged**

The discharge time depends on the testing voltage and UUT characteristics. Assume that the high voltage on the UUT is equivalent to the high voltage on a 0.01uF capacitor in parallel with a 100MΩ resistance circuit. After turning off the power, the voltage on the UUT will decrease to lower than 30V in approximately 3.5 seconds. When the test voltage is 500V it takes approximately 2.8 seconds. To calculate the time required for the voltage to decrease below 30V, use the formula shown in Figure 3-3.

$$\text{Calculation: } V_0 e^{-t/RC} = V_{IL}$$

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

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

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

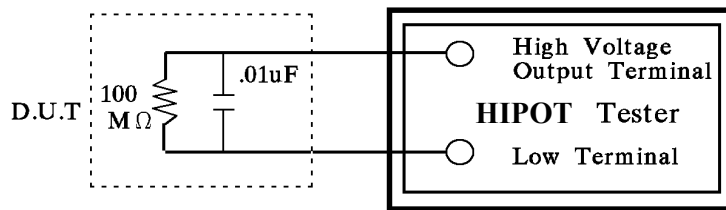


Figure 3-3

**11. Remote controlling the Tester**

This instrument allows remote control of the high voltage output by an external control signal. To prevent shock hazards, observe the following rules:

- \* **Use caution against accidentally accessing any high voltage output that may cause a shock hazard.**
- \* **When the tester is putting out high voltage, do not permit the operator or other personnel to contact the UUT, test cable, or probe output terminal.**

**12. Turning the power switch on and off**

The tester should be positioned so that the power switch can be easily reached by the operator during an emergency. When the power switch is turned off, wait a few seconds before turning it back on. Do not turn it on and off continuously, especially during high voltage output. **Do not connect any object to the high voltage output terminal when switching the power on or off.**

**13. Other notices**

Insure the cover of the tester has been connected to earth ground before the high voltage output terminal is short-circuited with the LOW voltage terminal.

**14. Handling a dangerous event**

Under any hazardous situation, such as shock, the UUT is burning, or the tester is burning, follow the steps below to remove the danger:

- \* In the case of an emergency, turn OFF the POWER switch using a “hot stick” and disconnect the AC power cord from the wall. **DO NOT TOUCH THE INSTRUMENT OR THE UUT.**

**15. Instrument Problems**


The following is a very dangerous situation. If this condition occurs, turn off power and remove the AC power plug immediately. Do not use the instrument; send it back to Chroma for repair.

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

#### 16. DANGER Indicator failure

When the **START** key is pressed, if there is already a reading on the voltage meter and the DANGER LED is not illuminated, turn the tester off immediately. Return the unit to Chroma ATE for repair.

17. The tester uses 100V-240VAC with auto range switching. The fuse is rated at **15A Slow/250V**. To avoid electric shock the fuse should only be changed when the power cord is not plugged in. When replacing the fuse, use a flat screwdriver to pry open the fuse holder inside the power socket and remove the fuse and replace it with a new one by pushing it in gently, and then pushing the power socket back into position.

 **CAUTION** Failure to use a fuse with the correct specifications may result in a hazardous situation.

#### 18. Unstable AC power

If the AC power is unstable within the selected voltage range it may cause the unit to malfunction. If necessary, use a power stabilizer to correct the situation.

#### 19. Tester drawing maximum current

When the UUT is drawing maximum current before a fail judgment is made it may continue to draw the maximum current (about ten amperes) up to ten milliseconds before shutdown.

#### 20. Storage

The tester normally operates in a temperature/humidity range of 5°C-35°C, 70% RH. Operating outside of this range may cause a malfunction. The tester storage temperature/humidity range is -10°C to 60°C, ≤ 80% RH. If the tester will not be used for a long time, store it in the original packing material. Keep the tester from direct sunlight, high temperature, vibration, humidity, or dusty places.

#### 21. Warm up

The tester should be warmed-up for 15 minutes prior to use and 30 minutes prior to calibration.

#### 22. Safety symbols



**DANGER – High voltage.**



**Explanation:** To avoid injury, death of personnel, or damage to the instrument, the operator must refer to the explanation in the instruction manual.



**Protective grounding terminal:** This symbol indicates that the terminal must be connected to ground before operation of the equipment to protect against electrical shock in case of a fault.



The **WARNING** sign highlights an essential operating or maintenance



procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.



**CAUTION**

The **CAUTION** sign highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in damage to, or destruction of, equipment.



**Notice**

The **Notice** sign denotes important information in procedures, applications, or areas that require special attention.

**23. Warning label during test**

“DANGER – HIGH VOLTAGE TEST IN PROGRESS, UNAUTHORIZED PERSONS KEEP AWAY.”

**24. Operating 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**

Keep the high voltage cable and the UUT away from the panel by at least 30 cm during operation to avoid display interference caused by high-voltage discharge.

**26. Connecting automated devices**

- (1) Connect the grounds of the device and the automated station together.
- (2) Add an anti-interference iron core to the high voltage cable and the 2 ends (device output and UUT) of the RTN/LOW test cable with a minimum of one turn of wire through the core.
- (3) The high voltage and RTN/LOW test cables must be separated from the control cable.
- (4) The high voltage and RTN/LOW test cable must be separated from the scanner panel.



## 4. Operation

### 4.1 Front Panel

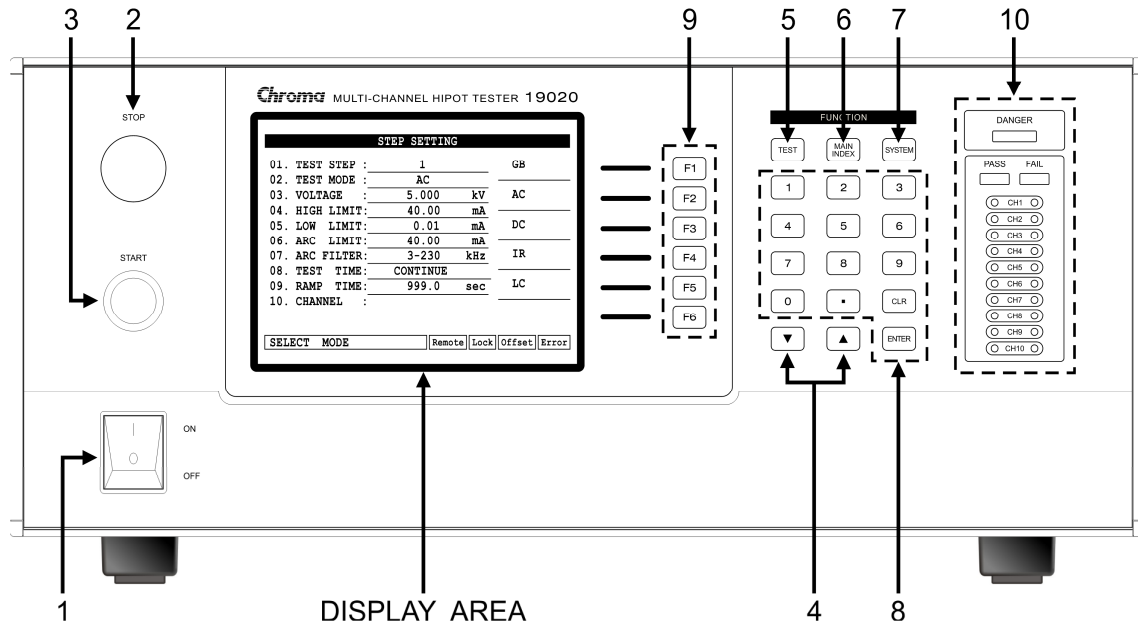
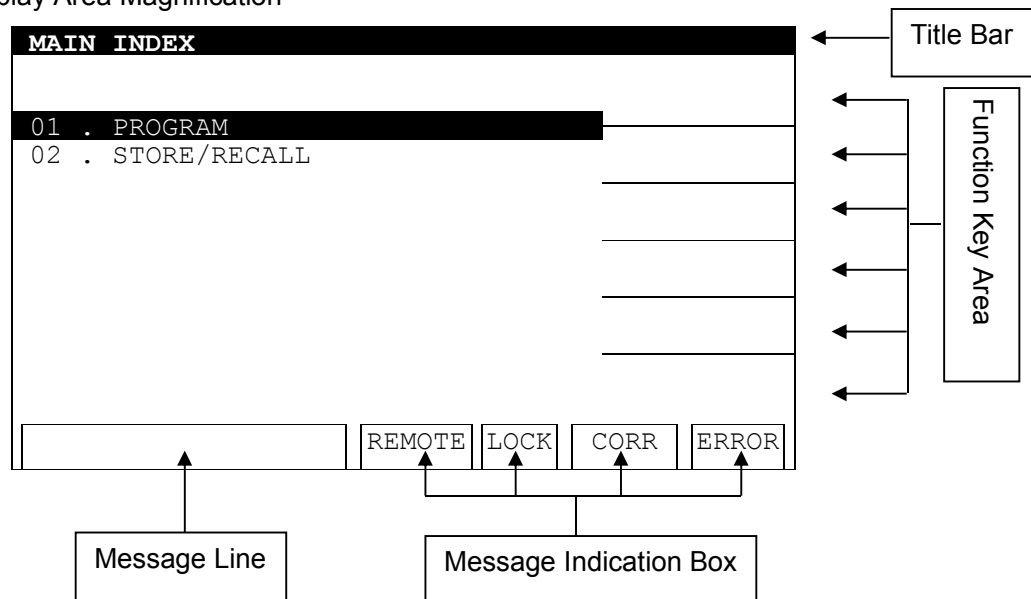


Figure 4-1

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

- Display Area Magnification



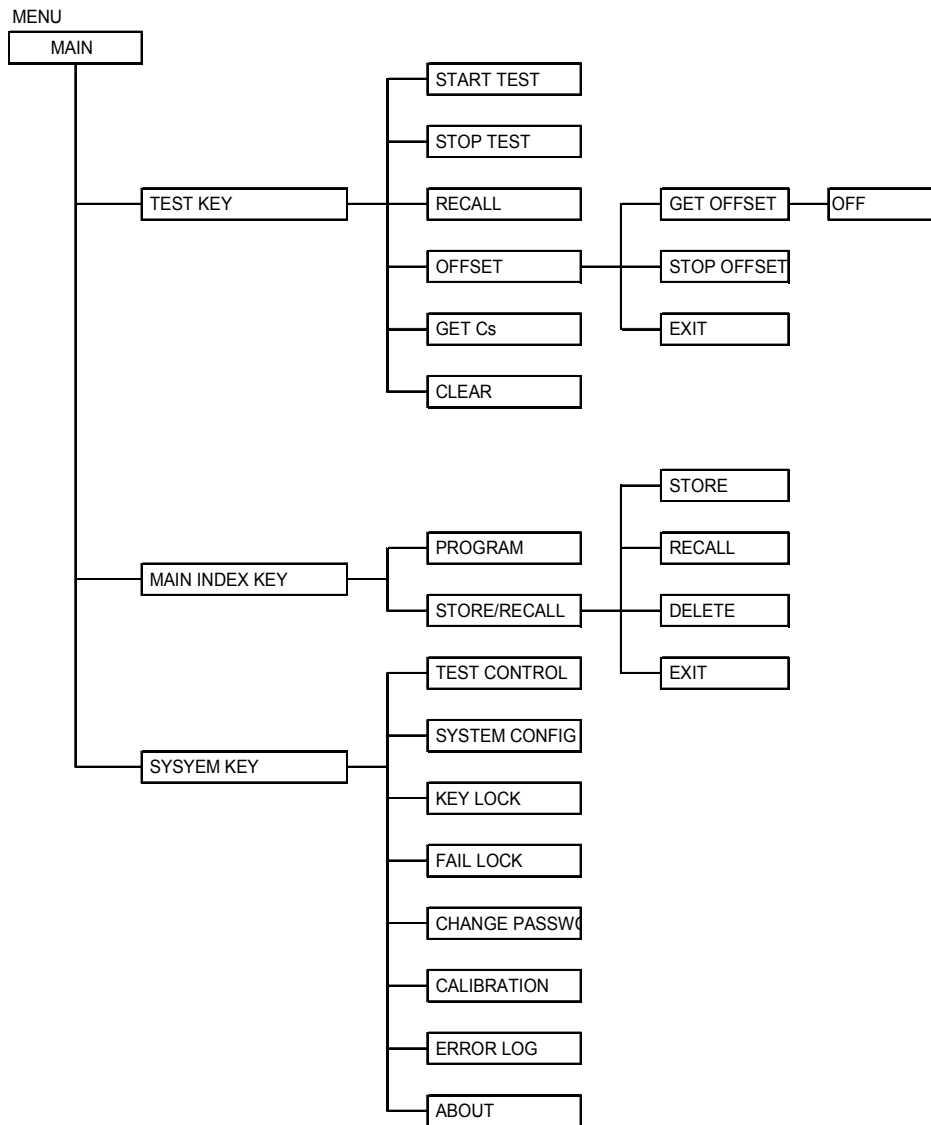
## Display Area

- Title Bar: This list displays the current setting of the tester or testing mode.
- Function Key Area: Different function descriptions are displayed for each of the different menus. The right side of the display shows the corresponding Function Keys. If the description is blank or gray scale font, the corresponding function is invalid.
- Message Line: This list displays the setting mode, the range of the setting value, and the testing time.



## Message Indication Box

- REMOTE**: When this area is highlighted, the tester is under remote control (the tester is being controlled by a PC through either the RS-232 or GPIB interfaces connected to the PC). At the same time, all of the keys are disabled except for the **STOP** and **ENTER** keys.
- LOCK**: When this area is highlighted it indicates the tester is in parameter protection mode. All other keys are disabled except for "TEST", "RECALL" and "KEY LOCK".
- CORR**: When this area is highlighted, the tester has zeroed the leakage current of test cables and test leads or completed the actions of GET Cs.
- ERROR**: When this area is highlighted it indicates error messages have been generated for the RS232 or GPIB interface.




## Simple Function Flow Chart



## Buttons

- (1) **Power Switch** : This switch turns on AC power to the tester. Before starting, read *Chapter 3 "Safety Precautions"*.
- (2) **STOP** Key : The reset key. When pressed, the Hipot Tester will immediately cut off the output or return to the ready-to-test state and clear all judgments.
- (3) **START** Key : The test activation key. When pressed, the Hipot Tester starts a test and applies high voltage to the Test Terminals.
- (4) **Cursor Keys** :  and  keys are used to move the highlighted cursor.
- (5) **TEST** Key : Under each main display mode, press this key to return to the "TEST" main screen.
- (6) **MAIN INDEX** Key: Under each main display mode, press this key to return to the "MAIN INDEX" main screen.
- (7) **SYSTEM** Key : Under each main display mode, press this key to return to the "SYSTEM" main screen.


## (8) Data Entry Keys/Program Keys

-    : The Numeric key/character key, for inputting test parameter data (numeric or alphabetic).
- ENTER** : Enter key. After entering a test parameter, press this key to confirm entry.
- CLR** : Clear key. If an error is made when entering a test parameter, press this key to cancel the input.

- (9) **Function Keys** : Function Keys. Selects sub-menus and enters test parameters. If the description is blank, the corresponding function is invalid.

## (10) Indicators

- DANGER LED** : Test status indicator. When ON it indicates the tester is performing a test. Do not touch the test terminals as they may contain high voltage output.
- PASS LED** : Pass item indicator. CH1-CH10 indicators display 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** : Failed item indicator. CH1-CH10 indicators display the test results of CH1-CH10. The rectangular FAIL LED is ON when one of the CH1-CH10 test results is bad and will stay on until **STOP** is pressed.

 **Notice** : The indicators show the test results in the channel numbers specific to the model, for instance, the 19020 shows the test results of CH1-CH10 and the 19020-4 shows the test results of CH1-CH4.

## 4.2 Rear Panel

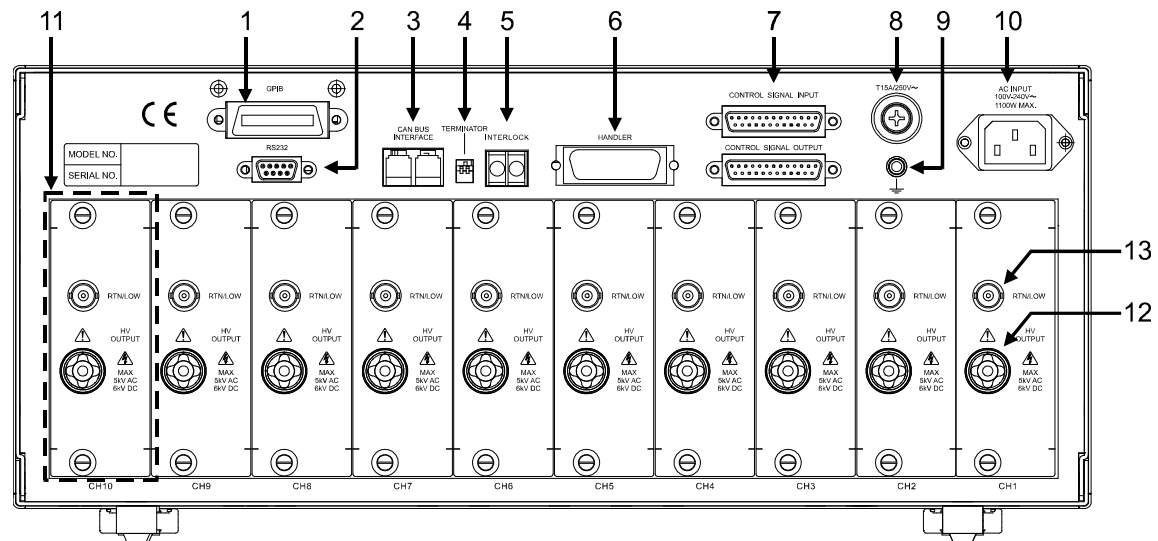


Figure 4-2

- (1) **GPIB Interface:**  
This is the connector for the GPIB interface card using the IEEE-488-1978 standard. See *Chapter 6 GPIB/RS232 Interface (IEEE-488.2)* for a detailed usage description.
- (2) **RS232 Interface:**  
This is the connector for the 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 the MASTER and SLAVE units.
- (4) **Terminal Resistance Selector:**  
This DIP switch is used to set the terminal resistance for the CAN BUS interface. 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 output when these two terminals are short-circuited.
- (6) **HANDLER Interface:**  
This is the connector for the HANDLER interface. See *Chapter 5 HANDLER Interface* for a detailed usage description.
- (7) **Internal Communication Interface:**  
This connector is used for control signal transmission between the MASTER and SLAVE units.
- (8) **Fuse Holder:**  
See *Chapter 3 "Safety Precautions"* for detailed specifications, or the label mark on the rear panel.

**(9) GND Terminal:**

Safety GND terminal. Connect this terminal to earth ground. If this terminal is not grounded, high voltage may exist on the cover, resulting in a safety hazard.

**(10) AC Input:**

Three-wire AC power socket. The AC power required by the tester is supplied by this power socket.

**(11) High Voltage Module:**

A combination of high voltage output circuits. Be sure the anchor screws are secured.

**(12) High Voltage Output Channel:**

The high voltage output terminal. Do not touch it, especially when the DANGER LED is ON during high voltage output.

**(13) RTN/LOW Channel:**

The reference terminal for a high voltage test. It is the low potential terminal that is almost equal to the chassis grounding terminal.

## 4.3 Notes and Procedures before Operating

1. Before plugging in the AC power cord, insure the fuse and voltage selector settings match the power source being used and the power switch is OFF.
2. Before turning on power, read *Chapter 3 "Safety Precautions"*.
3. When the power is turned on, the tester will automatically perform a self-test. If the self-test indicates there is a problem, turn off the power switch and remove the power cord.



## 4.4 Setting SYSTEM Parameters

### 4.4.1 Entering SYSTEM Setting Screen

Pressing **SYSTEM** in any screen will display the following:

SYSTEM	
01 . TEST CONTROL	
02 . SYSTEM CONFIG	
03 . KEY LOCK	
04 . FAIL LOCK	
05 . CHANGE PASSWORD	
06 . CALIBRATION	
07 . ERROR LOG	
08 . ABOUT	
	REMOTE LOCK CORR ERROR

#### Procedure

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

The following table lists the parameters in the SYSTEM menu and their descriptions.

Parameter	Description
TEST CONTROL	Sets the test related parameters. See section 4.4.2 for details.
SYSTEM CONFIG	Sets the system related parameters. See section 4.4.3 for details.
KEY LOCK	Sets the keyboard lock function. See section 4.4.4 for details.
FAIL LOCK	Sets the fail lock function on the keyboard. See section 4.4.5 for details.
CHANGE PASSWORD	Changes the user’s password. See section 4.4.6 for details.
CALIBRATION	Sets the calibration related parameters. See section 4.4.7 for details.
ERROR LOG	Logs the error messages generated when connected to a PC. See section 4.4.8 for details.
ABOUT	Shows the firmware version and related descriptions.

## 4.4.2 Setting TEST CONTROL

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

TEST CONTROL	
01. PASS HOLD	: 0.2 sec
02. ACV FREQUENCY	: 60 Hz
03. SOFTWARE AGC	: ON
04. MIN. VOLTAGE	: 80%
05. WV AUTO RANGE	: OFF
06. CH AFTER FAIL	: STOP
07. RAMP JUDGMENT	: ON
08. DEF. CHANNELS	: STEUP
09. SCREEN	: ON
10. EOT	: TEST
11. DISCH. Vmin	: OFF EXIT
12. AC OFFSET	: 0.01
0.2-99.9S	REMOTE LOCK OFFSET ERROR

In the TEST CONTROL screen, press the **▲**, **▼** keys to move the highlighted cursor to the parameter to be set.

The following table lists the parameters in the TEST CONTROL menu and their descriptions.

No.	Parameter	Range	Default	Description
01	PASS HOLD	0.2-99.9sec	0.2sec	Sets the length of time the beeper sounds for a PASS judgement.
02	AC FREQUENCY	50, 60Hz	60	Sets the frequency of the output voltage when doing the AC withstand voltage test.
08	SOFTWARE AGC	ON/OFF	ON	Sets the software AGC function to ON or OFF.
04	MIN. VOLTAGE	OFF, 50-95%	80%	Sets the percentage for the output voltage to reach the set voltage.
05	WV AUTO RANGE	ON/OFF	OFF	Sets the auto range function for the withstand voltage test to ON or OFF.
06	CH AFTER FAIL	STOP/CONTINUE	STOP	Sets if the channel stops testing when a FAIL occurs during a test.
07	RAMP JUDGMENT	ON / OFF	ON	When set to ON, determines if the current readings exceed the high limit during ramp time execution. When set to OFF, does not determine if the current readings exceed the high limit during ramp time execution.
08	DEF. CHANNELS	-----	Output channels of Frame 0 are ON	Sets the default channels to be ON. The setting here will become the default PROGRAM channel. See <i>Setting DEF. CHANNELS</i> for details.
09	SCREEN	ON/OFF	ON	Turns the LCD screen ON or OFF during a test.
10	EOT	TIMER /	TEST	1. When EOT is set to TIMER, nEOT

		TEST		and PASS_FAIL signals act immediately after the test time ends without waiting for the high voltage discharge to end. 2. When EOT is set to TEST, nEOT and PASS_FAIL signals act after the high voltage discharge ends.
11	DISCH. Vmin <Notice 1>	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 a safe voltage.
12	AC OFFSET <Notice 2>	0.001-2.5mA	0.001mA	1. When the offset is larger than the <b>AC OFFSET</b> setting, current reading = measured current - offset. 2. When the offset is smaller than the <b>AC OFFSET</b> setting, current reading = $\sqrt{(\text{measured value})^2 - (\text{offset})^2}$

 **Notice**



1. The DISCH. Vmin setting is only valid when EOT is set to TEST. When EOT is set to TIMER, the tester will end the testing without discharging and the DISCH. Vmin is invalid.
2. If the AC OFFSET is in the 30uA current measurement range, the calculation of OFFSET is always current value = measured current – offset.

**Setting DEF. CHANNELS:**

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

TEST CONTROL											
FRAME	0	1	2	3	4	5	6	7	8	9	NEXT FRAME
CH	01	√									
	02	√									ON
	03	√									OFF
	04	√									
	05	√									
	06	√									
	07	√									
	08	√									
	09	√									
	10	√									

Remote Lock offset Error

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

 **Notice**

1. The number of channels that can be set is determined by the model type.

- The 19020 can set output channels CH1-CH10 while the 19020-4 can only set channels CH1-CH4. The message line on the test screen will show "Module Fail" if an incorrect channel is selected and the test will not start.

### 4.4.3 Setting SYSTEM CONFIG

In the SYSTEM screen, move the highlighted cursor to SYSEYEM CONFIG and press **ENTER** to go to the SYSEYEM CONFIG setting screen shown below:

SYSTEM CONFIG			
01. CONTRAST	:	06	UP
02. BEEPER	:	LOW	
03. GPIB	:	UNINSTALLED	DOWN
04. RS232	:	9600	
05. LINK SETUP	:	MASTER	
06. LINK ADDRESS	:	0	
07. ACA MEAS.	:	RMS	
08. DC ARC RATE	:	1.0	
EXIT			
1-16	REMOTE	LOCK	OFFSET ERROR

In the SYSTEM CONFIG screen, press the **▲**, **▼** keys to move the highlighted cursor to the parameter to be set.

The following table lists the parameters in the SYSEYEM CONFIG menu and their descriptions.

Parameter	Range	Default	Description
CONTRAST	1 - 16	06	Adjusts the LCD brightness.
BEEPER	HIGH / LOW / OFF	LOW	Adjusts the beeper volume.
GPIB	UNINSTALLED / ADDRESS = 0-30	03	Sets the GPIB interface address. Shows UNINSTALLED if the GPIB card is not installed.
RS232	9600 / 19200 / 38400	9600	Sets the transmission baud rate of the RS232 interface.
LINK SETUP	MASTER/SLAVE/SCANNER	MASTER	Sets the tester to MASTER or SLAVE when linked for test. Set to SCANNER when connecting to A190201/A190202.
LINK ADDRESS	1-9	0	Sets the tester address when linked for test. <b>Note:</b> The tester address is fixed at 0 when set to MASTER.
ACA MEAS	RMS/GENERAL	RMS	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.



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

## 4.4.5 Setting FAIL LOCK

### Set FAIL LOCK:

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

FAIL LOCK				
FAIL KEY:				
USER PASSWORD:■				
				EXIT
	REMOTE	LOCK	CORR	ERROR

1. Enter the PASSWORD in the FAIL LOCK screen.
2. When FAIL LOCK is ON, the LOCK text is highlighted 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] functions cannot be changed.
3. When FAIL LOCK is set and a test FAILs, all keys are locked except the [CLEAR] and **STOP** Function Keys in the TEST screen. Press the [CLEAR] Function Key to enter the FAIL LOCK password to continue the test.

### Release FAIL LOCK:

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

FAIL LOCK				
UNLOCK:				
USER PASSWORD:■				
EXIT				
	REMOTE	LOCK	CORR	ERROR

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 the SYSTEM screen, move the highlighted cursor to CHANGE PASSWORD and press **ENTER** to go to the CHANGE PASSWORD setting screen shown below:

CHANGE PASSWORD				
USER PASSWORD:■				
EXIT				
	REMOTE	LOCK	CORR	ERROR

1. Enter the PASSWORD (enter 0000 if it has not been set) and press **ENTER**. The screen will display a "NEW PASSWORD" window.
2. Enter the NEW PASSWORD (maximum 10 characters) and press **ENTER**. The screen will display a "CONFIRM PASSWORD" window.
3. Enter the same password again and press **ENTER**. The message "CHANGE PASSWORD OK!" will appear to indicate the password has been changed. Press the [EXIT] Function Key to exit the setting screen.

#### Notice

- If the memory has been cleared following the procedure in "Clear the settings and test procedures in memory" in section 4.4.7, the PASSWORD will be reset to the default value of "0000".

## 4.4.7 Setting CALIBRATION

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

CALIBRATION				
CAL. PASSWORD : ■				
_____				
_____				
_____				
_____				
EXIT				
_____	REMOTE	LOCK	CORR	ERROR

In the CALIBRATION screen, press the appropriate keys to set the related functions.

The following table lists the parameters in the CALIBRATION menu and their descriptions.

Paramter	Password	Description
Enter into Calibration Mode	7931	Refer to Chapter 7 <i>Calibration Procedure</i> for related information.
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 Viewing the ERROR LOG

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

ERROR LOG				
1. +0 , No error				
_____				
_____				
_____				
_____				
EXIT				
_____	REMOTE	LOCK	CORR	ERROR

The ERROR LOG screen will display any error messages generated during operation. The ERR box highlight will be turned off upon entering the ERROR LOG screen.





### 4.5.3 Selecting Test Mode

1. In the PROGRAM screen, press the  key to move the highlighted cursor to the following position:

PROGRAM								
01. TEST STEP	:	1	AC					
02. TEST MODE	:	AC						
03. VOLTAGE	:	OFF	DC					
04. HIGH LIMIT	:	0.500 mA						
05. LOW LIMIT	:	OFF	IR					
06. ARC LIMIT	:	OFF						
07. TEST TIME	:	3.0 sec	OSC					
08. RAMP TIME	:	OFF						
09. FALL TIME	:	OFF	PA					
10. CHANNELS	:	DEFAULT						
			EXIT					
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:25%;">SELECT MODE</td> <td style="width:15%;">REMOTE</td> <td style="width:15%;">LOCK</td> <td style="width:15%;">CORR</td> <td style="width:15%;">ERROR</td> </tr> </table>				SELECT MODE	REMOTE	LOCK	CORR	ERROR
SELECT MODE	REMOTE	LOCK	CORR	ERROR				

2. Use the [AC], [DC], [IR], [OSC] and [PA] Function Keys to select the test mode. The test modes that are available for selection depend on the model number of the tester.

### 4.5.4 Description of Parameters

The parameters set in each test mode are described below.

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

PROGRAM								
01. TEST STEP	:	1	AC					
02. TEST MODE	:	AC						
03. VOLTAGE	:	0.050 kV	DC					
04. HIGH LIMIT	:	0.500 mA						
05. LOW LIMIT	:	OFF	IR					
06. ARC LIMIT	:	OFF						
07. TEST TIME	:	3.0 sec	OSC					
08. RAMP TIME	:	OFF						
09. FALL TIME	:	OFF	PA					
10. CHANNELS	:	DEFAULT						
11. SCANNER	:	NONE	EXIT					
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:25%;">SELECT MODE</td> <td style="width:15%;">REMOTE</td> <td style="width:15%;">LOCK</td> <td style="width:15%;">CORR</td> <td style="width:15%;">ERROR</td> </tr> </table>				SELECT MODE	REMOTE	LOCK	CORR	ERROR
SELECT MODE	REMOTE	LOCK	CORR	ERROR				

- VOLTAGE : Sets the voltage for the AC withstand voltage test.
- HIGH LIMIT : Sets the high limit for the leakage current.
- LOW LIMIT : Sets the low limit for the leakage current. The range is less than the high limit for leakage current or OFF.
- ARC LIMIT : Sets the ARC limit; 0 means OFF.
- TEST TIME : Sets the required test time; 0 means continuous test.
- RAMP TIME : Sets the time required for ramping to the set voltage; 0 means OFF.
- FALL TIME : Sets the time required for dropping to a low voltage; 0 means OFF.

- CHANNELS : Sets the high voltage channel for output. Select the [DEFAULT] Function Key to use the “DEF. CHANNELS” settings in “TEST CONTROL.” Select the [SETUP] Function Key to reset the high voltage channel for output.
- SCANNER : Sets the output mode of the A190201/A190202 SCANNER. The selection options are [ P→S ], [ P→C ], [ S→C ], [ P+S→C ] and [ P→S+C ]. This setting is only valid when the LINK SETUP in the SYSTEM menu of the 19020/19020-4 is set to SCANNER.

 **Notice**

The number of channels that can be set is determined by the model type. The 19020 can set output channels CH1-CH10 while the 19020-4 can only set channels CH1-CH4. The message line on the test screen will show “Module Fail” if an incorrect channel is selected and the test will not start.

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

PROGRAM		
01. TEST STEP	:	1 AC
02. TEST MODE	:	DC
03. VOLTAGE	:	0.050 kV DC
04. HIGH LIMIT	:	0.500 mA
05. LOW LIMIT	:	OFF IR
06. ARC LIMIT	:	OFF
07. TEST TIME	:	3.0 sec OSC
08. RAMP TIME	:	OFF
09. DWELL TIME	:	OFF PA
10. FALL TIME	:	OFF
11. CHANNELS	:	DEFAULT EXIT
12. SCANNER	:	NONE
SELECT MODE		
REMOTE		
LOCK		
CORR		
ERROR		

- VOLTAGE : Sets the voltage for the DC withstand voltage test.
- HIGH LIMIT : Sets the high limit for the leakage current.
- LOW LIMIT : Sets the low limit for the leakage current. The range is less than the high limit of leakage current or OFF.
- ARC LIMIT : Sets the ARC limit; 0 means OFF.
- TEST TIME : Sets the required test time; 0 means continuous test.
- RAMP TIME : Sets the time to ramp to the set voltage; 0 means OFF.
- DWELL TIME : Sets the DWELL time; 0 means OFF.  
(The high and low limits of leakage current are not checked during the DWELL TIME. The limit is only tested when the set range is within the high limit.)
- FALL TIME : Sets the time required for dropping to a low voltage; 0 means OFF.
- CHANNELS : Sets the high voltage channel for output. Select the [DEFAULT] Function Key to use the “DEF. CHANNELS” settings in “TEST CONTROL.” Select the [SETUP] Function Key to reset the high voltage channel for output.
- SCANNER : Sets the output mode of the A190201/A190202 SCANNER. The selection options are [ P→S ], [ P→C ], [ S→C ], [ P+S→C ] and [ P→S+C ]. This setting is only valid when the LINK SETUP in the SYSTEM menu of the 19020/19020-4 is set to SCANNER.

 **Notice**

The number of channels that can be set is determined by the model type. The 19020 can set output channels CH1-CH10 while the 19020-4 can only set channels CH1-CH4. The message line on the test screen will

- show "Module Fail" if an incorrect channel is selected and the test will not start.

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

PROGRAM		
01. TEST STEP	:	1 AC
02. TEST MODE	:	IR
03. VOLTAGE	:	0.050 kV DC
04. LOW LIMIT	:	1.0 MΩ
05. HIGH LIMIT	:	OFF IR
06. TEST TIME	:	3.0 sec
07. RAMP TIME	:	OFF OSC
08. FALL TIME	:	OFF
09. RANGE	:	AUTO PA
10. CHANNELS	:	DEFAULT
11. SCANNER	:	NONE EXIT
<input type="button" value="SELECT MODE"/> <input type="button" value="REMOTE"/> <input type="button" value="LOCK"/> <input type="button" value="CORR"/> <input type="button" value="ERROR"/>		

- VOLTAGE : Sets the voltage for the insulation resistance test.  
 LOW LIMIT : Sets the low limit of the insulation resistance.  
 HIGH LIMIT : Sets the high limit of the insulation resistance. The range is higher than the low limit of the insulation resistance or OFF.  
 TEST TIME : Sets the required test time; 0 means continuous test.  
 RAMP TIME : Sets the time to ramp to the set voltage; 0 means OFF.  
 FALL TIME : Sets the time required for dropping to a low voltage; 0 means OFF.  
 RANGE : Sets the current test range for insulation resistance, AUTO switches the range automatically. The table below shows the relationship between the current range and the resistance measurement range.

Range	IR Display	
	Set voltage to 50V-499V	Set voltage to 500V-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, calculate the current using the test voltage and the UUT's insulation impedance and then select the proper current range. The display will show "UUUUU" if the IR range exceeds 60GΩ.

- CHANNELS : Sets the high voltage channel for output. Select the [DEFAULT] Function Key to use the "DEF. CHANNELS" settings in "TEST CONTROL." Select the [SETUP] Function Key to reset the high voltage channel for output.
- SCANNER : Sets the output mode of the A190201/A190202 SCANNER. The selection options are [ P→S ], [ P→C ], [ S→C ], [ P+S→C ] and [ P→S+C ]. This setting is only valid when the LINK SETUP in the SYSTEM menu of the 19020/19020-4 is set to SCANNER.

**Notice**

The number of channels that can be set is determined by the model type. The 19020 can set output channels CH1-CH10 while the 19020-4 can only set channels CH1-CH4. The message line on the test screen will show "Module Fail" if an incorrect channel is selected and the test will not start.

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

PROGRAM							
01. TEST STEP	:	1 AC					
02. TEST MODE	:	OSC					
03. OPEN	:	50% DC					
04. SHORT	:	OFF					
05. CHANNELS	:	DEFAULT IR					
06. SCANNER	:	NONE					
		OSC					
		PA					
		EXIT					
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">SELECT MODE</td> <td style="width: 15%;">REMOTE</td> <td style="width: 15%;">LOCK</td> <td style="width: 15%;">CORR</td> <td style="width: 15%;">ERROR</td> </tr> </table>			SELECT MODE	REMOTE	LOCK	CORR	ERROR
SELECT MODE	REMOTE	LOCK	CORR	ERROR			

- OPEN : Sets the OPEN condition for a test result judgment by comparing the test reading and the standard capacitance [Cs].)
- SHORT : Sets the SHORT condition for a test result judgment by comparing the test reading and the standard capacitance [Cs].)
- CHANNELS : Sets the high voltage channel for output. Select the [DEFAULT] Function Key to use the "DEF. CHANNELS" settings in "TEST CONTROL." Select the [SETUP] Function Key to reset the high voltage channel for output.
- SCANNER : Sets the output mode of the A190201/A190202 SCANNER. The selection options are [ P→S ], [ P→C ], [ S→C ], [ P+S→C ] and [ P→S+C ]. This setting is only valid when the LINK SETUP in the SYSTEM menu of the 19020/19020-4 is set to SCANNER.

**Notice**

1. Read the standard capacitance (GET Cs) before conducting a test or testing the new capacitance UUT or replacing the capacitance UUT in OSC Mode.
2. Press the [OFFSET] Function Key to perform the offset before reading the standard capacitance (GET Cs). OFFSET needs to be

- done every time a 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 GET Cs value.
- 4. The number of channels that can be set is determined by the model type. The 19020 can set output channels CH1-CH10 while the 19020-4 can only set channels CH1-CH4. The message line on the test screen will show "Module Fail" if an incorrect channel is selected and the test will not start.

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

PROGRAM			
01.	TEST STEP	:	1 AC
02.	TEST MODE	:	PA
03.	MESSAGE	:	PAUSE-MODE DC
04.	TIME	:	CONTINUE
			IR
			OSC
			PA
			EXIT
SELECT MODE		REMOTE	LOCK
		CORR	ERROR

- MESSAGE : Enter the message string to be displayed in the pause mode (up to a maximum of 13 characters).
- TIME : Sets the PAUSE MODE response:
- (1) CONTINUE: The pause mode only ends when **START** on the panel is pressed or a START signal is received on the HANDLER card.
  - (2) 0.1-999.9sec: The pause mode ends when the timer reaches zero.



STORE/RECALL				
01 . (01)	CHROMA			
02 . (00)				
03 . (00)			NEXT CH.	
04 . (00)				
05 . (00)				
06 . (00)				
07 . (00)				
08 . (00)				
09 . (00)				
10 . (00)				
			EXIT	
	REMOTE	LOCK	CORR	ERROR

- Use the numeric keys **0-9** to select the location for entering the memory name. Then use the numeric/character keys to enter the memory name. Pressing one numeric/character key repeatedly will cycle the number and English letter display in turn. Pressing the [NEXT CHAR] Function Key to move the cursor to the next character position can use the same number/character key to enter the name in sequence.
- Press **ENTER** and a confirmation dialog box will appear.
- Press the [YES] Function Key to confirm it or press the [NO] Function Key to cancel it.



**Notice**

⋮ If there is data in the memory, it will be overwritten when new data is saved. Make sure it is OK to delete the old data before saving.

### 4.6.3 Deleting Memory

Follow the steps below to delete a program from memory:

- Use the **▲**, **▼** keys to move the highlighted cursor to the memory location to be deleted and press the [DELETE] Function Key.

STORE/RECALL				
01 . (01)	CHROMA		YES	
02 . (00)				
03 . (00)			NO	
04 . (00)				
05 . (00)				
06 . (00)				
07 . (00)				
08 . (00)				
09 . (00)				
10 . (00)				
	DELETE MEMORY 1		CORR	ERROR

- A delete confirmation dialog box will display. Press the [YES] Function Key to confirm the delete or press the [NO] Function Key to cancel it.



## 4.6.4 Recalling Memory

Follow the steps below to recall a program stored in memory:

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

STORE/RECALL					
01	.	(01)	CHROMA	YES	
02	.	(00)			
03	.	(00)		NO	
04	.	(00)			
05	.	(00)			
06	.	(00)			
07	.	(00)			
08	.	(00)			
09	.	(00)			
10	.	(00)			
RECALL FROM MEMORY 1					
STANDBY		REMOTE	LOCK	CORR	ERROR

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

## 4.7 Using OFFSET or GET Cs

### 4.7.1 How to Get in OFFSET or GET Cs Screen

1. Select the OFFSET or GET Cs function in the TEST screen shown below:

TEST - 1/2					
MODE	CH	SOURCE	LIMIT	RES.	
OSC	01	50V	0.0 nF		RECALL
	02	50V	0.0 nF		OFFSET
	03	50V	0.0 nF		GET Cs
	04	50V	0.0 nF		
	05	50V	0.0 nF		
	06	50V	0.0 nF		
	07	50V	0.0 nF		
	08	50V	0.0 nF		CLEAR
	09	50V	0.0 nF		
	10	50V	0.0 nF		
					SLAVE 1 2 3 4 5 6 7 8 9
STANDBY		REMOTE	LOCK	CORR	ERROR

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

## 4.7.2 Using GET OFFSET

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

GET OFFSET				
1. PLEASE OPEN THE OUTPUT TERMINAL.				OFF
PRESS <START> TO START				
				EXIT
STANDBY	REMOTE	LOCK	CORR	ERROR

2. GET OFFSET offsets the leakage current of AC / DC / IR MODE test leads and fixtures as well as the stray capacitance of the OSC MODE.
3. Remove the UUT from the fixture and press **START** to offset the leakage current or leakage capacitance.
4. The message box [CORR] will be highlighted when the offset has been completed.
5. Pressing the [OFF] Function Key will cancel OFFSET.

## 4.7.3 Using GET Cs

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

GET Cs				
1. PLEASE CONNECTED THE STANDARD UUT.				
2. GET OFFSET BEFORE THAT.				
3. ONLY FOR OSC MODE.				
4. Cs VALUE WILL BE REPLEASSED.				
PRESS <START> TO START				
				EXIT
STANDBY	REMOTE	LOCK	CORR	ERROR

2. Use the standard sample under the capacitance test as the UUT and connect it to the 1<sup>st</sup> 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

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 the high voltage output terminal. Then connect the low potential test cable to the UUT and then the high potential test cable to the UUT.

### 4.8.2 Procedure for AC/DC Test

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

The screenshot shows a screen titled "TEST - 1/2". It features a table with columns for MODE, CH, SOURCE, LIMIT, RES., and RECALL. The MODE column is set to "AC". The SOURCE column is set to "0.050kV" and the LIMIT column is set to "0.500 mA". The RES. column is empty. The RECALL column has options: "RECALL", "OFFSET", "GET Cs", "CLEAR", and "SLAVE". Below the table is a status line with buttons for "STANDBY", "REMOTE", "LOCK", "CORR", and "ERROR". Three callout boxes labeled "Position 1", "Position 2", and "Position 3" point to the "MODE", "SOURCE", and "LIMIT" columns respectively.

MODE	CH	SOURCE	LIMIT	RES.	RECALL
AC	01	0.050kV	0.500 mA		RECALL
	02	0.050kV	0.500 mA		OFFSET
	03	0.050kV	0.500 mA		GET Cs
	04	0.050kV	0.500 mA		
	05	0.050kV	0.500 mA		
	06	0.050kV	0.500 mA		
	07	0.050kV	0.500 mA		
	08	0.050kV	0.500 mA		CLEAR
	09	0.050kV	0.500 mA		
	10	0.050kV	0.500 mA		SLAVE

SLAVE  
1 2 3 4 5 6 7 8 9

STANDBY    REMOTE    LOCK    CORR    ERROR

Illustration:

"TEST - 1/2" means there are 2 test steps and the 1<sup>st</sup> test step is currently running. "AC" means the test mode. "SOURCE" means the set voltage, "LIMIT" is the high limit set for the current, while "RES." is the test result.

3. Press **STOP** to prepare for the test. The status line shows "STANDBY".
4. Press **START** to activate the test.  
When this key is pressed the tester starts to output voltage and the DANGER LED is turned ON. The status line shows a counter to count down. "SOURCE" will show the output voltage value, "LIMIT" will show the current readings and "RES." 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 turn off the output. The HANDLER interface outputs the PASS signal and the beeper sounds at the same time.
6. NO GOOD Judgment  
If the test value is abnormal, the tester judges it as FAIL and turns off the output

immediately. The HANDLER outputs the FAIL signal and the beeper sounds at the same time until the **STOP** key on the tester is pressed. The test result will show the FAIL state.

FAIL State:

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

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

### 4.8.3 Procedure for IR Test

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

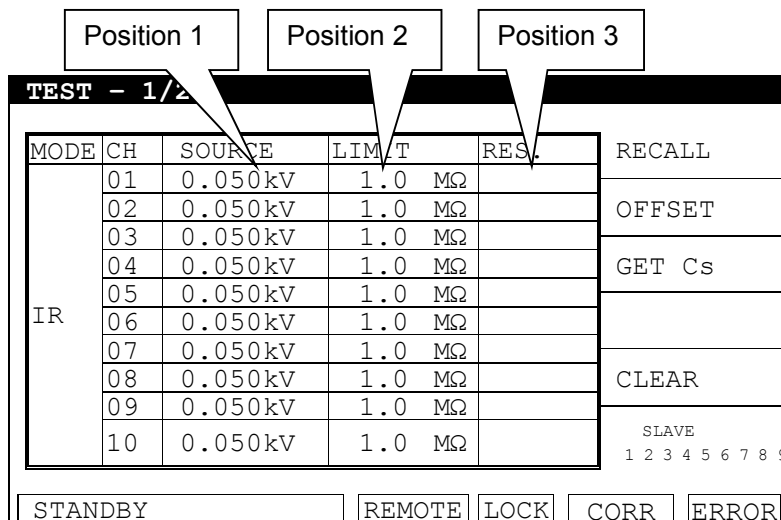


Illustration:

“TEST- 1/2” means there are 2 test steps and the 1<sup>st</sup> test step is currently running. “IR” means the test mode. “SOURCE” means the set voltage, “LIMIT” is the low limit set for the insulation impedance, while “RES.” is the test result.

3. Press **STOP** to prepare for the test. The status line shows “STANDBY”.
4. Press **START** to activate the test.  
 When this key is pressed the tester starts to output voltage and the DANGER LED is turned ON. The status line shows a counter to count down. “SOURCE” will show the output voltage value, “LIMIT” will show the current readings and “RES.” will show the test result.
5. GOOD Judgment  
 When all the tests are done and the results show PASS, the tester will see the UUT as a GOOD product and turn off the output. The HANDLER interface outputs the PASS signal and the beeper sounds at the same time.
6. NO GOOD Judgment  
 If the test value is abnormal, the tester judges it as FAIL and turns off the output immediately. The HANDLER outputs the FAIL signal and the beeper sounds at the same

time until the **STOP** key on the tester is pressed. The test result will show the FAIL state.

FAIL State:

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

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

#### 4.8.4 Procedure for OSC Test

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

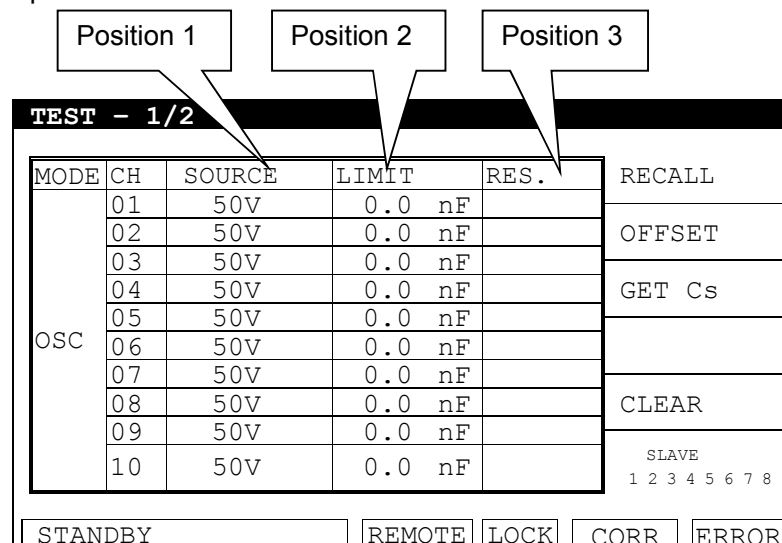


Illustration:

“OSC” means the tester is in the Open/Short Check mode. “SOURCE” is the set voltage and “LIMIT” is the standard capacitance (Cs) while “RES.” shows the test result.

3. Press **STOP** to prepare for the test. The status line shows “STANDBY”.
4. Press **START** to activate the test.  
When this key is pressed the tester starts to output voltage and the DANGER LED is turned ON. The status line shows a counter to count down. “SOURCE” will show the output voltage value, “LIMIT” will show the current readings and “RES.” 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 turn off the output. The HANDLER interface outputs the PASS signal and the beeper sounds at the same time.
6. NO GOOD Judgment  
If the test value is abnormal, the tester judges it as FAIL and turns off the output immediately. The HANDLER outputs the FAIL signal and the beeper sounds at the same time until the **STOP** key on the tester is pressed. The test result will show the FAIL state.

FAIL State:

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

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

**Notice**

1. Every time a cable or fixture is changed for an OSC test, be sure to run OFFSET in advance to ensure the test accuracy.
2. Run GET Cs when testing a new UUT or replacing a UUT for the OSC tests. Read the standard capacitance from the test sample as the standard value.
3. To use OSC GET CS, see section 4.7.3 for detailed information.

### 4.8.5 Test Procedure for PA Test

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

The screenshot shows a terminal window titled "TEST - 1/2". It contains a table with columns: MODE, CH, SOURCE, LIMIT, RES., and a set of function keys on the right. Callout boxes point to "Position 1" (SOURCE) and "Position 2" (RES.).

MODE	CH	SOURCE	LIMIT	RES.	FUNCTION KEYS
PA	01	PAUSE-MODE			RECALL
	02	PAUSE-MODE			OFFSET
	03	PAUSE-MODE			GET Cs
	04	PAUSE-MODE			
	05	PAUSE-MODE			
	06	PAUSE-MODE			
	07	PAUSE-MODE			
	08	PAUSE-MODE			CLEAR
	09	PAUSE-MODE			
	10	PAUSE-MODE			

At the bottom of the screen, there is a status line with buttons: STANDBY, REMOTE, LOCK, CORR, ERROR. Below the table, the text "SLAVE" and "1 2 3 4 5 6 7 8 9" is visible.

Illustration:

“PA” means it is in pause mode. “SOURCE” is the message string to be displayed during the pause mode and “RES.” is the test result.

3. Press **STOP** to prepare for the test. The status line shows “STANDBY”.
4. Press **START** to activate the test.  
 When this key is pressed it starts PA MODE. If the test time is set for PA MODE, the status line will show a countdown timer. If the test time is set to CONTINUE, the status line will show PAUSE and wait for the input of a START signal to end the PA MODE.

### 4.8.6 Auto Range

1. Set **Auto Range** to **ON**.
2. The "LIMIT" shown in the figure below shows the tester is set to the high current range.

Position 1

TEST - 1/2					
MODE	CH	SOURCE	LIMIT	RES.	RECALL
AC	01	0.500kV	10.00 mA		
	02	0.500kV	10.00 mA		OFFSET
	03	0.500kV	10.00 mA		
	04	0.500kV	10.00 mA		GET Cs
	05	0.500kV	10.00 mA		
	06	0.500kV	10.00 mA		
	07	0.500kV	10.00 mA		
	08	0.500kV	10.00 mA		CLEAR
	09	0.500kV	10.00 mA		
	10	0.500kV	10.00 mA		

SLAVE  
1 2 3 4 5 6 7 8 9

STANDBY    REMOTE    LOCK    CORR    ERROR

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

Position 1

TEST - 1/2					
MODE	CH	SOURCE	LIMIT	RES.	RECALL
AC	01	0.500kV	0.050 mA		
	02	0.500kV	0.050 mA		OFFSET
	03	0.500kV	0.050 mA		
	04	0.500kV	0.050 mA		GET Cs
	05	0.500kV	0.050 mA		
	06	0.500kV	0.050 mA		
	07	0.500kV	0.050 mA		
	08	0.500kV	0.050 mA		
	09	0.500kV	0.050 mA		
	10	0.500kV	0.050 mA		

SLAVE  
1 2 3 4 5 6 7 8 9

TEST: 0.0s    REMOTE    LOCK    CORR    ERROR

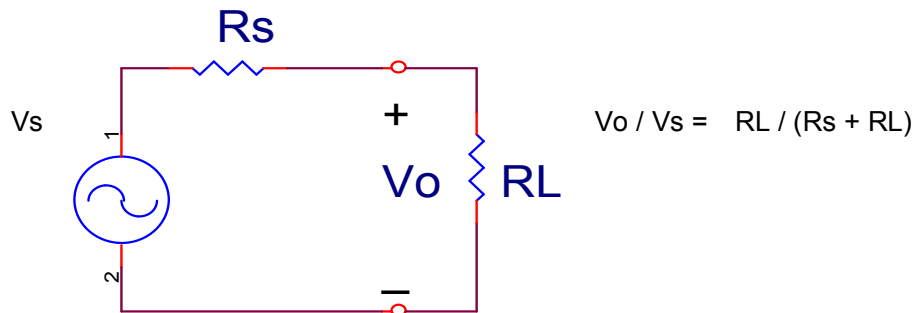
### 4.8.7 Hardware/Software AGC

The AGC function compensates for the effect of a changing load on the output voltage.

- 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, H/W AGC is turned OFF.



1. H/W AGC: Since the load effect can cause  $V_o < V_s$ , a hardware comparator circuit is used to make  $V_o$  the same as  $V_s$  within 0.1sec.
2. S/W AGC: The tester uses software AGC only in IR MODE. Since the software compensation is slow, it will not cause a transient voltage spike at the UUT. The common IR impedance ( $R_L$ ) is much larger than the output impedance ( $R_s$ ) of this tester, thus  $V_o \approx V_s$ .



## 5. HANDLER Interface

### 5.1 Introduction

The HANDLER interface card is an optional I/O card that can be purchased for the tester. It allows the tester to be controlled by external signals or to send response signals back to the controlling device.

### 5.2 Specifications

#### 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

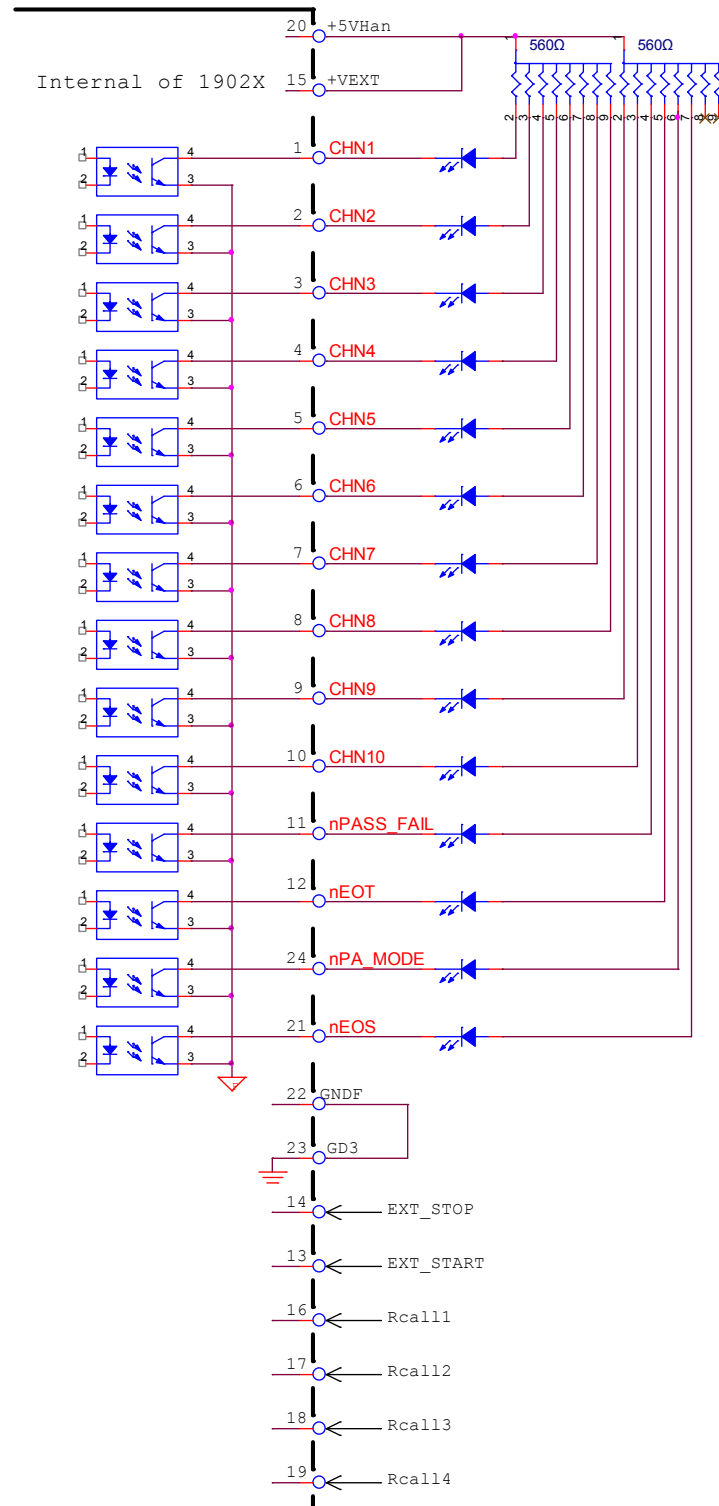
The pin assignments of the HANDLER card are described in the table below:

Pin No.	Signal	Input/Output	Description
1	CHN1	Output	The output signals from 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 combined test result of all channels when each Step ends. Lo: TOTAL PASS, Hi: TOTAL FAIL.
12	nEOT	Output	The output signal nEOT indicates if the test procedure has ended. When the signal is HIGH, the test procedure is under execution. When the signal is LOW, the test procedure has ended or the tester is in standby.
13	nEXT_START	Input	The external START signal (input - active LOW).
14	nEXT_STOP	Input	The external STOP signal (input - active LOW).
15	+VEXT	-	The external DC voltage input. The input voltage range is between +3V and +26V.

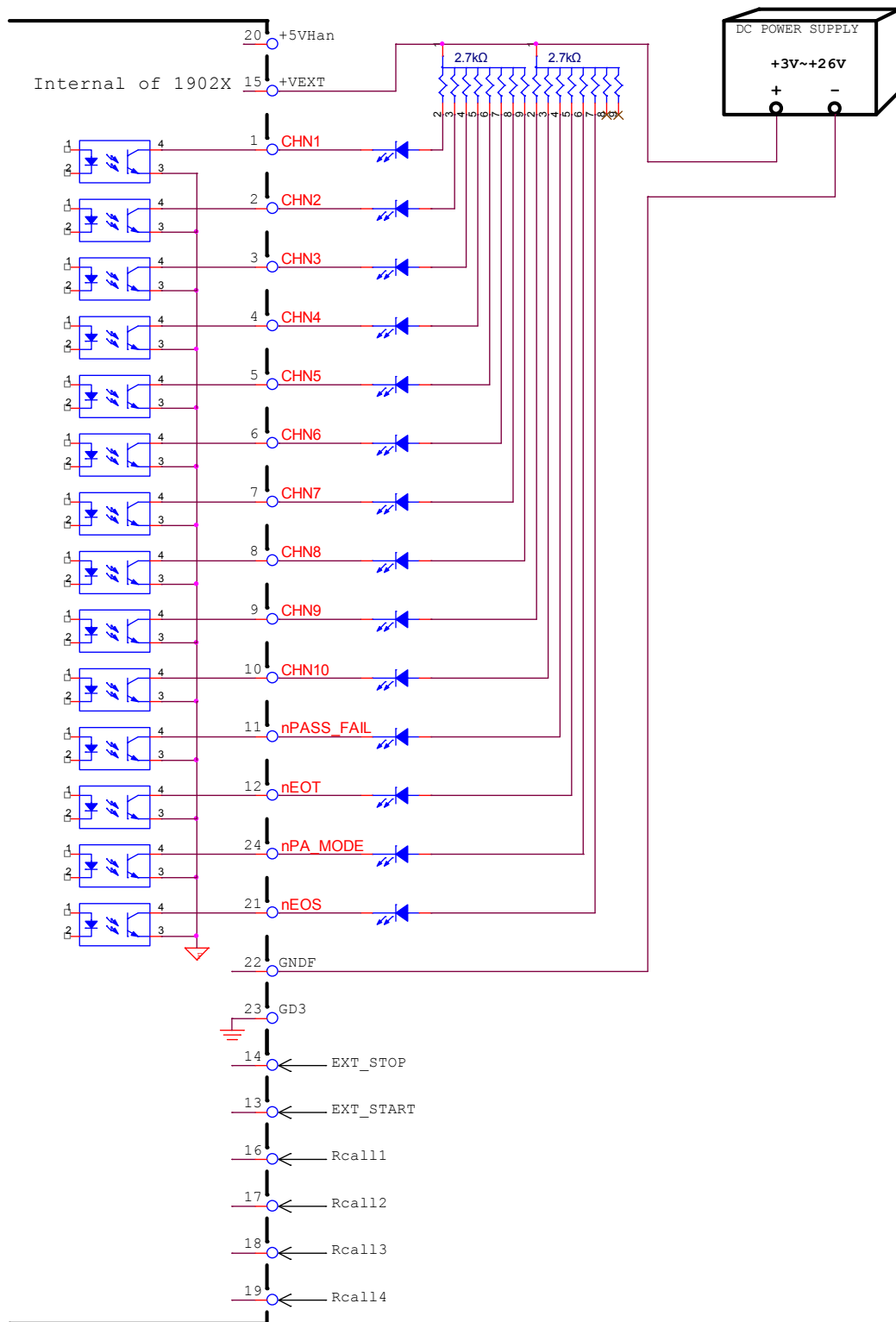
Pin No.	Signal	Input/Output	Description
16	nRecall1	Input	nRecall1-nRecall3 signals indicate the memory position to be read. It uses 3 bits to represent the 7 test steps. The input format is binary code (001-011). (nRecall1 is the low bit, while nRecall3 is the high bit.) 001 recalls memory 1 111 recalls memory 7 nRecall4 signal is the switch for reading memory. When nRecall4 receives a LOW level signal, the memory data can be retrieved.
17	nRecall2		
18	nRecall3		
19	nRecall4		
20	+5VHan	-	The internal DC voltage output.
21	nEOS	Output	The output signal nEOS indicates if the test procedure has ended. When the signal is HIGH, the test procedure is running. When the signal is LOW, the test procedure has ended or is in standby.
22	GNDf	-	The external DC voltage input and the low voltage terminal for the input/output signal.
23	GD3	-	The low voltage terminal for the internal voltage output.
24	nPA_MODE	Output	This signal indicates PA Mode is active.

## 5.3 Example of External Control Circuit

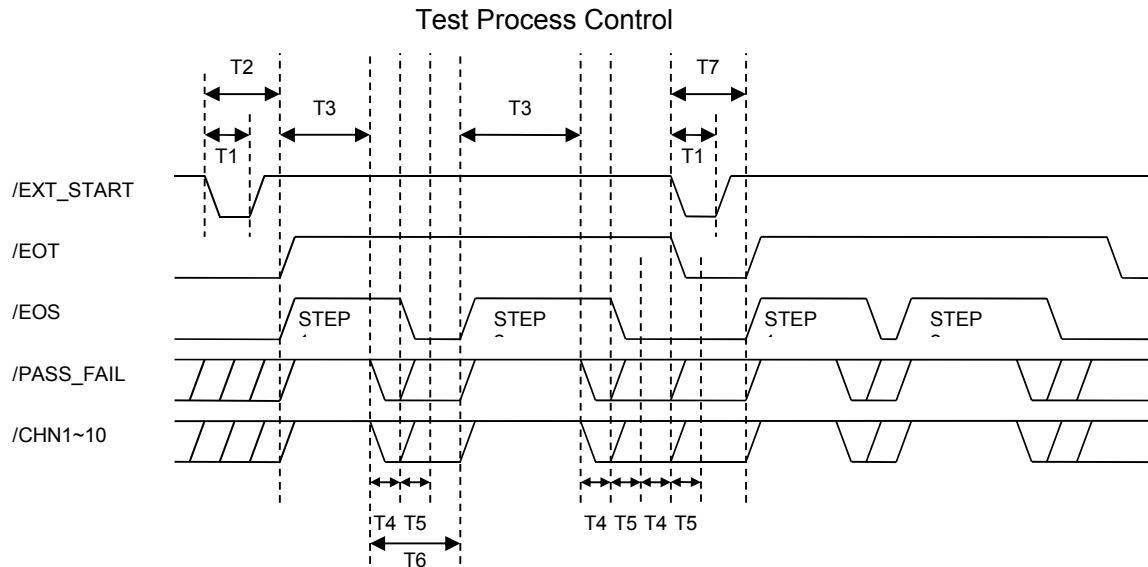
### 5.3.1 Example of Using Internal Power Supply



### 5.3.2 Example of Using External Power Supply



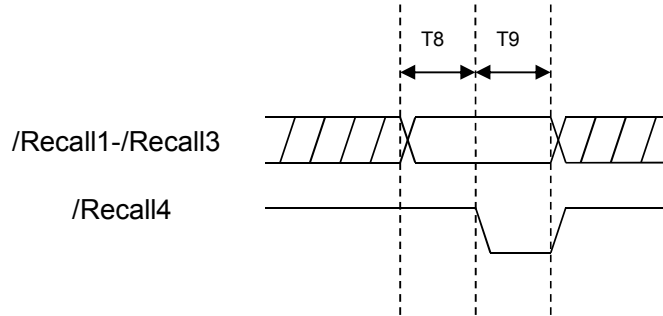
## 5.4 Timing Diagram



Time	Limit	Description
T1	> 10mS	Sets the minimum pulse width of the external trigger signal (/EXT_START).
T2	< 20mS	Sets the time from external trigger signal (/EXT_START) to /EOT signal.
T3	-	Sets the length of time required for the test.
T4	> 5mS	Sets the delay time for the /PASS_FAIL signal to be stable.
T5	> 5mS	Sets the delay time for the /EOT and /EOS signals to be stable.
T6	Note	The time delay between test steps.
T7	Note	The time delay between test procedures.

**Note** : The value varies according to the situation. For instance, T6 for Screen On is about 320mS and for Screen Off is about 40mS, while T7 for Screen On is about 280mS and for Screen Off is about 60mS. (The values used here are estimated, the exact values are based on the actual measurement.)

Control for Recalling Saved Parameter



Time	Limit	Description
T8	> 5mS	Sets the width of the /Recall1-/Recall3 signal.
T9	> 5mS	Sets the width of the /Recall4 signal.

## 6. GPIB/RS232 Interface (IEEE-488.2)

### 6.1 Introduction

The tester can be controlled remotely by a PC through the RS232 or GPIB (IEEE 488-1978) interface.

### 6.2 GPIB Interface

#### 6.2.1 Applied Standard

The tester follows 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 describes the tester's response to the following interface messages:

Interface Message	Meaning	Response
GTL	Go To Local	Switches the tester to Local mode.
SDC	Selected Device Clear	Clears the selected device.
LLO	Local Lockout	Prevents the use of the <b>ENTER</b> key to switch to Local mode.
IFC	Interface Clear	Clears the GPIB interface.

## 6.2.4 Command Format





The GPIB interface utilizes ASCII commands to allow remote control from a PC. The command string is formed by [command+parameter]. The semicolon “;” is used to connect multiple commands, ending with the End Code. The End Code is in one of the following formats:

### End Code

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

## 6.2.5 Panel Description

### 1. Setting the Address

- When “SYSTEM” appears in the title bar, press the ,  keys to move the highlighted cursor to [SYSTEM CONFIG] and press **ENTER** to go to the SYSTEM CONFIG screen.
- Press the ,  keys again to move the highlighted cursor to [GPIB] and use the [UP] and [DOWN] Function Keys to select the GPIB Address.
- When the address has been set, press the [EXIT] Function Key to exit the menu.

### 2. Remote & Panel Control

- When the message box “Remote” is highlighted it indicates the tester is in the remote control state.
- In the remote control state, use the **ENTER** key on the front panel to switch the tester to the panel control state.
- In the remote control state, all keys are invalid except **ENTER** (switch to panel control state) and **STOP** (reset the tester).
- The GPIB LLO [Local Lockout] command can be used to lock the **ENTER** key.

## 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 RS232 interface utilizes ASCII commands to allow remote control from a PC. The command string is formed by [command+parameter]. The semicolon “;” is used to connect multiple commands, ending with the End Code. The End Code is in one of the following formats:

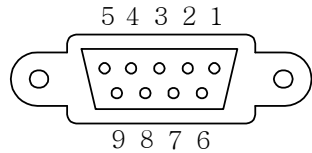


**End Code**

LF
CR + LF

**6.3.3 Connector**

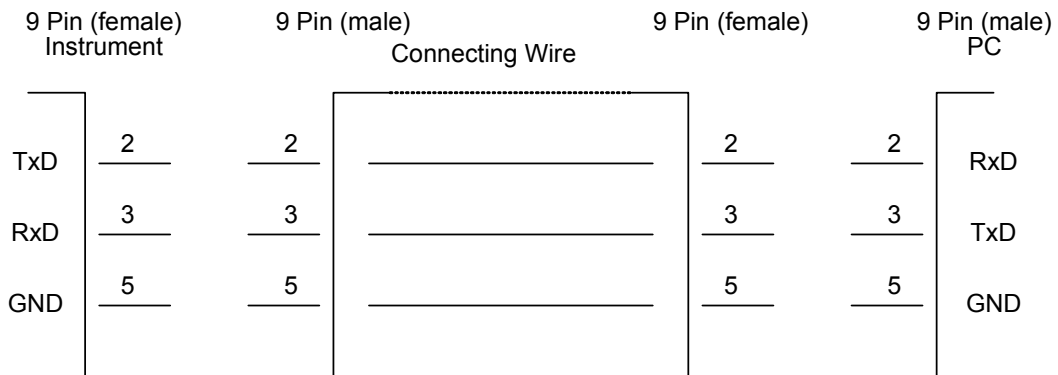
The RS232 connector on the tester is a 9-pin female connector.



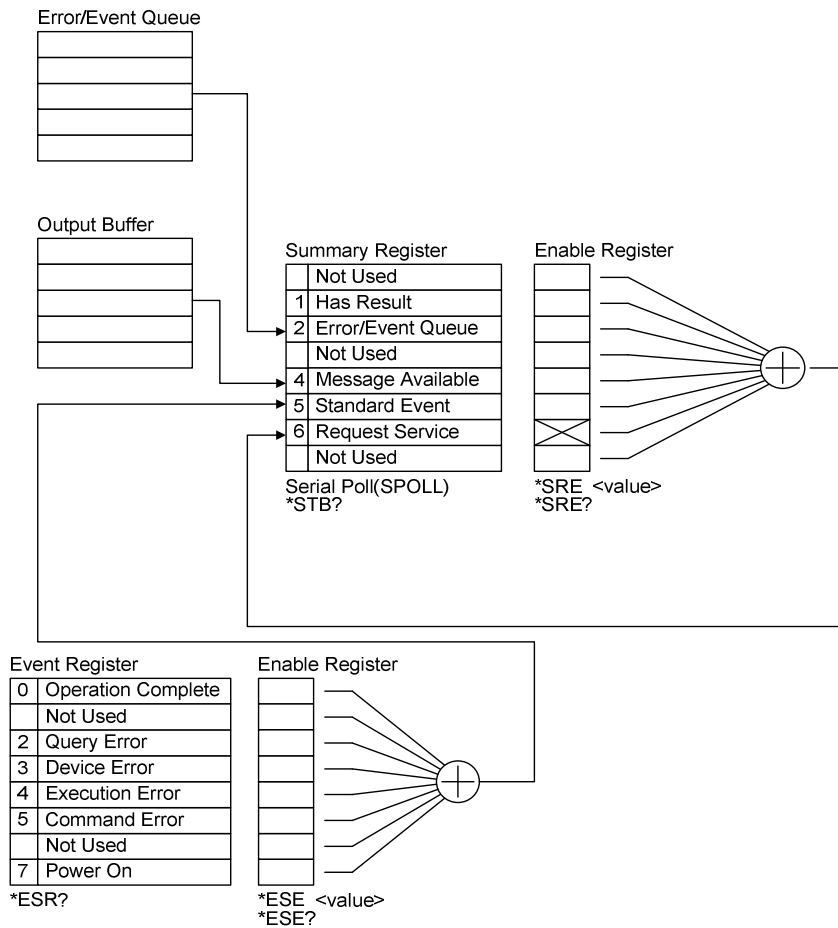
Pin No.		Description
1	*	Unused
2	TxD	Send data
3	RxD	Receive data
4	*	Unused
5	GND	Ground signal
6	*	Unused
7	*	Unused
8	*	Unused
9	*	Unused

**6.3.4 Connection**

Wire the RS232 interface according to the diagram below:



## 6.4 Remote Interface Structure



## 6.5 Remote Interface Commands

### 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?

SCPI commands use the following syntax parameters:

- (1) "< >" indicates the defined parameter format of a standard SCPI command.
- (2) "< numeric value >" is decimal data while "< boolean >" is Boolean program data with a value of 0 or 1.
- (3) The vertical bar "|" indicates the OR parameter.
- (4) "< channel list >" indicates the Channel status and the expression is:  
 (@C1, C2...) where C1, C2... indicates the Channel number. The format of this model's Channel number is 3 digits: the first digit is the Frame index and the last two digits are the Channel index; for example, the Channel number of the 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

```



```

| | | | | :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
| | | | | | | :DWELl <number value>
| | | | | | | :DWELl?
| | | | | | | :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?
| | | | | | | :CORRection
| | | | | | | | [:CAPacitance]
| | | | | | | | | :SAMPle <range>,<number value>
| | | | | | | | | :SAMPle?
| | | | | | | :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
| | | :ADDRes?
| | | :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?
| | | | :OFFSet <number value>
| | | | | :OFFSet?
| | :VERSion?
    
```

## 6.5.2 Command Descriptions

- **IEEE 488.2 Commands**

**\*CLS**

Clears the status data structure:  
Clears the standard event register.  
Clears the byte register except MAV bit (bit 4).

**\*ESE < decimal data >**

Sets the value for the standard event enable register. The value is <decimal data> between 0-255.

**\*ESE?**

Queries the standard event enable register value. The output format is <decimal data> between 0-255.

**\*ESR?**

Queries the standard event register value. The register is cleared to 0 when this command is executed. The output format is <decimal data> between 0-255.

**\*IDN?**

Returns the instrument identification information. The output format is divided by commas into 4 columns: manufacturer, device model no., serial no. and firmware version.

**\*OPC**

It completes the operation.

**\*OPC?**

Queries if the operation has completed. The ASCII character "1" is output when done.

**\*PSC 0 | 1**

Clears the power on state.

**\*PSC?**

Queries the power on state for clearing. The output format is an ASCII character "1" or "0".

**\*RST**

Resets the device by stopping the test.

**\*RCL < decimal data >**

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 >**

Save command.  
This command saves the current settings 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 >**

Sets the value of the service request register. The value is <decimal data> between 0-255.

**\*SRE?**

Reads the contents of the service request enable register. The output format is <decimal data> within 0-255.

**\*STB?**

Reads the contents of the status bit register. The output format is <decimal data> between 0-255.

- **SCPI Command**

**:MEMory:DELeTe[:NAME] <name>**

Deletes the parameter data specified by <name> in the main memory. <name> is a string with a maximum of 13 characters.

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

**:MEMory:DELeTe:LOCation <register number>**

Deletes the parameter data specified by <register number> in the main memory. <register number> is an integer with a range between 0-30 where 0 clears the memory.

Example:           Input the command "MEM:DEL : LOC 1".  
Description:       Deletes the parameter data for register number 1 in the main memory.

**:MEMory:STATe:DEFine <name>, <register number>**

Defines a name for the memory location specified by <register number>. <register number> is an integer with a range between 1-30.

Example:           Input the command "MEM:STAT:DEF TEST,1".  
Description:       Names the parameter data "TEST" for the 1<sup>st</sup> memory location set in main memory.

**:MEMory:STATe:DEFine? <name>**

Queries the memory's <register number> specified by the <name>.

Example:           Input the command "MEM:STAT:DEF? TEST".  
                      The tester returns "1".  
Description:       The returned value "1" means the parameter data named "TEST" is located in the 1<sup>st</sup> memory location.

**:MEMory:FREE:STATe?**

Queries the unused capacity in the main memory.

Example:           Input the command "MEM:FREE:STAT?".  
                      The tester returns "27".  
Description:       The returned value "27" means the number of remaining data parameters available for setting.

**:MEMory:NSTATes?**

Queries the capacity of the main memory. The value returned is the maximum number of parameters plus 1 for \*SAV and \*RCL commands.



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

**[[:SOURce]:SAFety[:CHANnel]<m>:FETCh? [ < item > ] [, < item > ]**

Queries the host for the test result when the Screen is set to ON. The format of the variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04 (19020-4/19021-4/19022-4). If the variable is not entered it defaults to 001 to indicate Channel 1 of the Master. <item> is string data as shown below:

String	Returned Data
STEP	Current STEP No.
MODE	Current MODE
OMETerage	Current reading of the output meter
MMETerage	Current reading of the measurement meter
RELapsed	The completed RAMP time
RLEave	The remaining RAMP time
DELapsed	The completed DWELL time
DLEave	The remaining DWELL time
TELapsed	The TEST time completed When the Test Time is short it returns the time remaining. When the Test Time is set to CONT, it returns 9.9000001E+37.
TLEave	The TEST time remaining When the Test Time is short it returns the time remaining. When the Test Time is set to CONT, it returns 9.9000001E+37.
FELapsed	The completed FALL time
FLEave	The remaining FALL time

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** means the settings for STEP, MODE, and the output result for CH3 of Address 0 are STEP1, AC MODE, and 0.500kV.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL[:JUDGment]?**

Queries all judgment results when the Screen is set to ON. The format of the variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 001 to indicate Channel 1 of the Master. The return format is First Step Result, Second Step Result, ..., Last Step Result. The Code values are shown below:

**Code of Test Result**

Mode	AC		DC		IR		OSC		ALL	
	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				

Mode	AC		DC		IR		OSC		ALL	
	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
LOW FAIL	22	34	32	50	42	66				
ARC FAIL	23	35	33	51						
OCF	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 means the judgements for CH3 STEP1-STEP10 of Address 0 are PASS, PASS, PASS, PASS, PASS, PASS, PASS, PASS, PASS, PASS, PASS.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:ALL:MMETerage?**

Queries the readings of MEASURE METER in all STEPs when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 means the settings for MEASURE METER in CH4 STEP1-STEP10 of Address 0 are 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?**

Queries the MODE of all STEPs when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 means the MODE settings for CH5 STEP1-STEP10 of Address 0 are 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?**

Queries the OUTPUT METER readings in all STEPs when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 means the output readings of the OUTPUT METER for CH1 STEP1-STEP10 of Address 1 are 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]:DWELI?**

Queries the DWELL time of all STEPs when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 means the dwell times for CH5 STEP1-STEP10 of Address 0 are 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?**

Queries the voltage fall time for all STEPs when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 means the voltage fall times for CH5 STEP1-STEP10 of Address 0 are 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?**

Queries the time required for the voltage to ramp up for all STEPs when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 means the times required for the voltage to ramp up for CH5 STEP1-STEP10 of Address 0 are 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]?**

Queries the test time of all STEPs when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and

the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 means the times required for testing CH5  
 STEP1-STEP10 of Address 0 are 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**  
 Sets or clears the automatic reporting of the test results (only valid for the RS232 interface.) This command is only valid for this tester, so the Address 0 variable <m> can use 001, the Address 1 variable <m> can use 101 and so forth. The Address 9 variable <m> can use 901. The returned data is the Total Pass/Fail state in string format indicating "PASS" or "FAIL".

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

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:AREPort?**  
 Queries if the device automatically reports the test result. It returns either 1 or 0. (Applicable for the RS232 interface only.)

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

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:COMPleted?**  
 Queries if all tests have completed. It returns either 1 or 0.

Example: Input the command SAF001:RES:COMP?  
 The tester returns 1.  
 Description: The returned string "1" means Address 0 has completed all the tests.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>[:JUDGment]?**  
 Queries the judgment of a specified STEP when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 001 to indicate Channel 1 of the Master. Return format: First Step Result, Second Step Result, ..., Last Step Result. The Code values are shown below:

**Code of Test Result**

Mode	AC		DC		IR		OSC		ALL	
	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
STOP									70	112

Mode	AC		DC		IR		OSC		ALL	
	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
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 string "116" means the result for CH3 STEP 3 of Address 0 is PASS.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:MMETerage?**

Queries the MEASURE METER reading of the specified STEP when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 string means the MEASURE METER reading for CH4 STEP 3 of Address 0 is 0.04mA.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:OMETerage?**

Queries the OUTPUT METER reading of the specified STEP when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 string means the OUTPUT METER reading for CH1 STEP 3 of Address 0 is 0.100kV.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed]: DWELI?**

Queries the DWELL time of the specified STEP when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 string means the DWELL time for CH5 STEP 1 of Address 0 is 0.5sec.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed]: FALL?**

Queries the voltage fall time for the specified STEP when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 string means the voltage fall time for CH5 STEP 4 of Address 0 is 2.0sec.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed]: RAMP?**

Queries the voltage ramp time for the specified STEP when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 string means the voltage ramp time for CH5 STEP 1 of Address 0 is 0.5sec.

**[[:SOURce]:SAFety[:CHANnel]<m>:RESult:STEP<n>:TIME[:ELAPsed] [:TEST]?**

Queries the test time of the specified STEP when the Screen is set to ON. The format of variable <m> after [:CHANnel] is 3 digits. The first digit is the Frame index in the range of 0-9 and the last two digits are the Channel index in the range of 01-10 (19020/19021/19022) or 01-04(19020-4/19021-4/19022-4). If the variable is not entered it defaults to 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 string means the test time required for CH5 STEP 2 of Address 0 is 3.0sec.

**[[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>[:JUDGment]?**

Queries the judgment of the specified STEP for all channels of a Frame when the Screen is set to ON. The variable <f> at the end of the FRAMe<f> command means the Frame value (0-9). If <f> is not entered it defaults to 1 to indicate querying the judgment results of all channels for Slave 1. Return format: Ch1 Result, Ch2 Result, ..., Ch10 Result. The Code values are shown below:

**Code of Test Result**

Mode	AC		DC		IR		OSC		ALL	
	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		

Mode	AC		DC		IR		OSC		ALL	
Code	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
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 string means the judgment results of STEP 3 for all Channels of Frame 0 are "PASS".

**[[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:MMETerage?**

Queries the MEASURE METER readings of the specified STEP for all channels of a Frame when the Screen is set to ON. The variable <f> at the end of the FRAME<f> command means the Frame value (0-9). If <f> is not entered it defaults to 1 to indicate querying the MEASURE METER readings of all channels for Slave 1.

Example: Input the command SAF:FRAM0: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 string means the MEASURE METER readings for all channels for STEP3 of Frame 0 are 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?**

Queries the OUTPUT METER readings of the specified STEP for all channels of a Frame when the Screen is set to ON. The variable <f> at the end of the FRAME<f> command means the Frame value (0-9). If <f> is not entered it defaults to 1 to indicate querying 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 string means the OUTPUT METER readings for all channels for STEP3 of Frame 1 are 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?**

Queries the DWELL time of the specified STEP for all channels of a Frame when the Screen is set to ON. The variable <f> at the end of the FRAME<f> command means the Frame value (0-9). If <f> is not entered it defaults to 1 to indicate querying 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.

Description: The returned string means the DWELL times for STEP 1 for all channels of Frame 0 are 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

**[[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:TIME[:ELAPsed]:FALL?**

Queries the elapsed voltage fall time of the specified STEP for all channels of a Frame when the Screen is set to ON. The variable <f> at the end of the FRAME<f> command means the Frame value (0-9). If <f> is not entered it defaults to 1 to query the elapsed

voltage fall time 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 string means the voltage fall times for STEP 4 for all channels of Frame 0 are 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

**[[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:TIME[:ELAPsed]:RAMP?**

Queries the elapsed voltage ramp time of the specified STEP for all channels of a Frame when the Screen is set to ON. The variable <f> at the end of the FRAMe<f> command means the Frame value (0-9). If <f> is not entered it defaults to 1 to query the elapsed voltage ramp time 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 string means the times required for the voltage to ramp up to the set voltage in STEP 1 for all channels of Frame 0 are 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

**[[:SOURce]:SAFety:FRAMe<f>:RESult:STEP<n>:TIME[:ELAPsed]][:TEST]?**

Queries the test time of the specified STEP for all channels of a Frame when the Screen is set to ON. The variable <f> at the end of the FRAMe<f> command means the Frame value (0-9). If <f> is not entered it defaults to 1 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 string means the test times required for STEP 2 for all channels of Frame 0 are 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec, 3sec.

**[[:SOURce]:SAFety:STARt[:ONCE]**

Starts the test.

Example: Input the command SAF:STAR

Description: Starts the 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: Gets the correction value.

**[[:SOURce]:SAFety:STARt:CORRection:OPEN?**

Queries if the correction has been done.

Example: Input the command SAF:STAR:CORR:OPEN?

The tester returns 0.

Description: 0 means the correction has not been done.

**[[:SOURce]:SAFety:STARt:CORRection:SAMPle GET**

Starts the GET Cs function in Open Short Check mode.

Example: Input the command SAF:STAR:CORR:SAMP GET

Description: Starts the GET Cs function in Open Short Check mode.



**[[:SOURce]:SAFety:STARt:CORRection:SAMPlE?**

Queries if the GET Cs function has been started in Open Short Check mode.

Example: Input the command SAF:STAR:CORR:SAMP ?

The tester returns 1

Description: 1 means the GET Cs function has been started in Open Short Check mode.

**[[:SOURce]:SAFety:STATus?**

Queries the current execution status. The returned string is RUNNING| STOPPED.

Example: Input the command SAF:STAT?

The tester returns RUNNING.

Description: RUNNING means the host is currently conducting tests.

**[[:SOURce]:SAFety:STEP<n>:AC:CHANnel[:CLOSe] <channel\_list>**

Sets the status of the high voltage output channel of the selected STEP.

Example: Input the command SAF:STEP1:AC:CHAN (@001,002,201:210)

Description: Starts the high voltage output on channels CH1 and CH2 in STEP 1 of Address 0. Also starts the high voltage output on channels CH1-CH10 of Address 2.

**[[:SOURce]:SAFety:STEP<n>:AC:CHANnel[:CLOSe]?**

Queries the status of the high voltage output channel of the selected STEP.

Example: Input the command SAF:STEP1:AC:CHAN?

The tester returns (@001,002,201:210).

Description: Means the high voltage output channels CH1 and CH2 of Address 0 and the channels CH1-CH10 of Address 2 in STEP 1 are started.

**[[:SOURce]:SAFety:STEP<n>:AC:CHANnel:DEFault:ON**

Sets the selected STEP to use the DEF. CHANNELS option in TEST CONTROL for setting the high voltage output channel.

Example: Input the command SAF:STEP1:AC:CHAN:DEF:ON

Description: Sets STEP 1 using the DEF. CHANNELS option in TEST CONTROL for setting the high voltage output channel.

**[[:SOURce]:SAFety:STEP<n>:AC:CHANnel:DEFault:STATe?**

Queries if the selected STEP is using the DEF. CHANNELS option in TEST CONTROL for setting the high voltage output channel.

Example: Input the command SAF:STEP1:AC:CHAN:DEF:STAT?

The tester returns 1.

Description: The returned string "1" means STEP 1 is using the DEF. CHANNELS option in TEST CONTROL for setting the high voltage output channel.

**[[:SOURce]:SAFety:STEP<n>:AC:CHANnel:PSC P | S | PS, S | C | SC**

Sets the scan channel status of the selected STEP.

Example: Input the command SAF:STEP1:AC:CHAN:PSC P,S

Description: Sets the scan channel of STEP 1 to P→S.

**[[:SOURce]:SAFety:STEP<n>:AC:CHANnel:PSC?**

Queries the scan channel status of the selected STEP.

Example:            Input the command SAF:STEP1:AC:CHAN:PSC?  
                      The tester returns P,S.

Description:        The scan channel of STEP 1 is set to P→S.

**[[:SOURce]:SAFety:STEP<n>:AC[:LEVel] < numeric value >**

Sets the voltage required for the AC withstand voltage test of the selected STEP in Volts (V).

Range:             The range of the 19020 is 50V-5000V and the range of the 19021 is 50V-6000V.

Example:            Input the command SAF:STEP1:AC 3000.

Description:        Sets the voltage required for the AC withstand voltage test for STEP 1 to 3kV.

**[[:SOURce]:SAFety:STEP<n>:AC[:LEVel]?**

Queries the voltage required for the AC withstand voltage test of the selected STEP.

Example:            Input the command SAF:STEP1:AC?  
                      The tester returns 3.000000E+03.

Description:        The returned string "3.000000E+03" means the voltage required by the AC withstand voltage test for STEP 1 is set to 3kV.

**[[:SOURce]:SAFety:STEP<n>:AC:LIMit:ARC < numeric value >**

Sets the ARC test value of the selected STEP in Amperes (A).

Range:             0 or 0.001-0.020 (0 is OFF).

Example:            Input the command SAF:STEP1:AC:LIM:ARC 0.004.

Description:        Sets the ARC test value in AC Mode for STEP 1 to 4mA.

**[[:SOURce]:SAFety:STEP<n>:AC:LIMit:ARC?**

Queries the ARC test value of the selected STEP.

Example:            Input the command SAF:STEP1:AC:LIM:ARC?  
                      The tester returns 4.000000E-03.

Description:        The returned string "4.000000E-03" means the ARC test value for STEP 1 is set to 4mA.

**[[:SOURce]:SAFety:STEP<n>:AC:LIMit[:HIGH] < numeric value >**

Sets the high limit of the AC withstand leakage current of the selected STEP in Amperes (A).

Range:             The range of the 19020 is 0.000001A-0.01A and the range of the 19021 is 0.000001A-0.008A.

Example:            Input the command SAF:STEP1:AC:LIM 0.01.

Description:        Sets the high limit of the AC withstand leakage current for STEP 1 to 10mA.

**[[:SOURce]:SAFety:STEP<n>:AC:LIMit[:HIGH]?**

Queries the high limit of the AC withstand leakage current of the selected STEP.

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

**[[:SOURce]:SAFety:STEP<n>:AC:LIMit:LOW < numeric value >**  
Sets the low limit of the AC withstand leakage current of the selected STEP in Amperes (A).

Range: The range of the 19020 is 0.000001A-0.01A and the range of the 19021 is 0.000001A-0.008A (the low limit of leakage current ≤ the high limit.)

Example: Input the command SAF:STEP1:AC:LIM:LOW 0.00001.  
Description: Sets the low limit of the AC withstand leakage current for STEP 1 to 0.01mA.

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

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

**[[:SOURce]:SAFety:STEP<n>:AC:TIME:FALL < numeric value >**  
Sets the time required for the voltage to fall to 0 in the selected STEP in Seconds (s).

Range: 0 or 0.1-999.9 (0 is OFF).  
Example: Input the command SAF:STEP1:AC:TIME:FALL 3  
Description: Sets the time required for the voltage to fall to 0 in STEP 1 to 3.0sec.

**[[:SOURce]:SAFety:STEP<n>:AC:TIME:FALL?**  
Queries the time required for the voltage to fall to 0 in the selected STEP.

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

**[[:SOURce]:SAFety:STEP<n>:AC:TIME:RAMP < numeric value >**  
Sets the time required for the voltage to ramp up to a set value of the selected STEP in second (s).

Range: 0 or 0.1-999.9 (0 is OFF).  
Example: Input the command SAF:STEP1:AC:TIME:RAMP 5.  
Description: Sets the time required for the voltage to ramp up to the set value for STEP 1 to 5.0sec.

**[[:SOURce]:SAFety:STEP<n>:AC:TIME:RAMP?**  
Queries the time required for the voltage to ramp up to the set value of the selected STEP.

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

**[[:SOURce]:SAFety:STEP<n>:AC:TIME[:TEST] < numeric value >**  
Sets the time required for the test of the selected STEP in Second (s).

Range: 0 or 0.03-999.9 (0 is CONTINUE).  
Example: Input the command SAF:STEP1:AC:TIME 10.

Description: Sets the time required for the test in STEP 1 to 10.0sec.

**[[:SOURce]:SAFety:STEP<n>:AC:TIME[:TEST]?**

Queries the time required for the test of the selected STEP.

Example: Input the command SAF:STEP1:AC:TIME?  
The tester returns 1.000000E+01.

Description: The returned string "1.000000E+01" means the time required for the test in STEP 1 is set to 10.0sec.

**[[:SOURce]:SAFety:STEP<n>:DC:CHANnel[:CLOSe] <channel\_list>**

Sets the high voltage output channel status of the selected STEP.

Example: Input the command SAF:STEP2:DC:CHAN (@001,002,201:210).

Description: The high voltage output channels CH1 and CH2 of Address 0 in STEP 2 are enabled as well as the high voltage output channels CH1-CH10 of Address 2.

**[[:SOURce]:SAFety:STEP<n>:DC:CHANnel[:CLOSe]?**

Queries the high voltage output channel status of the selected STEP.

Example: Input the command SAF:STEP2:DC:CHAN?  
The tester returns (@001,002,201:210).

Description: The returned string means the high voltage output channels CH1 and CH2 of Address 0 in STEP 2 are enabled as well as the high voltage output channels CH1-CH10 of Address 2.

**[[:SOURce]:SAFety:STEP<n>:DC:CHANnel:DEFault:ON**

Sets the high voltage channel settings in the DEF. CHANNELS option under TEST CONTROL of the selected STEP.

Example: Input the command SAF:STEP2:DC:CHAN:DEF:ON

Description: Sets the high voltage channel settings in the DEF. CHANNELS option under TEST CONTROL for STEP 2.

**[[:SOURce]:SAFety:STEP<n>:DC:CHANnel:DEFault:STATe?**

Queries the high voltage channel settings set by the DEF. CHANNELS option in TEST CONTROL of the selected STEP.

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

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

**[[:SOURce]:SAFety:STEP<n>:DC:CHANnel:PSC P | S | PS, S | C | SC**

Sets the scan channel status of the selected STEP.

Example: Input the command SAF:STEP1:DC:CHAN:PSC P,S

Description: Sets the scan channel of STEP 1 to P→S.

**[[:SOURce]:SAFety:STEP<n>:DC:CHANnel:PSC?**

Queries the scan channel status of the selected STEP.

Example: Input the command SAF:STEP1:DC:CHAN:PSC?  
The tester returns P,S.

Description: The scan channel of STEP 1 is set to P→S.

**[[:SOURce]:SAFety:STEP<n>:DC[:LEVel] < numeric value >**

Sets the voltage required for the DC withstand voltage test of the selected STEP in Volts (V).

Range: 50-6000 for 19020, 50-8000 for 19022.

Example: Input the command SAF:STEP2:DC 4000.

Description: Sets the voltage for the DC withstand voltage test for STEP 2 to 4kV.

**[[:SOURce]:SAFety:STEP<n>:DC[:LEVel]?]**

Queries the voltage set for the DC withstand voltage test of the selected STEP

Example: Input the command SAF:STEP2:DC?

The tester returns 4.000000E+03.

Description: The returned string “4.000000E+03” means the voltage set for the DC withstand voltage test for STEP 2 is set to 4kV.

**[[:SOURce]:SAFety:STEP<n>:DC:LIMit:ARC < numeric value >**

Sets the ARC test value of the selected STEP in Amperes (A).

Range: 0 or 0.001-0.010 (0 is OFF).

Example: Input the command SAF:STEP2:DC:LIM:ARC 0.0025.

Description: Sets the ARC test value for STEP 2 to 2.5mA.

**[[:SOURce]:SAFety:STEP<n>:DC:LIMit:ARC?]**

Queries the ARC test value of the selected STEP.

Example: Input the command SAF:STEP2:DC:LIM:ARC?

The tester returns 2.500000E-03.

Description: The returned string “2.500000E-03” means the ARC test value for STEP 2 is set to 2.5mA.

**[[:SOURce]:SAFety:STEP<n>:DC:LIMit[:HIGH] < numeric value >**

Sets the high limit of the DC withstand voltage leakage current of the selected STEP in Amperes (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: Sets the high limit of the DC withstand voltage leakage current for STEP 2 to 2.999mA.

**[[:SOURce]:SAFety:STEP<n>:DC:LIMit[:HIGH]?]**

Queries the high limit of the DC withstand voltage leakage current of the selected STEP.

Example: Input the command SAFE:STEP2:DC:LIM?

The tester returns 2.999000E-03.

Description: The returned string “2.999000E-03” means the high limit of the DC withstand voltage leakage current for STEP 2 is set to 2.999mA.

**[[:SOURce]:SAFety:STEP<n>:DC:LIMit:LOW < numeric value >**

Sets the low limit of the DC withstand voltage leakage current of the selected STEP in Amperes (A).

Range: 0.000001-0.005 for 19020, 0.000001-0.0035 for 19022.  
(Low limit of leakage current  $\leq$  high limit.)  
Example: Input the command SAF:STEP2:DC:LIM:LOW 0.000001.  
Description: Sets the low limit of the DC withstand voltage leakage current for STEP 2 to 0.001mA.

**[[:SOURce]:]SAFety:STEP<n>:DC:LIMit:LOW?**

Queries the low limit of the DC withstand voltage leakage current of the selected STEP.

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

**[[:SOURce]:]SAFety:STEP<n>:DC:TIME:DWELI < numeric value >**

Sets the DWELL time of the selected STEP in Seconds (s).

Range: 0 or 0.1-999.9, 0 is OFF.  
Example: Input the command SAF:STEP2:DC:TIME:DWEL 2.5.  
Description: Sets the DWELL time for STEP 2 to 2.5sec.

**[[:SOURce]:]SAFety:STEP<n>:DC:TIME:DWELI?**

Queries the DWELL time of the selected STEP.

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

**[[:SOURce]:]SAFety:STEP<n>:DC:TIME:FALL < numeric value >**

Sets the time required for the voltage to fall to 0 of the selected STEP in Seconds (s).

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

**[[:SOURce]:]SAFety:STEP<n>:DC:TIME:FALL?**

Queries the time required for the voltage to fall to 0 of the selected STEP.

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

**[[:SOURce]:]SAFety:STEP<n>:DC:TIME:RAMP < numeric value >**

Sets the time required to ramp up to the set voltage of the selected STEP in Seconds (s).

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

**[[:SOURce]:SAFety:STEP<n>:DC:TIME:RAMP?**

Queries the time required to ramp up to the set voltage of the selected STEP.

Example:            Input the command SAF:STEP3:DC:TIME:RAMP?  
                      The tester returns 2.000000E+00.

Description:        The returned string "2.000000E+00" means the time required to ramp up to the set voltage for STEP 2 is set to 2.0sec.

**[[:SOURce]:SAFety:STEP<n>:DC:TIME[:TEST] < numeric value >**

Sets the test time required of the selected STEP in Seconds (s).

Example:            Input the command SAF:STEP2:DC:TIME 1.  
Range:              0 or 0.1-999.9, 0 is CONTINUE.

Description:        Sets the test time required for STEP 2 to 1.0sec.

**[[:SOURce]:SAFety:STEP<n>:DC:TIME[:TEST]?**

Queries the test time required of the selected STEP.

Example:            Input the command SAFE:STEP2:DC:TIME?  
                      The tester returns 1.000000E+00.

Description:        The returned string "1.000000E+00" means the test time required for STEP 2 is set to 1.0sec.

**[[:SOURce]:SAFety:STEP<n>:DELete**

Deletes STEP <n> and moves the subsequent STEPs forward.

Example:            Input the command SAF:STEP1:DEL.

Description:        Clears the settings in STEP 1 in the working memory.

**[[:SOURce]:SAFety:STEP<n>:IR:CHANnel[:CLOSE] <channel\_list>**

Sets the high voltage output channel status of the selected STEP.

Example:            Input the command SAF:STEP3:IR:CHAN (@001,002,201:210).

Description:        The high voltage output channels CH1 and CH2 of Address 0 in STEP 3 are enabled as well as the high voltage output channels CH1-CH10 of Address 2.

**[[:SOURce]:SAFety:STEP<n>:IR:CHANnel[:CLOSE]?**

Queries the high voltage output channel status of the selected STEP.

Example:            Input the command SAF:STEP3:IR:CHAN?  
                      The tester returns (@001,002,201:210).

Description:        The high voltage output channels CH1 and CH2 of Address 0 in STEP 3 have been enabled as well as the high voltage output channels CH1-CH10 of Address 2.

**[[:SOURce]:SAFety:STEP<n>:IR:CHANnel:DEFault:ON**

Sets the high voltage output channel using the options in DEF. CHANNELS under TEST CONTROL of the selected STEP.

Example:            Input the command SAF:STEP3:IR:CHAN:DEF:ON.

Description:        Sets the high voltage output channel using the options in DEF. CHANNELS under TEST CONTROL for STEP 3.

**[[:SOURCE]:SAFety:STEP<n>:IR:CHANnel:DEFault:STATe?**

Queries if the high voltage output channel uses the options in DEF. CHANNELS under TEST CONTROL of the selected STEP.

Example: Input the command SAF:STEP3:IR:CHAN:DEF:STAT?  
The tester returns 1.

Description: The returned string "1" 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:PSC P | S | PS, S | C | SC**

Sets the scan channel status of the selected STEP.

Example: Input the command SAF:STEP1:IR:CHAN:PSC P,S

Description: Sets the scan channel of STEP 1 to P→S.

**[[:SOURCE]:SAFety:STEP<n>:IR:CHANnel:PSC?**

Queries the scan channel status of the selected STEP.

Example: Input the command SAF:STEP1:IR:CHAN:PSC?  
The tester returns P,S.

Description: The scan channel of STEP 1 is set to P→S.

**[[:SOURCE]:SAFety:STEP<n>:IR[:LEVel] < numeric value >**

Sets the voltage required for the insulation resistance test of the selected STEP in Volts (V).

Range: 50-1000

Example: Input the command SAF:STEP3:IR 1000.

Description: Sets the voltage required for the insulation resistance test for STEP3 to 1kV.

**[[:SOURCE]:SAFety:STEP<n>:IR[:LEVel]?**

Queries the voltage required for the insulation resistance test of the selected STEP.

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

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

**[[:SOURCE]:SAFety:STEP<n>:IR:LIMit:HIGH < numeric value >**

Sets the high limit of the insulation resistance of the selected STEP in Ohms.

Range: 100000-50000000000

Example: Input the command SAF:STEP3:IR:LIM:HIGH 50000000000.

Description: Sets the high limit of the insulation resistance for STEP 3 to 50GΩ.

**[[:SOURCE]:SAFety:STEP<n>:IR:LIMit:HIGH?**

Queries the high limit of the insulation resistance of the selected STEP.

Example: Input the command SAF:STEP3:IR:LIM:HIGH?

The tester returns 5.000000E+10

Description: The returned string "5.000000E+10" means the high limit of the insulation resistance for STEP 3 is set to 50GΩ.

**[[:SOURCE]:SAFety:STEP<n>:IR:LIMit[:LOW] < numeric value >**

Sets the low limit of the insulation resistance of the selected STEP in Ohms.

Range: 100000-50000000000 (low limit of insulation resistance ≤ high limit.)

Example: Input the command SAFE:STEP3:IR:LIM 100000.

Description: Sets the low limit of the insulation resistance for STEP 3 to 0.1MΩ.



**[[:SOURce]:SAFety:STEP<n>:IR:LIMit[:LOW]?]**

Queries the low limit of the insulation resistance of the selected STEP.

Example:            Input the command SAFE:STEP3:IR:LIM?  
                      The tester returns 1.000000E+05.

Description:        The returned string "1.000000E+05" means the low limit of the insulation resistance for STEP 3 is set to 0.1MΩ.

**[[:SOURce]:SAFety:STEP<n>:IR:RANGe:UPPer < numeric value >]**

Selects the upper current range for measurement based on the input current in Amperes (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:        The current for the IR measurement in STEP 3 is 300uA, so the upper current range selected for the IR measurement is 3mA.

**[[:SOURce]:SAFety:STEP<n>:IR:RANGe:UPPer?]**

Queries the upper current range setting.

Example:            Input the command SAF:STEP3:IR:RANG?  
                      The tester returns 3.000000E-03.

Description:        The returned string "3.000000E-03" means the range setting for STEP 3 is 3mA.

**[[:SOURce]:SAFety:STEP<n>:IR:RANGe[:LOWer] < numeric value >]**

Selects the lower current range for measurement based on the input current in Amperes (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:        The current for the IR measurement in STEP 3 is 300uA, so the lower current range selected for the IR measurement is 300uA.

**[[:SOURce]:SAFety:STEP<n>:IR:RANGe[:LOWer]?]**

Queries the lower range setting.

Example:            Input the command SAF:STEP3:IR:RANG:LOW?  
                      The tester returns 3.000000E-04.

Description:        The returned string "3.000000E-04" means the range setting of STEP 3 is set to 300uA.

**[[:SOURce]:SAFety:STEP<n>:IR:RANGe: AUTO < boolean > | ON | OFF]**

Turns the IR range AUTO switching ON or OFF. Parameter ON or 1 means use AUTO ranging while OFF or 0 means AUTO ranging is disabled.

**Note**    : If AUTO is not set, turning the parameter OFF will retain the original range setting. If AUTO is set, turning the parameter OFF will set the range to 5mA.

Example:            Input the command SAF:STEP3:IR:RANG:AUTO ON.

Description:        The current range setting for the STEP 3 IR measurement is AUTO.

**[[:SOURce]:SAFety:STEP<n>:IR:RANGe:AUTO?]**

Queries if the IR range setting is set 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 string "1" means the range is set to AUTO for STEP 3.

**[[:SOURce]:SAFety:STEP<n>:IR:TIME:DWELI < numeric value >**

Sets the dwell time of the selected STEP in Seconds (s).

Range: 0 or 0.1-999.9, 0 is OFF.

Example: Input the command SAF:STEP2:IR:TIME:DWEL 2.5.

Description: Sets the DWELL time for STEP 2 to 2.5 sec.

**[[:SOURce]:SAFety:STEP<n>:IR:TIME:DWELI?**

Queries the dwell time of the selected STEP.

Example: Input the command SAFE:STEP2:IR:TIME:DWEL?

The tester returns 2.500000E+00.

Description: The returned string "2.500000E+00" means the DWELL time for STEP 2 is 2.5 sec.

**[[:SOURce]:SAFety:STEP<n>:IR:TIME:FALL < numeric value >**

Sets the time required for the voltage to fall to 0 of the selected STEP in Seconds (s).

Range: 0 or 0.1-999.9, 0 is OFF.

Example: Input the command SAF:STEP3:IR:TIME:FALL 3.

Description: Sets the time required for the voltage to fall to 0 for STEP 3 to 3.0sec.

**[[:SOURce]:SAFety:STEP<n>:IR:TIME:FALL?**

Queries the time required for the voltage to fall to 0 of the selected STEP in Seconds (s).

Example: Input the command SAF:STEP3:IR:TIME:FALL?

The tester returns 3.000000E+00.

Description: The returned string "3.000000E+00" means the time required for the voltage to fall to 0 is set to 3.0sec.

**[[:SOURce]:SAFety:STEP<n>:IR:TIME:RAMP < numeric value >**

Sets the time to ramp up to the set voltage of the selected STEP in Seconds (s).

Range: 0 or 0.1-999.9 (0 is OFF).

Example: Input the command SAF:STEP3:IR:TIME:RAMP 0.5.

Description: Sets the time required for STEP 3 to ramp up to the set voltage to 0.5sec.

**[[:SOURce]:SAFety:STEP<n>:IR:TIME:RAMP?**

Queries the time to ramp up to the set voltage of the selected STEP.

Example: Input the command SAF:STEP3:IR:TIME:RAMP?

The tester returns 5.000000E-01.

Description: The returned string "5.000000E-01" means the time required for STEP 3 to ramp up to the set voltage is 0.5sec.

**[[:SOURce]:SAFety:STEP<n>:IR:TIME[:TEST] < numeric value >**

Sets the test time of the selected STEP in Seconds (s).

Range: 0 or 0.3-999.9, 0 is CONTINUE.

Example: Input the command SAFE:STEP3:IR:TIME 1.

Description: Sets the test time for STEP 3 to 1.0sec.

**[[:SOURCE]:SAFety:STEP<n>:IR:TIME[:TEST]?]**

Queries the test time of the selected STEP.

Example: Input the command SAFE:STEP3:IR:TIME?  
The tester returns 1.000000E+00.

Description: The returned string "1.000000E+00" means the test time for STEP 3 is set to 1sec.

**[[:SOURCE]:SAFety:STEP<n>:OSC:CHANnel[:CLOSe] <channel\_list>**

Sets the high voltage output channel status of the selected STEP.

Example: Input the command SAF:STEP4:OSC:CHAN (@001,002,201:210)

Description: The high voltage output channels CH1 and CH2 of Address 0 in STEP 4 are enabled as well as the high voltage output channels CH1-CH10 of Address 2.

**[[:SOURCE]:SAFety:STEP<n>:OSC:CHANnel[:CLOSe]?]**

Queries the high voltage output channel status of the selected STEP.

Example: Input the command SAF:STEP4:OSC:CHAN?

The tester returns (@001,002,201:210).

Description: The high voltage output channels CH1 and CH2 of Address 0 in STEP 4 are enabled as well as the high voltage output channels CH1-CH10 of Address 2.

**[[:SOURCE]:SAFety:STEP<n>:OSC:CHANnel:DEFault:ON]**

Sets the high voltage output channel using the options in DEF. CHANNELS under TEST CONTROL of the selected STEP.

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

Description: Sets the high voltage output channel using the options in DEF. CHANNELS under TEST CONTROL for STEP 4.

**[[:SOURCE]:SAFety:STEP<n>:OSC:CHANnel:DEFault:STATe?]**

Queries if the high voltage output channel uses the options in DEF. CHANNELS under TEST CONTROL of the selected STEP.

Example: Input the command SAF:STEP4:OSC:CHAN:DEF:STAT?

The tester returns 1.

Description: The returned string "1" 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:PSC P | S | PS, S | C | SC]**

Sets the scan channel status of the selected STEP.

Example: Input the command SAF:STEP1:OSC:CHAN:PSC P,S

Description: Sets the scan channel of STEP 1 to P→S.

**[[:SOURCE]:SAFety:STEP<n>:OSC:CHANnel:PSC?]**

Queries the scan channel status of the selected STEP.

Example: Input the command SAF:STEP1:OSC:CHAN:PSC?

The tester returns P,S.

Description: The scan channel of STEP 1 is set to P→S.

**[[:SOURce]:SAFety:STEP<n>:OSC:CORREction[:CAPacitance]:SAMPlE <range>, <numeric value>**

Sets the measurement range and standard capacitance of the selected STEP. This command requires two parameters. The first parameter selects the measurement range from 1-3, where 1 is the smallest capacitance range. The second parameter sets the standard capacitance in farads. The valid standard capacitance range is 0.001E-09 - 500E-09.

Example:            Input the command SAF:STEP4:OSC:CORR:SAMP 2,5e-9.  
Description:        OSC uses the 2<sup>nd</sup> range for host STEP 4 and the standard capacitance is 5nF.

**[[:SOURce]:SAFety:STEP<n>:OSC:CORREction[:CAPacitance]:SAMPlE?**

Queries the measurement range and standard capacitance for the selected STEP. It will return two values separated by a comma (.). The first parameter is the measurement range while the second parameter is the standard capacitance in farads.

Example:            Input the command SAF:STEP4:OSC:CORR:SAMP?  
                      The tester returns 2,3.000000E-09.  
Description:        The returned string "2,3.000000E-09" means host STEP 4 uses the 2<sup>nd</sup> range for OSC and the standard capacitance is 3nF.

**[[:SOURce]:SAFety:STEP<n>:OSC:LIMit[:OPEN] <numeric value>**

Sets the percentage of the open check when doing the OSC of the selected STEP in Percent (%).

Range:             0.1-1.0  
Example:            Input the command SAF:STEP4:OSC:LIM 0.3.  
Description:        Sets the percentage of the open check when doing the OSC for STEP 4 to 30%.

**[[:SOURce]:SAFety:STEP<n>:OSC:LIMit[:OPEN]?**

Queries the percentage of open check when doing the OSC of the selected STEP.

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

**[[:SOURce]:SAFety:STEP<n>:OSC:LIMit: SHORt <numeric value>**

Sets the percentage of the short check when doing the OSC of the selected STEP in Percent (%).

Range:             0 or 1-5, 0 is OFF.  
Example:            Input the command SAF:STEP4:OSC:LIM:SHOR 3.  
Description:        Sets the percentage of the short check when doing the OSC in STEP 4 to 300%.

**[[:SOURce]:SAFety:STEP<n>:OSC:LIMit: SHORt?**

Queries the percentage of the short check when doing the OSC of the selected STEP.

Example:            Input the command SAF:STEP4:OSC:LIM:SHOR?  
                      The tester returns 3.000000E+00.

Description: The returned string "3.000000E+00" means the percentage of the short check when doing the OSC in STEP 4 is set to 300%.

**[[:SOURce]:SAFety:STEP<n>:PAuse[:MESSAge] <string data >**

Sets the message prompt string for the PAUSE mode.

Example: Input the command SAF:STEP5:PA "WAIT".  
 Description: Sets the message string of STEP 5 to "WAIT".

**[[:SOURce]:SAFety:STEP<n>:PAuse[:MESSAge]?**

Queries the message prompt string set of the selected step.

Example: Input the command SAF:STEP5:PA.  
 The tester returns "WAIT".  
 Description: The message string of STEP 5 is "WAIT".

**[[:SOURce]:SAFety:STEP<n>:PAuse:TIME[:TEST] <numeric value>**

Sets the pause time for the PA mode of the selected STEP.

Example: Input the command SAF:STEP5:PA:TIME 5.  
 Description: Sets the pause time for the PA mode of STEP 5 to 5.0sec.

**[[:SOURce]:SAFety:STEP<n>:PAuse:TIME[:TEST]?**

Queries the pause time for the PA mode of the selected STEP.

Example: Input the command SAF:STEP5:PA:TIME ?  
 The tester returns 5.000000E+00.  
 Description: The returned string "5.000000E+00" means the pause time for the PA mode for STEP 5 is set to 5.0sec.

**[[:SOURce]:SAFety:STEP<n>:MODE?**

Queries the MODE of the selected STEP and returns the string data: AC, DC, IR, OSC or PA.

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

**[[:SOURce]:SAFety:STEP<n>:SET?**

Queries all of the settings of the 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: The STEP1 settings in the working memory are "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**

Stops the test.

Example: Input the command SAF:STOP  
 Description: Stop the test.

**:SYSTem:ERRor[:NEXT]?**

Reads the message in the 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:       0,"No error" means there is no message in the error queue.

**:SYSTem:KLOCK < boolean > | ON | OFF** **(RS232 only)**

Enables or disables the key lock function. The function is the same as the GPIB LLO command. However, it does not affect the Remote/Local state of the GPIB.

Example:           Input the command SYST:KLOC ON.

Description:       The key lock function is enabled.

**:SYSTem:KLOCK?**

Queries if the panel has been locked.

Example:           Input the command SYST:KLOC?  
                  The tester returns 1.

Description:       The returned string "1" means the panel is locked.

**:SYSTem:LINK:ADDRess?**

Queries the address set for the system connection.

Example:           Input the command SYST:LINK:ADDR?  
                  The tester returns 1.

Description:       The returned string "1" means the address of the system connection is set to 1.

**:SYSTem:LINK:MASTer?**

Queries if the system connection is set to Master.

Example:           Input the command SYSTem:LINK:MAST?  
                  The tester returns 1.

Description:       The returned string "1" means the system connection is set to Master.

**:SYSTem:LOCK:OWNer?**

Queries if the system is in the LOCAL or REMOTE state.

Example:           Input the command SYSTem:LOCK:OWN?  
                  The tester returns LOCAL.

Description:       LOCAL means the system is in the local panel control state.

**:SYSTem: LOCK:RELease**

Switches back to the local panel control state.

Example:           Input the command SYSTem:LOCK:REL.

Description:       Switches the system to the local panel control state.

**:SYSTem:LOCK:REQuest?**

Queries if the system is in the remote control state.

Example:           Input the command SYSTem:LOCK:REQ?  
                  The tester returns 1.

Description:       The returned string "1" means the system is being remotely controlled.

**:SYSTem:TCONtrol:AGC[:SOFTware] <boolean> | ON | OFF**  
 Enables or disables the software AGC function.

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

**:SYSTem:TCONtrol:AGC[:SOFTware]?**  
 Queries if the software AGC function is enabled.

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

**:SYSTem:TCONtrol:CHANnel[:DEFault][:CLOSe] <channel\_list>**  
 Sets the default for the high voltage channel to CLOSe.

Example:            Input the command SYST:TCON:CHAN (@001:003).  
 Description:        Sets the default for the high voltage channel to CLOSe for CH1-CH3  
                       of Address 0.

**:SYSTem:TCONtrol:CHANnel[:DEFault][:CLOSe]?**  
 Queries the default setting of the high voltage channel.

Example:            Input the command SYST:TCON:CHAN?  
                       The tester returns (@001:003).  
 Description:        The default for the high voltage channel is set to CLOSe for CH1-CH3  
                       of Address 0.

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

Example:            Input the command SYST:TCON:DISC:VMIN ON  
 Description:        Turns on the total discharge function.

**:SYSTem:TCONtrol:DISCharge:VMINimum?**  
 Queries if the total discharge function is turned ON.

Example:            Input the command SYST:TCON:DISC:VMIN?  
                       The tester returns 1.  
 Description:        The total discharge function is turned ON.

**:SYSTem:TCONtrol:EOT TIMer | TEST**  
 Sets the EOT signal to mean either "End of Test" or "End of Timer".

Example:            Input the command **SYST:TCON:EOT TIM**  
 Description:        Sets the EOT signal to mean "End of Timer".

**:SYSTem:TCONtrol:EOT?**  
 Queries the EOT setting.

Example:            Input the command **SYST:TCON:EOT?**  
                       The tester returns TIMer.  
 Description:        TIMer means EOT is set to "End of Timer".

**:SYSTem:TCONtrol:FAIL:OPERation            STOP | CONTinue**  
 Sets the tester response if a test FAILs.

Example: Input the command SYST:TCON:FAIL:OPER CONT.  
Description: The test will continue to the next step if a test FAILs.

**:SYSTem:TCONtrol:FAIL:OPERation?**

Queries the setting of the FAIL:OPER function.

Example: Input the command SYST:TCON:FAIL:OPER?  
The tester returns CONTInue.  
Description: CONTInue means to go to the next test step.

**:SYSTem:TCONtrol:RJUDgment < boolean > | ON | OFF**

Sets the RAMP JUDGMENT to ON or OFF.

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

**:SYSTem:TCONtrol:RJUDgment?**

Queries the RAMP JUDGMENT setting.

Example: Input the command SYST:TCON:RJUD?  
The tester returns 1.  
Description: The returned string "1" means the RAMP JUDGMENT is set to ON.

**:SYSTem:TCONtrol:SCReen < boolean > | ON | OFF**

Sets the SCREEN to ON or OFF.

Example: Input the command SYST:TCON:SCR ON.  
Description: The SCREEN is set to ON.

**:SYSTem:TCONtrol:SCReen?**

Queries if the SCREEN is ON or OFF.

Example: Input the command SYST:TCON:SCR?  
The tester returns 1.  
Description: The returned string "1" means the SCREEN is set to ON.

**:SYSTem:TCONtrol:TIME:PASS[:HOLD] < number value >**

Sets the PASS HOLD time in Seconds (s).

Range: 0.2-99.9  
Example: Input the command SYST:TCON:TIME:PASS 0.5.  
Description: The PASS HOLD time is set to 0.5sec.

**:SYSTem:TCONtrol:TIME:PASS[:HOLD]?**

Queries the PASS HOLD time.

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

**:SYSTem:TCONtrol:VPERcent[:MINimum] < number value >**

Sets the ratio of MIN. VOLTAGE in Percent (%).



Range: 0.0.5-0.95, 0 is OFF.  
 Example: Input the command SYST:TCON:VPER 0.6.  
 Description: The MIN. VOLTAGE ratio is set to 60%.

**:SYSTem:TCONtrol:VPERcent[:MINimum]?**

Queries the MIN. VOLTAGE ratio setting.

Example: Input the command SYST:TCON:VPER?  
 The tester returns 6.000000E-01.  
 Description: The returned string "6.000000E-01" means the MIN. VOLTAGE ratio is set to 60%.

**:SYSTem:TCONtrol:WRANge[:AUTO] < boolean > | ON | OFF**

Enables or disables the WV mode auto range function.

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

**SYSTem:TCONtrol:WRANge[:AUTO]?**

Queries if the WV mode auto range is enabled.

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

**:SYSTem:TCONtrol:WVAC:FREQuency < number value >**

Sets the ACV FREQUENCY in Hertz (Hz).

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

**:SYSTem:TCONtrol:WVAC:FREQuency?**

Queries the ACV FREQUENCY setting.

Example: Input the command SYST:TCON:WVAC:FREQ?  
 The tester returns 5.000000E+01.  
 Description: The returned string "5.000000E+01" means the ACV FREQUENCY is set to 50Hz

**:SYSTem:TCONtrol:WVAC:OFFSET < number value >**

Sets the AC OFFSET in Amperes (A).

Range: 0.000001-0.002  
 Example: Input the command SYST:TCON:WVAC:OFFS 0.001.  
 Description: The AC OFFSET is set to 1mA.

**:SYSTem:TCONtrol:WVAC:OFFSet?**

Queries the AC OFFSET setting.

Example: Input the command SYST:TCON:WVAC:OFFS?  
 The tester returns 5.000000E-04.  
 Description: The returned string "5.000000E-04" means the AC OFFSET is set to 0.5mA.

**:SYSTem:VERSion?**

Queries the supported SCPI version of this device.

Example:           Input the command SYST:VERS?  
                  The tester returns 1990.0.

Description:       The returned string "1990.0" means the SCPI version supported by  
                  this device is 1990.0.

## 6.6 Error Messages

- The error messages stored in the error queue will be returned in a First In, First Out (FIFO) sequence, which means the first error message returned is the first one saved.
- When the number of error messages exceeds 30, the last one stored in the error queue will be set to “ -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 the error queue.

-101	Invalid character There is an invalid character in the command string.
-102	Syntax error The syntax error is generated when an invalid character is used in a command.
-103	Invalid separator There is an invalid separator in the command string.
-104	Data type error The parameter format is incorrect.
-108	Parameter not allowed The device received an invalid parameter.
-109	Missing parameter A 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 received an undefined command header.
-114	Header suffix out of range The command header suffix variable is out of range.
-120	Numeric data error A numeric parameter is incorrect.
-141	Invalid character data The device received invalid character data.
-151	Invalid string data The device received invalid string data, usually a missing double quote.
-158	String data not allowed The device received an invalid string parameter.
-168	Block data not allowed The device received an invalid block parameter.
-171	Invalid expression error The device received an invalid math expression parameter
-178	Expression data not allowed The device received invalid math expression data.
-200	Execution error An error occurred during command execution.
-203	Command protected The device received a protected command.
-221	Settings conflict A command is in conflict with the device and cannot be executed.
-222	Data out of range The parameter value exceeds the data range.
-241	Hardware missing

- 292      The hardware does not exist.  
Referenced name does not exist  
The name specified does not exist.
- 293      Referenced name already exist  
The specified name already exists.
- 350      Queue overflow  
The error message queue is full.
- 363      Input buffer overrun  
The input buffer received more characters than it can hold.
- 410      Query INTERRUPTED  
The query is interrupted due to another query being received before the result of the  
previous query has been read.
- 420      Query UNTERMINATED  
A command is received to read the output queue data when no data is available.

## 7. Calibration Procedure

**Attention!** Before performing the calibration procedures described in this chapter, warm the unit 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

#### 19021/19021-4

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

**19021/19021-4**

ACA 0.03mA OFFSET ( 0.002mA )	; AC current 0.03mA range OFFSET point
ACA 0.03mA FULL ( 0.02mA )	; AC current 0.03mA range FULL point
ACA 0.3mA OFFSET ( 0.02mA )	; AC current 0.3mA range OFFSET point
ACA 0.3mA FULL ( 0.2mA )	; AC current 0.3mA range FULL point
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 200M $\Omega$ OFFSET (4M $\Omega$ )	; IR Resistor 200M $\Omega$ OFFSET point
IRR 200M $\Omega$ FULL (20M $\Omega$ )	; IR Resistor 200M $\Omega$ FULL point
IRR 2G $\Omega$ OFFSET (40M $\Omega$ )	; IR Resistor 2G $\Omega$ OFFSET point
IRR 2G $\Omega$ FULL (200M $\Omega$ )	; IR Resistor 2G $\Omega$ FULL point
IRR 20G $\Omega$ OFFSET (400M $\Omega$ )	; IR Resistor 20G $\Omega$ OFFSET point
IRR 20G $\Omega$ FULL (2G $\Omega$ )	; IR Resistor 20G $\Omega$ FULL point
IRR 200G $\Omega$ OFFSET (4G $\Omega$ )	; IR Resistor 200G $\Omega$ OFFSET point
IRR 200G $\Omega$ FULL (20G $\Omega$ )	; IR Resistor 200G $\Omega$ FULL point
IRR 550G $\Omega$ OFFSET (40G $\Omega$ )	; IR Resistor 550G $\Omega$ OFFSET point
IRR 550G $\Omega$ FULL (200G $\Omega$ )	; IR Resistor 550G $\Omega$ FULL point

**Note** ■ 19021/19021-4 has no IRR related calibration.

**ARC Calibration (see Section 7.7)**

**19020/19020-4**

AC ARC 15mA (5mA)	; AC ARCing Calibration
DC ARC 5mA (3mA)	; DC ARCing Calibration

**19021/19021-4**

AC ARC 15mA (5mA)	; AC ARCing Calibration
-------------------	-------------------------

**19022/19022-4**

DC ARC 5mA (3mA)	; DC ARCing Calibration
------------------	-------------------------







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

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

CALIBRATION				
ACV 5kV AGC FULL (4kV)			NEXT CH	
			PREV CH	
CHANNEL: 1				
OUTPUT	READING			
4.000kV	3.991kV			
STANDARD				
3.977kV				
DEF=4kV	REMOTE	LOCK	CORR	ERROR

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

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

CALIBRATION				
ACV 5kV 50Hz OFFSET (0.1kV)			NEXT CH	
			PREV CH	
CHANNEL: 1				
OUTPUT	READING			
0.100kV	0.100kV			
STANDARD				
0.101kV				
DEF=0.1kV	REMOTE	LOCK	CORR	ERROR

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

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

CALIBRATION	
ACV 5kV 50Hz FULL (4kV)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
4.000kV	3.990kV
STANDARD	
3.985kV	
DEF=4kV	REMOTE LOCK CORR ERROR

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

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

CALIBRATION	
ACV 5kV 60Hz OFFSET (0.1kV)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
0.100kV	0.103kV
STANDARD	
0.104kV	
DEF=0.1kV	REMOTE LOCK CORR ERROR

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

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

CALIBRATION				
ACV 5kV 60Hz FULL (4kV)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
4.000kV	4.012kV			
STANDARD				
3.998kV				
DEF=4kV	REMOTE	LOCK	CORR	ERROR

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

## 7.4.2 DCV Calibration

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

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

CALIBRATION				
DCV 6kV AGC OFFSET (0.1kV)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
0.100kV	0.102kV			
STANDARD				
0.101kV				
DEF=0.1kV	REMOTE	LOCK	CORR	ERROR

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

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

CALIBRATION				
DCV 6kV AGC FULL (4kV)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
4.000kV	3.991kV			
STANDARD				
3.991kV				
DEF=4kV	REMOTE	LOCK	CORR	ERROR

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

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

CALIBRATION				
DCV 6kV OFFSET (0.1kV)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
0.100kV	0.095kV			
STANDARD				
0.093kV				
DEF=0.1kV	REMOTE	LOCK	CORR	ERROR

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

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

CALIBRATION				
DCV 6kV FULL (4kV)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
4.000kV	3.982kV			
STANDARD				
3.991kV				
DEF=4kV	REMOTE	LOCK	CORR	ERROR

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

### 7.4.3 OSCV Calibration

**OSC 100V OFFSET(50V) Calibration Screen:**

CALIBRATION				
OSC 100V OFFSET (50V)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
50V	55V			
STANDARD				
62V				
DEF=50V	REMOTE	LOCK	CORR	ERROR


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

### OSC 100V FULL (100V) Calibration Screen:

CALIBRATION	
OSC 100V FULL (100V)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT 100V	READING 104V
STANDARD 110V	
DEF=100V	REMOTE
	LOCK
	CORR
	ERROR

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

## 7.5 Current Calibration

 **CAUTION** : The virtual load must be connected between the high potential terminal and the ammeter input terminal to prevent a safety hazard.

### 7.5.1 ACA Current Calibration

(30uA and 300uA are for 19021, 19021-4 only)

- Connect a 4.42pF capacitance load (60Hz equivalent impedance is 600MΩ) with a 20kΩ shunt resistance between the HV OUTPUT and the low potential terminal (RTN/LOW) of the channel to be calibrated. Connect the handheld meter to the Shunt resistor to measure the AC voltage.

**ACA 30uA OFFSET(2uA) Calibration Screen:**

CALIBRATION	
ACA 30uA OFFSET (2uA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
0.100kV	1.78uA
STANDARD	
2.00uA	
LOAD=600MΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage and read the data from the AC meter.
  2. Press the **0** **.** **9** numeric keys to input the reading from the AC meter.
  3. Press **ENTER** to confirm the input.
  4. Press **STOP** to stop the high voltage output.
  5. Press **▼** to go to the ACA 30uA FULL (20uA) calibration.
- **Change the simulated load capacitance to 44.21pF, equivalent impedance 60MΩ, 5watt or higher power.**

**ACA 30uA FULL(20uA) Calibration Screen:**

CALIBRATION	
ACA 30uA	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
0.100kV	19.97uA
STANDARD	
20.00uA	
	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage and read the data from the AC meter.
2. Press the **0** **.** **9** numeric keys to input the reading from the AC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop the high voltage output.
5. Press **▼** to go to the ACA 300uA OFFSET (20uA) calibration.

- Change the simulated load resistance to 60MΩ, 10watt or higher power.

**ACA 300uA OFFSET(20uA) Calibration Screen:**

CALIBRATION			
	ACA 300uA	NEXT CH	
		PREV CH	
CHANNEL: 1			
OUTPUT	READING		
1.200kV	19.7uA		
STANDARD			
20.0uA			
	REMOTE	LOCK	CORR ERROR

- Press **START** to output voltage and read the data from the AC meter.
- Press the **0** **.** **9** numeric keys to input the reading from the AC meter.
- Press **ENTER** to confirm the input.
- Press **STOP** to stop the high voltage output.
- Press **▼** to go to the ACA 300uA FULL (200uA) calibration.

- Change the simulated load resistance to 6MΩ, 10watt or higher power.

**ACA 300uA FULL(200uA) Calibration Screen:**

CALIBRATION			
	ACA 300uA	NEXT CH	
		PREV CH	
CHANNEL: 1			
OUTPUT	READING		
1.200kV	199.6uA		
STANDARD			
200.0uA			
	REMOTE	LOCK	CORR ERROR

- Press **START** to output voltage and read the data from the AC meter.
- Press the **0** **.** **9** numeric keys to input the reading from the AC meter.
- Press **ENTER** to confirm the input.
- Press **STOP** to stop the high voltage output.
- Press **▼** to go to the ACA 3mA OFFSET(0.12mA) calibration.



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

**ACA 3mA OFFSET(0.12mA) Calibration Screen:**

CALIBRATION	
ACA 3mA OFFSET (0.12mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.200kV	0.118mA
STANDARD	
0.119mA	
LOAD=10MΩ	REMOTE LOCK CORR ERROR

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

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

**ACA 3mA FULL(2.4mA) Calibration Screen:**

CALIBRATION	
ACA 3mA FULL (2.4mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.200kV	2.376mA
STANDARD	
2.402mA	
LOAD=500kΩ	REMOTE LOCK CORR ERROR

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

### ACA 10mA OFFSET(2.4mA) Calibration Screen:

CALIBRATION	
ACA 10mA OFFSET (2.4mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.200kV	2.36mA
STANDARD	
2.40mA	
LOAD=500kΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage and read the data from the AC meter.
2. Press the **0** **.** **9** numeric keys to input the reading from the AC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop the high voltage output.
5. Press **▼** to go to the 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:

CALIBRATION	
ACA 10mA FULL (4.8mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.200kV	4.83mA
STANDARD	
4.92mA	
LOAD=250kΩ	REMOTE LOCK CORR ERROR

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

## 7.5.2 DCA Current Calibration

- Connect a 10M $\Omega$  0.5 Watt or high power simulated load resistance between the high voltage output terminal (HV OUTPUT) of the channel to be calibrated on this tester and the high potential terminal of the AC meter. Connect the low potential terminal (RTN/LOW) of the channel to be calibrated on this tester to the low potential terminal of the AC meter.

DCA 3mA OFFSET(0.12mA) Calibration Screen:

CALIBRATION	
DCA 3mA OFFSET (0.12mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.200kV	0.118mA
STANDARD	
0.120mA	
LOAD=10M $\Omega$	REMOTE LOCK CORR ERROR

- Press **START** to output voltage and read the data from the DC meter.
- Press the **0** **.** **9** numeric keys to input the reading from the DC meter.
- Press **ENTER** to confirm the input.
- Press **STOP** to stop the high voltage output.
- Press **▼** to go to the DCA 3mA FULL (2.4mA) calibration.

- Change the simulated load resistance to 500k $\Omega$  10watt or higher power.

DCA 3mA FULL(2.4mA) Calibration Screen:

CALIBRATION	
DCA 3mA FULL (2.4mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.200kV	2.378mA
STANDARD	
2.401mA	
LOAD=500k $\Omega$	REMOTE LOCK CORR ERROR

- Press **START** to output voltage and read the data from the DC meter.
- Press the **0** **.** **9** numeric keys to input the reading from the DC meter.

3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop the high voltage output.
5. Press **▼** to go to the DCA 5mA OFFSET (2.4mA) calibration.

**DCA 5mA OFFSET(2.4mA) Calibration Screen:**

CALIBRATION				
DCA 5mA OFFSET (2.4mA)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
1.200kV	2.35mA			
STANDARD				
2.40mA				
LOAD=500kΩ	REMOTE	LOCK	CORR	ERROR

1. Press **START** to output voltage and read the data from the DC meter.
2. Press the **0** **.** **9** numeric keys to input the reading from the DC meter.
3. Press **ENTER** to confirm the input.
4. Press **STOP** to stop the high voltage output.
5. Press **▼** to go to the 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:**

CALIBRATION				
DCA 10mA FULL (4.8mA)			NEXT CH	
CHANNEL: 1			PREV CH	
OUTPUT	READING			
1.200kV	4.82mA			
STANDARD				
4.91mA				
LOAD=250kΩ	REMOTE	LOCK	CORR	ERROR

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

## 7.6 Insulation Resistance (IR) Calibration

- Connect a  $4\text{M}\Omega$  standard resistance between the high voltage output terminal (HV OUTPUT) and the low potential terminal (RTN/LOW) of the channel to be calibrated on the tester.

IRR 200MΩ OFFSET (4MΩ) Calibration Screen:

CALIBRATION	
IRR 200MΩ OFFSET (4MΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	4.1MΩ
STANDARD	
4MΩ	
LOAD=4MΩ	REMOTE LOCK CORR ERROR

- Press **START** to output voltage.
- Press the **0**, **.**, **9** numeric keys to input the actual resistance.
- Press **ENTER** to confirm the input.
- Press **STOP** to stop the high voltage output.
- Press **▼** to go to the IRR 200MΩ FULL(20MΩ) calibration.

- Connect a  $20\text{M}\Omega$  standard resistance between the high voltage output terminal (HV OUTPUT) and the low potential terminal (RTN/LOW) of the channel to be calibrated on the tester.

IRR 200MΩ FULL (20MΩ) Calibration Screen:

CALIBRATION	
IRR 200MΩ FULL (20MΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	20.4MΩ
STANDARD	
20MΩ	
LOAD=20MΩ	REMOTE LOCK CORR ERROR

- Press **START** to output voltage.
- Press the **0**, **.**, **9** numeric keys to input the actual resistance.
- Press **ENTER** to confirm the input.

4. Press **STOP** to stop the high voltage output.
  5. Press **▼** to go to the IRR 2GΩ OFFSET (40MΩ) calibration.
- **Connect a 40MΩ standard resistance between the high voltage output terminal (HV OUTPUT) and the low potential terminal (RTN/LOW) of the channel to be calibrated on the tester.**

**IRR 2GΩ OFFSET (40MΩ) Calibration Screen:**

CALIBRATION	
IRR 2GΩ OFFSET (40MΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	40.7MΩ
STANDARD	
40MΩ	
LOAD=40MΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage.
  2. Press the **0** **.** **9** numeric keys to input the actual resistance.
  3. Press **ENTER** to confirm the input.
  4. Press **STOP** to stop the high voltage output.
  5. Press **▼** to go to the IRR 2GΩ FULL (200MΩ) calibration.
- **Connect a 200MΩ standard resistance between the high voltage output terminal (HV OUTPUT) and the low potential terminal (RTN/LOW) of the channel to be calibrated on the tester.**

**IRR 2GΩ FULL (200MΩ) Calibration Screen:**

CALIBRATION	
IRR 2GΩ FULL (200MΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	204MΩ
STANDARD	
200MΩ	
LOAD=200MΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage.
2. Press the **0** **.** **9** numeric keys to input the actual resistance.

3. Press **ENTER** to confirm the input.
  4. Press **STOP** to stop the high voltage output.
  5. Press **▼** to go to the 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:**

CALIBRATION	
IRR 20GΩ OFFSET (400MΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	408MΩ
STANDARD	
400MΩ	
LOAD=400MΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage.
  2. Press the **0** **.-** **9** numeric keys to input the actual resistance.
  3. Press **ENTER** to confirm the input.
  4. Press **STOP** to stop the high voltage output.
  5. Press **▼** to go to the IRR 20GΩ FULL (2GΩ) calibration.
- Connect a **2GΩ** standard resistance between the high voltage output terminal (HV OUTPUT) and the low potential terminal (RTN/LOW) of the channel to be calibrated on the tester.

**IRR 20GΩ FULL (2GΩ) Calibration Screen:**

CALIBRATION	
IRR 20GΩ FULL (2GΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	2.04MΩ
STANDARD	
2.00GΩ	
LOAD=2GΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage.
  2. Press the **0** **.** **9** numeric keys to input the actual resistance.
  3. Press **ENTER** to confirm the input.
  4. Press **STOP** to stop the high voltage output.
  5. Press **▼** to go to the IRR 200GΩ OFFSET (4GΩ) calibration.
- **Connect a 4GΩ standard resistance between the high voltage output terminal (HV OUTPUT) and the low potential terminal (RTN/LOW) of the channel to be calibrated on the tester.**

**IRR 200GΩ OFFSET (4GΩ) Calibration Screen:**

CALIBRATION	
IRR 200GΩ OFFSET (4GΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	4.12GΩ
STANDARD	
4.0GΩ	
LOAD=4GΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage.
  2. Press the **0** **.** **9** numeric keys to input the actual resistance.
  3. Press **ENTER** to confirm the input.
  4. Press **STOP** to stop the high voltage output.
  5. Press **▼** to go to the IRR 200GΩ FULL (20GΩ) calibration.
- **Connect a 20GΩ standard resistance between the high voltage output terminal (HV OUTPUT) and the low potential terminal (RTN/LOW) of the channel to be calibrated on the tester.**

**IRR 200GΩ FULL (20GΩ) Calibration Screen:**

CALIBRATION	
IRR 200GΩ FULL (20GΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	20.5GΩ
STANDARD	
20.0GΩ	
LOAD=20GΩ	REMOTE LOCK CORR ERROR



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

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

**IRR 550GΩ OFFSET (40GΩ) Calibration Screen:**

CALIBRATION	
IRR 550GΩ OFFSET (40GΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	40.5GΩ
STANDARD	
40GΩ	
LOAD=40GΩ	REMOTE LOCK CORR ERROR

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

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

**IRR 550GΩ FULL (200GΩ) Calibration Screen:**

CALIBRATION	
IRR 550GΩ FULL (200GΩ)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.000kV	198GΩ
STANDARD	
200GΩ	
LOAD=200GΩ	REMOTE LOCK CORR ERROR

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

## 7.7 ARC Calibration

### **⚠WARNING**

1. ARC calibration is a dangerous test as the high voltage is exposed outside the terminal. Use extreme caution when performing the test.
2. For more detailed information, contact Chroma or its local distributors.

### 7.7.1 AC ARC Calibration

- **Connect one end of a 250kΩ 10Watt or higher power simulated load resistance to the high voltage output terminal (HV OUTPUT) of the channel to be calibrated on the tester, and move the other end close to the low potential terminal (RTN/LOW) of the channel to be calibrated without making any physical connection in order to create sparks.**

AC ARC 15mA (5mA) Calibration Screen:

CALIBRATION	
AC ARC 15mA (5mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.250kV	4.1mA
STANDARD	
5mA	
LOAD=500kΩ	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage.
2. When the status indicator shows PASS the device has returned the correct ARC value and turned off the high voltage output.
3. Press **▼** to go to the DC ARC 5mA (3mA) calibration.

## 7.7.2 DC ARC Calibration

### DC ARC 5mA (3mA) Calibration Screen:

CALIBRATION	
DC ARC 5mA (3mA)	NEXT CH
	PREV CH
CHANNEL: 1	
OUTPUT	READING
1.500kV	1.9mA
STANDARD	
3.0mA	
LOAD=500k $\Omega$	REMOTE LOCK CORR ERROR

1. Press **START** to output voltage.
2. When the status indicator shows PASS the device has returned the correct ARC value and turned off the high voltage output.

## 7.8 When Calibration is Done

1. Press **SYSTEM** to exit the calibration mode or press **▼** to return to the A/D REFERENCE calibration screen.
2. Press the [NEXT CH],[PREV CH] Function Keys to select another channel for calibration.



## **Chroma's Continuous Quality Process User Manual Customer Feedback**

Chroma welcomes all comments and recommendations to improve this publication in future editions. Please scan the QR code below or click the URL <http://www.chromaate.com/survey?n=793ce6db-17ef-4cd3-b0de-8bbd09aa38e0> to fill in the customer feedback form. Thank you!





CHROMA ATE INC.

致茂電子股份有限公司

66 Huaya 1st Road, Guishan,

Taoyuan 33383, Taiwan

台灣桃園市 33383 龜山區

華亞一路 66 號

T +886-3-327-9999

F +886-3-327-8898

Mail: [info@chromaate.com](mailto:info@chromaate.com)

<http://www.chromaate.com>