Chroma

# Wound Component EST Analyzer

## 19036

## User's Manual

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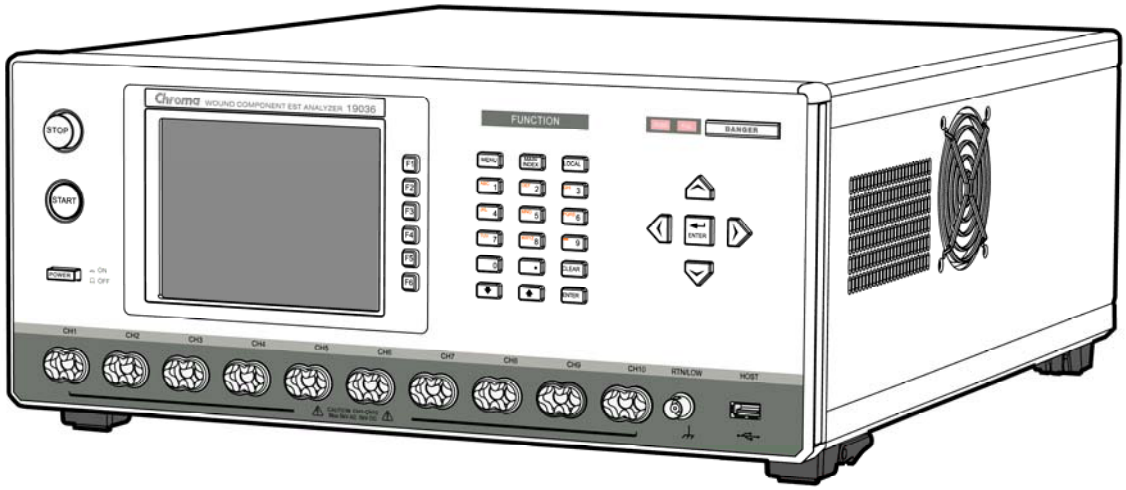


Version 1.2
October 2014

# Legal Notices

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

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

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

# Warranty

All 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.

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# Material Contents Declaration

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


: See **<Table 1>**.

: See **<Table 2>**.

**<Table 1>**

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

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

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

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**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 a new one, the retailer is legally obligated to take back your old appliances for disposal free of charge.

**<Table 2>**

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

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

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

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

**Disposal**

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

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# Declaration of Conformity

For the following equipment :

**Wound Component EST Analyzer, Impulse Winding Tester**

(Product Name/ Trade Name)

**19036, 19305, 19305-10**

(Model Designation)

**CHROMA ATE INC.**

(Manufacturer Name)

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

(Manufacturer Address)

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

**EN 61326-1:2006 Class A**

**EN 61000-3-2:2006+A1:2009+A2:2009, EN 61000-3-3:2008**

**EN 61326-1:2006 (Industrial Locations)**

EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010, EN 61000-4-4:2004,

EN 61000-4-5:2006, EN 61000-4-6:2009, EN 61000-4-8:2010, EN 61000-4-11:2004

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

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

**CHROMA ATE INC.**

(Company Name)

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

(Company Address)

Person responsible for this declaration:

**Mr. Benjamin Huang**

(Name, Surname)

**Division Vice President**

(Position/Title)

| **Taiwan** | **2013.03.29** | Benjamin Huang |
|---|---|---|
| (Place) | (Date) | (Legal Signature) |

# Safety Summary

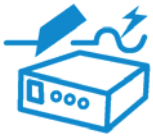
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the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

**BEFORE APPLYING POWER**

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

**PROTECTIVE GROUNDING**

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



**NECESSITY OF PROTECTIVE GROUNDING**

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

**FUSES**

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

**DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE**

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

**DO NOT REMOVE THE COVER OF THE INSTRUMENT**

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

**⚠WARNING**

1. Lethal voltage. The output may up to 6kV voltage.
2. Touching the connected circuit or output terminal on the front panel when power is on may result in death.

# Safety Symbols

| | |
|---|---|
|  | **DANGER –** High voltage. |
|  | **Explanation:** To avoid injury, death of personnel, or damage to the instrument, the operator must refer to the explanation in the instruction manual. |
|  | **High temperature:** This symbol indicates the temperature is hazardous to human beings. Do not touch it to avoid any personal injury. |
|  | **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. |
|  | **Functional grounding:** To identify an earth (ground) terminal in cases where the protective ground is not explicitly stated. This symbol indicates the power connector does not provide grounding. |
|  | **Frame or chassis:** To identify a frame or chassis terminal. |
|  | **Alternating Current (AC)** |
|  | **Direct Current (DC) / Alternating Current (AC)** |
|  | **Direct Current (DC)** |
|  | **Push-on/Push-off power switch** |
|  | 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. |
|  | 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. |
|  | The **Notice** sign highlights an essential operating or maintenance procedure, condition, or statement. |

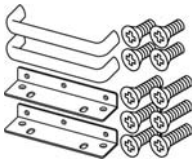
# Unpacking for Check & Inspection

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

## Standard Package


19036 Wound Component EST Analyzer


User's Manual CD



Ears & Handles


High Voltage Hazard Sticker


Warning Card

## Standard Accessories (Cable)

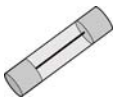
90 Degree Elbow Power Cord US Standard 1.8 meter 1 pc.

Power Adapter 3PIN to 2PIN 1 pc.

Test Wire for HV Terminal 10 pcs. (Bare Wires)

Test Wire for HV Terminal 2 pcs. (with Small Alligator Clip)

BNC Test Cable for RTN/LOW 1 pc.



10.0A Fuse 2 pcs.

Handle Connector 1 pc.

**Note** When additional items are required, contact Chroma and provide item's description.

# Hazard Operations

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

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

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

3. Remote controlling the Tester: The EST Analyzer can be remote controlled generally for high voltage output via external control signal. When performing it, it is necessary to follow the control guidelines below for safety and precautions.

   - Do not allow any accidental high voltage output that may cause hazard.
   - When there is high voltage output from the Tester, do not allow any operator or other personnel to touch the DUT, test cable or probe output and etc.
   - Remote control is generally controlled by the high voltage test bar; however, other control circuits can also be used to control it instead. The test bar is the switch for controlling high voltage output, so the connected control wire should not near the high voltage site and test cable to avoid causing any hazard.

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


**CAUTION** See Chapter 3 “*Precautions before Use*” for the details of using notes and dangerous operation.

# Storage, Freight & Maintenance

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

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

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

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

This product requires regular check and calibration to ensure it meets the specification. The suggested calibration period is 12 months.

**Cleaning**
Be sure to unplug the input power cord from the device before cleaning. Use a brush to clean the dust on the machine surface and use a low pressure air gun to clean the dust inside the device or send it to the agent for cleaning.

# Revision History

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

| Date | Version | Revised Sections |
|---|---|---|
| May 2013 | 1.0 | Complete this manual. |
| Dec. 2013 | 1.1 | Modify the following sections:<br>– "*Standard Accessories (Cable)*" in "*Unpacking for Check & Inspection*"<br>– "*Features*" in the chapter of "*Preface*"<br>– "*Setting SYSTEM CONFIG*" in the chapter of "*Operation*"<br>– "*Commands for Remote Interface*" in the chapter of "*Using Remote Interface*"<br>Delete "*GPIB* Interface(Option)" section in the chapter of "*Using Remote Interface*"<br>Add "*IWT BREAKDOWN VOLT MODE*" section in the chapter of "*Operation*" |
| Oct. 2014 | 1.2 | Modify the following sections:<br>- "*Features*" in the chapter of "*Preface*."<br>- Note in the chapter of "*Specification*."<br>- Setting items in the section of "*Setting the SYSTEM*" under the chapter of "*Operation*."<br>- "*Pin Assignment*" and "*Timing Diagram*" in the chapter of "*HANDLER Interface*."<br>- "*Command Format*" and the SCPI commands in the section of "*Commands for Remote Interface*" under the chapter of "*Using Remote Interface*."<br>- "*DC Resistance Calibration*" in the chapter of "*Calibration Procedure*." |

# Table of Contents

# 1. Preface

## 1.1 Product Overview

The Chroma 19036 Wound Component EST Analyzer is an automatic equipment designed to perform AC/DC hipot test, IR test and impulse winding test to wound components. The maximum AC output is 100mA / 120mA (output voltage ≤ 4kV) and DC output is 20mA. Besides the basic AC/DC hipot and IR tests, a new HFCC (High Frequency Contact Check) function is added in addition to the patented design OSC (Open Short Check) for contact check in production line test to improve the test reliability and efficiency.

For hipot test, the EST Analyzer has AC5kV/DC6kV high voltage output that can meet the hipot testing requirements for wound components. The maximum output current is up to AC 100mA/120mA (output voltage ≤ 4kV)/ DC 20mA, which can be used for withstand voltage test on electronic and electrical devices as well as on the components.

In IR testing, the measurement range is 0.1MΩ ~ 50GΩ with voltage output up to 5kV to test if the insulation resistance of wound components complies with the standard. As to DCR test, besides measuring the basic specification of wound components it can be perform contact check before connecting for safety hipot test.

This EST Analyzer is able to test the wound components. Different STEP is able to call different main waveform data stored for impulse winding test to facilitate multiple series testing that is to recall different golden sample waveform.

Before doing high voltage test, Open or Short Check can be performed on the capacitor to ensure the DUT (Device Under Test) is in well contact for testing.

The HFCC (High Frequency Contact Check) can check if the tiny capacitance DUT is short or open before performing high voltage test to ensure the contact is in good condition for testing.

The display of the EST Analyzer is clear that all setting status including time, current, voltage, resistance and memory number can be seen on the screen without memorizing the status and parameters set previously.

The EST Analyzer is a device that can judge the product from good or no good and output signals for the test result. It has remote control device with RS233 and HANDLER interface to facilitate automatic test. In addition, it has DCR measurement temperature compensation interface available for use. With the above functions the EST Analyzer is able to perform highly efficient and accurate tests on wound components.

## 1.2 Features

- Impulse winding test
- Temperature compensation functions for DCR mode
- HFCC (High Frequency Contact Check) design
- HSCC (High Speed Contact Check) design
- OSC (Open Short Check) patented design

- Standard RS232 and USB interface on rear panel
- Front panel USB for storing programs
- Improved design of DC rapid discharge
- Key lock and data protection function
- Instruction window for 8 types of judgment results
- Breakdown voltage analysis
- Save up to 200 sets of memories in total and each memory set can save 60 test steps.

**Note** IWT & IWT COMPARE can only save 40 test steps.

## 1.3 Initial Inspection

Before shipment, this Model 19036 was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, user should inspect for any damage that may have occurred in transit. Save all packing materials in case the Analyzer has to be returned. If damage is found, please file a claim with the carrier immediately. Do not return the product to Chroma without prior approval.

## 1.4 Common Environment

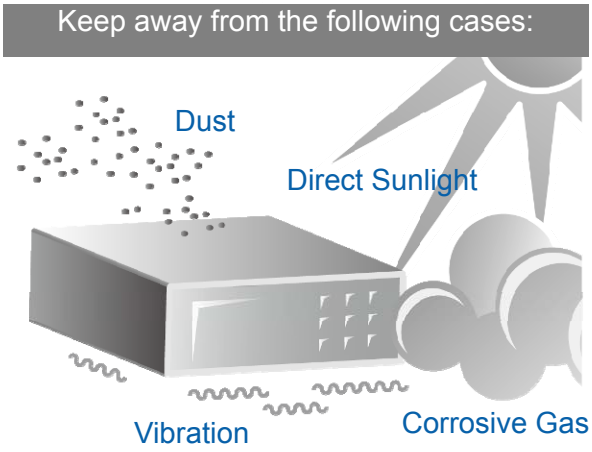
1. Indoor use only.
2. Altitude up to 2000 meters.
3. 2500V maximum transient overvoltage for main power supply.
4. Level II pollution degree.

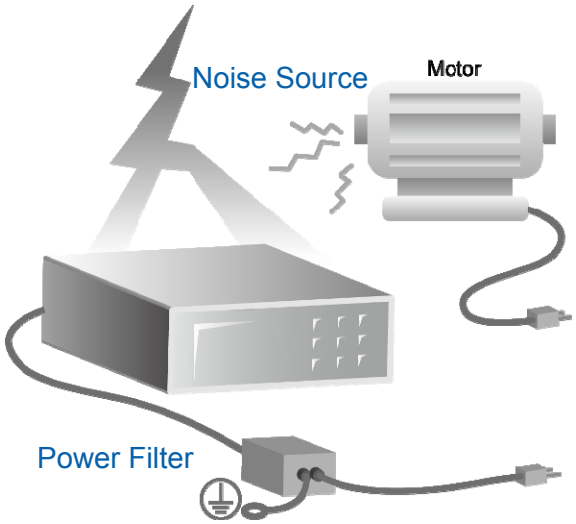
# 1.5 Ambient Environment

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

2. The Model 19036 has been carefully designed to reduce the noise from the AC power source. However, it should be used in a noise-free or as low as possible environment. If noise is inevitable, please install a power filter.

3. The Model 19036 should be stored within the temperature range of -10°C ~ +50°C. If the unit is not going to be used for a long time, please store it in its original box or a similar package and keep it from direct sunlight and humidity.



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

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

| | |
|---|---|
| ❑ Mode | ACV /DCV /IR /DCR /IWT /HSCC/PA |
| ❑ Scanner (all testing mode) | 10 Channel Programming : H/L/X |
| ■ **Withstanding Test (Note3)** | |
| ❑ Output Voltage | AC: 0.050~5.000kV, steps 0.001kV, 50Hz/60Hz ± 0.1%, sine wave<br>DC: 0.050~6.000kV, steps 0.001kV |
| | Voltage Accuracy: ± (1% of setting + 0.1% of full scale) |
| | Load Regulation: ≤ (1% of output + 0.1% of full scale), Rated load |
| ❑ Voltage monitor | ±(1% of reading + 0.1% of full scale), 2V resolution |
| ❑ Cutoff Current | AC:<br>Voltage≦4kV: 0.001mA ~ 120mA<br>Voltage>4kV: 0.001mA ~ 100mA<br>DC: 0.0001mA ~ 20mA |
| ❑ Leakage Current Meter | ACA<br>3.000mA: 0.100mA–2.999mA, 0.001mA resolution<br>30.00mA: 3.00mA–29.99mA, 0.01mA resolution<br>120.0mA: 30.0mA–120mA, 0.1mA resolution<br>DCA<br>300uA: 0.1uA– 299.9uA, 0.1uA resolution<br>3.000mA: 0.300mA–2.999mA, 0.001mA resolution<br>20.00mA: 3.00mA–20.00mA, 0.01mA resolution |
| | Measurement Accuracy:<br>±(1% of reading + 0.5% of full range)<br>AC Real current measurement accuracy:<br>±(1% of reading + 5% total current + 5counts) |
| ❑ Flashover(ARC) Detection (Note 2) | AC: 1mA – 20mA, resolution 0.1mA<br>DC: 1mA – 10mA, resolution 0.1mA |
| ■ **Insulation Resistance Test (Note 1)** | |
| ❑ Output Voltage(DCV) | 0.050 ~ 5.000 kV, steps 0.001kV |
| ❑ Voltage Accuracy (No AGC) | ±(1% of setting + 0.1% of full scale) |
| ❑ Output Voltage monitor | ±(1% of reading + 0.1% of full scale), 2V resolution |
| ❑ Resistance Range | <500V: 0.1MΩ ~ 1.00GΩ<br>≥ 500V: 1.0MΩ ~ 50GΩ |
| ❑ Measuring Accuracy | >1000V:<br>1MΩ ~ 1GΩ: ±(3% of reading + 0.1% of full scale)<br>1GΩ ~ 10GΩ: ±(7% of reading + 2% of full scale)<br>10GΩ ~ 50GΩ: ±(10% of reading + 1% of full scale)<br>≥500V and ≤ 1000V:<br>0.1MΩ ~ 1GΩ: ±(3% of reading + 0.1% of full scale)<br>1GΩ ~ 10GΩ: ±(7% of reading + 2% of full scale)<br>10GΩ ~ 50GΩ: ±(10% of reading + 1% of full scale)<br>< 500V:<br>0.1MΩ ~ 1GΩ: ±(5% of reading+(0.2x500V/Vs)% of full scale) |
| ■ **Test Time** | Test time: 0.3 – 999 sec., and Continue<br>Ramp/Fall time: 0.1 – 999 sec., and OFF<br>DWELL time: 0.1 – 999 sec., and OFF (WDC only) |
| ■ **OSC** | (1) Test voltage level: Less than ac 200V, Test frequency 600Hz<br>(2) No contact judge: Measured capacitance comparison. (Refer to attachment for detail)<br>(3) Add SCPI command for entry Cs value & test range by customer directly |

<table>
<tr><td>■ HFCC (Note 4)</td><td>High Frequency Contact Check<br>(1) No contact judge: Measured capacitance comparison. (Refer to attachment for detail).<br>(2) Cs, Open, Short value setting in PROGRAM.</td></tr>
<tr><td>■ HSCC</td><td>Typical 1kΩ.</td></tr>
<tr><td colspan="2">■ DC Resistance measurement (Four terminals)</td></tr>
<tr><td>❑ Test Signal</td><td>DC<10V, 500mA max (design in spec)</td></tr>
<tr><td>❑ DCR Test Timer</td><td>Test Time: 0.1 ~ 999 Sec., and Continue (≦100kΩ)<br>Test Time: 0.5 ~ 999 Sec., and Continue (＞100kΩ)<br>DWELL Time: 0.1 ~ 999 Sec., and Off</td></tr>
<tr><td rowspan="2">❑ Test Range and accuracy</td><td>NORMAL MODE(TIME≧0.5sec, Hold Range)
<table>
<tr><th>Range</th><th>Test range</th><th>Measurement Accuracy</th></tr>
<tr><td>100mΩ</td><td>10.0mΩ~100.0mΩ</td><td>± (0.5% of reading + 1.0% of range)</td></tr>
<tr><td>1Ω</td><td>0.100Ω~1.000Ω</td><td>± (0.5% of reading + 0.2% of range)</td></tr>
<tr><td>10Ω</td><td>1.00Ω~10.00Ω</td><td>± (0.5% of reading + 0.05% of range)</td></tr>
<tr><td>100Ω</td><td>10.0Ω~100.0Ω</td><td>± (0.5% of reading + 0.05% of range)</td></tr>
<tr><td>1kΩ</td><td>0.100kΩ~1.000kΩ</td><td>± (0.5% of reading + 0.05% of range)</td></tr>
<tr><td>10kΩ</td><td>1.00kΩ~10.00kΩ</td><td>± (0.5% of reading + 0.05% of range)</td></tr>
<tr><td>100kΩ</td><td>10.0kΩ~100.0kΩ</td><td>± (0.5% of reading + 0.05% of range)</td></tr>
</table>
FAST MODE(TIME=0FF,TIME<0.5sec, Hold Range)
<table>
<tr><th>Range</th><th>Test range</th><th>Measurement Accuracy</th></tr>
<tr><td>100mΩ</td><td>10.0mΩ~100.0mΩ</td><td>± (1.5% of reading + 2.4% of range)</td></tr>
<tr><td>1Ω</td><td>0.100Ω~1.000Ω</td><td>± (1.5% of reading + 0.6% of range)</td></tr>
<tr><td>10Ω</td><td>1.00Ω~10.00Ω</td><td>± (1.5% of reading + 0.15% of range)</td></tr>
<tr><td>100Ω</td><td>10.0Ω~100.0Ω</td><td>± (1.5% of reading + 0.15% of range)</td></tr>
<tr><td>1kΩ</td><td>0.100kΩ~1.000kΩ</td><td>± (1.5% of reading + 0.15% of range)</td></tr>
<tr><td>10kΩ</td><td>1.00kΩ~10.00kΩ</td><td>± (1.5% of reading + 0.15% of range)</td></tr>
<tr><td>100kΩ</td><td>10.0kΩ~100.0kΩ</td><td>± (1.5% of reading + 0.15% of range)</td></tr>
</table>
** Measurement accuracy is only correct while Zero correction is well performed.</td></tr>
<tr><td>Display range up to 500kΩ in 100kΩ range, test range 100kΩ~500kΩmeasuring accuracy:<br>NORMAL MODE : ±(0.5% of reading + 0.5kΩ) (minimum test time is 0.5s)<br>Display range 1.0mΩ to 9.9mΩ in 100mΩ range, test range 1.0mΩ~9.9mΩ measuring accuracy:<br>NORMAL MODE : ± (0.5% of reading + 3.0% of range)<br>FAST MODE : ± (1.5% of reading + 5.0% of range)</td></tr>
<tr><td>■ Temp Compensation Port</td><td>(1) PT100 thermal sensor (Optional)<br>(2) Measurement range & accuracy (the PT100 error not included)
<table>
<tr><th>Range</th><th>Measurement Accuracy</th></tr>
<tr><td>-10°C~39.9°C (14°F~103.8°F)</td><td>± (0.3% of reading + 0.5°C)</td></tr>
<tr><td>40.0°C ~100°C (104°F ~211.8°F)</td><td>± (0.3% of reading + 1.0°C)</td></tr>
</table></td></tr>
</table>

| | |
|---|---|
| ■ **Impulse Winding Test** | |
| ❑ Applied Voltage | 0.50kV~6.00kV, steps 0.01kV |
| ❑ Energy | Max 0.21 Joules |
| ❑ Inductance Test Range | More than 10uH |
| ❑ Sampling Range | 11 Range |
| ❑ Pulse Number | Pulse Number: 1~32, Dummy Pulse Number: 0~9 |
| ❑ Detection Mode | Area Size Comparison<br>Differential Area Comparison<br>Flutter Comparison<br>Laplacian Comparison |
| ■ **Ground fault interrupt (WAC only)** | AC: 0.25mA~0.75mA, ON/OFF selectable. |
| ■ **OFFSET compensation** | Open Circuit:<br>Leakage current offset compensation for WAC, WDC. |
| ■ **Indicator and alarm** | PASS: beeps for time as Pass-Hold timer.<br>Fail: Continuously beeps till manually reset. Alarm is for final Fail judge.<br>High/Low Fail (WV, IR, DCR)<br>ARC Fail (WV)<br>GFI Fail (WV, IR)<br>Open/Short Fail (OSC, HFCC)<br>IWT Fail (IWT) |
| ■ **Interlock** | 2 pins connector, pin1 pull-up to digital +V source with 4.7kohm resistor, and pin 2 tied to digital GND. |
| ■ **Handler interface** | 36 pins connector, ALL input/output are negative true logic and optically-isolated open collector signals (General-speed photo-coupler used).<br>* All outputs must be pulled-up with 10kohm resistor to +VEXT (external power supply).<br>* All input optic-diode must be series with current limit (10mA±4mA for +3V ~ +26V) circuit. |
| ■ **Remote interface** | |
| ❑ RS-232 | The programming language is SCPI. |
| ❑ USB (B-type) | Meet USBTMC. |
| ❑ LAN | Supporting 10M/100M Ethernet. |
| ■ **Memory Storage** | 200 instrument setups, Each setup can be programmed up to 40 steps max. |
| ■ **USB flash drive (A-type)** | Test parameters, result and waveform (BMP) storage. (EXP. function).<br>One memory of test procedure and parameter can be storage/recall.<br>Backup/restore all memory data to USB flash.<br>Supporting USB Flash up to 32GB in size. |
| ■ **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 50°C, ≤ 80% RH. |
| ■ **Power Requirement** | |
| ❑ Line Input | 100Vac ~ 240Vac, 50/60 Hz. |
| ❑ Power Consumption | No Load:<150W, Rated Load:<1000W |
| ❑ Dimension | 428 W x 177 H x 500 D mm / 16.85 x 6.97 x 19.69 inches |
| ❑ Weight | < 26 kg / 57.32lbs |

| ■ **Safety** | |
|---|---|
| ❑ Ground Bond | Less than 100mΩ at 25Amp, 2sec. |
| ❑ Hi-Pot L + N to Earth | Less than 15mA at WVAC 1.5kV, 60Hz, 3sec no flashover happen (ARC level<8mA, tested by Chroma 19032). |
| ❑ Hi-Pot L + N to Earth | Hi-Pot L + N to Earth:<br>Less than 0.1mA at WVDC 2.2kV, 60sec no flashover happen, ramp time 2sec (ARC level<5mA, tested by Chroma 19032). |
| ❑ Insulation L + N to Earth | Greater than 20MΩ at 500V dc, 2sec. |
| ❑ Line leakage current | Line leakage current:<br>Less than 3.5mA at 264V Vin max, normal and reverse. |

**Note**

1. IR full scale of measuring range:
   0.1MΩ~49.9MΩ→ full scale=49.9MΩ.
   50MΩ~499MΩ→ full scale=499MΩ.
   0.50GΩ~4.99GΩ→ full scale=4.99GΩ.
   5.0GΩ~49.9GΩ→ full scale=49.9GΩ.
   50GΩ~60GΩ→ full scale=60GΩ.
2. Design in Specifications. Validation point is 2.5kV with a 500kΩ resistor.
3. The minimum testing time arrives at 90% output voltage specification (NO load). Except Real current, minimum test time is 1s.
4. The maximum measured capacitance (Cs + $C_{offset}$) < 100pF
5. Lx mode and Lx Balance mode require Chroma Transformer Tester 3252 (F/W: ver. 7.90 above).

# 3. Precautions before Use

The Model 19036 Wound Component EST Analyzer can output up to 6kV high voltage for external test. Accidents may occur or even cause death if using the instrument incorrectly. It is strongly recommended that the following be read and followed carefully to avoid injury and/or death.

1. **Electric shock**
   To prevent electric shock, it is suggested that all operators wear insulated rubber gloves before using the instrument.

2. **Grounding**
   A safety ground terminal is located at the rear of the rear chassis of the instrument; please ensure proper ground exactly has shown. A dangerous condition can occur if ground is loose or becomes disconnected during testing as the chassis may carry a high potential. Anyone touching the device in this case may experience electric shock. Therefore, it is necessary to connect the safety ground terminal to earth properly and securely as Figure 3-1 shows.

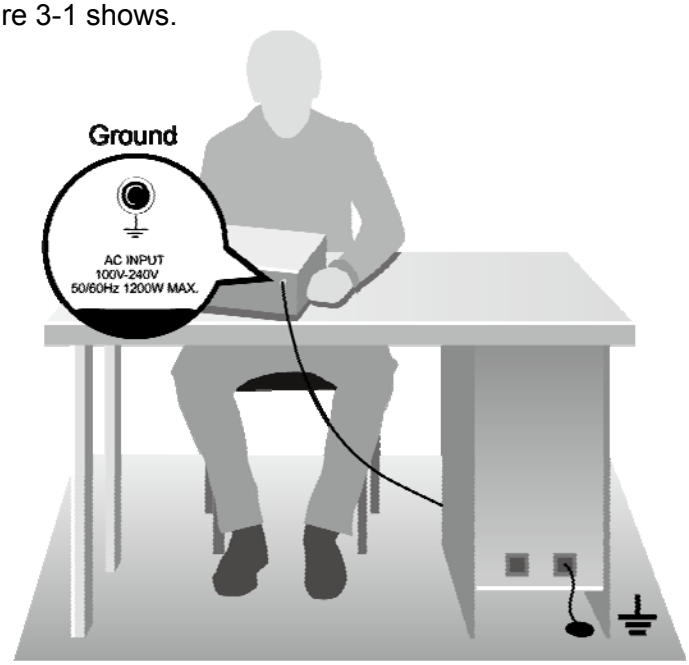



Figure 3-1 Diagram for Safety Grounding

3. **Fragile liquid panel**
   Do not press the front liquid panel heavily or use a sharp object to touch the panel as it may cause the panel to break or display improperly.

**4. Handling precautions**

The gross weight of the Impulse Winding Tester is about 26kg (57.32lbs). It is recommended to be a two-man lift or use a lifting aid to avoid injury during lifting and transportation.

**5. Connecting test cable to HV terminal**

It is necessary to check if the test cable on HV terminal is connected at all times and is not loose. When connecting a test unit with an external test cable, connect the RTN/LOW test cable to the test unit first. It is very dangerous if the test cable on HV or RTN/LOW terminal is not connected correctly or falls off as the entire Device Under Test may contain high voltage.

**6. Connecting test cable to high voltage output terminal**

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

- Press [STOP].
- Make sure the DANGER indicator is not on.
- Short the test cable of RTN/LOW and HV terminal to make sure there is no voltage output.
- Plug in the high voltage test cable to HV terminal.
- At last connect the RTN/LOW test cable to the DUT (Device Under Test) and then connect the HV test cable.

**7. End of test**

When the test has ended or Analyzer is no longer in use or is unattended, it is necessary to toggle the power switch to OFF (i.e. to shut down the power) as Figure 3-2 shows.

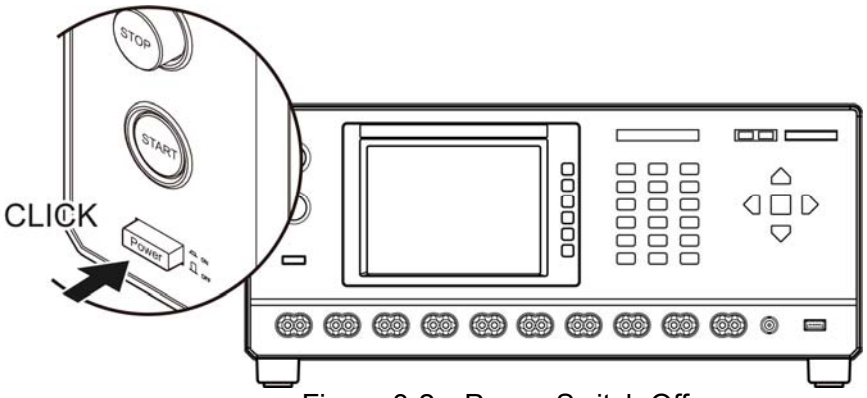



Figure 3-2 Power Switch Off

**8. Do not touch hazard areas when the EST Analyzer is in test mode**

When the EST Analyzer is in use, it is a very dangerous to touch the areas of DUT, test cable, probe and output terminal that contain high voltage.

**CAUTION** Do not touch the alligator clip on the test cable as Figure 3-3 shows. When the host is in testing state the insulation of rubber shield on it is not enough; therefore it is hazardous to touch it.

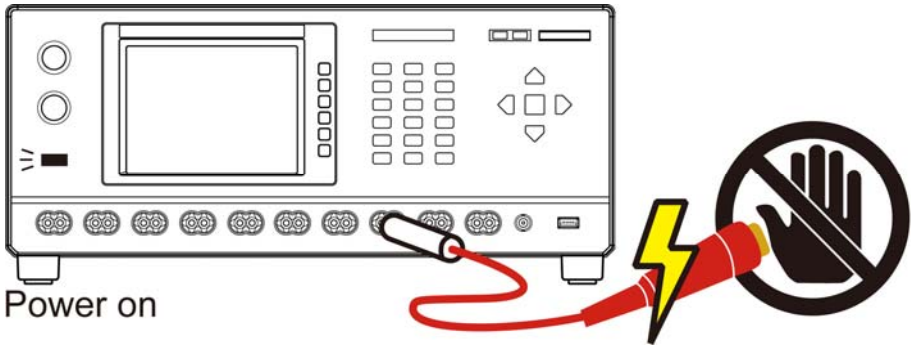



Figure 3-3 No Touch When Outputting High Voltage

**<<< Warning! When output terminal is cutoff >>>**

**9. Ensure the test is done**

Sometimes the user might need to touch the high voltage areas such as DUT, high voltage test cable or output terminal etc. due to configuration or test required change. In that case, please make sure the following:

- **The power switch is turned off.**
- **Being an insulation resistance test object the DUT after test may contain high voltage; therefore it is necessary to read the description of item 10 and 11 for execution.**

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

**10. Charging**

When doing insulation resistance test, the DUT, capacitor, test cable, probe and output terminal, even the EST Analyzer itself may contain high voltage. The charged voltage may need some time to discharge completely after turning off the power switch. It is necessary to follow the instruction described above for actions. Do not touch any area that may cause electric shock especially when the power is just turned off.

**11. Ensure the charged voltage is fully discharged**

The time required for fully discharging the voltage depends on the test voltage applied and the features of DUT. Assuming the high voltage added on the DUT equals the high voltage added to a 0.01uF capacitor and paralleled to a 100MΩ resistance circuit. When the test voltage is 1000V, then it requires approximately 3.5 seconds for the voltage that added to test and on DUT to fall to 30V under after turned off the power. For 500V test voltage, it requires about 2.8 seconds. Assuming the time constant of a DUT is already known, the way described above can be used to calculate the time required for voltage falling to 30V under after powered off by timing the time constant multiple to the time decreased to 30V under as Figure 3-4 shows.

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

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

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

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

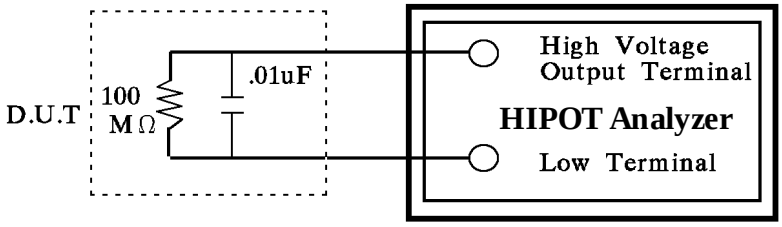



Figure 3-4

**12. Remote controlling the EST Analyzer**

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

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

**<<< CAUTION >>>**

**13. Turning on or off the power switch**

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

**14. Other notices**

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

**<<< Emergency Case >>>**

**15. Process for emergency case**

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

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

**<<< Resolving Problem >>>**

**16. Problems occurred**

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

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

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

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

18. **Be aware of the following when using the EST Analyzer for long hour in normal state**
    If the tested leakage current is maximum power (AC: 500VA (5kV, 100mA), be aware of its temperature change. If the ambient temperature exceeds 40°C, stop using it temporarily until the temperature drops to normal. Be sure to check the room temperature before use.

19. **Applicable AC INPUT for EST Analyzer is 100Vac ~ 240Vac, 50/60 Hz**
    Be sure to replace the fuse when the power cord is unplugged to avoid electric shock. Use a flat screwdriver to pry the fuse holder inside the power socket and remove the fuse to replace with a new one by pushing it in gently, and then push the power socket back to its position.

**⚠WARNING** Be sure to use the fuse with correct specification or it may cause hazard.

20. **This EST Analyzer is normally operated under AC power**
    If the power supply is unstable, it may cause the device to work inaccurately or abnormally. Thus, please use appropriate equipment such as a power supply regulator to convert it to a suitable one.

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

22. **Storage**
    The storage temperature for the EST Analyzer is from -10°C to 50°C, 80% RH. If it is not in use for a long time, please pack it with its original package for storage. For proper test and safety measures, do not place the EST Analyzer under direct sunlight, high temperature, trembling, humid or dusty area.

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

24. **Warning label during test**
    **"DANGER – HIGH VOLTAGE TEST IN PROGRESS, UNAUTHORIZED PERSON KEEP AWAY"**

25. **Keep test cables away from panel**
    When operating the device, be sure to keep the high voltage wire or DUT at least 30 cm away from the panel to avoid high voltage discharge interfering the display.

**26. Precautions for connecting automated device**

- The grounding system of EST Analyzer and automatic device should be connected together.
- Install anti-interference iron power cores winding at least 1 circle for the two ends of high voltage wire and RTN/LOW test cable.
- High voltage wire and RTN/LOW test cable must be separated from the control cable.
- High voltage wire and RTN/LOW test cable must keep appropriate distance from the device/panel.

# 4. Operation

## 4.1 Front Panel

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

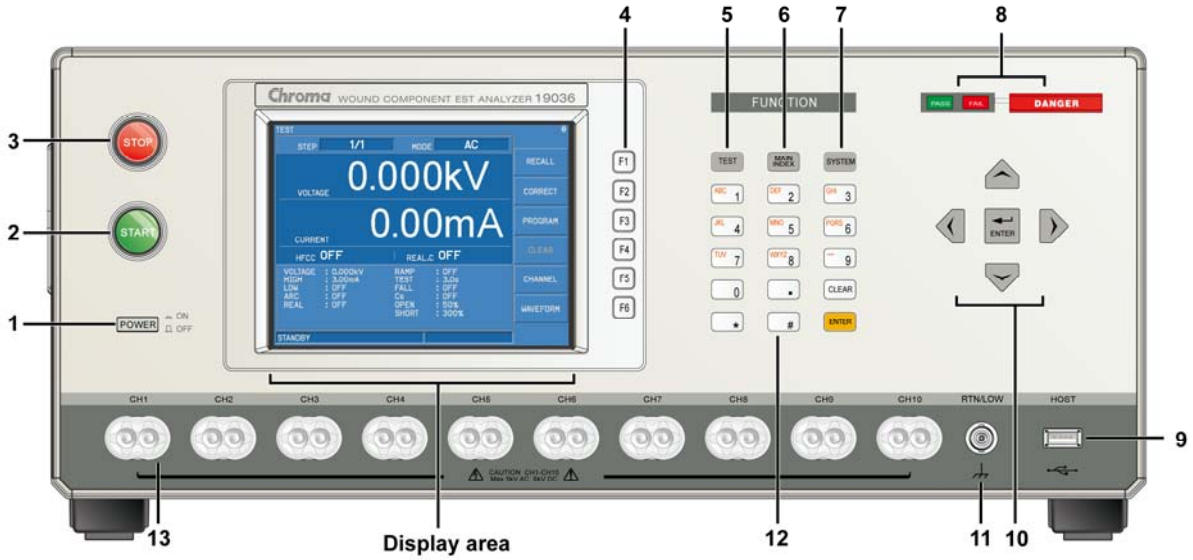
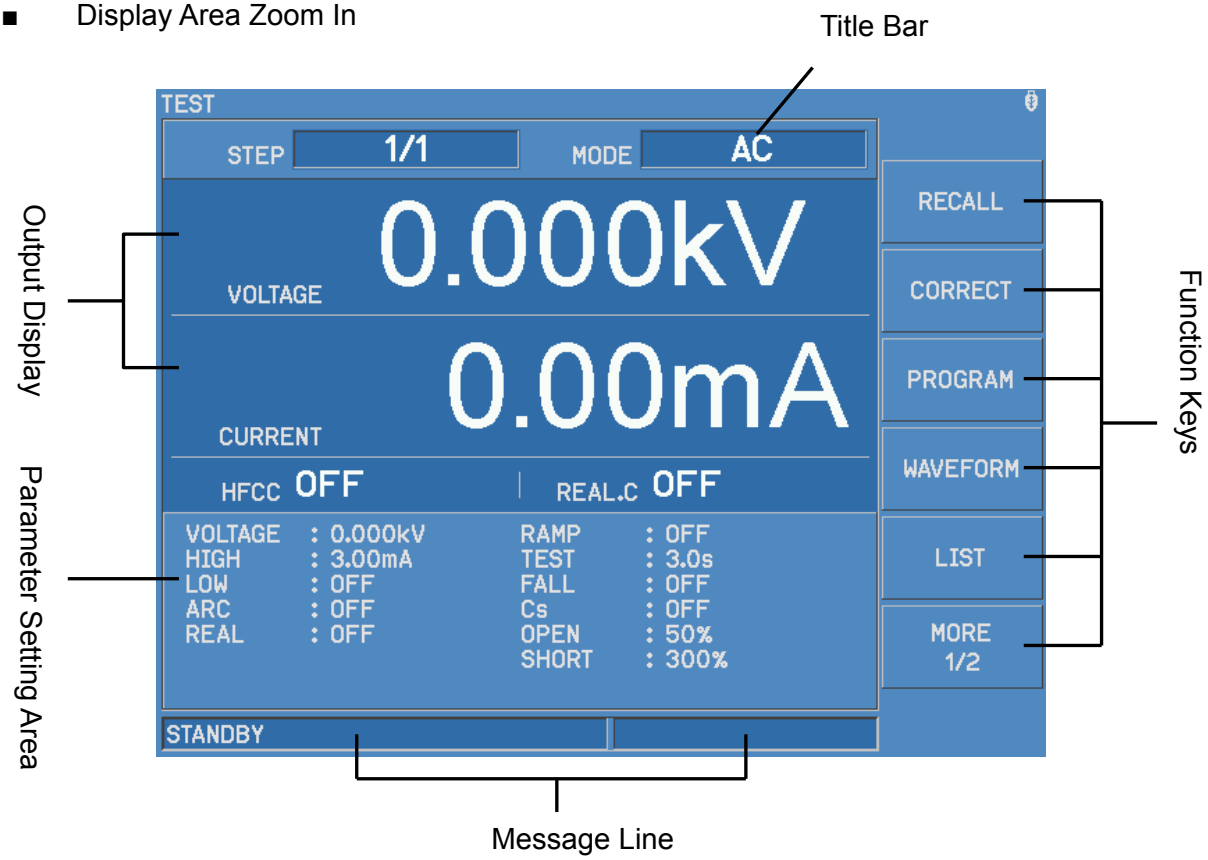
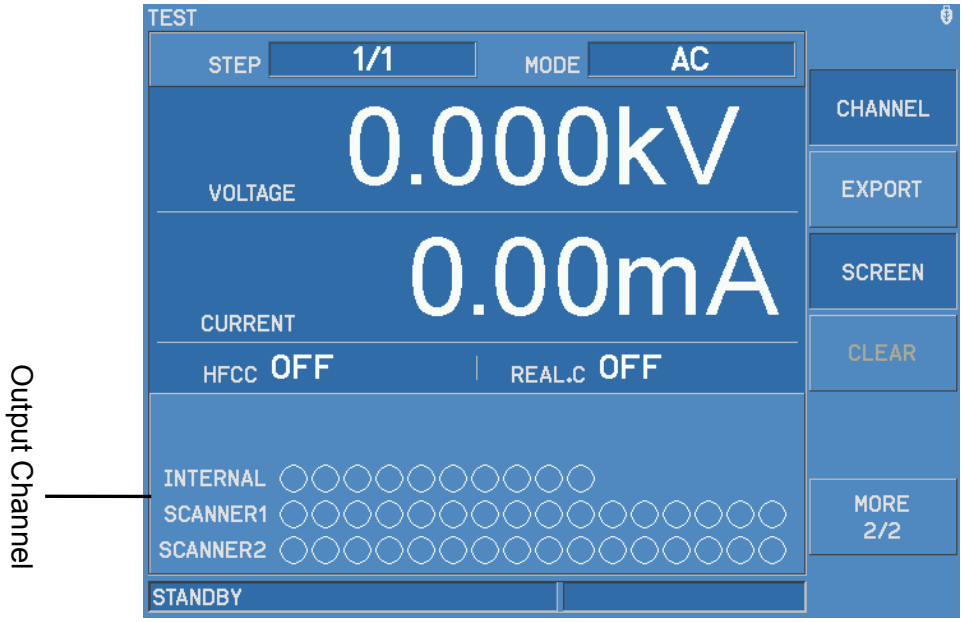



Figure 4-1 Front Panel

■ Display Area Zoom In



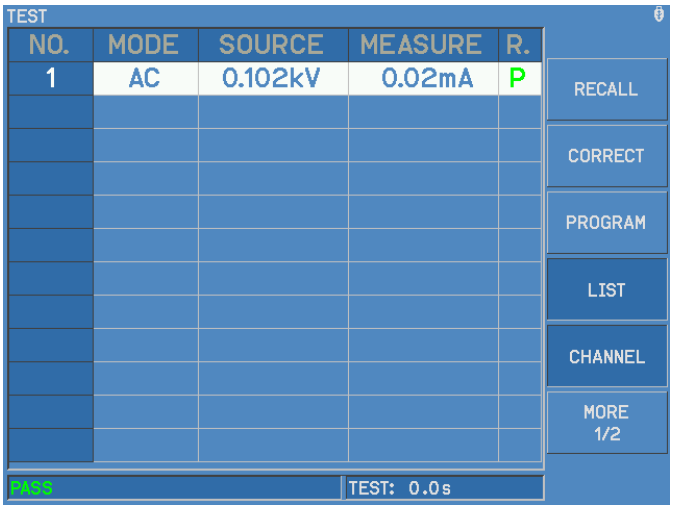



**Display Area**

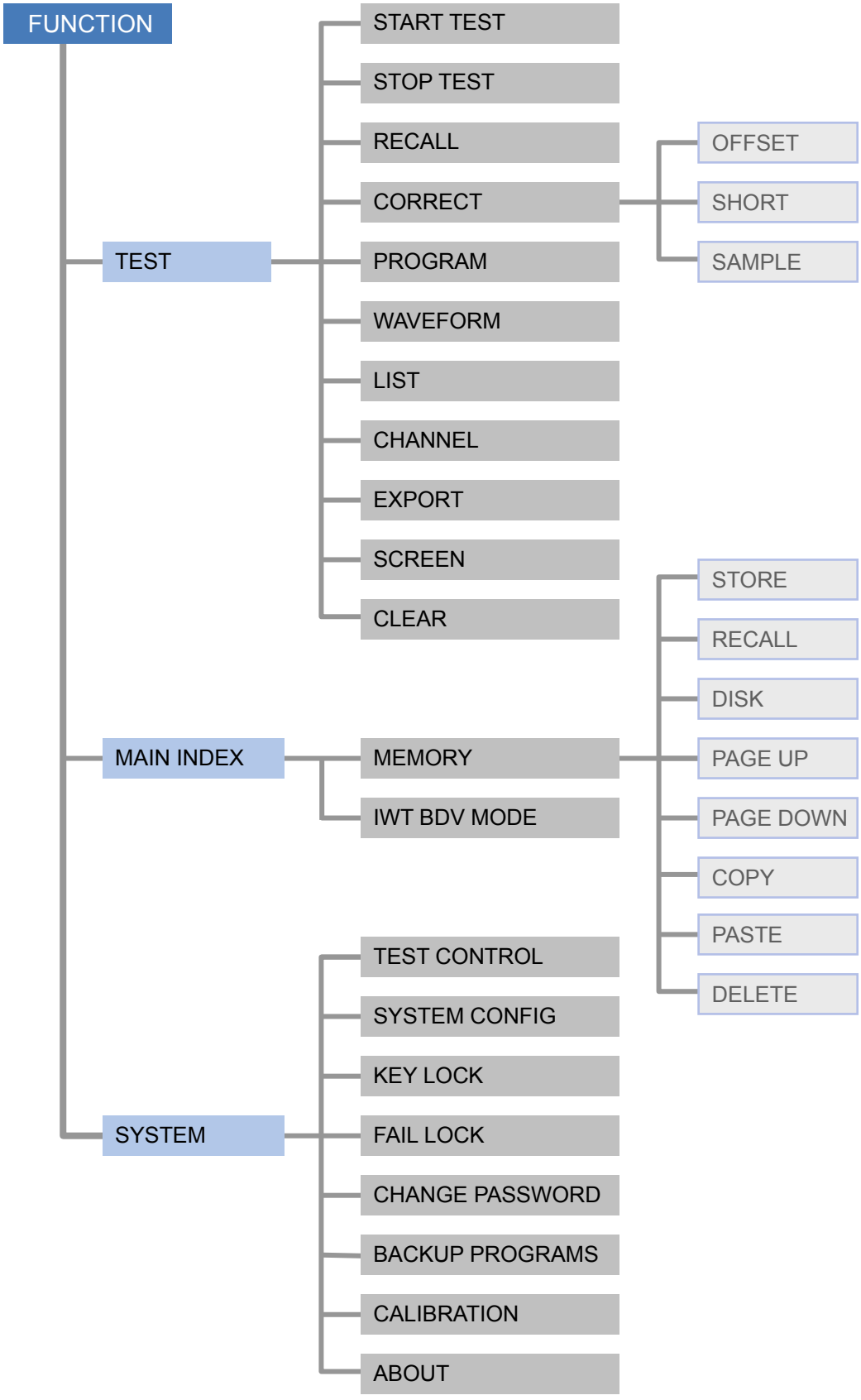
| | |
|---|---|
| Title Bar: | The text here indicates the current setting in use or the test mode the device is in. |
| Output Display: | The text in this area shows the output and readings from current device. |
| Parameter Setting: | The text in this area shows the parameter settings of current device. |
| Function Keys: | Different function key descriptions will appear in different screen and the mapping function keys are on the right of LCD. If the description is blank, it indicates the mapping function key is invalid. |
| Message Line: | This line of text instructs the setting method, range and test time. |
| Output Channel: | Press Function Keys [CHANNEL] and this area will change to Output Channel from Parameter Setting. |

Press Function Key [LIST] the screen will change from single test parameter and result to multiple parameters and results as the figure shown below.

■ LIST Display Area



## Function Key Flow Chart



**Buttons**

**(1) Power Switch** : It is the AC power switch of the Wound Component EST Analyzer. Be sure to read Chapter 3 *Precautions before Use* before using this switch.

**(2) START Key** It is the test activation key. The EST Analyzer is in test state when pressed, which means there is output on test terminal and the judging functions are activated at the same time.

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

**(4) Function Keys** : The functions are varied when in different screen. The mapping function names are listed on the right of LCD. If the mapping area is blank it indicates the function key is invalid.

**(5) TEST Key** : Press this key in any screen can return to [TEST] mode.

**(6) MAIN INDEX** : It is the key to manage the test. Press this key can enter into the memory management screen for saving and deleting test procedures.

**(7) SYSTEM Key** : It is the key to enter the system setting screen.

**(8) Indicator** It has TESTING LED and judgment LED indicators.

**(9) HOST** It can be used as extended memory with common USB flash drive on the market.

**(10) Cursor Keys** : [▲] [▼] [◀] [▶] are the cursor movement keys for setting functions or editing test procedures. Press **ENTER** to confirm the entry.

**(11) RTN/LOW** It is common test terminal as well as the reference terminal for high voltage test which is the low potential end. It is almost equivalent to chassis grounding terminal.

**(12) Data Entry Keys/ Program Keys**

**[0][.]～[9] [*] [#]** : The numeric/character keys to input various programs (value or English alphabet.)

**[ENTER]** : It is the confirmation key. Press this key to confirm the entered value of program.

**[CLR]** : It is the clear key. Press this key to clear the error data when entering the program.

**(13) HV** : It is the high potential end for high voltage output. It is very dangerous especially when the DANGER light is on which means there is high voltage output. Do not touch it.

# 4.2 Rear Panel

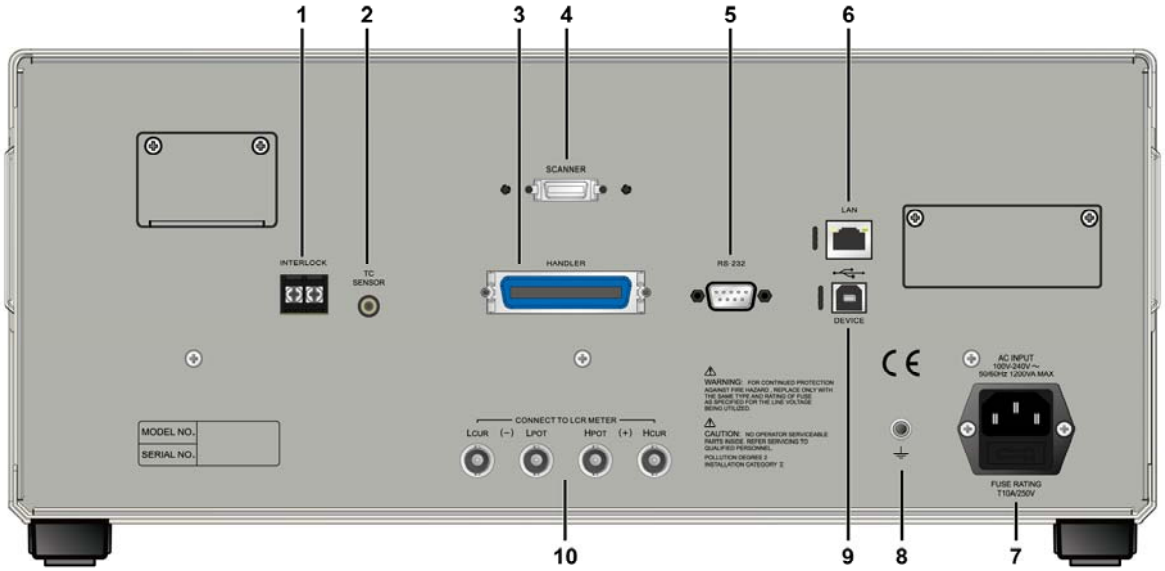



Figure 4-2 Rear Panel

**(1) INTER LOCK** : High voltage output is enabled when these two terminals are short-circuited.

**(2) TC Interface** : This connector is the interface for connecting temperature probe. See 4.6.4 *Temperature Measurement* for detail usage.

**(3) HANDLER Interface** : This connector is for the optional HANDLER interface. See Chapter 5 *HANDLER Interface* for detail usage.

**(4) SCAN Interface** This connector is the interface for connecting the EST Analyzer to A190359 16 HV External Scanning Box.

**(5) RS232 Interface** : This connector is the interface for connecting the RS232 interface card on PC.

**(6) LAN Interface** This connector is the interface for connecting the LAN interface on PC.

**(7) AC LINE** It contains a three-wire AC power socket and a fuse holder. The AC power required by the EST Analyzer is supplied by this power socket. For detail specification of fuse, please see Chapter 3 *Precautions before Use* or the instruction on the rear panel.

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

**(9) DEVICE Interface** : This connector is the interface for connecting the USB terminal on PC.

**(10) BNC Terminals** : These are the BNC terminals to connect the Transformer Tester.

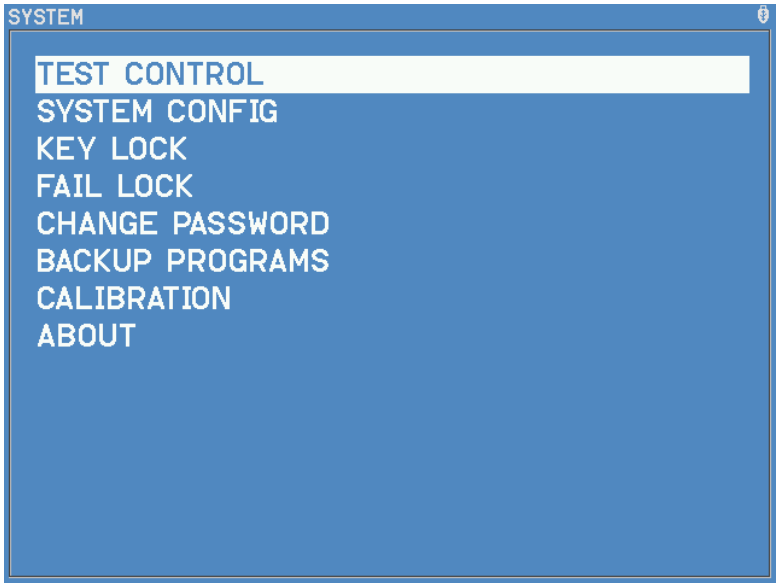
# 4.3 Notices before Use & Operating Procedure

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

# 4.4 Setting the SYSTEM

## 4.4.1 Entering the SYSTEM Setting Screen

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



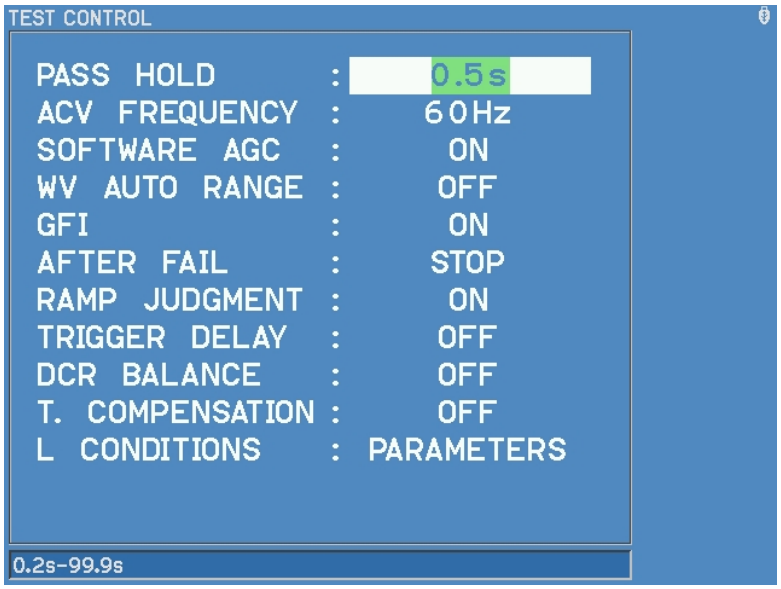

Use the **Cursor Key** [▲] [▼] to move the highlight to the item desired. Press **ENTER** to go to the setting screen of selected function.

Table 4-1 List of System Setting Parameters

| Setting Items | Description |
|---|---|
| TEST CONTROL | It sets the related parameters for test. See Section 4.4.2 for details. |
| SYSTEM CONFIG | It sets the system related parameters. |
| KEY LOCK | It sets the keyboard lock function. |
| FAIL LOCK | It locks the keyboard when a failure product is detected. |
| CHANGE PASSWORD | It changes the user's password. |
| BACKUP PROGRAMS | It backups the setting data in PROGRAM menu. |
| CALIBRATION | It sets the calibration related function. |
| ABOUT | It shows the version related information. |

## 4.4.2 Setting TEST CONTROL

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



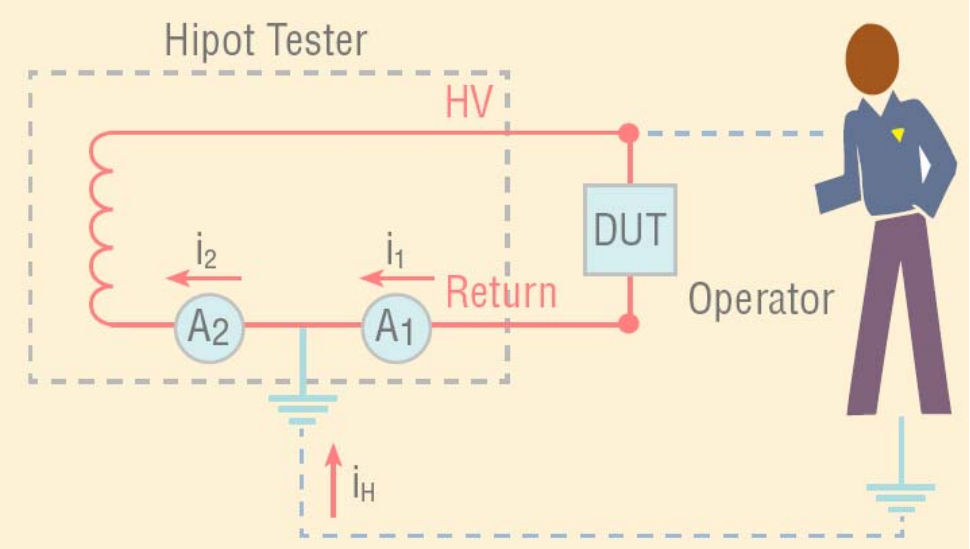

When in TEST CONTROL screen, press ▲ ▼ to move the highlight to the item to be set and press numeric keys or Function Key **F1** **F2** **F3** **F4** **F5** **F6** to set the mapped functions.

Table 4-2 Setting Items of TEST CONTROL

| Setting Items | Range | Default | Description |
|---|---|---|---|
| PASS HOLD | 0.2~99.9S | 0.5 | It sets the time for the beeper to sound when the DUT is judged as PASS. |
| ACV FREQUENCY | 50Hz / 60Hz | 60Hz | It sets the frequency of output voltage when performing AC withstand voltage test. |
| SOFTWARE AGC | ON/OFF | ON | It sets the software AGC function to be on or off. |
| WV AUTO RANGE | ON/OFF | OFF | It sets the low range auto change function for withstand voltage test to be on or off. |
| GFI | ON/OFF | ON | It sets the Ground Failure Interrupt function to be on or off. See 4.4.3 for details. |
| AFTER FAIL | CONTINUE/ STOP | STOP | It sets the action after the test step is judged as FAIL. When set to CONTINUE, it won't stop test after detected FAIL. It will continue the steps afterwards. When set to STOP, it will stop test after detected FAIL and it is necessary to press [STOP] first and follow by [START] to begin the test. |
| RAMP JUDGMENT | ON/OFF | ON | When set to ON, it will judge high limit during ramp time when in DC mode. When set to OFF, it won't judge high limit during ramp time when in DC mode. |
| TRIGGER DELAY | 0 (OFF), 10~9999mS | OFF | It sets the time delayed after pressing the START key to begin the test. |
| DCR BALANCE | 0(OFF), | OFF | (1) When the difference of maximum and |

| | | | |
|---|---|---|---|
| | 0.001~999Ω | | minimum DCR is larger than the setting of DCR Balance, the judgment is Balance Fail (shows on the message line.)<br>(2) When the difference of maximum and minimum DCR is larger than the setting of DCR Balance, the judgment is Pass. |
| T. COMPENSATION | | | It sets the temperature compensation. (The setting is invalid here. Use the submenu to modify the settings and see section 4.6.4.2 for detail description.) |
| L CONDITIONS | | | It sets the parameters for Transformer Tester. (This setting is only valid when in the submenu. See section 4.4.4 for detail description.) |

## 4.4.3 Setting GFI (Ground Fault Interrupt)

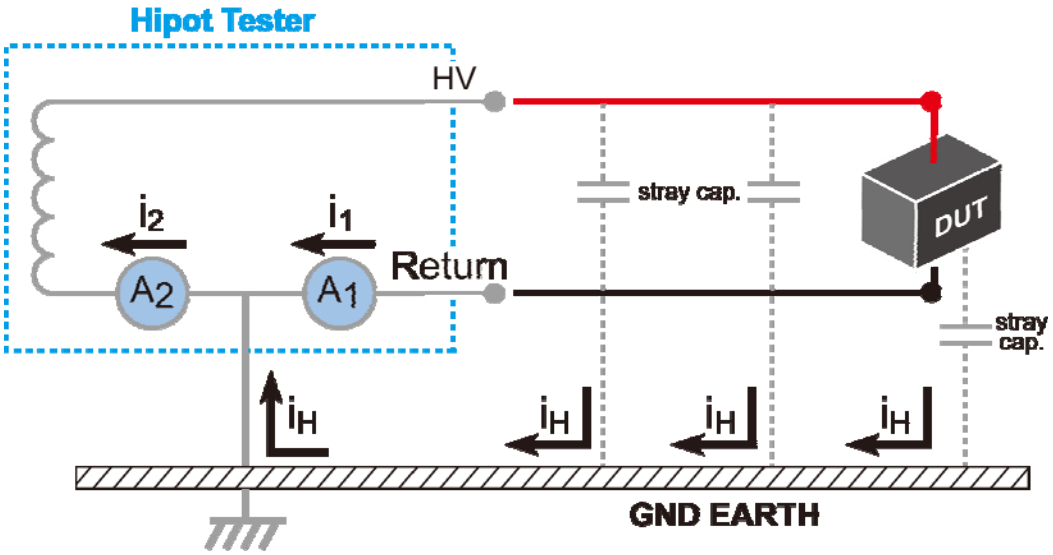



When the operator contacts the high voltage end inadvertently, a current $i_H$ will generate and flow through the human body.

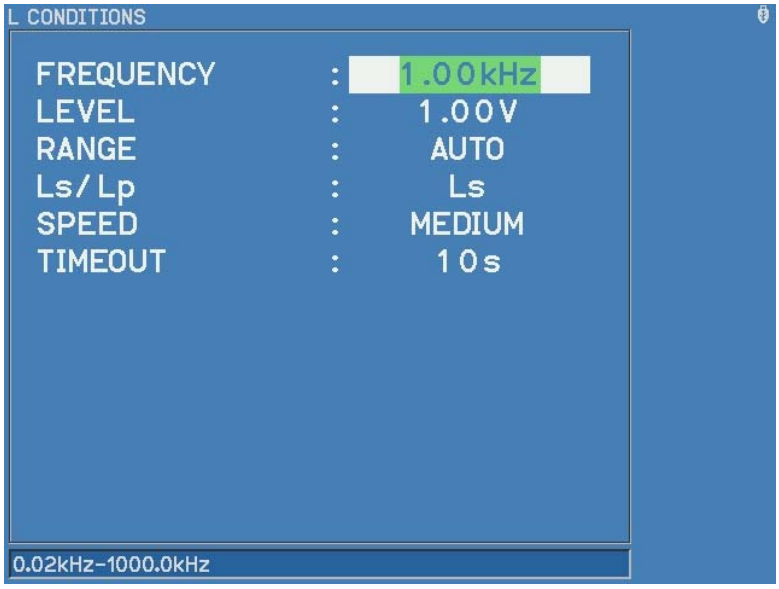
$$i_2 = i_1 + i_H$$

When $i_H$ is higher than GFI current (0.5mA), cutoff the high voltage output to guard the safety of operator.

**CAUTION** As the figure shown below, when AC high voltage outputs, the high voltage path or the stray capacitance of GND_EARTH on DUT will generate leakage current $i_H$ and a GFI FAIL will create when the leakage current meets the GFI level ($i_H$>0.5mA). When performing the test, it is necessary to diminish the GND_EARTH contact area for high voltage cable and DUT to reduce the impact caused by leakage current.



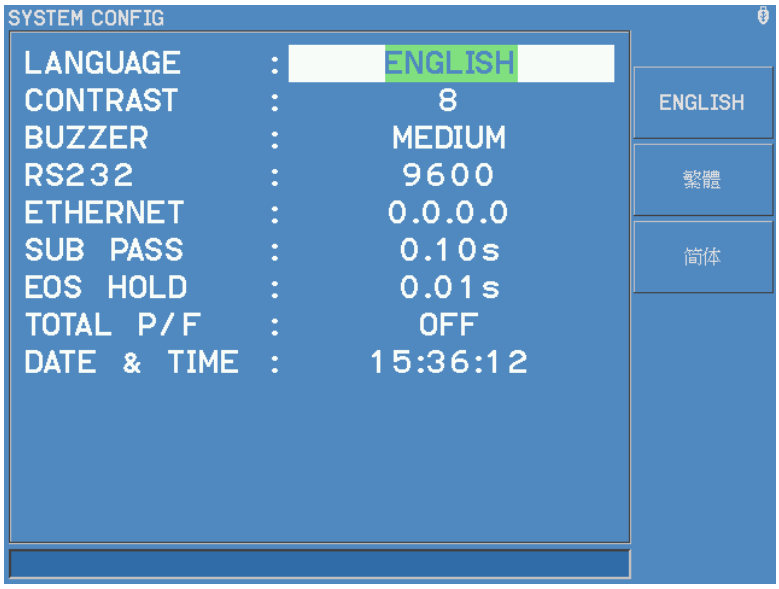

## 4.4.4 Setting L CONDITIONS




| Setting Items | Range | Default | Description |
|---|---|---|---|
| FREQUENCY | 0.02kHz~1000.0kHz | 1.00kHz | It sets the Transformer Tester's measurement frequency. |
| LEVEL | 0.01V~2.00V | 1.00V | It sets the Transformer Tester's measurement voltage. |
| RANGE | AUTO,1,3,5,7,8,10 | AUTO | It sets the Transformer Tester's measurement range. |
| Ls/Lp | Ls/Lp | Ls | It sets the measurement to series or parallel inductance. |
| SPEED | SLOW/MEDIUM/FAST | MEDIUM | It sets the measurement speed. |
| TIMEOUT | 1s~300s | 10s | It sets the timeout for communication. |

## 4.4.5 Setting SYSTEM CONFIG

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




When in SYSTEM CONFIG screen, press ▲ ▼ to move the highlight to the item to be set and press the numeric key or Function Key **F1** **F2** **F3** **F4** **F5** **F6** to set the mapped functions.

Table 4-3 Setting Items of SYSYTEM CONFIG

| Setting Items | | Range | Default | Description |
|---|---|---|---|---|
| LANGUAGE | | ENGLISH/ Traditional Chinese/ Simplified Chinese | ENGLISH | It sets the display language. |
| CONTRAST | | 1 - 16 | 06 | It adjusts the LCD brightness. |
| BUZZER | | HIGH / MEDIUM /LOW / OFF | MEDIUM | It adjusts the buzzer volume. |
| RS232 | BUND RATE | 9600/19200/38400/ 57600/115200 | 9600 | It sets the transmission baud rate of RS232 interface. |
| | FLOW CONTROL | NONE/HARDWARE | NONE | It sets if enable hardware FLOW CONTROL. |
| ENTERNET | | DYNAMIC IP / STATIC IP | DYNAMIC IP | It sets the IP address of LAN interface. If DYNAMIC IP is selected, the IP is specified by PC and the IP is set by the host if STATIC IP is selected. |
| SUB PASS | | 0.01 ~ 0.5S | 0.10S | Main step is the time for conducting SUB STEP during PASS. When Sub Step is skipped without test, Handle Board will send out Step Pass signal and the duration is determined by this setting. |
| EOS HOLD | | 0.01 ~ 0.5S | 0.01S | It sets the time hold for end of step. |

| | | | |
|---|---|---|---|
| TOTAL P / F | ON/OFF | OFF | It sets if sending out PASS/ FAIL signal from the Handler on the rear panel after all test steps are done. |
| DATE & TIME | NONE | NONE | It sets the time on the host. |
| L COMBINE | DISABLE/ENABLE | DISABLE | It sets if connecting the LCR METER. |
| WITH SCANBOX | DISABLE/ENABLE | DISABLE | When set to ENABLE, the host will set CH9 to high voltage output and CH10 to low voltage output automatically in order to connect to SCANBOX. |

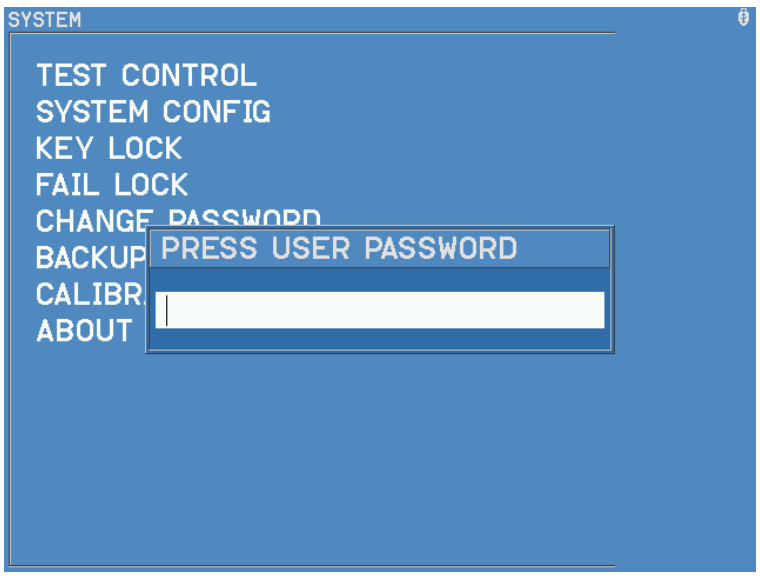
**Notice** When the LANGUAGE is reset, it is necessary to reboot the EST Analyzer to display the set language.

**CAUTION** The host will automatically set CH9 to high voltage output and CH10 to low voltage output when the function of WITH SCANBOX is enabled. Refer to the SCANBOX User's Manual to connect the host CH9 high voltage output to the SCANBOX high voltage input and the host CH10 low voltage output to the SCANBOX low voltage input correctly.

## 4.4.6 Setting KEY LOCK

**The way to set KEY LOCK:**

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



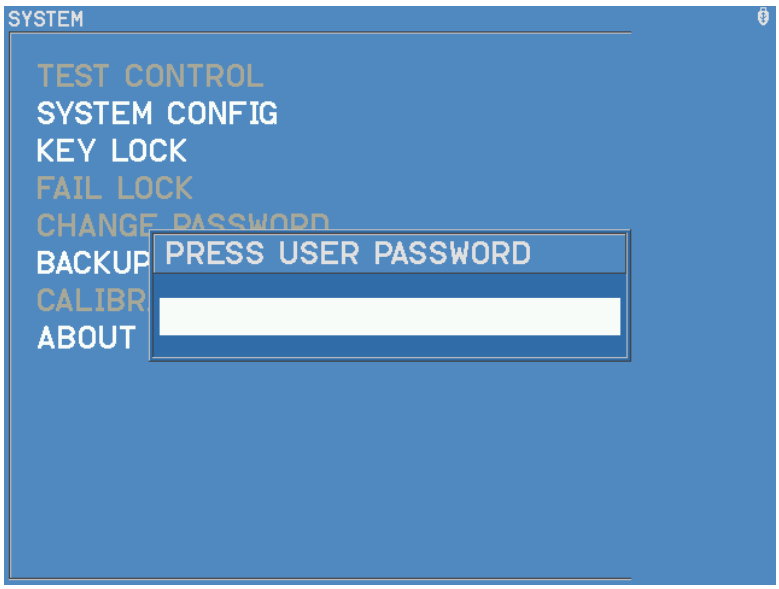

1. In KEY LOCK screen, press numeric keys to enter the PASSWORD (the default is 0000.)
2. Press **ENTER** will prompt a selection window to select if locking RECALL MEMORY. The users can use Function Keys **OFF**, **ON** to select if locking the function of MEMORY

RECALL as well.

3. When KEY LOCK is ON, the locked function will show in light gray. The "CORRECT", "PROGRAM" and "STORE", "DELETE", "COPY", "PASTE" of MEMORY in [MAIN INDEX] as well as the "TEST CONTROL", "FAIL LOCK", "CHANGE PASSWORD", "CALIBRATION" in [SYSTEM] all cannot be entered for setting.
4. When setting KEY LOCK, if RECALL LOCK ON is selected, the MEMORY RECALL function is also invalid.

**The way to release KEY LOCK:**

To release KEY LOCK, press **SYSTEM** to select KEY LOCK as shown below:

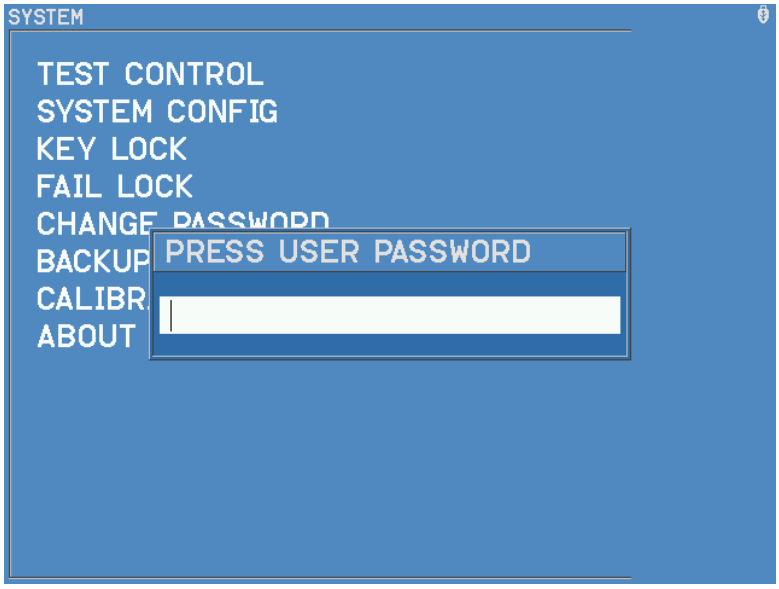



Use numeric keys to enter the PASSWORD and press **ENTER** again, the text of "KEY LOCK" will return to normal color to indicate the KEY LOCK function has been disabled.

## 4.4.7 Setting FAIL LOCK

**The way to set FAIL LOCK:**

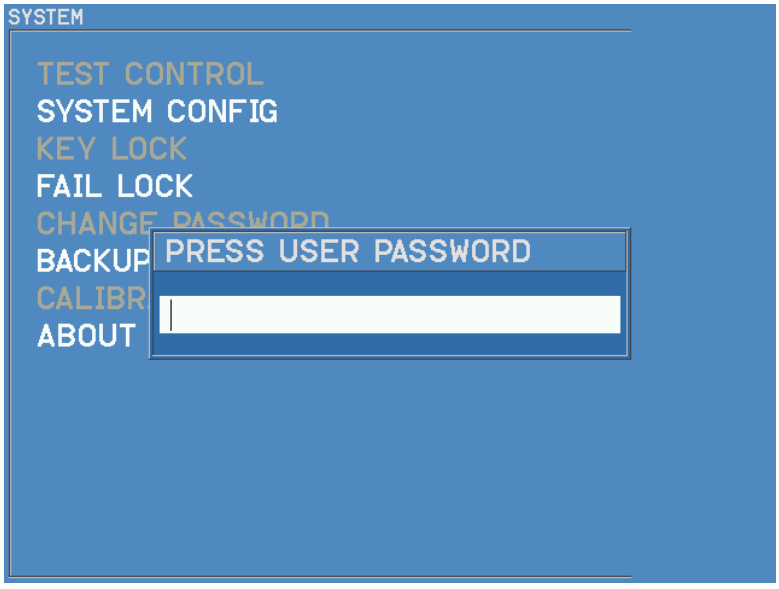
In SYSTEM SETUP screen, move the highlight to FAIL LOCK and press **ENTER** to go to FAIL LOCK setting screen as shown below:




1. In FAIL LOCK screen, press numeric keys to enter the PASSWORD (the default is 0000.)
2. When FAIL LOCK is ON, the locked function will show in light gray. The “RECALL”, “CORRECT”, “PROGRAM” and all function in [MAIN INDEX] as well as “TEST CONTROL”, “KEY LOCK”, “CHANGE PASSWORD”, “CALIBRATION” in [SYSTEM] all cannot be entered for setting.
3. When FAIL LOCK is ON, if the test result is FAIL, Function Keys [CLEAR] has to be pressed for inputting FAIL LOCK PASSWORD to clear the FAIL status and then continue the test.

**The way to release KEY LOCK:**

To release FAIL LOCK, press **SYSTEM** to select FAIL LOCK as shown below:

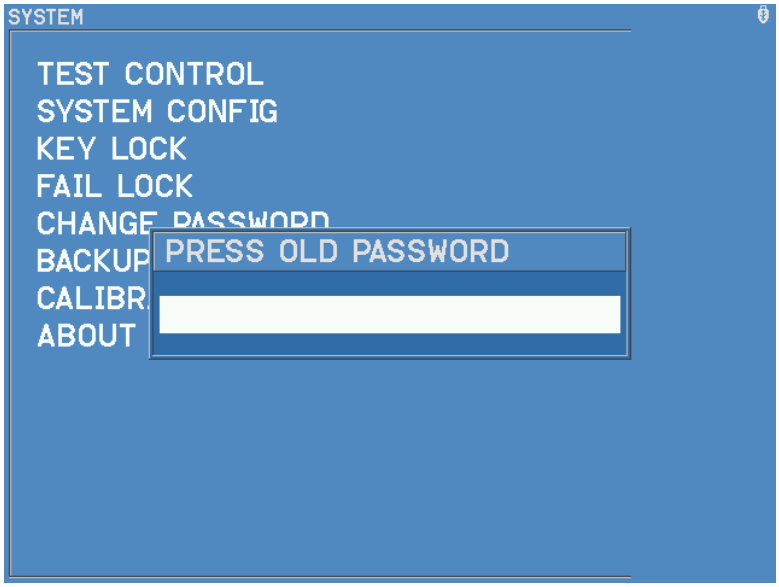



Use numeric keys to enter the PASSWORD and press **ENTER** again, the text of “FAIL LOCK” will return to normal color to indicate the FAIL LOCK function has been disabled.

## 4.4.8 Changing PASSWORD

**Setting password for KEY LOCK:**

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



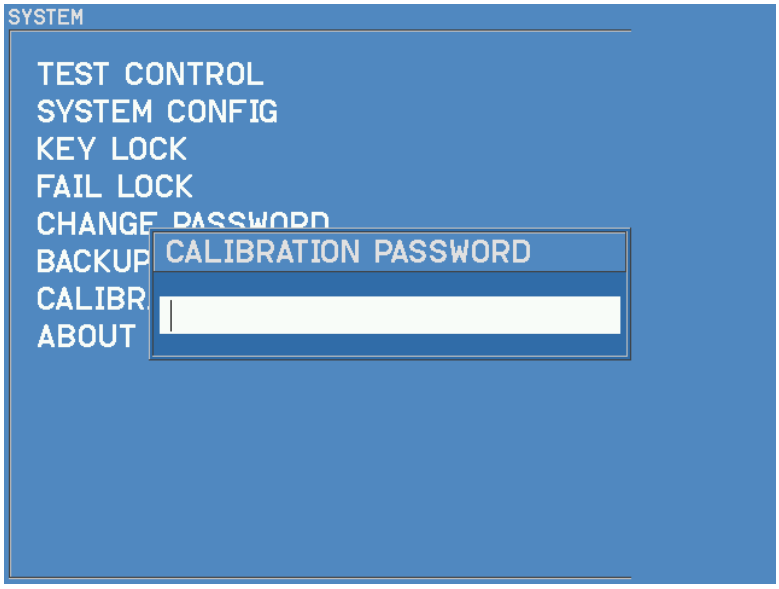

1. Use numeric keys to enter the PASSWORD (enter 0000 if the PASSWORD hasn't been set.) Press **ENTER** and a "PRESS NEW PASSWORD" window will appear.
2. Use numeric keys to enter NEW PASSWORD (maximum 10 characters) and press **ENTER**, a "PRESS NEW PASSWORD AGAIN" window will appear.
3. Use numeric keys to enter the NEW PASSWORD again and press **ENTER** to complete the PASSWORD change.

**Notice**

Please follow the procedure described in section 4.5.4 to erase the memory and reset the PASSWORD to its initial 0000 when the set password is forgotten.

## 4.4.9 Setting CALIBRATION

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




When in CALIBRATION screen, press ▲ ▼ to select the calibration item and use numeric keys to enter the calibration value to calibrate the related function.

Table 4-4 Setting Items for CALIBRATION

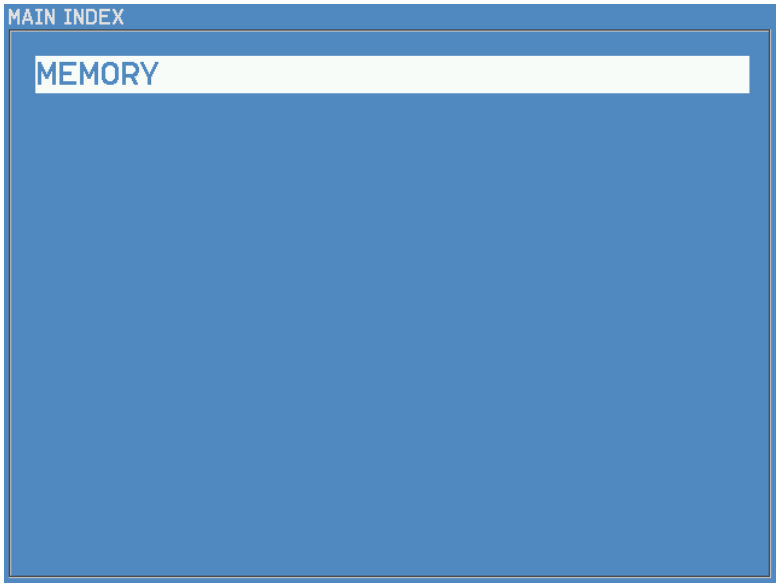
| Setting Items | Password | Description |
|---|---|---|
| Enter into Calibration Mode | 7931 | Please refer to Chapter 8 for Calibration Procedure related info. |
| Clear the settings and test procedures in memory | 85246 | This function will clear all settings and test procedures in the memory and return to factory default. |

# 4.5 Managing Programs & TEST CONTROL Memory

19036 has **200 sets** of memory and each of them can set 40 test steps including programs, TEST CONTROL parameters and the name of the memory.

## 4.5.1 Entering the Memory Screen

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

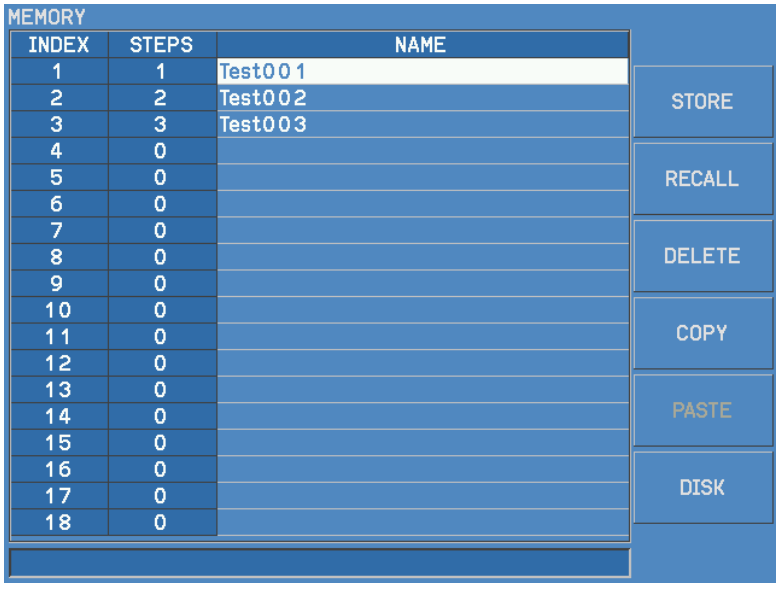



2. Press **ENTER** to get in Memory mode as shown below.
3. Use ▲ ▼ to move the highlight to the memory desired for process. Use the Function Key [MORE 1/2] to switch functions to store, recall, delete, copy or paste the memory.
4. Press PAGE UP or PAGE DOWN to change the page for memory index.
5. The value of STEPS indicates the number of test steps included in the memory.

## 4.5.2 Saving the Memory

Follow the steps below to save the set programs into memory:

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




2. When the cursor highlight is reversed, use numeric or character keys to input the memory name. Press the same number or letter repeatedly can cycle between the number and English letter case for display.

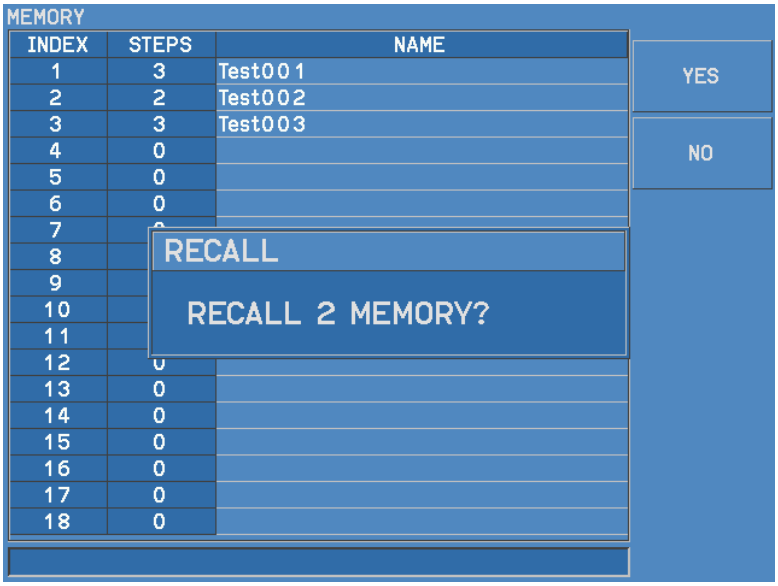
3. Once entered a character, the cursor will move to next position for input automatically.
4. Press **ENTER** to complete the task.

**CAUTION** The data will be overwritten if there is data in the memory name. Be sure to confirm it before saving.

## 4.5.3 Recalling the Memory

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

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

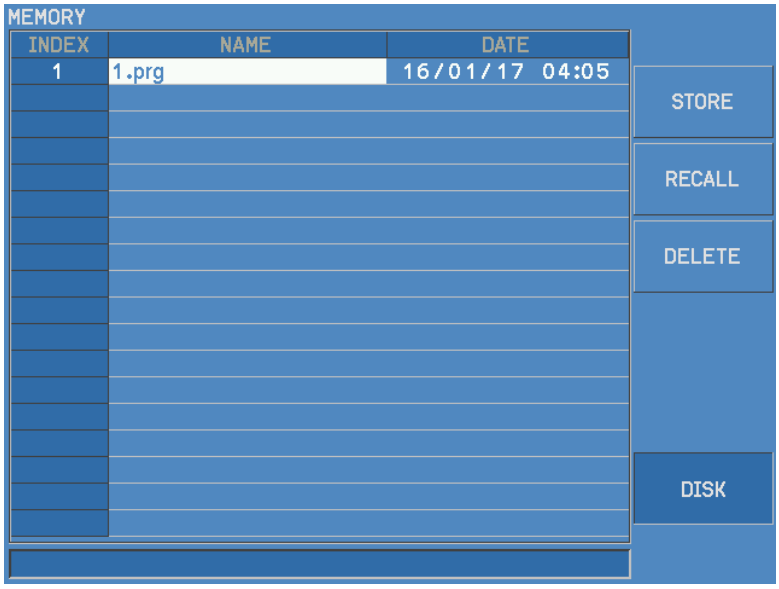



2. A recall confirmation dialog box is prompted. Press Function Key [YES] to confirm it or [NO] to cancel it.

## 4.5.4 Using USB for Memory Management

Follow the steps listed below if USB is used to manage the program.

1. Insert the USB flask drive into the HOST connector on the front panel. Please be aware that the capacity should be less than 32G and the format must be FAT16/FAT32.
2. Press Function Keys [DISK] to enter into USB memory for management as the figure shown below.

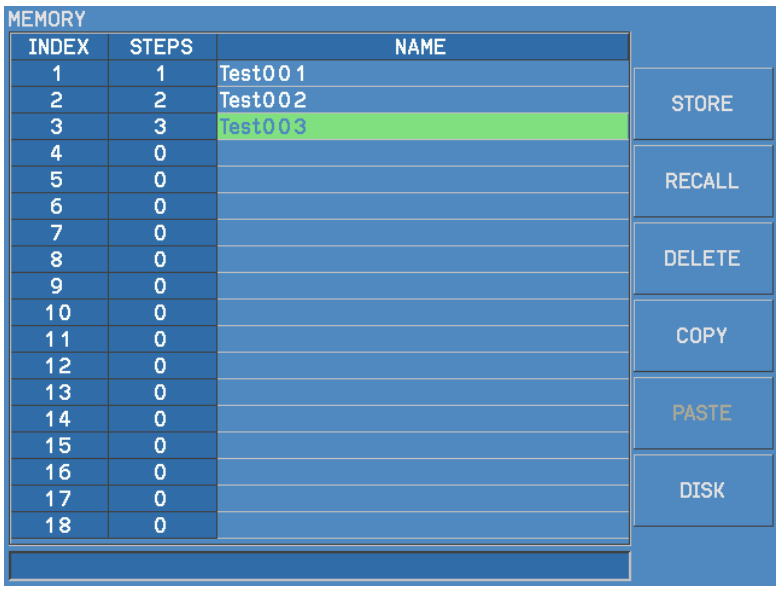



Use Function Keys [STORE], [RECALL], [DELETE] to manage the program.

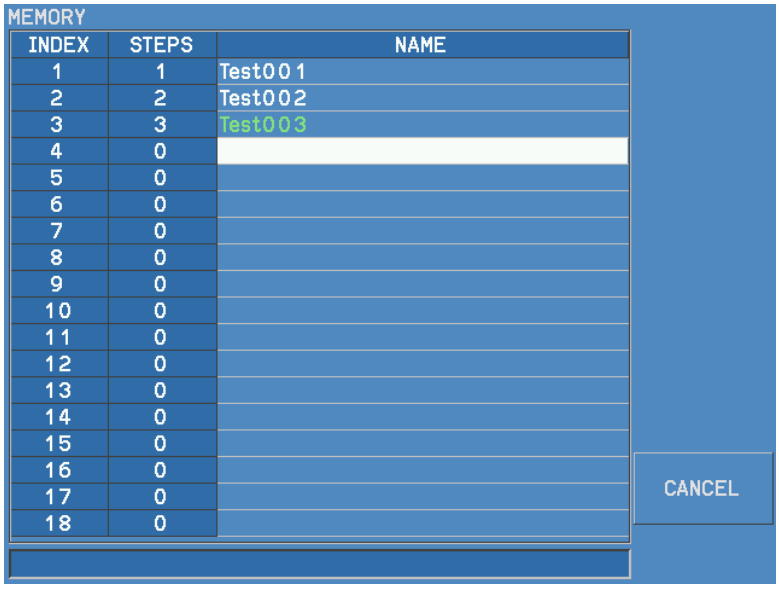
## 4.5.5 Coping & Pasting the Memory

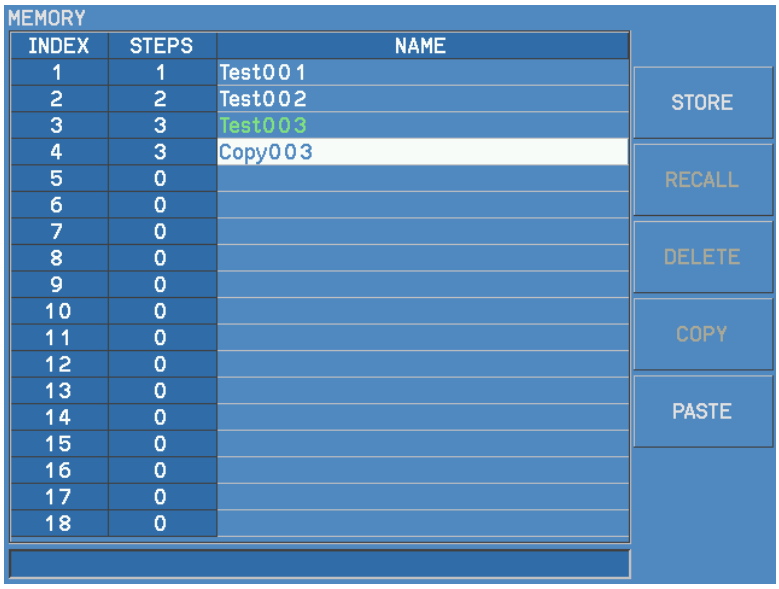
Please follow the steps below to copy the program stored in memory.

1. Use ▲ ▼ to move the highlight to the program desired for copying and press Function Keys [COPY].




2. The highlight of selected program will turn to green and then use ▲ ▼ to move the highlight to the position for pasting the program, press Function Key [PASTE]. Enter the memory name and press **ENTER** to save it.

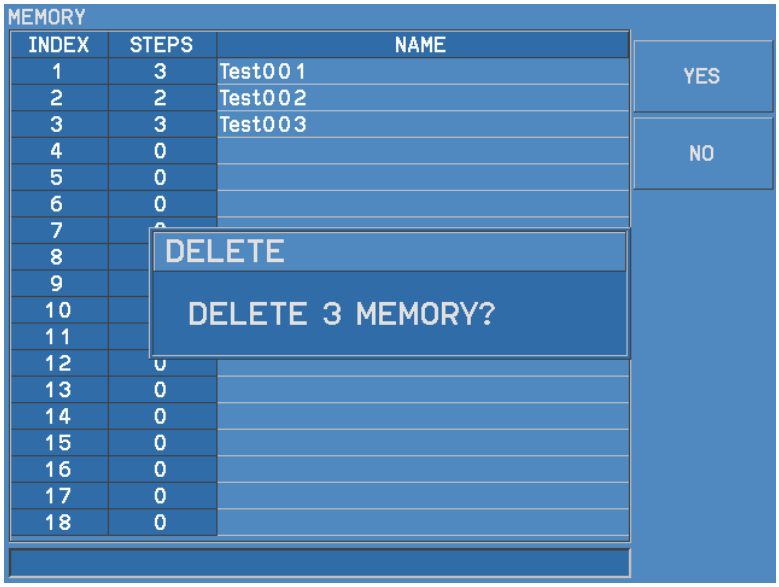



## 4.5.6 Deleting the Memory

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

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




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

# 4.6 Setting PROGRAM

## 4.6.1 Setting Program Procedure

1. Press Function Key [PROGRAM] in power on screen to go to PROGRAM setting screen as below:

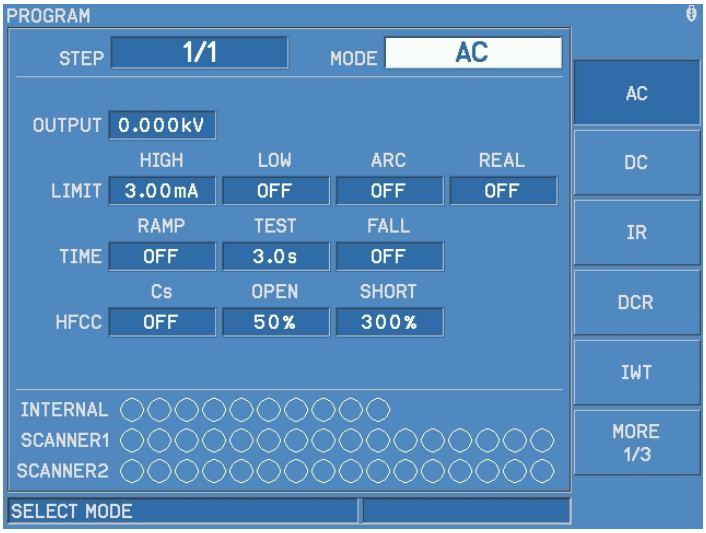

2. Press ▲ ▼ ◀ ▶ to move the highlight to the steps to be set. Use numeric/character keys or mapped function keys to modify the parameter and press **ENTER** to confirm the modification.
3. Use Function Keys [+][−] to move the cursor to previous or next test step.
4. Use Function Key [NEW STEP] to add a new test step. The range is 1~100.

5. Use Function Key [NEW SUB] to add a sub step. When the main step judges the DUT as Pass, the sub step will skip and it will run when the main step judges the DUT as fail to get a more complete test result.
6. Use Function Key [INSERT STEP] to insert a new test step.
7. Use Function Key [MORE 1/2] to switch to the Function Keys on next page as shown below.


8. Use Function Key [COPY] to copy a test step.
9. Use Function Key [PASTE] to paste up a test step.
10. Use Function Key [INSERT] to insert a copied test step.
11. Use Function Key [CUT] to cut a test step.
12. Use Function Key [DELETE] to delete a test step.
13. Press Function Key [NEXT 2/2] to return to previous page and continue to set other program.

## 4.6.2 Selecting Test Mode

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

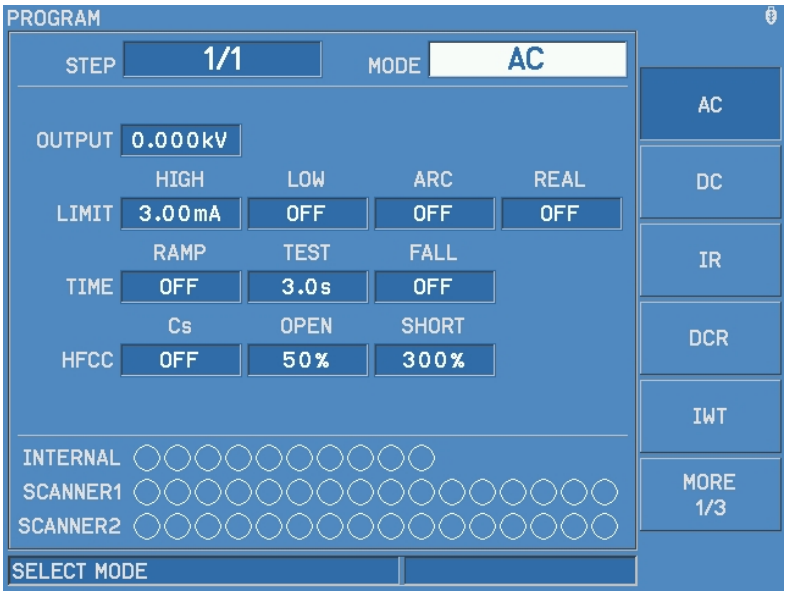


2. Use Function Keys [AC], [DC]. [IR], [DCR] , [IWT], [MORE 1/3] to select a test mode. There are AC / DC / IR / DCR / IWT / △/ Y DCR / IWT COMPARE / HSCC / OSC / PA / Lx / Lx BALANCE test modes available for selection. Different test mode has different programs for setting.

## 4.6.3 Description of Parameters

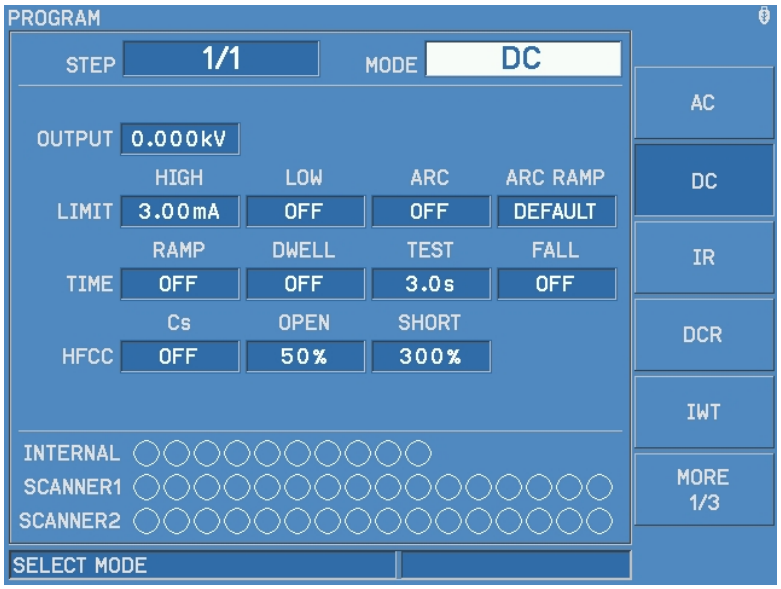
Following explains the parameters in each test mode.

**Withstand Voltage AC (WVAC) Test Mode**



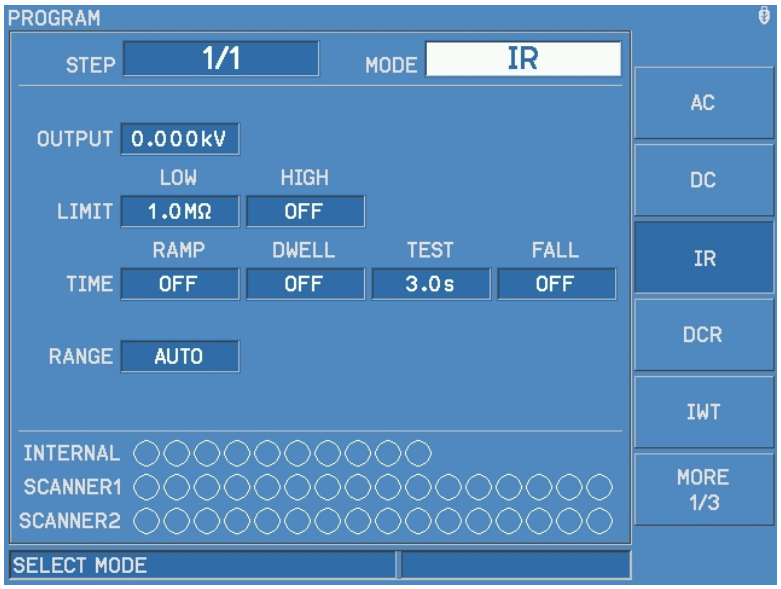

OUTPUT : It sets the voltage required for withstand voltage test.
HIGH : It sets the high limit of leakage current.
LOW : It sets the low limit of leakage current. The range is smaller than the leakage current high limit or OFF.
ARC : It sets the high limit of arc, 0 means OFF.
REAL : It sets the high limit of real leakage current. The range is smaller than the leakage current high limit or OFF.
RAMP : It sets the time required for ramping to the set voltage, 0 means OFF.
TEST : It sets the time required for test, 0 means continuous test.
FALL : It sets the time required for falling to low voltage from set, 0 means OFF.
Cs : It sets the standard capacitance for High Frequency Contact Check (HFCC). OFF means no check.
OPEN : It sets the test result of HFCC = open condition (compare test readings with the read standard capacitance.)
SHORT : It sets the test result of HFCC = short condition (compare test readings with the read standard capacitance.)
INTERNAL : It sets the status of EST Analyzer test output. Available settings are NONE/HI/LOW.
SCANNER1: It sets the output status of scanner test fixture 1. Available settings are NONE/HI/LOW.
SCANNER2: It sets the output status of scanner test fixture 2. Available settings are NONE/HI/LOW.

### Withstand Voltage DC (WVDC) Test Mode




OUTPUT : It sets the voltage required for withstand voltage test.
HIGH : It sets the high limit of leakage current.
LOW : It sets the low limit of leakage current. The range is smaller than the leakage current high limit or OFF.
ARC : It sets the high limit of arc, 0 means OFF.
ARC RAMP: It sets the high limit of arc for RAMP TIME, 0 means OFF.
RAMP : It sets the time required for ramping to the set voltage, 0 means OFF.
DWELL : It sets the time required for DWELL, 0 means OFF.
(It does not judge the high and low limit of leakage current during DWELL TIME but only when the set range is within the high limit.)
TEST : It sets the time required for test, 0 means continuous test.
FALL : It sets the time required for falling to low voltage from set, 0 means OFF.
Cs : It sets the standard capacitance for High Frequency Contact Check (HFCC). OFF means no check.
OPEN : It sets the test result of HFCC = open condition (compare test readings with the read standard capacitance.)
SHORT : It sets the test result of HFCC = short condition (compare test readings with the read standard capacitance.)
INTERNAL : It sets the status of EST Analyzer test output. Available settings are NONE/HI/LOW.
SCANNER1: It sets the output status of scanner test fixture 1. Available settings are NONE/HI/LOW.
SCANNER2: It sets the output status of scanner test fixture 2. Available settings are NONE/HI/LOW.

### Insulation Resistance (IR) Test Mode



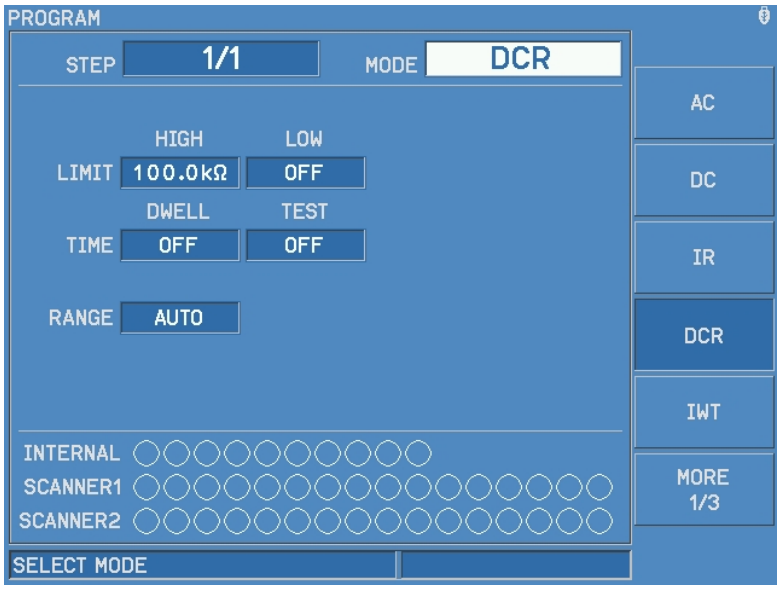

OUTPUT : It sets the required voltage for insulation resistance test.
LOW : It sets the low limit for insulation resistance.
HIGH : It sets the high limit for insulation resistance. The value is larger than the insulation resistance low limit or OFF.
ARC : It sets the high limit of arc for TEST TIME, 0 means OFF.
ARC RAMP: It sets the high limit of arc for RAMP TIME, 0 means OFF.
RAMP : It sets the time required for ramping to the set voltage, 0 means OFF.
DWELL : It sets the time required for DWELL, 0 means OFF.
(It does not judge the high and low limit of leakage current during DWELL TIME but only when the set range is within the high limit.)
TEST : It sets the time required for test, 0 means continuous test.
FALL : It sets the time required for falling to low voltage from set, 0 means OFF.
RANGE : It sets the current test range for insulation resistance, AUTO means switching the range automatically. When the DUT is having Corona, it is possible that the ranges are skipping in between, please use HOLD RANGE to do the test. The table below lists the relationship between current range and resistance measurement range.

| Range | IR Display | |
|---|---|---|
| | When voltage set to 100V ~ 499V | When voltage set to 500V ~ 5000V |
| 10mA(3~10mA) | -- | 1.0MΩ~22.0MΩ<br>20MΩ~220MΩ<br>0.20GΩ~2.20GΩ<br>2.0GΩ~50.0GΩ |
| 3mA(0.3~3mA) | 0.1MΩ~22.0MΩ<br>20MΩ~220MΩ<br>0.20GΩ~2.20GΩ | |
| 300uA(30~300uA) | | |
| 30uA(3~30uA) | | |
| 3uA(0.3~3uA) | | |
| 300nA(30~300nA) | | |
| 30nA(10~30nA) | -- | |

**Notice** To select an appropriate IR current range, please calculate the current by test voltage and DUT's insulation impedance, and then select the proper current range.

INTERNAL : It sets the status of EST Analyzer test output. Available settings are NONE/HI/LOW.
SCANNER1: It sets the output status of scanner test fixture 1. Available settings are NONE/HI/LOW.
SCANNER2: It sets the output status of scanner test fixture 2. Available settings are NONE/HI/LOW.

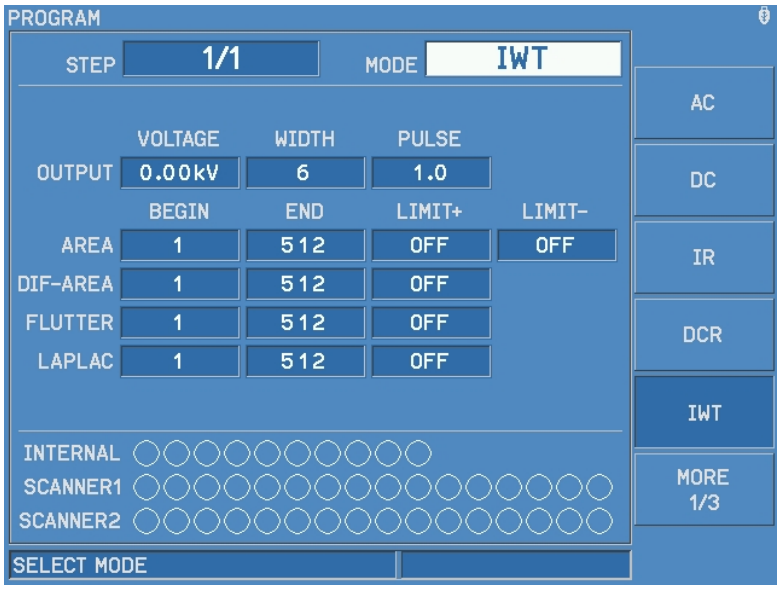
**DC Resistance (DCR) Test Mode**




HIGH : It sets the high limit for DC resistance. The maximum is 500KΩ.
LOW : It sets the low limit for DC resistance. The value is smaller than the insulation resistance high limit or OFF.
DWELL : It sets the time required for DWELL, 0 means OFF.
(It does not judge the high and low limit of leakage current during DWELL TIME but only when the set range is within the high limit.)
TEST : It sets the following 3 actions for DCR TIME.
(1) Set to OFF: Setting Function Key [OFF] to OFF indicate no test time is set for DCR. The test mode ends when the host read the DCR readings successfully.
(2) Set to KEY: Setting Function Key [KEY] to CONTINUE indicate the DCR test will continue until the START key on the panel is pressed or the /EXT_START signal on HANDLER card (OPTION) is retriggered.
(3) Set the test time: Use numeric keys to set the test time required by DCR.
RANGE : It sets the test range for DC resistance, AUTO means switching range automatically.
INTERNAL : It sets the status of EST Analyzer test output. Available settings are NONE/HI/LOW.
SCANNER1: It sets the output status of scanner test fixture 1. Available settings are NONE/HI/LOW.
SCANNER2: It sets the output status of scanner test fixture 2. Available settings are NONE/HI/LOW.

Please see section 4.6.4 for the temperature measurement function in DCR mode.

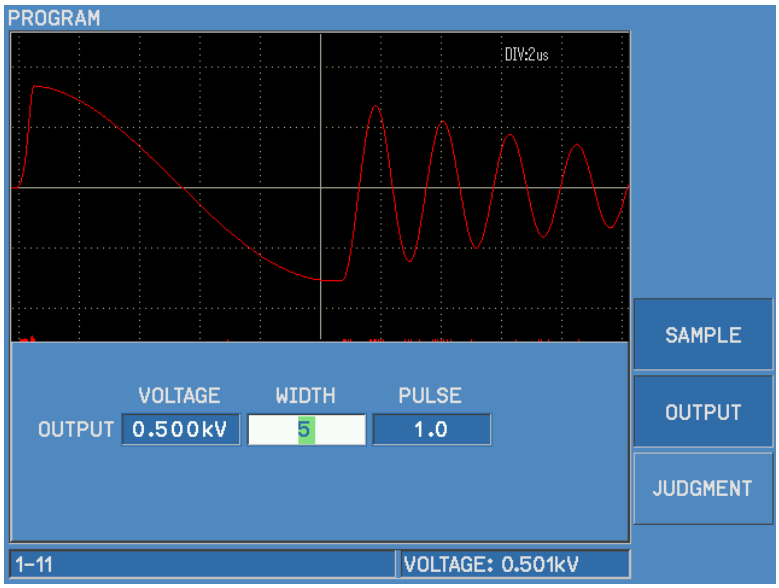
**Impulse Winding Test (IWT) Mode**




OUTPUT : It sets the required impulse voltage for testing.
WIDTH : It sets the waveform sampling rate. The range is 1~11 where 1 indicates high sampling rate and 11 indicate low sampling rate.
PULSE : It sets pulse number for testing.
AREA : It sets the boundary value for waveform area comparison.
(1) BEGIN: It sets the start for waveform area comparison
(2) END: It sets the end for waveform area comparison.
(3) LIMIT+: It sets the boundary high limit percentage for waveform area comparison. 0 indicates OFF.
(4) LIMIT-: It sets the boundary low limit percentage for waveform area comparison. 0 indicates OFF.
DIF-AREA : It sets the boundary for waveform differential area comparison.
(1) BEGIN: It sets the start for waveform differential area comparison
(2) END: It sets the end for waveform differential area comparison
(3) LIMIT+: It sets boundary percentage for waveform differential area comparison. 0 means OFF.
FLUTTER : It sets the boundary of flutter.
(1) BEGIN: It sets the start of flutter.
(2) END: It sets the cut-off point of flutter.
(3) LIMIT+: It sets the boundary of flutter. 0 indicates OFF.
LAPLAC : It sets the boundary of Laplancian.
(1) BEGIN: It sets the start of Laplancian.
(2) END: It sets the cut-off point of Laplancian.
(3) LIMIT+: It sets the boundary of Laplancian. 0 indicates OFF.
INTERNAL : It sets the status of EST Analyzer test output. Available settings are NONE/HI/LOW.
SCANNER1: It sets the output status of scanner test fixture 1. Available settings are NONE/HI/LOW.
SCANNER2: It sets the output status of scanner test fixture 2. Available settings are NONE/HI/LOW.

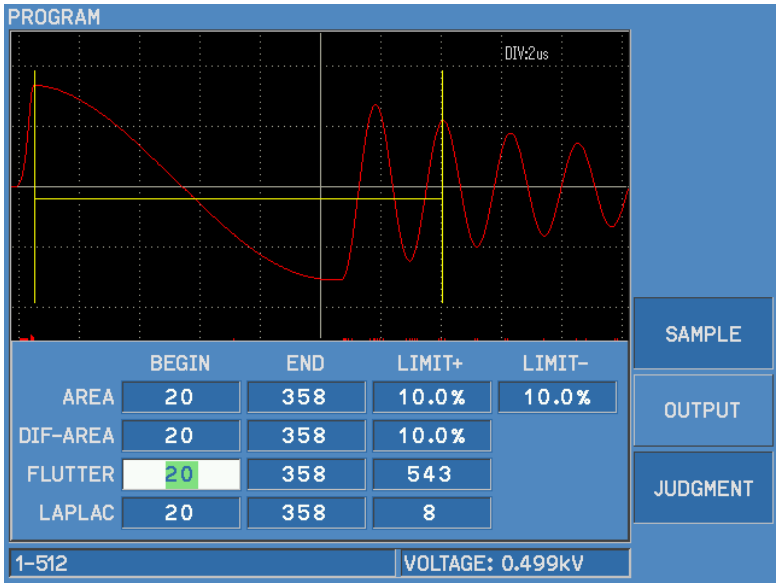
### Impulse Winding Test SAMPLE GET

When setting the program for IWT MODE, press Function Key [SAMPLE] to go to IWT MODE SAMPLE GET function setting as shown below.

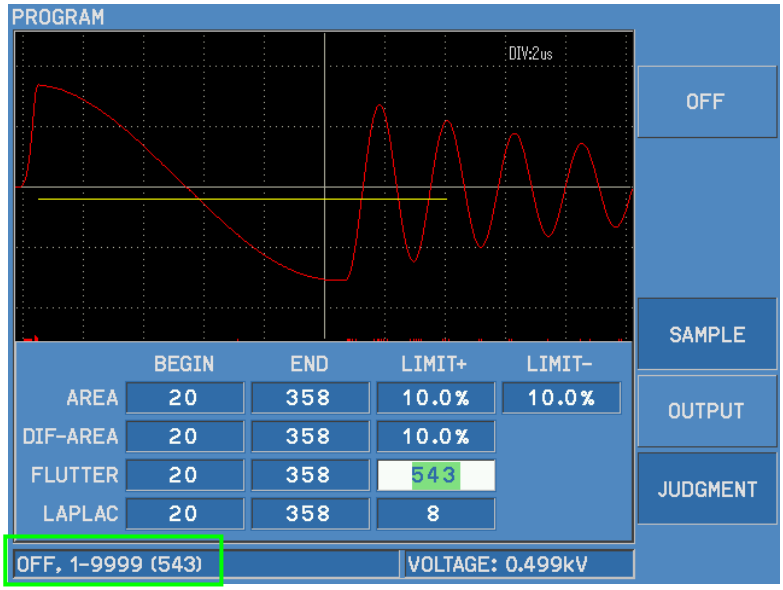



In the screen it can set the impulse [VOLTAGE], sampling rate [WIDTH] and [PULSE] number in IWT MDOE. The settings are the same as in PROGRAM screen. When the settings are done, connect the output to SAMPLE and press **START** to get the SAMPLE waveform as shown in red in the above figure.

Press Function Key [JUDGMENT] to show the screen below.




This screen sets the conditions of AREA, DIF-AREA, FLUTTER and LAPLAC as the judgment range for defect products in IWT MODE. [BEGIN] sets the start and [END] sets the cut-off point for judgment. When the cursor moves to [BEGIN] or [END], besides using the numeric keys to input the judgment range, it can use [◀] [▶] to set the range after pressing **ENTER** as the yellow line shown in the figure above.

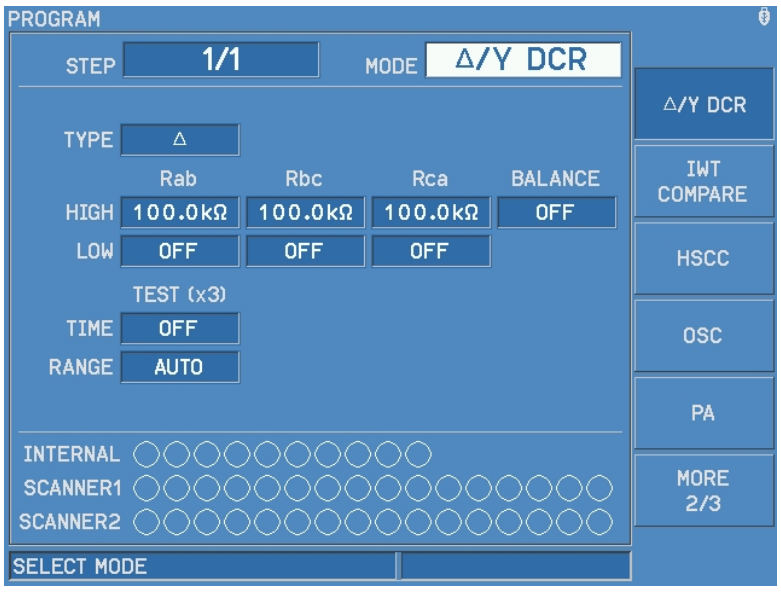



When the cursor moves to FLUTTER and LIMIT+ of LAPLAC, if the SAMPLE waveform has got, the lower left corner message line for input range will show the SAMPLE FLUTTER and LAPLAC reading in (xxx). This reading can be used as a reference for inputting the setting of LIMIT+ as the green box shown in the figure above.

**Notice**

1. The SAMPLE waveform of impulse winding testing will save to the memory along with the PROGRAM in IWT MODE.
2. Please Chapter 6 for detail description of impulse winding test mode.

### Δ/Y DC Resistance Test Mode (Δ/Y DCR)




TYPE : it sets the Δ/Y DC resistance measurement mode to Δ or Y mode.
(1) Δ mode
Rad: It sets the DC resistance judgment condition from measurement point A to B in Δ.
HIGH: It sets the high limit of Rab DC resistance.

LOW: It sets the low limit of Rab DC resistance. The value is smaller than insulation resistance high limit or OFF.

Rbc: It sets the DC resistance judgment condition from measurement point B to C in Δ.
HIGH: It sets the high limit of Rbc DC resistance.
LOW: It sets the low limit of Rbc DC resistance. The value is smaller than insulation resistance high limit or OFF.

Rca: It sets the DC resistance judgment condition from measurement point C to A in Δ.
HIGH: It sets the high limit of Rca DC resistance.
LOW: It sets the low limit of Rca DC resistance. The value is smaller than insulation resistance high limit or OFF.

(2) Y mode

R1: It sets the DC resistance judgment condition of R1 in Y mode.
HIGH: It sets the high limit of R1 DC resistance.
LOW: It sets the low limit of R1 DC resistance. The value is smaller than insulation resistance or OFF.

R2: It sets the DC resistance judgment condition of R2 in Y mode.
HIGH: It sets the high limit of R2 DC resistance.
LOW: It sets the low limit of R2 DC resistance. The value is smaller than insulation resistance or OFF.

R3: It sets the DC resistance judgment condition of R3 in Y mode.
HIGH: It sets the high limit of R3 DC resistance.
LOW: It sets the low limit of R3 DC resistance. The value is smaller than insulation resistance or OFF.

BALANCE : It sets the Δ/Y DCR BALANCE judgment condition. When the difference of DCR maximum and minimum is larger than the setting of DCR Balance, it is judged as Balance Fail. When the difference of DCR maximum and minimum is smaller than DCR Balance, it is judged as Pass.

TEST : It set the Δ/Y DCR test time. Since Δ/Y DCR needs to test 3 points to get actual resistance, thus the test time is the set time multiplies 3 times.

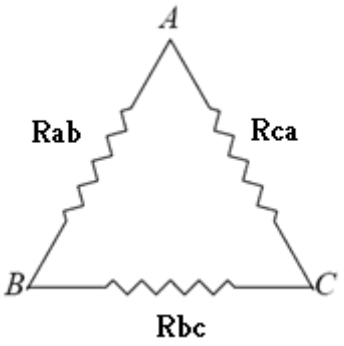
RANGE : It sets the resistance test range for DC resistance. AUTO means to switch the range automatically.

INTERNAL : It sets the output terminal status of this EST Analyzer. It can set Δ/Y DCR to measure point A or B or C. If more than 2 scanning test points are set to the same measurement points (such as setting 2 measurement A points), it means these two measurement points are parallel.

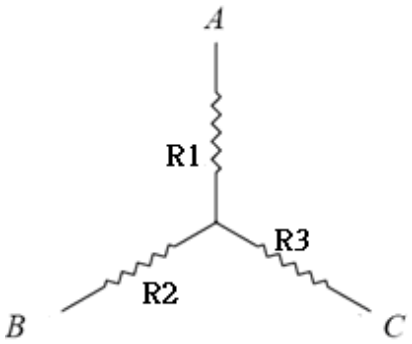
SCANNER1: It sets the output terminal status of external Scanner 1. It can set Δ/Y DCR to measure point A or B or C. If more than 2 scanning test points are set to the same measurement points (such as setting 2 measurement A points), it means these two measurement points are parallel.

SCANNER2: It sets the output terminal status of external Scanner 2. It can set Δ/Y DCR to measure point A or B or C. If more than 2 scanning test points are set to the same measurement points (such as setting 2 measurement A points), it means these two measurement points are parallel.

The measurement circuit diagrams of Δ and Y modes are shown below. The status of output terminals A B C are set to the A or B or C in the Δ or Y mode measurement circuit diagram below.

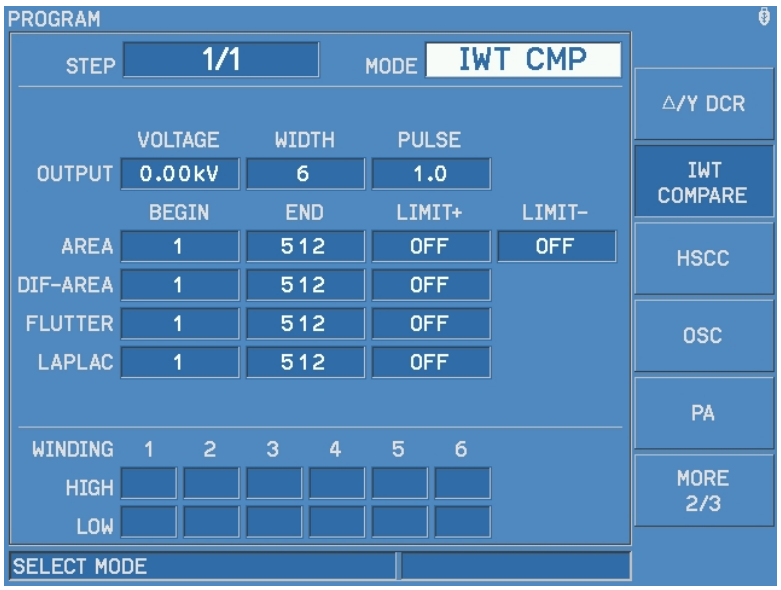



Δ Mode Measurement Diagram




Y Mode Measurement Diagram

**IWT COMPARE**




OUTPUT : It sets the impulse voltage required for testing.

WIDTH : It sets the waveform sampling rate. The range is 1~11 in which 1 is high sampling speed and 11 is low sampling speed.

PULSE : It sets the pulse number for testing.

AREA : It sets the waveform area comparison limit.

(1) BEGIN: It sets the start for waveform area comparison.
(2) END: It sets the end for waveform area comparison.
(3) LIMIT+: It sets the waveform area comparison percentage for high limit. 0 is OFF.
(4) LIMIT-: It sets the waveform area comparison percentage for low limit. 0 is OFF.

DIF-AREA : It sets the comparison of waveform area difference limit

(1) BEGIN: It sets the start for waveform area difference comparison.
(2) END: It sets the end for waveform area difference comparison.
(3) LIMIT+: It sets the comparison percentage for waveform area difference comparison. 0 is OFF.

FLUTTER : It sets the flutter limit.

(1) BEGIN: It sets the start of flutter.
(2) END: It sets the end of flutter.
(3) LIMIT+: It sets the limit of flutter. 0 is OFF.

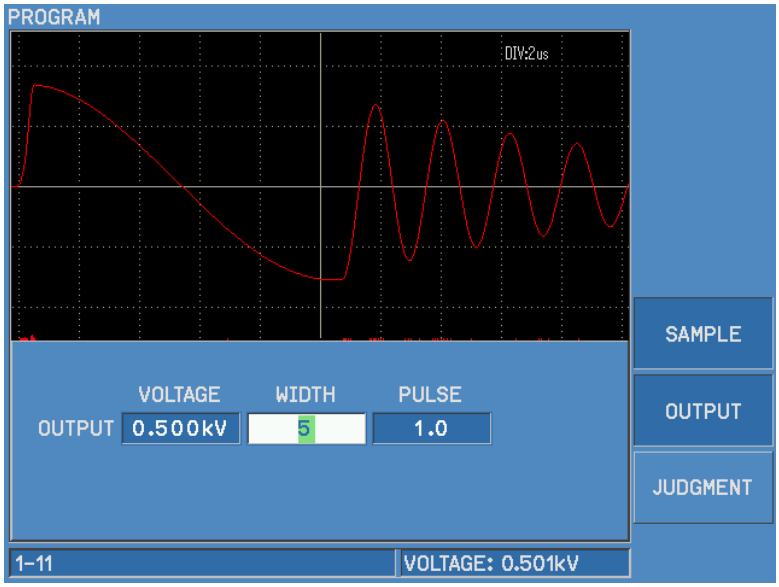
LAPLAC : It sets the LAPLACIAN limit.
(1) BEGIN: It sets the start of LAPLACIAN.
(2) END: It sets the end of LAPLACIAN.
(3) LIMIT+: It sets the limit of LAPLACIAN. 0 is OFF.
HIGH : It sets the HIGH scan channel for IWT Compare.
LOW : It sets the s LOW can channel for IWT Compare.

**Notice**

The numbers inputted for scan channels are:
1-10 indicate CH1~CH10 for EST Analyzer output (INTERNAL).
101-116 indicate CH1~CH16 of the SCANBOX (SCANNER1).
201-216 indicate CH1~CH16 of the SCANBOX (SCANNER2).
Function Key [OFF] can cancel the set channel.

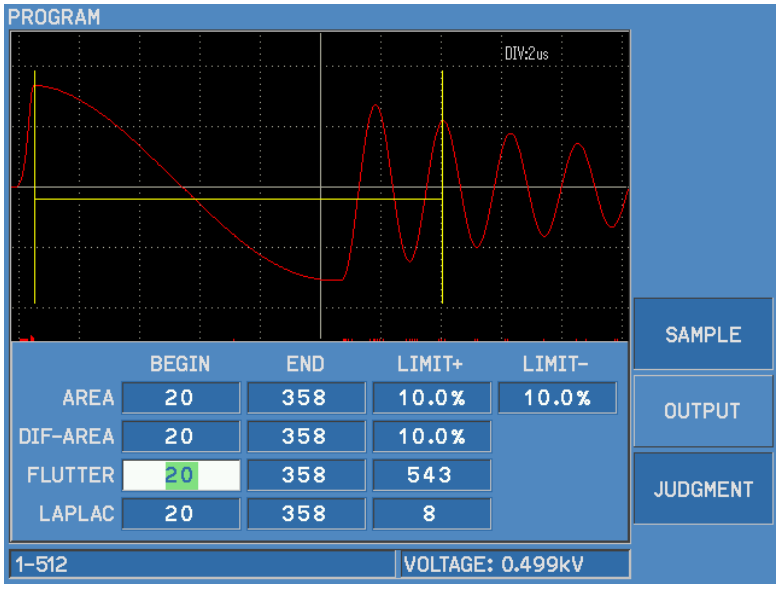
**IWT COMPARE SAMPLE GET**

When setting the parameters for IWT COMPARE, press Function Key [SAMPLE] to enter into the IWT COMPARE SAMPLE GET functions as the figure shown below.

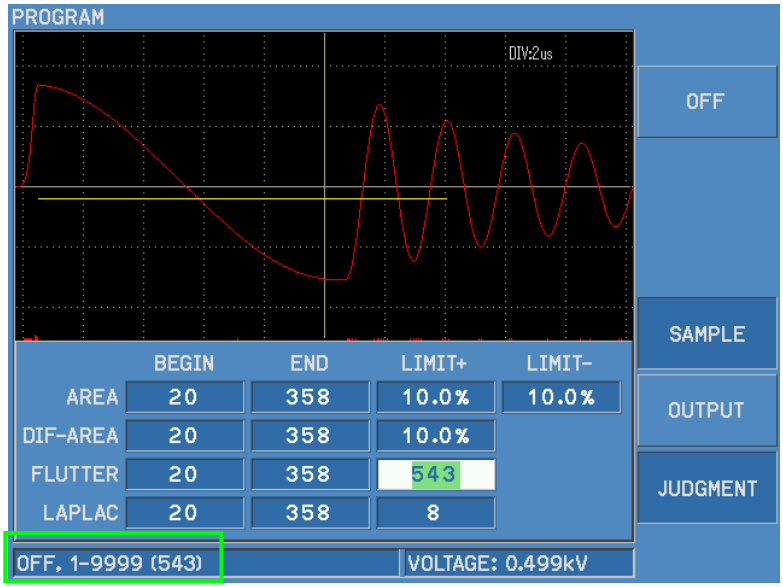



This screen sets the IWT COMPARE impulse [VOLTAGE], sampling rate [WIDTH] and no. of [PULSE]. The functions are the same as the PROGRAM setting screen. When the settings are done and the output is connected to SAMPLE, press **START** to get the SAMPLE waveform as the red waveform shown in the above figure.

Press Function Key [JUDGMENT] and the screen shown as below.




This screen sets the IWT MODE judgment ranges under the conditions of AREA, DIF-AREA, FLUTTER and LAPLAC. [BEGIN] is the start for judgment while [END] is the end. When the cursor moves to [BEGIN] or [END], beside using the numeric keys to enter the range, it can press **ENTER** and use [◀] [▶] to set the range as the yellow line shown in the above figure.

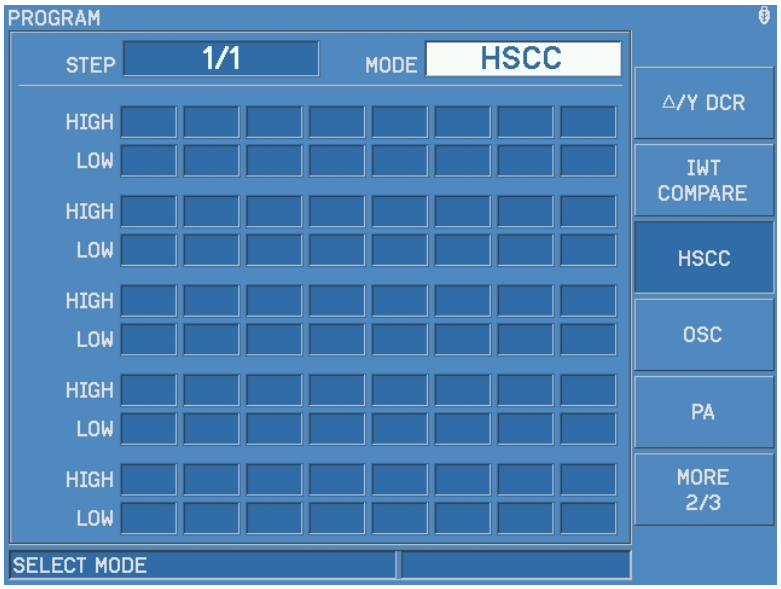



When the cursor moves to the LIMIT+ of FLUTTER and LAPLAC, if the SAMPLE waveform has got, the input range on message line at the lower left corner will show the reading of SAMPLE FLUTTER and LAPLAC in (xxx) which can be used to set the LIMIT+ as the green box and highlight shown above.

**Notice**

1. The IWT COMPARE SAMPLE waveform will save to the memory along with the data of IWT COMPARE PROGRAM.
2. Refer to Chapter 6 for the detail description of IWT COMPARE.

### High Speed Contact Check (HSCC)

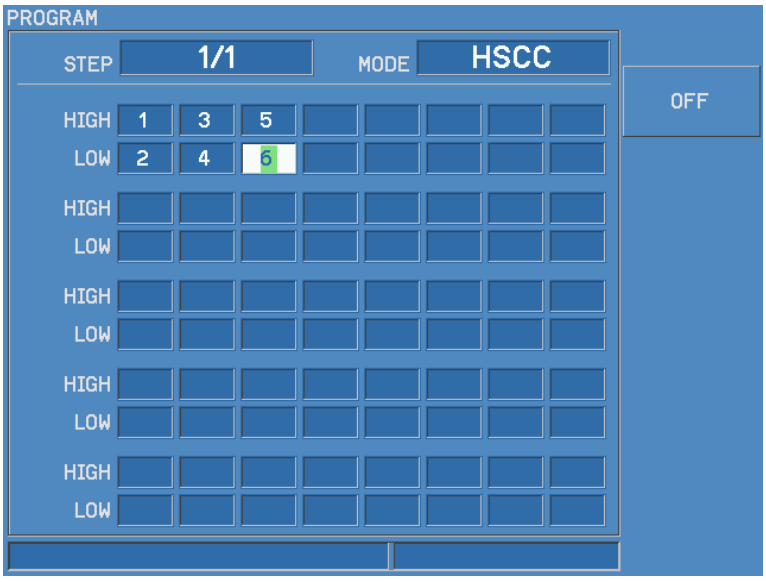



HIGH : It sets the HIGH end scan channel for High Speed Contact Check.
LOW : It sets the LOW end scan channel for High Speed Contact Check.

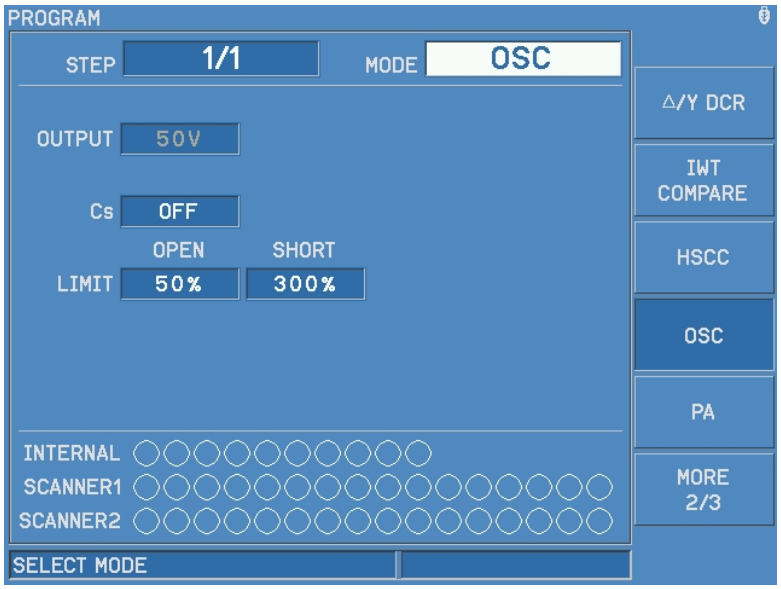
**Notice**

The numbers inputted for scan channels are:
1-10 indicate CH1~CH10 for EST Analyzer output (INTERNAL).
101-116 indicate CH1~CH16 of the SCANBOX (SCANNER1).
201-216 indicate CH1~CH16 of the SCANBOX (SCANNER2).
Function Key [OFF] can cancel the set channel.

As the figure shown below, the test is only PASS when the CH1 is opened with CH2, CH3 is opened with CH4 and CH5 is opened with CH6; otherwise it will be OPEN FAIL.



**Open/Short Check (OSC) Test Mode**




Cs : It sets the standard capacitance for Open/Short Check mode. If the standard capacitance is known already, enter it directly or use SAMPLE TEST to get a sample. See detail description of sampling in section 4.7.4.

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

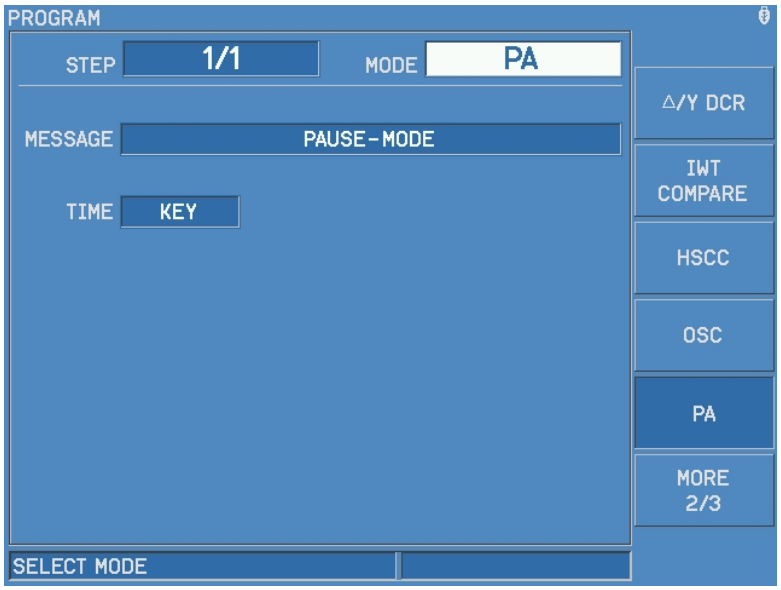
SHORT : It sets the SHORT condition for test result judgment. (Compare the test readings with the read standard capacitance [Cs].)

INTERNAL : It sets the status of EST Analyzer test output. Available settings are NONE/HI/LOW.

SCANNER1: It sets the output status of scanner test fixture 1. Available settings are NONE/HI/LOW.

SCANNER2: It sets the output status of scanner test fixture 2. Available settings are NONE/HI/LOW.

**Pause (PA) Mode**



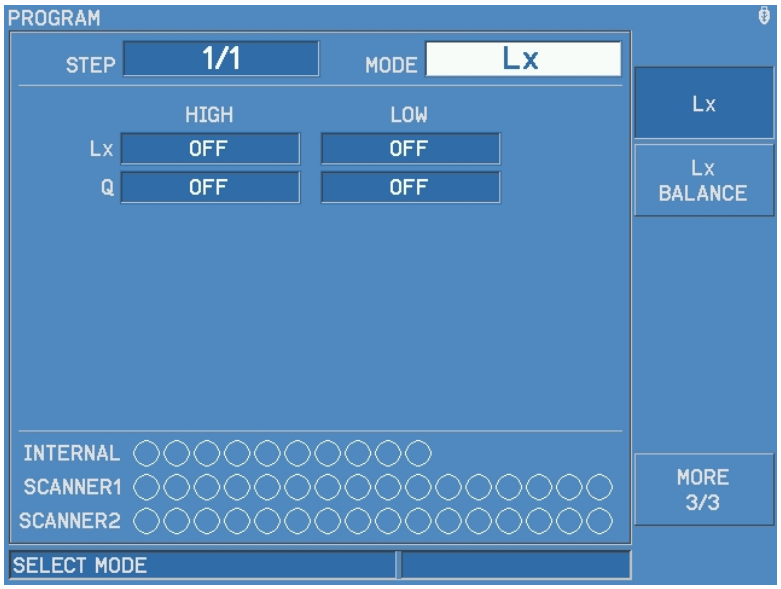
MESSAGE : It sets the message to show on the screen in pause mode for maximum 15 characters.

TIME : It sets the behavior of PAUSE MODE.

(1) Set to KEY: Press the Function Key [KEY] to set and the pause mode ends until the START key on panel is pressed or START signal from HANDLER card (OPTION) is triggered.

(2) Set to 0.1~999sec: The pause mode ends when it reaches the time set for pause.

**Inductance Mode (Lx)**




Lx : It sets the inductance HIGH/LOW limit. The HIGH limit is -99.999MH~99.999MH or OFF, while the LOW limit is -99.999MH~99.999MH or OFF.

Q : It sets the quality faction high/low limit. The maximum range (HIGH) is -99999~99999 or OFF, while the minimum range (LOW) is -99999~99999 or OFF.

INTERNAL : It sets the status of EST Analyzer test output. Available settings are NONE/HI/LOW.

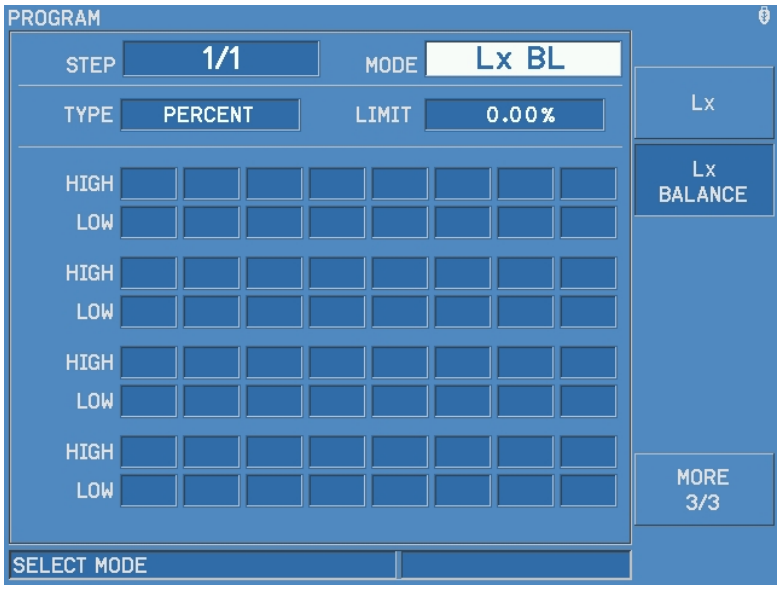
SCANNER1: It sets the output status of scanner test fixture 1. Available settings are NONE/HI/LOW.

SCANNER2: It sets the output status of scanner test fixture 2. Available settings are NONE/HI/LOW.

**Notice**

When setting the HIGH/LOW limits for Lx and Q, if the HIGH limit is smaller than the LOW limit, both of them are the HIGH limits; and if the LOW limit is bigger than the HIGH limit, then both of them are LOW limits.

**Inductance Balance Mode (Lx BALANCE)**




TYPE : It sets the error display of inductance and inductance average in percentage or absolute value:

1. Percentage: $\frac{|\text{Inductance} - \text{Inductance Average}|}{\text{Inductanceaverage}}$
2. Absolute value: $|\text{Inductance} - \text{Inductance Average}|$

LIMIT : It sets the high limit of error percentage or absolute value.
HIGH : It sets the HIGH scan channel for high speed contact check.
LOW : It sets the LOW scan channel for high speed contact check.

**Notice**

The numbers inputted for scan channels are:
1-10 indicate CH1~CH10 for EST Analyzer output (INTERNAL).
101-116 indicate CH1~CH16 of the SCANBOX (SCANNER1).
201-216 indicate CH1~CH16 of the SCANBOX (SCANNER2).
Function Key [OFF] can cancel the set channel.

## 4.6.4 Temperature Measurement

The temperature measurement function is available for 19036 when the temperature interface and temperature probe are purchased for use. It can measure the DUT and environment temperature. The temperature measurement function of 19036 needs to work with appropriate interface and probe purchased for application.

### 4.6.4.1 Temperature Measurement Interface

The temperature measurement interface is installed on the 19036 rear panel and uses the hole of TC SENSOR as measurement input in the figure below:

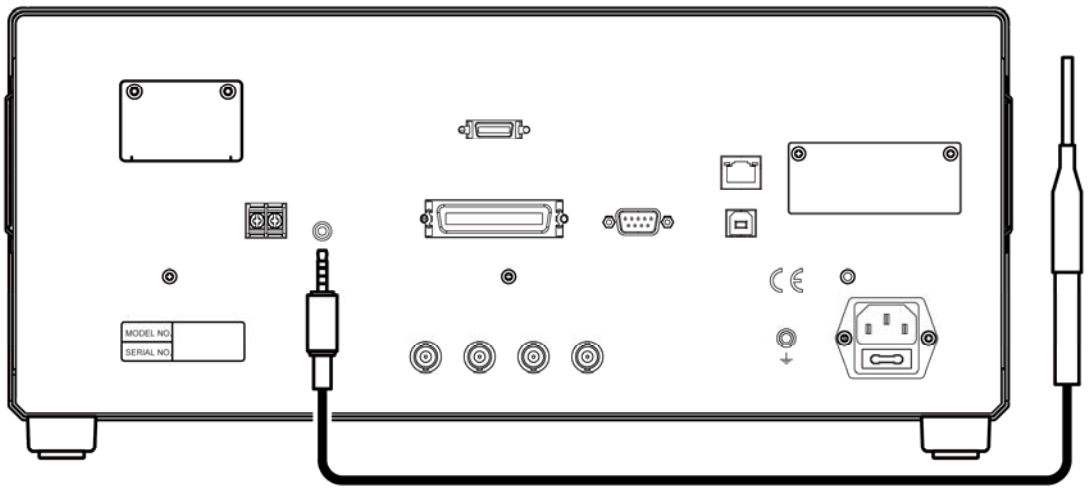



Figure 4-3

### 4.6.4.2 Temperature Probe

The standard temperature probe of 19036 is a PT100 Model platinum temperature sensor with a 1.5 meters cable. The probe head can measure the temperature from -50°C ~300°C. When using insert its plug to the TC SENSOR hole on the 19036 rear panel. The following figure shows the temperature probe.

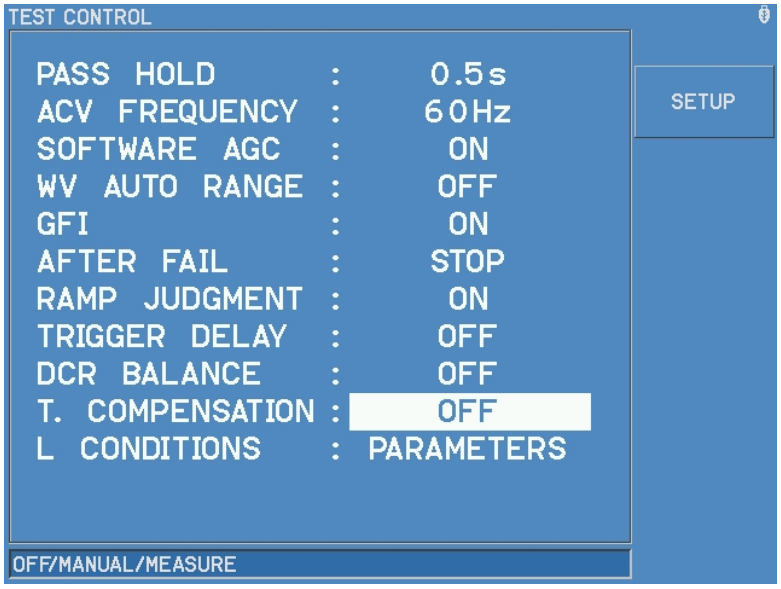
**A165015 Temperature Probe**

Figure 4-4

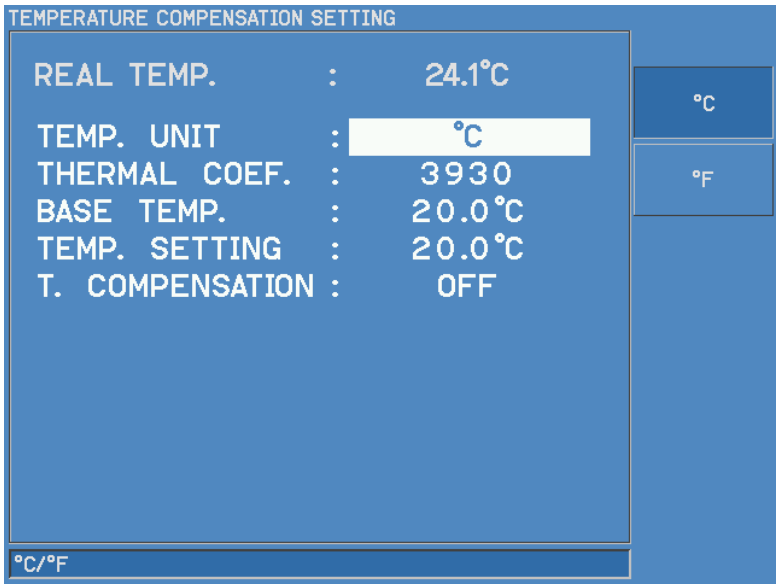
### 4.6.4.3 Setting Temperature Compensation

**Procedure:**

1. When the 19036 is powered on, press **SYSTEM** in any screen and move the highlight to TEST CONTROL, press **ENTER** to enter into TEST CONTROL setting screen. Next move the highlight to T. COMPENSATION and press Function Key [SETUP] to enter into temperature compensation setting as shown below.




2. The following screen shows the temperature compensation settings.




3. The table below lists the setting items of temperature compensation and their description:

| Items | Range | Default | Description |
|---|---|---|---|
| REAL TEMP. | | | It shows the temperature at present. It shows ----- if the hardware does not exist. |
| TEMP. UNIT | °C /°F | °C | It is the temperature unit. |
| THERMAL COEFF. | 0~9999ppm | 3930ppm | It is the temperature coefficient. |
| BASE TEMP. | -10°C ~99.9°C (14°F ~211.8°F) | 20°C (68°F) | It is standard site temperature. |
| TEMP. SETTING | -10°C ~99.9°C (14°F ~211.8°F) | 20°C (68°F) | It is the environment temperature. Use this parameter when set to MANUAL. |
| T. COMPENSATION | OFF/MANUAL/ MEASURE | OFF | It turns on the temperature compensation function. OFF means not |

| | | | |
|---|---|---|---|
| | | | to execute temperature compensation, MANUAL means to use temperature set by TEMP. SETTING for compensation, while MEASURE means to use the measured temperature for compensation. |

4. There are three modes available for selection when in the temperature compensation screen. They are T. COMPENSATION: OFF, T. COMPENSATION: MANUAL and T. COMPENSATION.: AUTO as described below:

   OFF: It closes the temperature compensation function; therefore, it will not show the temperature measurement. The 19036 panel shows the DUT's resistance under the measurement temperature at the time when OFF is set.

   MANUAL: This function opens for users to input the temperature t(°C). Other thermos can be used to enter the environment temperature at present when the temperature probe is not available. The value is adjusted by numeric keys. The 19036 panel shows the resistance that converted to the base temperature.

   MEASURE : This function needs to work with temperature probe. It will perform measurement automatically and show the environment temperature. The 19036 panel shows the resistance at what time the present environment temperature converted to the base temperature (the temperature set in BASE TEMP. under T. COMPENSATION) when AUTO is set.

#### 4.6.4.4 Usage of DCR Mode Temperature Compensation DCR Mode

The function of temperature compensation is to use the wire such as the copper wire or aluminum wire to get the resistance of a certain temperature (for instance 30°C is100Ω) and a known temperature coefficient (such as 3930PPM ) to calculate the resistance when at another temperature (such as 20°C).

1. Formula of Temperature Compensation

   $Rt0 = Rt/\{ 1+ \alpha t0^* (t-t0) \}$

   where

   Rt0: It is the base temperature resistance to be converted (default is 20°C.)
   Rt: It is the resistance measured under environment temperature.
   αt0: It is the temperature coefficient of base temperature.
   t(°C): It is environment temperature.
   t0 (°C): It is the base temperature to be converted.

2. Example:

   In this example the environment temperature is 30°C and the measured copper wire resistance is 100 Ω. To calculate the resistance at the temperature 20°C, users need to input the temperature to be converted (20°C) and the temperature coefficient (when the conductivity coefficient closes to 1 the temperature coefficient of copper is 3930 ppm.)

The calculation condition is that the resistance of copper wire measured is 100Ω under the environment temperature 30°C. The process of converting the 3930 ppm temperature coefficient to the resistance at 20°C is shown below.

R*t*0: unknown resistance
R*t*: 100Ω
*t*0: 3930 ppm
t(°C): 30 °C
t0 (°C): 20°C

R*t*0 = R*t*/{1+ α*t*0 * (t-t0)} = 100 / {1 + (3930 e-6) * (30 - 20)} =96.21Ω
Now the 19036 shows the resistance is 96.21Ω when at 20°C.

### 4.6.4.5 Description of Settings

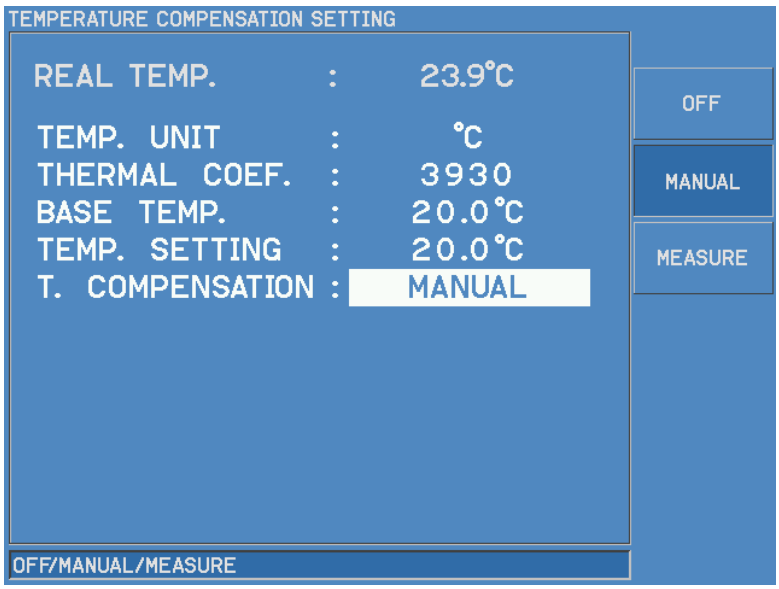
The setting of temperature coefficient is to set the base temperature for converting resistance and the wire temperature coefficient to get the resistance at base temperature.

**Procedure:**

1. Press **SYSTEM** → [TEST CONTROL]→ [T. COMPENSATION] to go to Temperature Compensation screen.
2. Move the highlight to THERMAL COEFF. and the press numeric keys to adjust the wire temperature coefficient. Then press **ENTER**.
3. Move the highlight to BASE TEMP. and press the numeric keys to adjust the base temperature to be converted. Then press **ENTER**.

**Setting MANUAL Mode:**

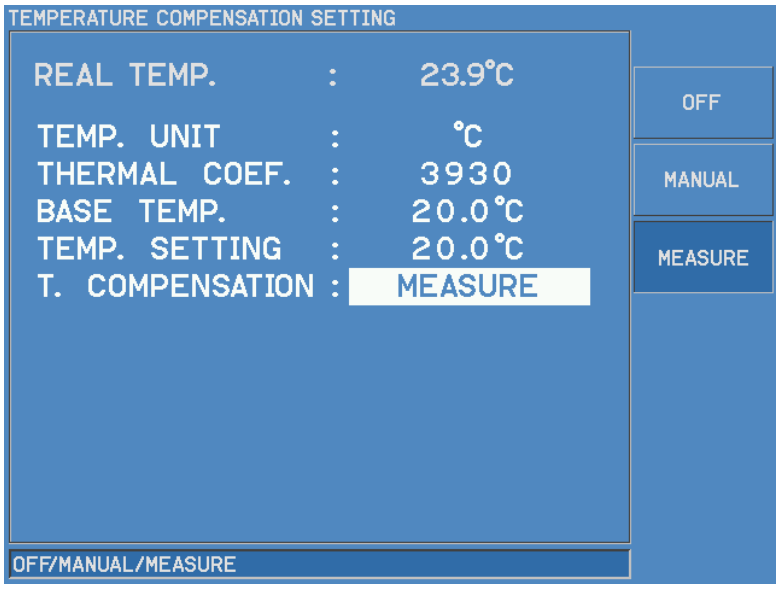
Press **SYSTEM** → [TEST CONTROL] →[T. COMPENSATION] and select MANUAL for [T. COMPENSATION], the temperature compensation of DCR measurement in 19036 is set to MANUAL mode.



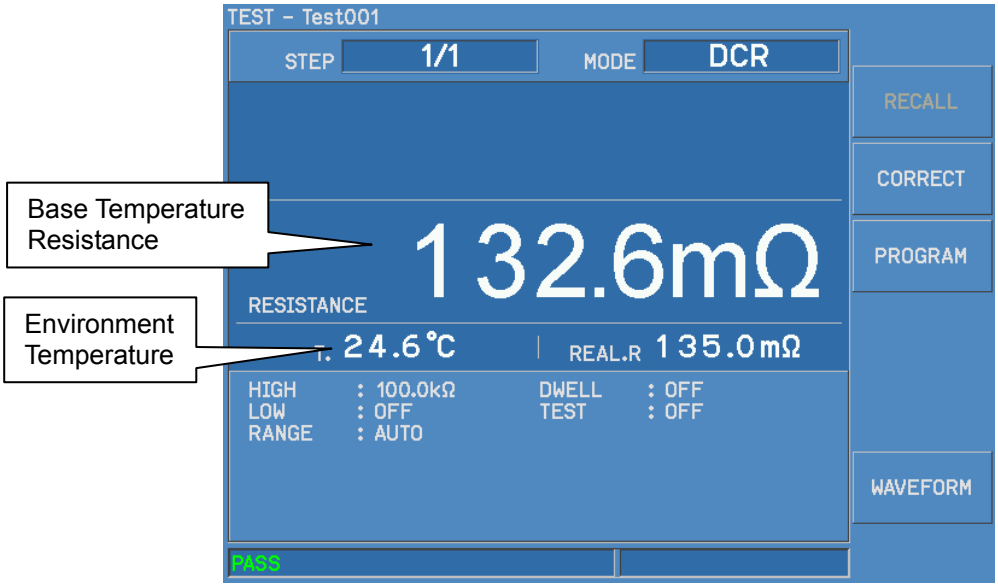
Please input the environment temperature for TEMP. SETTING. The 19036 panel shows the DCR mode measured resistance that is the one of base temperature after conversion.

**Setting MEASURE Mode:**

If the 19036 is installed with temperature interface and probe, it will measure and show the environment temperature automatically. Ensure the 19036 has installed the temperature interface and probe, and press **SYSTEM** → [TEST CONTROL]→ [T. COMPENSATION]. Select AUTO for [T. COMPENSATION], the temperature compensation of DCR measurement in 19036 is set to MEASURE mode.



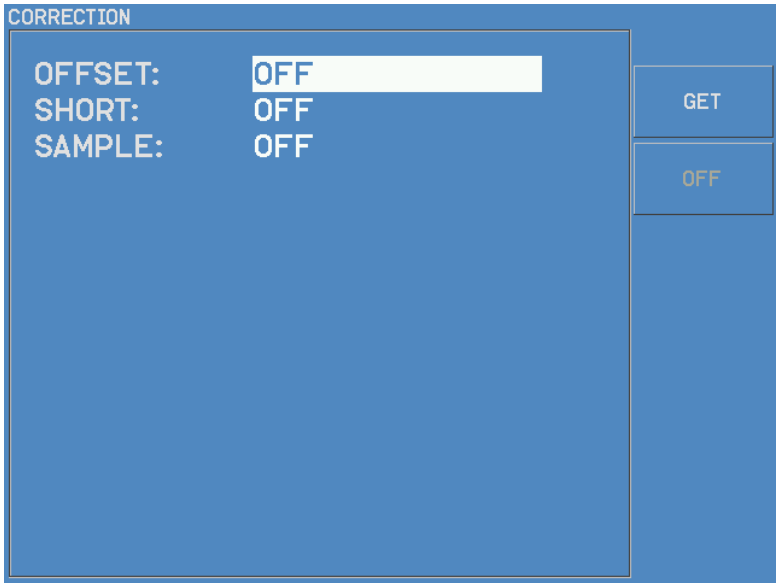

The 19036 panel shows the DCR mode measured resistance that is the one at base temperature after conversion.



# 4.7 Using Open/Short Offset or Correction

## 4.7.1 Entering Open/Short Offset or Correction Screen

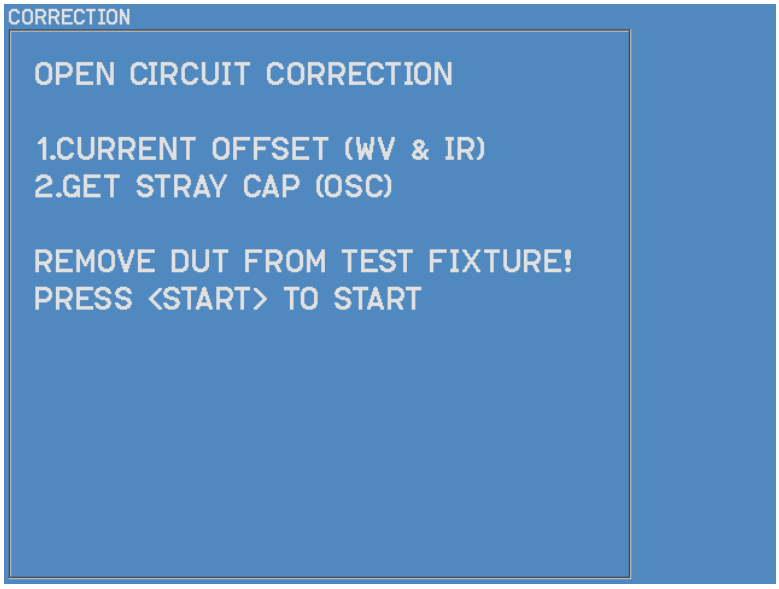
1. Press Function Key [CORRECT] in power on screen to go to Open/Short Offset or CORRECTION screen as shown below:




2. When the item in left area shows ON, it means the item is done and when OFF appears, it means the item is not done yet. If NO NEED is appeared, it indicates there is no need to execute this item.
3. Press ▲ ▼ to move the highlight to the desired function and use Function Key [GET] to select the function.

## 4.7.2 Using OPEN CIRCUIT

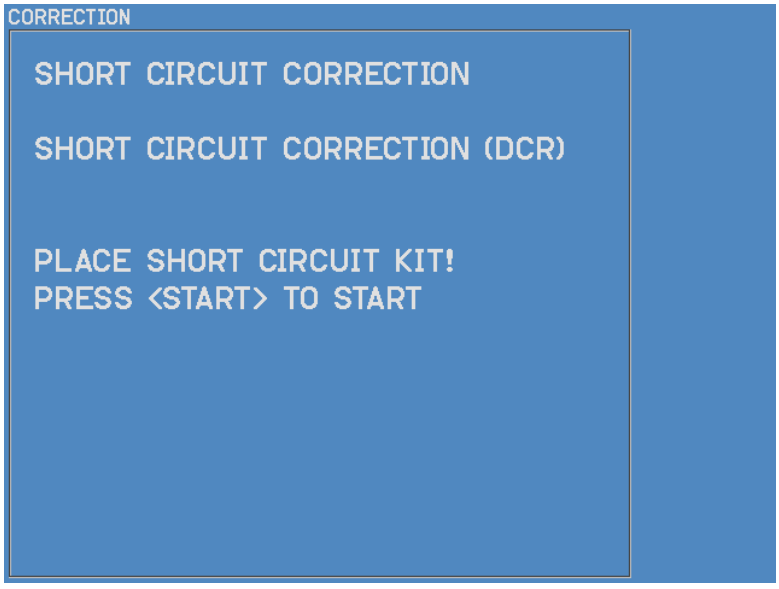
1. When in CORRECTION screen, press ▲ ▼ to move the highlight to OFFSET and press Function Key [GET] to go to OPEN CIRCUIT screen as shown below:




2. OPEN CIRCUIT is to offset the leakage current of AC / DC / IR MODE test lead and fixture as well as to offset the leakage capacitance in OSC MODE.
3. Remove the fixture from the DUT and press **START** to offset the leakage current or capacitance for related test items.

## 4.7.3 Using SHORT CIRCUIT

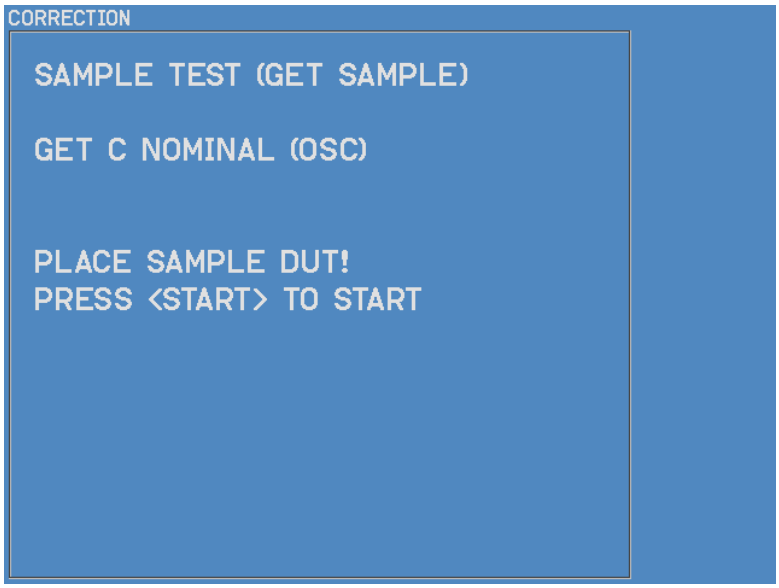
1. When in CORRECTION screen, press ▲ ▼ to move the highlight to SHORT and press Function Key [GET] to go to SHORT CIRCUIT screen as shown below:




2. SHORT CIRCUIT is to do short circuit offset for DCR.
3. Short-circuit the DCR test fixture and press **START** to do DCR short circuit offset.

### 4.7.4 Using SAMPLE TEST

1. When in CORRECTION screen, press ▲ ▼ to move the highlight to SAMPLE and press Function Key [GET] to go to SAMPLE TEST screen as shown below:




2. SAMPLE TEST is to read the standard values as the DUT judgment criteria for test in OSC mode.
3. Connect the DUT as test standard in OSC mode, press **START** to read the standard value for test in OSC mode.

**Notice** Please refer to section 4.6.3 for detail description of SAMPLE GET in IWT mode.

## 4.8 Setting & Using SUB Step

### 4.8.1 Setting SUB Step

Follow the steps below to set the Sub Step

1. Press Function Key [PROGRAM] and the reversed cursor stops at the STEP to add SUB. Press Function Key [MORE 1/2] and [NEW SUB], it will appear the 1st SUB setting screen of the STEP.
2. Follow the step above to set the 2nd and 3rd SUB STEP and so forth.
3. The message displayed in STEP indicates the setting screen of STEP/SUB, for instance **"2.1/3+5"** in the figure below, **2.1** means the setting screen is the 1st SUB of 2nd STEP and **3+5** means there are 3 STEP/5 SUB.

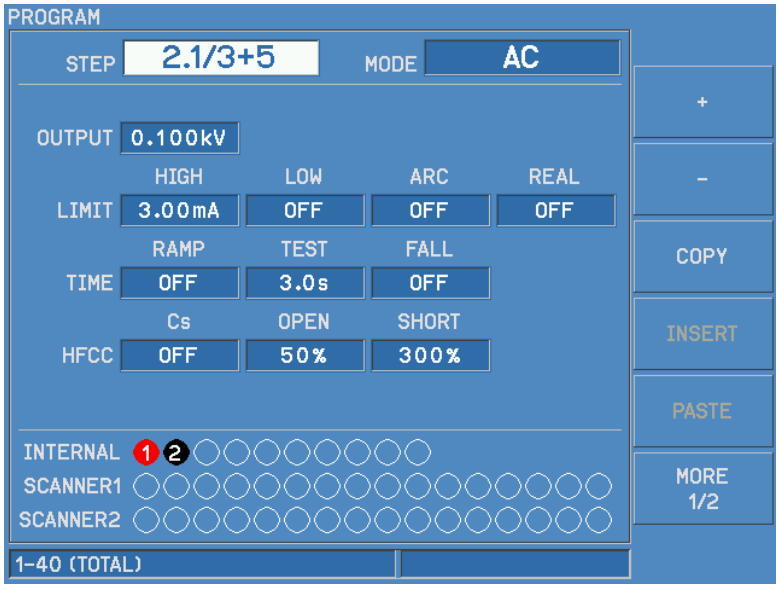



Table 4-5 Correlation of SUB STEP and AFTER FAIL Setting

| Setting TEST CONTROL | Test Result | Execution Status |
|---|---|---|
| Set AFTER FAIL to STOP | Main Step judges as Fail | It starts Sub Step test. |
| | | It stops test when Sub Step is judged as Fail. |
| | | It does not start the next Main Step test when all Sub Steps are done. (All Sub Steps are judged as Pass). |
| | Main Step judges as Pass | It does not start Sub Step test. |
| | | It starts the next Main Step test. |
| Set AFTER FAIL to CONTINUE | Main Step judges as Fail | It starts the Sub Step test. |
| | | It continues to test the next Sub Step when the Sub Step is judged as Fail. |
| | | It starts the next Main Step test. |
| | Main Step judges as Pass | It does not start the Sub Step test. |
| | | It starts the next Main Step test. |

4. The application of SUB STEP
   The Main Step can test multiple DUTs at the same time. When the Main Step is judged as Fail, it will execute the Sub Step of this Main Step to a more complete judgment result. If the Main Step is judged as Pass then it will not conduct the Sub Step of this Main Step to reduce the test time.

# 4.9 Conducting the Test

## 4.9.1 Connecting the DUT

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

## 4.9.2 Test Procedure for AC/DC

1. Connect the DUT properly.
2. The standby menu shows:

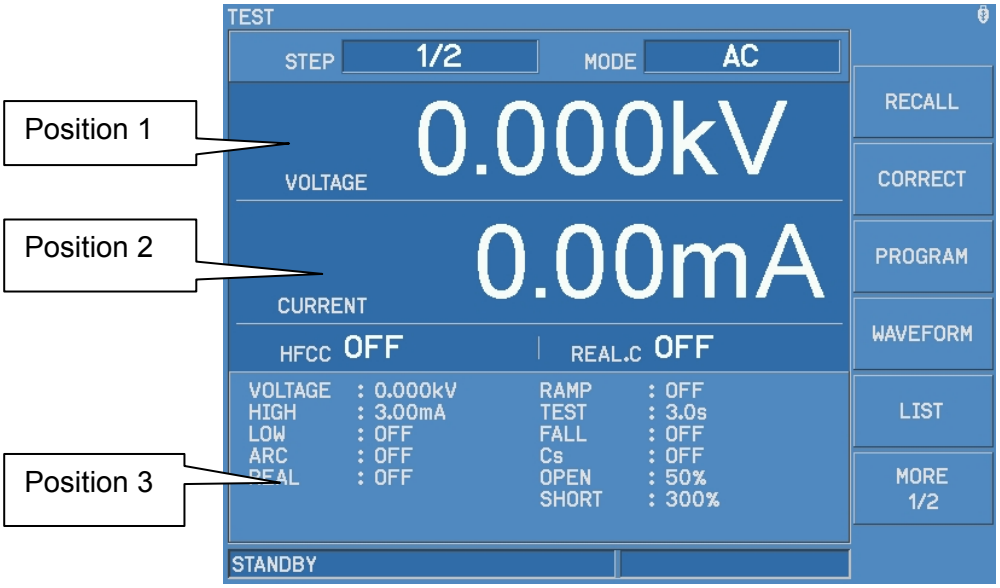



Illustration:
STEP 1/2 means there are 2 test steps and it is running the 1st test step at present. AC indicates the test mode. "Position 1" indicates the set voltage, "Position 2" is the high limit set for current, while "Position 3" is the test time. The status line shows the test result.

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 it starts to output voltage and the DANGER LED is on. The status line shows "UNDER TEST" to warn it is in test state with voltage output. "Position 1" will show the output voltage value, "Position 2" will show the current readings and the timer on status line will start to count down.

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

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

FAIL State:

| Test Result | Meaning |
|---|---|
| HIGH FAIL | The current/resistance measured exceeds the range or the set high limit. |
| LOW FAIL | The current/resistance measured exceeds the range or the set low |

| | |
|---|---|
| | limit. |
| ARC FAIL | The current arc exceeds the high limit. |
| GFI FAIL | The grounding fails and interrupted. |
| REAL FAIL | The real current measured exceeds the range or the set high limit. |
| OUTPUT FAIL | The output voltage is unable to reach 95% of set value. |
| SHORT | The current/resistance measured exceeds the hardware high limit. |

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

## 4.9.3 Test Procedure for IR

1. Connect the DUT properly.
2. The standby menu shows:

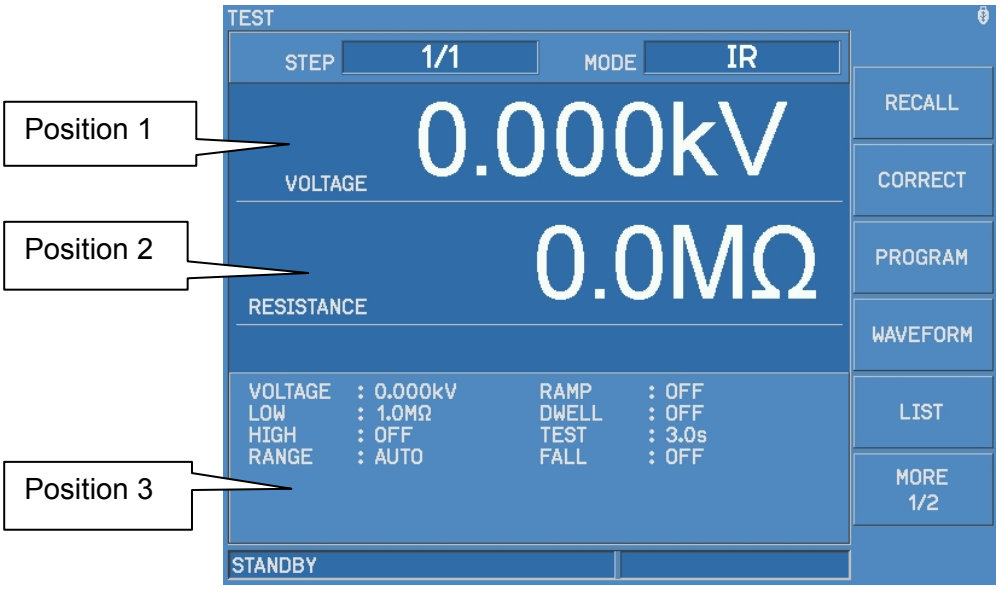



Illustration:
IR means it is in Insulation Resistance test mode. "Position 1" is the output voltage at present and "Position 2" is the read resistance at present, while "Position 3" shows the PROGRAM setting. The status line shows the test result.

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 it starts to output voltage and the DANGER LED is on. Next the test line will show the test result and "Position 1" shows the voltage output value. "Position 2" shows the current reading and the timer on status line will start to count down.

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

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

   FAIL State:

| Test Result | Meaning |
|---|---|
| HIGH FAIL | The current/resistance measured exceeds the range or the set high limit. |
| LOW FAIL | The current/resistance measured exceeds the range or the set low limit. |
| GFI FAIL | The grounding fails and interrupted. |
| OUTPUT FAIL | The output voltage is unable to reach 95% of set value. |
| SHORT | The current/resistance measured exceeds the hardware high limit. |

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

## 4.9.4 Test Procedure for DCR

1. Connect the DUT properly.
2. The standby menu shows:

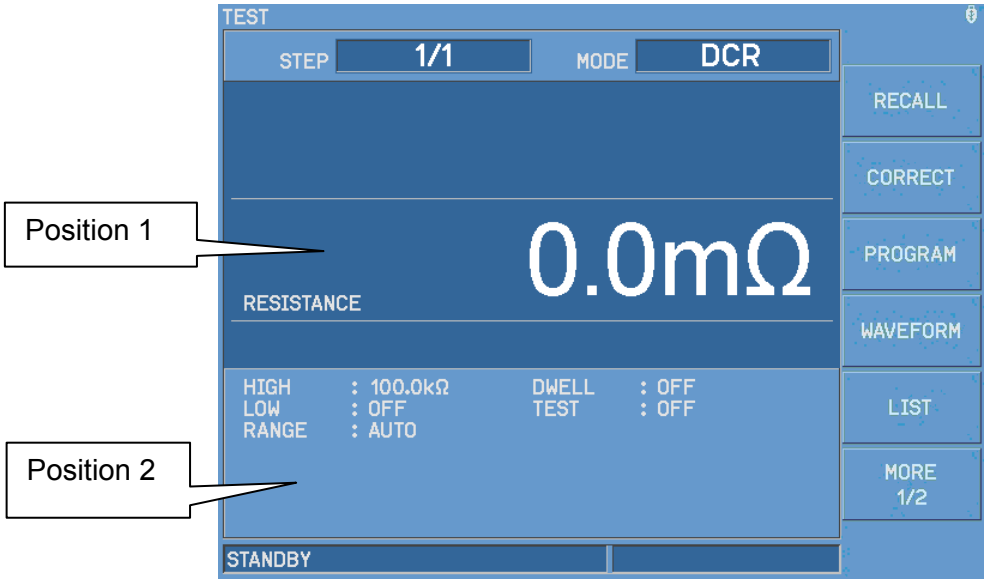


Illustration:
DCR means it is in DC Resistance measurement mode. “Position 1” is the reading of DCR at present and “Position 2” is the PROGRAM setting. The test result is on the status line.

**Note** When the test time sets to OFF, no test time is displayed on the status line.

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 to output voltage and the DANGER LED is on. Next the status line will show the test result and “Position 1” shows the DCR reading.

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

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

Fail State:

| Test Result | Meaning |
|---|---|
| HIGH FAIL | The measured DC resistance exceeds the high limit. |
| LOW FAIL | The measured DC resistance exceeds the low limit. |
| PROBE FAIL | It is unable to measure the temperature. |
| BALANCE FAIL | The measured DC resistance is not balanced. |

**Note**
1. Every time the wiring material or fixture is changed for DCR measurement, be sure to run DCR SHORT CIRCUIT CORRECTION in advance to ensure the test accuracy.
2. Refer to 4.7.3 *Using SHORT CIRCUIT* for using DCR SHORT CIRCUIT CORRECTION.

## 4.9.5 Test Procedure for IWT

1. Connect the DUT properly.
2. The standby menu shows:

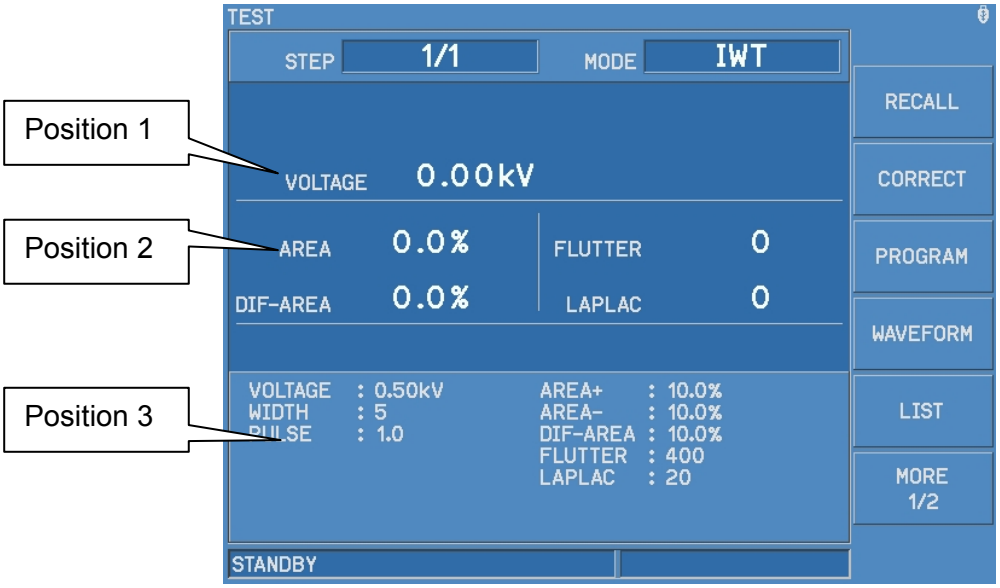



Illustration:
IWT means it is in impulse winding test mode. "Position 1" is the output voltage, "Position 2" is the condition test value for IWT judgment, while "Position 3" shows the PROGRAM setting. The test result is on the status line.

3. Press Function Key [WAVEFORM] and the screen displays as below:

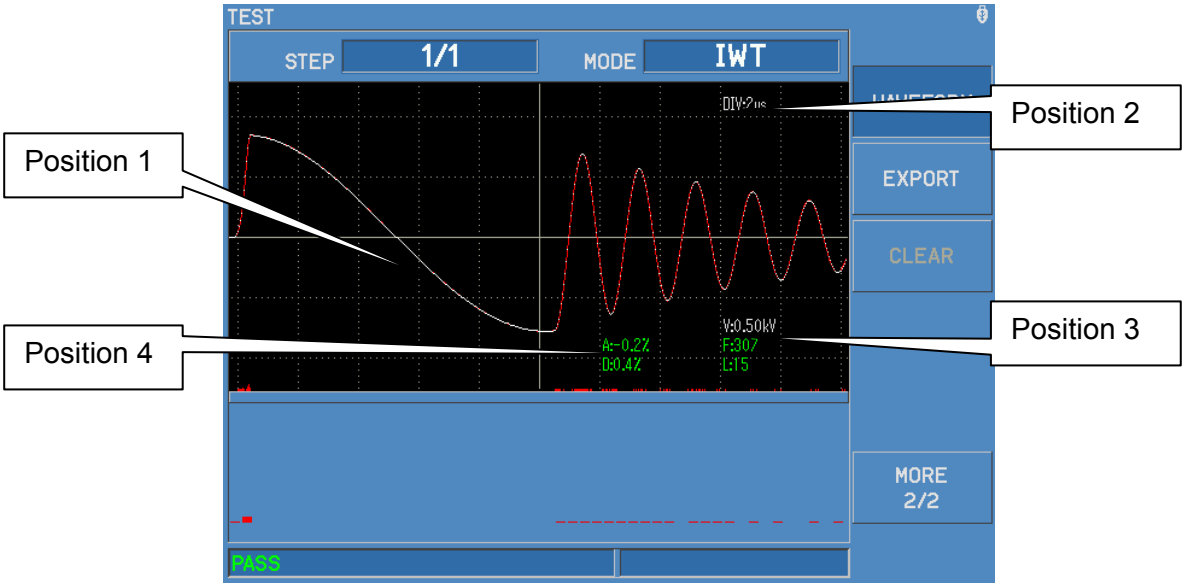



Illustration:
IWT means it is impulse winding test mode.
"Position 1" shows the SAMPLE waveform in red and DUT waveform in white.
"Position 2" shows the assistant grid set for displaying waveform and each grid indicates the time width.
"Position 3" shows the output voltage.
"Position 4" shows the test value of judgment condition. The test result is on the status line.

4. Press [STOP] to prepare for the test. The status line shows "STANDBY".

5. Press [START] to activate the test
   When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows “TESTING” to warn it is in test state with voltage output.

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

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

   Fail State:

| Test Result | Meaning |
|---|---|
| AREA FAIL | The test result is over the boundary judgment of area comparison. |
| DAREA FAIL | The test result is over the boundary judgment of differential area comparison. |
| FLUTTER FAIL | The test result is over the boundary judgment of Flutter. |
| LAPLAC FAIL | The test result is over the boundary judgment of Laplacian |

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

**Note**

1. It is necessary to run SAMPLE TEST when testing a new DUT ore replacing one for IWT. Read the standard value from the test sample for impulse test.
2. Refer to 4.7.4 *Using SAMPLE TEST* for using IWT SAMPLE TEST.

## 4.9.6 Δ/Y DCR Test Procedure

1. Connect the DUT properly.
2. The power on screen shows:

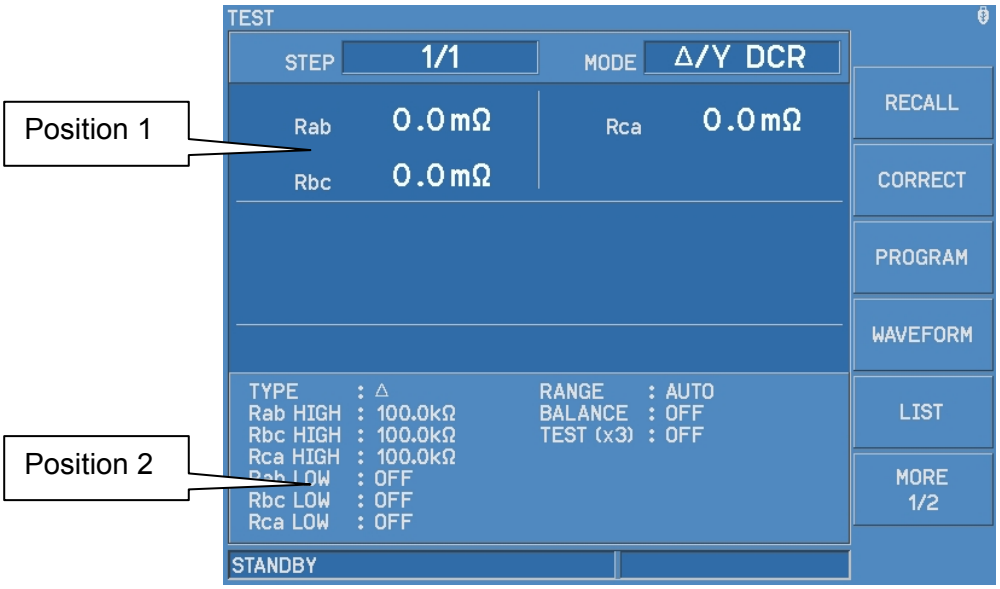


Illustration:
Δ/Y DCR indicates it is in Δ/Y DC Resistance mode for testing. "Position 1" shows the readings of DC resistance and "Position 2" shows the PROGRAM settings. The test result is shown on the message line.

**Note** When the test time sets to OFF, no test time is displayed on the status line.

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 testing and the DANGER LED is on. The status line shows the test result and "Position 1" will show the Rab, Rbc and Rca DC resistance reading.

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

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

Fail State:

| Test Result | Meaning |
|---|---|
| HIGH FAIL | It tests if the measured Δ/Y DC resistance exceeds high limit. |
| LOW FAIL | It tests if the measured Δ/Y DC resistance exceeds low limit. |
| BALANCE FAIL | It tests if the measured DC resistance is not balanced. |

## 4.9.7 IWT COMPARE Test Procedure

1. Connect the DUT properly.
2. The power on screen shows:

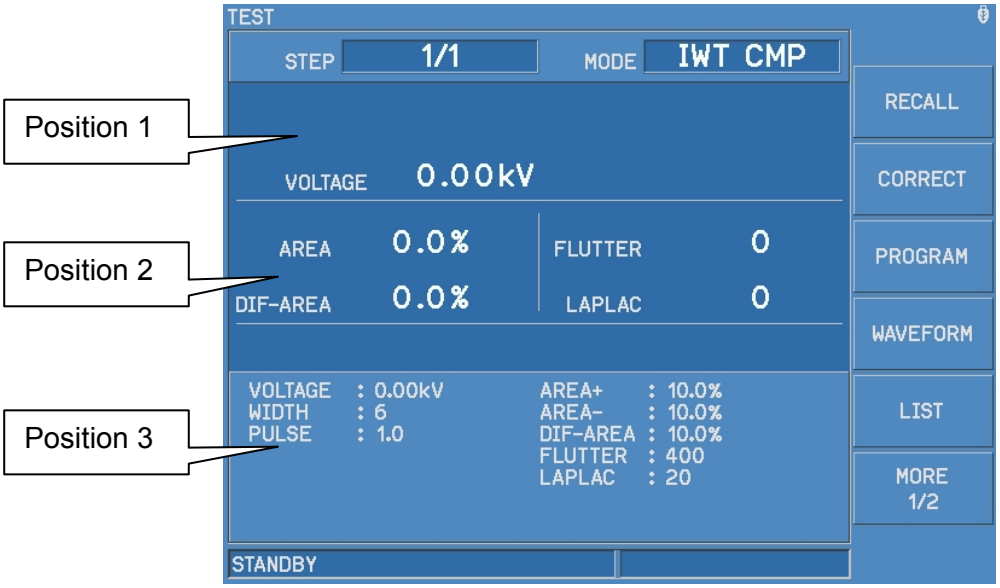



Illustration:
IWT CMP means it is IWT Compare test mode. “Position 1” shows the output voltage, “Position 2” is the IWT set conditions and “Position 3” shows the PROGRAM settings. The test result is shown on the message line.

3. Press Function Key [WAVEFORM] and the screen is shown below:

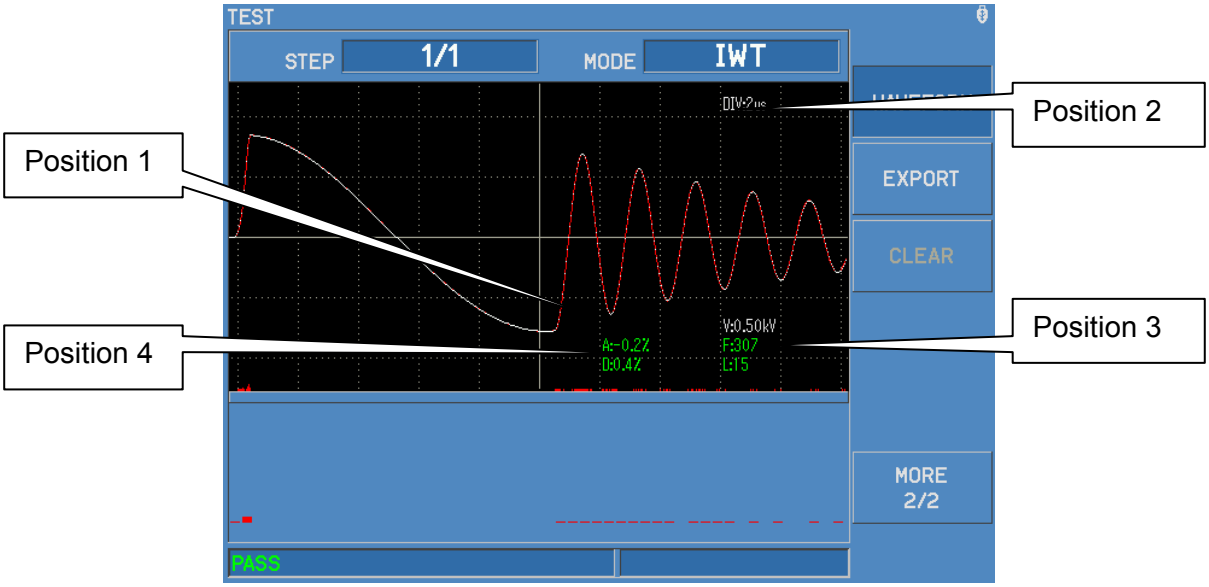



Illustration:
IWT means it is in the Impulse Winding Test mode.
“Position 1”: The red waveform indicates it is the SAMPLE waveform and the white is the DUT waveform.
“Position 2”: It is the waveform display grid to indicate the time width.
“Position 3”: It shows the output voltage.
“Position 4”: It shows the value of test condition. The test result is shown on the message line.

4. Press [STOP] to prepare for the test. The status line shows “STANDBY”.

5. Press [START] to activate the test
   When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows a "TESTING" warning to inform the user it is in test and has voltage output.

6. PASS/FAIL Judgment
   The IWT COMPARE mode can set a maximum of 6 windings and Pass is judged only when all windings are compared pass. If one of them is fail, it is judged as Fail.

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

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

   Fail State:

| Test Result | Meaning |
|---|---|
| AREA FAIL | The test result exceeds the waveform area compare limit. |
| DAREA FAIL | The test result exceeds the waveform area difference compare limit. |
| FLUTTER FAIL | The test result exceeds the flutter limit. |
| LAPLAC FAIL | The test result exceeds the LAPLACIAN limit. |

To stop the test output in any circumstances, just press [STOP].

**Note**

1. When testing a new DUT or replacing a DUT for IWT COMPARE, it has to run SAMPLE TEST first.
2. Refer to 4.6.3 for the detail description of IWT SAMPLE TEST.
3. The judgment of PASS/FAIL is the comparison between windings not with the SAMPLE.

## 4.9.8 Test Procedure for HSCC

1. Connect the DUT properly.
2. The standby menu shows:

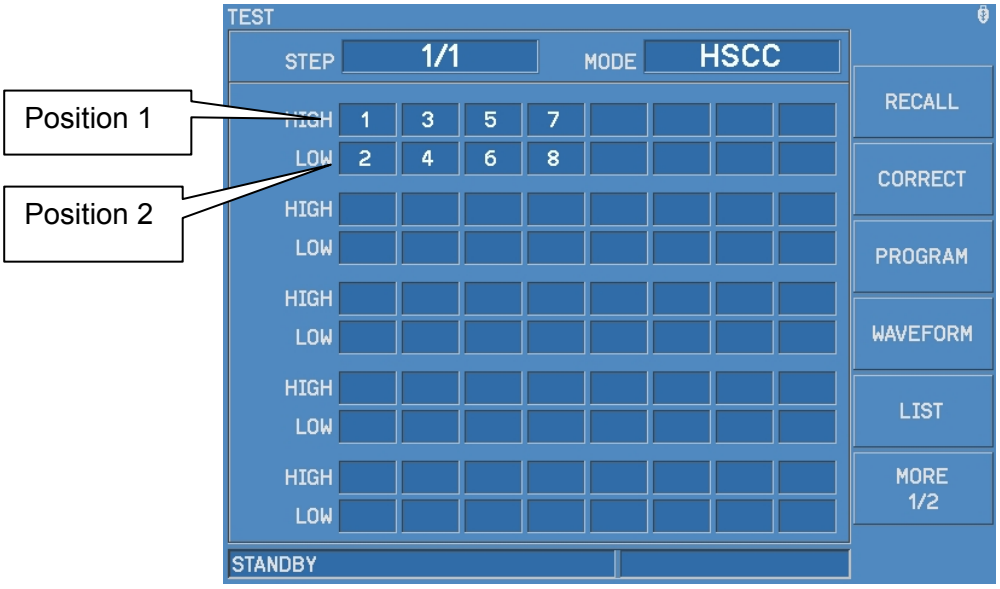



Illustration:
HSCC means it is in high speed contact check measurement mode. "Position 1" sets the high potential channel to be on and "Position 2" sets the low potential channel to be on.

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 to output voltage and the DANGER LED is on. The status line shows the test result.

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

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

Fail State:

| Test Result | Meaning |
|---|---|
| OPEN FAIL | The result of high speed contact check is open. |

## 4.9.9 Test Procedure for OSC

1. Connect the DUT properly.
2. The standby menu shows:

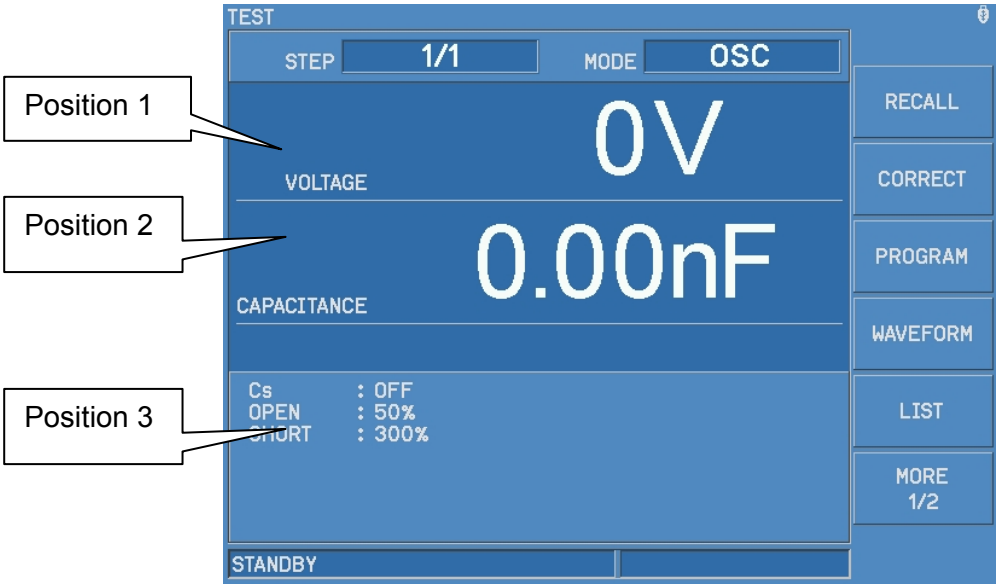



Illustration:
OSC means it is in Open Short Check mode. "Position 1" is the output voltage while "Position 2" is the capacitance read, while "Position 3" shows the PROGRAM setting. The test result shows in status line.

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 to output voltage and the DANGER LED is on. The status line shows "UNDER TEST" to warn it is in test state with voltage output. "Position 1" shows the output voltage value and "Position 2" shows the capacitance readings.

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

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

Fail State:

| Test Result | Meaning |
|---|---|
| OPEN FAIL | The setting of Open/Capacitance Reading is smaller than OPEN. |
| SHORT FAIL | The setting of Short/Capacitance Reading is larger than SHORT. |

To stop the test output in any circumstances, just press [STOP].

**Note**

1. Every time the wiring material or fixture is changed for OSC, be sure to run OPEN CIRCUIT CORRECTION in advance to ensure the test accuracy.
2. It is necessary to run SAMPLE TEST when replacing a new DUT for OSC. Read the capacitance from the test sample as the standard value.
3. For OPEN CIRCUIT CORRECTION in OSC, please refer to 4.7.2 *Using OPEN CIRCUIT*.

4. For SAMPLE TEST in OSC, please refer to 4.7.4 *Using SAMPLE TEST*.

## 4.9.10 PA Test Procedure

1. Connect the DUT properly.
2. The standby menu shows:

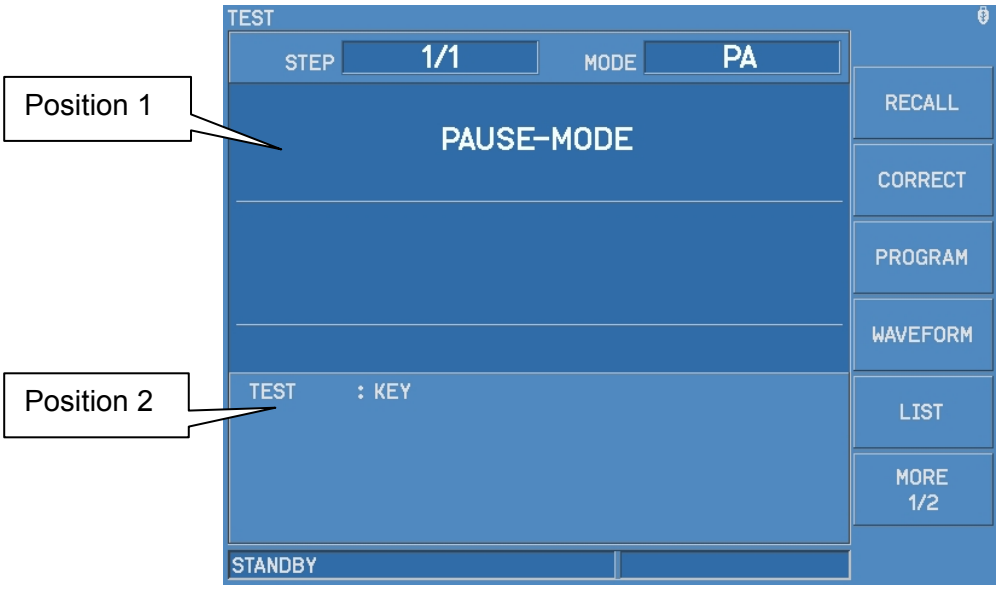


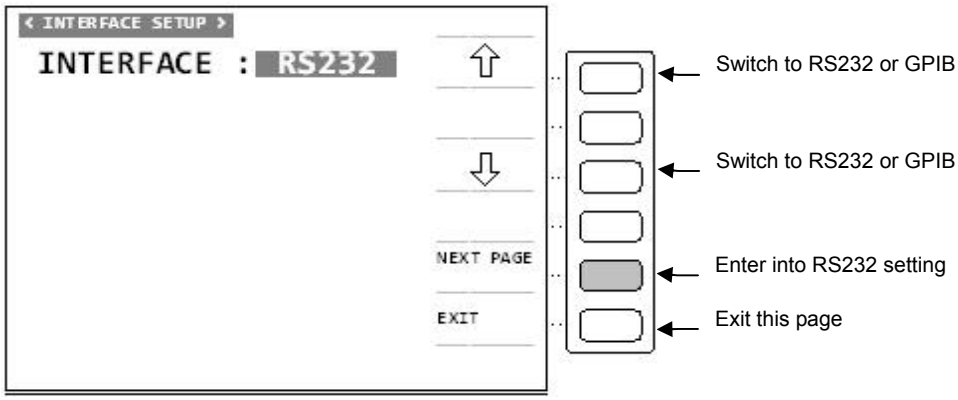

Illustration:
PA indicates it is in Pause Mode for testing. “Position 1” shows the prompt message and “Position 2” shows the time set. The test result is shown on the message line.

3. GOOD Judgment
When the PA Mode test time ends, the result will show PASS. The HANDLER interface outputs PASS signal and the beeper acts at the same time.

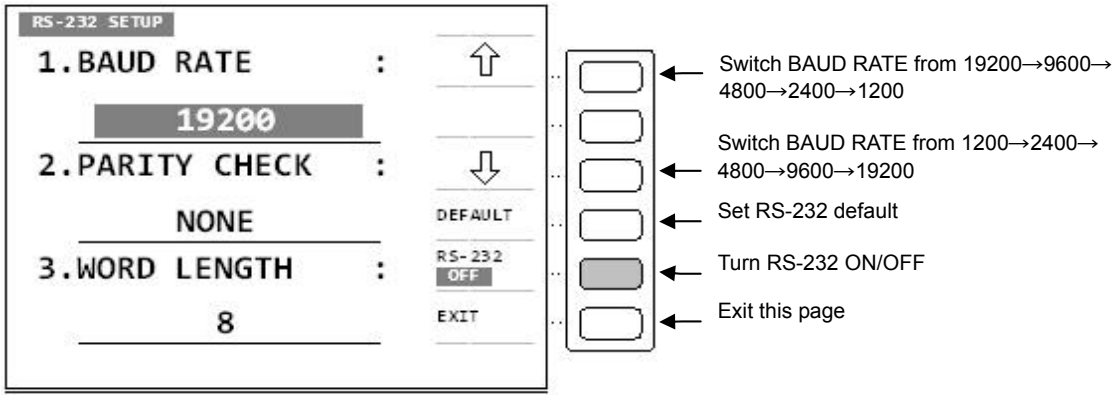
## 4.9.11 Lx Test Procedure

1. Use an RS232 and BNC cable to connect the Transformer Tester and the EST Analyzer.

2. Turn on the Transformer Tester and set the RS232 baudrate. Press 4 under SYSTEM SETUP to enter into the < INTERFACE SETUP> screen as the figure shown below.

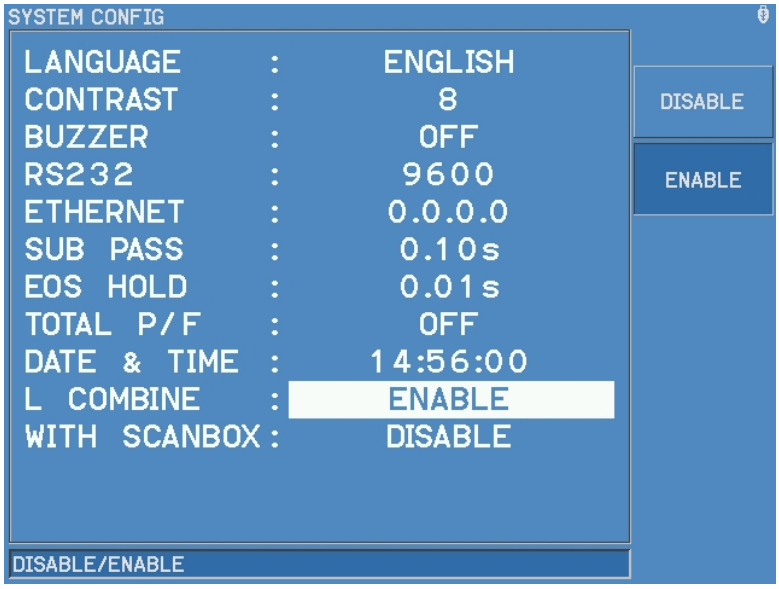



Press NEXT PAGE to enter into the BAUD RATE… settings page as the figure shown below.




Move the highlight to BAUD RATE and press the ↑↓ on the LCD to set the baudrate to 9600.

3. Enable the EST Analyzer's L COMBINE function.
Move the highlight to SYSTEM CONFIG in the SYSTEM page and press **ENTER**. The settings of SYSTEM CONFIG are shown in the figure below.



Move the highlight to L COMBINE and press [ENALBE] to activate the L COMBINE function. If it is connected successfully, RS232 ON will show on the Transformer Tester screen.

**Note** If one of the connected devices is restarted, the EST Analyzer has to restart the L COMBINE function.

4. Set the L CONDITIONS
   Move the highlight to TEST CONTROL in the SYSTEM page and press **ENTER**. Move the highlight to L CONDITINS in the SYSTEM CONFIG page and press [SETUP] to do the settings. Refer to the 4.4.4 *Setting L CONDITIONS* for detail description.

5. The standby menu shows:


Illustration:
Lx indicates it is in Inductance Mode for testing. “Position 1” shows the measured inductance, “Position 2” shows the inductance quality factor and “Position 3” shows the PROGRAM settings. The test result is shown on the message line.

7. Press [STOP] to prepare for the test. The status line shows “STANDBY”.

8. Press [START] to activate the test
   When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows “UNDER TEST” to warn it is in test state with voltage output.

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

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

Fail State:

| Test Result | Meaning |
|---|---|
| HIGH FAIL | The measured inductance or quality factor exceeds the high limit. |
| LOW FAIL | The measured inductance or quality factor exceeds the low limit. |

To stop the test output in any circumstances, just press [STOP].

## 4.9.12 Lx BALANCE Test Procedure

1. Use an RS232 and BNC cable to connect the Transformer Tester and the EST Analyzer. See 4.9.11 *Lx Test Procedure* for the settings.

2. The standby menu shows:


Illustration:
Lx BL indicates it is in Inductance Balance Mode for testing. "Position 1" shows the absolute value or percentage of the measured inductance error. "Position 2" shows the PROGRAM settings. The test result is shown on the message line.

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 to output voltage and the DANGER LED is on. The status line shows "UNDER TEST" to warn it is in test state with voltage output.

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

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

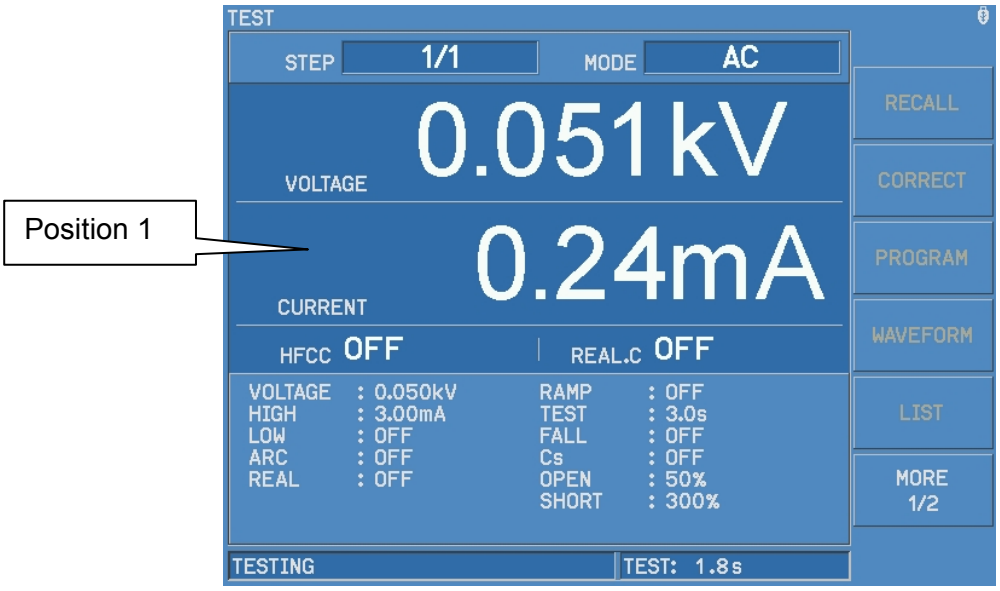
Fail State:

| Test Result | Meaning |
|---|---|
| HIGH FAIL | The test result exceeds the up limit. |
| LOW FAIL | The test result exceeds the low limit. |

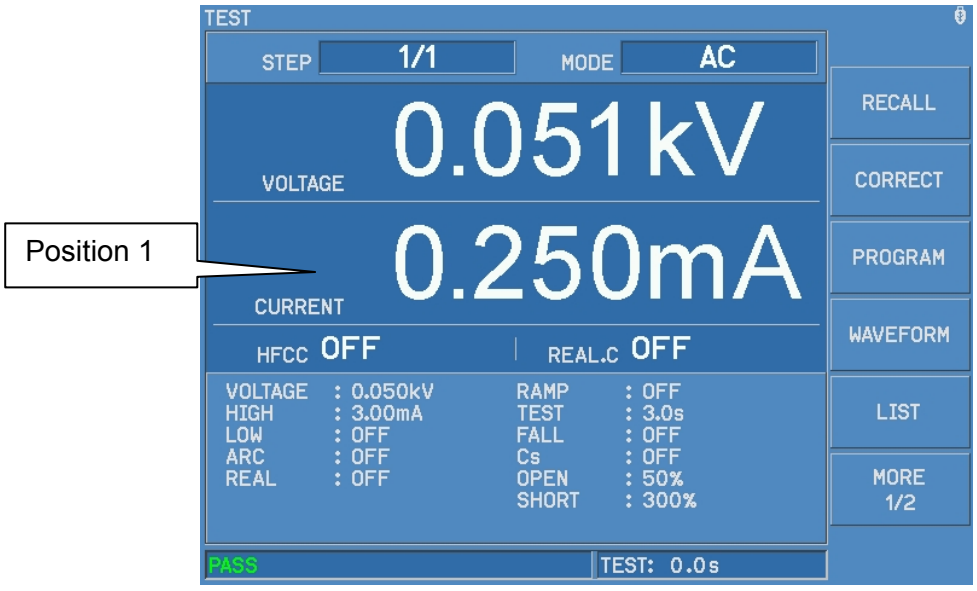
To stop the test output in any circumstances, just press [STOP].

## 4.9.13 Auto Range

1. Set the **Auto Range** to **ON**.
2. As Position 1 shows in the figure below it is set to high potential range.




3. If the tested current is in low potential range at 0.6 seconds before the test ends, the current range as Position 1 showed above will switch to low potential range automatically.



## 4.10 Scan Test

The EST Analyzer is able to perform multiple dots scanning for fast and efficiency test.

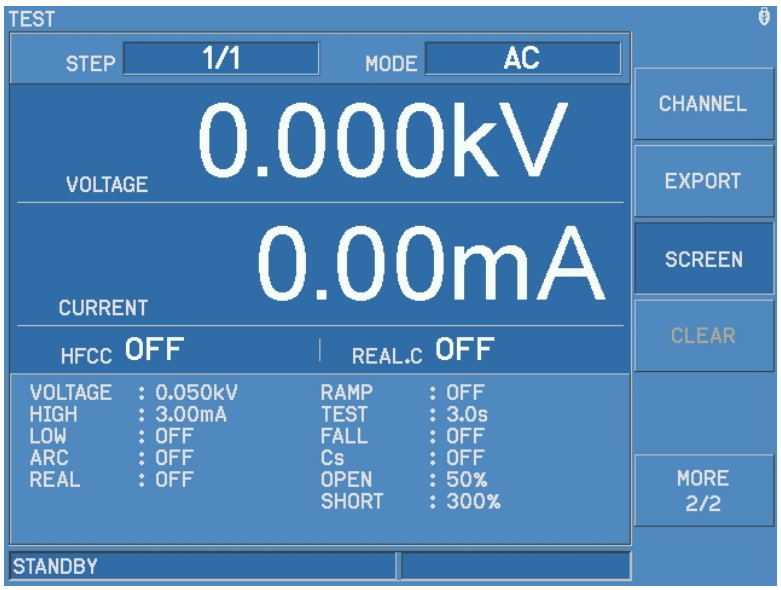
1. When in program setting screen, set the programs accordingly.
2. Move the highlighted to "INTERNAL", "SCANNER1", "SCANNER2" and press Function Keys [NONE], [HIGH] and [LOW] to set the scan test output states which are open, high voltage output and low voltage output.
3. When done press **TEST** to confirm and exit.

**Notice** The EST Analyzer has no default output channel. To begin the test please set one high voltage output channel at least.

## 4.11 EXPORT Function

The EST Analyzer is able to save the test procedure of PROGRAM function in text to a USB flash disk. The file is saved in CSV (Comma Separated Values) format via the following steps.

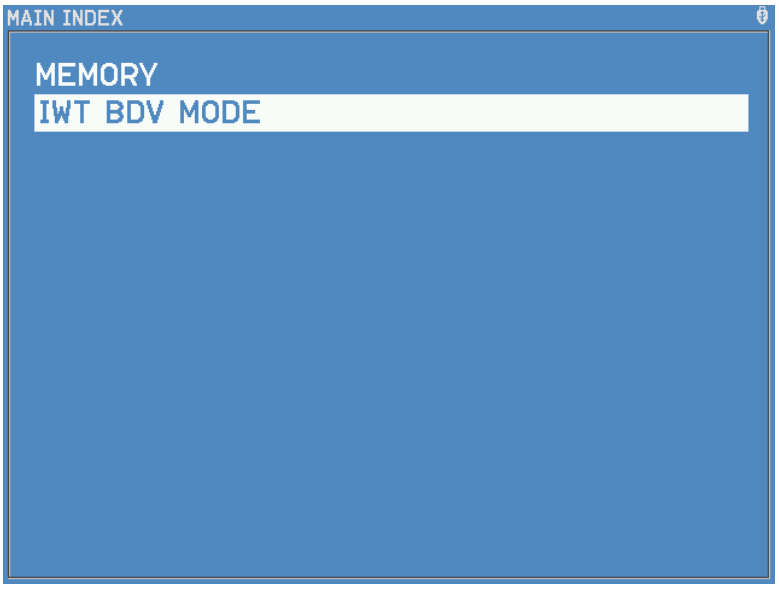
1. In standby menu, press Function Key [MORE1/2] and the screen shows as below.




2. Insert the USB flash disk into the USB port on the front panel.
3. Press Function Key [EXPORT] to save the test procedure of PROGRAM function in text to the USB flash disk.

# 4.12 IWT BREAKDOWN VOLT MODE

Press **MAIN INDEX** to enter into the MEMORY and IWT BREAKDOWN VOLT MODE (IWT BDV MODE) selection page as the figure shown below.




Select IWT BDV MODE and it appears as shown in the figure below. To quit the IWT BDV MODE, simply press **MAIN INDEX** again.

**19036 IWT BDV MODE**

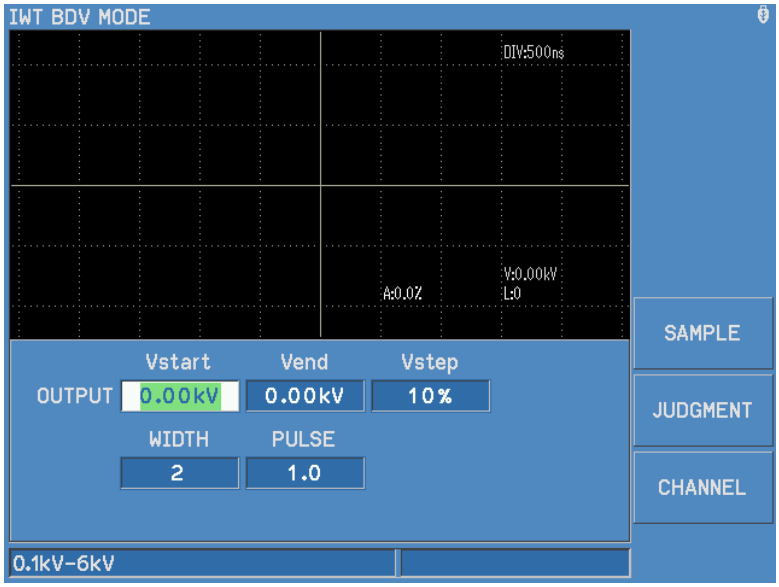


Table 4-6 19036 IWT BEARKDOWN VOLT MODE Parameters

| Parameter | Range | Default | Description |
|---|---|---|---|
| Vstart | 0.1kV~6kV | 0V | It sets the voltage start value. |
| Vend | Vsrart-6kV | 0V | It sets the voltage end value. |
| Vstep | 1%~20% | 1% | It sets the STEP percentage for voltage rise. |
| WIDTH | 1~11 | 6 | It sets the waveform sampling rate. The range is 1~11 where 1 is high speed sampling rate and 11 is low sampling rate. |
| PULSE | 1.0~32.9 | 1.0 | It sets the pulse number for testing. |

Press Function Keys [JUDGMENT] to set the judgment condition and range of IWT BDV MODE as shown in the figure below. To exit the setting menu, simply press Function Keys [JUDGMENT].

**19036 IWT BDV MODE JUDGMENT**

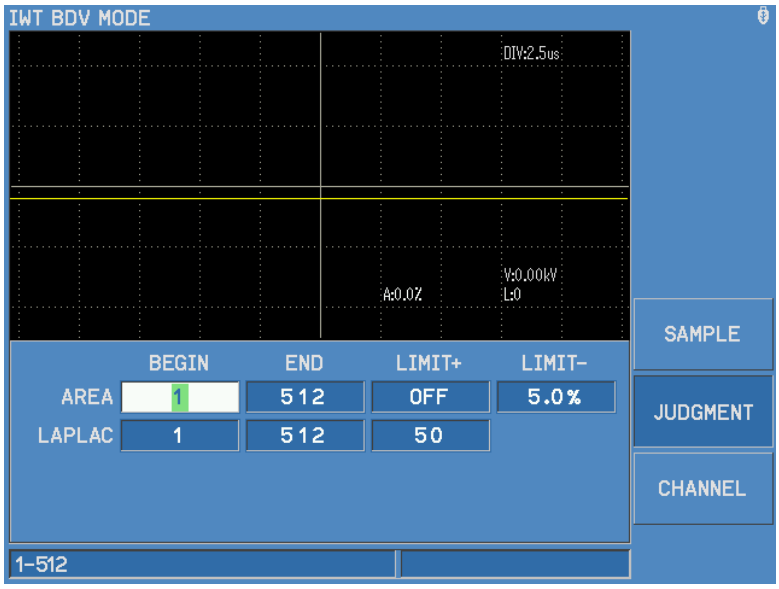
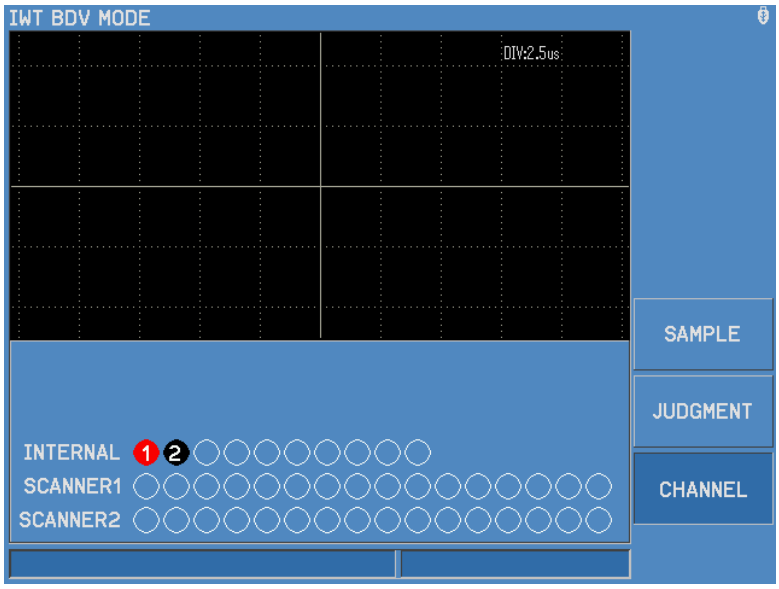



Table 4-7 19036 IWT BEARKDOWN VOLT MODE JUDGMENT Parameters

| Parameter | | Range | Default | Description |
|---|---|---|---|---|
| AREA | BEGIN | 1~512 | 1 | It sets the beginning point of waveform area for comparison. |
| | END | 1~512 | 512 | It sets the end point of waveform area for comparison. |
| | LIMIT+ | OFF,0.1%~99.9% | OFF | It sets the maximum percentage of limit for waveform area comparison. 0 means OFF. |
| | LIMIT- | OFF,0.1%~99.9% | 5% | It sets the minimum percentage of limit for waveform area comparison. 0 means OFF. |
| LAPLAC | BEGIN | 1~512 | 1 | It sets the beginning point of LAPLAC. |
| | END | 1~512 | 512 | It sets the end point of LAPLAC. |
| | LIMIT+ | OFF,0.1%~99.9% | 50% | It sets the limit of LAPLAC. 0 means OFF. |

### 19036 IWT BDV MODE CHANNEL



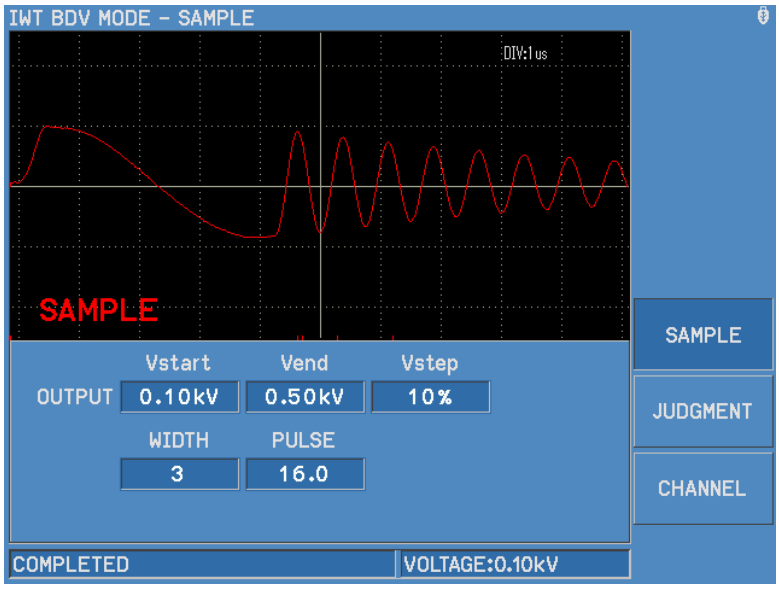

Setting the IWT BDV MODE channel output status:

INTERNAL : It sets the output status of Tester to NONE (no output) /HI (high potential output) /LOW (low potential output.)
SCANNER1: It sets the output status of test fixture 1 to NONE (no output) /HI (high potential output) /LOW (low potential output.)
SCANNER2: It sets the output status of test fixture 2 to NONE (no output) /HI (high potential output) /LOW (low potential output.)

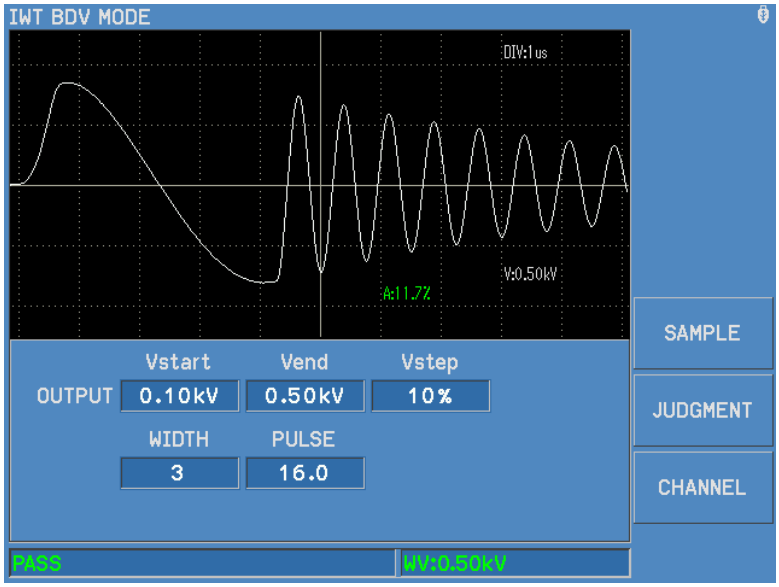
### IWT BDV MODE

When the parameters are set in IWT BDV MODE, it needs to do SAMPLE GET first before performing the IWT BDV MODE test. Press Function Keys [SAMPLE] to enter into the IWT BDV MODE SAMPLE GET function as shown in the figure below.

1. Press [START] in SAMPLE menu to start SAMPLE GET. The 19036 will follow the set Vstart voltage to perform SAMPLE GET as shown in the figure below.




2. When SAMPLE is done, press Function Keys [SAMPLE] again to exit the SAMPLE menu. Press [START] to start the IWT BDV MODE testing.



# 5. HANDLER Interface

## 5.1 Specification

### 5.1.1 Driving Capability

Internal Signal Output Specification: DC 24V, 20~40mA
External Signal Input Specification: DC 3V~26V (HIGH), 10mA± 4mA

### 5.1.2 Pin Assignment

| Pin No. | Signal | | | | Input/ Output | Description |
|---|---|---|---|---|---|---|
| | AC | DC | IR | OSC | | |
| 1 | /STN0 | | | | Output | /STN0~/STN5 signals are sent out in sequential order regardless of the Main Step or Sub Step. There are 6 bits to indicate 60 test steps and the output format is in binary. (/STN0 is low bit and /STN5 is high bit.) |
| 2 | /STN1 | | | | | |
| 3 | /STN2 | | | | | |
| 4 | /STN3 | | | | | |
| 5 | /STN4 | | | | | |
| 6 | /STN5 | | | | | |
| 7 | /PASS_FAIL | | | | Output | It outputs LOW when the test result is PASS. At this time no output for /HIGH, /LOW, /ARC_FAIL & IWT_FAIL signals (all are HIGH.) It outputs HIGH when the test result is FAIL. At this time there is output for /HI, /LO, /ARC_FAIL & IWT_FAIL signals (acting LOW.) |
| | /TOTL_PASS | | | | Output | When TOTL P/F sets to ON, the definition of this pin is to output LOW if the results of all test procedures are PASS. |
| 8 | /HIGH FAIL | /HIGH FAIL | /HIGH FAIL | X | Output | It turns to Low from high when the test result is HIGH FAIL. |
| 9 | /LOW FAIL | /LOW FAIL | /LOW FAIL | X | Output | It turns to low from high when the test result is LOW FAIL. |
| 10 | /ARC_FAIL | /ARC_FAIL | X | X | Output | It turns to Low from High when the test result is ARC_FAIL. |
| 11 | Reserved | | | | Output | Reserved pin. |
| 12 | /REAL_FAIL | X | X | X | Output | It turns to Low from High when the test result is REAL_FAIL in AC Mode. |
| 13 | /HFCC_OPEN | /HFCC_OPEN | X | /OPEN_FAIL | Output | It turns to Low from High when the test result is HFCC_OPEN in AC/DC Mode and OPEN_FAIL in OSC Mode |
| 14 | /HFCC_SHORT | /HFCC_SHORT | X | /SHORT_FAIL | Output | It turns to Low from High when the test result is HFCC_SHORT in AC/DC Mode and |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | SHORT_FAIL in OSC Mode. |
| 15 | /SYSTEM ERROR | | | | Output | It is the signal output pin for system internal error which means the system has internal error when output is LOW. |
| 16 | /EOT | | | | Output | When the signal is HIGH, it indicates the test program is running.<br>When the signal is LOW, it indicates the test program is ended or in standby mode. |
| 17 | /EOS | | | | Output | When the signal is HIGH, it indicates the test step is running.<br>When the signal is LOW, it indicates the test step is done before going to the next or all of the steps are ended. |
| 18 | /PA | | | | Output | The signal is HIGH when enabled for test. Later, the /PA signal and the HIGH or LOW level of COM will change once every time it goes through the PA mode. |
| 19,20 | +VEXT | | | | ——— | It is the external DC voltage input. The range of input voltage is +3V~+26V. |
| 21,22 | +24VF1 | | | | ——— | It is the internal DC voltage input which is +24V. |
| 23 | Reserved | | | | Input | Reserved pin. |
| 24 | /RECALL1 | | | | Input | /RECALL1~/RECALL3 signal indicate the read memory code. The input used 3 bits to indicate 8 sets of memory (INDEX 1 ~8). The input format is in binary (/RECALL1 is the low bit and /RECALL3 is the high bit.) |
| 25 | /RECALL2 | | | | Input | |
| 26 | /RECALL3 | | | | Input | |
| 27 | /E_STOP | | | | Input | External STOP signal input when signal state is LOW. |
| 28 | /E_START | | | | Input | External START signal input when signal state is LOW. |
| 29 | Reserved | | | | Output | Reserved pin. |
| 30 | Reserved | | | | Output | Reserved pin. |
| 31 | /TOTL_FAIL | | | | Output | The output turns to LOW from High if the results of all test procedures are FAIL. |
| 32 | Reserved | | | | Output | Reserved pin. |
| 33,34 | EXTGND | | | | ——— | It is the low voltage terminal for input/output signal. |
| 35,36 | DGND | | | | ——— | It is the low voltage terminal for internal voltage output. |

| Pin No. | Signal | | | | Input/ Output | Description |
|---|---|---|---|---|---|---|
| | DCR | IWT | HSCC | PA | | |
| 1 | /STN0 | | | | Output | /STN0~/STN5 signals are sent out in sequential order regardless of the Main Step or Sub Step. There are 6 bits to indicate 60 test steps and the output format is in binary. (/STN0 is low bit and /STN5 is high bit.) |
| 2 | /STN1 | | | | | |
| 3 | /STN2 | | | | | |
| 4 | /STN3 | | | | | |
| 5 | /STN4 | | | | | |
| 6 | /STN5 | | | | | |
| 7 | /PASS_FAIL | | | | Output | It outputs LOW when the test result is PASS. At this time no output for /HIGH, /LOW, /ARC_FAIL & IWT_FAIL signals (all are HIGH.)<br>It outputs HIGH when the test result is FAIL. At this time there is output for /HI, /LO, /ARC_FAIL & IWT_FAIL signals (acting LOW.) |
| | /TOTL_PASS | | | | Output | When TOTL P/F sets to ON, the definition of this pin is to output LOW if the results of all test procedures are PASS |
| 8 | /HIGH FAIL | /FAIL_ area+ | X | X | Output | It turns to low from high when the test result is HIGH_FAIL in DCR Mode and FAIL_Area+ in IWT Mode. |
| 9 | /LOW FAIL | /FAIL_ area- | X | X | Output | It turns to low from high when the test result is LOW_FAIL in DCR Mode and FAIL_area- in IWT Mode |
| 10 | /DCR_ balance | /FAIL_area_diff | X | X | Output | It turns to low from high when the test result is DCR_balance FAIL in DCR Mode and FAIL_area_diff FAIL in IWT Mode. |
| 11 | X | /FAIL_Laplacian | X | X | Output | It turns to low from high when the test result is FAIL_Laplacian in IWT Mode |
| 12 | X | /FAIL_flutter | X | X | Output | It turns to low from high when the test result is FAIL_flutter in IWT Mode. |
| 13 | X | /FAIL_breakdown | /OPEN_FAIL | X | Output | It turns to low from high when the test result is FAIL_breakdown in IWT Mode and OPEN_FAIL in HSCC Mode. |
| 14 | Reserved | | | | Output | Reserved pin. |
| 15 | /SYSTEM ERROR | | | | Output | It is the signal output pin for system internal error which means the system has internal error when output is LOW. |
| 16 | /EOT | | | | Output | When the signal is HIGH, it indicates the test program is running.<br>When the signal is LOW, it indicates the test program is ended or in standby mode. |
| 17 | /EOS | | | | Output | When the signal is HIGH, it indicates the test step is running.<br>When the signal is LOW, it indicates the test step is done before going to the next or all of the steps are ended. |
| 18 | /PA | | | | Output | The signal is HIGH when enabled for test. Later, the /PA signal and the HIGH or LOW level of COM will change once every time it goes through the PA mode. |
| 19,20 | +VEXT | | | | ——— | It is the external DC voltage input. The range of input voltage is +3V~+26V. |
| 21,22 | +24VF1 | | | | ——— | It is the internal DC voltage input which is +24V. |

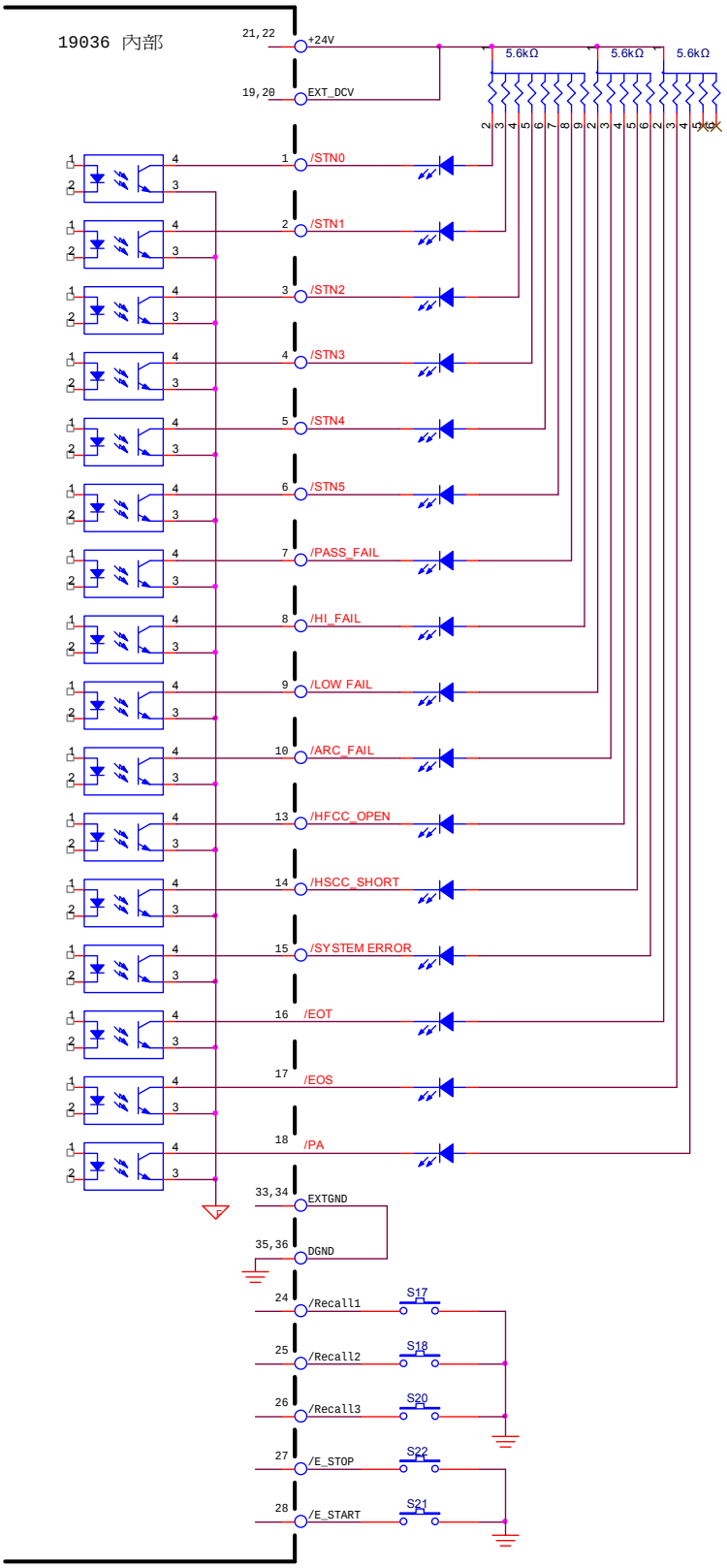
| | | | |
|---|---|---|---|
| 23 | Reserved | Input | Reserved pins |
| 24 | /Recall1 | Input | /RECALL1~/RECALL3 signal indicate the read memory code. The input used 3 bits to indicate 8 sets of memory (INDEX 1 ~8). The input format is in binary (/RECALL1 is the low bit and /RECALL3 is the high bit.) |
| 25 | /Recall2 | Input | |
| 26 | /Recall3 | Input | |
| 27 | /E_STOP | Input | External STOP signal input when signal state is LOW. |
| 28 | /E_START | Input | External START signal input when signal state is LOW. |
| 29, | Reserved | Output | Reserved pin. |
| 30 | Reserved | Output | Reserved pin. |
| 31 | /TOTL_FAIL | Output | The output turns to LOW from High if the results of all test procedures are FAIL. |
| 32 | Reserved | Output | Reserved pin. |
| 33,34 | EXTGND | ——— | It is the low voltage terminal for input/output signal. |
| 35,36 | DGND | ——— | It is the low voltage terminal for internal voltage output. |

**Note**

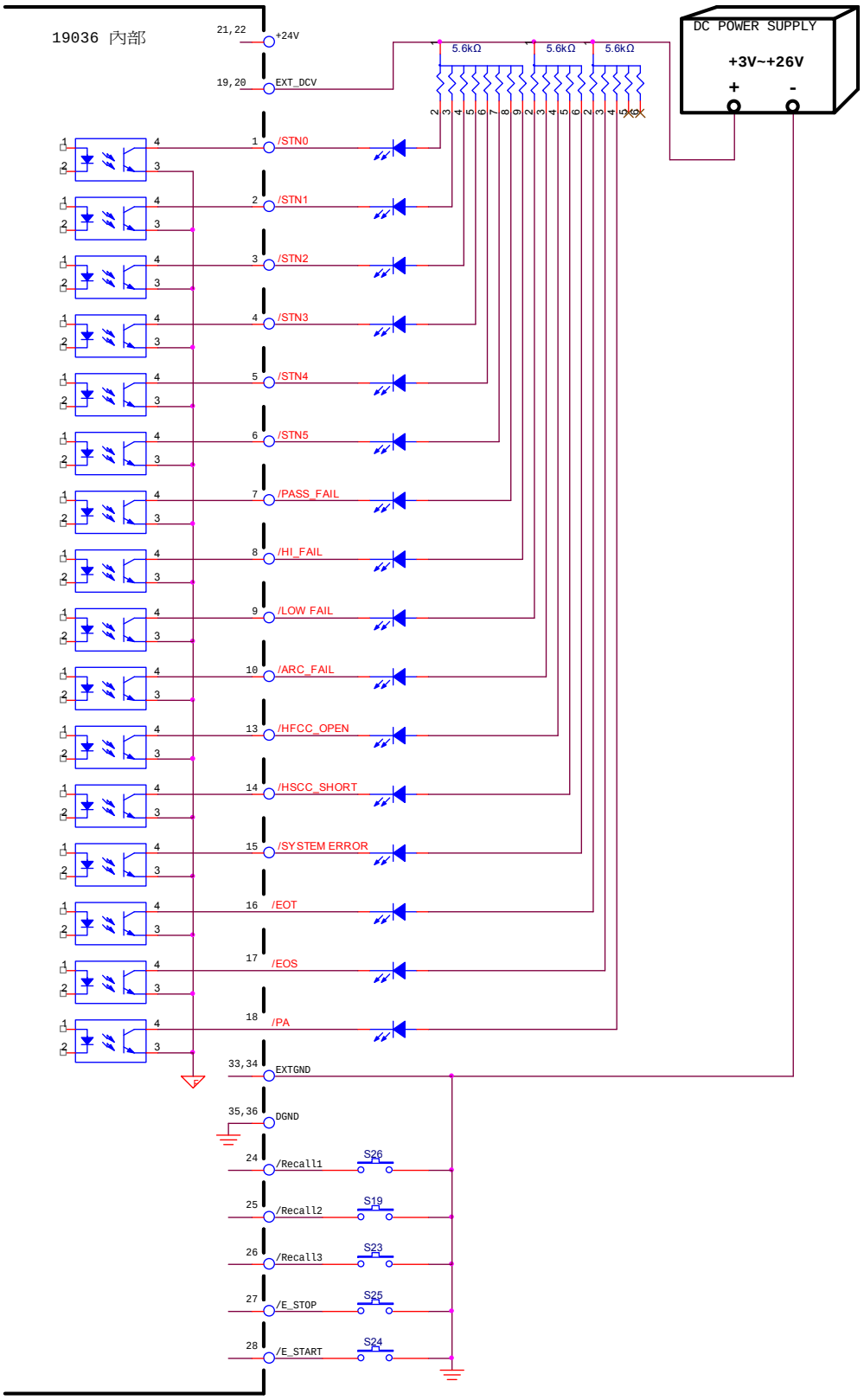
1. The test step code signal of Handler Board will send out sequentially no matter it is Main Step or Sub Step.

# 5.2 Example of External Control Circuit

## 5.2.1 Example of Using Internal Power Supply



## 5.2.2 Example of Using External Power Supply



## 5.3 Timing Diagram

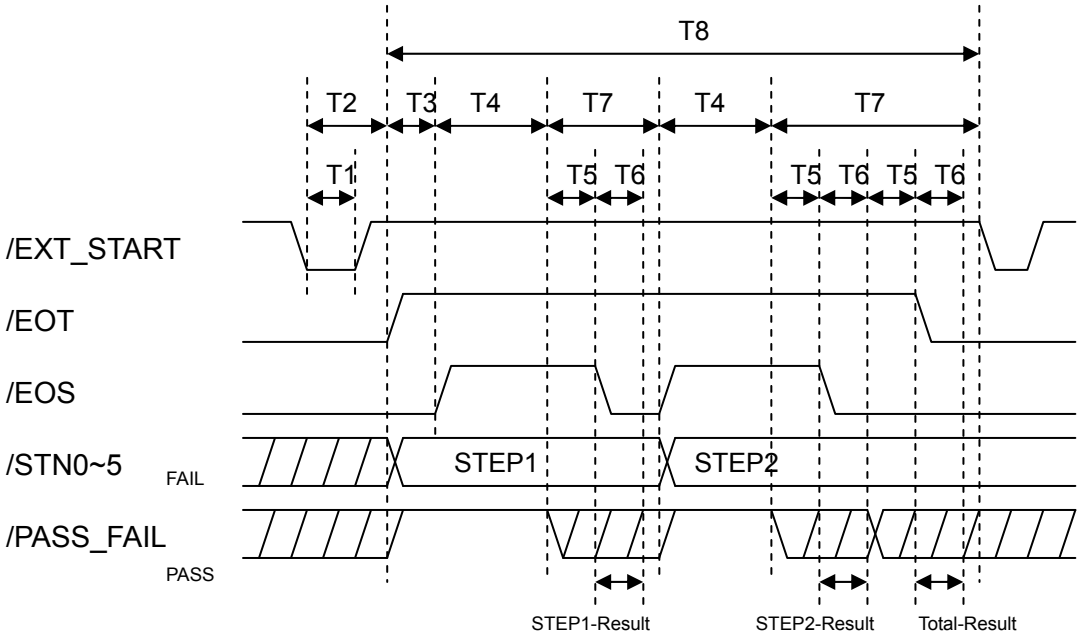



Figure 5-1 Timing Diagram – Example of 2 Test Steps

| Timing | Limit | Description |
|---|---|---|
| T1 | > 20mS | It sets the time required for external trigger signal (/EXT_START) to sustain. It should be more than 20mS. |
| T2 | < 20mS | It sets the time for clear from external trigger signal (/EXT_START) to /EOT signal. It should be less than 20mS. |
| T3 | - | It sets the time for Trigger Delay. |
| T4 | - | It sets the time required for each test step. |
| T5 | > 5mS | The waiting time will be more than 5mS for /PASS_FAIL signal to be stable. |
| T6 | > 5mS | The waiting time will be more than 5mS for EOS Hold time, EOS HOLD time + SUB PASS time or /EOT signals to be stable. |
| T7 | - | The time required for each test step to end. |
| T8 | - | The time required for a test program. |

# 6. Usage of Impulse Winding Test Modes

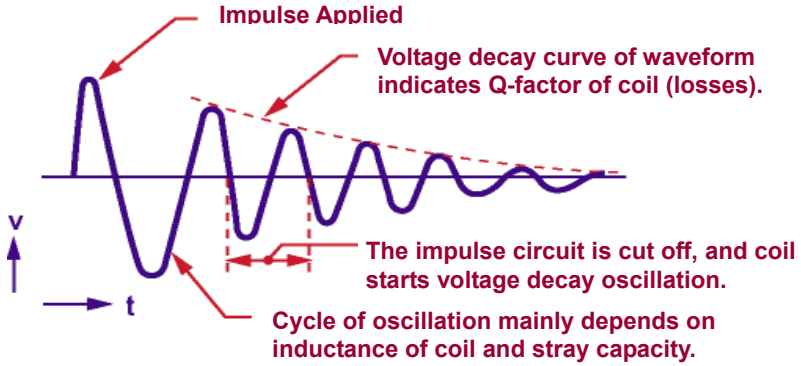
## 6.1 Features & Functions

The impulse winding test modes of 19036 Wound Component EST Analyzer has built-in the following commonly used detection methods.

(1) AREA (Area Size Comparison)
(2) DIF-AREA (Differential Area Comparison)
(3) FLUTTER (Flutter Value Comparison)
(4) LAPLACIAN (Laplacian Value Comparison)

## 6.2 Introduction to Impulse Test

The Impulse Coil Winding Tester tests the electrical characteristics of coil winding without giving damage to the samples. The prerequisite conditions for quality of a coil can be detected at just a glance. The detection is carried out when the same electric impulse by capacitor discharge is applied to the master and the test coils. The voltage decay waveform is generated in response to the impulse, related to the Q-factor and inductance (impedance) of the coils. In this sense, the tester can detect turn & layer short, the differences in the number of turns and the material of the core. If high impulse voltage is applied, the poor insulation will appear as corona or layer discharge. The figure below explains the working theory of this product in a simple way.




## 6.3 Precautions for Setting Up Impulse Testing Environment

Since the characteristic of wound component is easy to affect by magnetic field or floating capacity, the environment to conduct the test needs to take the installation of main device and the connection of coil fixture under test into consideration to assure the accuracy of test. The air coils is most sensitive to the environment that needs to pay special attention to its usage and test environment.

Before running initialization and getting the SAMPLE waveform for comparison test, be sure the test environment for coils under test is the same as the initial setting of SAMPLE waveform. In addition, be sure not to use a metal work platform to avoid the errors caused by magnetic effects. If a metal work platform is required, be sure to cover with a layer of non-metallic material pads to prevent affecting the coil characteristic.

Another important parameter for environmental factor is the test cable in use. Be sure to confirm the test cable is the same as the one used for Master waveform initialization when conducting GO/NG comparison test especially in length and winding.

## 6.4 Acceptance (OK) / Rejection (NG) Detection

- AREA SIZE
  This compares each area size of the master coil and the sample coil waveforms in the intentionally determined zone. In Figure 6-1, the area size is calculated between 'a' and 'b', and OK/NG (Pass/Fail) is determined by comparing the area size (i.e. what percent (%) the sample waveform's area size differs from that of the master waveform). The detecting criterion is set by %. When the result is within the set value in %, the test coil is considered to be "OK". The area size of the waveform is nearly proportional to the energy loss in the coil; therefore, the test coil is considered to be OK/NG by the amount of its energy loss. For example, when a sample coil layer has a short circuit, the short circuit area is reflected as an increase of energy loss.

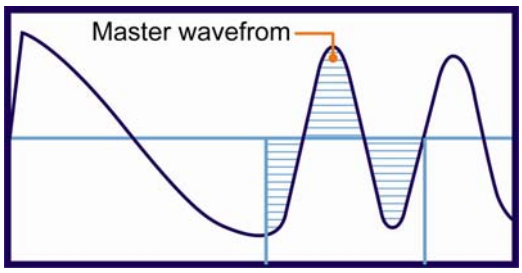



Figure 6-1

- DIFFERENTIAL AREA
  This calculates the area size of differential portion between the master coil and the sample coil waveforms in the intentionally determined zone. In Figure 6-2, the differential area size is calculated between 'a' and 'b', and OK/NG is judged by detecting how large the differential area size is. The detecting criterion is set by %. When the result is within the set value in %, it is considered to be "OK". The differential area size represents the change in L value and total energy loss. This method is especially effective, for example, when the change of the L value causes major problems.

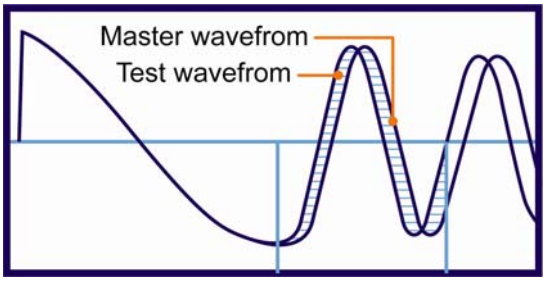



Figure 6-2

- FLUTTER VALUE
  Regardless of the difference in waveforms, this method only detects the high frequency energy of corona discharge as shown in Figure 6-3. It detects the corona value in the intentionally determined zone of the waveform, and judges OK/NG by the corona evaluation value. The detecting criterion is set by an integer. The result that appears within the range is considered to be “OK”. The waveform is converted by derivative calculation and then its area size is calculated. In an equivalent analog circuit, the energy value of the waveform that passes through a high pass filter is measured.

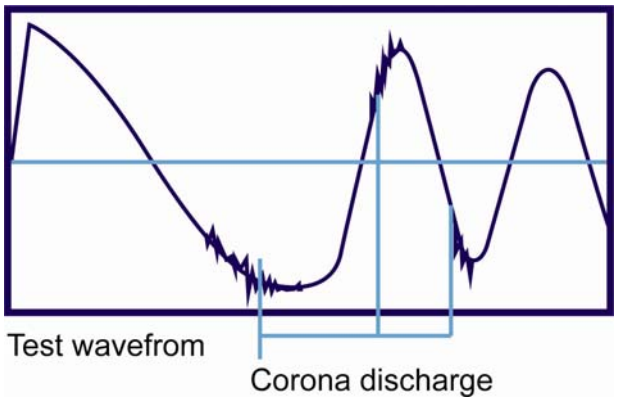



Figure 6-3

- LAPLACIAN VALUE
  Laplacian uses graphical digital filter to detect the discharge signal on waveform edge and then uses the second derivative to calculate the maximum discharge. This way can detect the discontinuous noise in the waveform and graphicalize the value for comparison. The noise is the discharge level that should not occur in normal winding components.

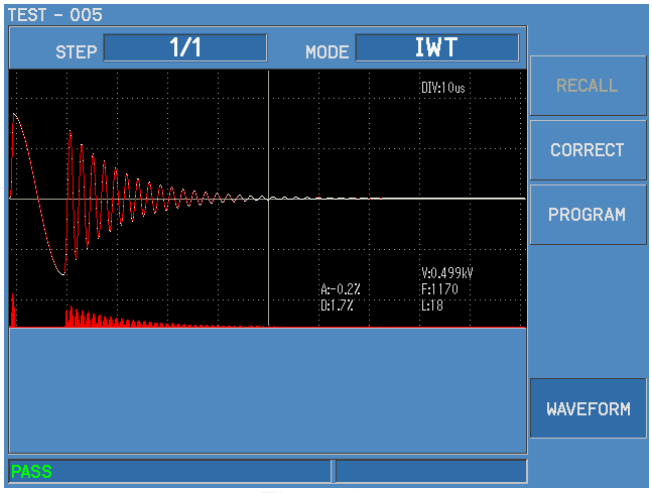



Figure 6-4

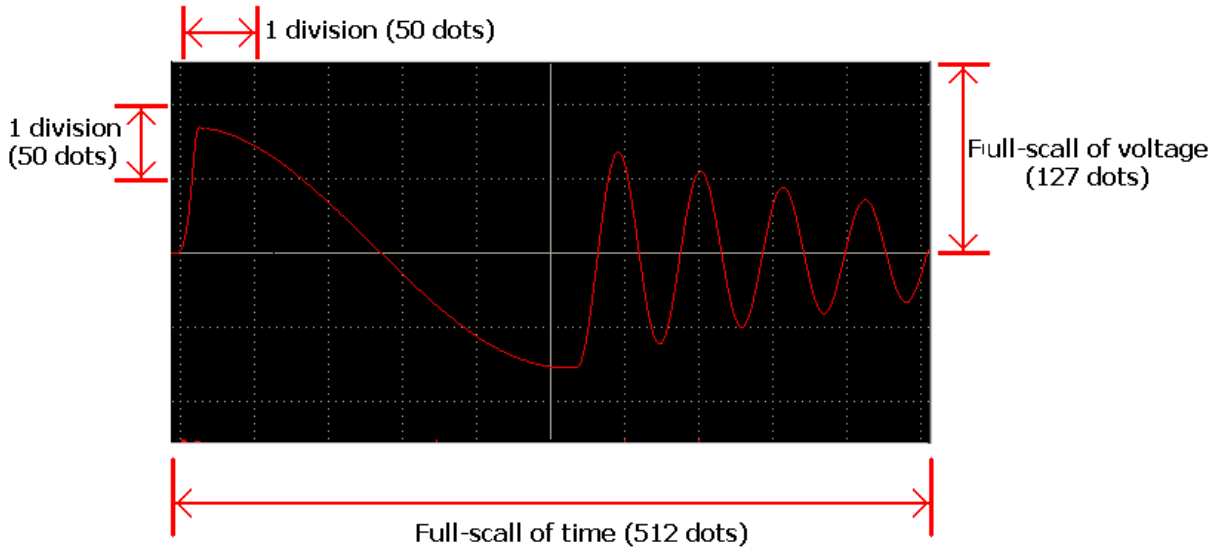
## 6.5 Waveform Resolution

The transient waveform, generated by the applied impulse, is digitized by a microcomputer and the high speed A/D converter. The memory capacity available for a single transient waveform of the Wound Component EST Analyzer is 8192 bytes (one sample dot per one byte). In other words, a maximum of 8192 sampling dots can be used to record a transient

waveform. The obtained data then is used for display on the LCD, and for OK/NG detection according to the preset criteria.

In case of a coil with a fast transient waveform (a greater frequency), the levels of sampling points are much different from one another, so a slow A/D converter cannot follow the changes. For the Wound Component EST Analyzer, the 5 nano-seconds speedy A/D converter is used in order to digitize the high-speed transient waveform.

Besides the 512 dots resolution in the time axis (X-axis), the recorded resolution of Wound Component EST Analyzer on level vertical axis (Y-axis) is 256 (±128) dots. In other words, each dot on time axis (X-axis) has 256 dots resolution to show the amplitude size.




The horizontal and vertical grids appearing on the LED of Wound Component EST Analyzer can give the information about the waveform unit. The resolution of each division is 50 dots and 5 dots resolution for each dot. Multiply the value with the time unit on the upper right corner can get a rough value.

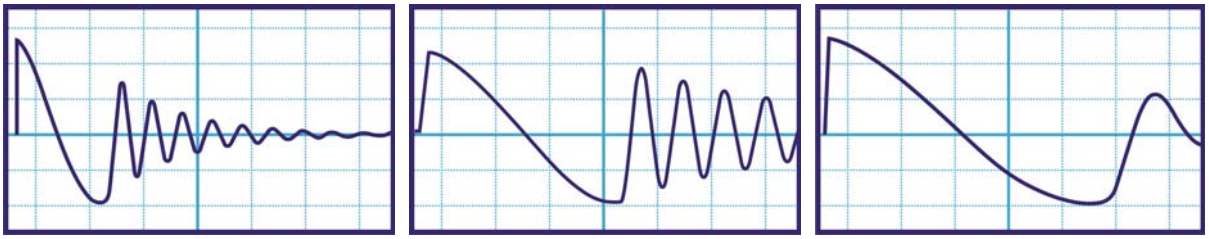
## 6.6 Setting Sampling Rate [WIDTH]

The setting of WIDTH column can be modified for sampling range (which is the adjustment of sampling rate.)

The available setting range is 1 ~ 11.

1: It means to enlarge the waveform display. (Highest sampling rate)
6: It means normal sampling rate. (Default)
11: It means to shrink the waveform display. (Lowest sampling rate)

Adjust [WIDTH] setting to change sampling rate. Different [WIDTH] setting parameters draw the characteristic waveform of wound components as the example figures shown below:



Low Sampling Speed
WIDTH=7,8～11

Appropriate Sampling Speed
WIDTH= 6

High Sampling Speed
WIDTH= 1,2～5

Based on the [WIDTH] in [PROGRAM], press [START] the EST Analyzer will apply impulse and set the sampling rate to display waveform. It can change the setting of WIDTH and press [START] again to re-apply impulse to confirm the most appropriate sampling rate.

Table 6-1 Actual Scanning Rate of WIDTH

| WIDTH Range | A/D Sampling Rate | Point Interval | Remarks |
|---|---|---|---|
| 1 | 5 ns | 1/1 | Highest rate |
| 2 | 10 ns | 1/1 | |
| 3 | 10 ns | 1/2 | |
| 4 | 10 ns | 1/3 | |
| 5 | 10 ns | 1/4 | |
| 6 | 10 ns | 1/5 | |
| 7 | 20 ns | 1/5 | |
| 8 | 20 ns | 1/10 | |
| 9 | 50 ns | 1/8 | |
| 10 | 100 ns | 1/8 | |
| 11 | 160 ns | 1/10 | |

**Note** The higher sampling rate means quick or slight discharge phenomena can be caught.

# 6.7 Setting Pulse Number [PULSE]

Impulse Winding Test follows the number set here to apply the impulse on the coils of wound component. The available setting range is 1 ~ 32 times. The set impulse number shows in creating SAMPLE waveform and Impulse Winding Test.

Moreover, it can also set Dummy Pulse when setting the impulse number by entering it after the decimal point. The available setting range for Dummy Pulse is 0 ~ 9 and not applying dummy pulse when set to 0.

Ex.) When Applying impulse for 6.3
└ Dummy Pulse
└ Judgment Pulse

In the example above, 6.3 is to apply 3 times of dummy pulse (no judgment) and then apply 6 times of judgment impulse for final determination. The impulse applied is 9 times in total.

**Notice** Residual magnetic field may still exist in Motor coil or Solenoid body after cutting off the power. Performing impulse test under this circumstance may cause the magnetic characteristic initial setting error. Thus, the

results got from applying the 1st impulse and the impulses afterwards are significantly different. Therefore, it is necessary to set proper Dummy Pulse to release the residual magnetic field when testing the instable wound components for good or no good.

## 6.8 Creating SAMPLE Waveform

It is necessary to draw a waveform of applying impulse on good coil to get the SAMPLE waveform in IWT Mode. The waveform is used to compare and judge the quality of coil under test. Based on the setting of 6.7 *Setting Pulse Number [PULSE]*, the result of plural impulse will be averaged first to derive the final waveform data and get SAMPLE waveform.

Different parameter settings may lead to unable obtaining the SAMPLE waveform in some time. In this circumstance, please check if the setting is appropriate. For instance, if the applied impulse voltage was set too high or the wound component is failure.

**CAUTION**

The reasons for unable obtaining the SAMPLE waveform are:

(1) The applied voltage is too high and causes the SAMPLE coil under test is having a serious discharge.

(2) Proper "WIDTH" sampling rate is not set and causes the cycle of displayed waveform to be very short.

(3) The coil under test is easy to produce magnetic saturation phenomenon that made the output unable to reach the set voltage.

(4) The inductance of coil under test is too low and out of spec. thus it is unable to output the set voltage. ◦

## 6.9 Setting Conditions for Judging Good Product

It compares the SAMPLE waveform to judge if the coil under test is good. The conditions for judgment are:

AREA (Area Comparison)
DIF-AREA (Differential Area Comparison)
FLUTTER (Discharge volume)
LAPLACIAN (Discharge of Quadratic Differential)

(1) First, determine what condition needs judgment and what doesn't. The setting of LIMIT column is a judgment condition. When LIMIT column sets to OFF, it means do not judge.

(2) Next, set the columns of BEGIN and END to confirm the start and end of comparison range.
"AREA+", "AREA-" and "DIF-AREA" is 0.1% ~ 99.9%
"FLUTTER" & "LAPLAC" is the integer between 1~9999.

**Notice**

Once "OFF" is selected for the settings in the above (1), the test procedure performs neither test nor judgment, and "OFF" will show on the screen for inputting judgment condition.

## 6.10 Impulse Applied & Test Time

It is necessary to set the number for impulse applied to EST Analyzer before test. The number of impulse applied should be proportional to the test time. The interval of each applied impulse is about **50 mS**. Once the impulse is applied, the waveform and judgment process needs certain time of which the proportion will increase according to the number of time applied. See the table below for the time required.

Table 6-2 No. of Impulse Applied & Time Required for Test

| No. of Impulse Applied | Time (Second) |
|---|---|
| 1 | 1.0 |
| 5 | 1.5 |
| 10 | 2.0 |

## 6.11 Impulse Applied & Residual Magnetic Field

Residual magnetic field may still exist in Motor coil or Solenoid body after cutting off the power. Performing impulse test under this circumstance may cause the magnetic characteristic initial setting error. Thus, the results got from applying the 1st impulse and the impulses afterwards are significantly different. Therefore, it is necessary to set proper Dummy Pulse to release the residual magnetic field when testing the instable wound components for good or no good. See 6.7 *Setting Pulse Number [PULSE]* for detail setting description.

## 6.12 Description of Laplacian

When Laplacian bar chart displays, the X-axis (time axis) in the waveform screen is divided into 51 segments and the system will calculate the discharge peak generated in each segment automatically and show them in mapped longitudinal axis bar chart.

There is no unit in the bar chart except the mapped position of discharge volume. The height of bar charge is proportional with the discharge volume so that it can be learned visually.

When Laplacian shows, the horizontal axis resolution is 512 dots which is divided into 51 segments every 10 dots for process in graph. Laplacian bar chart shows the peak level of each segment as the chart standard which is also applied for comparison.

# 7. Using Remote Interface

## 7.1 Introduction

The EST Analyzer can be controlled by PC for data transmission through remote interface.

## 7.2 RS232 Interface

### 7.2.1 Data Format

- Baud Rate: 9600 / 19200 / 38400 / 57600 / 115200
- Flow Control: NONE / HARDWARE
- Transmission bit: 1 start bit
- 8 data bits
- 1 stop bit

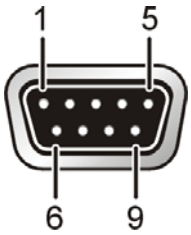
### 7.2.2 Command Format

The function of RS232 interface is to input the ASCII code composed commands for remote control and setting. The command string length is limited to 4096 characters including End Code. [Command+Parameter] forms an instruction and semicolon ";" is used to connect any two commands with an end code at last. The End Code is one of the following formats:

| End Code |
|---|
| LF |
| CR＋LF |

### 7.2.3 Connector

The RS232 connector of the EST Analyzer is a male 9-pin connector.

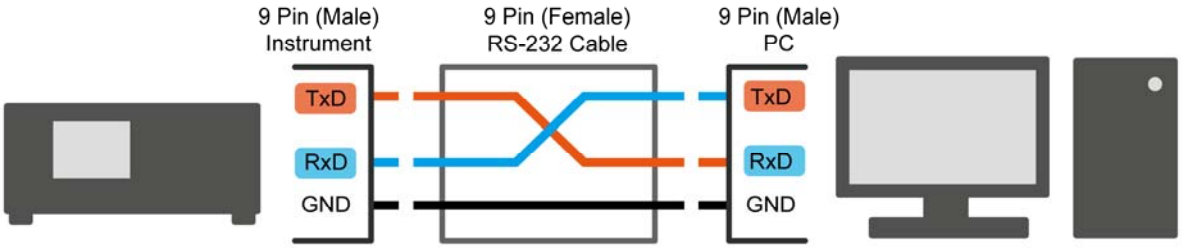



| Pin No. | | Description |
|---|---|---|
| 1 | * | Unused |
| 2 | RxD | Sending data |
| 3 | TxD | Receiving data |
| 4 | * | Unused |

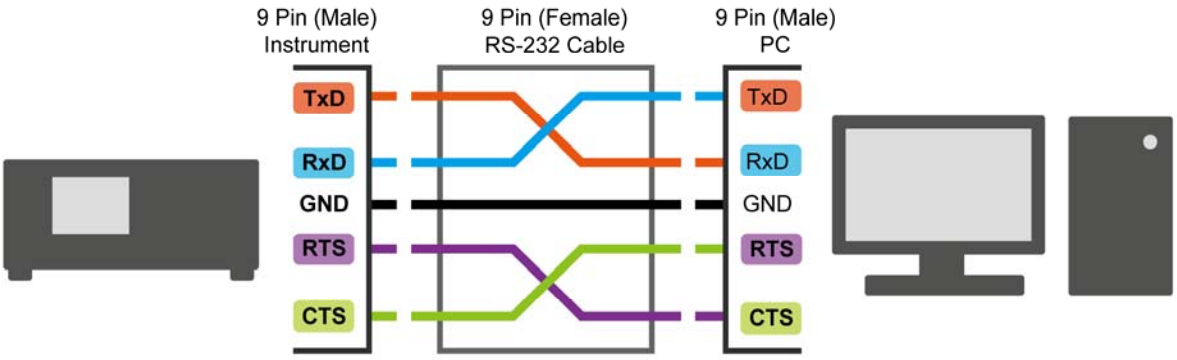
| | | |
|---|---|---|
| 5 | GND | Grounding signal |
| 6 | * | Unused |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | * | Unused |

### 7.2.4 Connection

When the flow control sets to NONE:




When the flow control sets to HARDWARE:




## 7.3 USB Interface

### 7.3.1 Specification

USB (B-type): Meet USBTMC

### 7.3.2 Command Format

The function of USB interface is to input the ASCII code composed commands for remote control and setting. The command string length is limited to 4096 characters including End Code. [Command+Parameter] forms an instruction and semicolon ";" is used to connect any two commands with an end code at last. The End Code is one of the following formats:

**End Code**

| |
|---|
| LF |
| CR＋LF |

# 7.4 LAN Interface

## 7.4.1 Specification

It supports 10M/100M Ethernet.

## 7.4.2 Command Format

The function of LAN interface is to input the ASCII code composed commands for remote control and setting. The command string length is limited to 4096 characters including End Code. [Command+Parameter] forms an instruction and semicolon ";" is used to connect any two commands with an end code at last. The End Code is one of the following formats:

**End Code**

| |
|---|
| LF |
| CR＋LF |

# 7.5 Commands for Remote Interface

## 7.5.1 Commands Summary

- **IEEE 488.2 Command**

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

The parameter syntax of SCPI command includes:
(1) Use "< >" to indicate the defined parameter of standard SCPI command.
(2) "<numeric value>" is a decimal data while "<boolean>" is Boolean program data with value 0 or 1.

(3) Use vertical bar "|" to indicate parameter OR.
(4) "<channel list>" indicates the status of EST Analyzer and Channel. The presentation is: (@S(C1, C2…)) where S indicates Scan number and C1, C2… indicates Channel number.

- **SCPI Command**

```
:MEMory
|       :DELete
|       |     [:NAME]          < name >
|       |     :LOCation        < register number >
|       :NSTates?
|       :STATe
|       |     :DEFine    < name >, < register number >
|       |     :DEFine?   < name >
|       |     :SNUMber?        < register number >
:SYSTem
|       :ERRor
|       |     [:NEXT]?
|       :KLOCk    <boolean> | ON | OFF                                    (RS232 only)
|       :KLOCk?
|       :LOCK
|       |     :OWNer?
|       |     :RELease                                                    (RS232 only)
|       |     :REQuest?                                                   (RS232 only)
|       :TCONtrol
|       |     :AGC
|       |     |     [:SOFTware]     < boolean > | ON | OFF
|       |     |     [:SOFTware]?
|       |     :DCRBalance    < number value >| OFF
|       |     :DCRBalance?
|       |     :FAIL
|       |     |     :OPERation      CONTinue | STOP
|       |     |     :OPERation?
|       |     :GFI        <boolean> | ON | OFF
|       |     :GFI?
|       |     :RJUDgment     <boolean> | ON | OFF
|       |     :RJUDgment?
|       |     :TEMPerature
|       |     |     [:COMPensation]
|       |     |     |     [:ENABle]        OFF | MANual | MEASure
|       |     |     |     [:ENABle]?
|       |     |     |     :UNIT        C | F
|       |     |     |     :UNIT?
|       |     |     |     :TCOefficient     <number value>
|       |     |     |     :TCOefficient?
|       |     |     |     :BTEMperature  <temperature>
|       |     |     |     :BTEMperature?
|       |     |     |     :ETEMperature  <temperature>
|       |     |     |     :ETEMperature?
|       |     :TIME
|       |     |     :PASS      <number value>
|       |     |     :PASS?
|       |     :TRIGger
|       |     |     [:DELay]   <number value> | OFF
|       |     |     [:DELay]?
|       |     :AC
|       |     |     :FREQuency     <number value>
|       |     |     :FREQuency?
```

```
|           |     :WRANge
|           |     |     [:AUTO]    <boolean> | ON | OFF
|           |     |     [:AUTO]?
|           :VERSion?
[:SOURce]
|           :FUNCtion      "BREakdown" | "GENeral"
|           :FUNCtion?
|           :SAFety
|           |     :BREakdown
|           |     |     :IWT
|           |     |     |     :AREA
|           |     |     |     |     :LIMit
|           |     |     |     |     |     :MINus      <number> | OFF
|           |     |     |     |     |     :MINus?
|           |     |     |     |     |     :PLUS       <number> | OFF
|           |     |     |     |     |     :PLUS?
|           |     |     |     |     :SCOPe
|           |     |     |     |     |     :BEGin      <number>
|           |     |     |     |     |     :BEGin?
|           |     |     |     |     |     :END        <number>
|           |     |     |     |     |     :END?
|           |     |     |     :CORRection
|           |     |     |     |     :OUTPut      <voltage>
|           |     |     |     |     :OUTPut?
|           |     |     |     |     [:WAVeform]
|           |     |     |     |     |     :SAMPle
|           |     |     |     |     |     |     [:DATA]       GET | <waveform>
|           |     |     |     |     |     |     [:DATA]?
|           |     |     |     |     |     |     :VALid?
|           |     |     |     |     |     |     :VOLTage?
|           |     |     |     :LAPLac
|           |     |     |     |     :LIMit      <number> | OFF
|           |     |     |     |     :LIMit?
|           |     |     |     |     :SCOPe
|           |     |     |     |     |     :BEGin      <number>
|           |     |     |     |     |     :BEGin?
|           |     |     |     |     |     :END        <number>
|           |     |     |     |     |     :END?
|           |     |     |     [:LEVel]      <start>, <end>, <step>
|           |     |     |     [:LEVel]?
|           |     |     |     :PULSe      <number>
|           |     |     |     :PULSe?
|           |     |     |     :RESult
|           |     |     |     |     :WVOLtage?
|           |     |     |     :WIDTh      <number>
|           |     |     |     :WIDTh?
|           |     |     :FETCh?   [<item>][,<item>]
|           |     |     :RESult
|           |     |     |     :ALL
|           |     |     |     |     [:JUDGment]?
|           |     |     |     |     :METerage<m>?
|           |     |     |     |     :MODE?
|           |     |     |     |     :TIME
|           |     |     |     |     |     [:ELAPsed]
|           |     |     |     |     |     :DWELl?
|           |     |     |     |     |     :FALL?
|           |     |     |     |     |     :RAMP?
|           |     |     |     |     |     [:TEST]?
|           |     |     |     :AREPort  <boolean> | ON | OFF                    (RS232 only)
```

```
|       |       |       :AREPort?                                                    (RS232 only)
|       |       |       :COMPleted?
|       |       |       [:LAST]
|       |       |       |       [:JUDGment] ?
|       |       |       :STEP<n>
|       |       |       |       [:MAIN]   |   :SUB<n>(Note1)
|       |       |       |       |       [:JUDGment]?
|       |       |       |       |       :METerage<m>?
|       |       |       |       |       :TIME
|       |       |       |       |       |       [:ELAPsed]
|       |       |       |       |       |       |       :DWELl?
|       |       |       |       |       |       |       :FALL?
|       |       |       |       |       |       |       :RAMP?
|       |       |       |       |       |       |       [:TEST]?
|       |       |       :TOTal
|       |       |       |       [:JUDGment]?
|       |       :SNUMber?
|       |       :STARt
|       |       |       [:ONCE]
|       |       |       :CORRection
|       |       |       |       :OPEN       GET | OFF
|       |       |       |       :OPEN?
|       |       |       |       :SHORt      GET | OFF
|       |       |       |       :SHORt?
|       |       |       |       :SAMPle     GET
|       |       |       |       :SAMPle?
|       |       :STOP
|       |       :STATus?
|       |       :STEP<n>
|       |       |       [:MAIN]   |   :SUB<n>(Note1)
|       |       |       |       :DELete
|       |       |       |       :MODE?
|       |       |       |       :AC
|       |       |       |       |       :CHANnel
|       |       |       |       |       |       [:HIGH]     <channel list>
|       |       |       |       |       |       [:HIGH]?
|       |       |       |       |       |       :LOW        <channel list>
|       |       |       |       |       |       :LOW?
|       |       |       |       |       :CORRection
|       |       |       |       |       |       [:CURRent]
|       |       |       |       |       |       |       :OPEN
|       |       |       |       |       |       |       |       [:RANGe]
|       |       |       |       |       |       |       |       |       [:BEST]  <number value>
|       |       |       |       |       |       |       |       |       [:BEST]?
|       |       |       |       |       |       |       |       |       :ALL      <range 1>,<range 2>,<range 3>
|       |       |       |       |       |       |       |       |       :ALL?
|       |       |       |       |       |       :RCURrent
|       |       |       |       |       |       |       :OPEN
|       |       |       |       |       |       |       |       [:RANGe]
|       |       |       |       |       |       |       |       |       [:BEST]  <number value>
|       |       |       |       |       |       |       |       |       [:BEST]?
|       |       |       |       |       |       |       |       |       :ALL      <range 1>,<range 2>,<range 3>
|       |       |       |       |       |       |       |       |       :ALL?
|       |       |       |       |       |       :HFCC
|       |       |       |       |       |       |       :OPEN
|       |       |       |       |       |       |       |       [:RANGe]
|       |       |       |       |       |       |       |       |       [:BEST]  <number value>
|       |       |       |       |       |       |       |       |       [:BEST]?
|       |       |       |       |       |       |       |       |       :ALL      <number value>
```

```
|           |     |     |     |     |     |     |     |     :ALL?
|           |     |     |     |     [:LEVel]    <number value>
|           |     |     |     |     [:LEVel]?
|           |     |     |     |     :LIMit
|           |     |     |     |     |     :ARC      <number value> | OFF
|           |     |     |     |     |     :ARC?
|           |     |     |     |     |     [:HIGH]   <number value>
|           |     |     |     |     |     [:HIGH]?
|           |     |     |     |     |     :LOW      <number value> | OFF
|           |     |     |     |     |     :LOW?
|           |     |     |     |     |     :REAL     <number value> | OFF
|           |     |     |     |     |     :REAL?
|           |     |     |     |     |     :OPEN     <number value>
|           |     |     |     |     |     :OPEN?
|           |     |     |     |     |     :SHORt    <number value> | OFF
|           |     |     |     |     |     :SHORt?
|           |     |     |     |     :CSTandard     <number value> | OFF
|           |     |     |     |     :CSTandard?
|           |     |     |     |     :TIME
|           |     |     |     |     |     :FALL     <number value> | OFF
|           |     |     |     |     |     :FALL?
|           |     |     |     |     |     :RAMP     <number value> | OFF
|           |     |     |     |     |     :RAMP?
|           |     |     |     |     |     [:TEST]   <number value> | CONTinue
|           |     |     |     |     |     [:TEST]?
|           |     |     |     :DC
|           |     |     |     |     :CHANnel
|           |     |     |     |     |     [:HIGH]   <channel list>
|           |     |     |     |     |     [:HIGH]?
|           |     |     |     |     |     :LOW      <channel list>
|           |     |     |     |     |     :LOW?
|           |     |     |     |     :CORRection
|           |     |     |     |     |     [:CURRent]
|           |     |     |     |     |     |     :OPEN
|           |     |     |     |     |     |     |     [:RANGe]
|           |     |     |     |     |     |     |     |     [:BEST] <number value>
|           |     |     |     |     |     |     |     |     [:BEST]?
|           |     |     |     |     |     |     |     |     :ALL     <range 1 >,<range 2 >,<range 3>
|           |     |     |     |     |     |     |     |     :ALL?
|           |     |     |     |     |     :HFCC
|           |     |     |     |     |     |     :OPEN
|           |     |     |     |     |     |     |     [:RANGe]
|           |     |     |     |     |     |     |     |     [:BEST] <number value>
|           |     |     |     |     |     |     |     |     [:BEST]?
|           |     |     |     |     |     |     |     |     :ALL     <number value>
|           |     |     |     |     |     |     |     |     :ALL?
|           |     |     |     |     [:LEVel]    <number value>
|           |     |     |     |     [:LEVel]?
|           |     |     |     |     :LIMit
|           |     |     |     |     |     :ARC
|           |     |     |     |     |     |     [:LEVel]   <number value> | OFF
|           |     |     |     |     |     |     [:LEVel]?
|           |     |     |     |     |     |     :RLEVel    <number value> | DEFault
|           |     |     |     |     |     |     :RLEVel?
|           |     |     |     |     |     [:HIGH]   <number value>
|           |     |     |     |     |     [:HIGH]?
|           |     |     |     |     |     :LOW      <number value> | OFF
|           |     |     |     |     |     :LOW?
|           |     |     |     |     |     :OPEN     <number value>
```

```
|       |   |   |   |   |   :OPEN?
|       |   |   |   |   |   :SHORt    <number value> | OFF
|       |   |   |   |   |   :SHORt?
|       |   |   |   |   :CSTandard    <number value> | OFF
|       |   |   |   |   :CSTandard?
|       |   |   |   |   :TIME
|       |   |   |   |   |   :DWELl    <number value> | OFF
|       |   |   |   |   |   :DWELl?
|       |   |   |   |   |   :FALL     <number value> | OFF
|       |   |   |   |   |   :FALL?
|       |   |   |   |   |   :RAMP     <number value> | OFF
|       |   |   |   |   |   :RAMP?
|       |   |   |   |   |   [:TEST]   <number value> | CONTinue
|       |   |   |   |   |   [:TEST]?
|       |   |   |   :IR
|       |   |   |   |   :CHANnel
|       |   |   |   |   |   [:HIGH]   <channel list>
|       |   |   |   |   |   [:HIGH]?
|       |   |   |   |   |   :LOW      <channel list>
|       |   |   |   |   |   :LOW?
|       |   |   |   |   :CORRection
|       |   |   |   |   |   :CURRent
|       |   |   |   |   |   |   :OPEN
|       |   |   |   |   |   |   |   [:RANGe]
|       |   |   |   |   |   |   |   |   [:BEST]  <number value>
|       |   |   |   |   |   |   |   |   [:BEST]?
|       |   |   |   |   |   |   |   |   :ALL      <range 1>,<range 2>,<range 3>,
<range 4>,<range 5>,<range 6 >,<range 7>
|       |   |   |   |   |   |   |   |   :ALL?
|       |   |   |   |   [:LEVel]  <number value>
|       |   |   |   |   [:LEVel]?
|       |   |   |   |   :LIMit
|       |   |   |   |   |   :HIGH     <number value> | OFF
|       |   |   |   |   |   :HIGH?
|       |   |   |   |   |   [:LOW]    <number value>
|       |   |   |   |   |   [:LOW]?
|       |   |   |   |   :RANGe
|       |   |   |   |   |   :UPPer    <number value>
|       |   |   |   |   |   :UPPer?
|       |   |   |   |   |   [:LOWer]  <number value>
|       |   |   |   |   |   [:LOWer]?
|       |   |   |   |   |   :AUTO     <boolean> | ON | OFF
|       |   |   |   |   |   :AUTO?
|       |   |   |   |   :TIME
|       |   |   |   |   |   :DWELl    <number value> | OFF
|       |   |   |   |   |   :DWELl?
|       |   |   |   |   |   :FALL     <number value> | OFF
|       |   |   |   |   |   :FALL?
|       |   |   |   |   |   :RAMP     <number value> | OFF
|       |   |   |   |   |   :RAMP?
|       |   |   |   |   |   [:TEST]   <number value> | CONTinue
|       |   |   |   |   |   [:TEST]?
|       |   |   |   :DCR
|       |   |   |   |   :CHANnel
|       |   |   |   |   |   [:HIGH]   <channel list>
|       |   |   |   |   |   [:HIGH]?
|       |   |   |   |   |   :LOW      <channel list>
|       |   |   |   |   |   :LOW?
|       |   |   |   |   :CORRection
```

```
|           |     |     |     |     |     [:RESistance]
|           |     |     |     |     |     |     :SHORt
|           |     |     |     |     |     |     |     [:RANGe]
|           |     |     |     |     |     |     |     |     [:BEST]  <number value>
|           |     |     |     |     |     |     |     |     [:BEST]?
|           |     |     |     |     |     |     |     |     :ALL     <range 1>,<range 2>,<range 3>,
<range 4>,<range 5>,<range 6>,<range 7>
|           |     |     |     |     |     |     |     |     :ALL?
|           |     |     |     |     |   :LIMit
|           |     |     |     |     |     |     [:HIGH]    <number value>
|           |     |     |     |     |     |     [:HIGH]?
|           |     |     |     |     |     |     :LOW       <number value> | OFF
|           |     |     |     |     |     |     :LOW?
|           |     |     |     |     |   :RANGe
|           |     |     |     |     |     |     :UPPer     <number value>
|           |     |     |     |     |     |     :UPPer?
|           |     |     |     |     |     |     [:LOWer]   <number value>
|           |     |     |     |     |     |     [:LOWer]?
|           |     |     |     |     |     |     :AUTO      <boolean> | ON | OFF
|           |     |     |     |     |     |     :AUTO?
|           |     |     |     |     |   :TIME
|           |     |     |     |     |     |     :DWELl     <number value> | OFF
|           |     |     |     |     |     |     :DWELl?
|           |     |     |     |     |     |     [:TEST]    <number value> | OFF | KEY
|           |     |     |     |     |     |     [:TEST]?
|           |     |     |     |   :OSC
|           |     |     |     |     |   :CHANnel
|           |     |     |     |     |     |     [:HIGH]    <channel list>
|           |     |     |     |     |     |     [:HIGH]?
|           |     |     |     |     |     |     :LOW       <channel list>
|           |     |     |     |     |     |     :LOW?
|           |     |     |     |     |   :CORRection
|           |     |     |     |     |     |     [:CAPacitance]
|           |     |     |     |     |     |     |     :OPEN
|           |     |     |     |     |     |     |     |     [:RANGe]
|           |     |     |     |     |     |     |     |     |     [:BEST]  <number value>
|           |     |     |     |     |     |     |     |     |     [:BEST]?
|           |     |     |     |     |     |     |     |     |     :ALL     <range 1 >,<range 2 >
|           |     |     |     |     |     |     |     |     |     :ALL?
|           |     |     |     |     |     |     |     |     :SAMPle   <range>,<number value>
|           |     |     |     |     |     |     |     |     :SAMPle?
|           |     |     |     |     |   :LIMit
|           |     |     |     |     |     |     [:OPEN]    <number value>
|           |     |     |     |     |     |     [:OPEN]?
|           |     |     |     |     |     |     :SHORt     <number value> | OFF
|           |     |     |     |     |     |     :SHORt?
|           |     |     |     |   :IWT
|           |     |     |     |     |   :CHANnel
|           |     |     |     |     |     |     [:HIGH]    <channel list>
|           |     |     |     |     |     |     [:HIGH]?
|           |     |     |     |     |     |     :LOW       <channel list>
|           |     |     |     |     |     |     :LOW?
|           |     |     |     |     |   :CORRection
|           |     |     |     |     |     |     :OUTPut    <voltage>
|           |     |     |     |     |     |     :OUTPut?
|           |     |     |     |     |     |     [:WAVeform]
|           |     |     |     |     |     |     |     :SAMPle
|           |     |     |     |     |     |     |     |     [:DATA]       GET | <waveform>
|           |     |     |     |     |     |     |     |     [:DATA]?
```

```
|           |     |     |     |     |     |     |     :VALid?
|           |     |     |     |     |     |     |     :VOLTage?
|           |     |     |     |     [:LEVel]    <number value>
|           |     |     |     |     [:LEVel]?
|           |     |     |     |     :WIDTh      <number value>
|           |     |     |     |     :WIDTh?
|           |     |     |     |     :PULSe      <number value>
|           |     |     |     |     :PULSe?
|           |     |     |     |     :AREA
|           |     |     |     |     |     :SCOPe
|           |     |     |     |     |     |     :BEGin      <number value>
|           |     |     |     |     |     |     :BEGin?
|           |     |     |     |     |     |     :END        <number value>
|           |     |     |     |     |     |     :END?
|           |     |     |     |     |     :LIMit
|           |     |     |     |     |     |     :PLUS       <number value> | OFF
|           |     |     |     |     |     |     :PLUS?
|           |     |     |     |     |     |     :MINus      <number value> | OFF
|           |     |     |     |     |     |     :MINus?
|           |     |     |     |     :DARea
|           |     |     |     |     |     :LIMit      <number value> | OFF
|           |     |     |     |     |     :LIMit?
|           |     |     |     |     |     :SCOPe
|           |     |     |     |     |     |     :BEGin      <number value>
|           |     |     |     |     |     |     :BEGin?
|           |     |     |     |     |     |     :END        <number value>
|           |     |     |     |     |     |     :END?
|           |     |     |     |     :FLUTter
|           |     |     |     |     |     :LIMit      <number value> | OFF
|           |     |     |     |     |     :LIMit?
|           |     |     |     |     |     :SCOPe
|           |     |     |     |     |     |     :BEGin      <number value>
|           |     |     |     |     |     |     :BEGin?
|           |     |     |     |     |     |     :END        <number value>
|           |     |     |     |     |     |     :END?
|           |     |     |     |     :LAPLac
|           |     |     |     |     |     :LIMit      <number value> | OFF
|           |     |     |     |     |     :LIMit?
|           |     |     |     |     |     :SCOPe
|           |     |     |     |     |     |     :BEGin      <number value>
|           |     |     |     |     |     |     :BEGin?
|           |     |     |     |     |     |     :END        <number value>
|           |     |     |     |     |     |     :END?
|           |     |     |     :PAuse
|           |     |     |     |     [:MESSage]      <string data>
|           |     |     |     |     [:MESSage]?
|           |     |     |     |     :TIME
|           |     |     |     |     |     [:TEST]     <number value> | KEY
|           |     |     |     |     |     [:TEST]?
|           |     |     |     :HSCC
|           |     |     |     |     :CHANnel
|           |     |     |     |     |     :CLEar
|           |     |     |     |     |     :GROup<n>       <number value 1>,<number value 2>
|           |     |     |     |     |     :GROup<n>?
|           |     |     |     :YDELta
|           |     |     |     |     :CHANnel
|           |     |     |     |     |     :A      <channel list>
|           |     |     |     |     |     :A?
|           |     |     |     |     |     :B      <channel list>
```

```
|          |    |    |    |    |    :B?
|          |    |    |    |    |    :C    <channel list>
|          |    |    |    |    |    :C?
|          |    |    |    |    :LIMit
|          |    |    |    |    |    :RAB
|          |    |    |    |    |    |    [:HIGH]    <number value>
|          |    |    |    |    |    |    [:HIGH]?
|          |    |    |    |    |    |    :LOW       <number value> | OFF
|          |    |    |    |    |    |    :LOW?
|          |    |    |    |    |    :RBC
|          |    |    |    |    |    |    [:HIGH]    <number value>
|          |    |    |    |    |    |    [:HIGH]?
|          |    |    |    |    |    |    :LOW       <number value> | OFF
|          |    |    |    |    |    |    :LOW?
|          |    |    |    |    |    :RCA
|          |    |    |    |    |    |    [:HIGH]    <number value>
|          |    |    |    |    |    |    [:HIGH]?
|          |    |    |    |    |    |    :LOW       <number value> | OFF
|          |    |    |    |    |    |    :LOW?
|          |    |    |    |    |    :BALance
|          |    |    |    |    |    |    [:HIGH]    <number value> | OFF
|          |    |    |    |    |    |    [:HIGH]?
|          |    |    |    |    :RANGe
|          |    |    |    |    |    :UPPer     <number value>
|          |    |    |    |    |    :UPPer?
|          |    |    |    |    |    [:LOWer]   <number value>
|          |    |    |    |    |    [:LOWer]?
|          |    |    |    |    |    :AUTO      <boolean> | ON | OFF
|          |    |    |    |    |    :AUTO?
|          |    |    |    |    :TIME
|          |    |    |    |    |    [:TEST]    <number value> | OFF
|          |    |    |    |    |    [:TEST]?
|          |    |    |    |    :TYPE      DELTa | Y
|          |    |    |    |    :TYPE?
```

**Note** [:MAIN] | :SUB<n> indicates there are two command nodes which are [:MAIN] and :SUB<n>.

## 7.5.2 Command Description

- **IEEE 488.2 Commands**

***CLS**
It clears the data structure of status in the following actions:
- Clear the error queue.
- Clear the standard event register.
- Clear the byte register except MAV bit (bit 4)

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

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

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

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

***OPC**
It completes the operation.

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

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

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

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

***RCL < *decimal data* >**
It is a read back command.
This command reads back the settings saved in the memory of the device. The parameter is the memory serial no.

***SAV < *decimal data* >**
It is a save command.
This command saves the settings at present of the device to memory. The parameter is the memory serial no.

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

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

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

- **SCPI Commands**

**:MEMory:DELete[:Name] *<name>***
It deletes the parameter data specified by <name> in main memory. <name> is a string.

**:MEMory:DELete: LOCation *<register number>***
It deletes the parameter data specified by < register number > in main memory. <register number> is an integer.

**:MEMory:STATe:DEFine** ***<name>, <register number>***
It sets a name for memory specified by <register number>.

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

**:MEMory:STATe:SNUMBer?** ***<register number>***
It queries the STEP number saved in memory specified by <register number >.

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

**:SYSTem:ERRor[:NEXT]?**
This command reads the messages in Error Queue. See Section 7.6 *Error Messages* for the returned messages.

**:SYSTem:KLOCk** ***<boolean>* | *ON* | *OFF***
It locks the panel control. The command does not affect the Remote/Local state of GPIB.

**:SYSTem:KLOCk?**
It queries if the panel is locked.

**:SYSTem:LOCK:OWNer?**
It queries if the EST Analyzer is in panel control or remote control state.

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

**:SYSTem:LOCK:REQuest?**
It switches to remote control state. It returns 1 if success or it returns 0.

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

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

**:SYSTem:TCONtrol:DCRBalance** ***<number value>***
It sets the value of DCR Balance in the unit of ohm.

**:SYSTem:TCONtrol:DCRBalance?**
It queries the value of DCR Balance in the unit of ohm.

**:SYSTem:TCONtrol:FAIL:OPERation** ***CONTinue* | *STOP***
It sets the action after the test step is judged as FAIL.
When set to *CONTinue*, it won't stop test after detected FAIL. It will continue the steps afterwards. When set to *STOP*, it will stop test after detected FAIL.

**:SYSTem:TCONtrol:FAIL:OPERation?**
It queries the setting of AFTER FAIL.

**:SYSTem:TCONtrol: GFI** ***<boolean>* | *ON* | *OFF***
It sets if enabling GFI.

**:SYSTem:TCONtrol: GFI?**
It queries if GFI is enabled with 0 or 1 returned. (0 means GFI is disabled and 1 means GFI is enabled.)

**SYSTem:TCONtrol: LX:ECIRcuit** ***SERies* | *PARallel***
It sets to series or parallel mode for inductance measurement.

**SYSTem:TCONtrol: LX:ECIRcuit?**
It queries the settings of series or parallel mode.

**SYSTem:TCONtrol: LX:FREQuency** ***<number>***
It sets the frequency for inductance measurement.

**SYSTem:TCONtrol: LX:FREQuency?**
It queries the frequency for inductance measurement.

**SYSTem:TCONtrol: LX:LEVel** ***<number>***
It sets the output voltage for inductance measurement.

**SYSTem:TCONtrol: LX:LEVel?**
It queries the output voltage for inductance measurement.

**SYSTem:TCONtrol: LX:RANGe:AUTO** ***<boolean>* | *ON* | *OFF***
It sets if enabling auto range for inductance measurement.

**SYSTem:TCONtrol: LX:RANGe:AUTO?**
It queries if enabled auto range for inductance measurement.

**SYSTem:TCONtrol: LX:RANGe:LOWer** ***1* | *3* | *5* | *7* | *8* | *10***
It sets the range for inductance measurement.

**SYSTem:TCONtrol: LX:RANGe:LOWer?**
It queries the range for inductance measurement.

**SYSTem:TCONtrol: LX:RANGe[:UPPer]** ***1* | *3* | *5* | *7* | *8* | *10***
It sets the range for inductance measurement.

**SYSTem:TCONtrol: LX:RANGe[:UPPer]?**
It queries the range for inductance measurement.

**SYSTem:TCONtrol: LX:SPEed** ***FAST* | *MEDium* | *SLOW***
It sets the test speed for inductance measurement.

**SYSTem:TCONtrol: LX:SPEed?**
It queries the test speed for inductance meansurement.

**SYSTem:TCONtrol: LX:TIMeout** ***<number>***
It sets the timeout for inductance measurement.

**SYSTem:TCONtrol: LX:TIMeout?**
It queries the timeout for inductance measurement.

**:SYSTem:TCONtrol: RJUDgment** ***< boolean >*** **|** ***ON*** **|** ***OFF***
It sets if enabling RAMP JUDGMENT.

**:SYSTem:TCONtrol: RJUDgment?**
It queries if RAMP JUDGMENT is enabled with 0 or 1 returned. (0 means OFF that is disabled and 1 means ON.)

**:SYSTem:TCONtrol:TEMPerature[:COMPensation] [:ENABle]** ***OFF*** **|** ***MANual*** **|** ***MEASure***
It enables the temperature compensation function.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation] [:ENABle]?**
It queries if the temperature compensation function is enabled.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]:UNIT** ***C*** **|** ***F***
It sets the temperature unit.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]:UNIT?**
It queries the temperature unit.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]:TCOefficient** ***<numeric value>***
It sets the temperature coefficient with the unit in ppm.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]:TCOefficient?**
It queries the temperature coefficient with the unit in ppm.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]:BTEMperature** ***<numeric value>***
It sets the standard site temperature in the unit of °C or °F following the setting of :SYSTem:TCONtrol:TEMPerature[:COMPensation]:UNIT.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]: BTEMperature?**
It queries the standard site temperature in the unit of °C or °F following the setting of :SYSTem:TCONtrol:TEMPerature[:COMPensation]:UNIT.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]:ETEMperature** ***<numeric value>***
It sets the environment temperature in the unit of °C or °F following the setting of :SYSTem:TCONtrol:TEMPerature[:COMPensation]:UNIT. Use this parameter when:SYSTem:TCONtrol:TEMPerature[:COMPensation] [:ENABle] is set to MANUal.

**:SYSTem:TCONtrol:TEMPerature[:COMPensation]:ETEMperature?**
It queries the environment temperature in the unit of °C or °F following the setting of :SYSTem:TCONtrol:TEMPerature[:COMPensation]:UNIT.

**:SYSTem:TCONtrol: TIME:PASS** ***<numeric_value>***
It sets the time for PASS HOLD duration. The unit is second.

**:SYSTem:TCONtrol: TIME:PASS?**
It queries the time for PASS HOLD duration.

**:SYSTem:TCONtrol:TRIGger[:DELay]** ***<numeric_value>***
It sets the time delayed for trigger. The unit is second.

**:SYSTem:TCONtrol: TRIGger[:DELay]?**
It queries the time delayed for trigger. The unit is second.

**:SYSTem:TCONtrol:AC:FREQuency** ***<numeric value>***
It sets the output voltage frequency when under AC withstand voltage test. The setting range is 50Hz or 60Hz.

**:SYSTem:TCONtrol:AC:FREQuency?**
It queries the output voltage frequency when under AC withstand voltage test.

**:SYSTem:TCONtrol:WRANge[:AUTO]** ***<boolean>* | *ON* | *OFF***
It sets if enabling the withstand voltage auto range function.

**:SYSTem:TCONtrol:WRANge[:AUTO]?**
It queries if the withstand voltage auto range function is enabled with 0 or 1 returned. (0 means OFF is disabled and 1 means ON.)

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

**[:SOURce]:FUNCtion** *"BREakdown"* | *"GENeral"*
It sets the test mode to be BDV mode or general mode. The input parameter format is string data.

**[:SOURce]:FUNCtion?**
It queries the setting value of test mode. The return data is string.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:LIMit:MINus** ***<numeric value>* |*OFF***
It sets the LIMIT- value of AREA condition for BDV testing and the range is 0.001~0.999. The LIMIT- setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:LIMit:MINus?**
It queries the LIMIT- setting of AREA condition for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:LIMit:PLUS** ***<numeric value>* |*OFF***
It sets the LIMIT+ value of AREA condition for BDV test and the range is 0.001~0.999. The LIMIT+ setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:LIMit:PLUS?**
It queries the LIMIT+ setting of AREA condition for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:SCOPe:BEGin** ***<numeric value>***
It sets the BEGIN value of AREA condition for BDV testing. The range is 1~512.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:SCOPe:BEGin?**
It queries the BEGIN setting of AREA condition for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:SCOPe:END** ***<numeric value>***
It sets the END value of AREA condition for BDV testing. The range is 1~512.

**[:SOURce]:SAFety:BREakdown:IWT:AREA:SCOPe:END?**
It queries the END setting of AREA condition for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:CHANnel[:HIGH]** ***<channel_list>***
**[:SOURce]:SAFety:BREakdown:IWT:CHANnel[:HIGH]** ***<channel_list>***
It sets the high voltage output scan channel for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:BREakdown:IWT:CHANnel[:HIGH]?**
It queries the high voltage output scan channel for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:CHANnel:LOW *<channel_list>***
**[:SOURce]:SAFety:BREakdown:IWT:CHANnel:LOW *<channel_list>***
It sets the output state of common test scan channel (RTN/LOW) for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:CHANnel:LOW?**
**[:SOURce]:SAFety:BREakdown:IWT:CHANnel:LOW?**
It queries the output state of common test scan channel (RTN/LOW) for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:CORRection:OUTPut *<voltage>***
It sets the actual output voltage which is different from the DUT voltage for BDV testing. The range is 0~7000V.

**[:SOURce]:SAFety:BREakdown:IWT:CORRection:OUTPut?**
It queries the actual output voltage for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:CORRection[:WAVeform]:SAMPLe[:DATA] *<block data>* | *GET***
It sets the sampling waveform data or starts sampling process for BDV testing. When the parameter is set to GET, it means to start sampling process. When the parameter is set to <block data>, it means to set the waveform data. The format of <block data> starts from "#0" followed by 512 dots waveform data and each dot is represented by 3 hexadecimal characters. The range is 000~3FF and the data length is 1538 (2+512x3) characters.

**[:SOURce]:SAFety:BREakdown:IWT:CORRection[:WAVeform]:SAMPLe[:DATA]?**
It queries the sampling waveform data for BDV testing. The return data format starts from "#0" followed by 512 dots waveform data and each dot is represented by 3 hexadecimal characters. The range is 000~3FF and the data length is 1538 (2+512x3) characters.

**[:SOURce]:SAFety:BREakdown:IWT:CORRection[:WAVeform]:SAMPLe:VALid?**
It queries if the sampling waveform data exists for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:CORRection[:WAVeform]:SAMPLe:VOLTage?**
It queries the sampling waveform data for BDV testing. The return data is 512 dots voltage and each voltage entry is separated by comma (,).

**[:SOURce]:SAFety:BREakdown:IWT:LAPLac:LIMit *<numeric value>* |*OFF***
It sets the LIMIT of LAPLAC condition for BDV testing. The range is 1~9999. The LIMIT setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:BREakdown:IWT:LAPLac:LIMit?**
It queries the LIMIT setting of LAPLAC condition for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:LAPLac:SCOPe:BEGin *<numeric value>***
It sets the BEGIN value of LAPLAC condition for BDV testing. The range is 1~512.

**[:SOURce]:SAFety:BREakdown:IWT:LAPLac:SCOPe:BEGin?**
It queries the BEGIN setting of LAPLAC condition for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:LAPLac:SCOPe:END** ***<numeric value>***
It sets the END value of LAPLAC condition for BDV testing. The range is 1~512.

**[:SOURce]:SAFety:BREakdown:IWT:LAPLac:SCOPe:END?**
It queries the END setting of LAPLAC condition for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT[:LEVel]** ***<start>, <end>, <step>***
It sets the voltage parameter required for BDV testing. The 1st parameter is start voltage with the range from 10V to1000V, the 2nd parameter is end voltage with range from 100V to 6000V and the 3rd parameter is voltage rise ratio with the range from 0.01 to 0.2.

**[:SOURce]:SAFety:BREakdown:IWT[:LEVel]?**
It queries the voltage parameter required for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:PULSe** ***<numeric value>***
It sets the PULSE value for BDV testing. The range is 1.0~32.9.

**[:SOURce]:SAFety:BREakdown:IWT:PULSe?**
It queries the PULSE value for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:RESult:WVOLtage?**
It sets the breakdown voltage for BDV testing.

**[:SOURce]:SAFety:BREakdown:IWT:WIDTh** ***<numeric value>***
It sets the WIDTH value for BDV testing. The range is 1~11.

**[:SOURce]:SAFety:BREakdown:IWT:WIDTh?**
It queries the WIDTH value for BDV testing.

**[:SOURce]:SAFety:FETCh?** ***[ <item> ] [ , <item> ]***
It queries the measurement result of EST Analyzer. <item> is string data as listed below:

| String | Returned Data |
|---|---|
| STEP | The present STEP No. |
| MODE | The present MODE. |
| METerage1 | The reading of Meterage 1. The meaning is listed in the table below. |
| METerage2 | The reading of Meterage 2. The meaning is listed in the table below. |
| METerage3 | The reading of Meterage 3. The meaning is listed in the table below. |
| METerage4 | The reading of Meterage 4. The meaning is listed in the table below. |
| METerage5 | The reading of Meterage 5. The meaning is listed in the table below. |
| RELApsed | The time elapsed for RAMP. |
| RLEAve | The time remained for RAMP. |
| DELApsed | The time elapsed for DWELL. |
| DLEAve | The time remained for DWELL. |
| TELApsed | The time elapsed for TEST. |
| TLEAve | The time remained for TEST. |
| FELapsed | The time elapsed for FALL. |
| FLEave | The time remained for FALL. |

The meaning of METerage1~5 in each MODE:

| | METerage1 | METerage2 | METerage3 | METerage4 | METerage5 |
|---|---|---|---|---|---|
| **AC** | Output | Current | HFCC | Real Current | |
| **DC** | Output | Current | HFCC | | |
| **IR** | Output | Resistance | | | |
| **DCR** | Resistance | Temperature | Real Resistance | | |
| **IWT** | Output | Area | DArea | Flutter | Laplac |
| **Delta/Y DCR** | Rab | Rbc | Rca | Temperature | |
| **IWT COMPARE** | Output | Area | DArea | Flutter | Laplac |
| **HSCC** | Fail Group Index | | | | |
| **OSC** | Output | Capacitance | | | |
| **PA** | | | | | |
| **Lx** | Lx | Q | | | |
| **Lx BALANCE** | Fail Group Index | Percent | ABS | | |

**[:SOURce]:SAFety:RESult:ALL[:JUDGment]?**
It queries all judgment results. The return format is First Step Result, Second Step Result, ..., Last Step Result. The meaning of Code is listed in the table below:

| Mode | AC | | DC | | IR | | OSC | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **HEX** | **DEC** | **HEX** | **DEC** | **HEX** | **DEC** | **HEX** | **DEC** |
| **STANDBY<br>UNCOMPLETED** | | | | | | | | |
| **ABORT** | | | | | | | | |
| **SAMPLE FAIL<br>OUTPUT INVALID<br>CHANNEL INVALID<br>SCANNER MISSING<br>T. PROBE MISSING** | | | | | | | | |
| **TESTING** | | | | | | | | |
| **SKIP<br>COMPLETED<br>PASS** | | | | | | | | |
| **OUTPUT FAIL** | 21 | 33 | 31 | 49 | 42 | 66 | | |
| **HIGH FAIL** | 21 | 33 | 31 | 49 | 41 | 65 | | |
| **LOW FAIL** | 22 | 34 | 32 | 50 | 42 | 66 | | |
| **ARC FAIL** | 23 | 35 | 33 | 51 | | | | |
| **SHORT FAIL** | 24 | 36 | 34 | 52 | 44 | 68 | 61 | 97 |
| **OPEN FAIL** | 22 | 34 | 32 | 50 | | | 62 | 98 |
| **REAL HIGH FAIL** | 2a | 42 | | | | | | |
| **AREA FAIL** | | | | | | | | |
| **DIF-AREA FAIL** | | | | | | | | |
| **FLUTTER FAIL** | | | | | | | | |
| **LAPLAC FAIL** | | | | | | | | |
| **GFI FAIL** | 24 | 36 | 34 | 52 | 44 | 68 | | |

| Mode | DCR | | IWT | | HSCC | | ALL | |
|---|---|---|---|---|---|---|---|---|
| Code | HEX | DEC | HEX | DEC | HEX | DEC | HEX | DEC |
| STANDBY<br>UNCOMPLETED | | | | | | | 70 | 112 |
| ABORT | | | | | | | 71 | 113 |
| SAMPLE FAIL<br>OUTPUT INVALID<br>CHANNEL INVALID<br>SCANNER MISSING<br>T. PROBE MISSING | | | | | | | 72 | 114 |
| TESTING | | | | | | | 73 | 115 |
| SKIP<br>COMPLETED<br>PASS | | | | | | | 74 | 116 |
| OUTPUT FAIL | | | | | | | | |
| HIGH FAIL | 11 | 17 | | | | | | |
| LOW FAIL | 12 | 18 | | | | | | |
| ARC FAIL | | | | | | | | |
| SHORT FAIL | | | | | 14 | 20 | | |
| OPEN FAIL | | | | | 12 | 18 | | |
| REAL HIGH FAIL | | | | | | | | |
| AREA FAIL | | | 51 | 81 | | | | |
| DIF-AREA FAIL | | | 52 | 82 | | | | |
| FLUTTER FAIL | | | 53 | 83 | | | | |
| LAPLAC FAIL | | | 54 | 84 | | | | |
| GFI FAIL | | | | | | | | |

**Notice**

Since the DCR Balance Fail is a combined judgment result of several steps instead of a single step, so please use [:SOURce]:SAFety:RESult:TOTal[:JUDGment]? command to read the judgment result.

**[:SOURce]:SAFety:RESult:ALL:METerage<m>?**
It queries the METerage<m> reading of all STEPs. The range of m is 1~5. Refer to the explanation of [:SOURce]:SAFety:FETCh? command for the Meterage meaning in each MODE.

**[:SOURce]:SAFety:RESult:ALL:MODE?**
It queries the MODE of all STEPs and returns the string data.
AC|DC|IR|OSC|DCR|IWT|HSCC|PA.

**[:SOURce]:SAFety:RESult:ALL:TIME[:ELAPsed]:DWELl?**
It queries the DWELL of all STEPs.

**[:SOURce]:SAFety:RESult:ALL:TIME[:ELAPsed]:FALL?**
It queries the voltage fall time of all STEPs.

**[:SOURce]:SAFety:RESult:ALL:TIME[:ELAPsed]:RAMP?**
It queries the voltage ramp time of all STEPs.

**[:SOURce]:SAFety:RESult:ALL:TIME[:ELAPsed][:TEST]?**
It queries the test time of all STEPs.

**[:SOURce]:SAFety:RESult:AREPort** ***<boolean>* | *ON* | *OFF***
It sets if auto reporting the test result. (For RS232 interface only)

**[:SOURce]:SAFety:RESult:AREPort?**
It queries if the device is auto reporting the test result with 1 or 0 returned. (For RS232 interface only)

**[:SOURce]:SAFety:RESult:COMPleted?**
It queries if the device has completed all test steps by returning 1 or 0.

**[:SOURce]:SAFety:RESult[:LAST][:JUDGment]?**
It queries the judgment code of the last executed STEP.

**[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:IWT:WAVeform:VOLTage?**
**[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:IWT:WAVeform:VOLTage?**
It queries the IWT waveform data of selected STEP. The returned data is 512 entries of voltage values separated by comma (,)
For instance, [:SOURce]:SAFety:RESult: STEP1:SUB2:IWT:WAV:VOLT? means to query the IWT waveform data of STEP 1.2.

**[:SOURce]:SAFety:RESult: STEP<n>[:MAIN][:JUDGment]?**
**[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>[:JUDGment]?**
It queries the judgement result of selected STEP.
For instance, [:SOURce]:SAFety:RESult:STEP1:SUB2:JUDGment? means to query the judgment result of STEP 1.2.

**[:SOURce]:SAFety:RESult:STEP<n>[:MAIN]:METerage<m>?**
**[:SOURce]:SAFety:RESult:STEP<n>:SUB<s>:METerage<m>?**
It queries the METerage<m> reading of selected STEP. The range of m is 1~5. Refer to the explanation of [:SOURce]:SAFety:FETCh? command for the Meterage meaning in each MODE.

**[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed]:DWELl?**
**[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed]:DWELl?**
It queries the DWELL time of selected STEP.

**[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed]:FALL?**
**[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed]:FALL?**
It queries the voltage fall time of selected STEP.

**[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed]:RAMP?**
**[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed]:RAMP?**
It queries the voltage ramp time of selected STEP.

**[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:TIME[:ELAPsed][:TEST]?**
**[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:TIME[:ELAPsed][:TEST]?**
It queries the test time of selected STEP.

**[:SOURce]:SAFety:RESult:TOTal[:JUDGment]?**
It queries the final judgment result. When the return is 0 it indicates there is no test result, -1 indicates FAIL and 1 indicates PASS.

**[:SOURce]:SAFety:SNUMber:MAIN?**
It queries the MAIN STEPs already set in the working memory.

**[:SOURce]:SAFety:SNUMber[:TOTal]?**
It queries the STEP set in the working memory including the sum of MAIN STEP and SUB STEP.

**[:SOURce]:SAFety:STARt[:ONCE]**
It starts the test following the [:SOURce]:FUNCtion command setting to normal testing or BDV testing.

**[:SOURce]:SAFety:STARt:CORRection:OPEN *GET* | *OFF***
When the parameter is set to GET, it gets the correction of OPEN. The main system may output high voltage at the time, and the correction is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STARt:CORRection:OPEN?**
It queries if OPEN correction is enabled.

**[:SOURce]:SAFety:STARt:CORRection:SHORt*GET* | *OFF***
It gets the correction of SHORT when the parameter is set to GET. The main system may output high voltage at the time, and the correction is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STARt:CORRection:SHORt?**
It queries if SHORT correction is enabled.

**[:SOURce]:SAFety:STARt:CORRection:SAMPle *GET***
It gets the sample correction when the parameter is set to GET. The main system may output high voltage at the time.

**[:SOURce]:SAFety:STARt:CORRection:SAMPle?**
It queries if sample correction is enabled.

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

**[:SOURce]:SAFety:STATus?**
It queries the status of current device. The returned data is RUNNING or STOPPED.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DELete**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DELete**
[:SOURce]:SAFety:STEP<n>[:MAIN]:DELete command will delete the <n> STEPs and the SUB STEPs underneath, the STEPs following <n> will forward to fill.
[:SOURce]:SAFety:STEP<n>:SUB<s>:DELete command will delete the <n>.<s> STEPs and the STEPs following <n>.<s> will forward to fill. Ex:
SOURce:SAFety:STEP2:SUB3:DELete means to delete the STEP of 2.3.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:MODE?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:MODE?**
It queries the MODE of selected STEP and the returned data is AC, DC, IR, OSC, DCR, IWT, HSCC, PA, YDELta.

**[:SOURce]:SAFety:STEP<n>[:MAIN]: AC:CHANnel[:HIGH] <*channel_list*>**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CHANnel[:HIGH] <*channel_list*>**
It sets the high voltage output channel status during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]: AC:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CHANnel[:HIGH]?**
It queries the high voltage output channel status during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]: AC:CHANnel:LOW *<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CHANnel:LOW *<channel_list>***
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]: AC:CHANnel:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CHANnel:LOW?**
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection[:CURRent]:OPEN[:RANGe][:BEST] *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection[:CURRent]:OPEN[:RANGe][:BEST] *<number value>***
It sets the open current for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.10A (the valid range is 0~0.12A when the voltage is set to 4kV.) This command will set the open current of all ranges to this value. Please be noted that the device may clear this open current if the test parameter is changed. It is suggested to set this open current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]?**
It queries the open current of minimum current range for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection[:CURRent]:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection[:CURRent]:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>***
It sets the open current of each range for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.10A (the valid range is 0~0.12A when the voltage is set to 4kV.) This command requires 2 parameters, the first parameter is the open current of small current range and the second parameter is the open current of large current range. Please be noted that the device may clear this open current if the test parameter is changed. It is suggested to set this open current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection[:CURRent]:OPEN[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection[:CURRent]:OPEN[:RANGe]:ALL?**
It queries the open current of selected STEP. The unit is ampere. This query command will return 2 open currents with comma as the separator. The first is the open current of small current range and the second is for large current range.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:RCURrent:OPEN[:RANGe][:BEST] *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:RCURrent:OPEN[:RANGe][:BEST] *<number value>***
It sets the open real current for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.10A (the valid range is 0~0.12A when the voltage is set to 4kV.). This command will set the open real current of all ranges to this value. Please be noted that the device may clear this open real current if the test parameter is changed. It is suggested to set this open real current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:RCURrent:OPEN[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:RCURrent:OPEN[:RANGe][:BEST]?**
It queries the open real current of minimum current range for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:RCURrent:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:RCURrent:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>***
It sets the open real current of each range for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.03A. This command requires 2 parameters, the first parameter is the open real current of small current range and the second parameter is the open real current of large current range. Please be noted that the device may clear this open real current if the test parameter is changed. It is suggested to set this open real current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:RCURrent:OPEN[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:RCURrent:OPEN[:RANGe]:ALL?**
It queries the open current of selected STEP. The unit is ampere. This query command will return 2 open currents with comma as the separator. The first is the open current of small current range and the second is for large current range.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:HFCC:OPEN[:RANGe][:BEST] *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:HFCC:OPEN[:RANGe][:BEST] *<number value>***
It sets the open real HFCC value for the selected STEP. The unit is F and the valid range is 0 ~ 100pF. Please be noted that the device may clear the value if the test parameter is changed. Thus, it is suggested to set this value after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:HFCC:OPEN[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:HFCC:OPEN[:RANGe][:BEST]?**
It queries the open real HFCC value for the selected STEP. The unit is F.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:HFCC:OPEN[:RANGe]:ALL *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:HFCC:OPEN[:RANGe]:ALL *<number value>***
It sets the open real HFCC value for the selected STEP. The unit is F and the valid range is 0 ~ 100pF. Please be noted that the device may clear the value if the test parameter is changed. Thus, it is suggested to set this value after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:CORRection:HFCC:OPEN[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:CORRection:HFCC:OPEN[:RANGe]:ALL?**
It queries the open real HFCC value for the selected STEP. The unit is F.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC[:LEVel] *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC[:LEVel] *<numeric value>***
It sets the required voltage during AC withstand voltage test for the selected STEP. The unit is volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC[:LEVel]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC[:LEVel]?**
It queries the required voltage during AC withstand voltage test for the selected STEP. The unit is volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:ARC *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:ARC *<numeric value>* | *OFF***
It sets the ARC test of the selected STEP. The unit is ampere. The ARC setting is disabled when the parameter is set to OFF

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:ARC?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:ARC?**
It queries the ARC test of the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit[:HIGH] *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit[:HIGH] *<numeric value>***
It sets the high limit of leakage current in AC withstand voltage for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit[:HIGH]?**
It queries the high limit of leakage current in AC withstand voltage for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:LOW < *numeric value* > | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:LOW *<numeric value>* | *OFF***
It sets the low limit of leakage current in AC withstand voltage for the selected STEP. The unit is ampere. The Low Limit setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:LOW?**
It queries the low limit of leakage current in AC withstand voltage for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:REAL *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:REAL*<numeric value>* | *OFF***
It sets the high limit of real leakage current in AC withstand voltage for the selected STEP. The unit is ampere. The Real Current setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:REAL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:REAL?**
It queries the high limit of real leakage current in AC withstand voltage for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:OPEN *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:OPEN*<numeric value>***
It sets the HFCC OPEN value in AC withstand voltage for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:OPEN?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:OPEN?**
It queries the HFCC OPEN value in AC withstand voltage for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:SHORt *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:SHORt *<numeric value>* | *OFF***
It sets the HFCC SHORT in AC withstand voltage for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:LIMit:SHORt?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:LIMit:SHORt?**
It queries the HFCC SHORT in AC withstand voltage for the selected STEP.

**[:SOURce]:SAFEty:STEP<n>[:MAIN]:AC:CSTandard < *numeric value* >**
**[:SOURce]:SAFEty:STEP<n>:SUB<s>:AC:CSTandard < *numeric value* >**
It sets the capacitance of HFCC in AC withstand voltage for the selected STEP. The unit is F.

**[:SOURce]:SAFEty:STEP<n>[:MAIN]:AC:CSTandard?**
**[:SOURce]:SAFEty:STEP<n>:SUB<s>:AC:CSTandard?**
It queries the capacitance of HFCC in AC withstand voltage for the selected STEP. The unit is F.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:TIME:FALL *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:TIME:FALL*<numeric value>* | *OFF***
It sets the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second. The Fall Time setting is disabled when the parameter is OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:TIME:FALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:TIME:FALL?**
It queries the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:TIME:RAMP *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:TIME:RAMP *<numeric value>* | *OFF***
It sets the time required to ramp to the voltage set for test for the selected STEP. The unit is second. The Ramp Time setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:TIME:RAMP?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:TIME:RAMP?**
It queries the time required to ramp to the voltage set for test for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:TIME[:TEST] <*numeric value*> | *CONTinue***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:TIME[:TEST] <*numeric value*> | *CONTinue***
It sets the time required for test for the selected STEP. The unit is second. The test runs continuously when the parameter is set to CONTinue.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:AC:TIME[:TEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:AC:TIME[:TEST]?**
It queries the time required for test for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CHANnel[:HIGH] <*channel_list*>**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CHANnel[:HIGH] <*channel_list*>**
It sets the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CHANnel[:HIGH]?**
It queries the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CHANnel:LOW <*channel_list*>**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CHANnel:LOW <*channel_list*>**
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CHANnel:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CHANnel:LOW?**
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection[:CURRent]:OPEN[:RANGe][:BEST] <*number value*>**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection[:CURRent]:OPEN[:RANGe][:BEST] <*number value*>**
It sets the open current for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.02A. This command will set the open current of all ranges to this value. Please be noted that the device may clear this open current if the test parameter is changed. It is suggested to set this open current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]?**
It queries the open current of minimum current range for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection[:CURRent]:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection[:CURRent]:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>***
It sets the open current of each range for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.02A. This command requires 3 parameters; the first parameter is the open current of small current range. Please be noted that the device may clear this open current if the test parameter is changed. It is suggested to set this open current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection[:CURRent]:OPEN[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection[:CURRent]:OPEN[:RANGe]:ALL?**
It queries the open current of selected STEP. The unit is ampere. This query command will return 3 open currents with comma as the separator. The first is the open current of small current range.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection:HFCC:OPEN[:RANGe][:BEST] *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection:HFCC:OPEN[:RANGe][:BEST] *<number value>***
It sets the open real HFCC value for the selected STEP. The unit is F and the valid range is 0 ~ 100pF. Please be noted that the device may clear the value if the test parameter is changed. Thus, it is suggested to set this value after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection:HFCC:OPEN[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection:HFCC:OPEN[:RANGe][:BEST]?**
It queries the open real HFCC value for the selected STEP. The unit is F.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection:HFCC:OPEN[:RANGe]:ALL *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection:HFCC:OPEN[:RANGe]:ALL *<number value>***
It sets the open real HFCC value for the selected STEP. The unit is F and the valid range is 0 ~ 100pF. Please be noted that the device may clear the value if the test parameter is changed. Thus, it is suggested to set this value after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:CORRection:HFCC:OPEN[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:CORRection:HFCC:OPEN[:RANGe]:ALL?**
It queries the open real HFCC value for the selected STEP. The unit is F.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC[:LEVel] *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC[:LEVel] *<numeric value>***
It sets the voltage required during DC withstand voltage test for the selected STEP. The unit is volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC[:LEVel]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC[:LEVel]?**
It queries the voltage required during DC withstand voltage test for the selected STEP. The unit is volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:ARC[:LEVel]** ***<numeric value>*** **|** ***OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:ARC[:LEVel]** ***<numeric value>*** **|** ***OFF***
It sets the ARC test value for the selected STEP. The unit is ampere. The ARC setting is disabled when the parameter is set to OFF

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:ARC?[:LEVel]**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:ARC?[:LEVel]**
It queries the ARC test value for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:ARC[:RLEVel]** ***<numeric value>*** **|** ***DEFault***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:ARC[:RLEVel]** ***<numeric value>*** **|** ***DEFault***
It sets the ARC RAMP test value for the selected STEP. The unit is ampere. It is the same as ARC when the parmeter is DEFault.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:ARC[:RLEVel]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:ARC[:RLEVel]?**
It queries the ARC RAMP test value for the selected STEP. The unit is ampere.

**[:SOURce:]SAFety:STEP<n>[:MAIN]:DC:LIMit[:HIGH]** ***<numeric value>***
**[:SOURce:]SAFety:STEP<n>:SUB<s>:DC:LIMit[:HIGH]** ***<numeric value>***
It sets the high limit of leakage current in DC withstand voltage for the selected STEP. The unit is ampere.

**[:SOURce:]SAFety:STEP<n>[:MAIN]:DC:LIMit[:HIGH]?**
**[:SOURce:]SAFety:STEP<n>:SUB<s>:DC:LIMit[:HIGH]?**
It queries the high limit of leakage current in DC withstand voltage for the selected STEP. The unit is ampere.

**[:SOURce:]SAFety:STEP<n>[:MAIN]:DC:LIMit:LOW** ***<numeric value>*** **|** ***OFF***
**[:SOURce:]SAFety:STEP<n>:SUB<s>:DC:LIMit:LOW** ***<numeric value>*** **|** ***OFF***
It sets the low limit of leakage current in DC withstand voltage for the selected STEP. The unit is ampere. The Low Limit setting is disabled when the parameter is set to OFF.

**[:SOURce:]SAFety:STEP<n>[:MAIN]:DC:LIMit:LOW?**
**[:SOURce:]SAFety:STEP<n>:SUB<s>:DC:LIMit:LOW?**
It queries the low limit of leakage current in DC withstand voltage for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:OPEN** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:OPEN***<numeric value>*
It sets the HFCC OPEN value in DC withstand voltage for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:OPEN?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:OPEN?**
It queries the HFCC OPEN value in DC withstand voltage for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:SHORt *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:SHORt *<numeric value>* | *OFF***
It sets the HFCC SHORT in DC withstand voltage for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:LIMit:SHORt?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:LIMit:SHORt?**
It queries the HFCC SHORT in DC withstand voltage for the selected STEP.

**[:SOURce]:SAFEty:STEP<n>[:MAIN]:DC:CSTandard < *numeric value* >**
**[:SOURce]:SAFEty:STEP<n>:SUB<s>:DC:CSTandard < *numeric value* >**
It sets the capacitance of HFCC in DC withstand voltage for the selected STEP. The unit is F.

**[:SOURce]:SAFEty:STEP<n>[:MAIN]:DC:CSTandard?**
**[:SOURce]:SAFEty:STEP<n>:SUB<s>:DC:CSTandard?**
It queries the capacitance of HFCC in DC withstand voltage for the selected STEP. The unit is F.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME:DWELl *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME:DWELl *<numeric value>* | *OFF***
It sets the time required for DWELL for the selected STEP. The unit is second. The Dwell Time setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME:DWELl?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME:DWELl?**
It queries the time required for DWELL for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME:FALL *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME:FALL *<numeric value>* | *OFF***
It sets the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second. The Fall Time setting is disabled when the parameter is OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME:FALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME:FALL?**
It queries the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME:RAMP *<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME:RAMP *<numeric value>* | *OFF***
It sets the time required to ramp to the voltage set for test for the selected STEP. The unit is second. The Ramp Time setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME:RAMP?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME:RAMP?**
It queries the time required to ramp to the voltage set for test for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME[:TEST] <*numeric value*> | *CONTinue***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME[:TEST] <*numeric value*> | *CONTinue***
It sets the time required for test for the selected STEP. The unit is second. The test runs continuously when the parameter is set to CONTinue.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DC:TIME[:TEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DC:TIME[:TEST]?**
It queries the time required for test for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CHANnel[:HIGH] *<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CHANnel[:HIGH] *<channel_list>***
It sets the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CHANnel[:HIGH]?**
It queries the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CHANnel:LOW <*channel_list*>**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CHANnel:LOW <*channel_list*>**
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CHANnel:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CHANnel:LOW?**
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CORRection:CURRent:OPEN[:RANGe][:BEST] *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CORRection:CURRent:OPEN[:RANGe][:BEST] *<number value>***
It sets the open current for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.02A. This command will set the open current of all ranges to this value. Please be noted that the device may clear this open current if the test parameter is changed. It is suggested to set this open current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CORRection:CURRent:OPEN[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CORRection:CURRent:OPEN[:RANGe][:BEST]?**
It queries the open current of minimum current range for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CORRection:CURRent:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>,<range 4>,<range 5>,<range 6>,<range 7>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CORRection:CURRent:OPEN[:RANGe]:ALL *<range 1>,<range 2>,<range 3>,<range 4>,<range 5>,<range 6>,<range 7>***
It sets the open current of each range for the selected STEP. The unit is ampere and the valid range is 0 ~ 0.02A. This command requires 7 parameters; the first parameter is the open current of minimum current range. Please be noted that the device may clear this open current if the test parameter is changed. It is suggested to set this open

current after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:CORRection:CURRent:OPEN[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:CORRection:CURRent:OPEN[:RANGe]:ALL?**
It queries the open current of selected STEP. The unit is ampere. This query command will return 7 open currents with comma as the separator. The first is the open current of minimum current range.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR[:LEVel]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR[:LEVel]** ***<numeric value>***
It sets the voltage required for insulation resistance test for the selected STEP. The unit is volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR[:LEVel]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR[:LEVel]?**
It queries the voltage required for insulation resistance test for the selected STEP. The unit is volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:LIMit:HIGH** ***<numeric value>*** **|** ***OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:LIMit:HIGH** ***<numeric value>*** **|** ***OFF***
It sets the high limit of insulation resistance for the selected STEP. The unit is ohm. The High Limit setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:LIMit:HIGH?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:LIMit:HIGH?**
It queries the high limit of insulation resistance for the selected STEP. The unit is ohm.

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

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:LIMit[:LOW]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:LIMit[:LOW]?**
It queries the low limit of insulation resistance for the selected STEP. The unit is ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:UPPer** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:UPPer** ***<numeric value>***
It sets the current range for test for the selected STEP. The unit is ampere. The set current range should be larger than the input current.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:UPPer?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:UPPer?**
It queries the current range for test for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe[:LOWer]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe[:LOWer]** ***<numeric value>***
It sets the current range for test for the selected STEP. The unit is ampere. The set current range should be smaller than the input current.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe[:LOWer]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe[:LOWer]?**
It queries the current range of test for the selected STEP. The unit is ampere.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:AUTO** ***<boolean> | ON |OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:AUTO** ***<boolean> | ON |OFF***
It sets the current range for test to auto for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:RANGe:AUTO?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:RANGe:AUTO?**
It queries if the current range for test is set to auto for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME:DWELl** ***<numeric value> | OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME:DWELl** ***<numeric value> | OFF***
It sets the time required for DWELL for the selected STEP. The unit is second. The Dwell Time setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME:DWELl?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME:DWELl?**
It queries the time required for DWELL for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME:FALL** ***<numeric value> | OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME:FALL** ***<numeric value> | OFF***
It sets the time required for the set voltage to fall to the low voltage for the selected STEP. The unit is second. The Fall Time setting is disabled when the parameter is OFF.

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

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME:RAMP** ***<numeric value> | OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME:RAMP** ***<numeric value> | OFF***
It sets the time required to ramp to the voltage set for test for the selected STEP. The unit is second. The Ramp Time setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME:RAMP?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME:RAMP?**
It queries the time required to ramp to the voltage set for test for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME[:TEST]** ***<numeric value> | CONTinue***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME[:TEST]** ***<numeric value> | CONTinue***
It sets the time required for test for the selected STEP. The unit is second. The test runs continuously when the parameter is set to CONTinue.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IR:TIME[:TEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IR:TIME[:TEST]?**
It queries the time required for test for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel[:HIGH]** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel[:HIGH]** ***<channel_list>***
It sets the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel[:HIGH]?**
It queries the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel:LOW** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel:LOW** ***<channel_list>***
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CHANnel:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CHANnel:LOW?**
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CORRection[:RESistance]:SHORt[:RANGe][:BEST]** ***<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CORRection[:RESistance]:SHORt[:RANGe][:BEST]** ***<number value>***
It sets the short resistance for the selected STEP. The unit is ohm and the valid range is 0 ~ 500kΩ. This command will set the short resistance of all ranges to this value. Please be noted that the device may clear this short resistance if the test parameter is changed. It is suggested to set this short resistance after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CORRection[:RESistance]:SHORt[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CORRection[:RESistance]:SHORt[:RANGe][:BEST]?**
It queries the short resistance of minimum resistance range for the selected STEP. The unit is ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CORRection[:RESistance]:SHORt[:RANGe]:ALL** ***<range 1>,<range 2>,<range 3>,<range 4>,<range 5>,<range 6>,<range 7>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CORRection[:RESistance]:SHORt[:RANGe]:ALL** ***<range 1>,<range 2>,<range 3>,<range 4>,<range 5>,<range 6>,<range 7>***
It sets the short resistance of each range for the selected STEP. The unit is ohm and the valid range is 0 ~ 500kΩ. This command requires 6 parameters; the first parameter is the short resistance of minimum resistance range. Please be noted that the device may clear this short resistance if the test parameter is changed. It is suggested to set this shrot resistance after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:CORRection[:RESistance]:SHORt[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CORRection[:RESistance]:SHORt[:RANGe]:ALL?**
It queries the short resistance of selected STEP. The unit is ohm. This query command will return 6 short resistances with comma as the separator. The first is the short resistance of minimum resistance range.

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

**[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:LIMit[:HIGH]?**
**[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:LIMit[:HIGH]?**
It queries the high limit of DC resistance for the selected STEP. The unit is ohm.

**[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:LIMit:LOW** ***<numeric value>* | *OFF***
**[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:LIMit:LOW** ***<numeric value>* | *OFF***
It sets the low limit of DC resistance for the selected STEP. The unit is ohm. The setting of Low Limit is disabled when the parameter is OFF.

**[:SOURce:]SAFety:STEP<n>[:MAIN]:DCR:LIMit:LOW?**
**[:SOURce:]SAFety:STEP<n>:SUB<s>:DCR:LIMit:LOW?**
It queries the low limit of DC resistance for the selected STEP. The unit is ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe:UPPer** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe:UPPer** ***<numeric value>***
It sets the DC resistance range for test for the selected STEP. The unit is ohm. The set DC resistance range should be larger than the input DC resistance.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe:UPPer?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe:UPPer?**
It queries the DC resistance range for test for the selected STEP. The unit is ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe[:LOWer]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe[:LOWer]** ***<numeric value>***
It sets the DC resistance range for test for the selected STEP. The unit is ohm. The set DC resistance range should be smaller than the input DC resistance.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe[:LOWer]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe[:LOWer]?**
It queries the DC resistance range for test for the selected STEP. The unit is ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe:AUTO** ***<boolean>* | *ON* |*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe:AUTO** ***<boolean>* | *ON* |*OFF***
It sets the DC resistance range for test to auto for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe:AUTO?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe:AUTO?**
It queries if the DC resistance range for test is set to auto for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:TIME:DWELl** ***<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:TIME:DWELl** ***<numeric value>* | *OFF***
It sets the time required for DWELL for the selected STEP. The unit is second. The Dwell Time setting is disabled when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:TIME:DWELl?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:TIME:DWELl?**
It queries the time required for DWELL for the selected STEP. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:TIME[:TEST] *<numeric value>* | *OFF* | *KEY***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:TIME[:TEST] *<numeric value>* | *OFF* | *KEY***
It sets the time required for test for the selected STEP. The unit is second. The Test Time setting is disabled when the parameter is set to OFF. The test runs continuously when the parameter is set to KEY.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:TIME[:TEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:TIME[:TEST]?**
It queries the time required for test for the selected STEP. The unit is second. When DCR sets to OFF, the return value is 0 and it returns 9.91E37 when sets to KEY.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel[:HIGH] *<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel[:HIGH] *<channel_list>***
It sets the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel[:HIGH]?**
It queries the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel:LOW *<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel:LOW *<channel_list>***
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CHANnel:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CHANnel:LOW?**
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CORRection[:CAPacitance]:OPEN[:RANGe][:BEST] *<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CORRection[:CAPacitance]:OPEN[:RANGe][:BEST] *<number value>***
It sets the open capacitance for the selected STEP. The unit is farad and the valid range is 0 ~ 40nF. This command will set the open capacitance of all ranges to this value. Please be noted that the device may clear this open capacitance if the test parameter is changed. It is suggested to set this open capacitance after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CORRection[:CAPacitance]:OPEN[:RANGe][:BEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CORRection[:CAPacitance]:OPEN[:RANGe][:BEST]?**
It queries the open resistance of minimum capacitance range for the selected STEP. The unit is farad.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CORRection[:CAPacitance]:OPEN[:RANGe]:ALL** ***<range 1>,<range 2>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CORRection[:CAPacitance]:OPEN[:RANGe]:ALL** ***<range 1>,<range 2>***
It sets the open capacitance of each range for the selected STEP. The unit is farad and the valid range is 0 ~ 40nF. This command requires 3 parameters; the first parameter is the open capacitance of minimum capacitance range. Please be noted that the device may clear this open capacitance if the test parameter is changed. It is suggested to set this open capacitance after all test parameters are set.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CORRection[:CAPacitance]:OPEN[:RANGe]:ALL?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CORRection[:CAPacitance]:OPEN[:RANGe]:ALL?**
It queries the open capacitance of selected STEP. The unit is ohm. This query command will return 3 open capacitances with comma as the separator. The first is the open capacitance of minimum capacitance range.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CORRection[:CAPacitance]:SAMPle** ***<range>,<number value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CORRection[:CAPacitance]:SAMPle** ***<range>,<number value>***
It sets measurement range and standard capacitance for the selected STEP. This command requires 2 parameters. The first parameter is the measurement range and the valid range is 1 or 2. 1 is to select the minimum capacitance range. The second parameter is to set the standard capacitance in the unit of farad. The valid standard capacitances are varied with range as the table listed below.

| Range | Minimum | Maximum |
|---|---|---|
| 1 | 0.01nF | 9.99nF |
| 2 | 0.1nF | 40.0nF |

**[:SOURce]:SAFety:STEP<n>[:MAIN]:OSC:CORRection[:CAPacitance]:SAMPle?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CORRection[:CAPacitance]:SAMPle?**
It queries the measurement range and standard capacitance of selected STEP. This query command will return 2 values with comma as the separator. The first value is the measurement range and the second is the standard capacitance in the unit of farad.

**[:SOURce]: SAFety: STEP<n>[:MAIN]:OSC:LIMit[:OPEN]** ***<numeric value>***
**[:SOURce]: SAFety: STEP<n>:SUB<s>:OSC:LIMit[:OPEN]** ***<numeric value>***
It sets the percentage of Open judgment for OSC for the selected STEP.

**[:SOURce]: SAFety: STEP<n>[:MAIN]:OSC:LIMit[:OPEN]?**
**[:SOURce]: SAFety: STEP<n>:SUB<s>:OSC:LIMit[:OPEN]?**
It queries the percentage of Open judgment for OSC for the selected STEP.

**[:SOURce]: SAFety: STEP<n>[:MAIN]:OSC:LIMit:SHORt** ***<numeric value>*** **|** ***OFF***
**[:SOURce]: SAFety: STEP<n>:SUB<s>:OSC:LIMit:SHORt** ***<numeric value>*** **|** ***OFF***
It sets the percentage of Short judgment for OSC for the selected STEP. The SHORt setting is disabled when the parameter is set to OFF.

**[:SOURce]: SAFety: STEP<n>[:MAIN]:OSC:LIMit:SHORt?**
**[:SOURce]: SAFety: STEP<n>:SUB<s>:OSC:LIMit:SHORt?**
It queries the percentage of Short judgment for OSC for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:CHANnel:CLEar**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:CHANnel:CLEar**
It clears the high voltage output scan channel for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:CHANnel:GROup<m>**
***<numeric value 1>,<numeric value 2>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:CHANnel:GROup<m>**
***<numeric value 1>,<numeric value 2>***
It sets the channel of selected gorupu in IWT COMPARE MODE. <m> is the group number and the range is 1~6. <number value 1> is the positive channel numbers which are 0, 1~10, 101~116 and 201~216. <number value 2> is the common test channel (RTN/LOW) numbers for scan which are 0, 1~10, 101~116 and 201~216.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:CHANnel:GROup<m>?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:CHANnel:GROup<m>?**
It queries the selected group channel in IWT COMPARE MODE. <m> is the group number and the range is 1~6.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:CORRection:OUTPut *<voltage>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:CORRection:OUTPut*<voltage>***
It sets the actual testing output voltage for the selected STEP. The value is different from the voltage on the DUT. The setting range is 0~7000V.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:CORRection:OUTPut?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:CORRection:OUTPut?**
It queries the actual testing output voltage of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare [:LEVel] *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare [:LEVel] *<numeric value>***
It sets the IWT COMPARE testing required voltage for the selected STEP. The unit is Volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare [:LEVel]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare [:LEVel]?**
It queries the IWT COMPARE testing required voltage for the selected STEP. The unit is Volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:WIDTh *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:WIDTh *<numeric value>***
It sets the IWT COMPARE testing WIDTH for the selected STEP. The range is 1~11.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:WIDTh?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:WIDTh?**
It queries the IWT COMPARE testing WIDTH of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:PULSe *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:PULSe *<numeric value>***
It sets the IWT COMPARE testing PULSE for the selected STEP. The range is 1.0~32.9.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:PULSe?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:PULSe?**
It queries the IWT COMPARE testing PULSE of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:SCOPe:BEGin *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:SCOPe:BEGin *<numeric value>***
It sets the IWT COMPARE testing AREA BEGIN for the selected STEP. The setting range for BEGIN is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:SCOPe:BEGin?**
It queries the IWT COMPARE testing AREA for the BEGIN setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:SCOPe:END *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:SCOPe:END *<numeric value>***
It sets the IWT COMPARE testing AREA END for the selected STEP. The setting range for END is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:SCOPe:END?**
It queries the IWT COMPARE testing AREA for the END setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:LIMit:PLUS *<numeric value>* |*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:LIMit:PLUS *<numeric value>* |*OFF***
It sets the IWT COMPARE testing AREA LIMIT+ for the selected STEP. The setting range for LIMIT+ is 0.1%~99.9%. The LIMIT+ setting is disabled when set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:LIMit:PLUS?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:LIMit:PLUS?**
It queries the IWT COMPARE testing AREA for the LIMIT+ setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:LIMit:MINus *<numeric value>* |*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:LIMit:MINus *<numeric value>* |*OFF***
It sets the IWT COMPARE testing AREA LIMIT- for the selected STEP. The setting range for LIMIT- is 0.1%~99.9%. The LIMIT- setting is disabled when set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:AREA:LIMit:MINus?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:AREA:LIMit:MINus?**
It queries the IWT COMPARE testing AREA for the LIMIT- setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:DARea:SCOPe:BEGin *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:DARea:SCOPe:BEGin *<numeric value>***
It sets the IWT COMPARE testing DAREA BEGIN for the selected STEP. The setting range for BEGIN is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:DARea:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:DARea:SCOPe:BEGin?**
It queries the IWT COMPARE testing DAREA for the BEGIN setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:DARea:SCOPe:END *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:DARea:SCOPe:END *<numeric value>***
It sets the IWT COMPARE testing DAREA END for the selected STEP. The setting range for END is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:DARea:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:DARea:SCOPe:END?**
It queries the IWT COMPARE testing DAREA for the END setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:DARea:LIMit *<numeric value>* |*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:DARea:LIMit *<numeric value>* |*OFF***
It sets the IWT COMPARE testing DAREA LIMIT for the selected STEP. The setting range for LIMIT+ is 0.1%~99.9%. The LIMIT setting is disabled when set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:DARea:LIMit?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:DARea:LIMit?**
It queries the IWT COMPARE testing DAREA for the LIMIT setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:FLUTter:SCOPe:BEGin *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:FLUTter:SCOPe:BEGin *<numeric value>***
It sets the IWT COMPARE testing FLUTTER BEGIN for the selected STEP. The range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:FLUTter:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:FLUTter:SCOPe:BEGin?**
It queries the IWT COMPARE testing FLUTTER for the BEGIN setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:FLUTter:SCOPe:END *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:FLUTter:SCOPe:END *<numeric value>***
It sets the IWT COMPARE testing FLUTTER END for the selected STEP. The range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:FLUTter:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:FLUTter:SCOPe:END?**
It queries the IWT COMPARE testing FLUTTER for the END setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:FLUTter:LIMit** ***<numeric value>*** **|*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:FLUTter:LIMit** ***<numeric value>*** **|*OFF***
It sets the IWT COMPARE testing FLUTTER LIMIT for the selected STEP. The range is 1~9999. The LIMIT setting is disabled when set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:FLUTter:LIMit?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:FLUTter:LIMit?**
It queries the IWT COMPARE testing FLUTTER for the LIMIT setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:LAPLac:SCOPe:BEGin** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:LAPLac:SCOPe:BEGin** ***<numeric value>***
It sets the IWT COMPARE testing LAPLAC BEGIN for the selected STEP. The range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:LAPLac:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:LAPLac:SCOPe:BEGin?**
It queries the IWT COMPARE testing LAPLAC for the BEGIN setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]: ICOMpare:LAPLac:SCOPe:END** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>: ICOMpare:LAPLac:SCOPe:END** ***<numeric value>***
It sets the IWT COMPARE testing LAPLAC END for the selected STEP. The range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:LAPLac:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:LAPLac:SCOPe:END?**
It queries the IWT COMPARE testing LAPLAC for the END setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]: ICOMpare:LAPLac:LIMit** ***<numeric value>*** **|*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>: ICOMpare:LAPLac:LIMit** ***<numeric value>*** **|*OFF***
It sets the IWT COMPARE testing LAPLAC LIMIT for the selected STEP. The range is 1~9999. The LIMIT setting is disabled when set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:ICOMpare:LAPLac:LIMit?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:ICOMpare:LAPLac:LIMit?**
It queries the IWT COMPARE testing LAPLAC for the LIMIT setting of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel[:HIGH]** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel[:HIGH]** ***<channel_list>***
It sets the status of high voltage output channel during scan test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel[:HIGH]?**
It queries the status of high voltage output channel during scan test for the selected

STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel:LOW** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel:LOW** ***<channel_list>***
It sets the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CHANnel:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CHANnel:LOW?**
It queries the output status of common test channel (RTN/LOW) during scan for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CORRection:OUTPut** ***<voltage>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CORRection:OUTPut** ***<voltage>***
It sets the actual output voltage which is different from the DUT voltage for selected STEP. The range is 0~7000V.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CORRection:OUTPut?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CORRection:OUTPut?**
It queries the actual output voltage of selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CORRection[:WAVeform]:SAMPLe[:DATA]** ***<block data>*** **|** ***GET***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CORRection[:WAVeform]:SAMPLe[:DATA]** ***<block data>*** **|** ***GET***
It sets the sampling waveform data or starts sampling process for testing the selected STEP. When the parameter is set to GET, it means to start sampling process. When the parameter is set to <block data>, it means to set the waveform data. The format of <block data> starts from "#0" followed by 512 dots waveform data and each dot is represented by 3 hexadecimal characters. The range is 000~3FF and the data length is 1538 (2+512x3) characters.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CORRection[:WAVeform]:SAMPLe[:DATA]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CORRection[:WAVeform]:SAMPLe[:DATA]?**
It queries the sampling waveform data for testing the selected STEP. The return data format starts from "#0" followed by 512 dots waveform data and each dot is represented by 3 hexadecimal characters. The data length is 1538 (2+512x3) characters.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CORRection[:WAVeform]:SAMPLe:VALid?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CORRection[:WAVeform]:SAMPLe:VALid?**
It queries if the sampling waveform data exists for testing the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:CORRection[:WAVeform]:SAMPLe:VOLTage?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:CORRection[:WAVeform]:SAMPLe:VOLTage?**
It queries the sampling waveform data for testing the selected STEP. The return data is 512 points voltage and each entry of voltage is separated by comma (,).

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT[:LEVel]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT[:LEVel]** ***<numeric value>***
It sets the voltage required for IWT test for selected STEP. The unit is Volt.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT[:LEVel]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT[:LEVel]?**
It queries the voltage required for IWT test for selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:WIDTh** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:WIDTh** ***<numeric value>***
It sets the WIDTH of IWT test for selected STEP. The setting range is 1~11.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:WIDTh?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:WIDTh?**
It queries the WIDTH of IWT test for selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:PULSe** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:PULSe** ***<numeric value>***
It sets the PULSE of IWT test for selected STEP. The setting range is 1.0~32.9.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:PULSe?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:PULSe?**
It queries the PULSE of IWT test for selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:SCOPe:BEGin** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:SCOPe:BEGin** ***<numeric value>***
It sets the BEGIN scope in AREA condition during IWT test for the selected STEP. The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:SCOPe:BEGin?**
It queries the BEGIN scope AREA condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:SCOPe:END** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:SCOPe:END** ***<numeric value>***
It sets the END scope in AREA condition during IWT test for the selected STEP. The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:SCOPe:END?**
It queries the END scope in AREA condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:LIMit:PLUS** ***<numeric value>*** **|*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:LIMit:PLUS** ***<numeric value>***
**|*OFF***
It sets the LIMIT+ in AREA condition during IWT Test for the selected STEP. The setting range is 0.1%~99.9% and it disables the LIMIT+ setting when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:LIMit:PLUS?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:LIMit:PLUS?**
It queries the LIMIT+ in AREA condition during IWT Test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:LIMit:MINus** ***<numeric value>*** **|*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:LIMit:MINus** ***<numeric value>*** **|*OFF***
It sets the LIMIT- in AREA condition during IWT Test for the selected STEP. The setting range is 0.1%~99.9% and it disables the LIMIT- setting when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:AREA:LIMit:MINus?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:AREA:LIMit:MINus?**
It queries the LIMIT- in AREA condition during IWT Test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:DARea:SCOPe:BEGin** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:DARea:SCOPe:BEGin** ***<numeric value>***
It sets the BEGIN scope in DAREA condition during IWT test for the selected STEP. The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:DARea:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:DARea:SCOPe:BEGin?**
It queries the BEGIN scope DAREA condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:DARea:SCOPe:END** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:DARea:SCOPe:END** ***<numeric value>***
It sets the END scope in DAREA condition during IWT test for the selected STEP. The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:DARea:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:DARea:SCOPe:END?**
It queries the END scope in DAREA condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:DARea:LIMit** ***<numeric value>*** **|*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:DARea:LIMit** ***<numeric value>*** **|*OFF***
It sets the LIMIT in DAREA condition during IWT Test for the selected STEP. The setting range is 0.1%~99.9% and it disables the LIMIT setting when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:DARea:LIMit?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:DARea:LIMit?**
It queries the LIMIT in DAREA condition during IWT Test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:FLUTter:SCOPe:BEGin** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:FLUTter:SCOPe:BEGin** ***<numeric value>***
It sets the BEGIN scope in FLUTTER condition during IWT test for the selected STEP. The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:FLUTter:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:FLUTter:SCOPe:BEGin?**
It queries the BEGIN scope in FLUTTER condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:FLUTter:SCOPe:END** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:FLUTter:SCOPe:END** ***<numeric value>***
It sets the END scope in FLUTTER condition during IWT test for the selected STEP.

The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:FLUTter:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:FLUTter:SCOPe:END?**
It queries the END scope in FLUTTER condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:FLUTter:LIMit *<numeric value>* |*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:FLUTter:LIMit *<numeric value>* |*OFF***
It sets the LIMIT in FLUTTER condition during IWT Test for the selected STEP. The setting range is 1~9999 and it disables the LIMIT setting when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:FLUTter:LIMit?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:FLUTter:LIMit?**
It queries the LIMIT in FLUTTER condition during IWT Test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:LAPLac:SCOPe:BEGin *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:LAPLac:SCOPe:BEGin *<numeric value>***
It sets the BEGIN scope in LAPLAC condition during IWT test for the selected STEP. The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:LAPLac:SCOPe:BEGin?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:LAPLac:SCOPe:BEGin?**
It queries the BEGIN scope in LAPLAC condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:LAPLac:SCOPe:END *<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:LAPLac:SCOPe:END *<numeric value>***
It sets the END scope in LAPLAC condition during IWT test for the selected STEP. The setting range is 1~512.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:LAPLac:SCOPe:END?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:LAPLac:SCOPe:END?**
It queries the END scope in LAPLAC condition during IWT test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:LAPLac:LIMit *<numeric value>* |*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:LAPLac:LIMit *<numeric value>* |*OFF***
It sets the LIMIT in LAPLAC condition during IWT Test for the selected STEP. The setting range is 1~9999 and it disables the LIMIT setting when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:IWT:LAPLac:LIMit?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:LAPLac:LIMit?**
It queries the LIMIT in LAPLAC condition during IWT Test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:CHANnel[:HIGH] *<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:CHANnel[:HIGH] *<channel_list>***
It sets the high voltage output scan channel for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:CHANnel[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:CHANnel[:HIGH]?**
It queries the high voltage output scan channel of the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:CHANnel:LOW** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:CHANnel:LOW** ***<channel_list>***
It sets the output status of common test scan channel (RTN/LOW) for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:CHANnel:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:CHANnel:LOW?**
It queries the output status of common test scan channel (RTN/LOW) for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit[:LX]:HIGH** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit[:LX]:HIGH** ***<numeric value>***
It sets the Lx mode inductance high limit for the selected STEP. The unit is Henry.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit[:LX]:HIGH?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit[:LX]:HIGH?**
It queries the Lx mode inductance high limit for the selected STEP. The unit is Henry.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit[:LX]:LOW** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit[:LX]:LOW** ***<numeric value>***
It sets the Lx mode inductance low limit for the selected STEP. The unit is Henry.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit[:LX]:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit[:LX]:LOW?**
It queries the Lx mode inductance low limit for the selected STEP. The unit is Henry.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit:Q:HIGH** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit:Q:HIGH** ***<numeric value>***
It sets the Lx mode Q high limit for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit:Q:HIGH?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit:Q:HIGH?**
It queries the Lx mode Q high limit for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit:Q:LOW** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit:Q:LOW** ***<numeric value>***
It sets the Lx mode Q low limit for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LX:LIMit:Q:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LX:LIMit:Q:LOW?**
It queries the Lx mode Q low limit for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:CHANnel:CLEar**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:CHANnel:CLEar**
It clears the high voltage output scan channel for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:CHANnel:GROup<m>**
***<numeric value 1>,<numeric value 2>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:CHANnel:GROup<m>**
***<numeric value 1>,<numeric value 2>***
It sets the group channel selected in Lx Balance mode. <m> is the group number and the range is 1~32. <number value 1> is the positive channel number 0, 1~10, 101~116

and 201~216. <number value 2> is the common scan channel (RTN/LOW) number 0, 1~10, 101~116 and 201~216.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:CHANnel:GROup<m>?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:CHANnel:GROup<m>?**
It queries the group channel selected in Lx Balance mode，<m> is the group number and the range is 1~32.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:LIMit:ABS** ***<value>*** **|** ***OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:LIMit:ABS** ***<value>*** **|** ***OFF***
It sets the inductance difference high limit in Lx Balance mode for the selected STEP. The unit is Henry.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:LIMit:ABS?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:LIMit:ABS?**
It queries the inductance difference high limit in Lx Balance mode for the selected STEP. The unit is Henry.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:LIMit:PERCent** ***<value>*** **|** ***OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:LIMit:PERCent** ***<value>*** **|** ***OFF***
It sets the inductance difference percentage high limit in Lx Balance mode for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:LIMit:PERCent?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:LIMit:PERCent?**
It queries the inductance difference percentage high limit in Lx Balance mode for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:TYPE** ***ABS*** **|** ***PERCent***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:TYPE** ***ABS*** **|** ***PERCent***
It sets the Lx Balance mode type for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:LBALance:TYPE?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:LBALance:TYPE*?***
It queries Lx Balance mode type for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:PA[:MESSage]** ***<string data>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:PA[:MESSage]** ***<string data>***
It sets the message string of PA MODE.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:PA[:MESSage]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:PA[:MESSage]?**
It queries the message string of PA MODE.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:PA:TIME[:TEST]** ***<numeric value>*** **|** ***KEY***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:PA:TIME[:TEST]** ***<numeric value>*** **|** ***KEY***
It sets the execution time of PA MODE. The unit is second. The test runs continuously when the parameter is set to CONTinue.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:PA:TIME[:TEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:PA:TIME[:TEST]?**
It queries the execution time of PA MODE. The unit is second.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:HSCC:CHANnel:CLEar**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:HSCC:CHANnel:CLEar**
It clears the selected STEP for the scanning test high voltage output channel status

**[:SOURce]:SAFety:STEP<n>[:MAIN]:HSCC:CHANnel:GROup<m>** ***<numeric value 1>,<numeric value 2>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:HSCC:CHANnel:GROup<m>** ***<numeric value 1>,<numeric value 2>***
It sets the channel status of selected group in HSCC MODE. <m> is the group no. and the range is 1~40. <number value 1> is the positive channel no. and the value is 0, 1~10, 101~116 and 201~216. <number value 2> is the no. of common scanning test channel (RTN/LOW) and the value is 0, 1~10, 101~116 and 201~216.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:HSCC:CHANnel:GROup<m>?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:HSCC:CHANnel:GROup<m>?**
It queries the channel status of selected group in HSCC MODE. <m> is the group no. and the range is 1~40.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:CHANnel:A** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:CHANnel:A** ***<channel_list>***
It sets the A channel status of scanning test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:CHANnel:A?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:CHANnel:A?**
It queries the A channel status of scanning test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:CHANnel:B** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:CHANnel:B** ***<channel_list>***
It sets the B channel status of scanning test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:CHANnel:B?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:CHANnel:B?**
It queries the B channel status of scanning test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:CHANnel:C** ***<channel_list>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:CHANnel:C** ***<channel_list>***
It sets the C channel status of scanning test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:CHANnel:C?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:CHANnel:C?**
It queries the C channel status of scanning test for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RAB[:HIGH]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RAB[:HIGH]** ***<numeric value>***
It sets the high limit of R1/Rab in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RAB[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RAB[:HIGH]?**
It queries the high limit of R1/Rab in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RAB:LOW** ***<numeric value>*** **| *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RAB:LOW** ***<numeric value>*** **| *OFF***
It sets the low limit of R1/Rab in Y/Delta mode for the selected STEP. The unit is Ohm. The setting of Low Limit is turned off when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RAB:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RAB:LOW?**
It queries the low limit of R1/Rab in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RBC[:HIGH]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RBC[:HIGH]** ***<numeric value>***
It sets the high limit of R2/Rbc in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RBC[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RBC[:HIGH]?**
It queries the high limit of R2/Rbc in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RBC:LOW** ***<numeric value>*** **| *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RBC:LOW** ***<numeric value>*** **| *OFF***
It sets the low limit of R2/Rbc in Y/Delta mode for the selected STEP. The unit is Ohm. The setting of Low Limit is turned off when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RBC:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RBC:LOW?**
It queries the low limit of R2/Rbc in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RCA[:HIGH]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RCA[:HIGH]** ***<numeric value>***
It sets the high limit of R3/Rca in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RCA[:HIGH]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RCA[:HIGH]?**
It queries the high limit of R3/Rca in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RCA:LOW** ***<numeric value>*** **| *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RCA:LOW** ***<numeric value>*** **| *OFF***
It sets the low limit of R3/Rca in Y/Delta mode for the selected STEP. The unit is Ohm. The setting of Low Limit is turned off when the parameter is set to OFF.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:LIMit:RCA:LOW?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:LIMit:RCA:LOW?**
It sets the low limit of R3/Rca in Y/Delta mode for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:RANGe:UPPer** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:RANGe:UPPer** ***<numeric value>***
It sets the testing resistance range for the selected STEP. The unit is Ohm.
The set resistance range will be larger than the inputted resistance.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe:UPPer?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe:UPPer?**
It queries the testing resistance range for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe[:LOWer]** ***<numeric value>***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe[:LOWer]** ***<numeric value>***
It sets the testing resistance range for the selected STEP. The unit is Ohm.
The set resistance range will be smaller than the inputted resistance.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe[:LOWer]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe[:LOWer]?**
It queries the testing resistance range for the selected STEP. The unit is Ohm.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe:AUTO** ***<boolean>* | *ON* |*OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe:AUTO** ***<boolean>* | *ON* |*OFF***
It sets the resistance range to auto selection for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:RANGe:AUTO?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:RANGe:AUTO?**
It queries the resistance range to auto selection for the selected STEP.

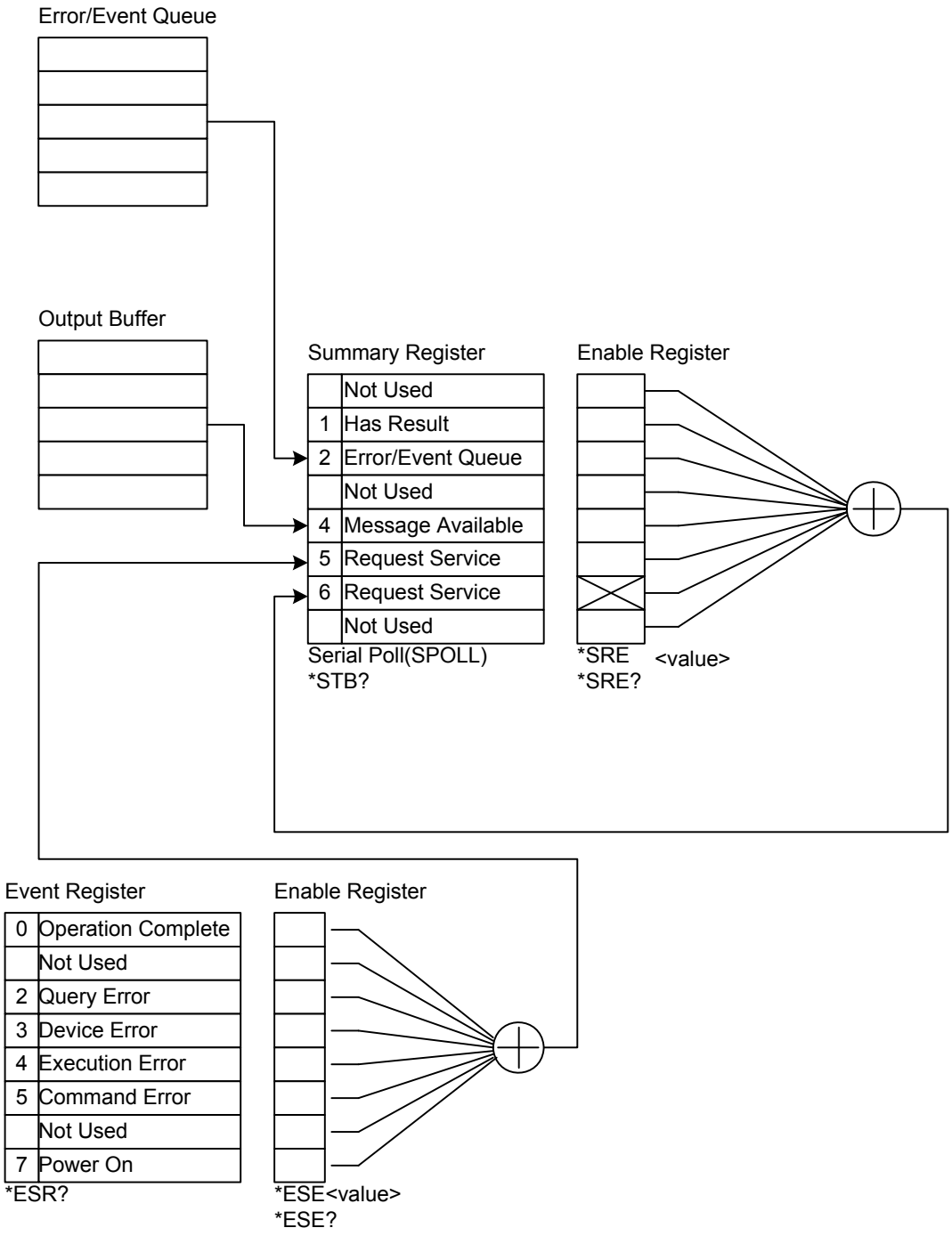
**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:TIME[:TEST]** ***<numeric value>* | *OFF***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:TIME[:TEST]** ***<numeric value>* | *OFF***
It sets the time required for test in the unit of second for the selecte STEP.
The Test Time is turned off when the parameter sets to OFF

**[:SOURce]:SAFety:STEP<n>[:MAIN]:DCR:TIME[:TEST]?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:TIME[:TEST]?**
It queries the time required for test in the unit of second for the selecte STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:TYPE** ***Y* | *DELTa***
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:TYPE** ***Y* | *DELTa***
It sets the Y/Delta mode test type for the selected STEP.

**[:SOURce]:SAFety:STEP<n>[:MAIN]:YDELta:TYPE?**
**[:SOURce]:SAFety:STEP<n>:SUB<s>:YDELta:TYPE?**
It queries the Y/Delta mode test type for the selected STEP.

## 7.5.3 SCPI System Status



# 7.6 Error Messages

**Notice**

- The error messages stored in error queue will be returned in the way of first in first out (FIFO) which means the first error message returned is the first one being saved.
- When error messages exceed 10, the last one be stored in the error queue will be –350 "Queue overflow". It means the error queue is unable to store another error message until the error messages are extracted.
- If no error is generated, +0 "No error" will be stored in the first position of error queue.

| | |
|---|---|
| -101 | Invalid character |
| -102 | Syntax error |
| -103 | Invalid separator |
| -104 | Data type error |
| -108 | Parameter not allowed |
| -109 | Missing parameter |
| -111 | Header separator error |
| -112 | Program mnemonic too long |
| -113 | Undefined header |
| -114 | Header suffix out of range |
| -120 | Numeric data error |
| -141 | Invalid character data |
| -151 | Invalid string data |
| -158 | String data not allowed |
| -161 | Invalid block data |
| -168 | Block data not allowed |
| -171 | Invalid expression error |
| -178 | Expression data not allowed |
| -200 | Execution error |
| -203 | Command protected |
| -221 | Settings conflict |
| -222 | Data out of range |
| -241 | Hardware missing |
| -292 | Referenced name does not exist |
| -293 | Referenced name already exist |
| -350 | Queue overflow |
| -363 | Input buffer overrun |
| -410 | Query INTERRUPTED |
| -420 | Query UNTERMINATED |

# 8. Calibration Procedure

Before performing the calibration procedure listed in this chapter, the EST Analyzer should be warmed up for at least 30 minutes.

- Please turn the two DIP switches of SW201 to ON before calibration.


**Note** The calibration switch SW201 is inside the Analyzer. If calibration is required, please remove the plate or GPIB CARD first.

- Press **SYSTEM** in any screen and move the highlight to “CALIBRATION” and then press **ENTER** to go into CAIBRATION setup screen.
- Use numeric keys to enter the PASSWORD [7] [9] [3] [1] and **ENTER** to get in the calibration procedure.

**Voltage Calibration (see Section 8.1)**

| | |
|---|---|
| ACV 5kV Offset (0.050kV) | ; AC Voltage OFFSET point |
| ACV 5kV Full (4kV) | ; AC Voltage FULL point |
| OSCV 100V Offset (50V) | ; OSC Voltage OFFSET point |
| OSCV 100V Full (100V) | ; OSC Voltage FULL point |
| DCV 6kV Offset (0.050kV) | ; DC Voltage OFFSET point |
| DCV 6kV Full (4kV) | ; DC Voltage FULL point |
| IRV 5kV Offset (0.050kV) | ; IR Voltage OFFSET point |
| IRV 5kV Full (4kV) | ; IR Voltage FULL point |

**Current Calibration (see Section 8.2)**

| | |
|---|---|
| ACA 3mA Offset (0.12mA) | ; AC total current 2.999mA range OFFSET point |
| RACA 3mA Offset (0.12mA) | ; AC real current 2.999mA range OFFSET point |
| ACA 3mA Full (2.4mA) | ; AC total current 2.999mA range FULL point |
| RACA 3mA Full (2.4mA) | ; AC real current 2.999mA range FULL point |
| ACA 30mA Offset (2.4mA) | ; AC total current 29.99mA range OFFSET point |
| RACA 30mA Offset (2.4mA) | ; AC real current 29.99mA range OFFSET point |
| ACA 30mA Full (12mA) | ; AC total current 29.99mA range FULL point |
| RACA 30mA Full (12mA) | ; AC real current 29.99mA range FULL point |
| ACA 120mA Offset (12mA) | ; AC total current 120.0mA range OFFSET point |

```
RACA 120mA Offset   (12mA)          ; AC real current 120.0mA range OFFSET point
ACA 120mA Full (48mA)               ; AC total current 120.0mA range FULL point
RACA 120mA Full (48mA)              ; AC real current 120.0mA range FULL point
DCA 300uA Offset   (12uA)           ; DC 299.9uA range OFFSET point
DCA 300uA Full (120uA)              ; DC 299.9uA range FULL point
DCA 3mA Offset   (0.12mA)           ; DC 2.999mA range OFFSET point
DCA 3mA Full (2.4mA)                ; DC 2.999mA range FULL point
DCA 20mA Offset   (2.4mA)           ; DC 20.00mA range OFFSET point
DCA 20mA Full (4.8mA)               ; DC 20.00mA range FULL point
```

**Insulation Resistance Calibration (see Section 8.3)**

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

**DC Resistance Calibration (see Section 8.4)**

```
DCR GET SHORT                       ; DCR Resistor Short Calibration
DCR 100mΩ OFFSET (10mΩ)             ; DCR Resistor 100mΩ OFFSET point
DCR 100mΩ FULL (100mΩ)              ; DCR Resistor 100mΩ FULL point
DCR 1Ω OFFSET (100mΩ)               ; DCR Resistor 1Ω OFFSET point
DCR 1Ω FULL (1000mΩ)                ; DCR Resistor 1Ω FULL point
DCR 10Ω OFFSET (1Ω)                 ; DCR Resistor 10Ω OFFSET point
DCR 10Ω FULL (10Ω)                  ; DCR Resistor 10Ω FULL point
DCR 100Ω OFFSET (10Ω)               ; DCR Resistor 100Ω OFFSET point
DCR 100Ω FULL (100Ω)                ; DCR Resistor 100Ω FULL point
DCR 1kΩ OFFSET (100Ω)               ; DCR Resistor 1kΩ OFFSET point
DCR 1kΩ FULL (1000Ω)                ; DCR Resistor 1kΩ FULL point
DCR 10kΩ OFFSET (1kΩ)               ; DCR Resistor 10kΩ OFFSET point
DCR 10kΩ FULL (10kΩ)                ; DCR Resistor 10kΩ FULL point
DCR 100kΩ OFFSET (10kΩ)             ; DCR Resistor 100kΩ OFFSET point
DCR 100kΩ FULL (100kΩ)              ; DCR Resistor 100kΩ FULL point
```

**High Frequency Contact Check Capacitance Calibration (see Section 8.5)**

```
HFCC   0pF      Offset Cali         ; HFCC 0pF        OFFSET point
HFCC   100pF    Full Cali           ; HFCC 100pF      FULL point
```

**ARC Calibration (see Section 8.6)**

```
AC ARC 15mA   (5mA)                 ; AC ARCing Calibration
DC ARC 10mA   (5mA)                 ; DC ARCing Calibration
```

**IWT GET OFFSET Calibration (see Section 8.7)**

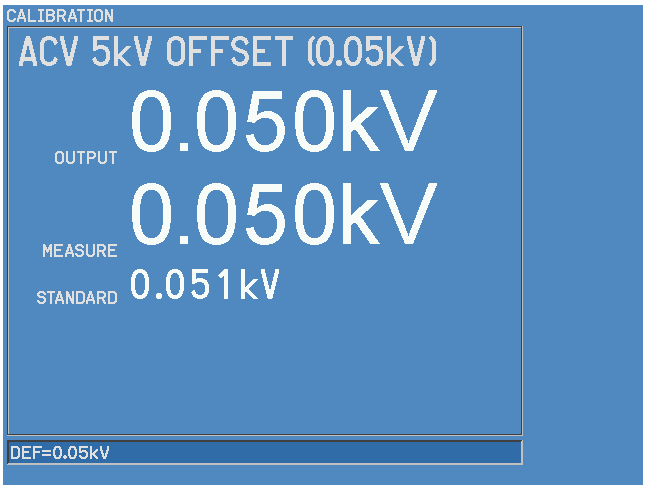
```
IWT      GET      OFFSET            ; IWT get offset Calibration
```

# 8.1 Voltage Calibration

## 8.1.1 Calibrating ACV

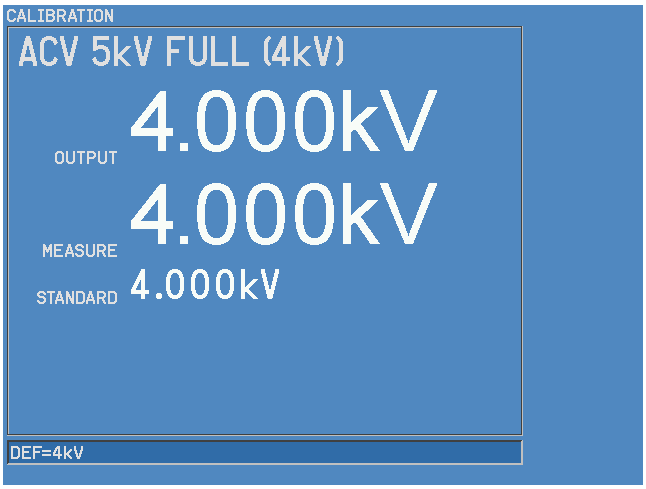
■ **Connect an ACV high voltage meter to the EST Analyzer with high voltage terminal connected to CH1 (DRIVE) and low voltage terminal connected to RETURN/LOW.**

**ACV 5kV OFFSET (0.05kV) Calibration Screen:**




1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to ACV 5kV FULL (4kV) calibration.

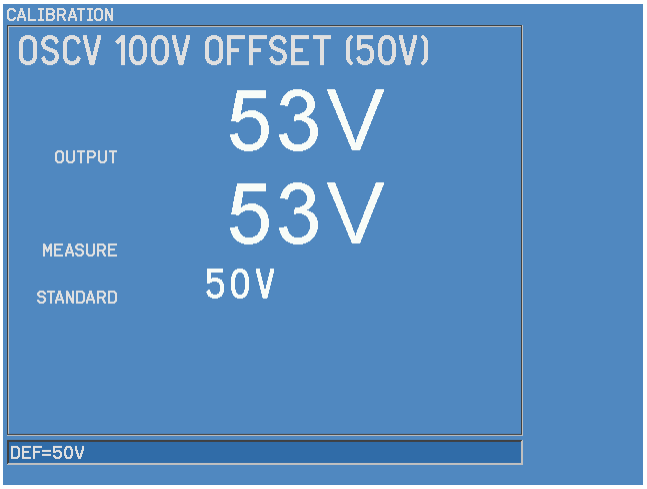
**ACV 5kV FULL (4kV) Calibration Screen:**




1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to OSCV 100V OFFSET (50V) calibration.

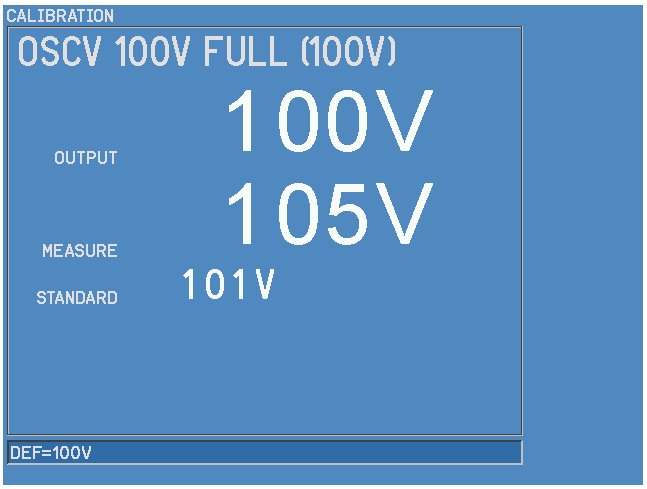
## 8.1.2 Calibrating OSCV

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




1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to OSCV 100V FULL (100V) calibration.

**OSCV 100V FULL (100V) Calibration Screen:**

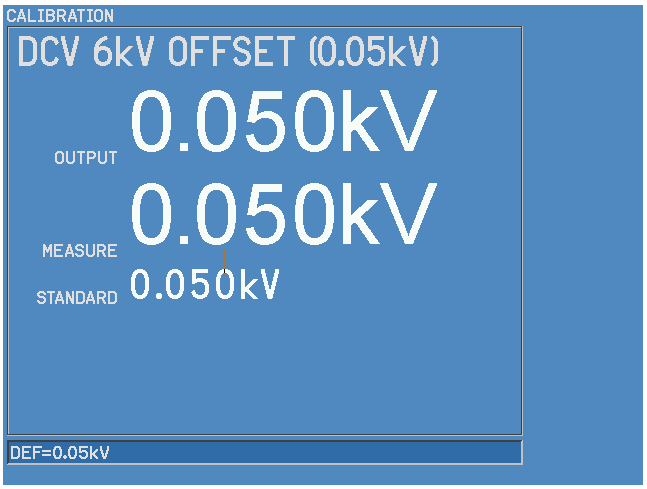



1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCV 6kV OFFSET (0.05kV) calibration.

## 8.1.3 Calibrating DCV

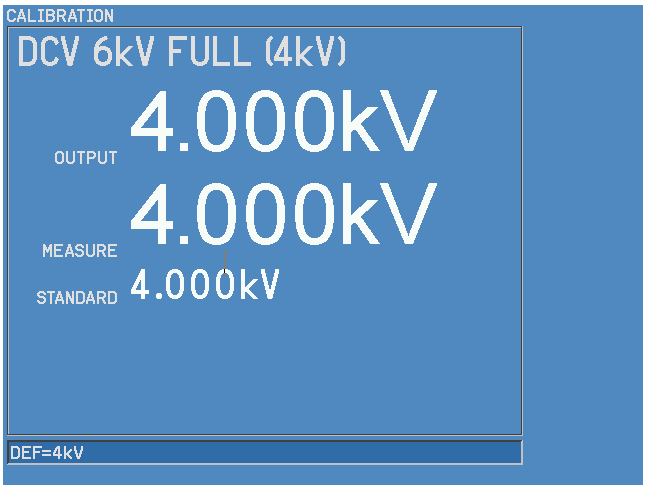
■ **Connect a DCV high voltage meter to this EST Analyzer with high voltage terminal connected to CH1 (DRIVE) and low voltage terminal connected to RETURN/LOW.**

**DCV 6kV OFFSET (0.05kV) Calibration Screen:**



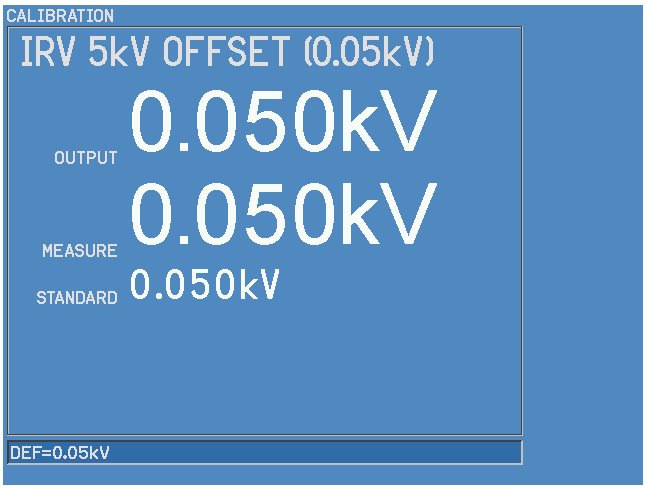

1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCV 6kV FULL (4kV) calibration.

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



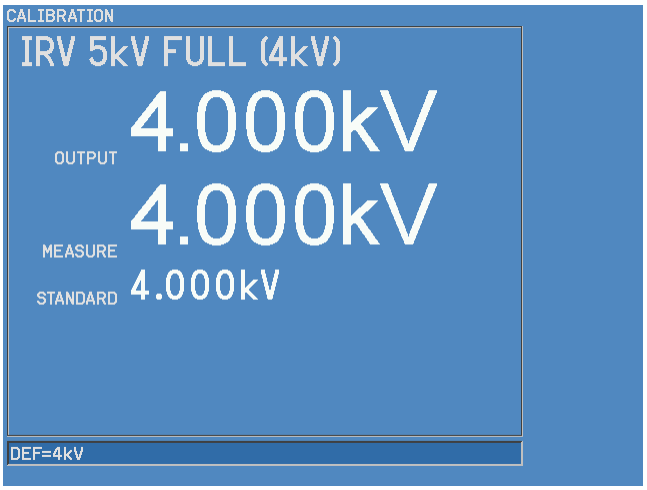

1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to IRV 5kV OFFSET (0.05kV) calibration.

**IRV 5kV OFFSET (0.05kV) Calibration Screen:**




1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to IRV 5kV FULL (4kV) calibration.

**IRV 5kV FULL (4kV) Calibration Screen:**




1. Press **START** to output voltage and get the readings on high voltage meter.
2. Use numeric keys to enter the readings from high voltage meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to ACA 3mA OFFSET (0.12mA) calibration.

# 8.2 Current Calibration

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

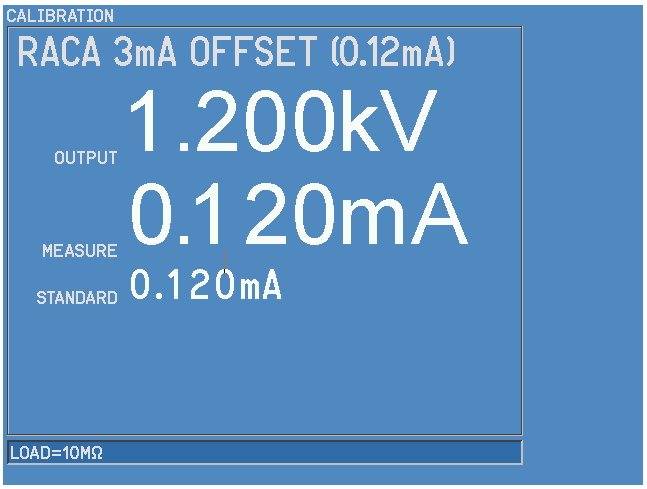
## 8.2.1 Calibrating ACA Current

■ **Connect a 10MΩ 0.5 Watt or high power simulated load resistance in between the high voltage output terminal (CH1<DRIVE>) of this EST Analyzer and the high potential terminal of AC meter, also connect the low potential terminal (RETURN/LOW) of this EST Analyzer to the low potential terminal of AC meter.**

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


1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to RACA 3mA OFFSET (0.12mA) calibration.

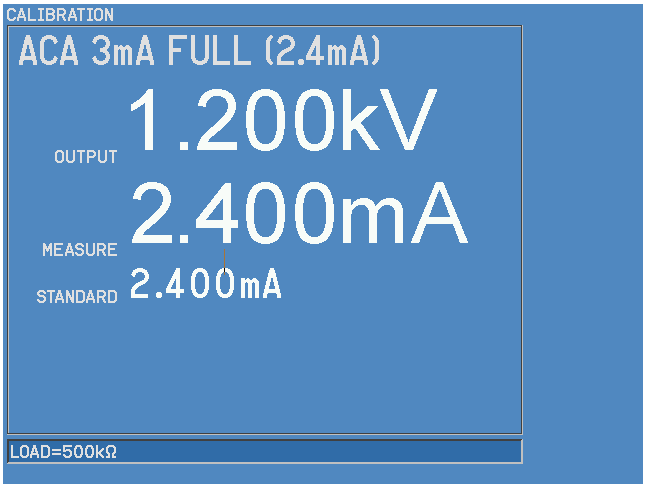
**RACA 3mA OFFSET (0.12mA) Calibration Screen:**




1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to ACA 3mA FULL (2.4mA) calibration.

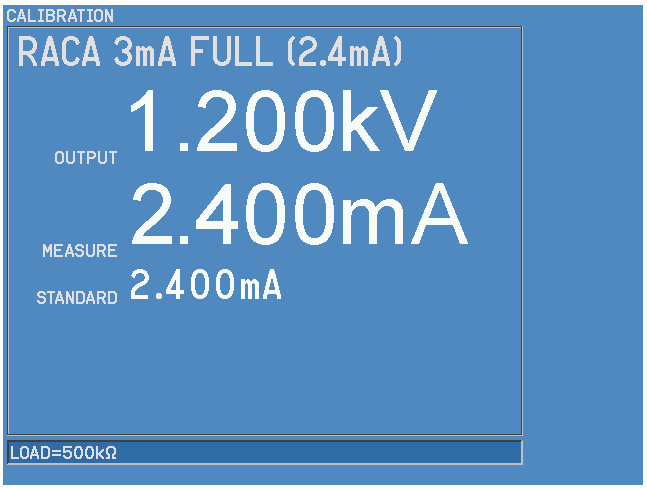
■ **Change the simulated load resistance to 500kΩ 10watt or higher power.**

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



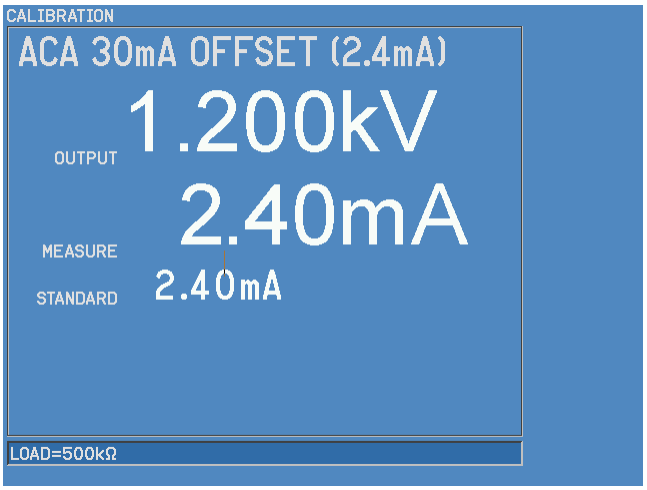

1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to RACA 3mA FULL (2.4mA) calibration.

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




1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to ACA 30mA OFFSET (2.4mA) calibration.

**ACA 30mA OFFSET (2.4mA) Calibration Screen:**




1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to RACA 30mA OFFSET (2.4mA) calibration.

**RACA 30mA OFFSET (2.4mA) Calibration Screen:**

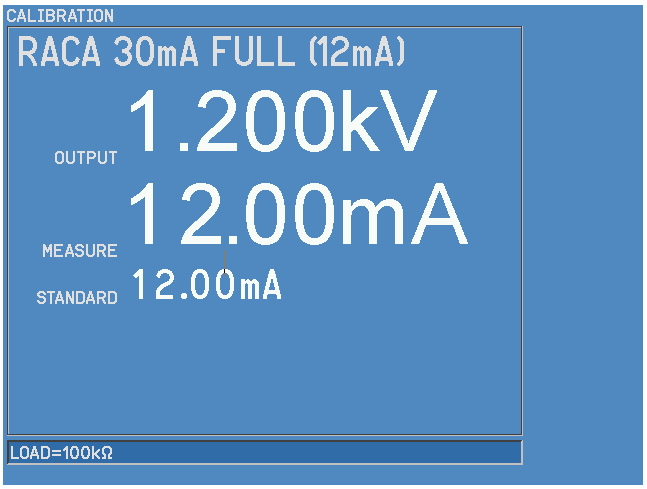

1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to ACA 30mA FULL (12mA) calibration.

■ **Change the simulated load resistance to 100kΩ 50 watts or higher power.**

**ACA 30mA FULL (12mA) Calibration Screen:**

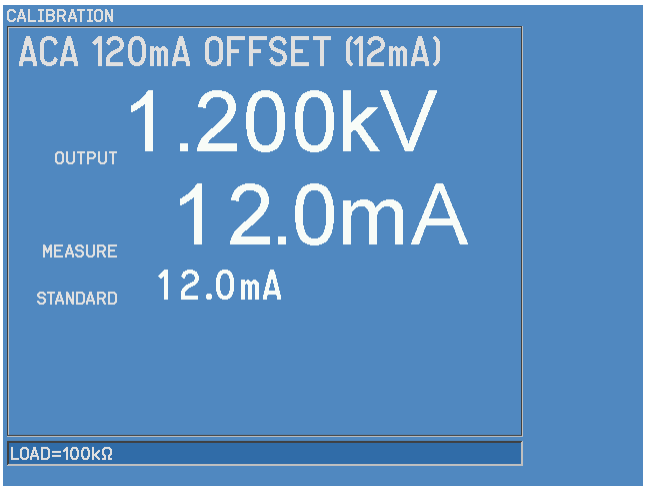

1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to RACA 30mA FULL (12mA) calibration.

**RACA 30mA FULL (12mA) Calibration Screen:**



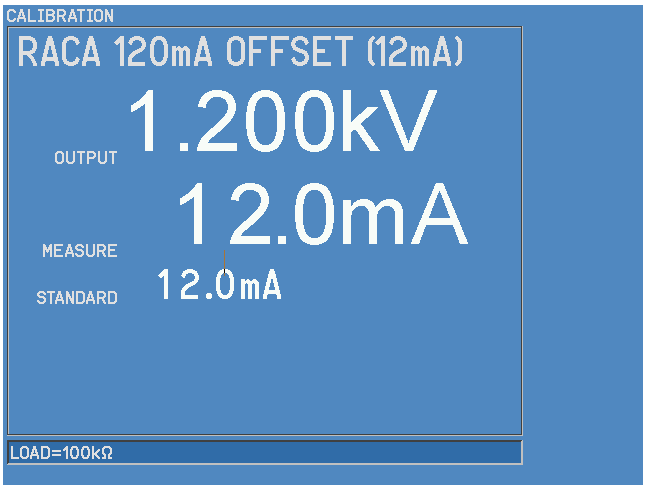

1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to ACA 120mA OFFSET (0.12mA) calibration.

**ACA 120mA OFFSET (12mA) Calibration Screen:**




1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to RACA 120mA OFFSET (12mA) calibration.

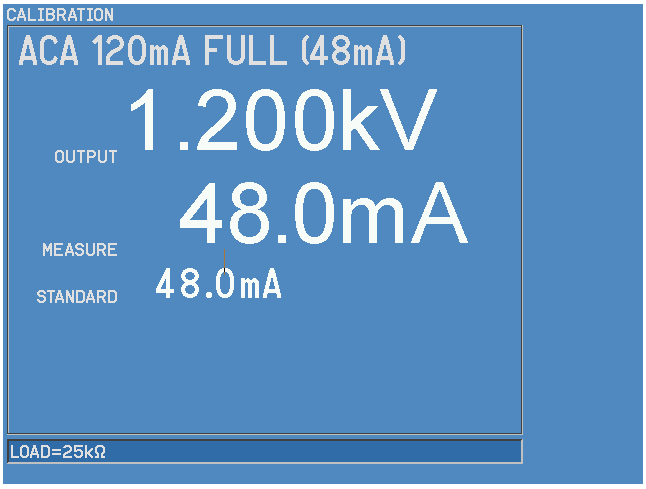
**RACA 120mA OFFSET (12mA) Calibration Screen:**




1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to ACA 120mA FULL (48mA) calibration.

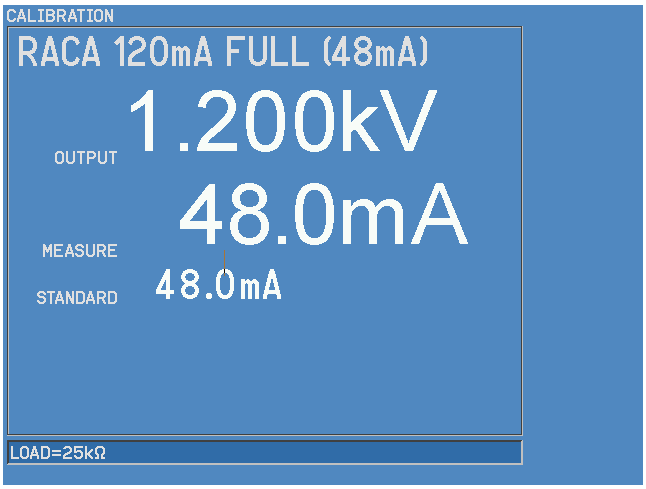
■ **Change the simulated load resistance to 25kΩ 400 watts or higher power.**

**ACA 120mA FULL (48mA) Calibration Screen:**




1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to RACA 120mA FULL (48mA) calibration.

**RACA 120mA FULL (48mA) Calibration Screen:**

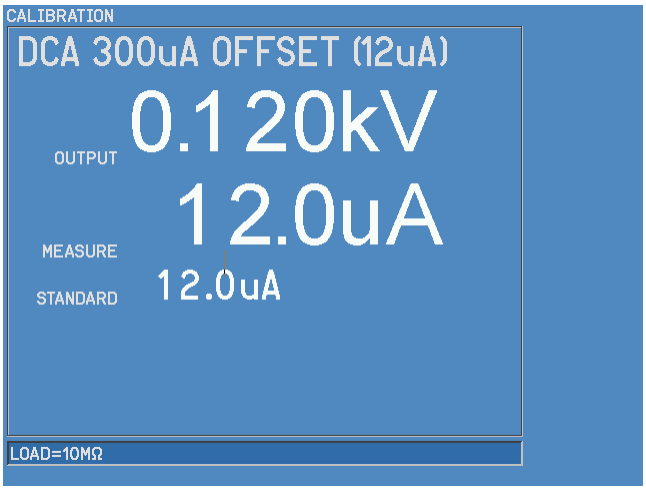



1. Press **START** to output voltage and get the readings on AC meter.
2. Use numeric keys to enter the readings from AC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCA 300uA OFFSET (12uA) calibration.

## 8.2.2 Calibrating DCA Current

■ **Connect a 100MΩ 0.25 Watt or high power simulated load resistance in between the high voltage output terminal (CH1<DRIVE>) of this EST Analyzer and the high potential terminal of DC meter, also connect the low potential terminal (RETURN/LOW) of this EST Analyzer to the low potential terminal of DC meter.**

**DCA 300uA OFFSET (12uA) Calibration Screen:**

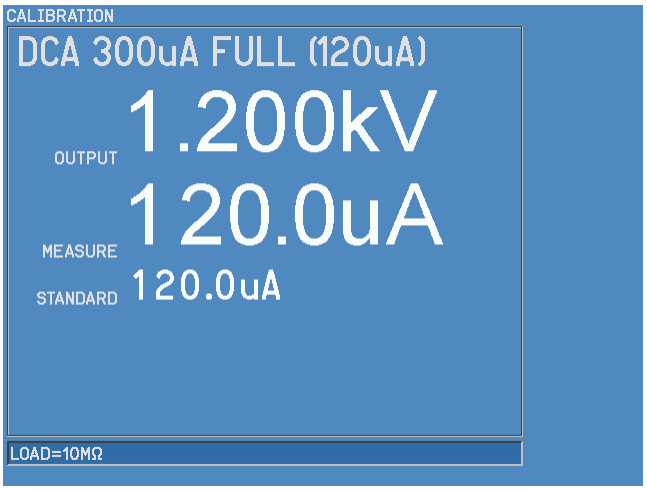



1. Press **START** to output voltage and get the readings on DC meter.
2. Use numeric keys to enter the readings from DC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.

5. Press ▼ to go to DCA 300uA FULL (120uA) calibration.

■ **Change the simulated load resistance to 10MΩ 0.5watt or higher power.**

**DCA 300uA FULL (120uA) Calibration Screen:**



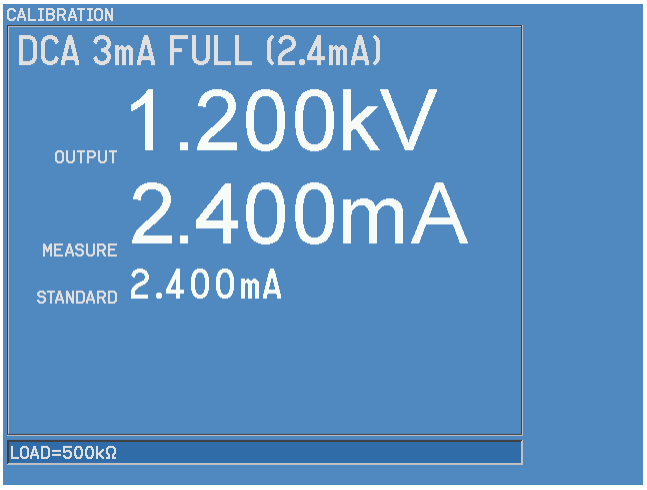

1. Press **START** to output voltage and get the readings on DC meter.
2. Use numeric keys to enter the readings from DC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCA 3mA OFFSET (0.12mA) calibration.

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


1. Press **START** to output voltage and get the readings on DC meter.
2. Use numeric keys to enter the readings from DC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCA 3mA FULL (2.4mA) calibration.

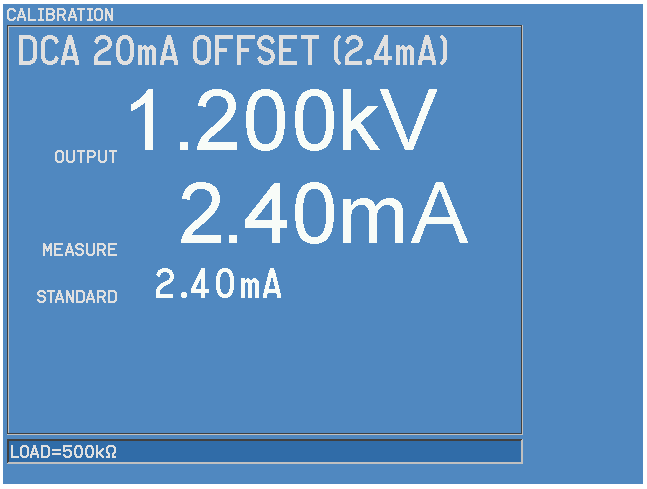
■ **Change the simulated load resistance to 500kΩ 10watt or higher power.**

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




1. Press **START** to output voltage and get the readings on DC meter.
2. Use numeric keys to enter the readings from DC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCA 20mA OFFSET (2.4mA) calibration.

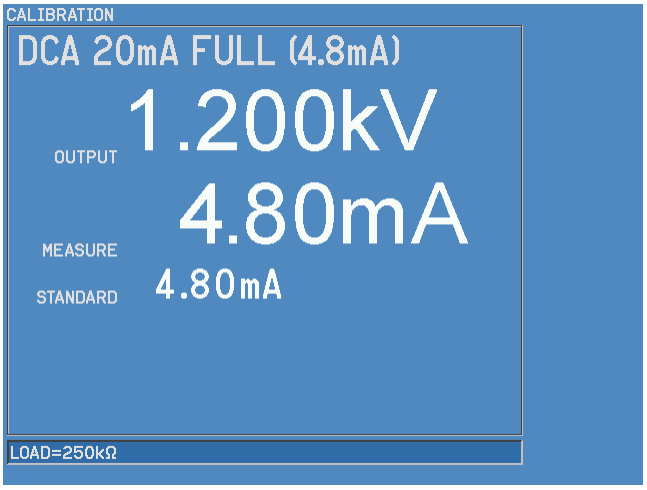
**DCA 20mA OFFSET (2.4mA) Calibration Screen:**




1. Press **START** to output voltage and get the readings on DC meter.
2. Use numeric keys to enter the readings from DC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCA 20mA FULL (4.8mA) calibration.

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

**DCA 20mA FULL (4.8mA) Calibration Screen:**




1. Press **START** to output voltage and get the readings on DC meter.
2. Use numeric keys to enter the readings from DC meter.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCA 20mA FULL (4.8mA) calibration.

## 8.3 Insulation Resistance (IR) Calibration

■ **Connect a standard resistance 4MΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

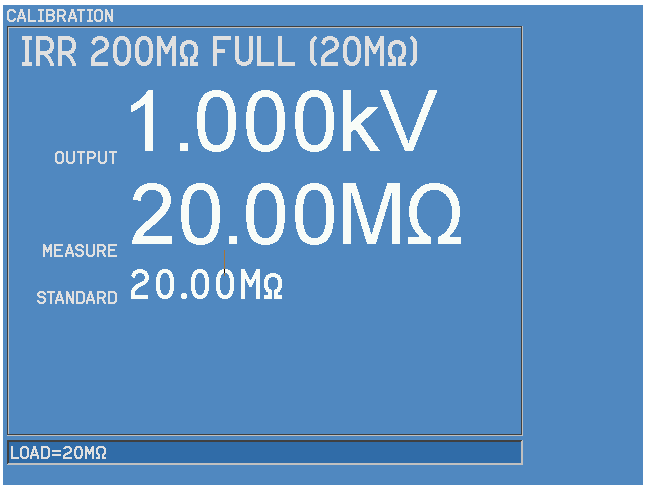
**IRR 200MΩ OFFSET (4MΩ) Calibration Screen:**


1. Press **START** to output voltage.
2. Use numeric keys to input the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.

5. Press ▼ to go to IRR 200MΩ FULL (20MΩ) calibration.

■ **Connect a standard resistance 20MΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

**IRR 200MΩ FULL (20MΩ) Calibration Screen:**




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

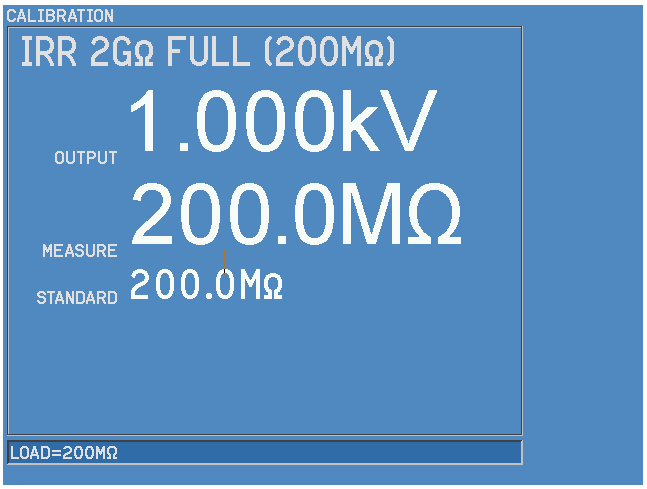
■ **Connect a standard resistance 40MΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

**IRR 2GΩ OFFSET (40MΩ) Calibration Screen:**


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

■ **Connect a standard resistance 200MΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

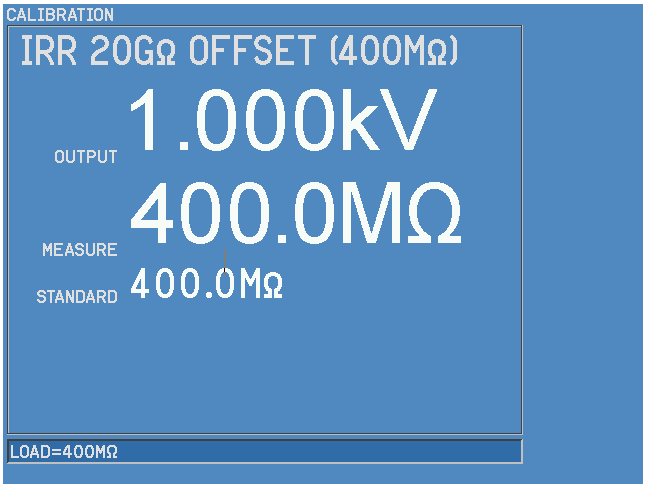
**IRR 2GΩ FULL (200MΩ) Calibration Screen:**




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

■ **Connect a standard resistance 400MΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

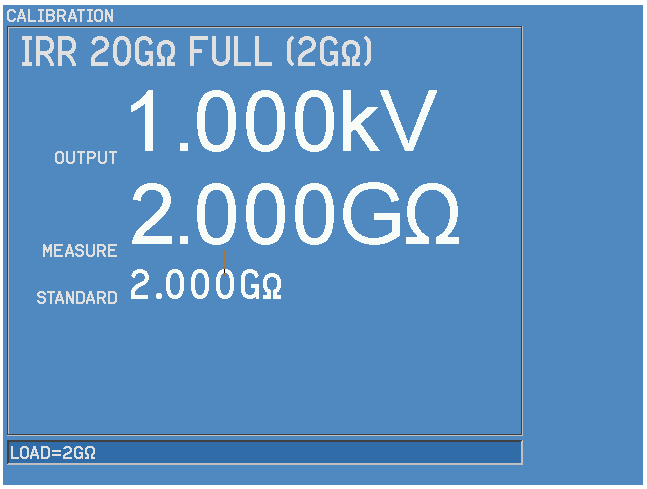
**IRR 20GΩ OFFSET (400MΩ) Calibration Screen:**




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

■ **Connect a standard resistance 2GΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

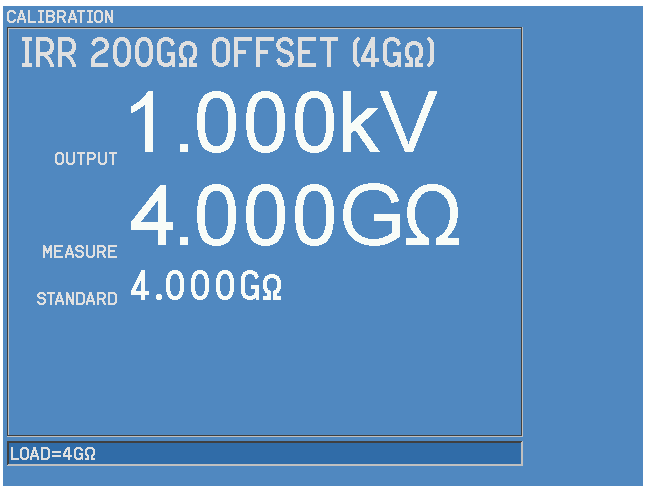
**IRR 20GΩ FULL (2GΩ) Calibration Screen:**




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

■ **Connect a standard resistance 4GΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

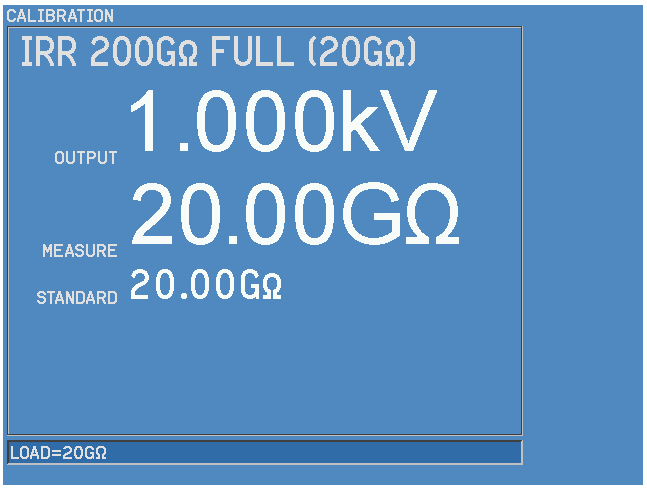
**IRR 200GΩ OFFSET (4GΩ) Calibration Screen:**




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

■ **Connect a standard resistance 20GΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

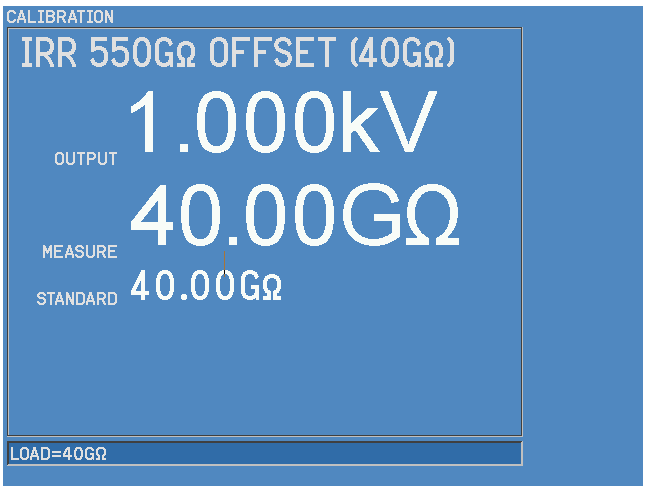
**IRR 200GΩ FULL (20GΩ) Calibration Screen:**




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

■ **Connect a standard resistance 40GΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

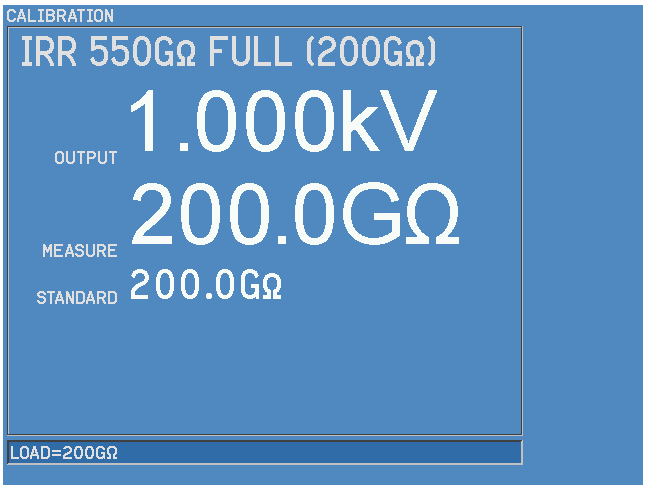
**IRR 550GΩ OFFSET (40GΩ) Calibration Screen:**




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

■ **Connect a standard resistance 200GΩ between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW) on the EST Analyzer.**

**IRR 550GΩ FULL (200GΩ) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR GET SHORT calibration.

## 8.4 DC Resistance Calibration

■ **Connect the 4-wire DCR fixture to standard resistance 10mΩ with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 400mV OFFSET(5mV) Calibration Screen:**


1. Press **START** to output voltage.
2. Use numeric keys to input the Sense voltage.
3. Press **ENTER** to confirm the input data.

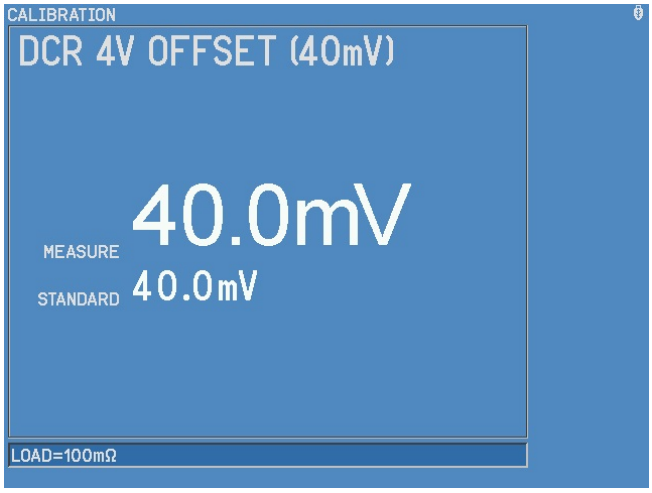
4. Press **STOP** to stop the voltage output.
5. Press ▼ to go to DCR 400mV FULL (50mV) calibration.

■ **Connect the 4-wire DCR fixture to standard resistance 100mΩ with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 400mV FULL(50mV) Calibration Screen:**


1. Press **START** to output voltage.
2. Use numeric keys to input the Sense voltage.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop the voltage output.
5. Press ▼ to go to DCR 4V FULL (40mV) calibration.

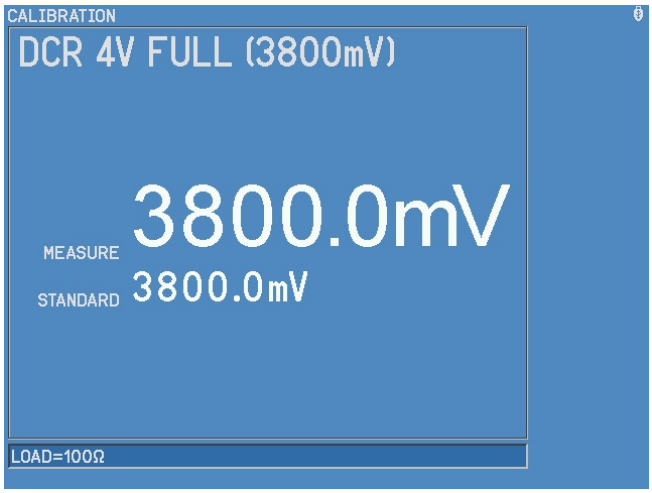
**DCR 4V OFFSET(40mV) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the Sense voltage.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop the voltage output.
5. Press ▼ to go to DCR 4V FULL (3800mV) calibration.

■ **Connect the 4-wire DCR fixture to standard resistance 100Ω with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 4V FULL(3800mV) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the Sense voltage.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop the voltage output.
5. Press ▼ to go to DCR 100mΩ FULL (10mΩ) calibration.

■ **Connect the 4-wire DCR fixture to standard resistance 10mΩ with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 100mΩ OFFSET (10mΩ) Calibration Screen:**

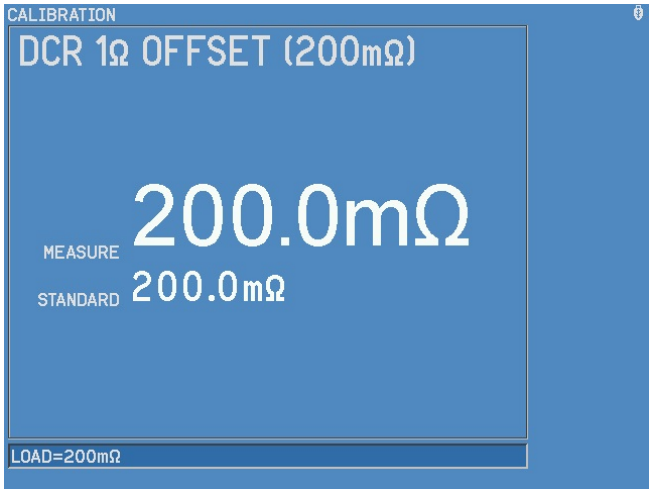

1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 100mΩ FULL (200mΩ) calibration.

■ **Connect the 4-wire DCR fixture to standard resistance 200mΩ with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 100mΩ FULL (200mΩ) Calibration Screen:**


1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop the voltage output.
5. Press ▼ to go to DCR 1Ω OFFSET (200mΩ) calibration.

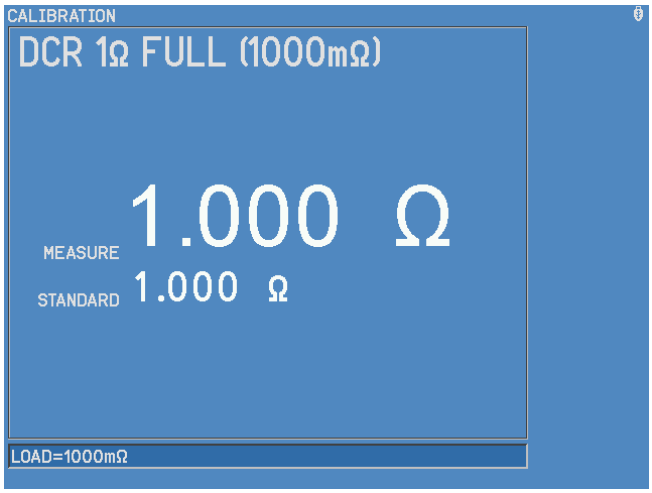
**DCR 1Ω OFFSET (200mΩ) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop the voltage output.
5. Press ▼ to go to DCR 1Ω FULL (1000mΩ) calibration.

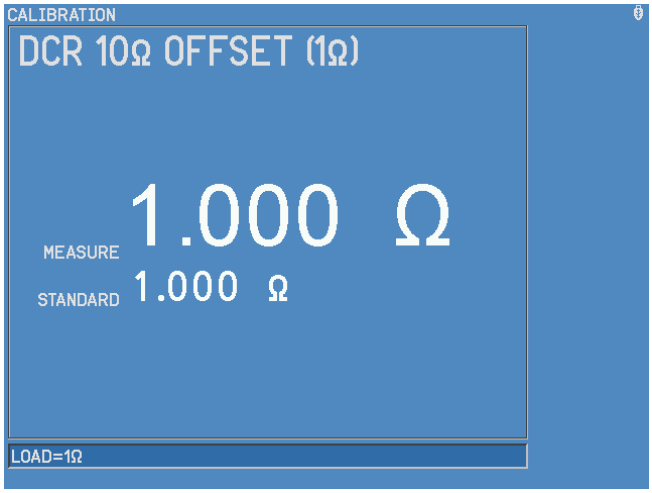
■ **Connect the 4-wire DCR fixture to standard resistance 1000mΩ with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 1Ω FULL (1000mΩ) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 10Ω OFFSET (1Ω) calibration.

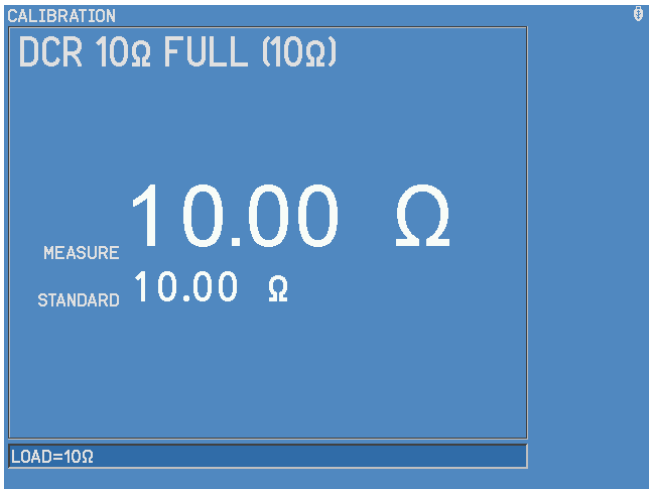
**DCR 10Ω OFFSET (1Ω) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 10Ω FULL (10Ω) calibration.

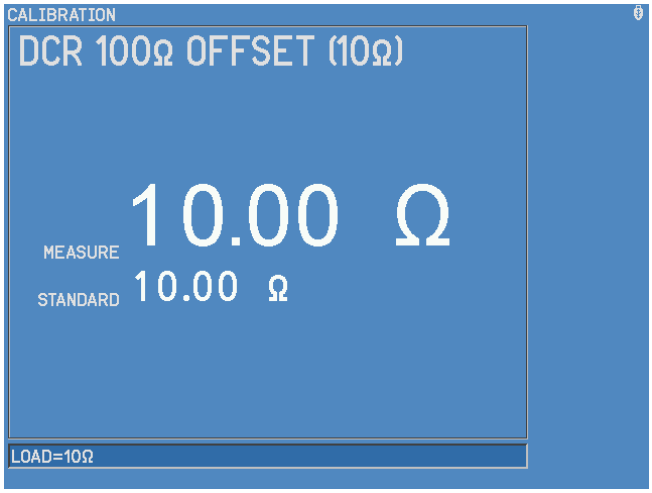
■ **Connect the 4-wire DCR fixture to standard resistance 10Ω with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 10Ω FULL (10Ω) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 100Ω OFFSET (10Ω) calibration.

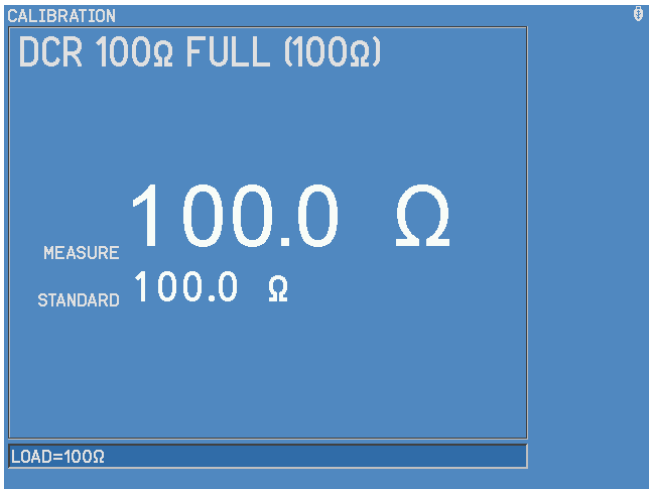
**DCR 100Ω OFFSET (10Ω) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 100Ω FULL (100Ω) calibration.

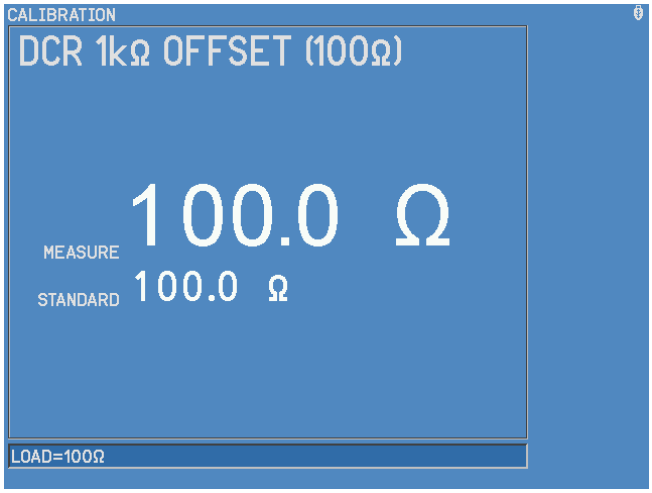
■ **Connect the 4-wire DCR fixture to standard resistance 100Ω with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 100Ω FULL (100Ω) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 1kΩ OFFSET (100Ω) calibration.

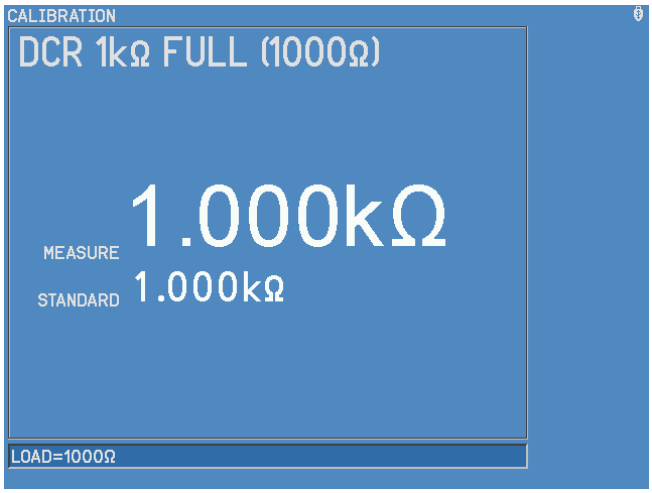
**DCR 1kΩ OFFSET (100Ω) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 1kΩ FULL (1000Ω) calibration.

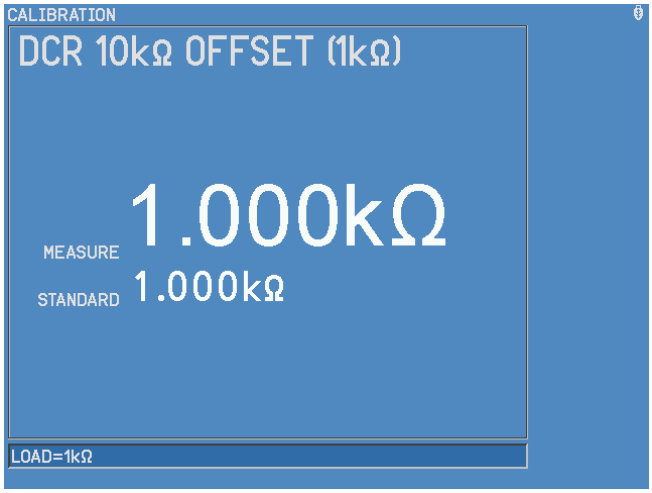
■ **Connect the 4-wire DCR fixture to standard resistance 1000Ω with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 1kΩ FULL (1000Ω) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 10kΩ OFFSET (1kΩ) calibration.

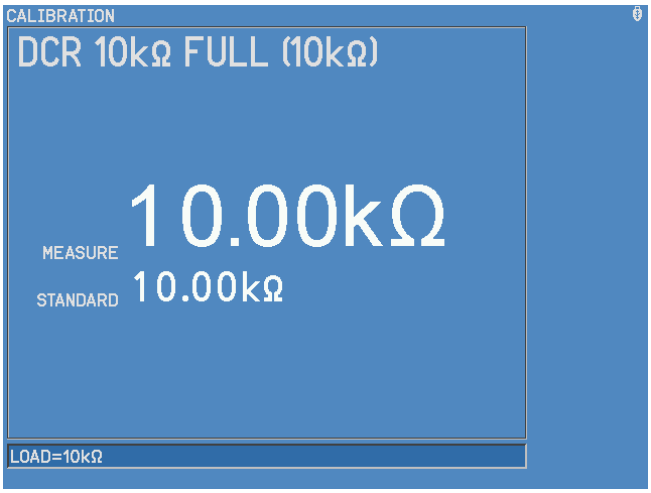
**DCR 10kΩ OFFSET (1kΩ) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 10kΩ FULL (10kΩ) calibration.

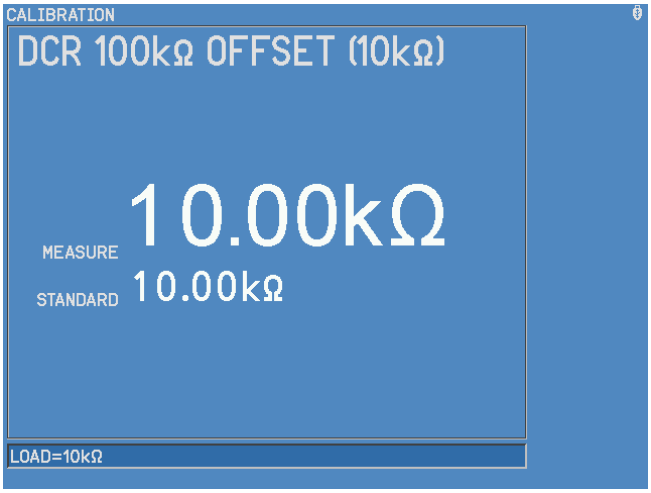
■ **Connect the 4-wire DCR fixture to standard resistance 10kΩ with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 10kΩ FULL (10kΩ) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 100kΩ OFFSET (10kΩ) calibration.

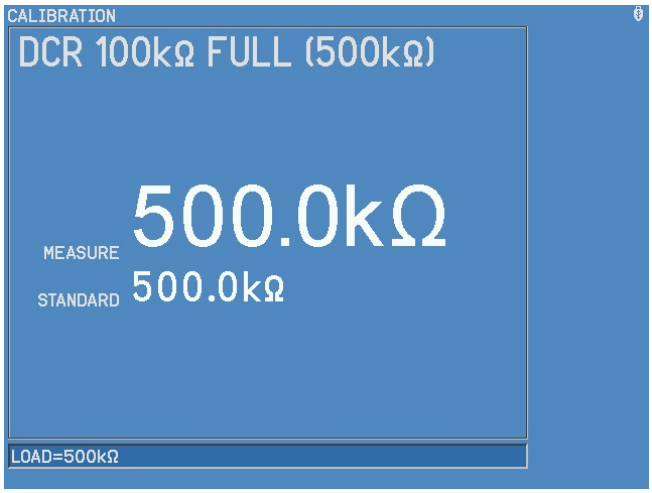
**DCR 100kΩ OFFSET (10kΩ) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to DCR 100kΩ FULL (500kΩ) calibration.

■ **Connect the 4-wire DCR fixture to standard resistance 500kΩ with one end to the high voltage output terminal CH9 and the other to the RET/LOW.**

**DCR 100kΩ FULL (500kΩ) Calibration Screen:**

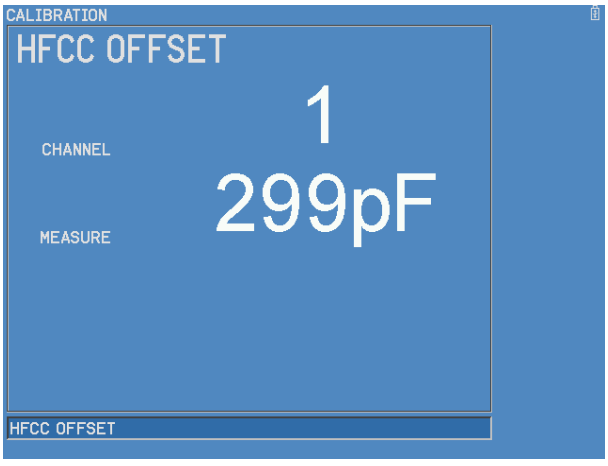



1. Press **START** to output voltage.
2. Use numeric keys to input the standard resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press ▼ to go to HFCC OFFSET (0pF) calibration.

## 8.5 High Frequency Contact Check Capacitance Calibration

■ **Connect a 0pF capacitor fixture to the EST Analyzer between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW).**

**HFCC 0pF Offset Calibration Screen:**

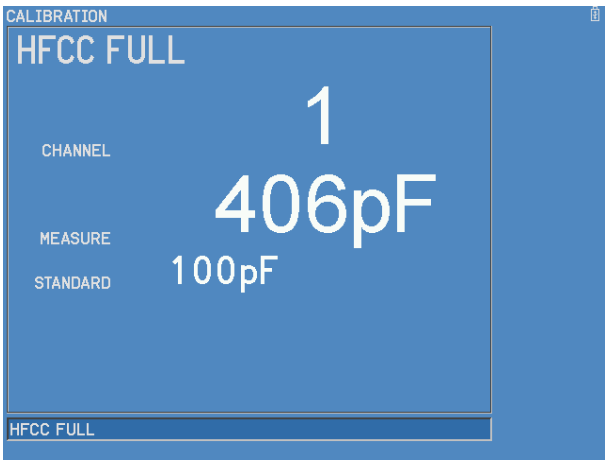



1. Press **START** to output voltage.

2. The calibration is done once the message line on the screen showed “**COMPLETED**”. Press ▼ to go to HFCC 100pF Full calibration.

■ **Connect a 100pF capacitor fixture to the EST Analyzer between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW). The high voltage output terminal for connection is determined by the channel displayed on the screen. The figure below shows CHANNEL 1, so the 100pF capacitor high voltage terminal is connected to CH1.**

**HFCC 100pF Full Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to input the capacitance (100pF) and press **ENTER**.
3. Press **STOP** to stop high voltage output.
4. Press ▼ to go to AC ARC 15mA FULL (5mA) calibration.

# 8.6 ARC Calibration

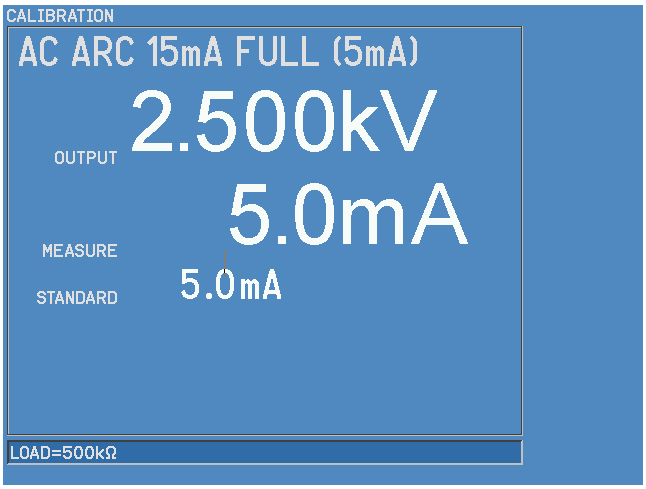
**CAUTION**

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

## 8.6.1 Calibrating AC ARC

■ Connect one end of 500kΩ 10Watt or high power simulated load resistance to the high voltage output terminal CH1 (DRIVE) on the EST Analyzer, and move the other end close to the low potential terminal (RETURN/LOW) without physical connection in order to create sparks.

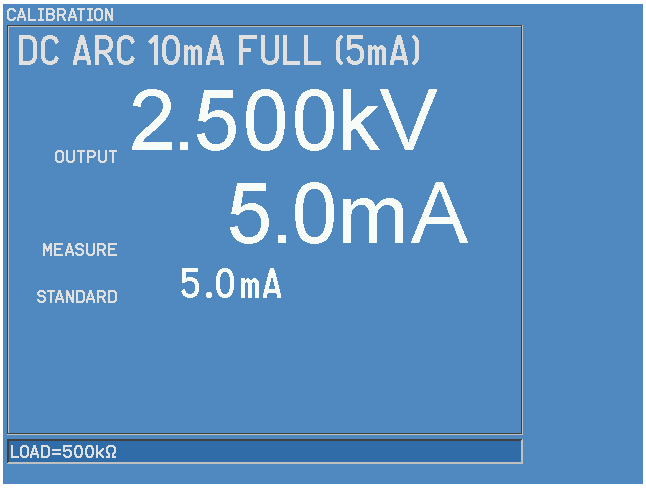
**AC ARC 15mA FULL (5mA) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to adjust the STANDARD current as the threshold of ARC FAIL and ARC PASS and then press **ENTER**.
3. Press **STOP** to stop high voltage output.
4. Press ▼ to go to DC ARC 15mA FULL (5mA) calibration.

## 8.6.2 Calibrating DC ARC

**DC ARC 10mA FULL (5mA) Calibration Screen:**




1. Press **START** to output voltage.
2. Use numeric keys to adjust the STANDARD current as the threshold of ARC FAIL and ARC PASS and then press **ENTER**.
3. Press **STOP** to stop high voltage output.
4. Press ▼ to go to IWT GET Offset calibration.

# 8.7 IWT GET OFFSET Calibration

■ **No need to connect any DUT between the high voltage output terminal (CH1<DRIVE>) and low potential terminal (RETURN/LOW).**

**IWT Get Offset Calibration Screen:**


1. Press **START** to perform IWT offset calibration automatically.
2. When done, a “COMPLETED” message line will show on the lower screen.

# 8.8 Calibration Completed

1. Press **SYSTEM** to exit the calibration screen.
2. After the calibration is done, please turn the two DIP switches on the calibration switch SW201 to OFF.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