Chroma

Wound Component EST Scanner

19035/19035-M/19035-S

User's Manual

Wound Component
EST Scanner
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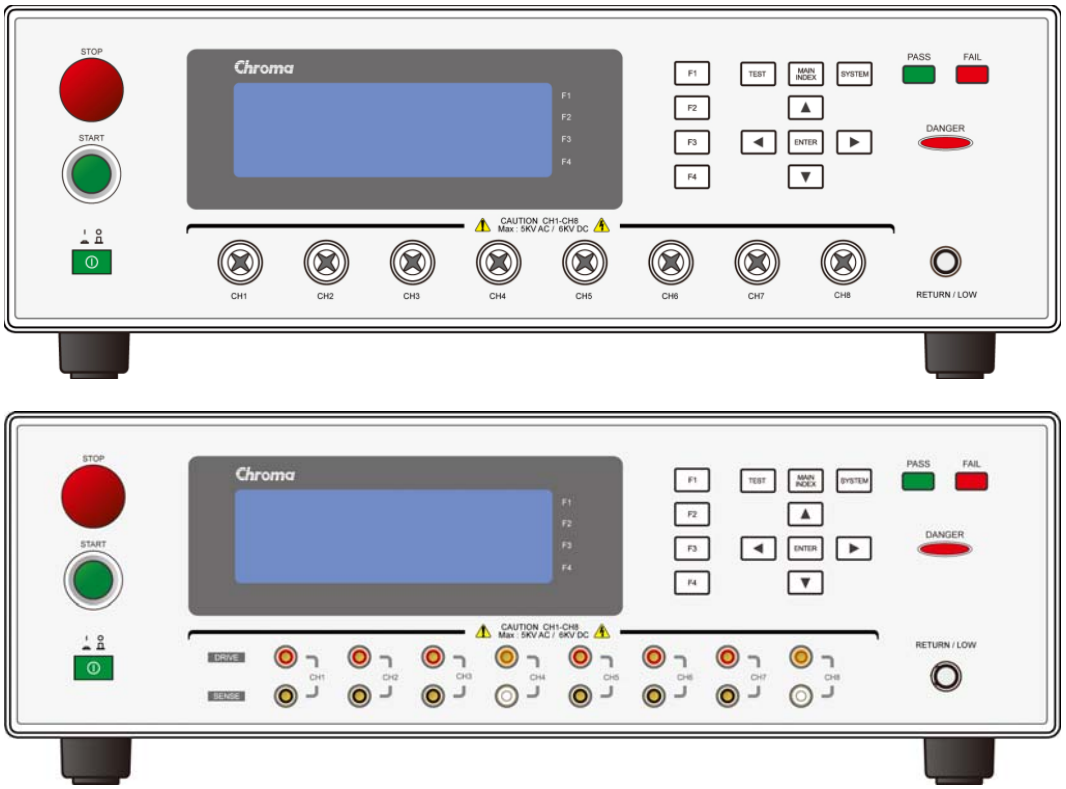

Version 1.5
July 2012
P/N A11 001066

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CHROMA ATE INC.
66 Hwa-Ya 1st Rd., Hwa-Ya Technical Park, Kuei-Shan Hsiang, Taoyuan County, Taiwan

Warranty

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

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Material Contents Declaration

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


: See **<Table 1>**.

: See **<Table 2>**.

<Table 1>

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

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

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

Disposal

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

<Table 2>

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

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

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

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

Disposal

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

www.chromaate.com

Declaration of Conformity

For the following equipment :

Wound Component EST Scanner

(Product Name/ Trade Name)

19035-ML, 19035-L, 19035-M, 19035-S, 19035, Hybrid 2000

(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) , Low-voltage Directive (2006/95/EC). For the evaluation regarding the Directives, the following standards were applied :

EN 61326-1: 2006

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

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

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

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

EN 61010-1: 2010(Edition 3.0)

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

Chroma ATE Inc.

(Company Name)

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

(Company Address)

Person responsible for this declaration:

Mr. Benjamin Huang

(Name, Surname)

T&M BU Division Vice President

(Position/Title)

Taiwan	**2012.05.30**	Benjamin Huang
(Place)	(Date)	(Legal Signature)

Unpacking for Check & Inspection

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

Standard Package of 19035 and 19035-S

Item Name	Qty	Description
19035 or 19305-S Main System	1	19035 or 19035-S Wound Component EST Scanner
Power Line	1	Power cord
3P – 2P Converter	1	Power cord converter
Test Cable (1)	1	1M HV Lead with RED clips
Test Cable (2)	1	1M LV Lead with BLACK clip
Test Cable (3)	8	1M 20kV Lead without clip
Fuse (1)	2	For 5.0A SLOW 110VAC
Fuse (2)	2	For 2.5A SLOW 240VAC
User's Manual	1	English version

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

Standard Package of 19035-M

Item Name	Qty	Description
19035-M Main System	1	19035-M Main System
Power Line	1	Power cord
3P – 2P Converter	1	Power cord converter
Test Cable (1)	1	1M HV Lead with RED clips
Test Cable (2)	1	1M LV Lead with BLACK clip
Test Cable (3)	6	High potential test cable
Test Cable (4)	2	Low potential test cable
Fuse (1)	2	For 5.0A SLOW 110VAC
Fuse (2)	2	For 2.5A SLOW 240VAC
User's Manual	1	English version

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

Hazard Operation Methods

1. Do not touch the testing area when this scanner 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 Scanner 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 Hipot Tester can be remote controlled generally for high voltage output via external control signal. When performing it, it is necessary to follow the control guidelines 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 UUT, 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 cable with RS232, Handler and GPIB control cables or other low voltage side wires. If so, it could cause the product or PC to be down or damaged.

Storage, Freight & Maintenance

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.

Revision History

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

Date	Version	Revised Sections
June 2006	1.0	Complete this manual
Mar. 2007	1.1	Modify the following chapters and sections: – "*Specification*" – "*Features*" – "*Precautions before Use*" – "*Setting TEST CONTROL*" – "*Description of Parameters*" – "*HANDLER Interface (OPTION)*" – "*Commands for Remote Interface*" – "*Command Description*" Add the following: – "*Material Contents Declaration*" – Description of "NAME" in Impulse Winding Test (IWT) Mode under the section of "*Description of Parameters*." – "*Example of External Control Circuit*" in the chapter of "*HANDLER Interface (OPTION)*."
Mar. 2008	1.2	Modify the following chapters and sections: – "*Features*" – "*Specification*" – "*Setting TEST CONTROL*" – "*Setting SYSTEM CONFIG*" – "*Description of Parameters*" – "*Test Procedure for OSC*" – "*HANDLER Interface (OPTION)*" – "*Commands for Remote Interface*" – "*Command Description*" – "*Error Messages*" – "*DC Resistance Calibration*" – "*Command Summary*" Add the following: – "*Temperature Measurement*" in the chapter of "*Operation*."
Nov. 2009	1.3	Modify the contents to add 19035-M & 19035-S two new models. Add DCR Balance & SUB STEP functions.
Dec. 2010	1.4	Update "*Material Contents Declaration.*"
Jul. 2012	1.5	Update "*CE Declaration of Conformity*"

Table of Contents

1. Preface

1.1 Product Overview

This automatic Wound Component EST (Electrical Safety Test) Scanner is an equipment designed to perform the tests of AC/DC Hipot, IR (Insulation Resistance) and Impulse Winding automatically for wound components.

It has AC5kV/DC6kV high voltage output that meets the withstand voltage test requirement of wound components for outputting maximum current up to AC 30mA/DC 10mA. Its IR insulation resistance ranged from 0.1MΩ to 50GΩ with voltage output up to 5kV is able to test if the insulation resistance of wound components meets the standard. In addition to measuring the electrical characteristic of wound components, the DC resistance test can also check the connection before performing the safety withstand voltage test.

The EST Scanner uses a clear display to show all settings, time, current, voltage, resistance and memory no., etc without the need to memorize the parameters set beforehand.

The 19035 Wound Component EST Scanner has equipped the device to identify pass or fail products as well as to output signals of test result and to remote control other devices. It has RS232 interface that is of advantage to automatic test system with optional GPIB/HANDLER interface available for selection. This EST Scanner equipped with assorted devices mentioned above is capable of performing highly efficient and accurate tests for wound components.

1.2 Features

- **Diverse Tests**
  The 19035 Wound Component EST Scanner is able to use the test functions such as Withstand Voltage test for AC (WVAC), Withstand Voltage test for DC (WVDC), Insulation Resistance (IR) test, DC Resistance (DCR) test and Open/Short Check separately.

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

- **Clear Display**
  The EST Scanner has made a clearest design for display. All programs for setting such as test voltage, current state, test readings, test steps and test state are able to be viewed from the LED display directly.

- **High/Low Limit Comparison for Pass/Fail Products**
  The EST Scanner has been designed to do High/Low Limit comparison for the DUT (Device Under Test). This function is available in Hipot test, Insulation Resistance test or DC resistance test. The low limit comparison for leakage and high limit comparison for insulation are used to test if there's any bad connection or loose test wire that causes misjudgment.

- **Remote Control**
  The EST Scanner is able to extend the [START] and [STOP] signals to HANDLER CARD for controlling externally. It also can send the test results to external through this interface as the response device for parts process.

- **Change Voltage Ramp Time**
  This instrument has [RAMP] function that can set the time required for voltage rises from zero to set value.

- **Change Voltage Fall Time**
  This instrument has [FALL] function that can set the time required for voltage falls from the set value to low when test time ends.

- **Auto Switch Leakage Current Test Range**
  The current meter ranges for withstand voltage test in this Scanner has two ranges for AC: 0~2.999mA and 3.00~30.00mA, and three ranges for DC: 0.0~299.9uA, 0.300~2.999mA and 3.00~10.00mA. If the tested current is low, software can be used to switch the current range to low range automatically for resolution improvement before the test ends as need.

- **An option of GP-IB/HANDLER/Temperature Compensation 3 in 1 interface is available for purchase.**

- **Impulse Winding Test (Optional)**
  This EST Scanner is able to install the optional RS232 interface card and ***Impulse Winding Tester*** for wound component pulse test. Different STEP can call different main wave data that saved in the ***Impulse Winding Tester*** for multiple continuous tests. It also means to recall different golden samples.

- **The EST Scanner has 50 sets of memories and each set contains up to 20 test steps.**

- **A full function front panel calibration is provided.**

- **DCR Mode Temperature Compensation**
  Since the wire resistance will change following the temperature, the resistance measurement needs to add the temperature as one of the test condition. The function of temperature compensation is to calculate the resistance at another temperature from the temperature and resistance already known. It is frequently used to convert the wire resistance under different temperature.

2. Specification (18°C~28°C RH ≤ 70%)

Model	19035	19035-M	19035-S
Mode	ACV/DCV/IR / DCR-8CH/IWT	ACV/DCV/IR / DCR-16CH/IWT	ACV/DCR -8CH
Impulse Winding Test (Layer Short)	External option	External option	–
Channel Programming	H/L/X in 8CHs	H/X in CH 1, 2, 3, 5, 6, 7 L/X in CH 4, 8	H/L/X in 8CHs
❑ Withstanding Voltage Test			
Output Voltage:	AC: 0.05-5.0 kV, steps 0.002kV, 50Hz/60Hz ± 0.1%, sinewave. DC: 0.05-6.0 kV, steps 0.002kV. Load Regulation: ≤ (1% of setting + 0.1% of full scale), Rated load, AGC ON Voltage Accuracy: ± (1% of setting + 0.1% of full scale)		
Output Voltage monitor	V-monitor: ± (1% of reading + 0.1% of full scale), 2V resolution		
Cutoff Current	AC:0.01mA~30mA (**Note 1**), DC:0.001mA~10mA,0.1uAdc resolution(note1) Current Accuracy: ± (1% of reading + 0.5% of range) AC real current accuracy: ± (1% of reading + 5% of total current +5counts)		
Current Display	Hi limit setting Display Range < 300uA : 0.1uA~299.9uA(dc only) < 3mA: 0.001mA~2.999mA <30mAac(10mAdc): 0.01mA~30.00mAac(10mAdc)		
Flashover(ARC) Detection <**Note 2**>	AC: 1mA – 15mA, DC: 1mA – 10mA, resolution 0.1mA		
ARC Current Display	0.1mA~15.0mA , OFF		
Ground Fault Interrupt leakage current (for WVAC only)	AC: 0.25mA～0.75mA AC, ON/OFF selectable		
Test timer <note3>	Test time: 0.3 – 999 sec., and Continuous Ramp timer: 0.1 – 999 sec., and OFF		
❑ Insulation Resistance measurement			
Output Voltage:	DC: 0.05-5.0 kV, steps 0.002kV Load Regulation: ≤ (1% of setting + 0.1% of full scale), Rated load, AGC ON Voltage Accuracy: ± (1% of setting + 0.1% of full scale)		
Output Voltage monitor	V-monitor: ± (1% of reading + 0.1% of full scale), 2V resolution		
Measurement Accuracy (RH≦60%, < 2 channels ON)	>1000V: 1MΩ～1GΩ: ± (3% of reading + 0.1% of full scale) 1GΩ～10GΩ: ± (7% of reading + 2% of full scale) 10GΩ～50GΩ: ± (10% of reading + 1% of full scale) ≥ 500V and ≤1000: 0.1MΩ～1GΩ: ± (3% of reading + 0.1% of full scale) 1GΩ～10GΩ: ± (7% of reading + 2% of full scale) 10GΩ～50GΩ: ± (10% of reading + 1% of full scale) < 500V: 0.1MΩ～1GΩ: ±[3% of reading + (0.2 x 500V /Vs)% of full scale]		
Test timer <note3>	Test time: 0.3 – 999 sec., and Continuous Ramp timer: 0.1 – 999 sec., and OFF		

<table>
<tr><td colspan="2">❑ DC Resistance measurement</td></tr>
<tr><td>Test signal:</td><td>< DC 10V, < DC 140mA</td></tr>
<tr><td>Test range and accuracy</td><td>
<table>
<tr><td colspan="2">2 Terminals measure (for 19035, 19035-L, 19035-S only)</td></tr>
<tr><td>Range</td><td>Measurement Accuracy</td></tr>
<tr><td>10Ω</td><td rowspan="5">± (2% of reading + 0.5% of range)</td></tr>
<tr><td>100Ω</td></tr>
<tr><td>1kΩ</td></tr>
<tr><td>10kΩ</td></tr>
<tr><td>100kΩ</td></tr>
<tr><td colspan="2">Test range: 50mΩ ~ 500kΩ</td></tr>
</table>
* Display range up to 500kΩ in 100kΩ range, 100kΩ~ 500kΩ. Accuracy is ± (2% of reading + 0.5kΩ.)
** Measurement accuracy is only correct while Zero correction is well performed.
<table>
<tr><td colspan="2">4 Terminals measure</td></tr>
<tr><td>Range</td><td>Measurement Accuracy</td></tr>
<tr><td>1Ω</td><td>± (0.5% of reading+0.5% of range)</td></tr>
<tr><td>10Ω</td><td rowspan="5">± (0.5% of reading+0.05% of range)</td></tr>
<tr><td>100Ω</td></tr>
<tr><td>1kΩ</td></tr>
<tr><td>10kΩ</td></tr>
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** Measurement accuracy is only correct while Zero correction is well performed.
</td></tr>
<tr><td>Test terminal:</td><td>8 ports for 2 terminals / 4 ports for 4 terminals (with Zero correction)</td></tr>
<tr><td>Test timer</td><td>Test time: OFF, KEY, 0.1~999. (F4 is off/key) with judgment during the test.
OFF is for no time (H/W control).
DWELL: 0.1~999, OFF(H/W control)
Timer accuracy : ± (0.01% + 0.05 sec)</td></tr>
<tr><td colspan="2">❑ Impulse Winding Test (Function only while ECG DWX-05/10 option is installed <option for 19035/19035-M>)</td></tr>
<tr><td>Connection:</td><td>Input from rear panel, 10kV peak maximum.</td></tr>
<tr><td>Control:</td><td>RS232C interface, 19035 functions as a controller (standard *1, option *1)</td></tr>
<tr><td>Control item</td><td>Start trigger and Pass/Fail tested result fetch.</td></tr>
<tr><td colspan="2">8 ports scanning with return terminal.</td></tr>
<tr><td>Output level:</td><td>10kV peak to Return terminal maximum.</td></tr>
<tr><td>Test port:</td><td>19035/19035-L/19035-S: 8 ports, HV or Return connection programmable for each test sequence (for WV, IR, DCR, OSC or IWT testing).
19035-M/19035-ML: 16 ports, 6 HV and 2 return connection programmable for each test sequence (for WV, IR, DCR, OSC or IWT testing). Others ports for DCR mode.</td></tr>
<tr><td colspan="2">❑ OSC – Contact Check</td></tr>
<tr><td>Test voltage level:</td><td>Less than ac 100V</td></tr>
<tr><td>Test frequency:</td><td>600Hz</td></tr>
</table>

No contact judge:	Measured capacitance comparison.
❑ Other functions	
Display:	240 x 64 dot matrix, blue, LED back light.
❑ Compensation (Correct):	
Open Circuit:	Leakage current offset compensation for WVAC, WVDC, and IR testing
Short Circuit:	DC resistance offset compensation for DCR measurement
Sample Test	Master coil test for IWT mode.
❑ PASS/FAIL System:	
Indication, Alarm:	PASS : (Short Sound) FAIL : High/Low Fail (WV, IR, DCR) ARC Fail (WV) GFI Fail (WV, IR) Open/Short Fail (OSC) IWT Fail /DWX ERROR (IWT)
❑ Memory Storage	
Save/Recall:	50 instrument setups with up to 20 test steps can be stored into and recalled from the internal memory.
Key lock:	Front panel keys can be locked to prevent undesired operation.
❑ Interface	
GPIB (Optional):	Standard: Complies with IEEE488.1 and 488.2. The programming language is SCPI. Data buffer: One set of tested values and comparator decision results can be stored and output.
RS232(Standard*1, option*1):	Standard: RS232, The programming language is SCPI. Data buffer: One set of tested values and comparator decision results can be stored and output.
❑ Handler interface (Optional): 24 pins connector, All input/output are negative true logic and optically-isolated open collector signals (General-speed photo-coupler used). All outputs must be pulled-up with 22k resistor to +Vext (external power supply). All inputs optic-diode must be series with current limit (10mA ± 4mA for +3V～+26V) circuit.	
Judge result (O/P):	Step number: 5 bits (/STN4, /STN3 …./STN0) Step tested result: Pass/Fail, Hi, Lo, ARC fail, IWT fail, System error, EOS, EOT
Sequence control:	Start trigger (I/P): Falling edge trigger. Stop Testing (I/P): Low active. End of step (O/P): Low active. End of test (O/P): Low active.
Power supply	Internal +Vint: 5V, 40～60mA limit current. Common Int. External +Vext: +3V～+26V allowable. Common Ext.
❑ Indication, Alarm	PASS(short Sound) Fail: Hi, Lo, ARC, IWT, System error (GFI,DWX ERROR, OUTPUT Fail) (Long Sound)
❑ Interlock:	2 pins connector, pin1 pull-up to digital +V source with 4.7kohm resistor, and pin 2 tied to digital GND.
❑ Ambient Temperature and Relative Humidity	
❑ Specifications range	18 to 28°C (64 to 82°F), ≤ 70% RH.

❑ Operable range	Maximum relative humidity 80% for temperature up to 31°C (88°F.) Decreasing linearly to 50% relative humidity at 40°C (104°F)
❑ Storage range	-10 to 60°C (-14 to 140°F), ≤ 80% RH.
❑ Power Requirement	
❑ Line Voltage	AC 100V, 120V, 220V ± 10%, 240V +5 -10%
❑ Frequency	50 or 60 Hz
❑ Power	No load: < 100VA
❑ Consumption	With rated load: <650VA
❑ Dimension	430 W x 133 H x 470 D mm (19035, 19035-M, 19035-S) 430 W x 301 H x 470 D mm (19035-L, 19035-ML)
❑ Weight	<22kg (19035/19035-M/19035-S) <30kg (19035-L/19035-ML)
❑ SAFETY	
❑ Ground Bond	Less than 100mΩ at 25Amp, 2sec
❑ Hi-Pot L + N to Earth	Less than 10mA at WVAC 1.5kV, 60Hz, 3sec no flashover happen (ARC level < 8mA, tested by Chroma 19032)
❑ Insulation L + N to Earth	Greater than 20MΩ at 500V dc, 2 sec.
❑ Line leakage current:	Less than 3.5mA at Vin max (132V at 120 selected voltage), normal and reverse.

Note1: AC set over 100VA, DC set over 40VA the maximum operating time is 60 seconds, and the same as rest time. If the period is 1/2 duty, for full rating output, the line input range is +10%, -0%.

Note2: Validation point is 2.5kV with a 500kΩ resistor.

Note3: The minimum testing time arrives at 90% output voltage specification (No load). Timer accuracy: ± (0.01% + 0.05 sec)

3. Precautions before Use

The Wound Component EST Scanner can output up to 6kV high voltage for external test. Accidents may occur or even cause death if using this Scanner incorrectly or in the wrong way. Thus for safety sake, be sure to read the precautions in this chapter to avoid any accidents from happening.

1. Electric shock

To prevent the incident of electric shock from occurring, it is suggested to wear the insulated rubber gloves before using the EST Scanner for electricity related tasks.

2. Grounding

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

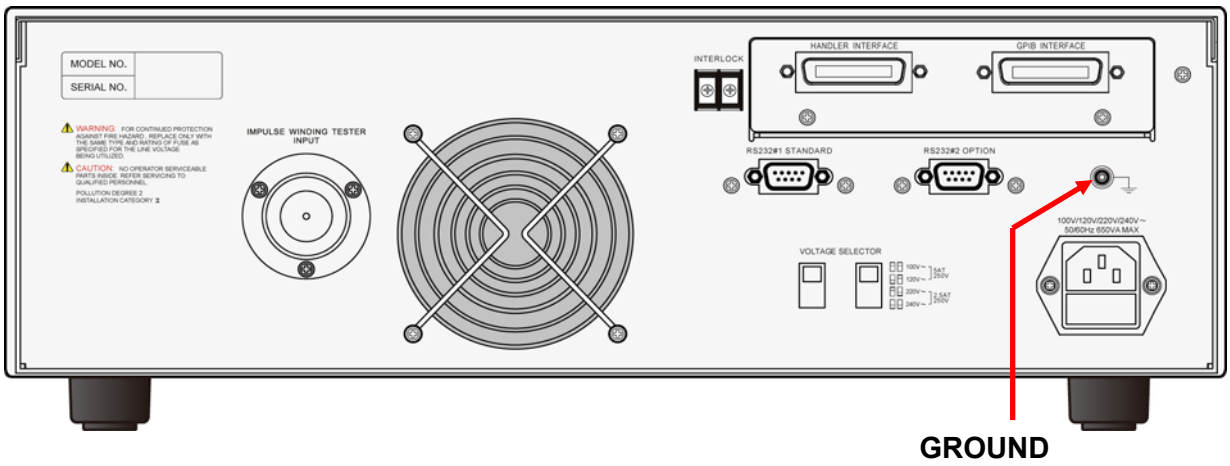


Figure 3-1

3. Connecting test cable to RTN/LOW terminal

As the arrow in Figure 3-2 shows, connect the test cable to RTN/LOW terminal. It is necessary to check if the test cable is connected all the time when the Scanner is in use. When connecting a test unit with test cable, connect the RTN/LOW test cable to the test unit first. When the host RTN/LOW terminal is connected, it is very dangerous if the test cable on RTN/LOW terminal is not connected correctly or falls as the entire unit under test may full of high voltage.

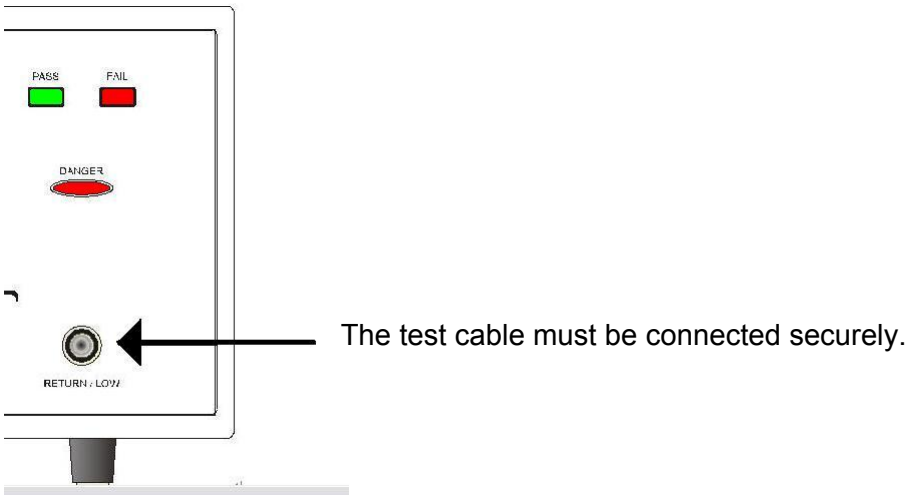


Figure 3-2

4. Connecting the test cable to high voltage output terminal

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

- Press [STOP].
- Ensure the DANGER indicator is not on.
- Short the test cable of RTN/LOW and high voltage output to make sure there is no voltage output.
- Plug in the high voltage test cable to high voltage output terminal.
- At last connect the RTN/LOW test cable to the unit under test and then connect high voltage test cable.

5. End the test

When the test is end or the Scanner is not in use or is in use but needs to leave it unattended for a while, it is necessary to toggle the power switch to 0 (i.e. to shut off the power) as Figure 3-3 shows.

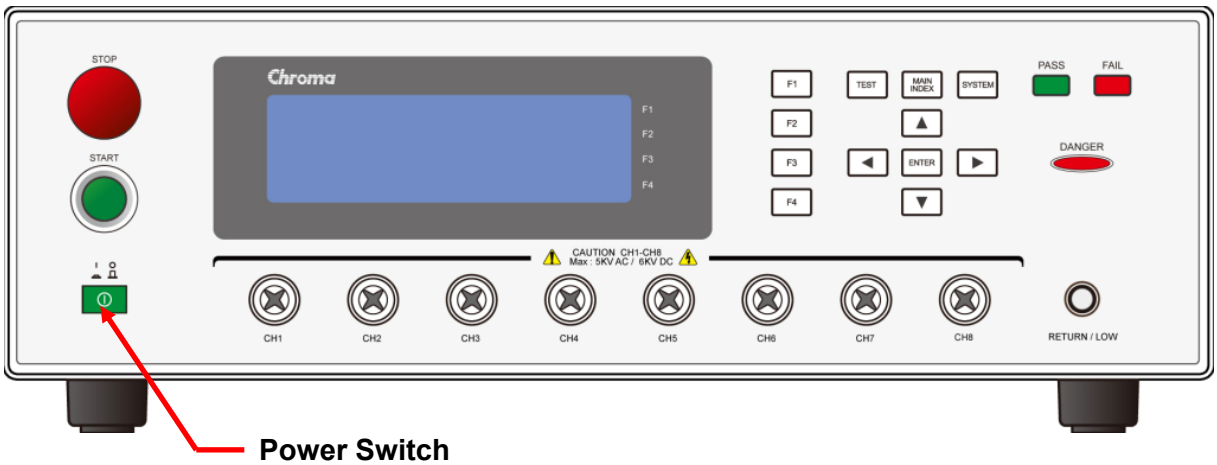


Figure 3-3

6. Hazard areas when the Scanner is in test mode

When the Scanner is in use, touching the areas of DUT, test cable, probe and output terminal that contain high voltage is a very dangerous thing.

Do not touch the alligator clip on the test cable as Figure 3-4 shows. When the host is in test state the insulation of rubber shield on it is not enough; therefore it is hazardous to touch it.

Do not touch here when outputting high voltage.

Figure 3-4

7. **Ensure the test is done**
   Sometimes users 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 power switch is turned off.

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

Being an insulation resistance test object the DUT after test may full of high voltage; therefore it is necessary to read the description of item 8 and 9 for execution.

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

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

9. **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 3-5 shows.

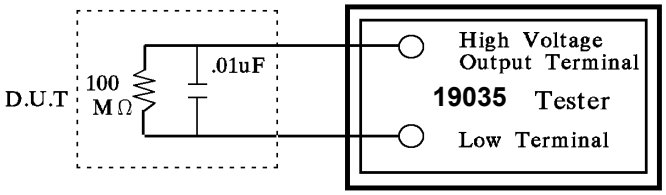


Figure 3-5

<Formula>
Test Voltage * e $^{-t/RC}$ = Remaining Voltage

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

10. Remote controlling the Scanner

The EST Scanner 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 Scanner, do not allow any operator or other personnel to touch the DUT, test cable or probe output and etc.

11. Turning on or off the power switch **CAUTION**

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.

12. 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 Scanner with dangerous voltage. To short-circuit the terminals of high voltage output and RTN/LOW, it is necessary to ground the Scanner chassis to earth properly.

<<< Emergency Case >>>

13. Process for emergency case

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

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

<<< Resolving Problem >>>

14. Problems occurred

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

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

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

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

16. **Be aware of the following when using the Scanner for long hour in normal state**
If the high limit is set to 20.00mA (for hipot test), 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.

17. There are four types of AC INPUT power applicable for this Scanner. Switch the voltage selector on the rear panel to a proper voltage that used locally.

    When plugging in the power cord, make sure the inputted AC power is the same as the power range indicated on the rear panel and the fuse is replaced with correct one. The table below lists the voltage and the fuse it uses.

Label	Fuse
100V	5A Slow/250V
120V	5A Slow/250V
220V	2.5A Slow/250V
240V	2.5A Slow/250V

    Check the voltage in use before replacing the fuse. Also to avoid electric shock the fuse should be changed when the power cord is not plugged in. 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.

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

19. This Scanner uses a power transformer with 500VA or above and 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.

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

21. Warming up

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

22. Safety symbols

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

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

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

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

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

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

23. Warning label during test

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

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.

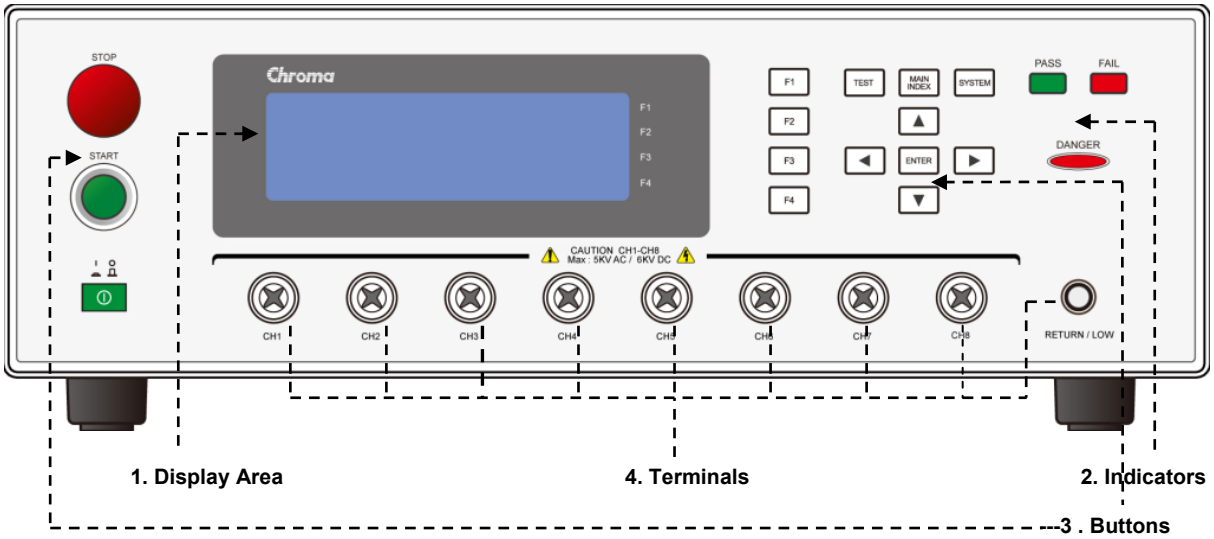
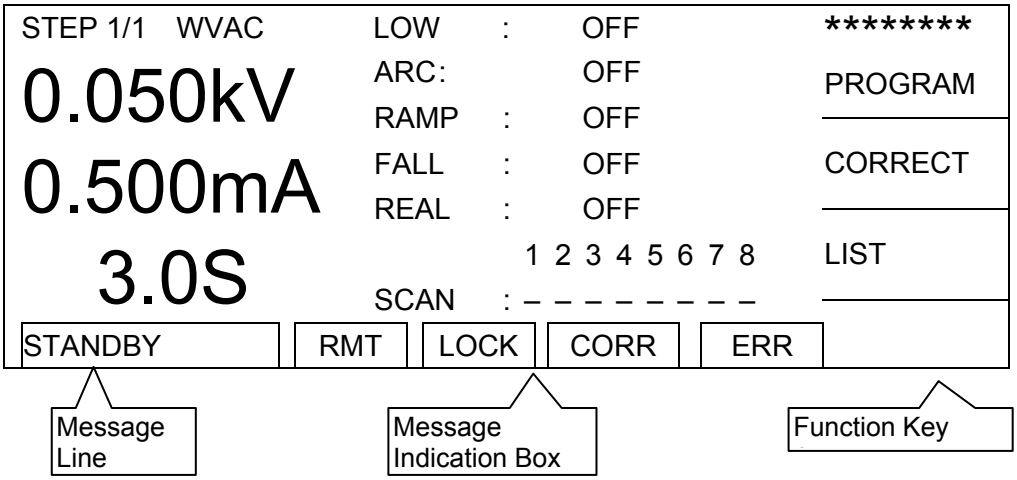


Figure 4-1

1. Display Area

- Zoom in of Display Area



Function Key Area: Different function key descriptions will appear in different screen and the mapping function keys (F1-F4) are at the right of LCD. If the description is blank, it indicates the mapping function key is invalid.

Message Line: This line of text instructs the setting method and range, also shows the test results of fail state.

Message Indication Box:

RMT : When this box is reversed it indicates the Scanner is in Remote state which means it is controlled by PC via GPIB/RS232 cable. At this time all buttons are invalid except [STOP], [DSP-LIST] and [LOCAL] keys.

LOCK : When this box is reversed it indicates the Scanner is in parameter protection mode. "PROGRAM", "CORRECT" and the "STORE/RECALL" of MEMORY in [MAIN INDEX] as well as the "TEST CONTROL" and "CALIBRATION" in [SYSTEM] are unable to access for setting.

CORR : When this box is reversed it indicates the Scanner has done the actions of open/short offset or correction.

ERR : When this box is reversed it indicates there are remaining errors in the error queues.

2. Indicators

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

PASS LED : It is the indicator for pass items. When on it means the DUT is identified as good after test.

FAIL LED : It is the indicator for fail items. When on it means the DUT is identified as no good after test. Once a fail item is identified the Scanner output will be cut off immediately and the LED will keep on until the [STOP] key on the Scanner is pressed.

3. Buttons

Power Switch : It is the AC power switch for this Wound Component EST Scanner.

STOP : It is the reset key. When pressed the EST Scanner will cutoff output immediately or return to ready-to-test state and clear all judgments.

START : It is the test activation key. The EST Scanner is in test state when pressed, which means there is output on test terminal and the judging functions are activated at the same time.

F1 **F2** **F3** **F4** : They are function keys F1~F4. Their functions are varied when in different screen. The mapping function names are listed at the right of LCD. If the mapping area is blank it indicates the function key is invalid.

TEST : It is the key to skip to main test screen.

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.

SYSTEM : It is the key to enter the system setting screen.

▲ **▼** **◀** **▶** : They are the cursor movement keys for setting functions or editing test procedures.

ENTER : It is the input confirmation key for setting functions or editing test procedures.

4. Terminals

OUTPUT : It is the high potential terminal for high voltage output that is very dangerous. Do not touch it especially when the DANGER LED is on.

RETURN/LOW : It is a common test terminal of low potential when doing high voltage test. It almost equals to the chassis grounding terminal.

4.2 Rear Panel

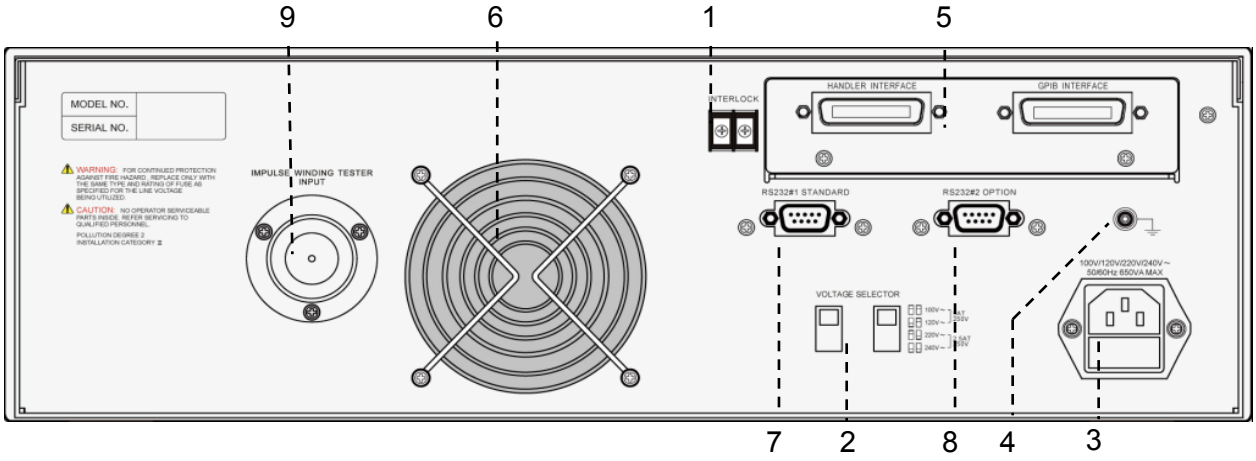


Figure 4-2

1. **INTER LOCK:** Short-circuit these two terminals to enable high voltage output.

2. **VOLTAGE SELECTOR**
   It can change the Input AC power supply of the Scanner to following 4 types:

   a. 100V AC
   b. 120V AC
   c. 220V AC
   d. 240V AC

   Switch the voltage selector and change the fuse based on the AC power supply.

3. **AC LINE:** It contains a three-wire AC power socket and a fuse holder. The AC power required by the Scanner 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.

4. **GND:** It is the safety grounding terminal. Please use an appropriate tool to connect it to earth properly. If it is not properly grounded, the Scanner 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.

5. **GPIB/HANDLER/TC INTERFACE: (Option)**
   These two sockets are for the optional GPIB/HANDLER/TC 3 in 1 interface card that can be purchased for this Scanner. The detail descriptions of GPIB and HANDLER interfaces are described in Chapter 6 HANDLER Interface, Chapter 7 RS232/GPIB Interface and Section 4.6.4 *Temperature Measurement (TC)*.

6. **FAN:** The fan is activated simultaneously when the Scanner is powered on.

7. **RS232 INTERFACE#1**
   It is the RS232 interface socket can be used to connect PC or ECG Winding Tester DWX-05/10.

8. **RS232 INTERFACE#2**
   It is for the second RS232 interface card that can be purchased for this Scanner as an option. If there is a need to connect PC and ECG Winding Tester DWX-05/10 with RS-232 at the same time, use RS-232 INTERFACE#1 to connect ECG Winding Tester DWX-05/10 and RS-232 INTERFACE#2 to connect PC.

9. **IWT INPUT:** This terminal is to connect the output of ECG Winding Tester DWX-05/10.

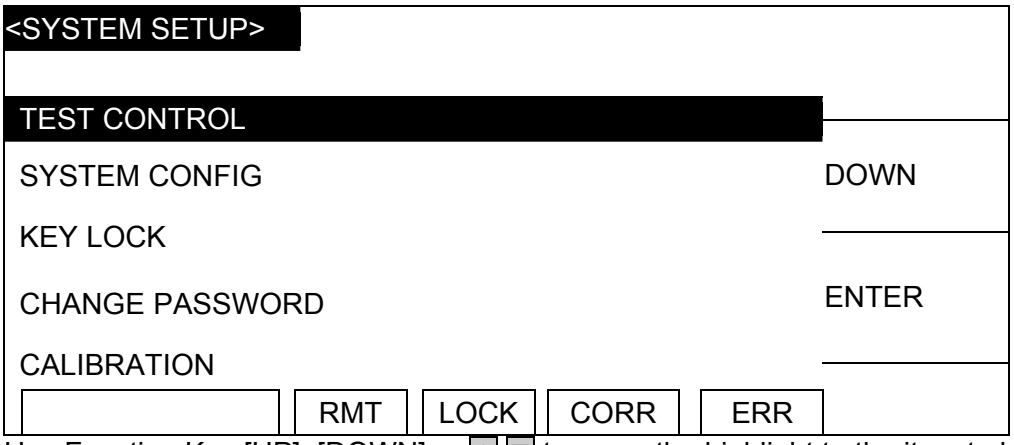
4.3 Notices before Use & Operating Procedure

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 carefully and keep them in mind before power-on the Scanner.
3. Once the Scanner is powered on, it will start self-test. If any abnormal occurs, turn off the power switch immediately and unplug the power cord.

4.4 Setting SYSTEM

4.4.1 Entering the SYSTEM Setting Screen

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



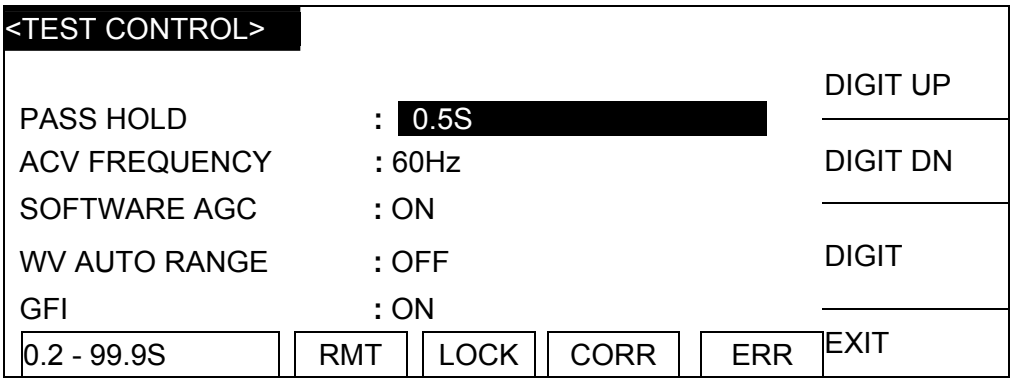
Use Function Key [UP], [DOWN] or ▲ ▼ to move the highlight to the item to be set. Press Function Key [ENTER] or **ENTER** to go to the setting screen of selected function.

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

Setting Items	Description
TEST CONTROL	It sets the related parameters for test. See Section 4.4.2 for details.
SYSTEM CONFIG	It sets the system related parameters.
KEY LOCK	It sets the keyboard lock function.
CHANGE PASSWORD	It changes the user's password.
CALIBRATION	It sets the calibration related function.
ERROR LOG	It logs the errors messages generated when connecting with PC.
ABOUT	It shows the version number.

4.4.2 Setting TEST CONTROL

In SYSTEM SETUP screen, move the highlight to TEST CONTROL and press Function Key [ENTER] or **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 Function Key **F1** **F2** **F3** **F4** to set the mapped functions.

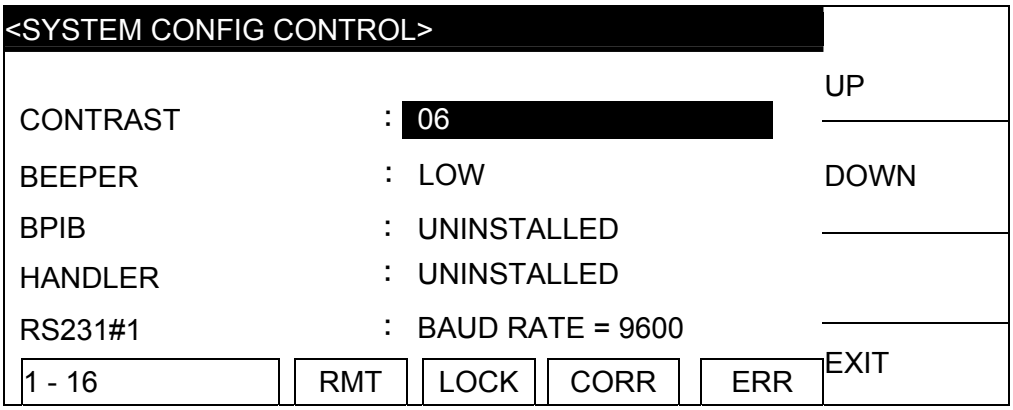
The following table lists the setting items of TEST CONTROL and their descriptions.

Setting Items	Range	Default	Description
PASS HOLD	0.2~99.9S	0.5	It sets the time the beeper sounds when the DUT is judged as PASS.
ACV FREQUENCY	50Hz/60Hz	60Hz	It sets the frequency of output voltage when doing 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 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.
AFTER FAIL	RESTART / CONTINUE / STOP	STOP	It sets the action after the test step is judged as FAIL. When set to RESTART, it will stop test after detected FAIL without pressing [STOP] and press [START] can begin the test. 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 test.
DCR BALANCE	0(OFF), 0.001~999Ω	OFF	(1) When the difference of maximum and minimum DCR is larger than the setting

			of DCR Balance, the judgment is Balance Fail (shows on the message line.) (2) When the difference of maximum and minimum DCR is larger than the setting of DCR Balance, the judgment is Pass.
DCR 4-TERMINAL	ON/OFF	OFF	When ON the DCR mode is in 4-terminal test mode. When OFF the DCR mode is in 2-terminal test mode.
T. COMPENSATION			It sets the temperature compensation. (The setting is invalid here. Use the submenu to modify the settings and see section 4.6.4.4 for detail description.)

4.4.3 Setting SYSTEM CONFIG

In SYSTEM SETUP screen, move the highlight to SYSTEM CONFIG and press Function Key [ENTER] or **ENTER** to go to 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 Function Key **F1** **F2** **F3** **F4** to set the mapped functions.

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

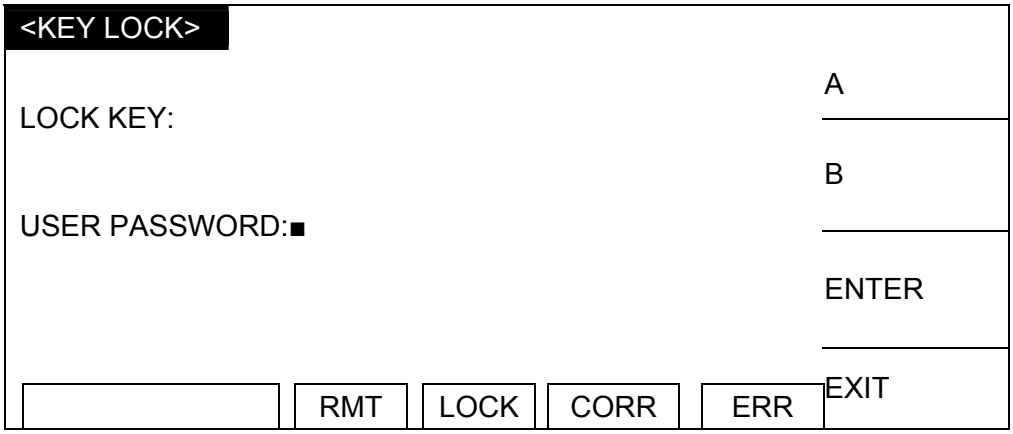
Setting Items	Range	Default	Description
CONTRAST	1 - 16	06	It adjusts the LCD brightness.
BEEPER	HIGH / LOW / OFF	LOW	It adjusts the beeper volume.
GPIB	UNINSTALLED / ADDRESS = 0~30	03	It sets the GPIB interface address. It shows UNINSTALLED if GPIB card is not installed.
HANDLER	UNINSTALLED / INSTALLED	N/A	It shows if the HANDLER card is installed.
RS232 #1	UNINSTALLED / 9600 / 19200 / 38400	9600	It sets the transmission baud rate of RS232 interface. It shows UNINSTALLED if RS232 card is not installed.
RS232 #2	UNINSTALLED / 9600 / 19200 / 38400	9600	It sets the transmission baud rate of RS232 interface. It shows UNINSTALLED if RS232 card is not installed.

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 to end of step.
T. BOARD	UNINSTALLED/ INSTALLED	N/A	It shows if the TEMPERATURE card is installed.
T. PROBE	NONE/PT100/ PT500	N/A	It shows the type of temperature probe.

4.4.4 Setting KEY LOCK

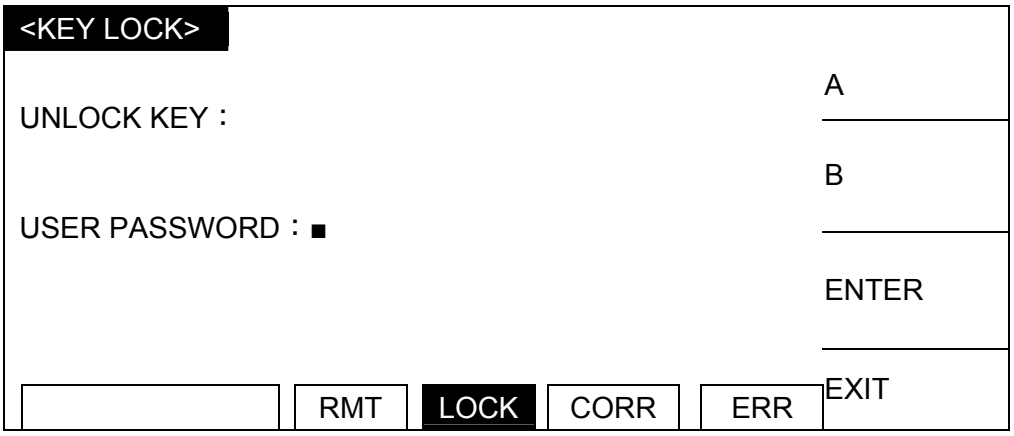
The way to set KEY LOCK:

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



1. In KEY LOCK screen, press Function Keys **A**, **B** to enter the PASSWORD (the default is AAAA.)
2. Press **ENTER** will prompt a selection window to select if to lock RECALL MEMORY. Users can use Function Keys **YES**, **NO** to select if locking the function of MEMORY RECALL as well.
3. When KEY LOCK is ON, the LOCK text is reversed to indicate the host is in parameter protection mode. The MEMORY of PROGRAM, CORRECT and [MAIN INDEX] as well as the TEST CONTROL and CALIBRATION of STORE and [SYSTEM] are invalid for setting.
4. When setting KEY LOCK, if RECALL LOCK ON is selected, the MEMORY RECALL function is also invalid.

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

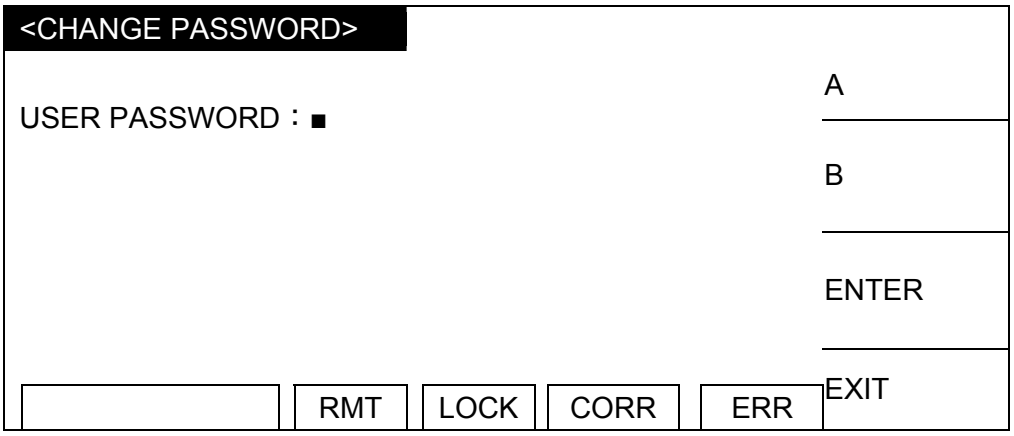


Use Function Keys [A], [B] to enter PASSWORD and press Function Key [ENTER], the LOCK box returns to normal indicating the KEY LOCK is cancelled.

4.4.5 Changing Password

Setting password for KEY LOCK:

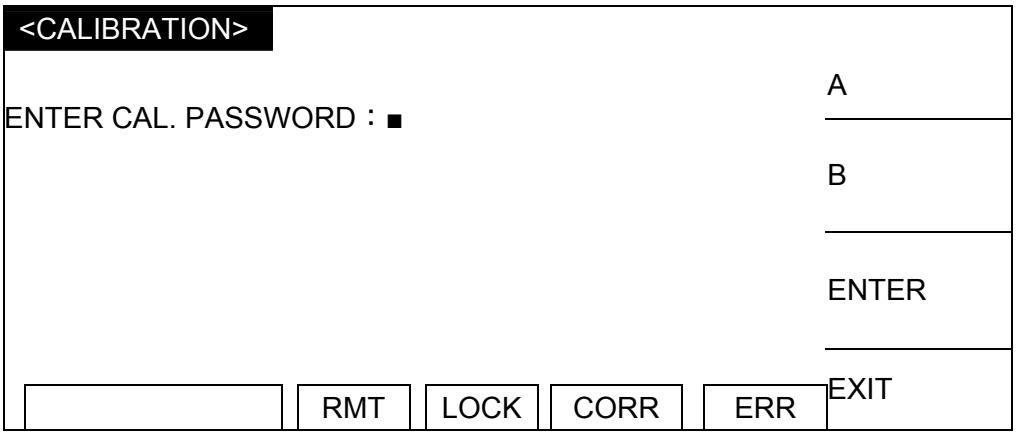
In SYSTEM SETUP screen, move the highlight to CHANGE PASSWORD and press Function Key [ENTER] or **ENTER** to go to CHANGE PASSWORD screen as shown below:



1. Use Function Keys **A**, **B** to enter PASSWORD (the default is AAAA before change), and press Function Key **ENTER** will prompt a NEW PASSWORD window.
2. Use Function Keys **A**, **B** to enter NEW PASSWORD (maximum 10 characters), press Function Key **ENTER** will prompt a CONFIRM PASSWORD window.
3. Use Function Keys **A**, **B** to enter CONFIRM PASSWORD (same as NEW PASSWORD), press **ENTER** will prompt a message "*CHANGE PASSWORD OK!*" to indicate the password has been changed successfully. Press **EXIT** to exit the setting screen.

4.4.6 Setting CALIBRATION

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



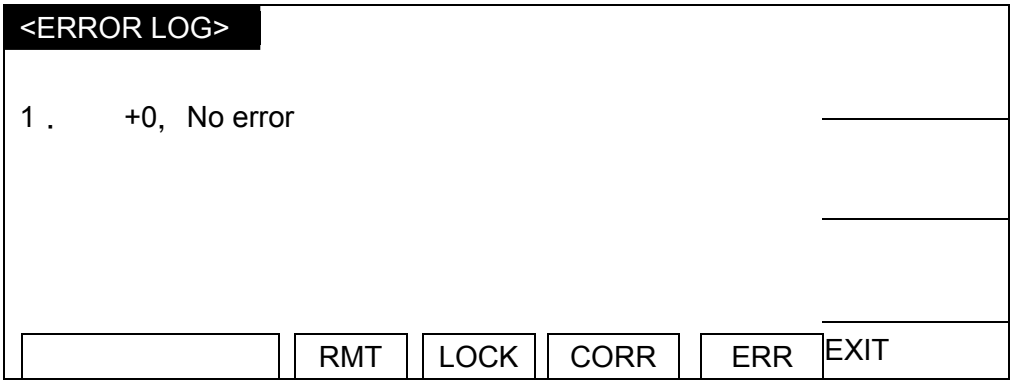
When in CALIBRATION screen, press Function Key **F1** **F2** **F3** **F4** that mapped to the related settings.

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

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

4.4.7 Setting ERROR LOG

In SYSTEM SETUP screen, move the highlight to ERROR LOG and Function Key [ENTER] or **ENTER** to go to ERROR LOG screen as shown below:

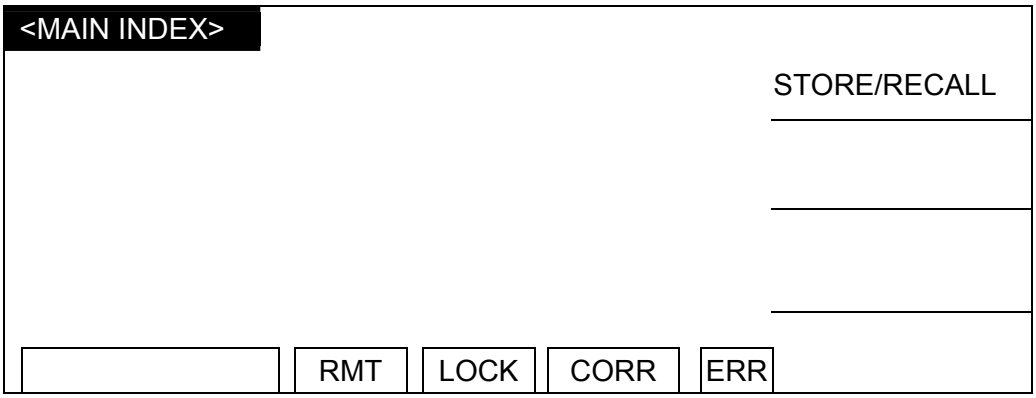


When in ERROR LOG screen it will show the error message generated during connection. Press Function Key **F1** **F2** **F3** **F4** for the mapped function to browse the error message. The ERR box will return to normal without reverse when in ERROR LOG screen.

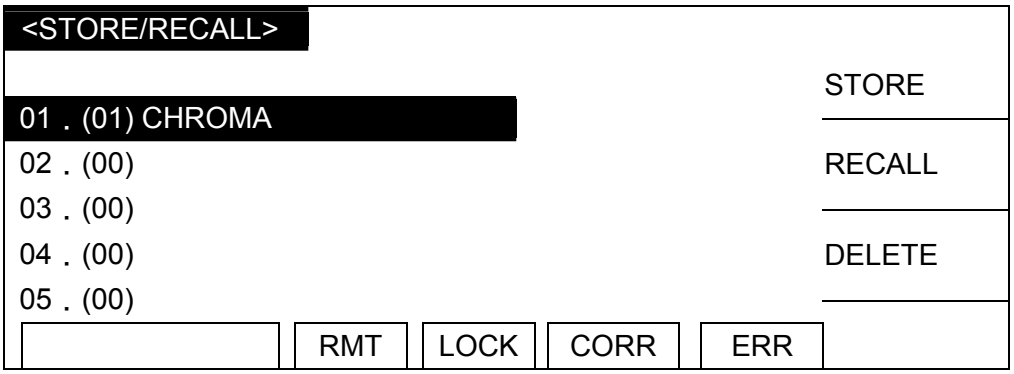
4.5 Managing Memory for Programs

4.5.1 Entering the Memory Screen

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



2. Press Function Key [STORE/RECALL] to go to Memory mode as shown below:

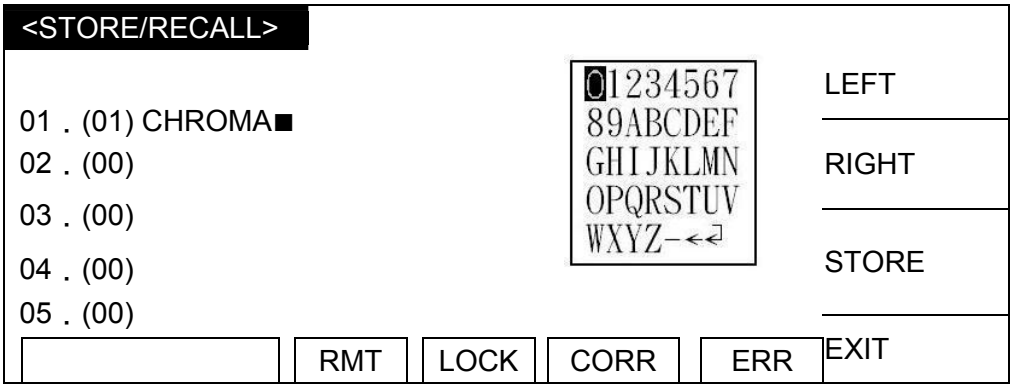


3. Use ▲ ▼ to move the highlight to the memory to be processed and follow the instruction of Function Key to read, save or erase that memory.
4. The number in parentheses means the test steps contained in the memory.

4.5.2 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].

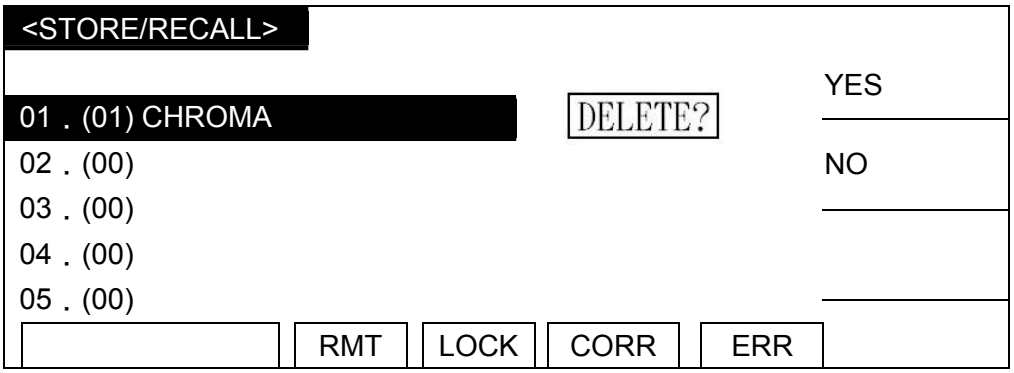


2. Use ▲ ▼ ◄ ► to move the cursor to select the character for memory's name and press **ENTER** to confirm the inputted character.
3. Use Function Key [LEFT], [RIGHT] to move the cursor to next character.
4. Press Function Key [STORE] will prompt a confirmation dialog box.
5. Press Function Key [YES] to confirm or press Function Key [NO] to cancel it.
   (Note: If data is already existed in the memory, it will be overridden. Please confirm it carefully before pressing YES.)

4.5.3 Deleting the Memory

Follow the steps below to delete the programs from memory:

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

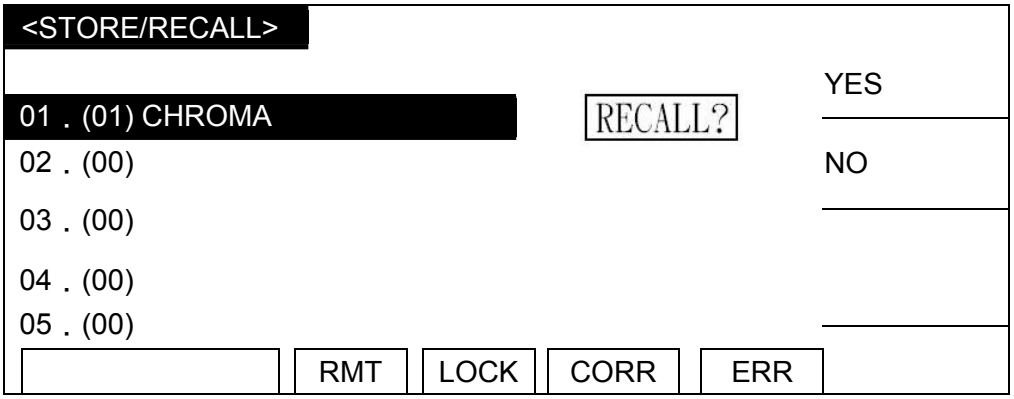


2. A delete confirmation dialog box is prompted. Press Function Key [YES] to confirm it or press Function Key [NO] to cancel it.

4.5.4 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].

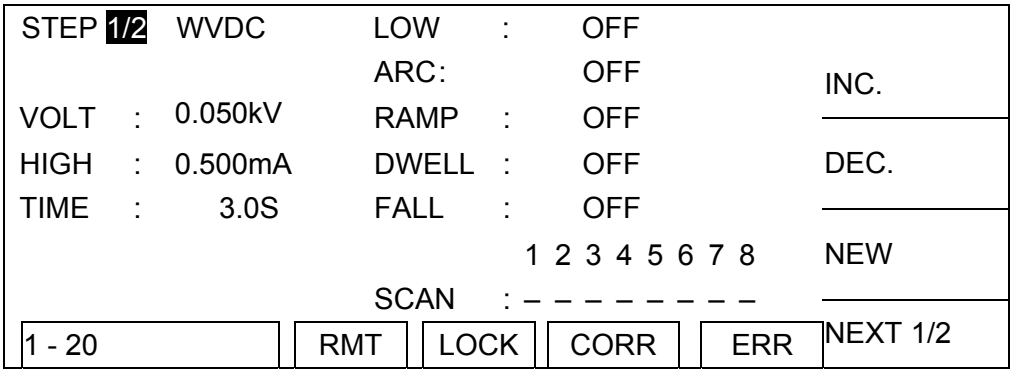


2. A recall confirmation dialog box is prompted. Press Function Key [YES] to confirm it or press Function Key [NO] to cancel it.

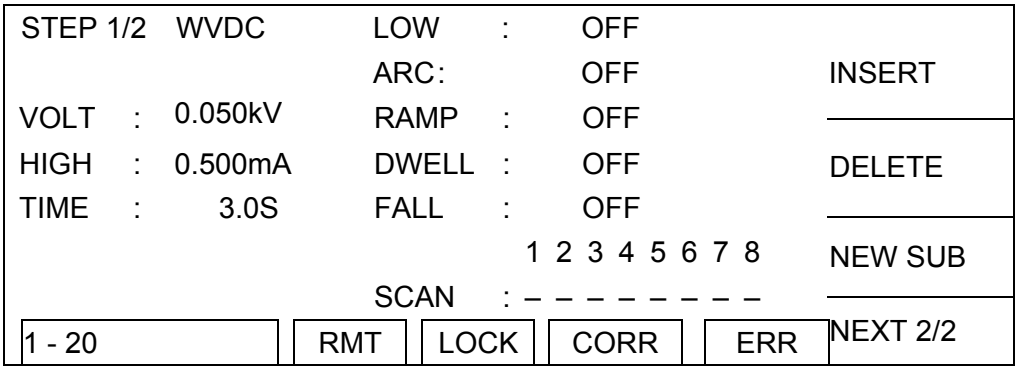
4.6 Setting PROGRAM

4.6.1 Setting Program Procedure

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



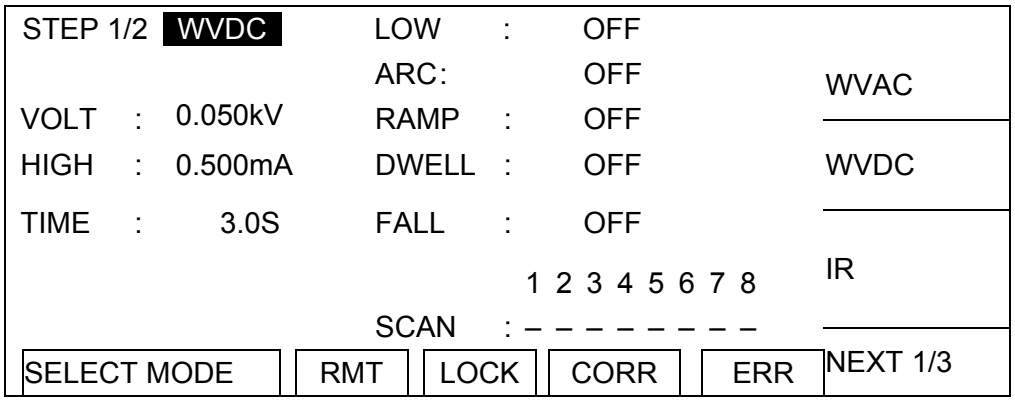
2. When in PROGRAM screen, use Function Keys [NEW] to add new test steps from 1 to 20.
3. Use Function Keys [INC.], [DEC.] to move the cursor to previous or next test step.
4. Press ▲ ▼ ◄ ► to move the highlight to other steps to be set or modified and press **ENTER** to confirm it.
5. Use Function Keys [NEXT 1/2] to switch Function Keys screen as shown below:



6. Use Function Keys [INSERT], [DELETE] to insert or delete a test step.
7. Use Function Keys [NEW SUB] to add a sub step. When the main step is judged as Pass, it will skip the sub step; and when the main step is judged as Fail, it will continue the sub step test to get a complete judgment result.
8. Press Function Key [NEXT 2/2] can return to the previous Function Keys screen for setting other programs.

4.6.2 Selecting Test Mode

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

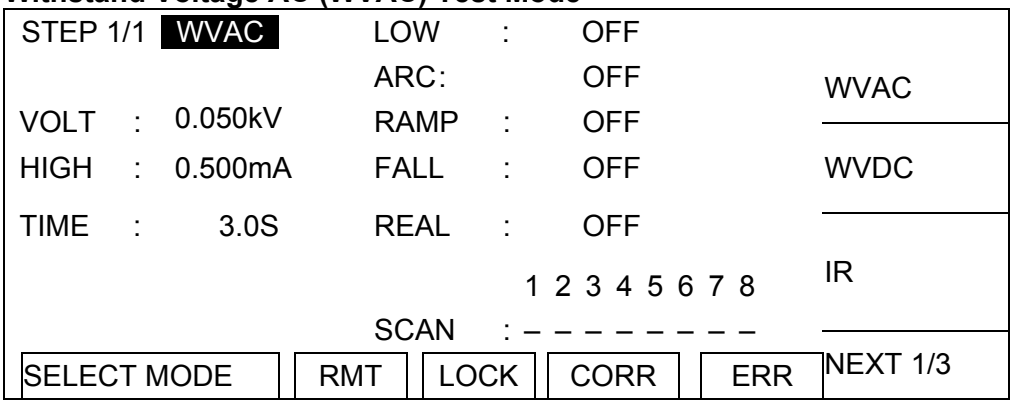


2. Use Function Key [WVAC], [WVDC], [IR], [NEXT 1/3] to select the test mode. There are WVAC / WVDC / IR / DCR / OSC / IWT /PA available for selection. Different test mode has different programs for setting.

4.6.3 Description of Parameters

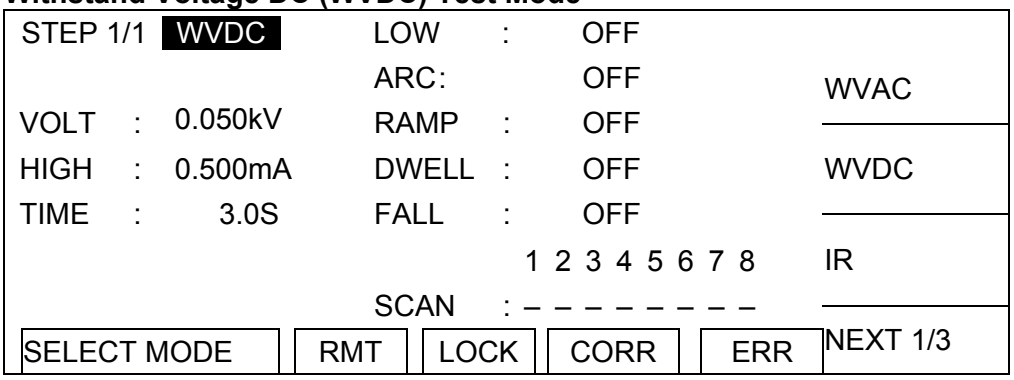
Following explains the parameters in each test mode.

Withstand Voltage AC (WVAC) Test Mode



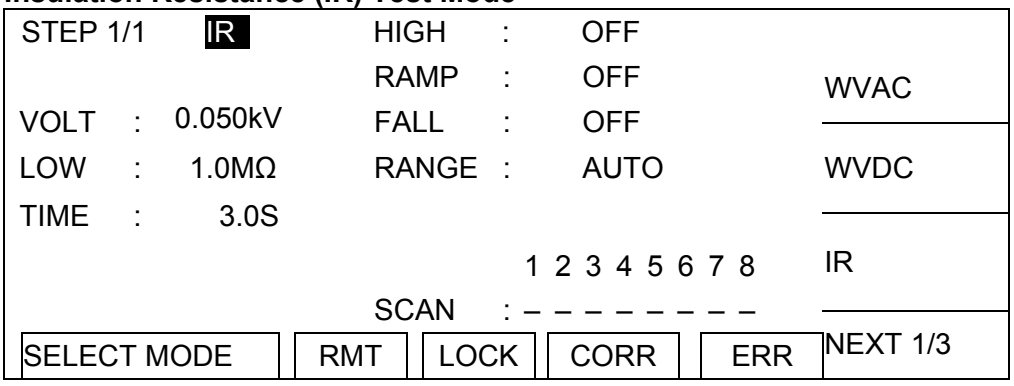
VOLT : It sets the voltage required for withstand voltage test.
HIGH : It sets the high limit of leakage current.
TIME : It sets the time required for test, 0 means continuous test.
LOW : It sets the low limit of leakage current. The range is smaller than the leakage current high limit or OFF.
ARC : It sets the high limit of arc, 0 means OFF.
RAMP : It sets the time required for ramping to the set voltage, 0 means OFF.
FALL : It sets the time required for falling to low voltage from set, 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.
SCAN : It sets the output terminal for scan test.

Withstand Voltage DC (WVDC) Test Mode



VOLT : It sets the voltage required for withstand voltage test.
HIGH : It sets the high limit of leakage current.
TIME : It sets the time required for test, 0 means continuous test.
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.
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.)
FALL : It sets the time required for falling to low voltage from set, 0 means OFF.
SCAN : It sets the output terminal for scan test.

Insulation Resistance (IR) Test Mode



VOLT : It sets the required voltage for insulation resistance test.
LOW : It sets the low limit for insulation resistance.
TIME : It sets the time required for test, 0 means continuous test.
HIGH : It sets the high limit for insulation resistance. The value is larger than the insulation resistance low limit or OFF.
RAMP : It sets the time required for ramping to the set voltage, 0 means OFF.
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 50V~499V	**When voltage set to 500V~5000V**
10mA (2.7~10mA)	0.1MΩ~2.4MΩ	0.1MΩ~7.7MΩ
3mA (0.27~3mA)	0.1MΩ~7.7MΩ	0.1MΩ~24.5MΩ
300uA (27~300uA)	0.1MΩ~24.5MΩ	0.1MΩ~49.9MΩ 50MΩ~245MΩ
30uA (2.7~30uA)	0.1MΩ~49.9MΩ 50MΩ~245MΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ
3uA (0.27~3uA)	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ
300nA (27~300nA)	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~2.45GΩ	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ 50GΩ~245GΩ
30nA (1~30nA)	----------	0.1MΩ~49.9MΩ 50MΩ~499MΩ 0.50GΩ~4.99GΩ 5.0GΩ~49.9GΩ 50GΩ~500GΩ

Note: 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.

SCAN : It sets the output terminal for scan test.

DC Resistance (DCR) Test Mode (2-Terminal)

STEP 1/1	DCR	HIGH	:	100.0kΩ	
		LOW	:	OFF	DCR
		RANGE	:	AUTO	
		DWELL	:	OFF	OSC
TIME :	OFF				
				1 2 3 4 5 6 7 8	IWT
		SCAN	:	– – – – – – – –	
SELECT MODE	RMT	LOCK	CORR	ERR	NEXT 2/3

TIME : It sets the following 3 actions for DCR TIME.
(1) Set the test time:
Use Function Keys [DIGIT], [DIGIT UP], [DIGIT DN] to set the test time required by DCR.
(2) Set to OFF:
Setting Function Keys [OFF/CONT] to OFF indicates no test time is set for DCR. The test mode ends when the host read the DCR readings successfully.
(3) Set to CONTINUE:
Setting Function Keys [OFF/CONT] to CONTINUE indicates the DCR test will continue until the START key on panel is pressed or the /EXT_START signal on HANDLER card (OPTION) is retriggered.

HIGH : It sets the high limit for DC resistance. The maximum is 100KΩ.
LOW : It sets the low limit for DC resistance.
RANGE : It sets the test range for DC resistance, AUTO means switching range automatically.
DWLL : It sets the time required for DWELL, 0 means OFF.
(When DWELL TIME is active, it does not judge the high and low limit of DCR.)
SCAN : It sets the output terminal for scan test.

DC Resistance (DCR) Test Mode (4-Terminal)

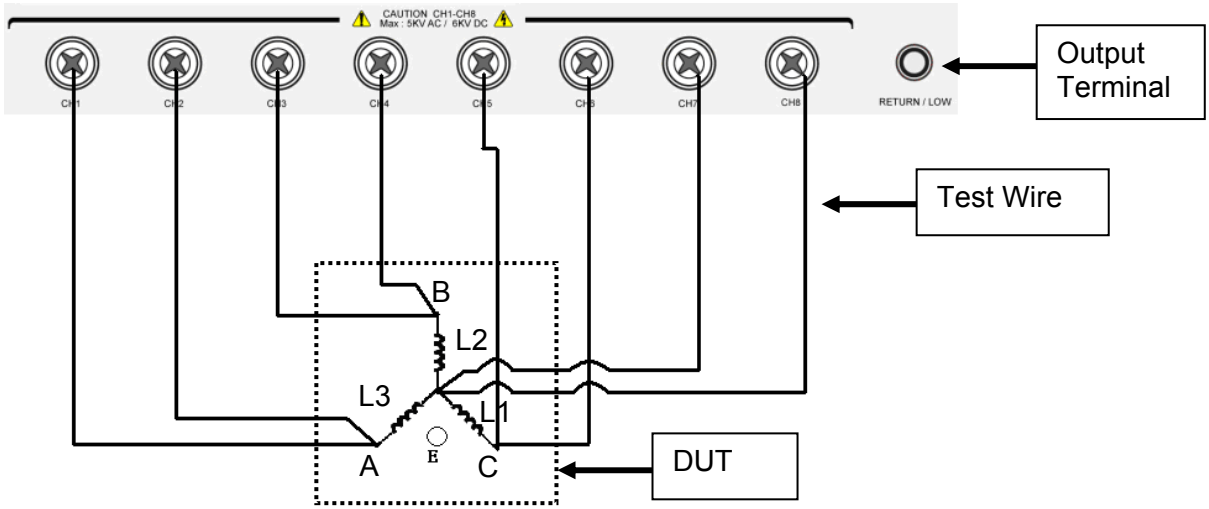
STEP 1/1	DCR	HIGH	:	100.0kΩ	
		LOW	:	OFF	DCR
		RANGE	:	AUTO	
		DWELL	:	OFF	OSC
TIME :	OFF				
				1 2 3 4 5 6 7 8	IWT
		SCAN	:	– – – –	
SELECT MODE	RMT	LOCK	CORR	ERR	NEXT 2/3

Note: DRIVE and SENSE have to be connected to the same terminal.

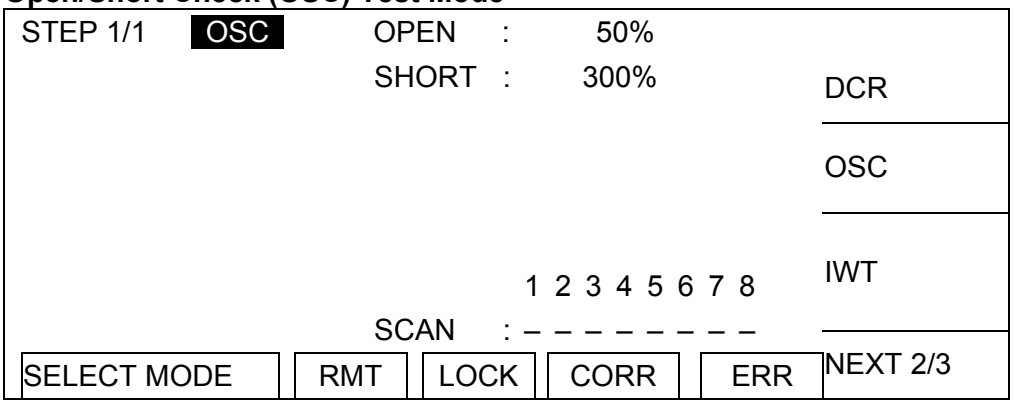
- SCAN: When SCAN1 set to H and SCAN3 set to L, it means
  CH1 output terminal is DRIVE+, CH3 output terminal is DRIVE-
  CH2 output terminal is SENSE+, CH4 output terminal is SENSE-

- The setting of DUT is using 3 sets of coil
  STEP1 Set DCR CH1 to H, CH7 to L
  STEP2 Set DCR CH3 to H, CH7 to L
  STEP3 Set DCR CH5 to H, CH7 to L

  DUT connecting diagram:

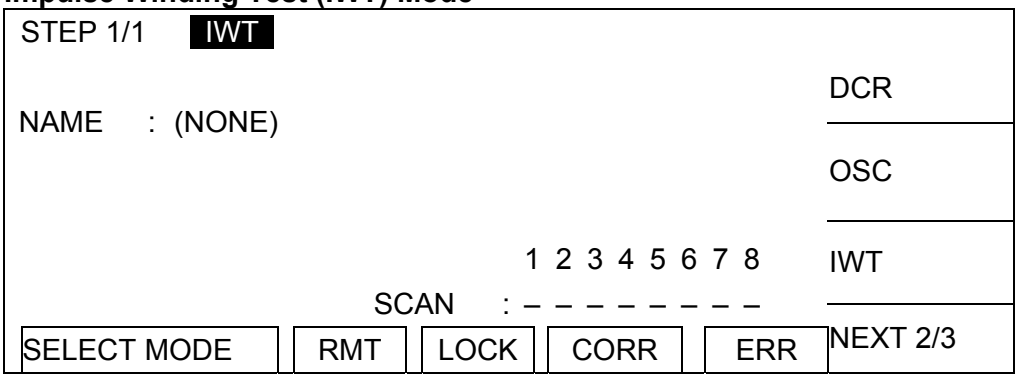


Open/Short Check (OSC) Test Mode



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

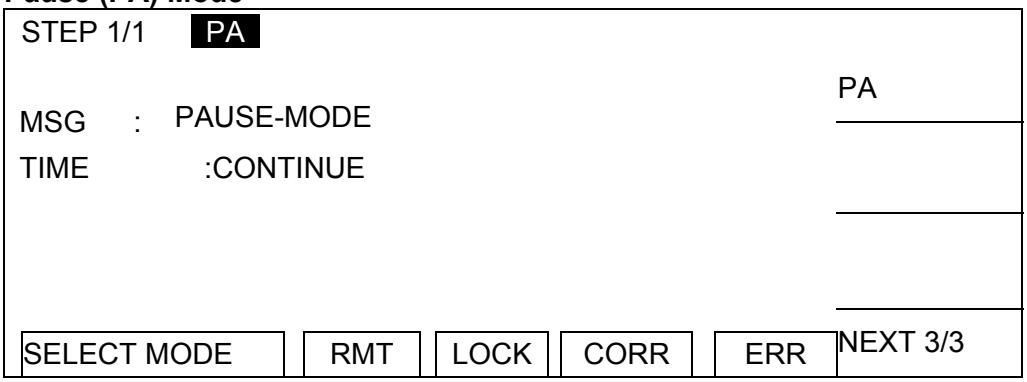
Impulse Winding Test (IWT) Mode



NAME: It is the filename saved in the memory of Impulse Winding Tester ECG DWX-05/10.
Different STEP can set different filename that saved in the memory of Impulse Winding Tester to recall different golden sample.
No filename is required if the main wave data in the memory of ECG DWX-05/10 is not in use.
Way to input the filename: Use Function Key [EDITING] and arrow keys to enter the filename.

The EST Scanner must connect to the Winding Tester ECG DWX-05/10 when performing this test item. For the IWT settings on DWX-05/10, please refer to the user's manual of DWX-05/10 for operation.

Pause (PA) Mode



MSG : 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 CONTINUE: The pause ends until the START key on panel is pressed or the START signal from HANDLER card (OPTION) is triggered.
(2) Set to 0.1~999sec: The pause end when it reaches the time set for pause.

4.6.4 Temperature Measurement

The temperature measurement function is available for 19035 when the temperature interface and temperature probe are purchased for use. It can measure the DUT and environment temperature. The temperature measurement function of 19035 only works when appropriate interface and probe are purchased for application.

4.6.4.1 Specification of Temperature Measurement & Compensation

Temperature Measurement Range	Temperature Measurement Accuracy (without PT100 temperature probe)	Temperature Compensation Accuracy (with the accuracy of resistance measurement)
-10.0 °C to 39.9°C (-14.0 to 103.8°F)	±0.3% of reading ±0.5°C (0.9°F)	±0.3%
40.0 to 99.9°C (104 to 211.8°F)	±0.3% of reading ±1.0°C (1.8°F)	±0.6%

Note: It is necessary to add the probe error (PT100 temperature probe is < ±0.5°C in typical) when measuring temperature.

4.6.4.2 Temperature Measurement Interface

The temperature measurement interface is installed on the 19035 rear panel and uses the hole of TC SENSOR as measurement input as the figure shown below.

4.6.4.3 Temperature Probe

The standard temperature probe of 19035 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 19035 rear panel. The following figure shows the temperature probe.

A165015 Temperature Probe

4.6.4.4 Setting Temperature Compensation

Procedure:

1. Press **SYSTEM** in any screen after powered on the 19035 and the screen shows:

<SYSTEM SETUP>

TEST CONTROL
SYSTEM CONTROL
KEY LOCK
CHANGE PASSWORD
CALIBRATION

DOWN
ENTER

	RMT	LOCK	CORR	ERR

Move the highlight to TEST CONTROL. Press **F3** and [ENTER] to go to TEST CONTROL screen as shown below.

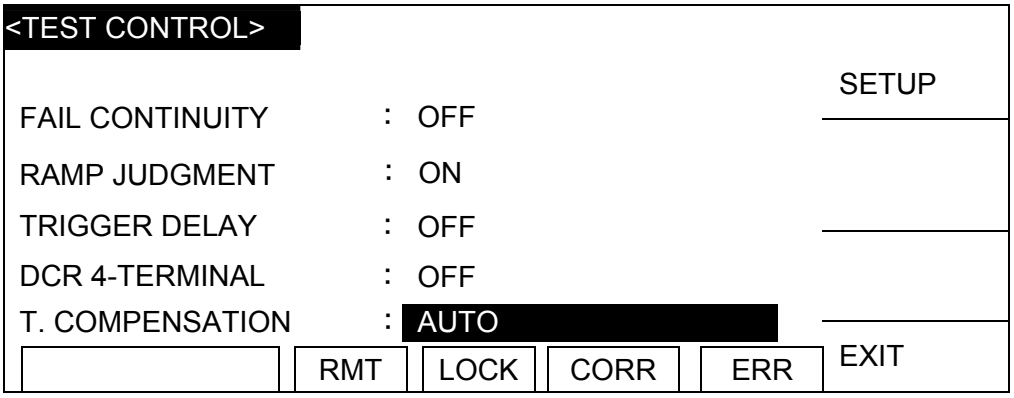
<TEST CONTROL>

PASS HOLD	:	0.5S
ACV FREQUENCY	:	60Hz
SOFTWARE AGC	:	ON
WV AUTO RANGE	:	OFF
GFI	:	ON

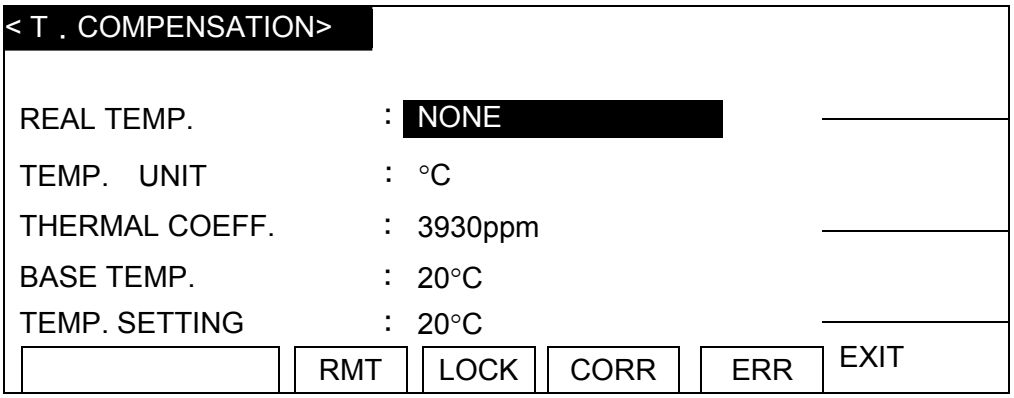
DIGIT UP
DIGIT DN
DIGIT
EXIT

0.2 - 99.9S	RMT	LOCK	CORR	ERR

2. Move the highlight to T. COMPENSATION. Press **F1** and [SETUP] to go to the setting screen of Temperature Compensation.



3. The following shows the screen of temperature compensation.



4. 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 NONE 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 MANUA.
T. COMPENSATION	AUTO/MANUAL/ OFF	OFF	It turns on the temperature compensation function. AUTO means to use the measured temperature for compensation, MANUAL means to use temperature set by TEMP. SETTING for compensation, while OFF means not to execute temperature compensation.

5. 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 19035 panel shows the DUT's resistance under the measurement temperature at the time when OFF is set.

AUTO : This function needs to work with temperature interface and probe. It will perform measurement automatically and show the environment temperature. The 19035 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.

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 [△], [▽], [◁] and [▷] keys. The [◁] and [▷] keys adjust the value roughly while the [△] and [▽] keys can do close adjustment. The 19035 panel shows the resistance that converted to the base temperature.

4.6.4.5 Usage of DCR Mode Temperature Compensation

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 100Ω. 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.

   Rt0: unknown resistance
   Rt: 100Ω
   t0: 3930 ppm
   t(°C): 30 °C
   t0 (°C): 20°C

   $Rt0 = Rt/\{1+t0 * (t-t0)\} = 100 / \{1 + (3930 e-6) * (30 - 20)\} = 96.21\ \Omega$

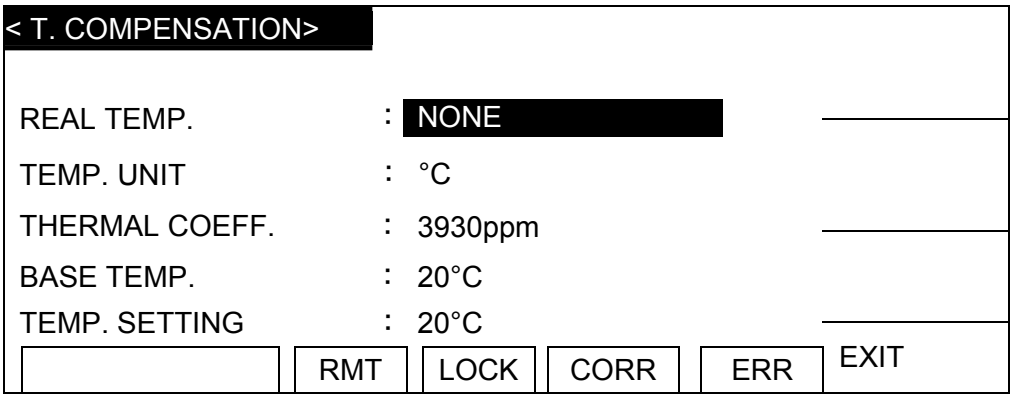
   Now the 19035 shows the resistance is 96.21 Ω when at 20°C.

4.6.4.6 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.

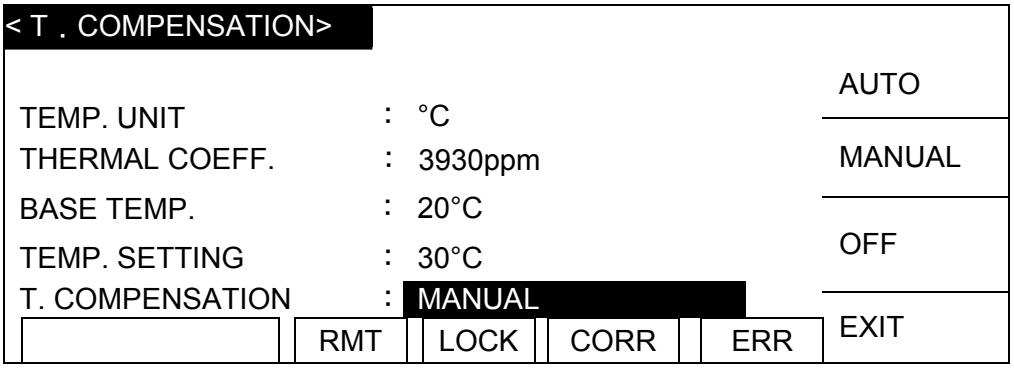


2. Move the highlight to THERMAL COEFF. and press [△], [▽], [◁], [▷] keys to adjust the wire temperature coefficient. Then press [ENTER].

3. Move the highlight to BASE TEMP. and press [△], [▽], [◁], [▷] keys to adjust the base temperature to be converted. Then press [ENTER].

4.6.4.6.1 Setting MANUAL Mode

Press **SYSTEM** → [TEST CONTROL] →[T. COMPENSATION] and select MANUAL for [T. COMPENSATION], the temperature compensation of DCR measurement in 19035 is set to MANUAL mode.

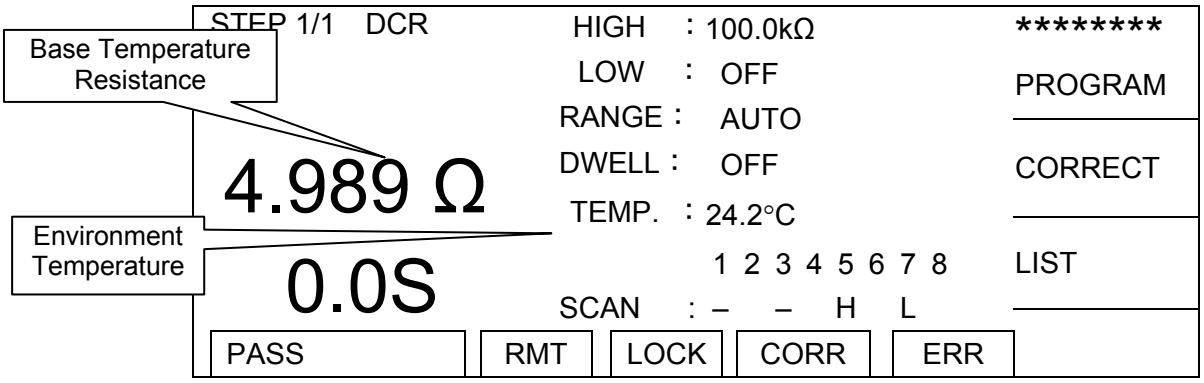


Please input the environment temperature for TEMP. SETTING. The 19035 panel shows the DCR mode measured resistance that is the one of base temperature after conversion.

4.6.4.6.2 Setting AUTO Mode

If the 19035 is installed with temperature interface and probe, it will measure and show the environment temperature automatically. Ensure the 19035 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 19035 is set to AUTO mode.

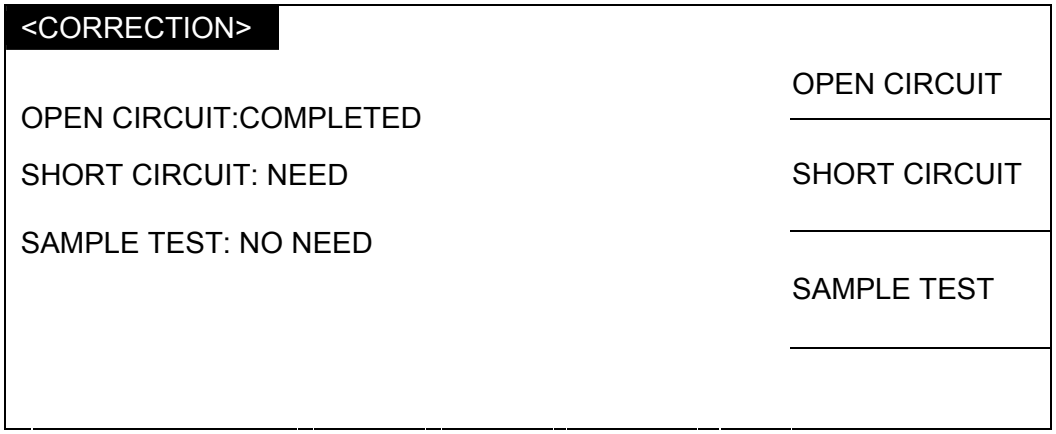
The 19035 panel shows the DCR mode measured resistance that is the one at base temperature after conversion.



4.7 Using Open/Short Offset or Correction

4.7.1 Entering Open/Short Offset or Correction Screen

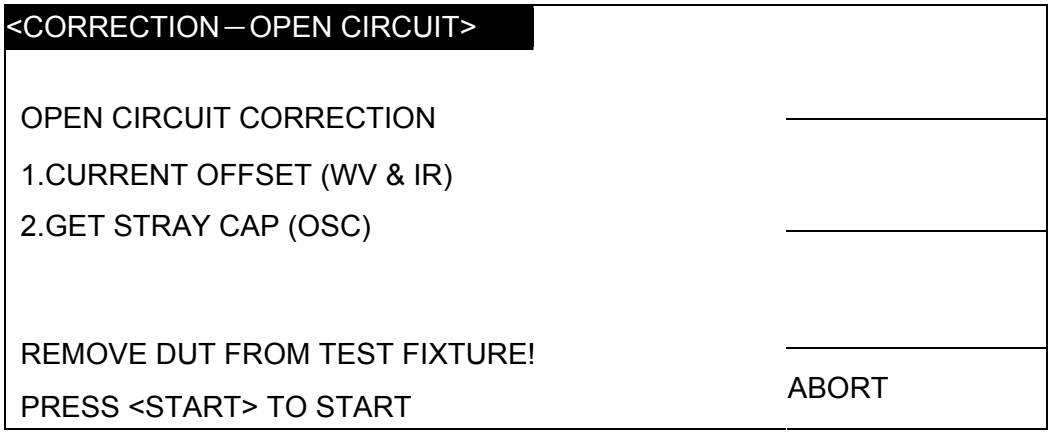
1. Press Function Key [CORRECT] in power on screen to go to Open/Short Offset or CORRECTION screen as shown below:



2. When the item in left area shows COMPLETED, it means the item is done and when NEED is appeared, it means the item is not done yet. When NO NEED is appeared, it indicates there is no need to execute this item. The CORR indicator will be on when all items are not showing NEED.
3. Use Function Keys [OPEN CIRCUIT], [SHORT CIRCUIT], [SAMPLE TEST] to select the function to be done.
4. Press **TEST** to exit this screen.

4.7.2 Using OPEN CIRCUIT

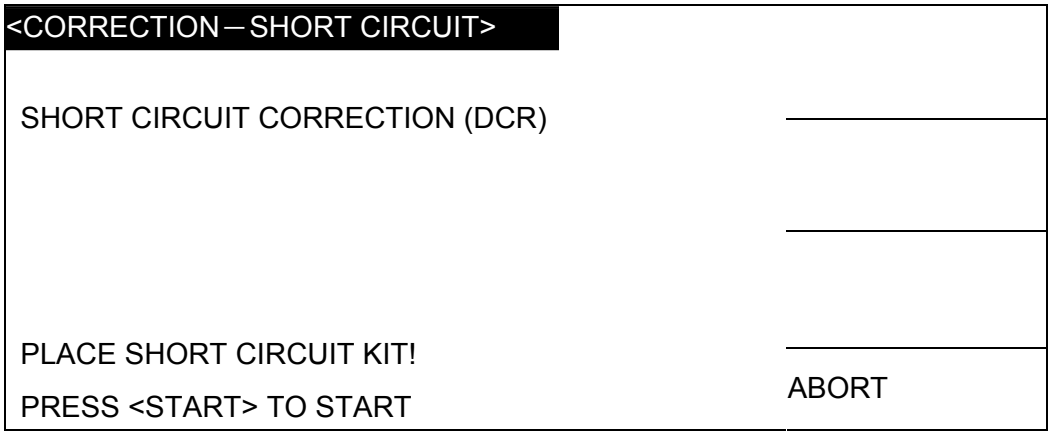
1. When in CORRECTION screen, press Function Key [OPEN CIRCUIT] to go to OPEN CIRCUIT screen as shown below:



2. OPEN CIRCUIT is to offset the leakage current of WVAC / WVDC / 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

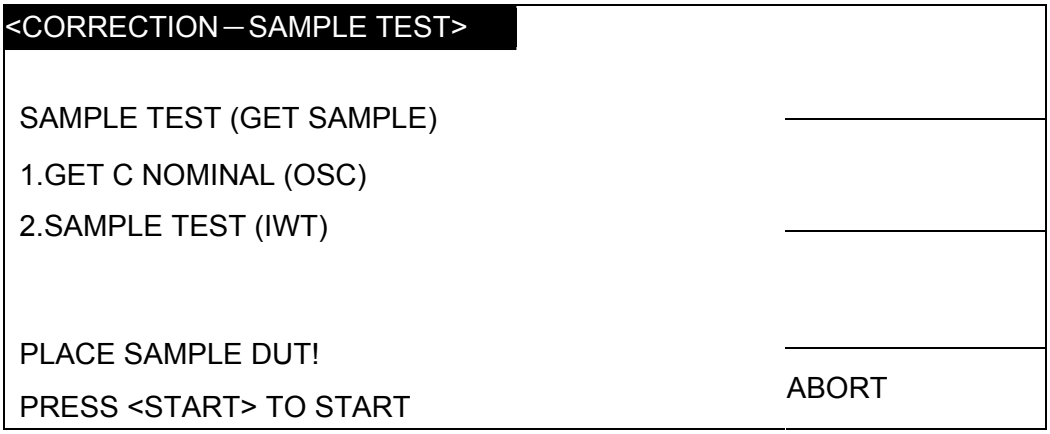
1. Press Function Key [SHORT CIRCUIT] in CORRECTION screen to go to SHORT CIRCUIT screen as shown below:



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. Press Function Key [SAMPLE TEST] in CORRECTION screen to go to SAMPLE TEST screen as shown below:



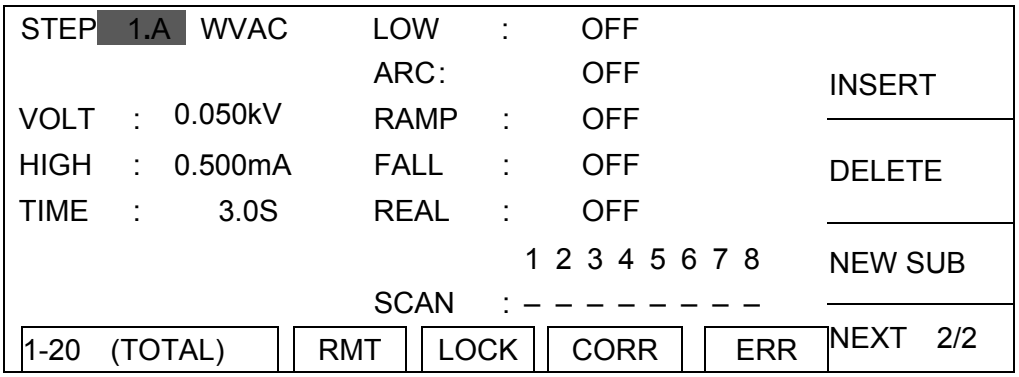
2. SAMPLE TEST is to read the standard values as DUT judgment criteria for test in OSC and IWT mode.
3. Connect the DUT as test standard in OSC or IWT mode, press **START** to read the standard value for test in OSC or IWT mode.
4. Once the Winding Tester read the standard value in IWT, press **START** to execute next test step.

4.8 Setting & Using SUB Step

4.8.1 Setting SUB Step

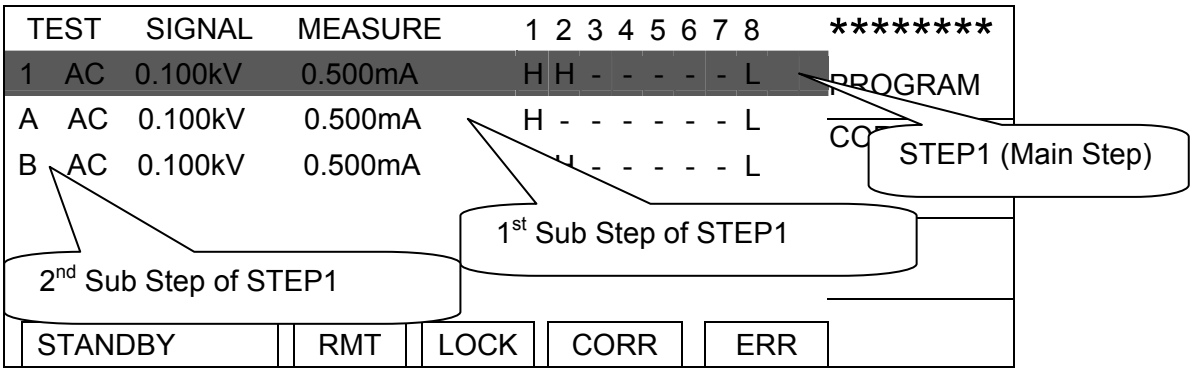
Follow the steps below to set the Sub Step of STEP1:

1. Finish the setting of STEP1.
2. Press Function Key [PROGRAM], the reversed cursor is at the STEP. Press Function Key [NEW SUB] will show the first SUB STEP screen of STEP1:



3. Follow the above step to set the 2nd Sub Step of STEP1 and the 3rd Sub Step of STEP1 and so forth.

Here shows the STEP1 under LIST screen and the Sub Step of STEP1:



Setting of Sub Step and Fail Continuity

Setting TEST CONTROL	Test Result	Execution Status
Set Fail Continuity to OFF	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 Fail Continuity to ON	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 Scanner 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 WVAC/WVDC/IR

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

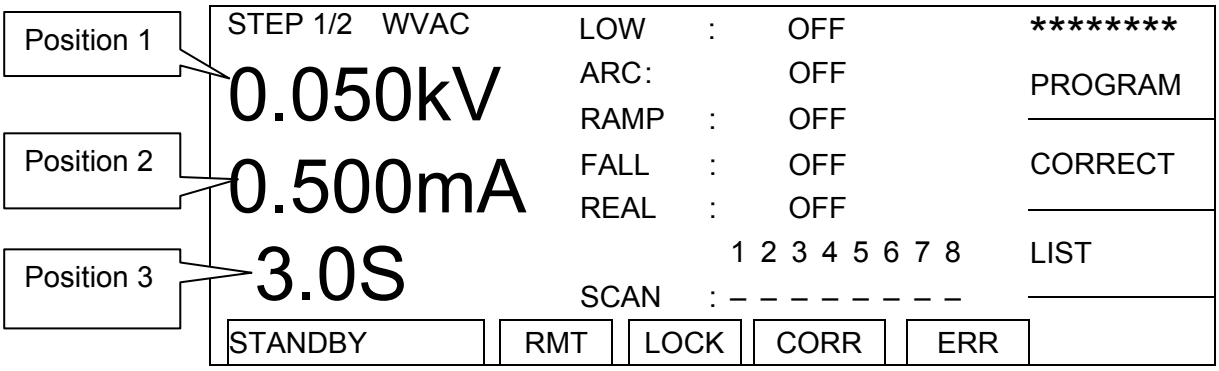


Illustration:
STEP 1/2 means there are 2 test steps and it is running the 1st test step at present. AC indicates the test mode. "Position 1" indicates the set voltage, "Position 2" is the high limit set for current, while "Position 3" is the test time. The status line shows the test result.

3. Press [STOP] to prepare for 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 "Position 3" timer will start to count down.

5. GOOD Judgment
When all tests are done and the results show PASS, the Scanner 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 Scanner 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 Scanner is pressed. The test result will show FAIL state.

FAIL State:

Test Result Display	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 DCR

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

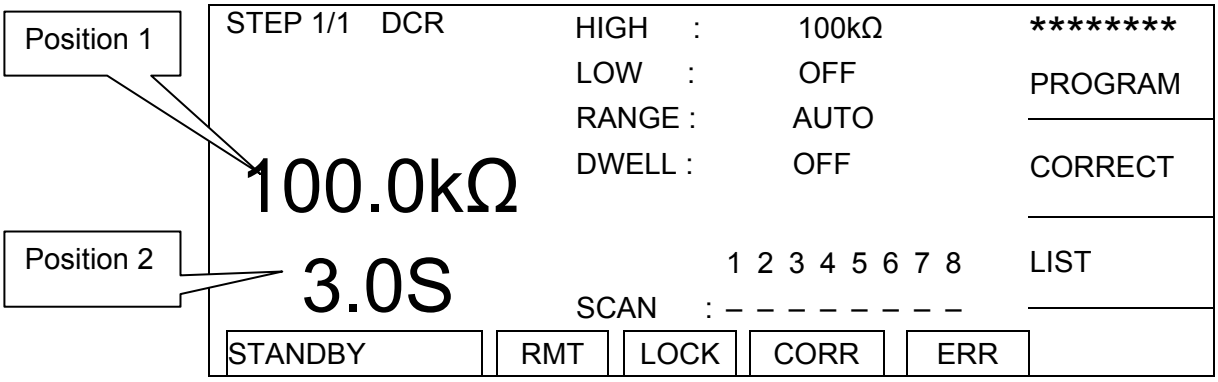


Illustration:
DCR means it is in DC Resistance measurement mode. "Position 1" is the high limit of DCR, the test result is on the status line and "Position 2" is the test time and the test result is also on the status line.

Note: When the test time is set to OFF, no test time will show on "Position 2".

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

4. Press [START] to activate the test
When this key is pressed it starts to output voltage and the DANGER LED is on. Next the test line will show the test result and "Position 1" shows the DCR value.

5. GOOD Judgment
When all tests are done and the results show PASS, the Scanner 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 Scanner 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 Scanner is pressed. The test result will show FAIL state.

FAIL State:

Test Result Display	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 DCR SHORT CIRCUIT CORRECTION.

4.9.4 Test Procedure for OSC

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

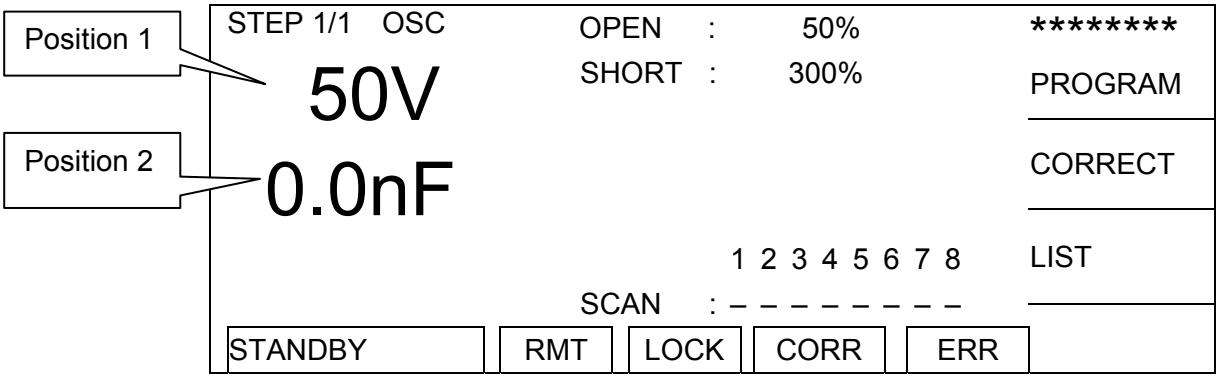


Illustration:
OSC means it is in Open Short Check mode. "Position 1" is the setting voltage while "Position 2" is the reading capacitance. The test result shows in status line.

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

4. Press [START] to activate the test
When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows "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 Scanner 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 Scanner 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 Scanner is pressed. The test result will show FAIL state.

Fail State:

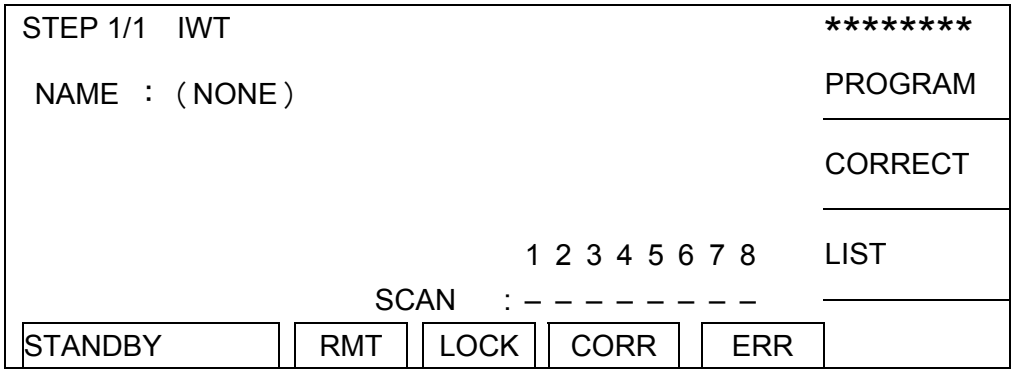
Test Result Display	Meaning
OPEN FAIL	The setting of Open / Capacitance Reading is smaller than OPEN.
SHORT FAIL	The setting of Short / Capacitance Reading is larger than SHORT.

To stop test output in any condition, 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 OPEN CIRCUIT*.
4. For SAMPLE TEST in OSC, please refer to *4.7.4 SAMPLE TEST*.

4.9.5 Test Procedure for IWT

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



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

4. Press [START] to activate the test
   When this key is pressed it starts to output voltage and the DANGER LED is on. The status line shows “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 Scanner 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 Scanner 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 Scanner is pressed. The test result will show FAIL state.

   Fail State:

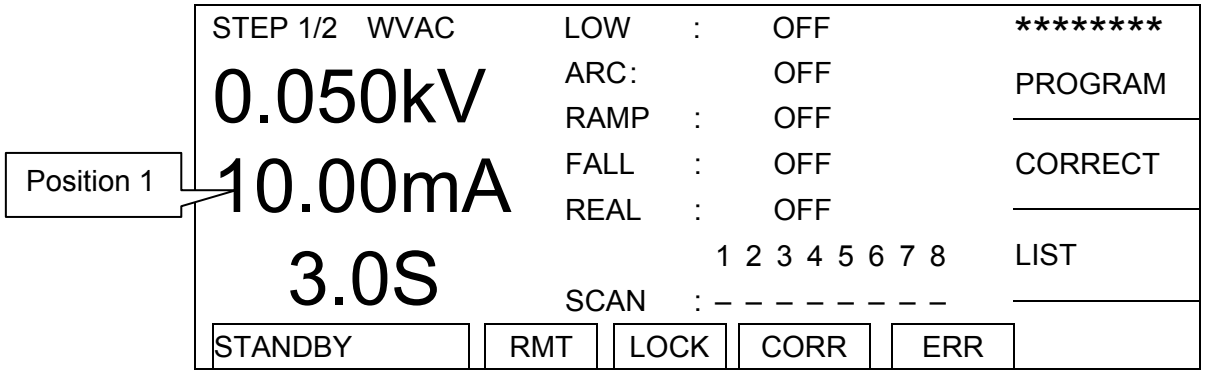
Test Result Display	Meaning
IWT FAIL	The Impulse Winding Test fails.
DWX ERROR	The communication of Impulse Winding Test is bad.

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

Note:
1. It is necessary to run SAMPLE TEST when replacing a new DUT for IWT. Read the standard value from the test sample for impulse test.
2. For SAMPLE TEST in IWT, please refer to *4.7.4 SAMPLE TEST*.

4.9.6 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.



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 0.500mA automatically.

4.10 Scan Test

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

Setting Method:

1. When in program setting screen, set the programs accordingly.
2. Move the highlighted bar to "SCAN" and press Function Key [CH NO.] to select the output channel to be set.
3. Now, use Function Key [H], [L] and [-] to set the scan test output states which are high voltage output, low voltage output and open.
4. When done press **ENTER** to confirm and exit.

Note: The Scanner has no preset output channel. To begin the test please set one high voltage output channel at least.

5. Using 19035-M

5.1 Precautions before Use

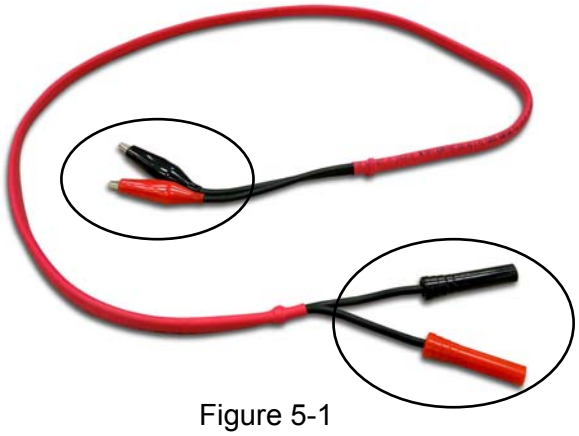


Figure 5-1

Do not touch the test wire terminals or the DUT during high voltage output to avoid electric shock from occurring. For the other precautions, see *Chapter 3 Precautions before Use*.

5.2 Front Panel of 19035-M

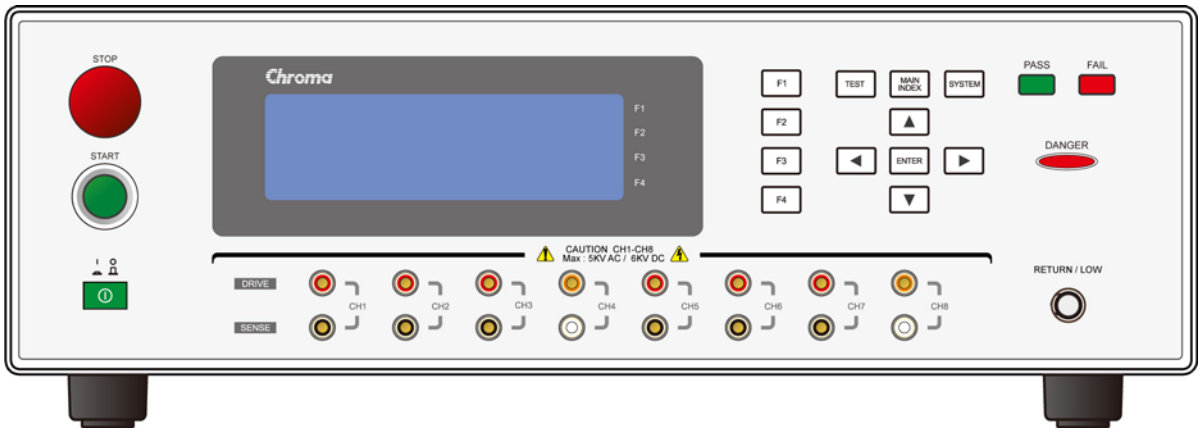


Figure 5-2

5.3 Rear Panel of 19035-M

It is the same as Figure 4-2.

5.4 Setting PROGRAM & Connecting DUT

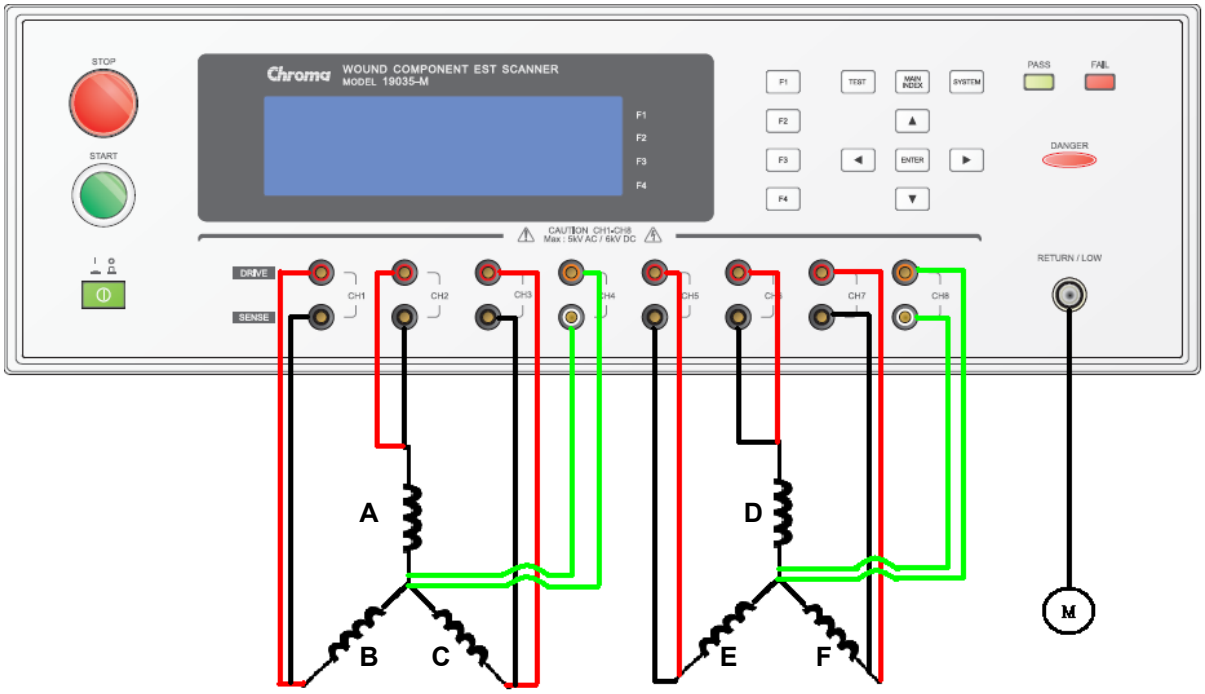


Figure 5-3

It can test 2 pieces of three-wire fan stators at one time. The test modes are DCR, IWT and Withstand Voltage with the settings listed below:

STEP	MODE	Channel	RETURN/LOW	Description
		1 2 3 4 5 6 7 8		
STEP1	DCR	H X X L H X X L		It conducts DCR test for B & E coils.
STEP2	DCR	X H X L X H X L		It conducts DCR test for A& D coils.
STEP3	DCR	X X H L X X H L		It conducts DCR test for C & F coils.
STEP4	IWT	H X X L H X X L		It conducts Layer Short test for B & E coils.
STEP5	IWT	X H X L X H X L		It conducts Layer Short test for A & D coils.
STEP6	IWT	X X H L X X H L		It conducts Layer Short test for C & F coils.
STEP7	WAC	H H H X H H H X	L	It conducts Withstand AC test for the core of A, B, C, D, E & F coils.
STEP7.A	WAC	H H H X X X X X	L	It conducts Withstand AC test for the core of A, B & C coils.
STEP7.B	WAC	X X X X H H H X	L	It conducts Withstand AC test for the core of D, E & F coils.

5.4.1 Connecting & Setting Diagram of Withstand Voltage Test Mode

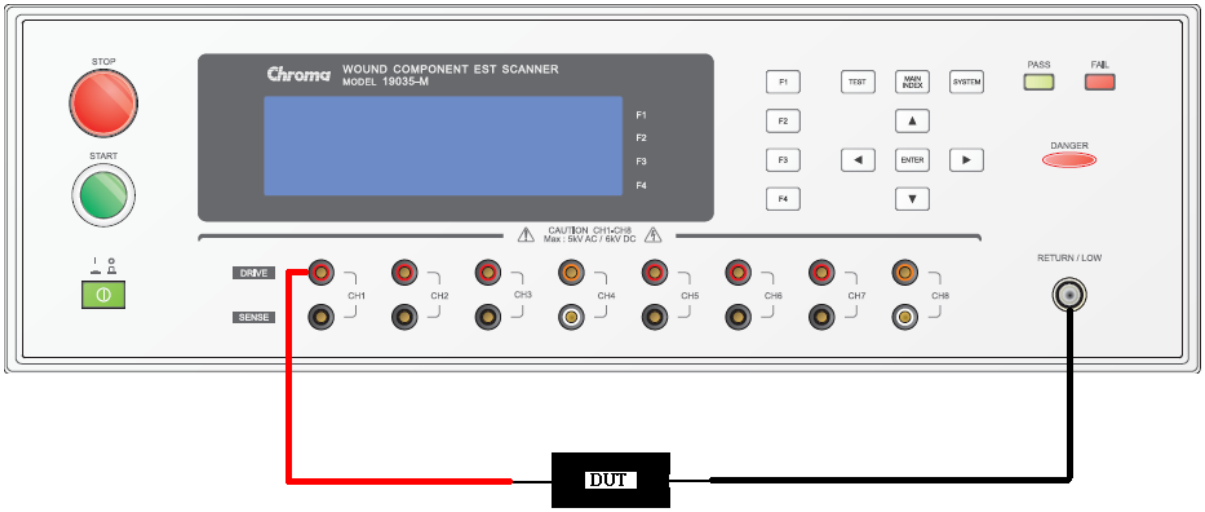


Figure 5-4

Withstand Voltage AC Test Mode (WVAC)

STEP 1/1	WVAC			LOW	:	OFF						
				ARC:		OFF						WVAC
VOLT	:	0.050kV		RAMP	:	OFF						
HIGH	:	0.500mA		FALL	:	OFF						WVDC
TIME	:	3.0S		REAL	:	OFF						
						1	2	3	4	5	6	7 8 IR
				SCAN	:	H	–	–	–	–	–	–
SELECT MODE			RMT	LOCK		CORR		ERR				NEXT 1/3

Withstand Voltage DC Test Mode (WVDC)

STEP 1/1	WVDC			LOW	:	OFF						
				ARC:		OFF						WVAC
VOLT	:	0.050kV		RAMP	:	OFF						
HIGH	:	0.500mA		DWELL	:	OFF						WVDC
TIME	:	3.0S		FALL	:	OFF						
						1	2	3	4	5	6	7 8 IR
				SCAN	:	H	–	–	–	–	–	–
SELECT MODE			RMT	LOCK		CORR		ERR				NEXT 1/3

Insulation Resistance Test Mode (IR)

STEP 1/1 **IR**	HIGH :	OFF	
	RAMP :	OFF	WVAC
VOLT : 0.050kV	FALL :	OFF	
LOW : 1.0MΩ	RANGE :	AUTO	WVDC
TIME : 3.0S			
		1 2 3 4 5 6 7 8	IR
	SCAN	: H – – – – –	
SELECT MODE	RMT	LOCK	CORR	ERR	NEXT 1/3

5.4.2 Connecting & Setting Diagram of DCR Test Mode

When doing DCR test, the DRIVE test wire and SENSE test wire need to be clipped at the same point.

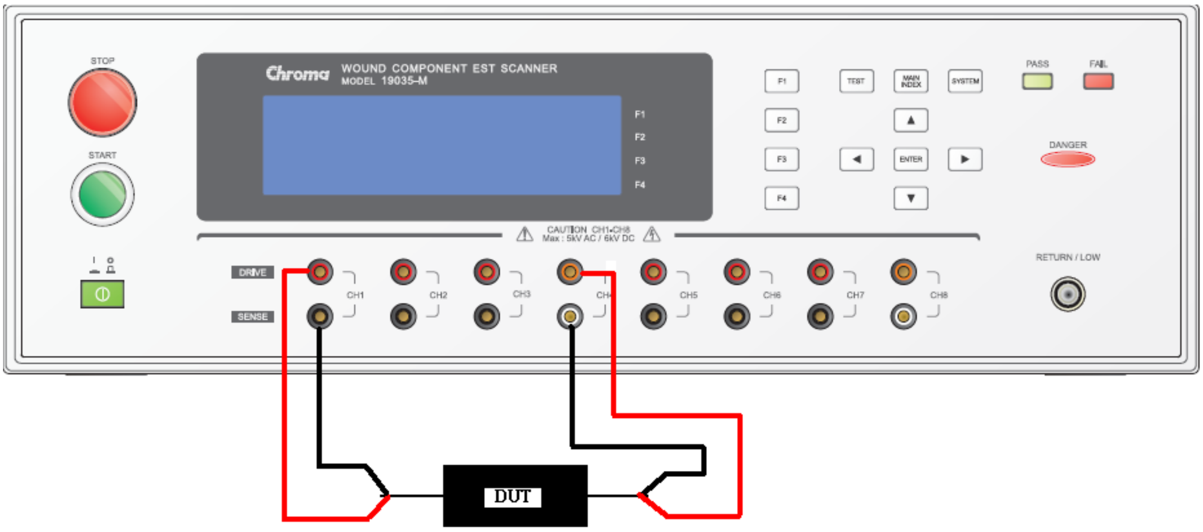


Figure 5-5

DC Resistance Test Mode (DCR 4-Terminal Test Mode)

STEP 1/1 **DCR**	HIGH :	100.0kΩ	
	LOW :	OFF	DCR
	RANGE :	AUTO	
	DWELL :	OFF	OSC
TIME : OFF			
		1 2 3 4 5 6 7 8	IWT
	SCAN	: H – – L – – – –	
SELECT MODE	RMT	LOCK	CORR	ERR	NEXT 2/3

5.4.3 Connecting & Setting Diagram of IWT Test Mode

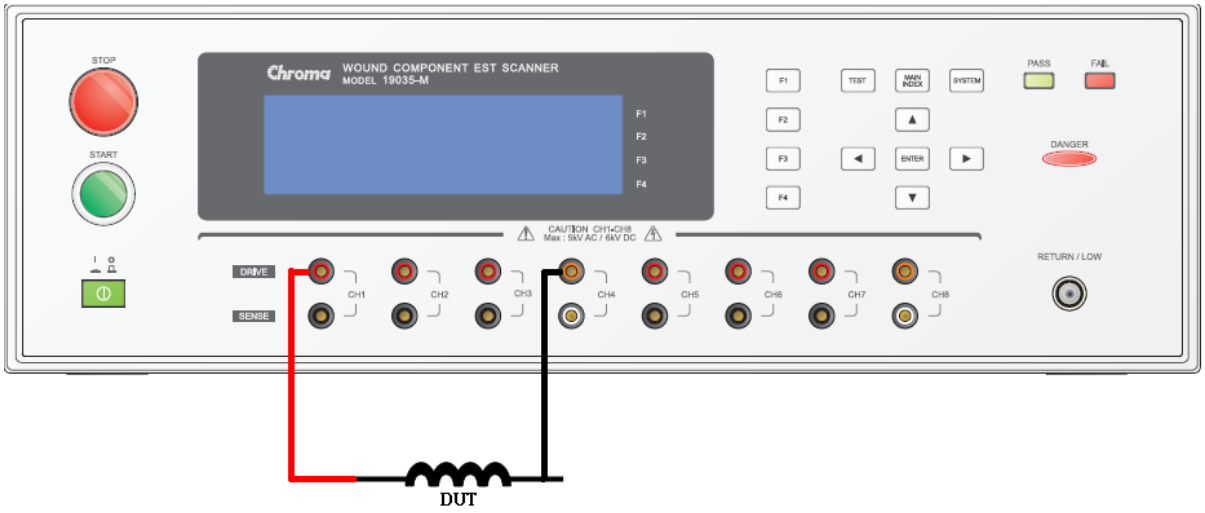


Figure 5-6

Impulse Winding Test Mode (IWT)

STEP 1/1 IWT						DCR
NAME : (NONE)						OSC
			1 2 3 4 5 6 7 8			IWT
		SCAN	: H – – L – – – –			
SELECT MODE	RMT	LOCK	CORR	ERR		NEXT 2/3

5.4.4 Connecting & Setting Diagram of OSC Test Mode

The connection of DUT is the same as Withstand Voltage test mode.

Open Short Check Test Mode (OSC)

STEP 1/1 OSC		OPEN : 50%				DCR
		SHORT : 300%				OSC
			1 2 3 4 5 6 7 8			IWT
		SCAN	: H – – – – –			
SELECT MODE	RMT	LOCK	CORR	ERR		NEXT 2/3

6. HANDLER Interface (Option)

6.1 Introduction

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

6.2 Specification

6.2.1 Driving Capability

Internal Signal Output Specification: DC 5V, 40~60mA
External Signal Input Specification: DC 3V~26V (HIGH), 10mA± 4mA

6.2.2 Pin Assignment

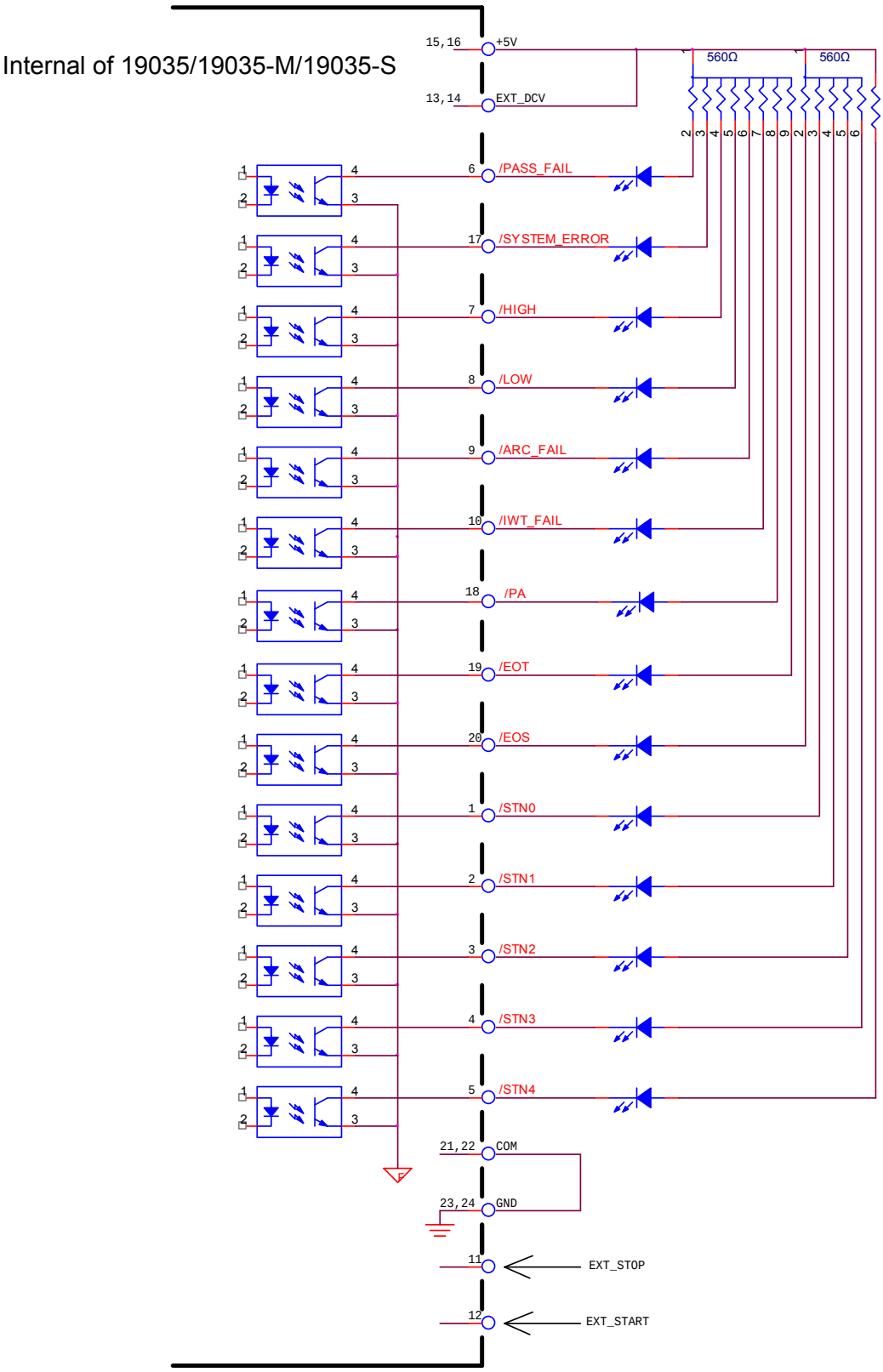
Pin No.	Signal	Input/Output	Description
1	/STN0	Output	/STN0~/STN4 signals indicate the test step code output. 5 bits are used to indicate 20 test steps. The output format is binary code. (/STN0 is low bit and /STN4 is high bit.) **Note (1)**
2	/STN1		
3	/STN2		
4	/STN3		
5	/STN4		
6	/PASS_FAIL	Output	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.)
7	/HIGH		It turns to Low from high when the test result is HIGH FAIL.
8	/LOW		It turns to low from high when the test result is LOW FAIL.
9	/ARC_FAIL		It turns to Low from High when the test result is ARC_FAIL.
10	/IWT_FAIL		It turns to Low from High when the test result is IWT_FAIL.
11	/EXT_STOP	Input	External STOP signal input when signal state is LOW.
12	/EXT_START	Input	External START signal input when signal state is LOW.
13,14	EXT_DCV	Input	External DC voltage input, the range is between +3V~+26V.
15,16	+5V	Output	The internal DC voltage output.
17	/SYSTEM ERROR	Output	The signal output pin for system internal error. It means the system has internal error when output is LOW.

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	/EOT	Output	When the signal is HIGH, it indicates the test program is running. When the signal is LOW, it indicates the test program is ended or is ready mode.
20	/EOS		When the signal is HIGH, it indicates the test step is running. When the signal is LOW, it indicates the test step is done before going to the next or all If them are ended.
21,22	COM	---	It is the low voltage terminal for input/output signal.
23,24	GND	---	It is the low voltage terminal for internal voltage output.

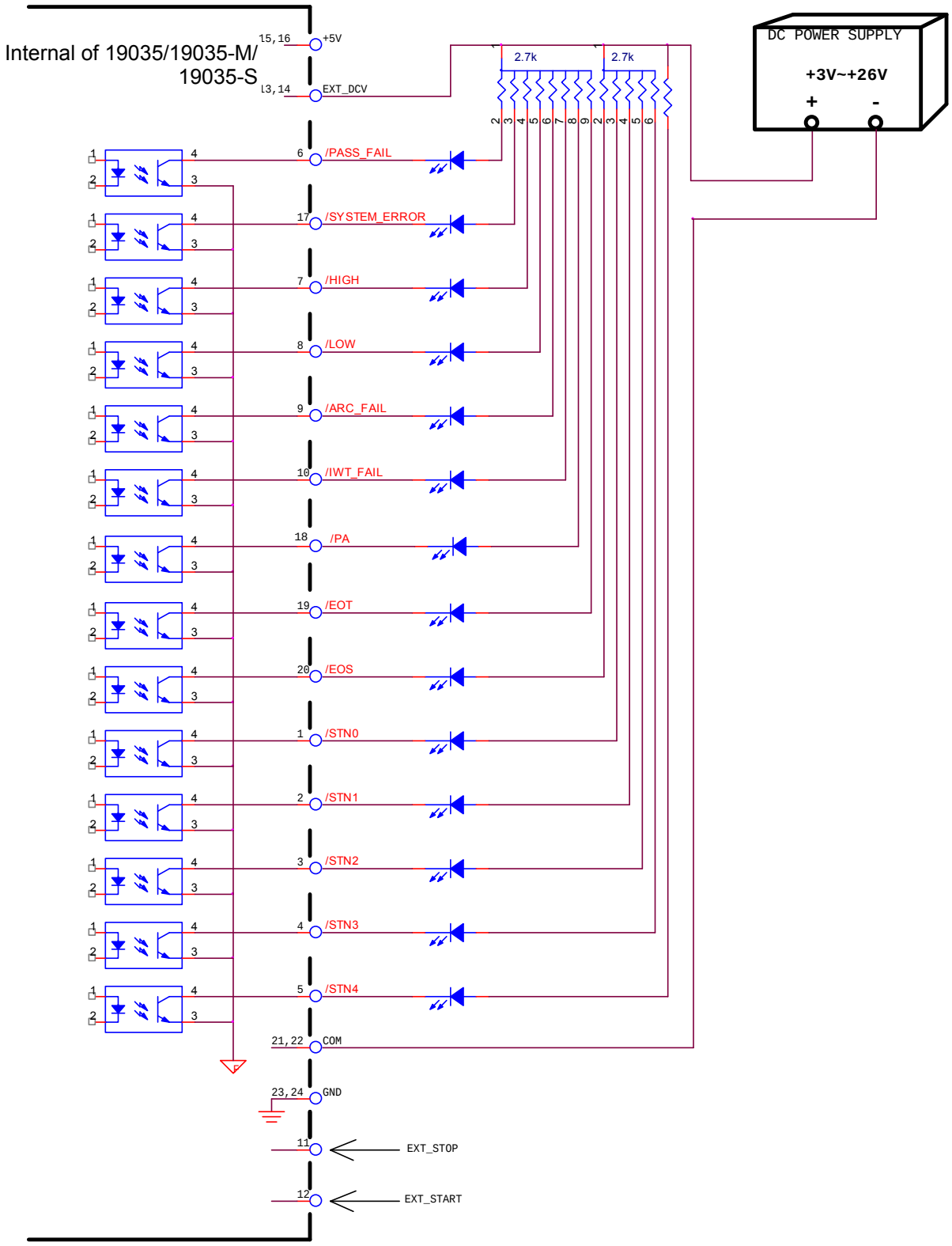
Note (1)：The test step code signal of Handler Board will send out sequentially no matter it is Main Step or Sub Step.

6.3 Example of External Control Circuit

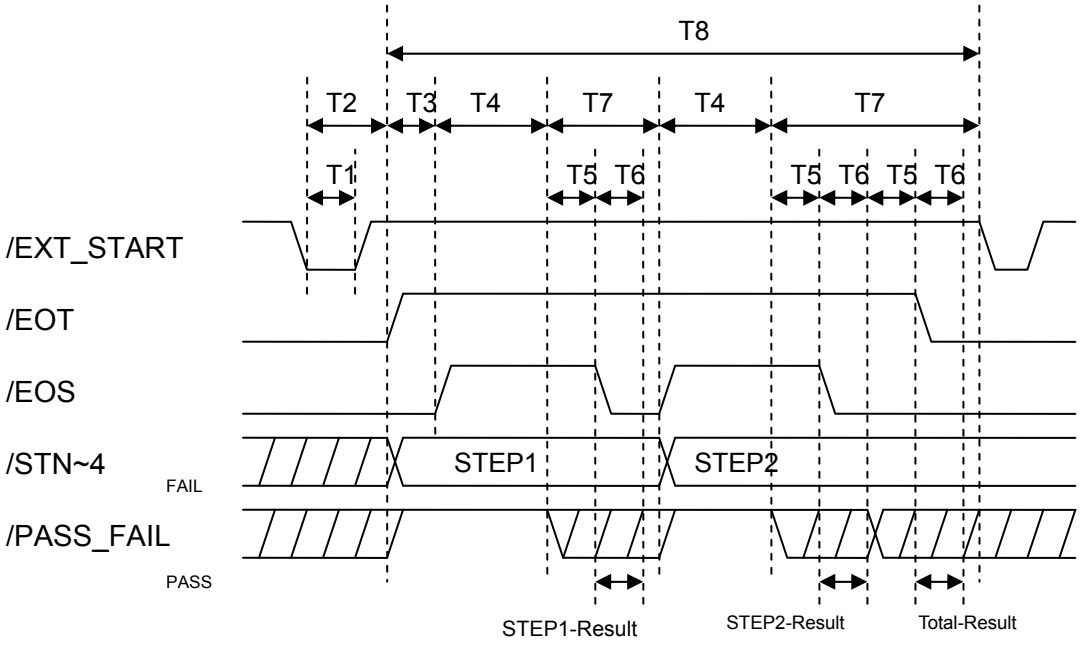
6.3.1 Example of Using Internal Power Supply



6.3.2 Example of Using External Power Supply



6.4 Timing Diagram



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	> 10mS	The waiting time will be more than 10mS for /PASS_FAIL signal to be stable.
T6	> 10mS	The waiting time will be more than 10mS 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.

7. A190351 8CH to 16CH Scan Box (Option)

7.1 Introduction

The optional A190351 8CH to 16CH Scan Box can be purchased for this scanner to change the output from 8 channels to 16 channels.

7.2 Front & Rear Panel of A190351

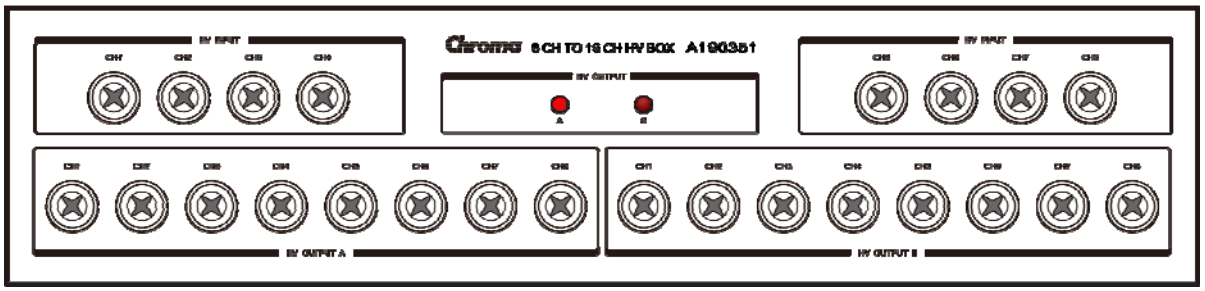


Figure 7-1 Front Panel of A190351

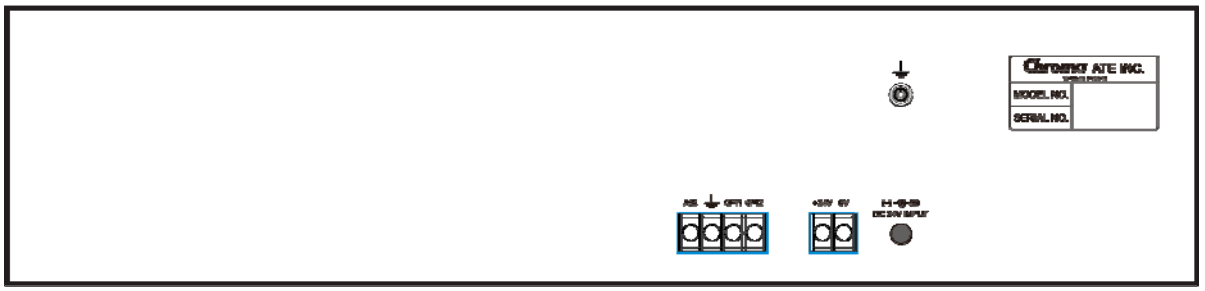


Figure 7-2 Rear Panel of A190351

7.3 Specification of A190351 8Ch to 16Ch Scan Box

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

A190351 (8-Channel to 16-Channel Scan Box)	
■ **Withstanding Voltage Section**	
❑ HV	Maximum Voltage is 5kVac, 6kVdc Maximum Current is 100mA ac or peak dc
❑ HV Output Port	A/B Ports.
■ **Ambient Temperature and Relative Humidity**	
❑ Specifications Range	18 to 28°C (64 to 82°F), 20 to 70% RH.
❑ Operable Range	Maximum 80% RH. for temperature up to 31°C (88°F) linearly to 50% RH. at 40°C (104°F)
■ Power Requirement	
❑ Input Voltage	DC 24V +5 -10%
❑ Consumption	With rated load: 10W max.
■ **Operation Time**	
❑ Operate Time	<10ms
■ **General**	
❑ Dimension	430mm(w) x 450mm(d) x 102mm(h)
❑ Weight	Approx. 6 kg

2. There is a safety ground terminal  at the rear chassis. Ensure it is grounded to earth exactly.
3. Operation
   The pin assignments on the rear panel are shown as below:

   (1) The control signals are A/B and GND. The 8 input connectors on the fixture are short-circuited with A group when the A/B and GND are open and short-circuited with B group when the A/B and GND are short.
   (2) The power is supplied by the 24V Adaptor. Input the power from +24V and 0V connector if to supply by other auto device. The +24V ADAPTER and the external power cannot be used at the same time (only one is available.)
   (3) OPT1 and OPT2 connectors are invalid at present.

4. Standard Accessory
   (1) 24V Adaptor x 1
   (2) High Voltage Input Wire x 8 pcs
   (3) High Voltage Output Wire x 16 pcs

7.4 Connecting 19035 & A190351

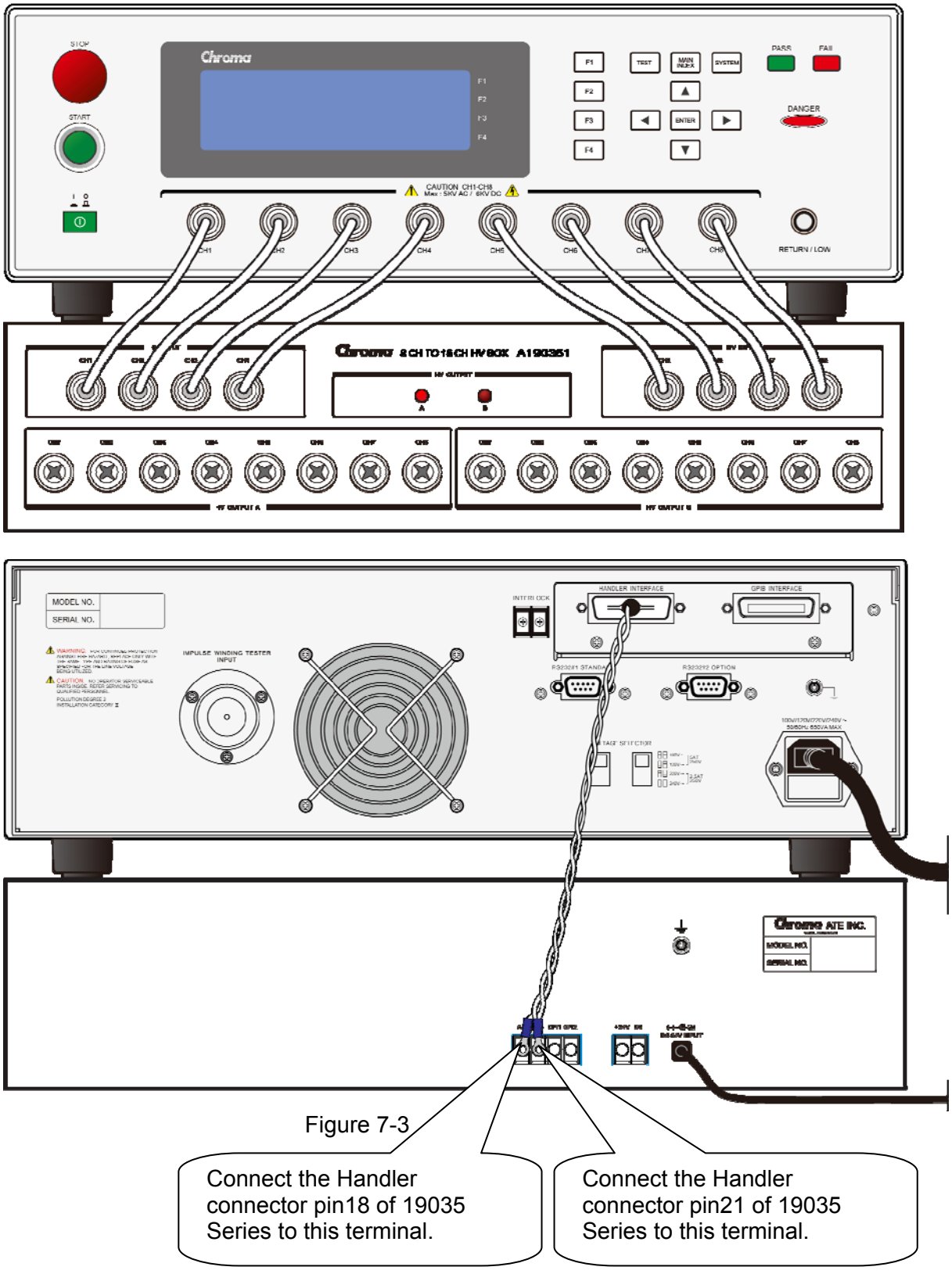


Figure 7-3

7.4.1 Example of 19035 Parameter Settings & A190351 Output

(1) 19035 Parameter Setting

TEST	SIGNAL	MEASURE	1 2 3 4 5 6 7 8	********
1 AC	0.100kV	0.500mA	H H H H H H H H	PROGRAM
2 PA	PAUSE			
3 AC	0.200kV	0.500mA	H H H H H H H H	CORRECT
4 PA	PAUSE			
5 AC	0.300kV	0.500mA	H H H H H H H H	STEP
STANDBY	RMT	LOCK	CORR	ERR		

(2) A190351 Output Status

19035 Execution Step	A190351 Output Status	A190351 Display
STEP1 AC	HV OUTPUT A (CH1~CH8) with output HV OUTPUT B (CH1~CH8) without output	HV OUTPUT A LED on
STEP2 PA	Switch A190351 to HV OUTPUT B	HV OUTPUT B LED on
STEP3 AC	HV OUTPUT A (CH1~CH8) without output HV OUTPUT B (CH1~CH8) with output	HV OUTPUT B LED on
STEP4 PA	Switch A190351 to HV OUTPUT A	HV OUTPUT A LED on
STEP5 AC	HV OUTPUT A (CH1~CH8) with output HV OUTPUT B (CH1~CH8) without output	HV OUTPUT A LED on

***Note:** Every time the 19035 executes the PA mode, the HV OUTPUT A and HV OUTPUT B of A190351 are alternated.

8. RS232/GPIB Interface

8.1 Introduction

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

8.2 RS232 Interface

8.2.1 Specification

The standard is RS232 interface with the following settings:

Baud Rate:	9600 / 19200 / 38400
Parity:	NONE
Flow Control:	NONE
Transmission Bit:	1 start bit + 8 data bits + 1 stop bit

8.2.2 Command Format

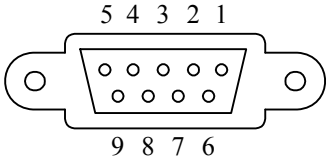
The function of RS232 interface is to input the ASCII code composed commands in order to do remote control and setting. The command string length is limited to 255 characters including End Code. [Command+parameter] forms an instruction and semicolon ";" can be used to connect any two commands with end code at last. The End Code one of the following formats:

End Code

LF
CR+LF

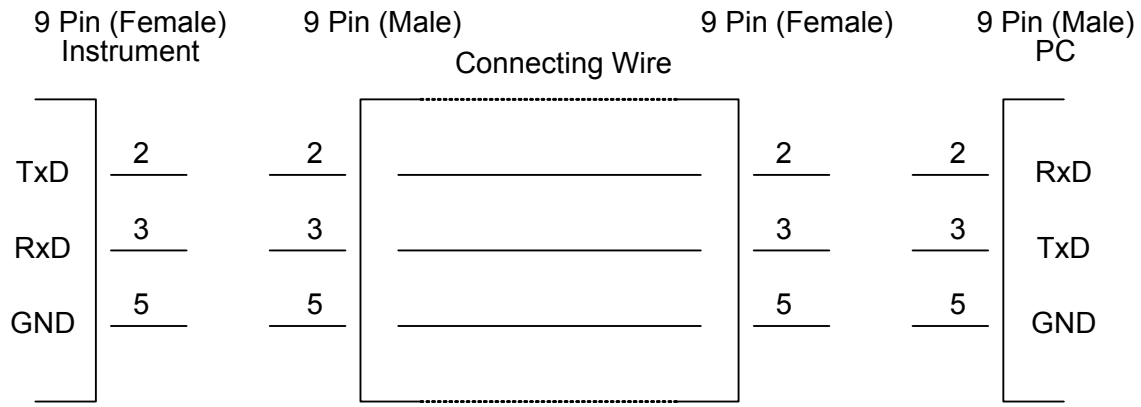
8.2.3 Connector

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



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

8.2.4 Connection



8.3 GPIB Interface (Option)

8.3.1 Applied Standard

It applies the IEEE488-1978 standard.

8.3.2 Interface Capability

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

8.3.3 Interface Message

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

Interface Message	Meaning	Reaction
GTL	Go To Local	It switches the Scanner to Local mode.
SDC	Selected Device Clear	It clears the GPIB interface state.
LLO	Local Lockout	It is unable to switch to Local mode by pressing [LOCAL] key.
IFC	Interface Clear	It resets the GPIB interface.

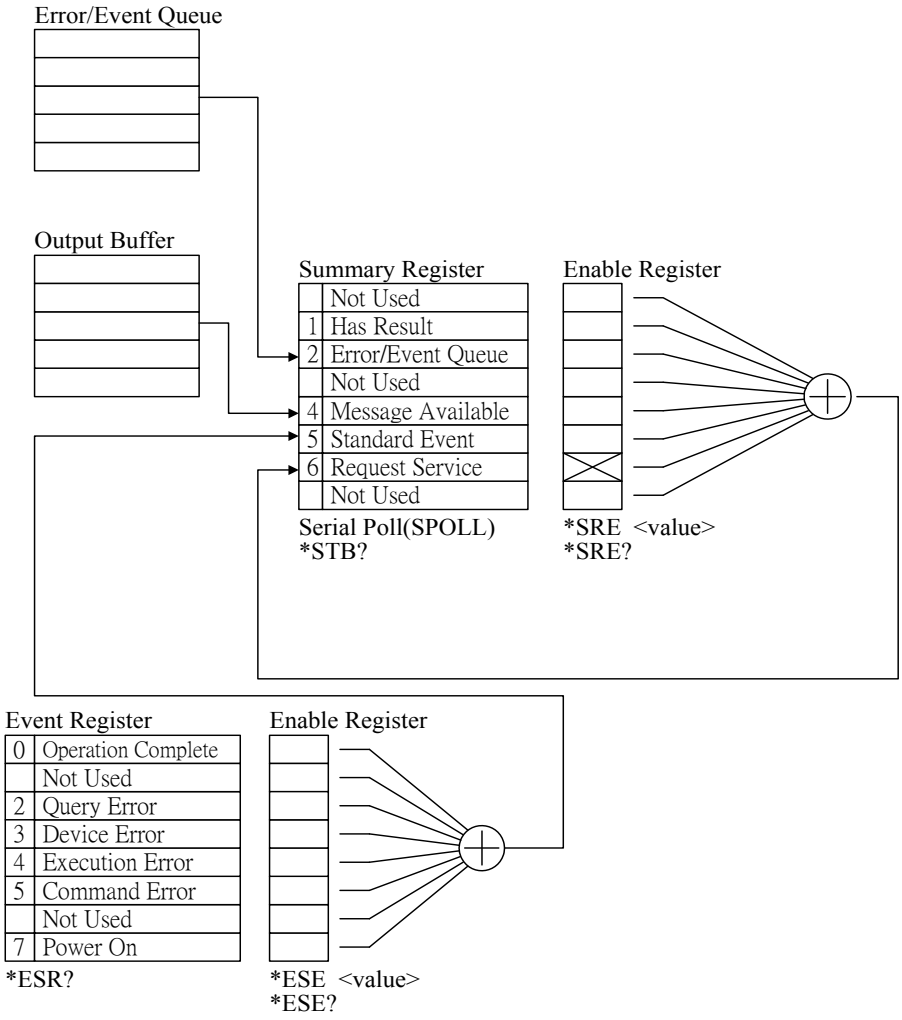
8.3.4 Command Format

The function of GPIB interface is to input the ASCII code composed commands in order to do remote control and setting. The command string length is limited to 255 characters including End Code. [Command+parameter] forms an instruction and semicolon ";" can be used to connect any two commands with end code at last. The End Code can be one of the following formats:

End Code

LF
CR＋LF
EOI
LF＋EOI
CR＋LF＋EOI

8.4 Structure of Remote Interface



8.5 Commands for Remote Interface

8.5.1 Commands Summary

- IEEE 488.2 Commands

  *CLS
  *ESE *<enable value>*
  *ESE?
  *ESR?
  *IDN?
  *OPC
  *OPC?
  *PSC *0|1*
  *PSC?
  *RST
  *RCL *<register number>*

*SAV *<register number>*
*SRE *<enable value>*
*SRE?
*STB?

The parameter syntax 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; "<string>" means string data and the format is to double quote the strings.
(3) Use vertical bar "|" to indicate parameter OR.
(4) "<channel list>" indicates the status of Scanner and Channel. The presentation is: (@(C1, C2…)) where C1, C2… means Channel number and (@(0)) means to Open all channels.
Ex: **(@(1,3))** sets CH1 and CH3.
Ex: **(@(0))** sets all SCAN Port to OFF.
(5) The suffix variable is <decimal numeric data> that has no separator between it and the command. For instance, the <n> and <s> in the command [:SOURce]:SAFety:RESult: STEP<n>:SUB<s>[:JUDGment]? Are suffix variables, the value is <decimal numeric data>. When <s> is 1, it means SUB-A step, 2 means SUB-B step and so forth.

- SCPI Commands

```
:MEMory
|       :DELete
|       |     [:NAME]          <name>
|       |     :LOCation        <register number>
|       :STATe
|       |     :DEFine    <name>, <register number>
|       |     :DEFine?   <name>
|       :FREE
|       |     :STATe?
|       NSTates?
: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      RESTart | CONTinue | STOP
|       |     |     :OPERation?
|       |     :FTERminal      <boolean> | ON | OFF
|       |     :FTERminal?
|       |     :GFI              <boolean> | ON | OFF
|       |     :GFI?
|       |     :RJUDgment     <boolean> | ON | OFF
|       |     :RJUDgment?
```

```
|       |       :TEMPerature
|       |       |       [:COMPensation]
|       |       |       |       [:ENABle]          OFF | MANUal | AUTO
|       |       |       |       [: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?
|       |       :WVAC
|       |       |       :FREQuency       <number value>
|       |       |       :FREQuency?
|       |       :WRANge
|       |       |       [:AUTO]    <boolean> | ON | OFF
|       |       |       [:AUTO]?
|       :VERSion?
[:SOURce]
|       :SAFety
|       |       :FETCh?    [<item>][,<item>]
|       |       :RESult
|       |       |       :ALL
|       |       |       |       [:JUDGment]?
|       |       |       |       :MMETerage?
|       |       |       |       :MODE?
|       |       |       |       :OMETerage?
|       |       |       |       :RMETerage?
|       |       |       |       :TIME
|       |       |       |       |       [:ELAPsed]
|       |       |       |       |       |       :DWELI?
|       |       |       |       |       |       :FALL?
|       |       |       |       |       |       :RAMP?
|       |       |       |       |       |       [:TEST]?
|       |       |       :AREPort          <boolean> | ON | OFF                    (RS232 only)
|       |       |       :AREPort?                                                  (RS232 only)
|       |       |       :COMPleted?
|       |       |       [:LAST]
|       |       |       |       [:JUDGment] ?
|       |       |       :STEP<n>
|       |       |       |       [:MAIN]
|       |       |       |       |       [:JUDGment]?
|       |       |       |       |       :MMETerage?
|       |       |       |       |       :RMETerage?
|       |       |       |       |       :OMETerage?
|       |       |       |       |       :TIME
|       |       |       |       |       |       [:ELAPsed]
|       |       |       |       |       |       |       :DWELI?
|       |       |       |       |       |       |       :FALL?
|       |       |       |       |       |       |       :RAMP?
```

```
|       |       |       |       |       |       |       [:TEST]?
|       |       |       |       :SUB<s>
|       |       |       |       |       [:JUDGment]?
|       |       |       |       |       :MMETerage?
|       |       |       |       |       :RMETerage?
|       |       |       |       |       :OMETerage?
|       |       |       |       |       :TIME
|       |       |       |       |       |       [:ELAPsed]
|       |       |       |       |       |       |       :DWELI?
|       |       |       |       |       |       |       :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]
|       |       |       |       :DELete
|       |       |       |       :MODE?
|       |       |       |       :SET?
|       |       |       |       :WVAC
|       |       |       |       |       :CHANnel
|       |       |       |       |       |       [:HIGH]     <channel list>
|       |       |       |       |       |       [:HIGH]?
|       |       |       |       |       |       :LOW        <channel list>
|       |       |       |       |       |       :LOW?
|       |       |       |       |       :CORRection
|       |       |       |       |       |       [:CURRent]
|       |       |       |       |       |       |       :OPEN
|       |       |       |       |       |       |       |       [:RANGe]
|       |       |       |       |       |       |       |       |       [:BEST]    <number value>
|       |       |       |       |       |       |       |       |       [:BEST]?
|       |       |       |       |       |       |       |       |       :ALL    <range 1>,<range 2>
|       |       |       |       |       |       |       |       |       :ALL?
|       |       |       |       |       |       :RCURrent
|       |       |       |       |       |       |       :OPEN
|       |       |       |       |       |       |       |       [:RANGe]
|       |       |       |       |       |       |       |       |       [:BEST]    <number value>
|       |       |       |       |       |       |       |       |       [:BEST]?
|       |       |       |       |       |       |       |       |       :ALL    <range 1>,<range 2>
|       |       |       |       |       |       |       |       |       :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?
|       |       |       |       |       :TIME
|       |       |       |       |       |       :FALL       <number value> | OFF
|       |       |       |       |       |       :FALL?
|       |       |       |       |       |       :RAMP       <number value> | OFF
|       |       |       |       |       |       :RAMP?
|       |       |       |       |       |       [:TEST]     <number value> | CONTinue
|       |       |       |       |       |       [:TEST]?
|       |       |       |       :WVDC
|       |       |       |       |       :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?
|       |       |       |       |       [:LEVel]           <number value>
|       |       |       |       |       [:LEVel]?
|       |       |       |       |       :LIMit
|       |       |       |       |       |       :ARC        <number value> | OFF
|       |       |       |       |       |       :ARC?
|       |       |       |       |       |       [:HIGH]     <number value>
|       |       |       |       |       |       [:HIGH]?
|       |       |       |       |       |       :LOW        <number value> | OFF
|       |       |       |       |       |       :LOW?
|       |       |       |       |       :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
| | | | | | | :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>*
| | | | | | | | | | :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 | CONTinue*
| | | | | | | [:TEST]?
| | | | | :OSC

```
|   |   |   |   |   :CHANnel
|   |   |   |   |   |   [:HIGH]   <channel list>
|   |   |   |   |   |   [:HIGH]?
|   |   |   |   |   |   :LOW      <channel list>
|   |   |   |   |   |   :LOW?
|   |   |   |   |   :CORRection
|   |   |   |   |   |   [:CAPacitance]
|   |   |   |   |   |   |   :OPEN
|   |   |   |   |   |   |   |   [:RANGe]
|   |   |   |   |   |   |   |   |   [:BEST]   <number value>
|   |   |   |   |   |   |   |   |   [:BEST]?
|   |   |   |   |   |   |   |   |   :ALL   <range 1>,<range 2>,<range 3>
|   |   |   |   |   |   |   |   |   :ALL?
|   |   |   |   |   |   |   |   :SAMPle    <range>,<number value>
|   |   |   |   |   |   |   |   :SAMPle?
|   |   |   |   |   :LIMit
|   |   |   |   |   |   [:OPEN]   <number value>
|   |   |   |   |   |   [:OPEN]?
|   |   |   |   |   |   :SHORt    <number value> | OFF
|   |   |   |   |   |   :SHORt?
|   |   |   |   :IWT
|   |   |   |   |   :NAME         <string data>
|   |   |   |   |   :NAME?
|   |   |   |   |   :CHANnel
|   |   |   |   |   |   [:HIGH]   <channel list>
|   |   |   |   |   |   [:HIGH]?
|   |   |   |   |   |   :LOW      <channel list>
|   |   |   |   |   |   :LOW?
|   |   |   |   :PAuse
|   |   |   |   |   [:MESSage]    <string data>
|   |   |   |   |   [:MESSage]?
|   |   |   |   |   :TIME
|   |   |   |   |   |   [:TEST]   <number value> | CONTinue
|   |   |   |   |   |   [:TEST]?
|   |   |   :SUB<n>
|   |   |   |   :DELete
|   |   |   |   :MODE?
|   |   |   |   :SET?
|   |   |   |   :WVAC
|   |   |   |   |   :CHANnel
|   |   |   |   |   |   [:HIGH]   <channel list>
|   |   |   |   |   |   [:HIGH]?
|   |   |   |   |   |   :LOW      <channel list>
|   |   |   |   |   |   :LOW?
|   |   |   |   |   :CORRection
|   |   |   |   |   |   [:CURRent]
|   |   |   |   |   |   |   :OPEN
|   |   |   |   |   |   |   |   [:RANGe]
|   |   |   |   |   |   |   |   |   [:BEST]   <number value>
|   |   |   |   |   |   |   |   |   [:BEST]?
|   |   |   |   |   |   |   |   |   :ALL   <range 1>,<range 2>
|   |   |   |   |   |   |   |   |   :ALL?
|   |   |   |   |   |   :RCURrent
|   |   |   |   |   |   |   :OPEN
|   |   |   |   |   |   |   |   [:RANGe]
|   |   |   |   |   |   |   |   |   [:BEST]   <number value>
|   |   |   |   |   |   |   |   |   [:BEST]?
```

```
|  |  |  |  |  |  |  |  |  :ALL  <range 1>,<range 2>
|  |  |  |  |  |  |  |  |  :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?
|  |  |  |  |  :TIME
|  |  |  |  |  |  :FALL  <number value> | OFF
|  |  |  |  |  |  :FALL?
|  |  |  |  |  |  :RAMP  <number value> | OFF
|  |  |  |  |  |  :RAMP?
|  |  |  |  |  |  [:TEST]  <number value> | CONTinue
|  |  |  |  |  |  [:TEST]?
|  |  |  |  :WVDC
|  |  |  |  |  :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?
|  |  |  |  |  [:LEVel]  <number value>
|  |  |  |  |  [:LEVel]?
|  |  |  |  |  :LIMit
|  |  |  |  |  |  :ARC  <number value> | OFF
|  |  |  |  |  |  :ARC?
|  |  |  |  |  |  [:HIGH]  <number value>
|  |  |  |  |  |  [:HIGH]?
|  |  |  |  |  |  :LOW  <number value> | OFF
|  |  |  |  |  |  :LOW?
|  |  |  |  |  :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
| | | | | | | :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>*
| | | | | | | | | | :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 | CONTinue
|     |     |     |     |     |     [:TEST]?
|     |     |     |     :OSC
|     |     |     |     |     :CHANnel
|     |     |     |     |     |     [:HIGH]    <channel list>
|     |     |     |     |     |     [:HIGH]?
|     |     |     |     |     |     :LOW       <channel list>
|     |     |     |     |     |     :LOW?
|     |     |     |     |     :CORRection
|     |     |     |     |     |     [:CAPacitance]
|     |     |     |     |     |     |     :OPEN
|     |     |     |     |     |     |     |     [:RANGe]
|     |     |     |     |     |     |     |     |     [:BEST]   <number value>
|     |     |     |     |     |     |     |     |     [:BEST]?
|     |     |     |     |     |     |     |     |     :ALL   <range 1 >,<range 2 >,<range 3>
|     |     |     |     |     |     |     |     |     :ALL?
|     |     |     |     |     |     |     |     :SAMPle     <range>,<number value>
|     |     |     |     |     |     |     |     :SAMPle?
|     |     |     |     |     :LIMit
|     |     |     |     |     |     [:OPEN]    <number value>
|     |     |     |     |     |     [:OPEN]?
|     |     |     |     |     |     :SHORt     <number value> | OFF
|     |     |     |     |     |     :SHORt?
|     |     |     |     :IWT
|     |     |     |     |     :NAME           <string data>
|     |     |     |     |     :NAME?
|     |     |     |     |     :CHANnel
|     |     |     |     |     |     [:HIGH]    <channel list>
|     |     |     |     |     |     [:HIGH]?
|     |     |     |     |     |     :LOW       <channel list>
|     |     |     |     |     |     :LOW?
|     |     |     |     :PAuse
|     |     |     |     |     [:MESSage]     <string data>
|     |     |     |     |     [:MESSage]?
|     |     |     |     |     :TIME
|     |     |     |     |     |     [:TEST]    <number value> | CONTinue
|     |     |     |     |     |     [:TEST]?
```

8.5.2 Command Description

- **IEEE 488.2 Command**

***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 command of read back.
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 command of save.
This command is to save 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 Command**

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

:MEMory:NSTates?
It queries the capacity of main memory. The value returned is one greater than the maximum that can be sent as a parameter to the *SAV and *RCL commands.

:SYSTem:ERRor[:NEXT]?
This command reads the messages in Error Queue. See Section 6.6 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 Scanner 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 ***RESTart*** **|** ***CONTinue*** **|** ***STOP***
It sets the action after the test step is judged as FAIL.
When set to *RESTart*, it will stop test after detected FAIL without pressing [STOP] and press [START] can begin the test.
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.

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

:SYSTem:TCONtrol:FTERminal ***<boolean>*** **|** ***ON*** **|** ***OFF***
It enables the DCR 4-wire measurement function.

:SYSTem:TCONtrol:FTERminal?
It queries if the DCR 4-wire measurement function is enabled.

: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: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*** **|** ***AUTO***
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] 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:WVAC:FREQuency *<numeric value>*
It sets the output voltage frequency when under AC withstand voltage test.

:SYSTem:TCONtrol:WVAC: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]:SAFety:FETCh? *[<item>] [, <item>]*
It queries the measurement result of the Scanner. <item> is string as listed below:

String	Returned Data
STEP	The present STEP No.
MODE	The present MODE
OMETerage	The present reading of output meter (DCR resistance reading)
MMETerage	The present reading of measure meter (The resistance after DCR temperature compensation.)
RMETerage	The present reading of real current meter (Environment temperature when in DCR.)

RELApsed	The time executed for RAMP
RLEAve	The time remained for RAMP
DELApsed	The time executed for DWELL
DLEAve	The time remained for DWELL
TELApsed	The time executed for TEST
TLEAve	The time remained for TEST
FELapsed	The time executed for FALL
FLEave	The time remained for FALL

[: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 as below:

19035 Judgment Code

Mode	WVAC		WVDC		IR		DCR		OSC		IWT		ALL	
Code	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
UNCOMPLETED													**70**	**112**
ABORT													**71**	**113**
VOLTAGE IS 0													**72**	**114**
TESTING													**73**	**115**
PASS/SKIPPED /COMPLETED													**74**	**116**
HIGH FAIL	21	33	31	49	41	65	11	17						
LOW FAIL	22	34	32	50	42	66	12	18						
ARC FAIL	23	35	33	51										
REAL FAIL	2A	42												
PROBE FAIL							14	20						
OUTPUT FAIL	21	33	31	49	42	66								
GFI FAIL	24	36	34	52	44	68								
SHORT	24	36	34	52	44	68			61	97				
OPEN									62	98				
IWT FAIL											51	81		
DWX ERROR											54	84		

Note: Since the DCR Balance Fail is the 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:MMETerage?
It queries the MEASURE METER readings of all STEPs. It is the temperature compensated resistance in DCR mode. If temperature compensation is not enabled, it will be resistance reading.

[:SOURce]:SAFety:RESult:ALL:RMETerage?
It queries the REAL CURRENT METER readings of all STEPs. It is the environment temperature when in DCR mode.

[:SOURce]:SAFety:RESult:ALL:MODE?
It queries the MODE of all STEPs and returns string.
WVAC|WVDC|IR|DCR|OSC|IWT|PA.

[:SOURce]:SAFety:RESult:ALL:OMETerage?
It queries the OUTPUT METER readings of all STEPs. It is the resistance reading when in DCR mode.

[: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: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: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][:JUDGment]?
[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>[:JUDGment]?
It queries the judgment result of selected STEP. <s> is the value data, 1 means A, 2 means B and so forth. For instance, :SOURce:SAFety:RESult: STEP1:SUB2:JUDGment? means to query the judgment result of STEP 1.B.

[:SOURce]:SAFety:RESult:STEP<n>[:MAIN]:MMETerage?
[:SOURce]:SAFety:RESult:STEP<n>:SUB<s>:MMETerage?
It queries the MEASURE METER readings of selected STEP.

[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:RMETerage?
[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:RMETerage?
It queries the REAL CURRENT METER readings of selected STEP.

[:SOURce]:SAFety:RESult: STEP<n>[:MAIN]:OMETerage?
[:SOURce]:SAFety:RESult: STEP<n>:SUB<s>:OMETerage?
It queries the OUTPUT METER readings of selected STEP.

[: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:SNUMber?
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.

[: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. <s> is a numeric data, in which 1 means A, 2 indicates B so forth. Ex: SOURce:SAFety:STEP2:SUB3:DELete means to delete the STEP of 2.C.

[: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 WVAC, WVDC, IR, DCR, OSC, IWT and PA.

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

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

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

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

[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]*<number value>*
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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 ~ 0.03A. 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]:WVAC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:CORRection[:CURRent]:OPEN[:RANGe]:ALL *<range 1>,<range 2>*
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:CORRection[:CURRent]:OPEN[:RANGe]:ALL *<range 1>,<range 2>*
It sets the open 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 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]:WVAC:CORRection[:CURRent]:OPEN[:RANGe]:ALL?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:CORRection:RCURrent:OPEN[:RANGe][:BEST] ***<number value>***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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 ~ 0.03A. 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]:WVAC:CORRection:RCURrent:OPEN[:RANGe][:BEST]?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:CORRection:RCURrent:OPEN[:RANGe]:ALL ***<range 1>,<range 2>***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:CORRection:RCURrent:OPEN[:RANGe]:ALL ***<range 1>,<range 2>***
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]:WVAC[:LEVel] ***<numeric value>***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC[:LEVel] ***<numeric value>***
It sets the required voltage during withstand voltage AC test for the selected STEP. The unit is volt.

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

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

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

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

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

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

[:SOURce]:SAFety:STEP<n>[:MAIN]:WVAC:TIME:FALL ***<numeric value>*** **|** ***OFF***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:TIME:FALL?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:TIME:RAMP ***<numeric value>*** **|** ***OFF***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:TIME:RAMP?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:TIME[:TEST] ***<numeric value>*** **|** ***CONTinue***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC: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]:WVAC:TIME[:TEST]?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVAC:TIME[:TEST]?
It queries the time required for test for the selected STEP. The unit is second.

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

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

[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]*<number value>*
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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 ~ 0.01A. 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]:WVDC:CORRection[:CURRent]:OPEN[:RANGe][:BEST]?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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]:WVDC:CORRection[:CURRent]:OPEN[:RANGe]:ALL ***<range 1>,<range 2>,<range 3>***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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 ~ 0.01A. 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]:WVDC:CORRection[:CURRent]:OPEN[:RANGe]:ALL?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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]:WVDC[:LEVel] ***<numeric value>***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC[:LEVel] ***<numeric value>***
It sets the voltage required during withstand voltage DC test for the selected STEP. The unit is volt.

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

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

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

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

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

[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:TIME:DWELI ***<numeric value>*** **|** ***OFF***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:TIME:DWELI ***<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]:WVDC:TIME:DWELI?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC:TIME:DWELI?
It queries the time required for DWELL for the selected STEP. The unit is second.

[:SOURce]:SAFety:STEP<n>[:MAIN]:WVDC:TIME:FALL ***<numeric value>*** **|** ***OFF***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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]:WVDC:TIME:FALL?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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]:WVDC:TIME:RAMP ***<numeric value>*** **|** ***OFF***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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]:WVDC:TIME:RAMP?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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]:WVDC:TIME[:TEST] ***<numeric value>*** **|** ***CONTinue***
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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]:WVDC:TIME[:TEST]?
[:SOURce]:SAFety:STEP<n>:SUB<s>:WVDC: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 ~ 0.01A. 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 ~ 0.01A. 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: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>***
[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:CORRection[:RESistance]:SHORt[:RANGe]:ALL ***<range 1>,<range 2>,<range 3>,<range 4>,<range 5>,<range 6>***
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*** **|** ***CONTinue***
[:SOURce]:SAFety:STEP<n>:SUB<s>:DCR:TIME[:TEST] ***<numeric value>*** **|** ***OFF*** **|** ***CONTinue***
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 CONTinue.

[: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 is set to OFF, the return value is 9.91E37, and when DCR is set to CONTinue, the return value is 0.

[: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 ~ 500nF. 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>,<range 3>***
[:SOURce]:SAFety:STEP<n>:SUB<s>:OSC:CORRection[:CAPacitance]:OPEN[:RANGe]:ALL ***<range 1>,<range 2>,<range 3>***
It sets the open capacitance of each range for the selected STEP. The unit is farad and the valid range is 0 ~ 500nF. 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, 2 or 3. 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	0.001nF	5nF
2	0.01nF	50nF
3	0.1nF	500nF

[: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 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]:IWT:NAME <*string data*>
[:SOURce]:SAFety:STEP<n>:SUB<s>:IWT:NAME <*string data*>
It sets the filename saved in the memory of ECG DWX-05/10 for the selected STEP. See ECG DWX-05/10 manual for its format.

[SOURce]:SAFety:STEP<n>[:MAIN]:IWT:NAME?
[SOURce]:SAFety:STEP<n>:SUB<s>:IWT:NAME?
It queries the filename from the ECG DWX-05/10 memory for 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]:PA[:MESSage] *<string>*
[:SOURce]:SAFety:STEP<n>:SUB<s>:PA[:MESSage] *<string>*
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>* | *CONTinue*
[:SOURce]:SAFety:STEP<n>:SUB<s>:PA:TIME[:TEST] *<numeric value>* | *CONTinue*
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.

8.6 Error Messages

- The error messages stored in error queue will be returned in the way of first in first out (FIFO) which means the first error message returned is the first one being saved.
- When error messages exceed 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
-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
-292 Referenced name does not exist
-293 Referenced name already exist
-350 Queue overflow
-363 Input buffer overrun
-410 Query INTERRUPTED
-420 Query UNTERMINATED

9. Calibration Procedure

Before performing the calibration procedure listed in this chapter, the Scanner should be warmed up for at least 30 minutes. Remove the top cover and press down the calibration switch (SW102) on the KEY BOARD inside the front panel. This switch has hardware protection circuit to prevent the calibration data from loss.

Following are the items must be calibrated:

Voltage Calibration (see Section 9.2)

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

Current Calibration (see Section 9.3)

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
ACA30mA Offset (2.4mA)	; AC total current 30mA range OFFSET point
RACA 30mA Offset (2.4mA)	; AC real current 30mA range OFFSET point
ACA 30mA Full (12mA)	; AC total current 30mA range FULL point
RACA 30mA Full (12mA)	; AC real current 30mA 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 10mA Offset (2.4mA)	; DC 10mA range OFFSET point
DCA 10mA Full (4.8mA)	; DC 10mA range FULL point

Insulation Resistance Calibration (see Section 9.4)

IRR GET OFFSET	; IR Resistor Offset Calibration
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 9.5)
DC Resistance Calibration (DCR 4-Terminal Model, see Section 9.5.1)

DCR GET SHORT	; DCR Resistor Short Calibration
DCR 1Ω OFFSET (100mΩ)	; DCR Resistor 1Ω OFFSET point
DCR 1Ω FULL (900mΩ)	; DCR Resistor 1Ω FULL point
DCR 10Ω OFFSET (0.9Ω)	; DCR Resistor 10Ω OFFSET point
DCR 10Ω FULL (9Ω)	; DCR Resistor 10Ω FULL point
DCR 100Ω OFFSET (9Ω)	; DCR Resistor 100Ω OFFSET point

DCR 100Ω FULL (90Ω) ; DCR Resistor 100Ω FULL point
DCR 1kΩ OFFSET (0.09kΩ) ; DCR Resistor 1kΩ OFFSET point
DCR 1kΩ FULL (0.9kΩ) ; DCR Resistor 1kΩ FULL point
DCR 10kΩ OFFSET (0.9kΩ) ; DCR Resistor 10kΩ OFFSET point
DCR 10kΩ FULL (9kΩ) ; DCR Resistor 10kΩ FULL point
DCR 100kΩ OFFSET (9kΩ) ; DCR Resistor 100kΩ OFFSET point
DCR 100kΩ FULL (90kΩ) ; DCR Resistor 100kΩ FULL point

DC Resistance Calibration (DCR 2-Terminal Model, see Section 9.5.2)

DCR GET SHORT ; DCR Resistor Short Calibration
DCR 10Ω OFFSET (0.9Ω) ; DCR Resistor 10Ω OFFSET point
DCR 10Ω FULL (9Ω) ; DCR Resistor 10Ω FULL point
DCR 100Ω OFFSET (9Ω) ; DCR Resistor 100Ω OFFSET point
DCR 100Ω FULL (90Ω) ; DCR Resistor 100Ω FULL point
DCR 1kΩ OFFSET (0.09kΩ) ; DCR Resistor 1kΩ OFFSET point
DCR 1kΩ FULL (0.9kΩ) ; DCR Resistor 1kΩ FULL point
DCR 10kΩ OFFSET (0.9kΩ) ; DCR Resistor 10kΩ OFFSET point
DCR 10kΩ FULL (9kΩ) ; DCR Resistor 10kΩ FULL point
DCR 100kΩ OFFSET (9kΩ) ; DCR Resistor 100kΩ OFFSET point
DCR 100kΩ FULL (0kΩ) ; DCR Resistor 100kΩ FULL point

ARC Calibration (see Section 9.6)

AC ARC 15mA (7mA) ; AC ARCing Calibration
DC ARC 10mA (5mA) ; DC ARCing Calibration

9.1 Entering Calibration Screen

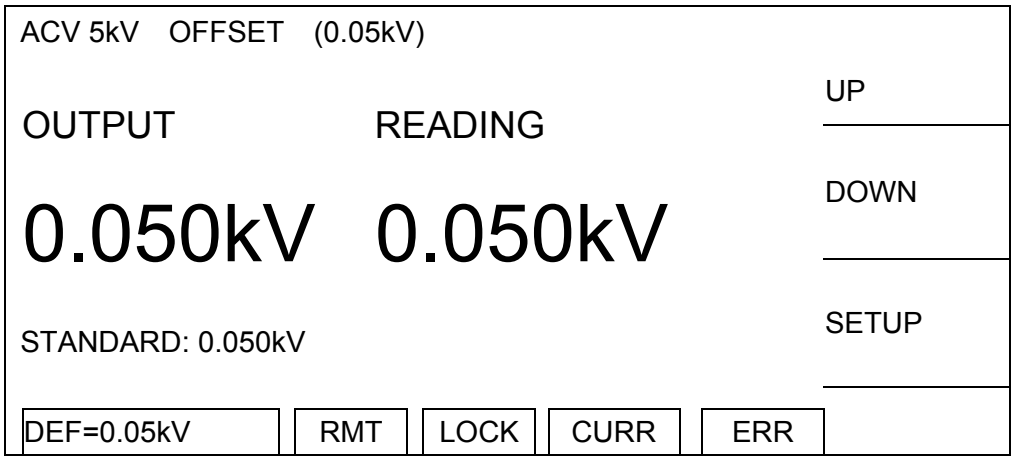
Press **SYSTEM**
Select CALIBRATION
Press **ENTER**
Display ENTER CAL. PASSWORD:
Press Function Key [A] [A] [A] [B] **ENTER** to enter into a calibration mode.

9.2 Voltage Calibration

9.2.1 Calibrating ACV

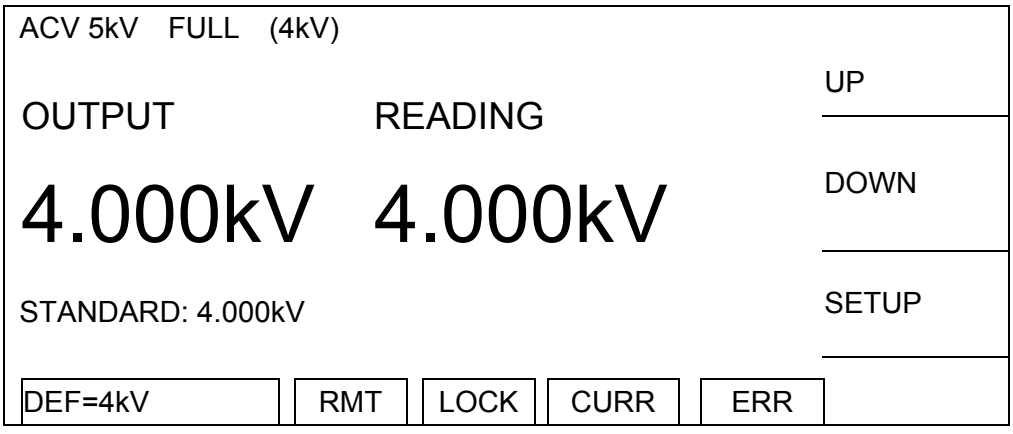
■ **Connect an ACV high voltage meter to the Scanner with high voltage terminal connected to CH1 and low voltage terminal connected to RETURN/LOW.**

ACV 5kV OFFSET (0.05kV) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACV 5kV FULL (4kV) calibration.

ACV 5kV FULL (4kV) Calibration Screen:

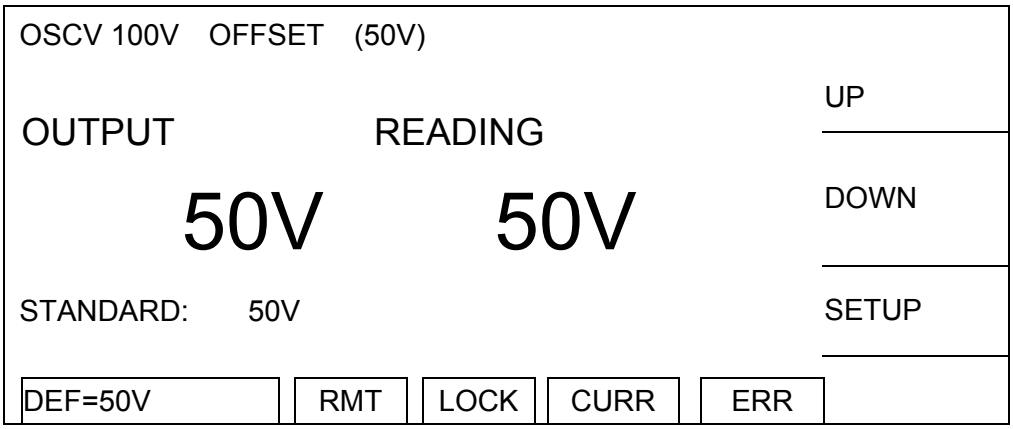


1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.

5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to OSCV 100V OFFSET (50V) calibration.

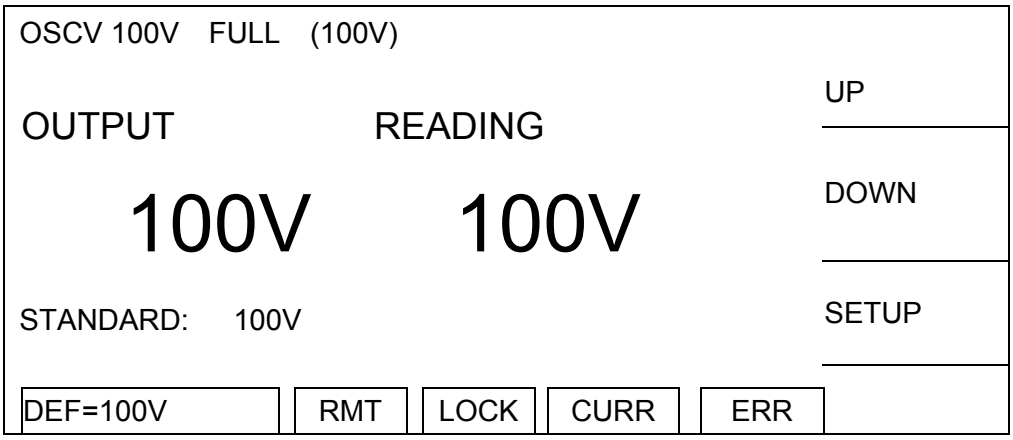
9.2.2 Calibrating OSCV

OSCV 100V OFFSET (50V) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to OSCV 100V FULL (100V) calibration.

OSCV 100V FULL (100V) Calibration Screen:

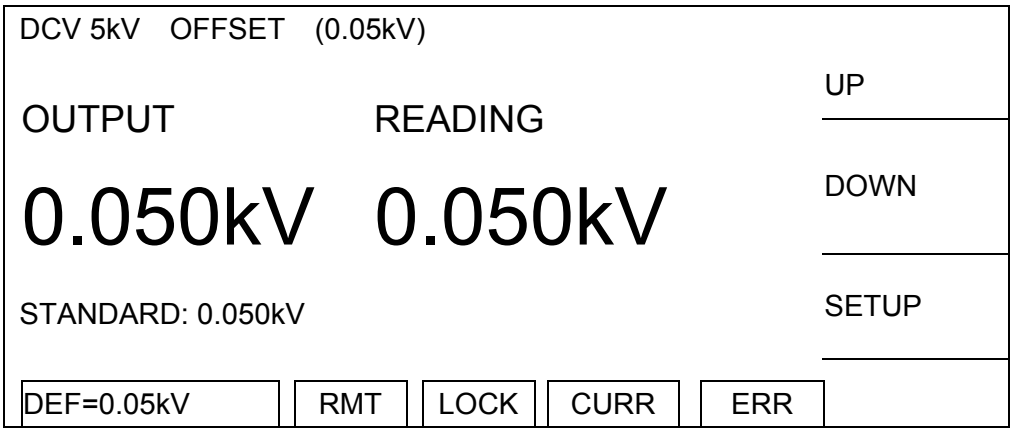


1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to OSCV 100V FULL (100V) calibration.

9.2.3 Calibrating DCV

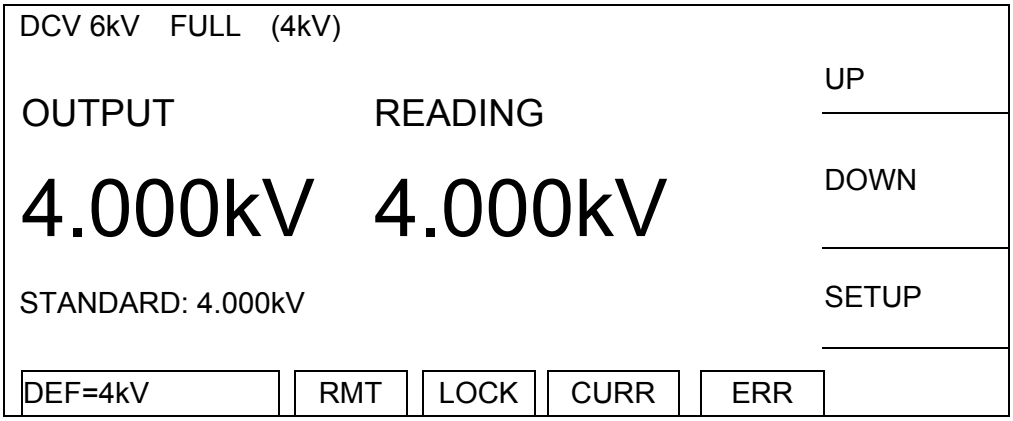
■ **Connect a DCV high voltage meter to this Scanner with high voltage terminal connected to CH1 and low voltage terminal connected to RETURN/LOW.**

DCV 6kV OFFSET (0.05kV) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCV 6kV FULL (4kV) calibration.

DCV 6kV FULL (4kV) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the high voltage meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from high voltage meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 3mA OFFSET (0.12mA) calibration.

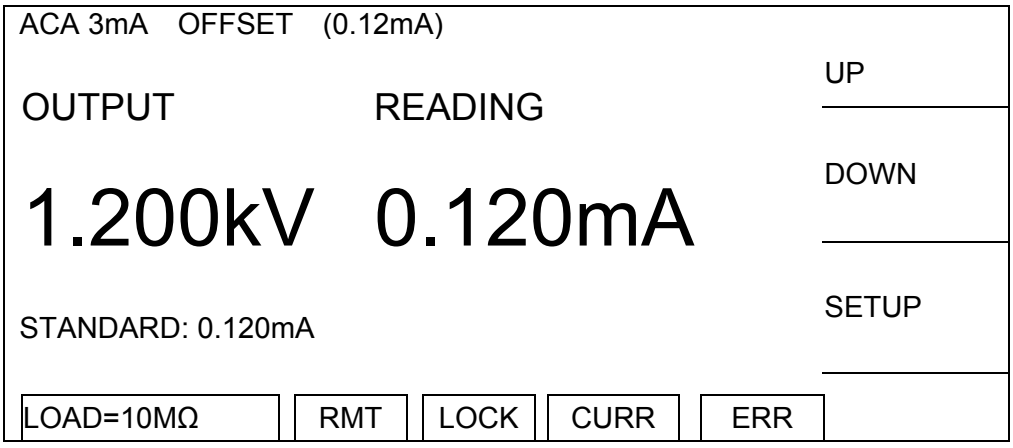
9.3 Current Calibration

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

9.3.1 Calibrating ACA Current

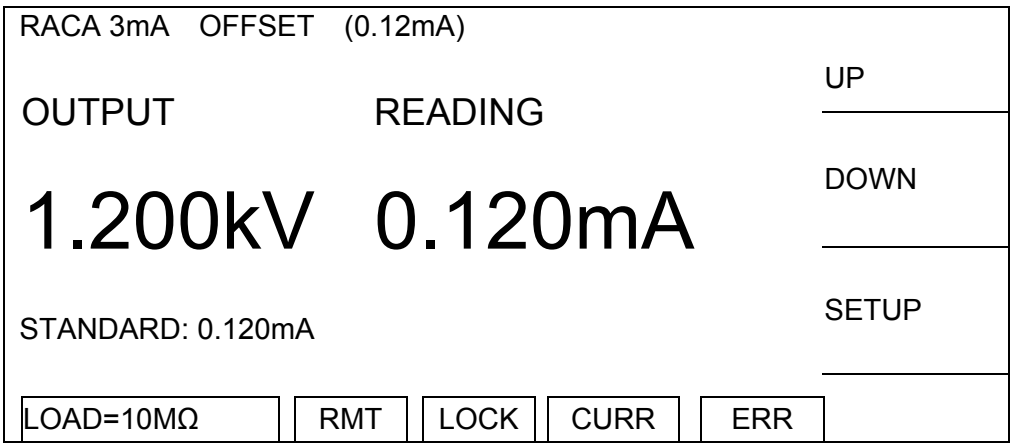
■ **Connect a 10MΩ 0.5 Watt or high power simulated load resistance in between the high voltage output terminal (CH1) of this Scanner and the high potential terminal of AC meter, also connect the low potential terminal (RETURN/LOW) of this Scanner to the low potential terminal of AC meter.**

ACA 3mA OFFSET (0.12mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to RACA 3mA OFFSET (0.12mA) calibration.

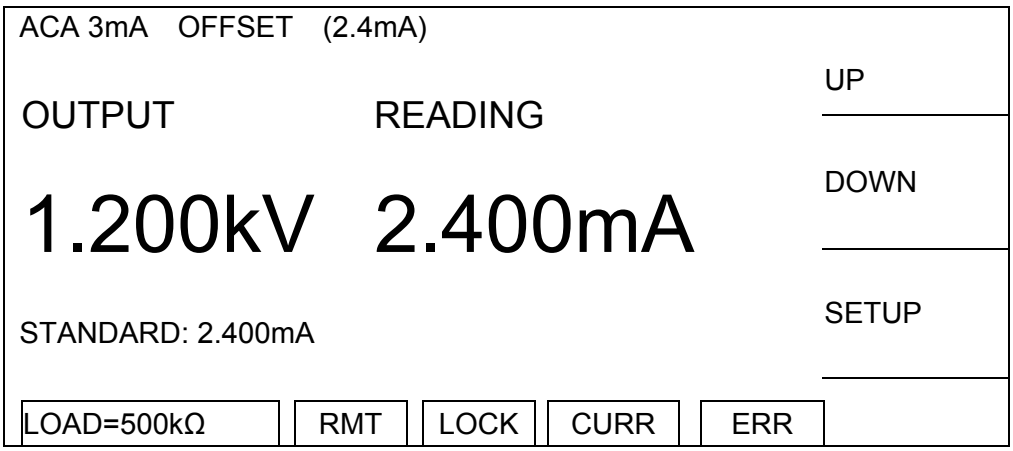
RACA 3mA OFFSET (0.12mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 3mA FULL (2.4mA) calibration.

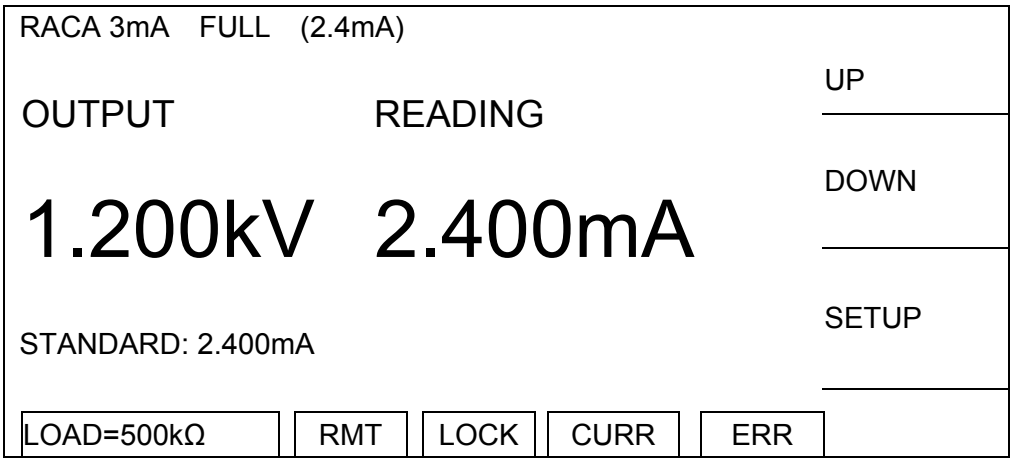
■ **Change the simulated load resistance to 500kΩ 10watt or higher power.**

ACA 3mA FULL (2.4mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to RACA 3mA FULL (2.4mA) calibration.

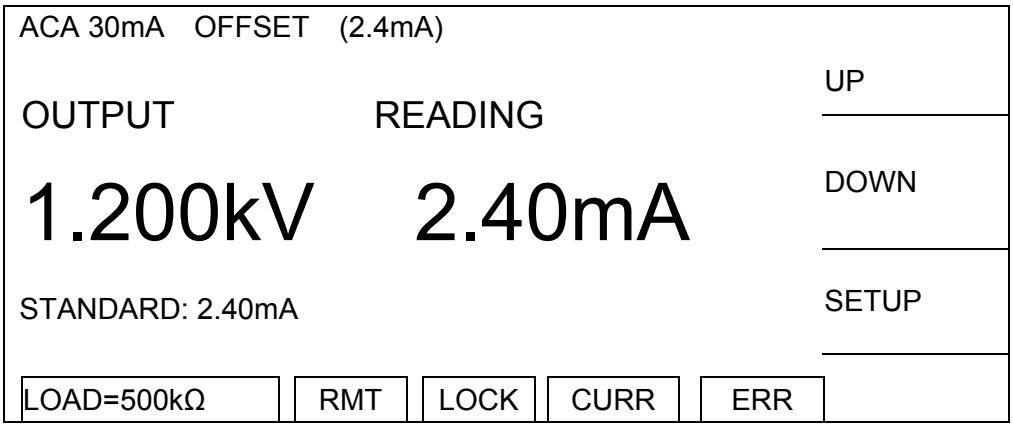
RACA 3mA FULL (2.4mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.

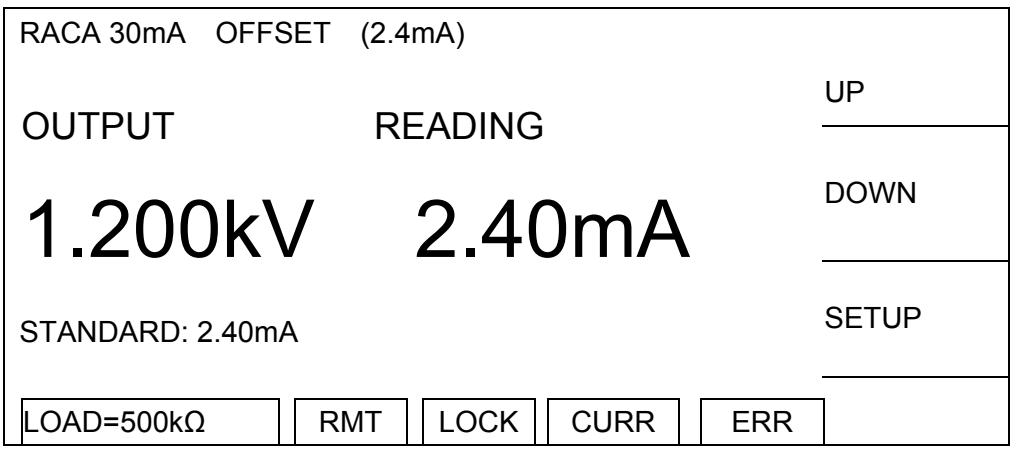
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 30mA OFFSET (2.4mA) calibration.

ACA 30mA FULL (2.4mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to RACA 30mA OFFSET (2.4mA) calibration.

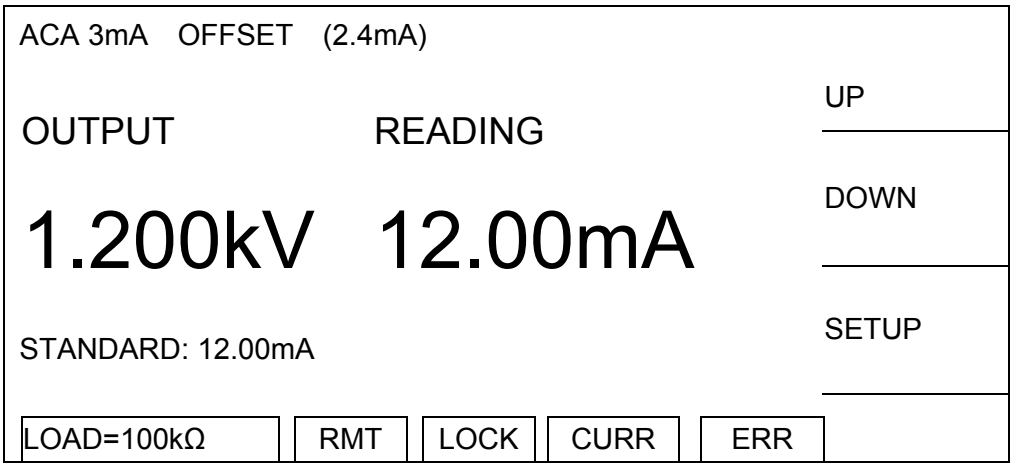
RACA 30mA OFFSET (2.4mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to ACA 30mA FULL (12mA) calibration.

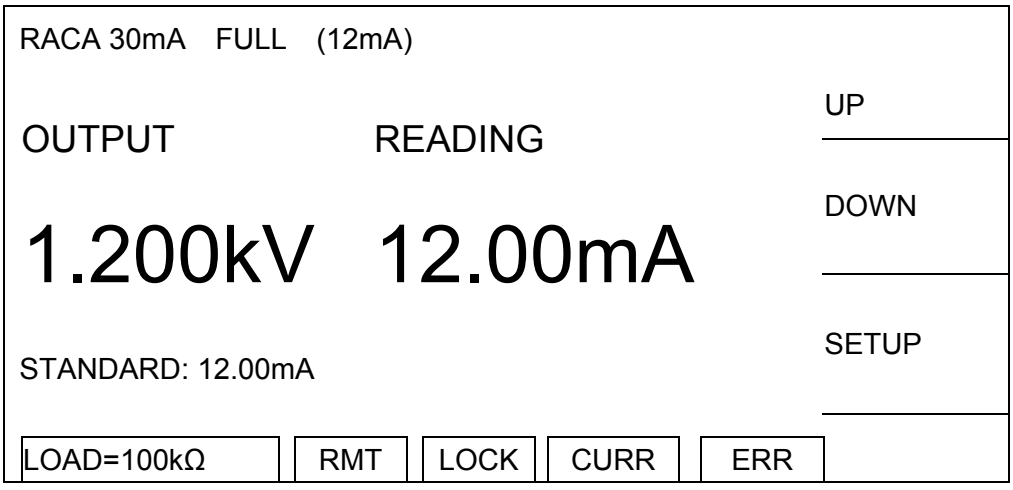
■ **Change the simulated load resistance to 100kΩ 50watt or higher power.**

ACA 3mA FULL (12mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to RACA 30mA FULL (12mA) calibration.

RACA 30mA FULL (12mA) Calibration Screen:

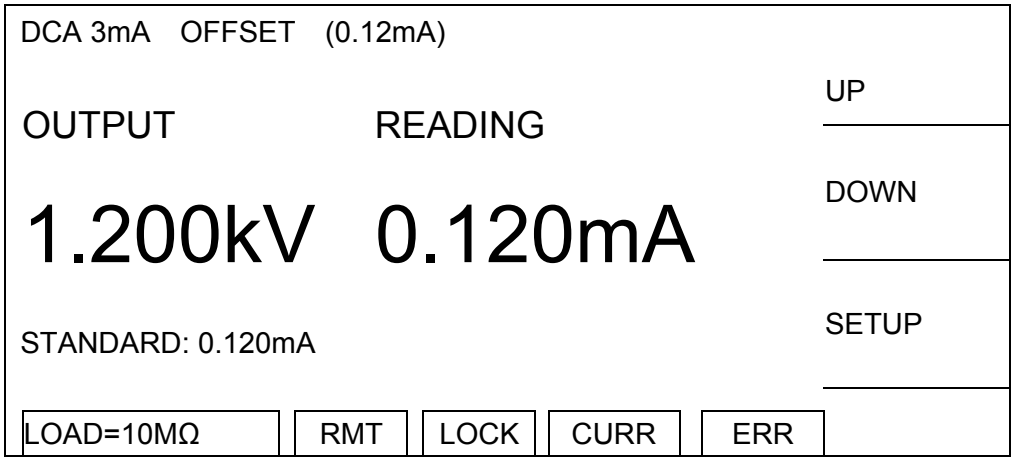


1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the AC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from AC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 3mA OFFSET (0.12mA) calibration.

9.3.2 Calibrating DCA Current

■ **Connect a 10MΩ 0.5 Watt or high power simulated load resistance in between the high voltage output terminal (CH1) of this Scanner and the high potential terminal of DC meter, also connect the low potential terminal (RETURN/LOW) of this Scanner to the low potential terminal of DC meter.**

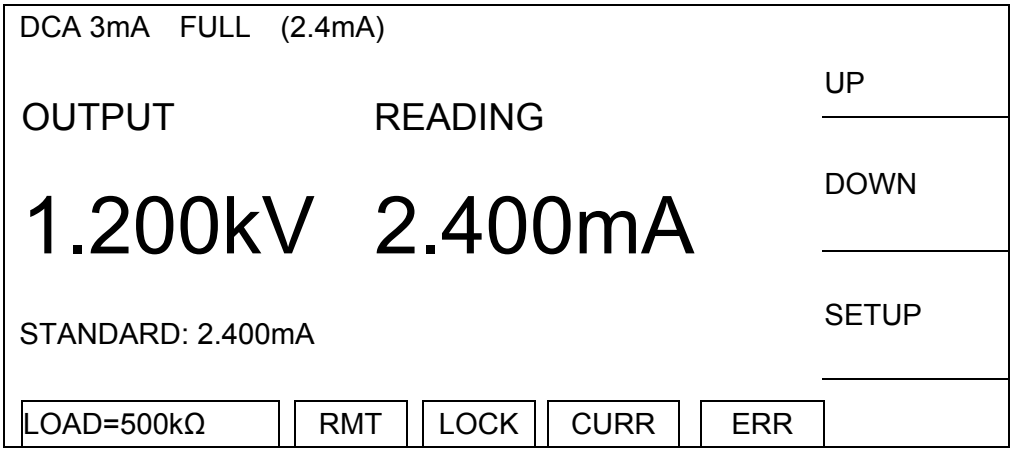
DCA 3mA OFFSET (0.12mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 3mA FULL (2.4mA) calibration.

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

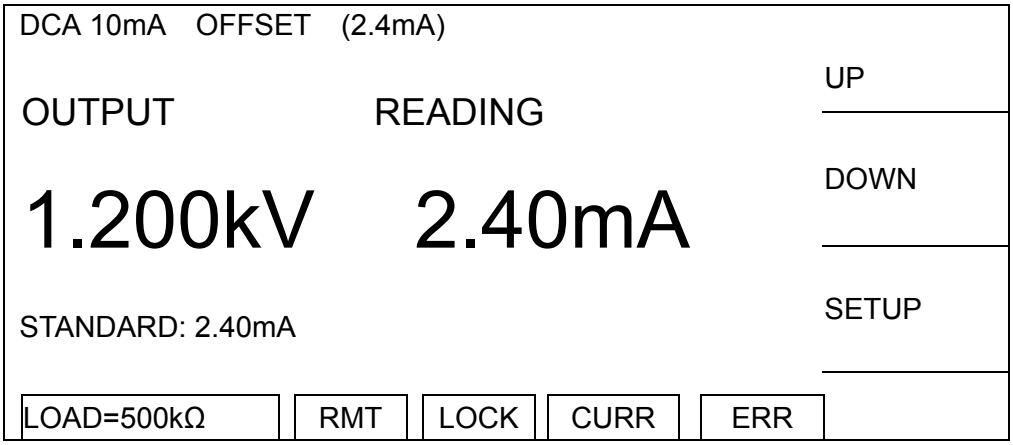
DCA 3mA FULL (2.4mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.

4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 10mA OFFSET (2.4mA) calibration.

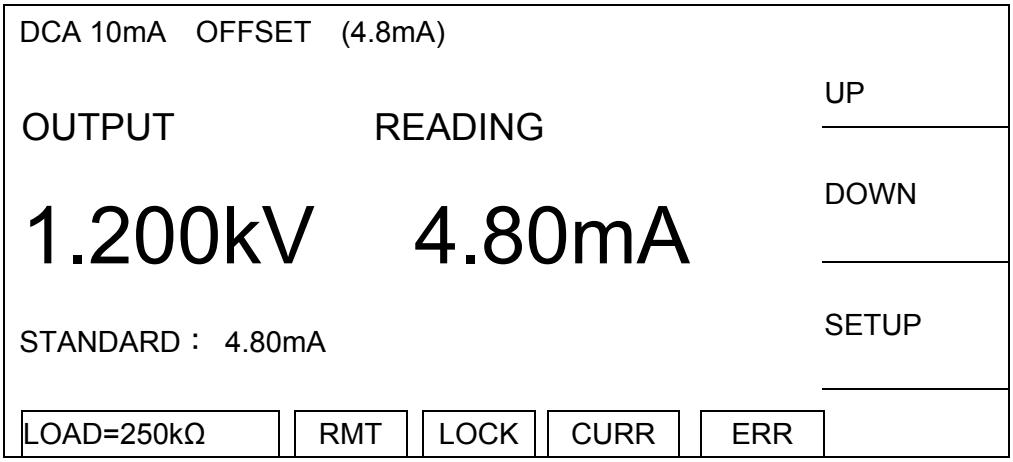
DCA 10mA OFFSET (2.4mA) Calibration Screen:



1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to DCA 10mA FULL (4.8mA) calibration.

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

DCA 10mA FULL (4.8mA) Calibration Screen:

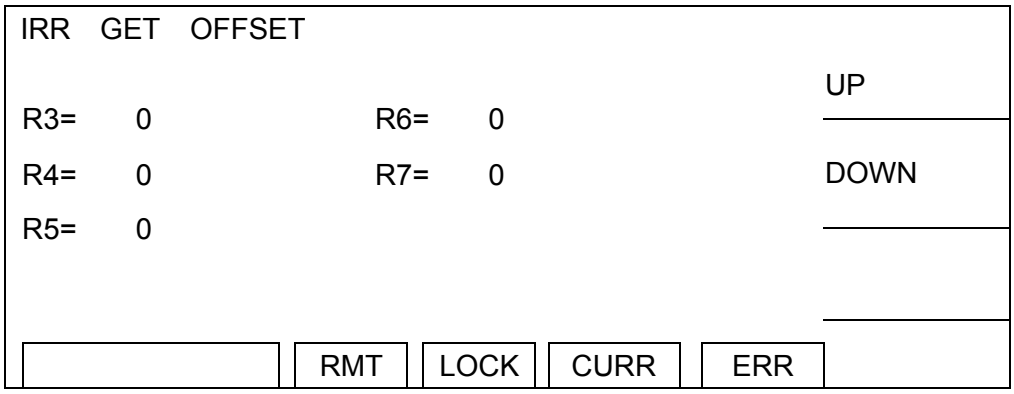


1. Press Function Key [SETUP] to change the output voltage.
2. Press **START** to output voltage and read data from the DC meter.
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the reading from DC meter.
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press Function Key [DOWN] to go to IRR GET OFFSET calibration.

9.4 Insulation Resistance (IR) Calibration

■ **Do not connect the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) to any DUT or wires for the following calibration procedure.**

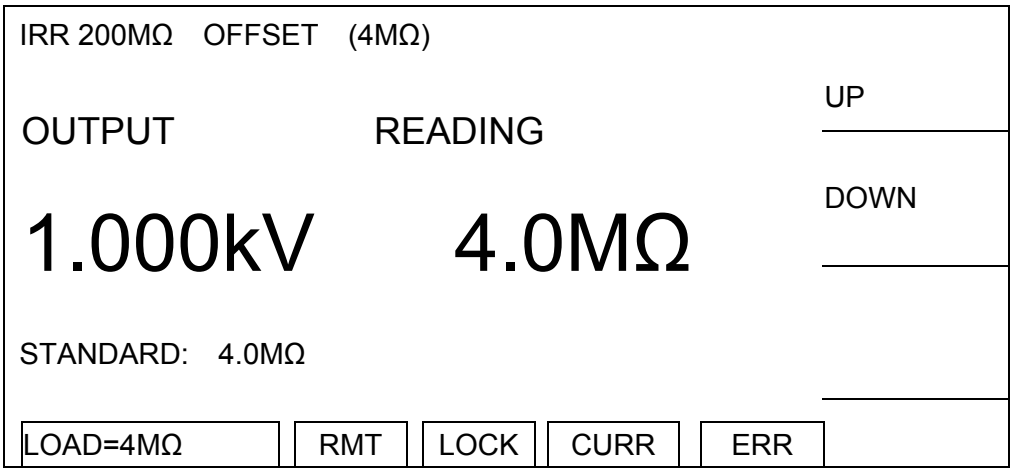
IRR GET OFFET Calibration Screen:



1. Press **START** to begin IR GET OFFET.
2. When the status line at the lower left corner shows [COMPLETED], it indicates the OFFSET calibration is done.
3. Press Function Key [DOWN] to go to IRR 200MΩ OFFSET (4MΩ) calibration.

■ **Connect a 4MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

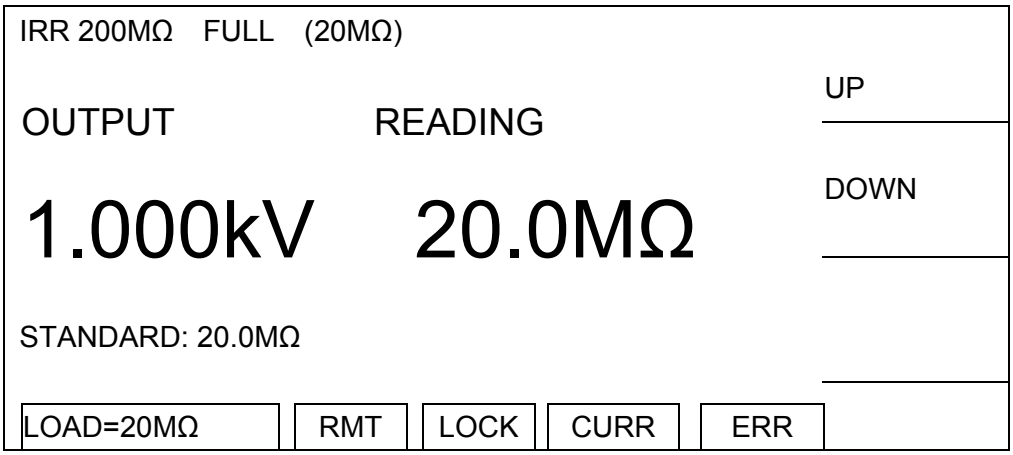
IRR 200MΩ OFFSET (4MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 200MΩ FULL (20MΩ) calibration.

■ **Connect a 20MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

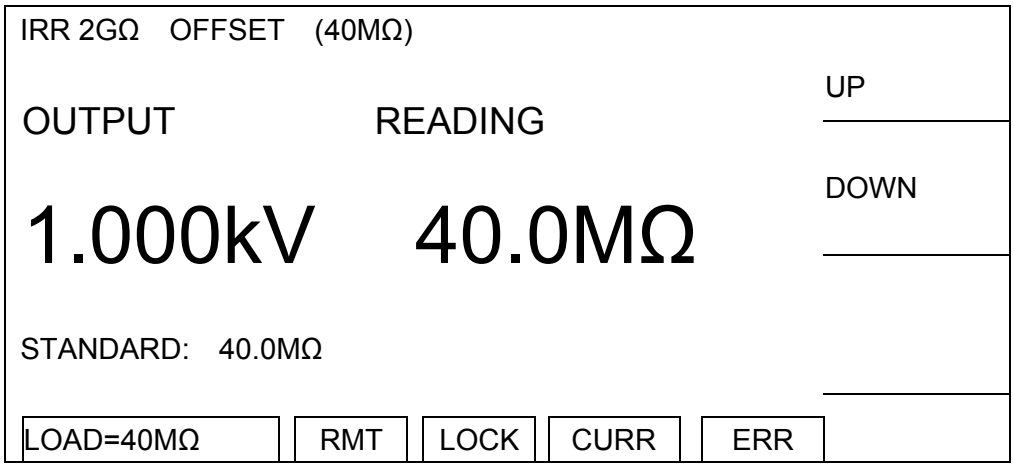
IRR 200MΩ FULL (20MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 2GΩ OFFSET (40MΩ) calibration.

■ **Connect a 40MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

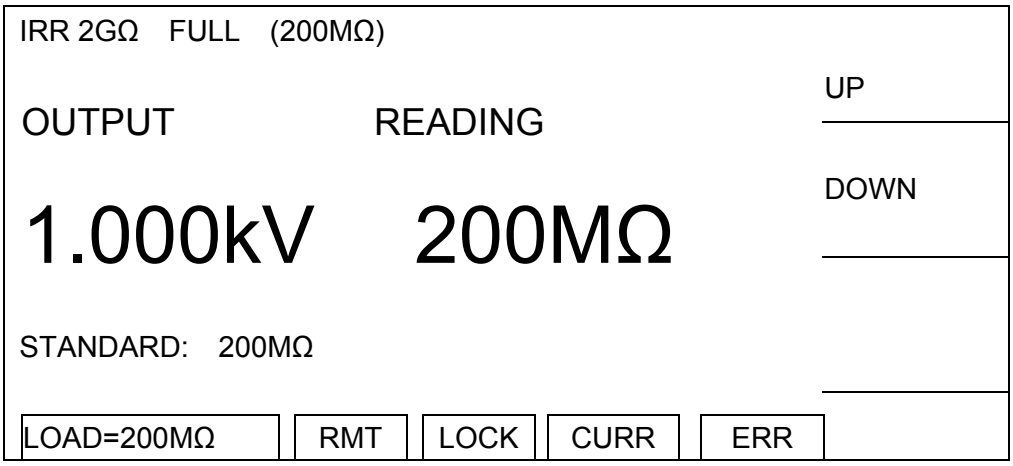
IRR 2GΩ OFFSET (40MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 2GΩ FULL (200MΩ) calibration.

■ **Connect a 200MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

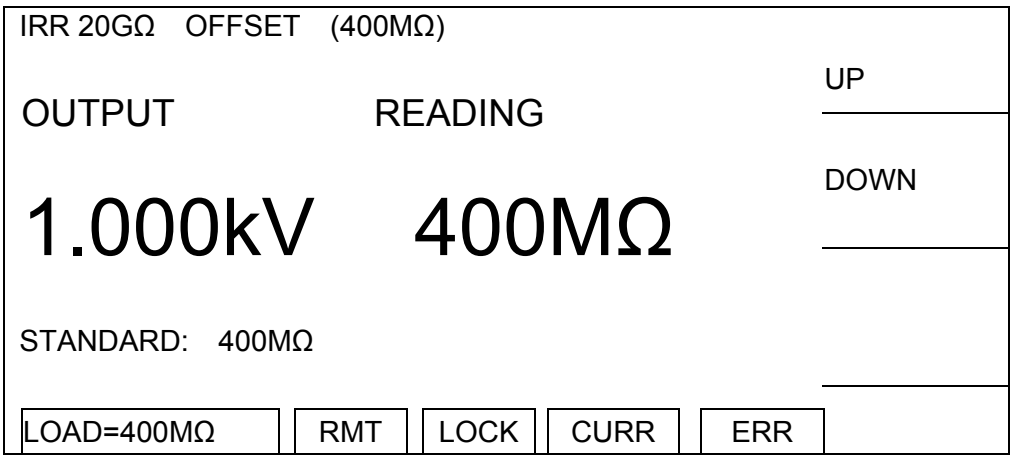
IRR 2GΩ FULL (200MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 20GΩ OFFSET (400MΩ) calibration.

■ **Connect a 400MΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

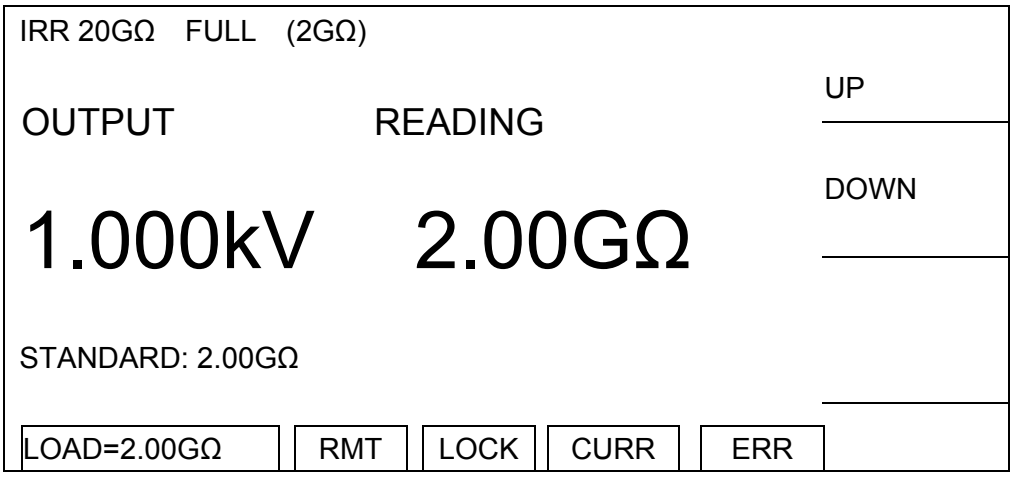
IRR 20GΩ OFFSET (400MΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 20GΩ FULL (2GΩ) calibration.

■ **Connect a 2GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

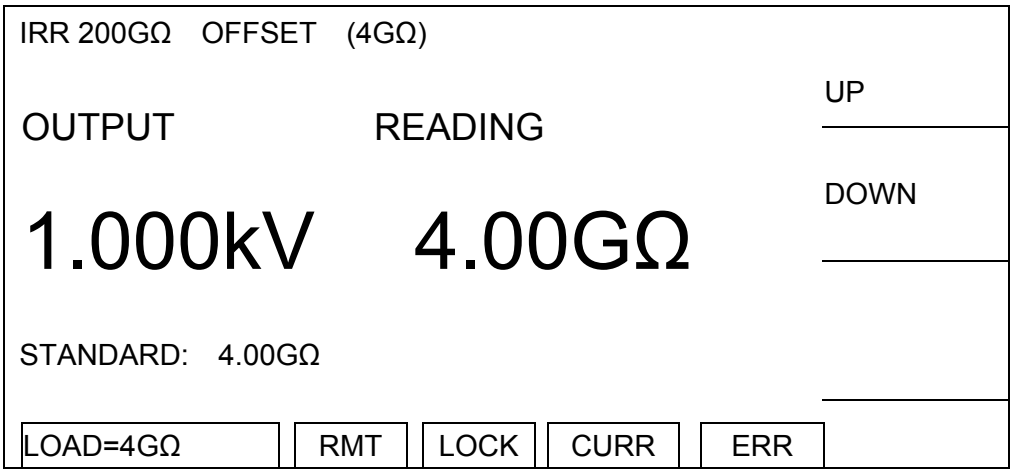
IRR 20GΩ FULL (2GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 200GΩ OFFSET (4GΩ) calibration.

■ **Connect a 4GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

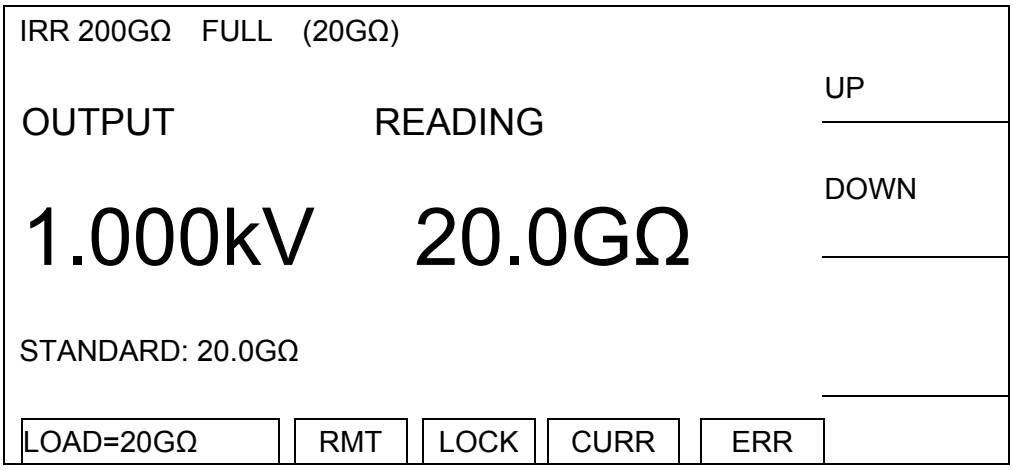
IRR 200GΩ OFFSET (4GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 200GΩ FULL (20GΩ) calibration.

■ **Connect a 20GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

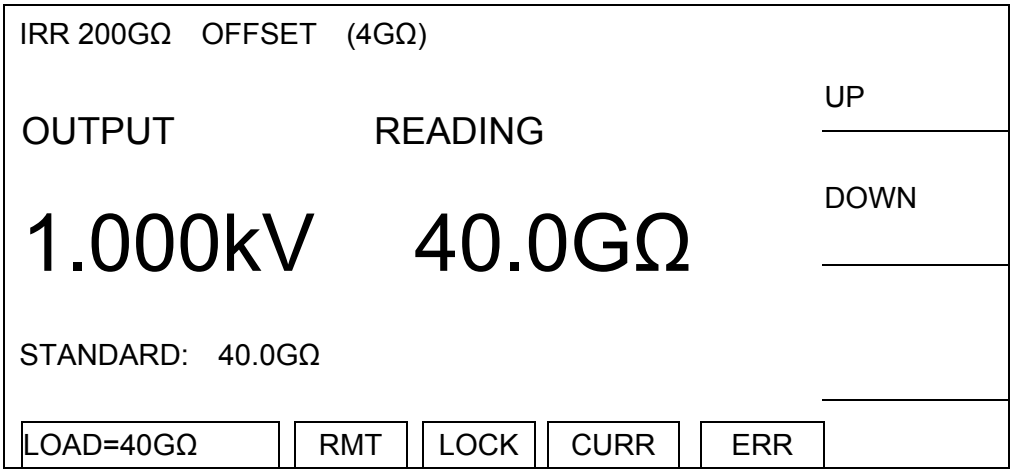
IRR 200GΩ FULL (20GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 550GΩ OFFSET (40GΩ) calibration.

■ **Connect a 40GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

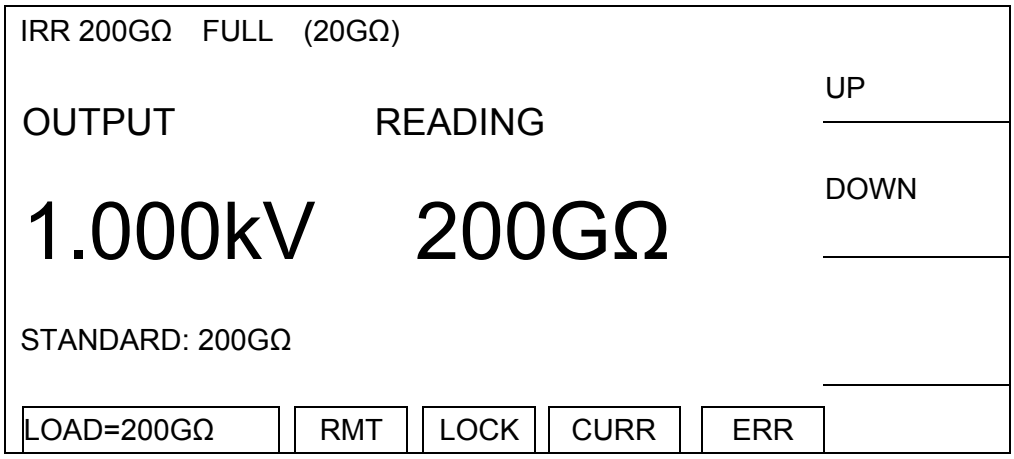
IRR 550GΩ OFFSET (40GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to IRR 200GΩ FULL (20GΩ) calibration.

■ **Connect a 200GΩ standard resistance in between the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) of the Scanner.**

IRR 550GΩ FULL (200GΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR GET SHORT calibration.

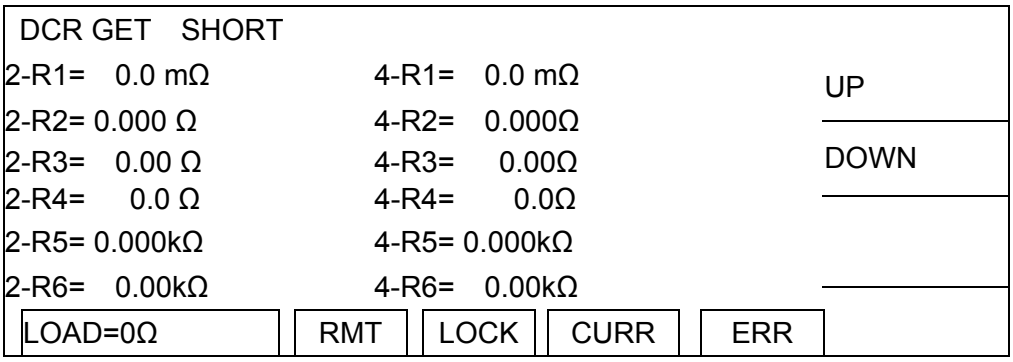
9.5 DC Resistance Calibration

(1) 19035 DCR 4-Terminal Model Calibration, see Section 9.5.1.
(2) 19035 DCR 2-Terminal Model Calibration, see Section 9.5.2.
(3) 19035-M Model Calibration, see Section 9.5.3.

9.5.1 DC Resistance Calibration (19035 DCR 4-Terminal)

■ **Use test wire to short circuit the output terminal (CH1), CH2, CH3 and CH4 for the following calibration procedures.**

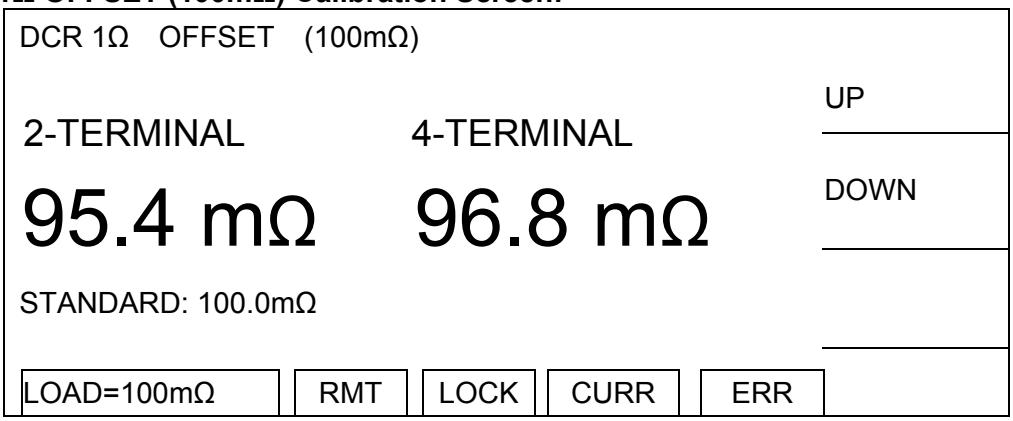
DCR GET SHORT Calibration Screen:



1. Press **START** to perform DCR GET SHORT.
2. When the status line at the lower left corner shows [COMPLETED] it indicates the OFFSET calibration is done.
3. Press Function Key [DOWN] to go to DCR 1Ω OFFSET (100mΩ) calibration.

■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 100mΩ resistance and CH3, CH4 to the other end.**

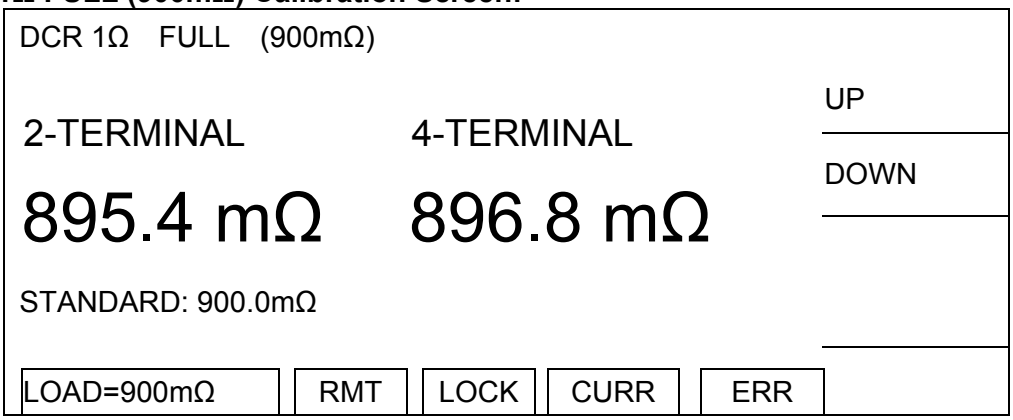
DCR 1Ω OFFSET (100mΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 1Ω FULL (900mΩ) calibration.

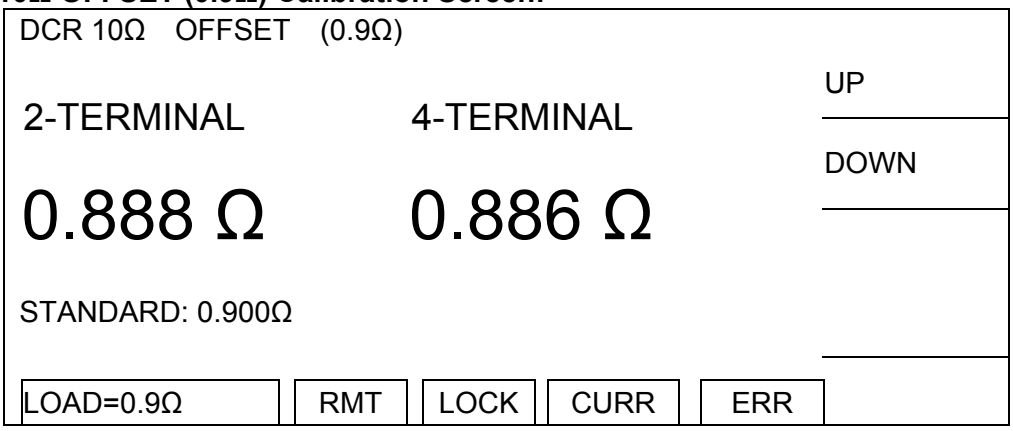
■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 900mΩ resistance and CH3, CH4 to the other end.**

DCR 1Ω FULL (900mΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10Ω OFFSET (0.9Ω) calibration.

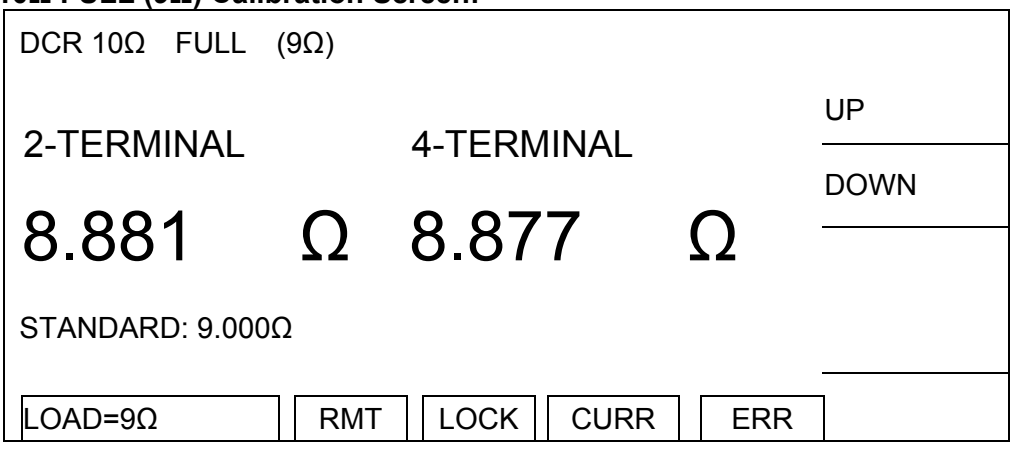
DCR 10Ω OFFSET (0.9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10Ω FULL (9Ω) calibration.

■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 9Ω resistance and CH3, CH4 to the other end.**

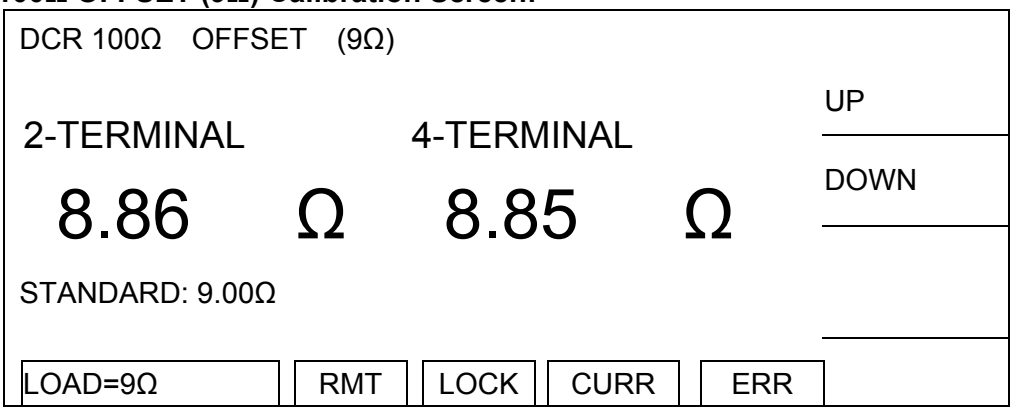
DCR 10Ω FULL (9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω OFFSET (9Ω) calibration.

■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 9Ω resistance and CH3, CH4 to the other end.**

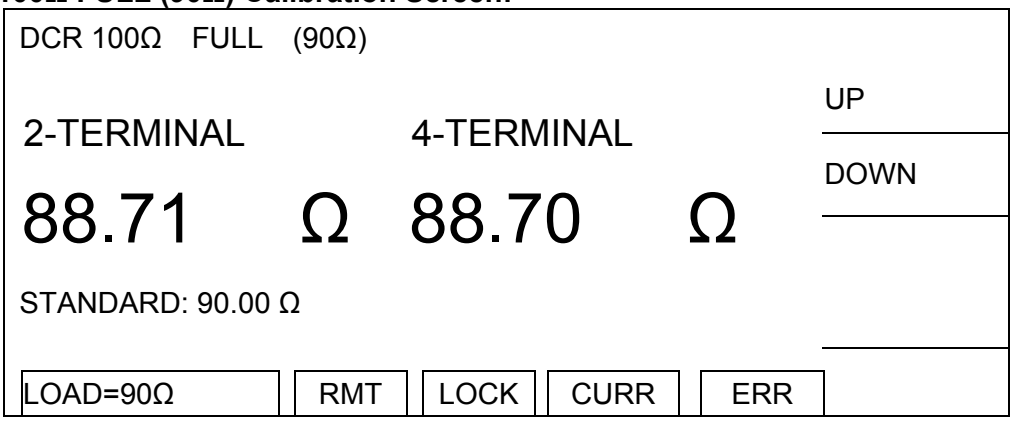
DCR 100Ω OFFSET (9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω FULL (90Ω) calibration.

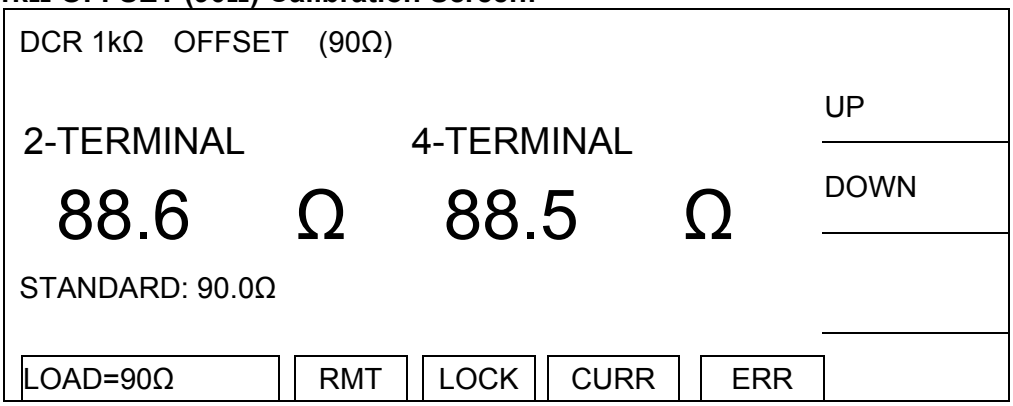
■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 90Ω resistance and CH3, CH4 to the other end.**

DCR 100Ω FULL (90Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 1kΩ OFFSET (90Ω) calibration.

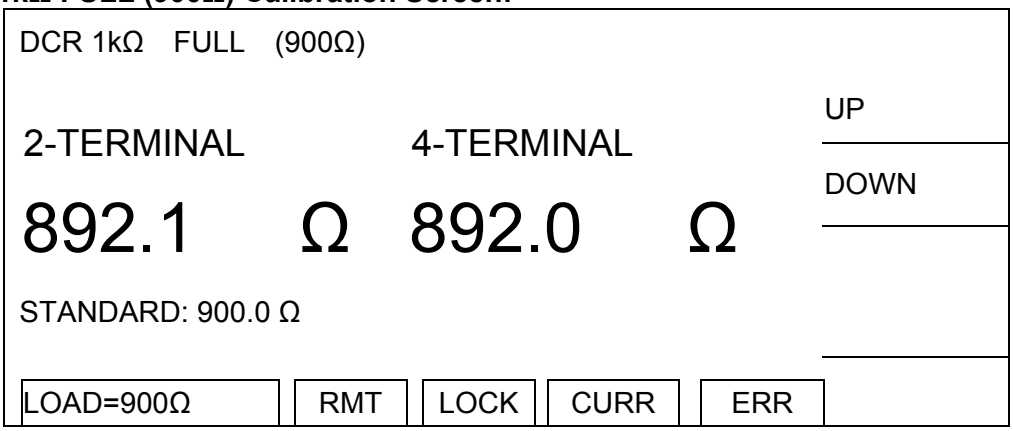
DCR 1kΩ OFFSET (90Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 1kΩ FULL (900Ω) calibration.

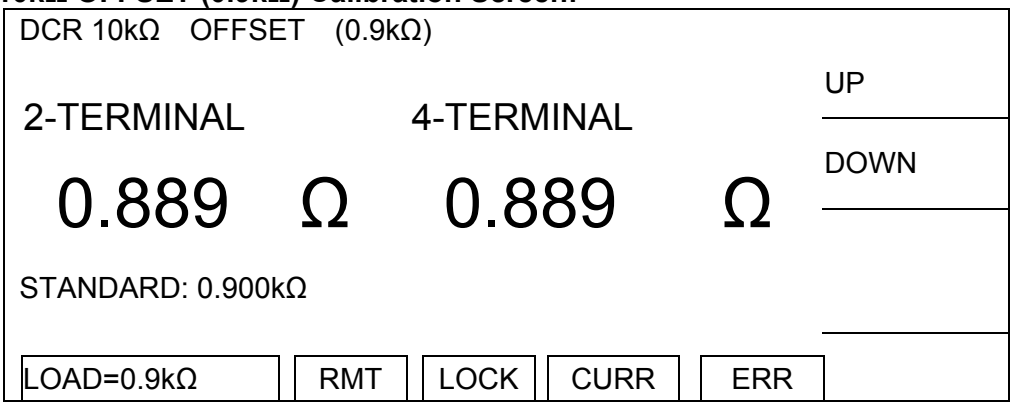
■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 900Ω resistance and CH3, CH4 to the other end.**

DCR 1kΩ FULL (900Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10kΩ OFFSET (0.9kΩ) calibration.

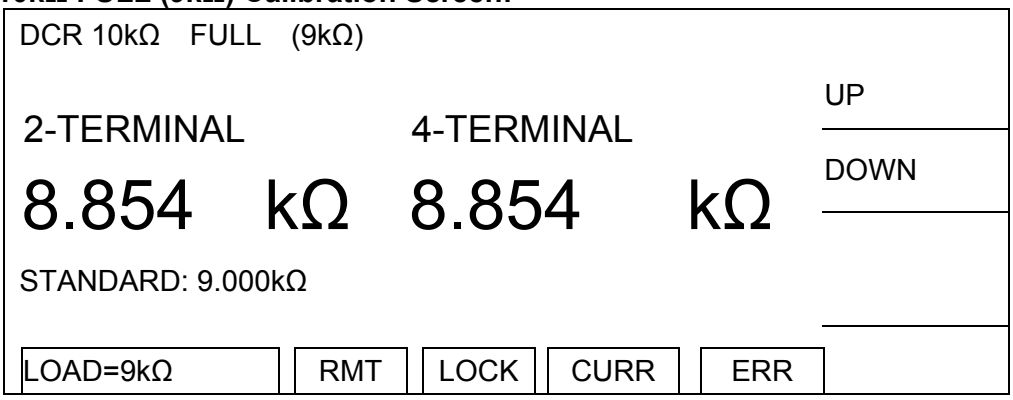
DCR 10kΩ OFFSET (0.9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10kΩ FULL (9kΩ) calibration.

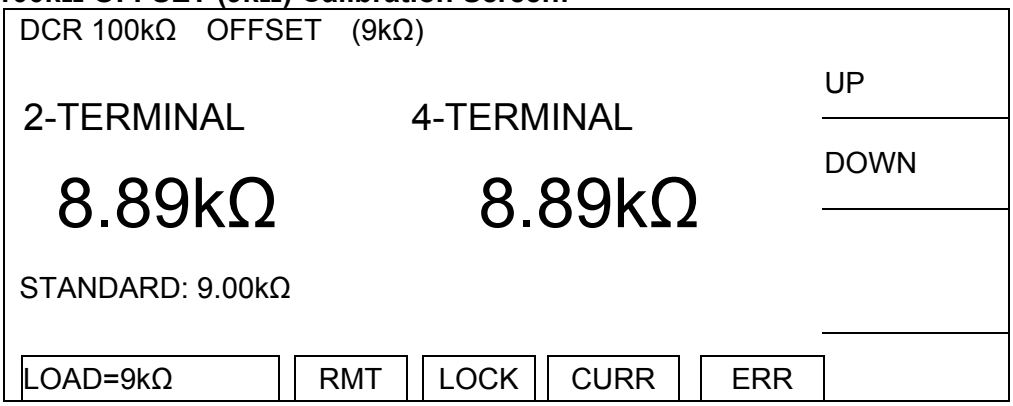
■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 9kΩ resistance and CH3, CH4 to the other end.**

DCR 10kΩ FULL (9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100kΩ OFFSET (9kΩ) calibration.

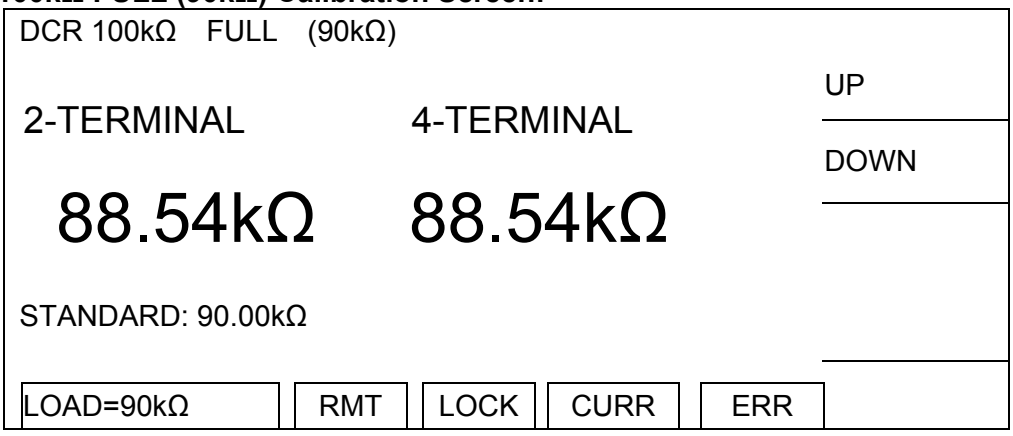
DCR 100kΩ OFFSET (9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 100kΩ FULL (90kΩ) calibration.

■ **Connect the high voltage output terminal CH1, CH2 to one end of the standard 90kΩ resistance and CH3, CH4 to the other end.**

DCR 100kΩ FULL (90kΩ) Calibration Screen:

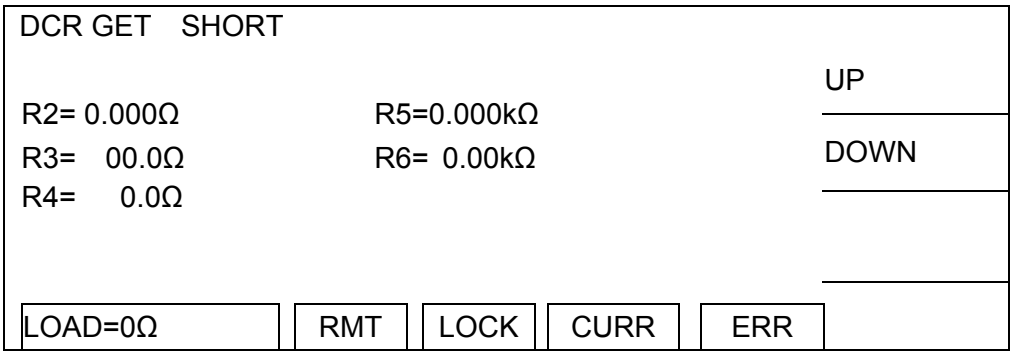


1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to AC ARC 15mA FULL (7mA) calibration.

9.5.2 DC Resistance Calibration (19035 DCR 2-Terminal)

■ **Short-circuit the high voltage output terminal (CH1) and low potential terminal (RETURN/LOW) for the following calibration procedures.**

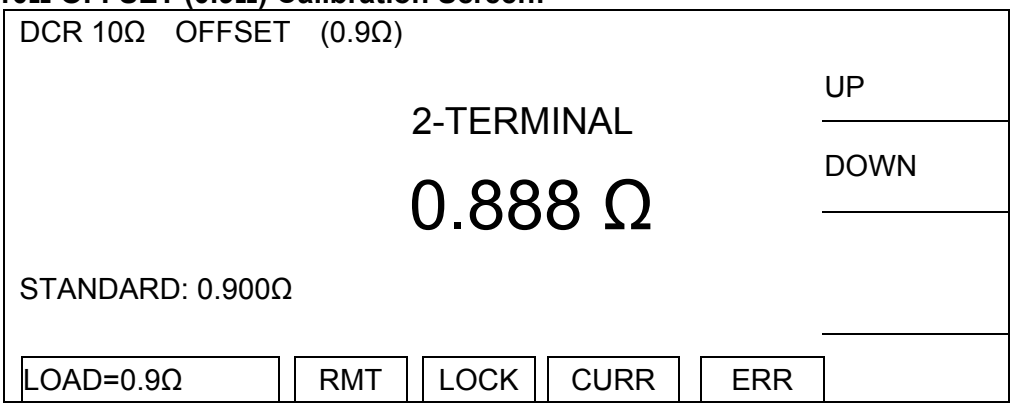
DCR GET SHORT Calibration Screen:



1. Press **START** to perform DCR GET SHORT.
2. When the status line at the lower left corner shows [COMPLETED], it indicates the OFFSET calibration is done.
3. Press Function Key [DOWN] to go to DCR 10Ω OFFSET (1Ω) calibration.

■ **Connect a 0.9Ω standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

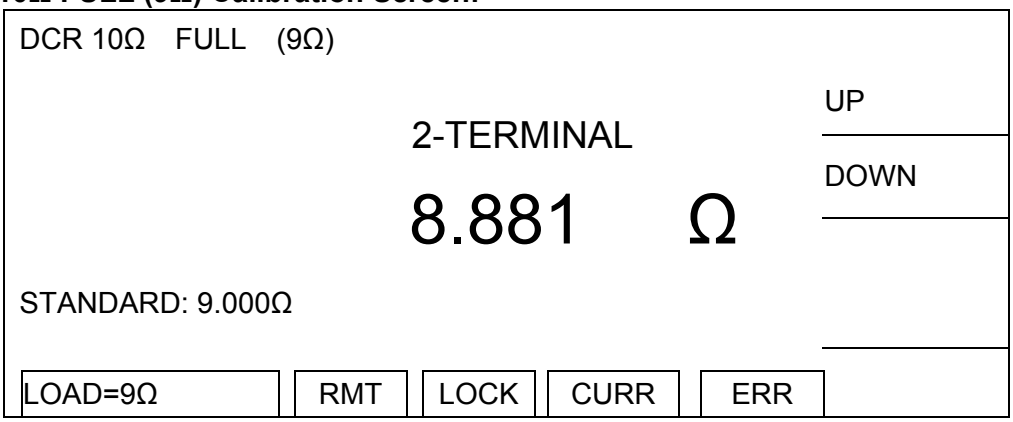
DCR 10Ω OFFSET (0.9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop voltage output.
5. Press Function Key [DOWN] to go to DCR 10Ω FULL (9Ω) calibration.

■ **Connect a 9Ω standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

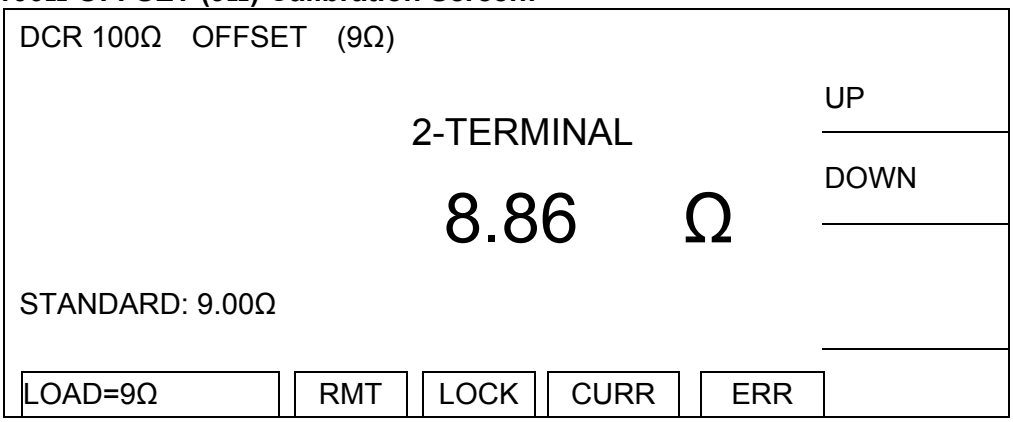
DCR 10Ω FULL (9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω OFFSET (9Ω) calibration.

■ **Connect a 9Ω standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

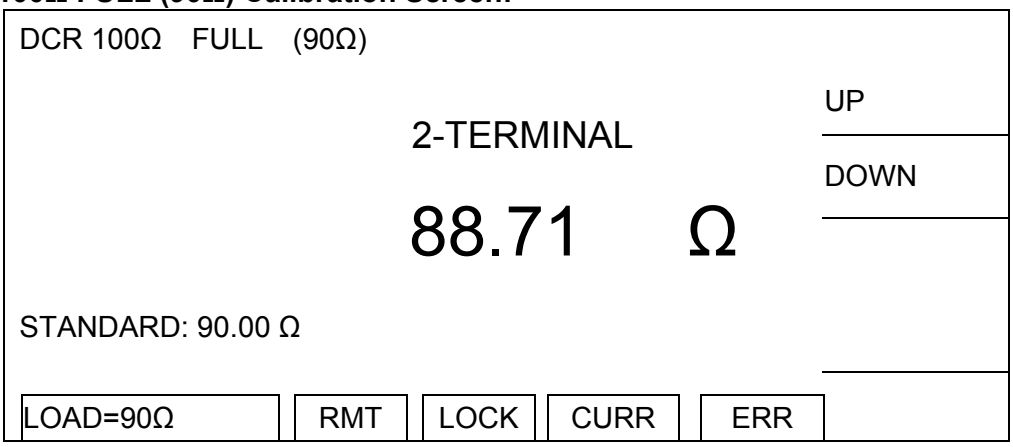
DCR 100Ω OFFSET (9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω FULL (90Ω) calibration.

■ **Connect a 90Ω standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

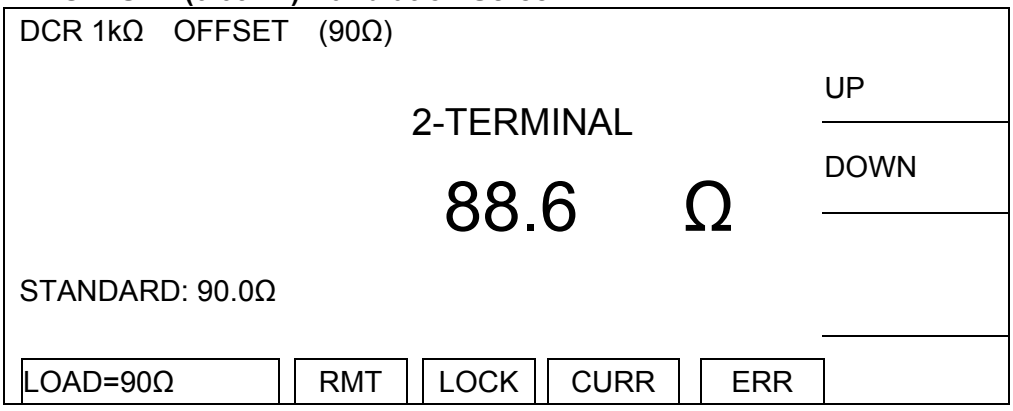
DCR 100Ω FULL (90Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 1KΩ OFFSET (0.09kΩ) calibration.

■ **Connect a 0.09kΩ standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

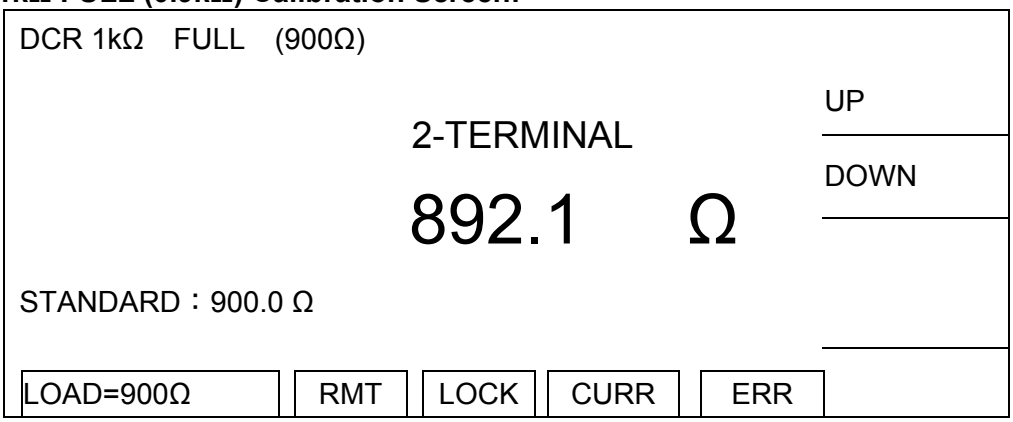
DCR 1kΩ OFFSET (0.09kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 1kΩ FULL (0.9kΩ) calibration.

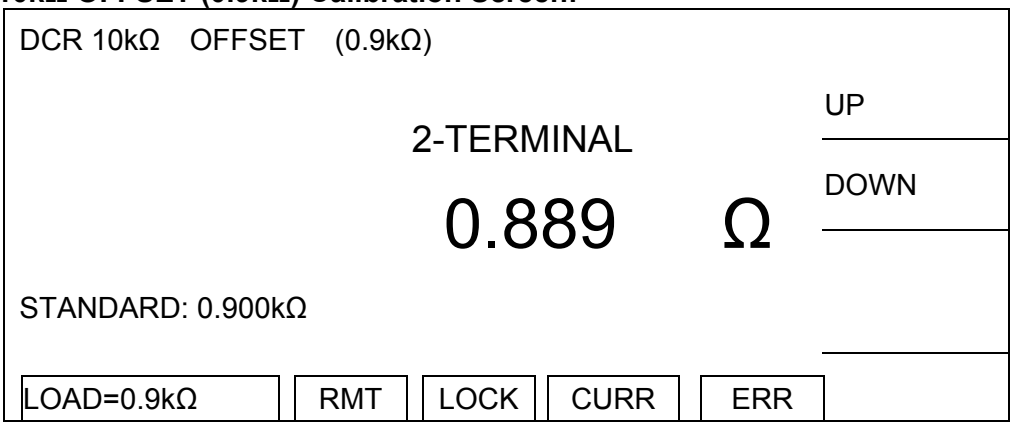
■ **Connect a 0.9kΩ standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

DCR 1kΩ FULL (0.9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 10KΩ OFFSET (0.9kΩ) calibration.

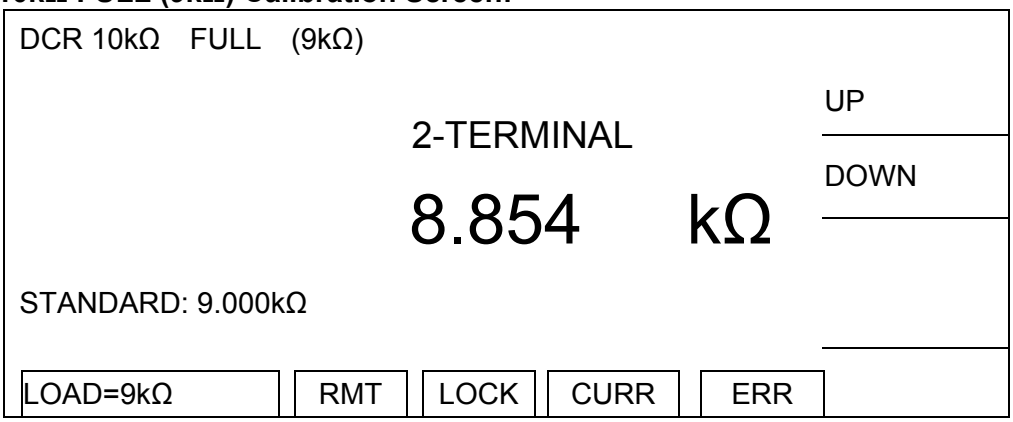
DCR 10kΩ OFFSET (0.9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 10kΩ FULL (9kΩ) calibration.

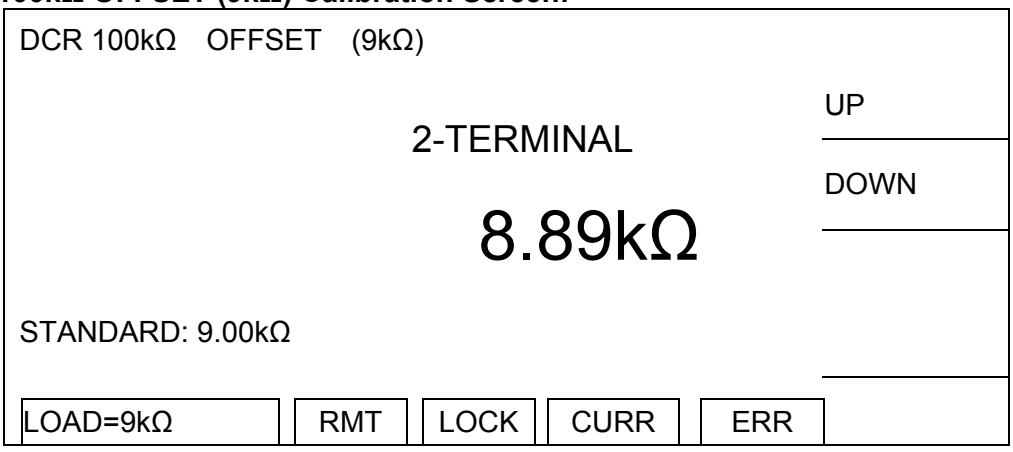
■ **Connect a 9kΩ standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

DCR 10kΩ FULL (9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100KΩ OFFSET (9kΩ) calibration.

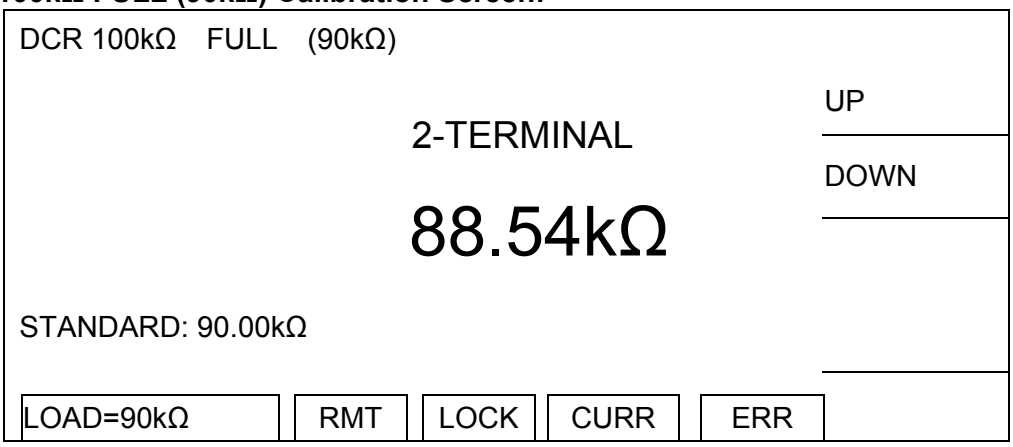
DCR 100kΩ OFFSET (9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100kΩ FULL (90kΩ) calibration.

■ **Connect a 90kΩ standard resistance in between the high voltage output terminal (CH1) and the low potential terminal (RETURN/LOW) of this Scanner.**

DCR 100kΩ FULL (90kΩ) Calibration Screen:

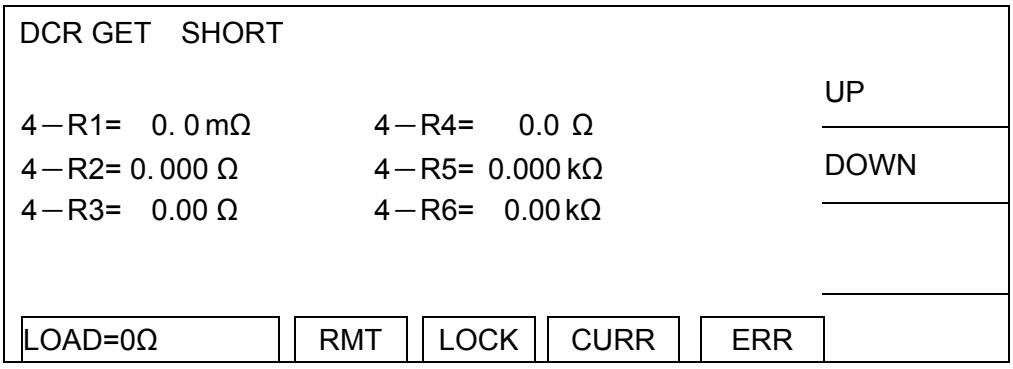


1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to AC ARC 15mA FULL (7mA) calibration.

9.5.3 DC Resistance Calibration (19035-M)

■ **Short-circuit the output terminal CH1 (DRIVE), CH1 (SENSE), CH4 (DRIVE) and CH4 (SENSE) with a test wire to conduct the following calibration procedures.**

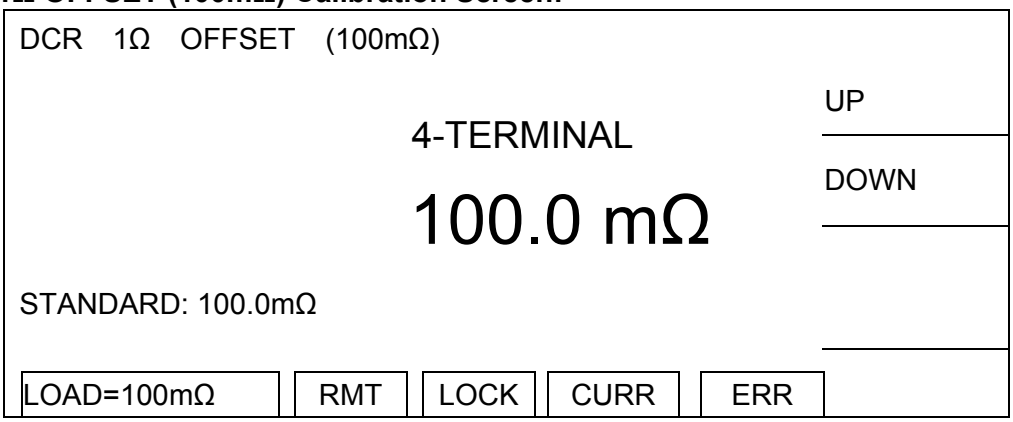
DCR GET SHORT Calibration Screen:



1. Press **START** to perform DCR GET SHORT.
2. When the status line at the lower left corner shows [COMPLETED], it indicates the OFFSET calibration is done.
3. Press Function Key [DOWN] to go to DCR 10Ω OFFSET (1Ω) calibration.

■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 100mΩ resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

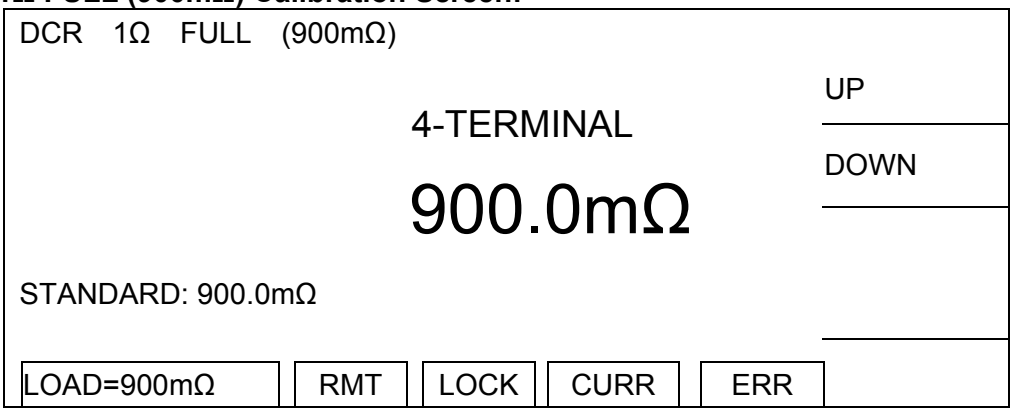
DCR 1Ω OFFSET (100mΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 1Ω FULL (0.9Ω) calibration.

■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 900mΩ resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

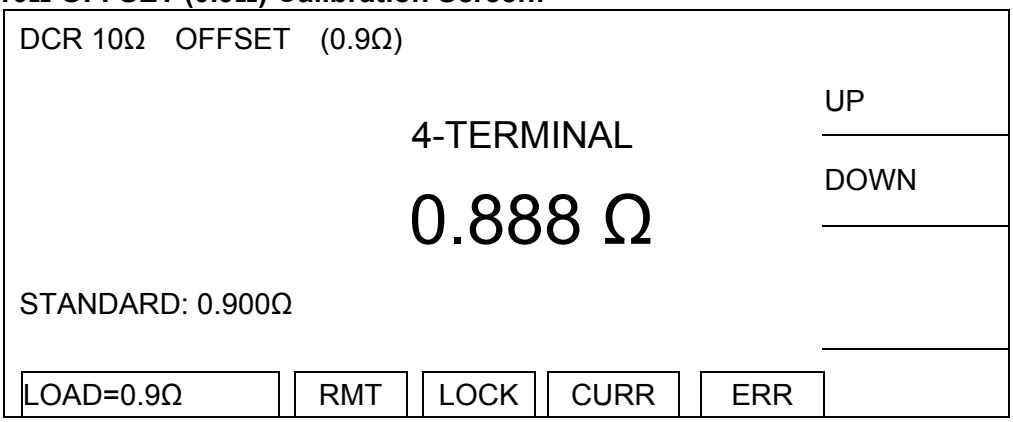
DCR 1Ω FULL (900mΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 10Ω OFFSET (0.9Ω) calibration.

■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 0.9Ω resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

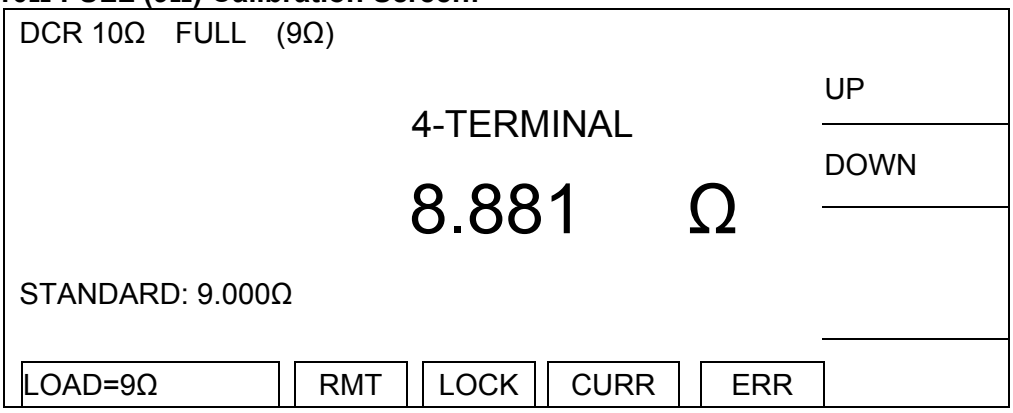
DCR 10Ω OFFSET (0.9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 10Ω FULL (9Ω) calibration.

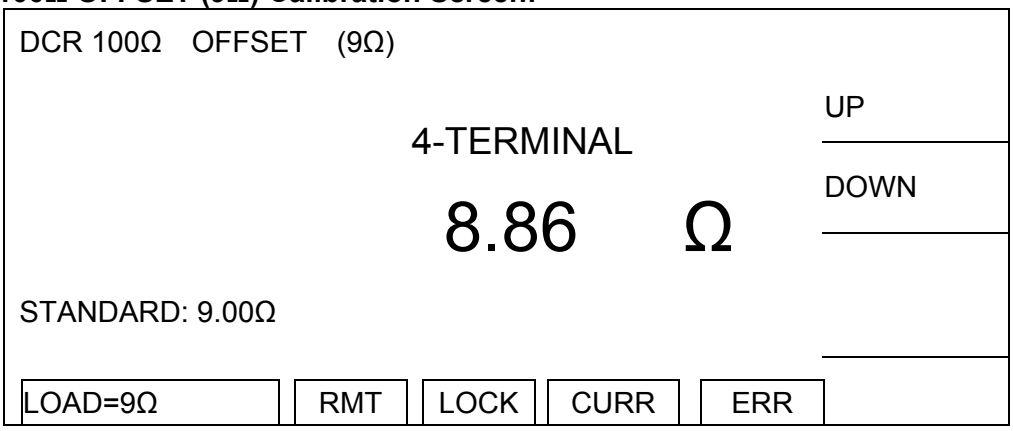
■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 9Ω resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

DCR 10Ω FULL (9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω OFFSET (9Ω) calibration.

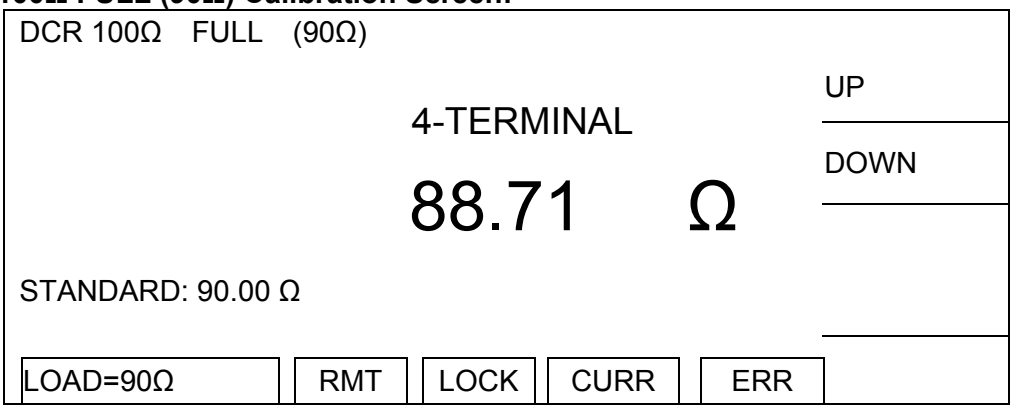
DCR 100Ω OFFSET (9Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100Ω FULL (90Ω) calibration.

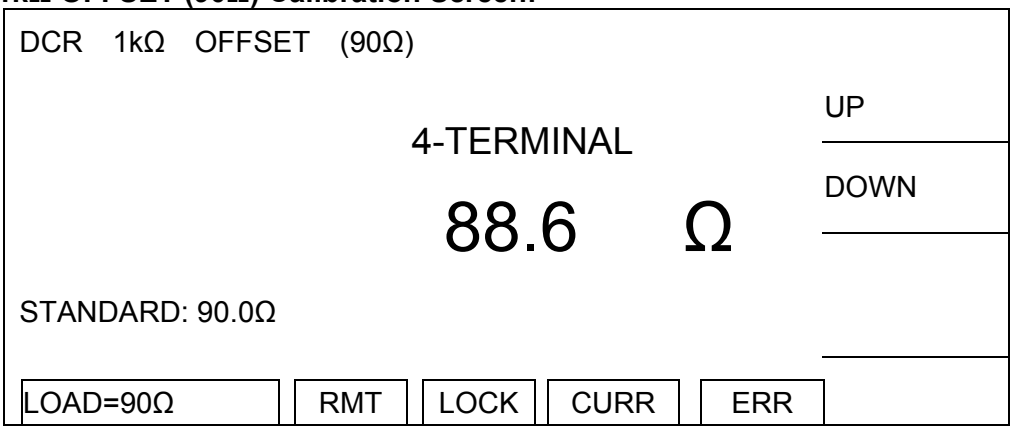
■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 90Ω resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

DCR 100Ω FULL (90Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 1KΩ OFFSET (0.09kΩ) calibration.

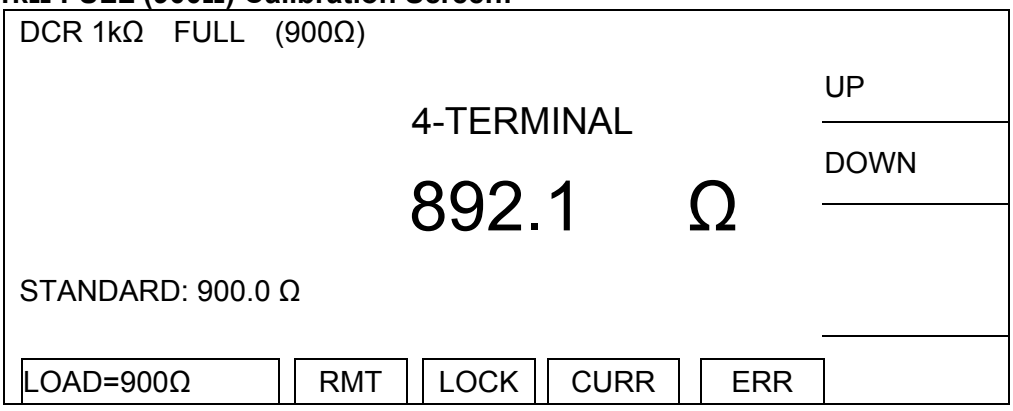
DCR 1kΩ OFFSET (90Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 1kΩ FULL (0.9kΩ) calibration.

■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 900Ω resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

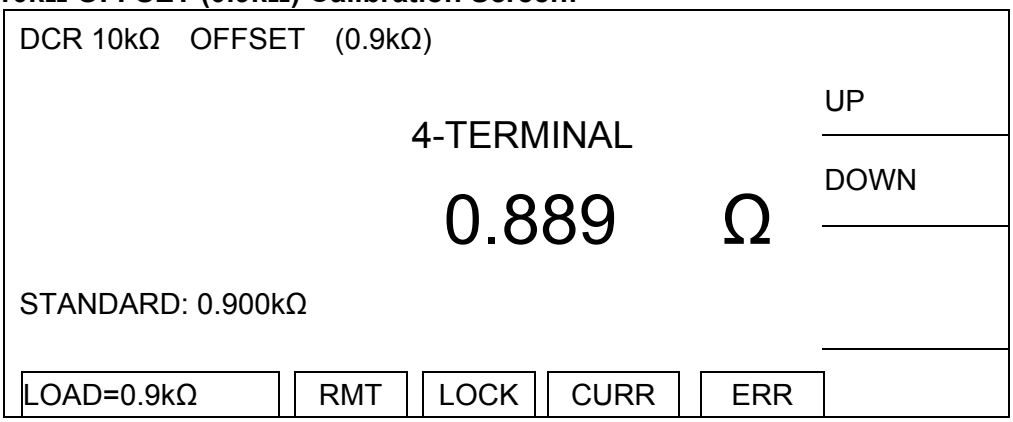
DCR 1kΩ FULL (900Ω) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 10KΩ OFFSET (0.9kΩ) calibration.

■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 0.9kΩ resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

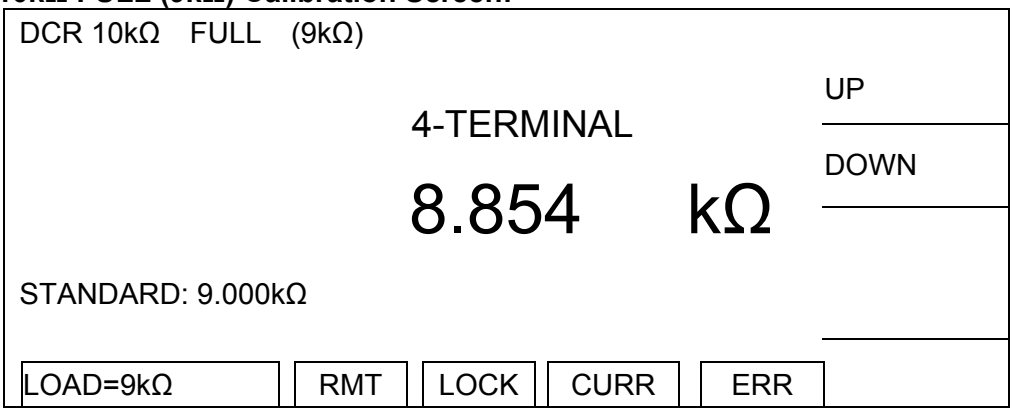
DCR 10kΩ OFFSET (0.9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 10kΩ FULL (9kΩ) calibration.

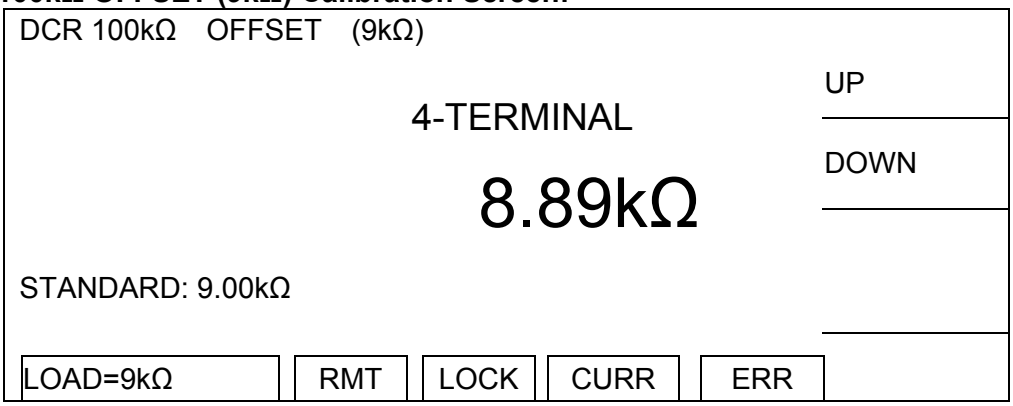
■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 9kΩ resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

DCR 10kΩ FULL (9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100KΩ OFFSET (9kΩ) calibration.

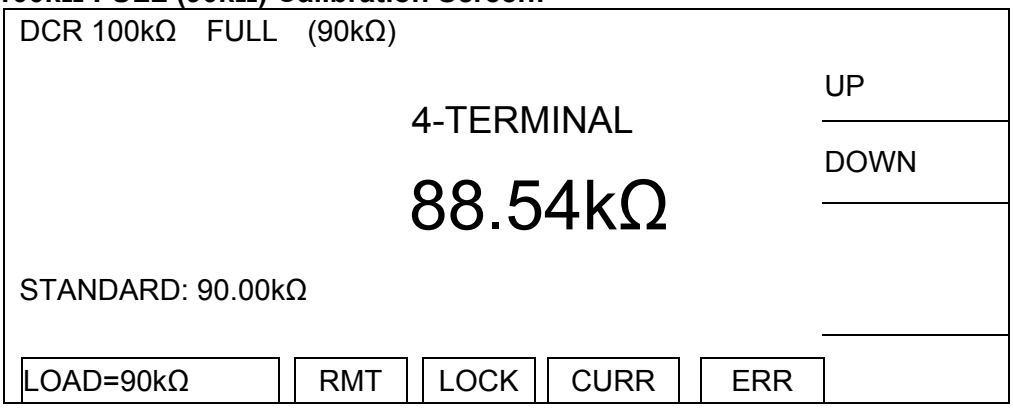
DCR 100kΩ OFFSET (9kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to DCR 100kΩ FULL (90kΩ) calibration.

■ **Connect the output terminal CH1 (DRIVE), CH2 (SENSE) to one end of the standard 90kΩ resistance and CH3 (DRIVE), CH4 (SENSE) to the other end.**

DCR 100kΩ FULL (90kΩ) Calibration Screen:



1. Press **START** to output voltage.
2. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter the actual resistance.
3. Press **ENTER** to confirm the input data.
4. Press **STOP** to stop high voltage output.
5. Press Function Key [DOWN] to go to AC ARC 15mA FULL (7mA) calibration.

9.6 ARC Calibration

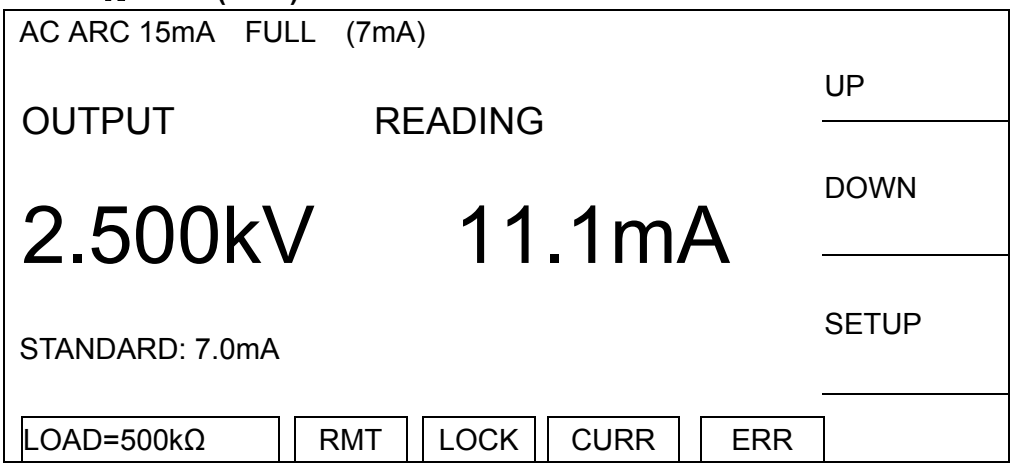
⚠WARNING

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

9.6.1 Calibrating AC ARC

- Connect one end of 500kΩ 10Watt or high power simulated load resistance to the high voltage output terminal (CH1) on this Scanner, and move the other end close to the low potential terminal (RETURN/LOW) without physical connection in order to create sparks.

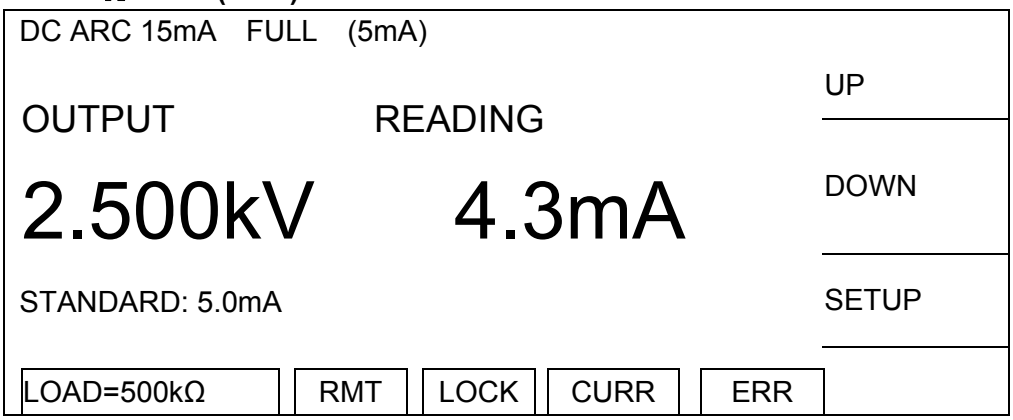
AC ARC 15mA FULL (7mA) Calibration Screen:



1. Press **START** to output voltage.
2. When the READING shows 11.1mA, press **ENTER** twice to enter the standard 7mA.
3. Press **STOP** to stop high voltage output.
4. Press Function Key [DOWN] to go to DC ARC 15mA FULL (5mA) calibration.

9.6.2 Calibrating DC ARC

DC ARC 15mA FULL (5mA) Calibration Screen:



1. Press **START** to output voltage.
2. When the status line at the lower left corner shows [COMPLETED]**, it indicates the device has got the ARC data correctly.**
3. Press **ENTER** and Function Key [DIGIT UP], [DIGIT DN], [DIGIT] to enter standard value. [**Note:** 2.5kV / 500kΩ = 5mA].
4. Press **ENTER** to confirm the input data.
5. Press **STOP** to stop high voltage output.
6. Press **SYSTEM** to exit calibration mode.

9.7 When Calibration is Done

■ When the calibration is done, press the calibration switch (SW102) on the KEY BOARD in side the front panel to open the protection circuit for backing up hardware data and prevent the calibration data from loss.

9.8 Remote Calibration Command

9.8.1 Command Line

```
:CALibration
|       :REQuest?
|       :RELease
|       :STATe <boolean> | ON | OFF
|       :VALue <number value>
|       :SAFety
|       |       :STARt
|       |       :STOP
|       |       :WVAC
|       |       |       :ARANge? MAXimum | MINimum
|       |       |       :ARC<n>
|       |       |       |       :SLOPe
|       |       |       |       |       [:SOURce]
|       |       |       |       |       |       [:VOLTage]       <number value>
|       |       |       |       |       |       [:VOLTage]?
|       |       |       |       |       :BEST?
|       |       |       :CRANge? MAXimum | MINimum
|       |       |         :CURRent<n>
|       |       |       |       :OFFSet
|       |       |       |       |       [:SOURce]
|       |       |       |       |       |       [:VOLTage]       <number value>
|       |       |       |       |       |       [:VOLTage]?
|       |       |       |       |       :BEST?
|       |       |       |       :FULL
|       |       |       |       |       [:SOURce]
|       |       |       |       |       |       [:VOLTage]       <number value>
|       |       |       |       |       |         [:VOLTage]?
|       |       |       |       |       :BEST?
|       |       |       :RCRange? MAXimum | MINimum
|       |       |       :RCURrent<n>
|       |       |       |       :OFFSet
|       |       |       |       |       [:SOURce]
```

```
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     |     :FULL
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     :VRANge? MAXimum | MINimum
|     |     |     :VOLTage<n>
|     |     |     |     :OFFSet
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     |     :FULL
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     :WVDC
|     |     |     :ARANge? MAXimum | MINimum
|     |     |     :ARC<n>
|     |     |     |     :SLOPe
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     :CRANge? MAXimum | MINimum
|     |     |     :CURRent<n>
|     |     |     |     :OFFSet
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     |     :FULL
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     :VRANge? MAXimum | MINimum
|     |     |     :VOLTage<n>
|     |     |     |     :OFFSet
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     |     :FULL
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     :IR
|     |     |     :OPEN
|     |     |     :RRANge? MAXimum | MINimum
|     |     |     :RESistance<n>
|     |     |     |     :OFFSet
```

```
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     |     :FULL
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     :DCR
|     |     |     :SHORt
|     |     |     :RRANge? MAXimum | MINimum
|     |     |     :RESistance<n>
|     |     |     |     :OFFSet
|     |     |     |     |     :BEST?
|     |     |     |     :FULL
|     |     |     |     |     :BEST?
|     |     :OSC
|     |     |     :VRANge? MAXimum | MINimum
|     |     |     :VOLTage<n>
|     |     |     |     :OFFSet
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
|     |     |     |     :FULL
|     |     |     |     |     [:SOURce]
|     |     |     |     |     |     [:VOLTage]     <number value>
|     |     |     |     |     |     [:VOLTage]?
|     |     |     |     |     :BEST?
```

9.8.2 Command Summary

- `:CALibration:REQuest?`

  It attempts to attain the lock on this device and returns 1 if successful and 0 if it fails.

- `:CALibration:RELease`

  It exits the test screen.

- `:CALibration:STATe` *<boolean>* | *ON* | *OFF*

  It sets if calibrating data (1) or (0). *RST command will change the state to ON.

- `:CALibration:VALue <Numeric_Value>`

  It inputs the calibration data. The error of -203 “Command protected” will occur if it is not in calibration or output state unless the execution is wrong.

- `:CALibration:SAFety:STARt`

  It begins to output voltage and is available for calibration data input. Sending this command in non-calibration state, the error of –203 “Command protected” will occur.

- `:CALibration:SAFety:STOP`

  It stops outputting power source.

- `:CALibration:SAFety:WVAC:ARANge? MAXimum|MINimum`

  It queries the maximum and minimum of ARC calibration range code in WVAC mode.

- `:CALibration:SAFety:WVAC:ARC<n>:SLOPe[:SOURce][:VOLTage] <Numeric Value>`

  It changes to ARC in WVAC mode and sets the output voltage for calibration. The traversal of header tree selects the code of current calibration range.

- `:CALibration:SAFety:WVAC:ARC<n>:SLOPe[:SOURce][:VOLTage]?`

  It changes to ARC in WVAC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:ARC<n>:SLOPe:BEST?`

  It changes to ARC in WVAC mode and returns to the best ARC value selected by device.

- `:CALibration:SAFety:WVAC:CRANge? MAXimum|MINimum`

  It queries the maximum and minimum of current meter calibration range code in WVAC mode.

- `:CALibration:SAFety:WVAC:CURRent<n>:OFFSet[:SOURce][:VOLTage] <Numeric Value>`

  It changes to the offset of current meter in WVAC mode and sets the output voltage used for calibration. The traversal of header tree selects the current calibration range code.

- `:CALibration:SAFety:WVAC:CURRent<n>:OFFSet[:SOURce][:VOLTage]?`

  It changes to the offset of current meter in WVAC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:CURRent<n>:OFFSet:BEST?`

  It changes to the offset of current meter in AC mode and returns to the best value selected by device.

- `:CALibration:SAFety:WVAC:CURRent<n>:FULL[:SOURce][:VOLTage] <Numeric Value>`

  It changes to all items in WVAC mode of current meter and sets the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:CURRent<n>:FULL[:SOURce][:VOLTage]?`

  It changes to all items in WVAC mode of current meter and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:CURRent<n>:FULL:BEST?`

  It changes to all items in WVAC mode of current meter and returns to the best value selected by device.

- `:CALibration:SAFety:WVAC:RCRange? MAXimum|MINimum`

  It queries the maximum and minimum of real current meter calibration range code in WVAC mode.

- `:CALibration:SAFety:WVAC:RCURrent<n>:OFFSet[:SOURce][:VOLTage] <Numeric Value>`

  It changes to the offset of real current meter in WVAC mode and sets the output voltage used for calibration. The traversal of header tree selects the code of current calibration range.

- `:CALibration:SAFety:WVAC:RCURrent<n>:OFFSet[:SOURce][:VOLTage]?`

  It changes to the offset in WVAC mode of real current meter and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:RCURrent<n>:OFFSet:BEST?`

  It changes to the offset in WVAC mode of real current meter and returns to the best value selected by device.

- `:CALibration:SAFety:WVAC:RCURrent<n>:FULL[:SOURce][:VOLTage] [<Numeric Value>]`

  It changes to all items in WVAC mode of real current meter and sets the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:RCURrent<n>:FULL[:SOURce][:VOLTage]?`

  It changes to all items in WVAC mode of real current meter and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:RCURrent<n>:FULL:BEST?`

  It changes to all items in WVAC mode of real current meter and returns to the best value selected by device.

- `:CALibration:SAFety:WVAC:VRANge? MAXimum|MINimum`

  It queries the maximum and minimum of calibration range code for power supply and meter in WVAC mode.

- `:CALibration:SAFety:WVAC:VOLTage<n>:OFFSet[:SOURce][:VOLTage] <Numeric Value>`

  It changes to the offset of power supply and voltage meter in WVAC mode to set the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:VOLTage<n>:OFFSet[:SOURce][:VOLTage]?`

  It changes to the offset of power supply and voltage meter in WVAC mode, also returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:VOLTage<n>:OFFSet:BEST?`

  It changes to the offset of power supply and voltage meter in WVAC mode, also returns to the best value selected by device.

- `:CALibration:SAFety:WVAC:VOLTage<n>:FULL[:SOURce][:VOLTage] <Numeric Value>`

  It changes to all items of power supply and voltage meter in WVAC mode to set the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:VOLTage<n>:FULL[:SOURce][:VOLTage]?`

  It changes to all items of power supply and voltage meter in WVAC mode, also returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVAC:VOLTage<n>:FULL:BEST?`

  It changes to all items of power supply and voltage meter in WVAC mode, also returns to the best value selected by device.

- `:CALibration:SAFety:WVDC:ARANge? MAXimum|MINimum`

  It queries the maximum and minimum of the calibration range code for the ARC in WVDC mode.

- `:CALibration:SAFety:WVDC:ARC<n>:SLOPe[:SOURce][:VOLTage] <Numeric Value>`

  It changes to the ARC in WVDC mode and sets the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:ARC<n>:SLOPe[:SOURce][:VOLTage]?`

  It changes to the ARC in WVDC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:ARC<n>:SLOPe:BEST?`

  It changes to the ARC in WVDC mode and returns to the best ARC value selected by device.

- `:CALibration:SAFety:WVDC:CRANge? MAXimum|MINimum`

  It queries the maximum and minimum of current meter in WVDC mode.

- `:CALibration:SAFety:WVDC:CURRent<n>:OFFSet[:SOURce][:VOLTage] <Numeric Value>`

  It changes to the offset of current meter in WVDC mode and sets the output voltage used for calibration. The traversal of header tree selects the code of current calibration range.

- `:CALibration:SAFety:WVDC:CURRent<n>:OFFSet[:SOURce][:VOLTage]?`

  It changes to the offset of current meter in WVDC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:CURRent<n>:OFFSet:BEST?`

  It changes to the offset of current meter in WVDC mode and returns to the best value selected by device.

- `:CALibration:SAFety:WVDC:CURRent<n>:FULL[:SOURce][:VOLTage] <Numeric Value>`

  It changes to all items of current meter in WVDC mode and sets the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:CURRent<n>:FULL[:SOURce][:VOLTage]?`

  It changes to all items of current meter in WVDC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:CURRent<n>:FULL:BEST?`

  It changes to all items of current meter in WVDC mode and returns to the best value selected by device.

- `:CALibration:SAFety:WVDC:VRANge? MAXimum | MINimum`

  It queries the maximum and minimum of calibration range code for power supply in WVDC mode.

- `:CALibration:SAFety:WVDC:VOLTage<n>:OFFSet[:SOURce][:VOLTage] <Numeric Value>`

  It changes to the offset of power supply and voltage meter in WVDC mode and sets the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:VOLTage<n>:OFFSet[:SOURce][:VOLTage]?`

  It changes to the offset of power supply and voltage meter in WVDC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:VOLTage<n>:OFFSet:BEST?`

  It changes to the offset of power supply and voltage meter in WVDC mode and returns to the best value selected by device.

- `:CALibration:SAFety:WVDC:VOLTage<n>:FULL[:SOURce][:VOLTage] <Numeric Value>`

  It changes to all items of power supply and voltage meter in WVDC mode and sets the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:VOLTage<n>:FULL[:SOURce][:VOLTage]?`

  It changes to all items of power supply and voltage meter in WVDC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:WVDC:VOLTage<n>:FULL:BEST?`

  It changes to all items of power supply and voltage meter in WVDC mode and returns to the best value selected by device.

- `:CALibration:SAFety:IR:OPEN`

  It changes to get the open current meter readings in IR mode.

- `:CALibration:SAFety:IR:RRANge? MAXimum|MINimum`

  It queries the maximum and minimum of calibration range code for resistance meter in IR mode.

- `:CALibration:SAFety:IR:RESistance<n>:OFFSet[:SOURce][:VOLTage]?`

  It changes to the offset of resistance meter in IR mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:IR:RESistance<n>:OFFSet:BEST?`

  It changes to the offset of resistance meter in IR mode and returns to the best value selected by device.

- `:CALibration:SAFety:IR:RESistance<n>:FULL[:SOURce][:VOLTage]?`

  It changes to all items of resistance meter in IR mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:IR:RESistance<n>:FULL:BEST?`

  It changes to all items of resistance meter in IR mode and returns to the best value selected by device.

- `:CALibration:SAFety:DCR:SHORt`

  It changes to get the short resistance meter readings in DCR mode.

- `:CALibration:SAFety:DCR:RRANge? MAXimum|MINimum`

  It queries the maximum and minimum of calibration range code for resistance meter in DCR mode.

- `:CALibration:SAFety:DCR:RESistance<n>:OFFSet:BEST?`

  It changes to the offset of resistance meter in DCR mode and returns to the best value selected by device.

- `:CALibration:SAFety:DCR:RESistance<n>:FULL:BEST?`

  It changes to all items of resistance meter in DCR mode and returns to the best value selected by device.

- `:CALibration:SAFety:OSC:VRANge? MAXimum | MINimum`

  It queries the maximum and minimum of calibration range code for power supply meter in OSC mode.

- `:CALibration:SAFety:OSC:VOLTage<n>:OFFSet[:SOURce][:VOLTage] <Numeric Value>`

  It changes to the offset of power supply and voltage meter in OSC mode and sets the output voltage used for calibration.

- `:CALibration:SAFety:OSC:VOLTage<n>:OFFSet[:SOURce][:VOLTage]?`

  It changes to the offset of power supply and voltage meter in OSC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:OSC:VOLTage<n>:OFFSet:BEST?`

  It changes to the offset of power supply and voltage meter in OSC mode and returns to the best value selected by device.

- `:CALibration:SAFety:OSC:VOLTage<n>:FULL[:SOURce][:VOLTage] <Numeric Value>`

  It changes to all items of power supply and voltage meter in OSC mode and sets the output voltage used for calibration.

- `:CALibration:SAFety:OSC:VOLTage<n>:FULL[:SOURce][:VOLTage]?`

  It changes to all items of power supply and voltage meter in OSC mode and returns to the output voltage used for calibration.

- `:CALibration:SAFety:OSC:VOLTage<n>:FULL:BEST?`

  It changes to all items of power supply and voltage meter in OSC mode and returns to the best value selected by device.

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