EXTECH Electronics Co.,Ltd.

ESD-140

DC Ground Bond Tester

Operation Manual

E 1.01

WARRANTY

eec certifies that the instrument listed in this manual meets or exceeds published manufacturing specifications. This instrument was calibrated using standards that are traceable to Chinese National Laboratory Accreditation (CNLA).

Your new instrument is warranted to be free from defects in workmanship and material for a period of (2) year from date of shipment. During the warranty period, you must return the instrument to eec or its branches or its authorized distributor for repair. eec reserves the right to use its discretion on replacing the faulty parts or replacing the assembly or the whole unit.

Any non-authorized modifications, tampering or physical damage will void your warranty. Elimination of any connections in the earth grounding system or bypassing any safety systems will void this warranty. This warranty does not cover batteries or accessories not of eec manufacture. Parts used must be parts that are recommended by eec as an acceptable specified part. Use of non-authorized parts in the repair of this instrument will void the warranty.

This warranty does not cover accessories not of eec manufacture.

Except as provided herein, eec makes no warranties to the purchaser of this instrument and all other warranties, express or implied (including, without limitation, merchantability or fitness for a particular purpose) are hereby excluded, disclaimed and waived.

Compliance Information

Conforms with the following product standards:

EMC Standard

EN 55011:2009+A1
EN 61326-1:2013

1. The product is intended for use in non-residential/non-domestic environments. Use of the product in residential/domestic environments may cause electromagnetic interference.
2. Connection of the instrument to a test object may produce radiations beyond the specified limit.
3. Use high-performance shielded interface cable to ensure conformity with the EMC standards listed above.

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1. Introduction

1.1 Safety Symbols

1.1.1 Product Marking Symbols

Product will be marked with this symbol when it is necessary to refer to the operation and service manual in order to prevent injury or equipment damage.

Product will be marked with this symbol when hazardous voltages may be present.

Product will be marked with this symbol at connections that require earth grounding.

1.1.2 Caution and Warning Symbols

WARNING Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or death.

CAUTION Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data

1.2 Glossary of Terms

Alternating Current, AC: Current that reverses direction on a regular basis, commonly in the U.S.A. 60 per second, in other countries 50 times per second.

Breakdown: The failure of insulation to effectively prevent the flow of current sometimes evidenced by arcing. If voltage is gradually raised, breakdown will begin suddenly at a certain voltage level. Current flow is not directly proportional to voltage. Once breakdown current has flown, especially for a period of time, the next gradual application of voltage will often show breakdown beginning at a lower voltage than initially.

Conductive: Having a volume resistivity of no more than 10^3 ohm-cm or a surface resistivity of no more than 10^5 ohms per square.

Conductor: A solid or liquid material which has the ability to let current pass through it, and which has a volume resistivity of no more than 10^3 ohm-cm.

Current: The movement of electrons through a conductor. Current is measured in amperes, milliamperes, microamperes, nanoamperes, or picoamperes. Symbol = **I**

Dielectric: An insulating material that is positioned between two conductive materials in such a way that a charge or voltage may appear across the two conductive materials.

Direct Current, DC: Current that flows in one direction only. The source of direct current is said to be polarized and has one terminal that is always at a higher potential than the other.

Hipot Tester: Common term for dielectric-withstand test equipment.

Insulation: Gas, liquid or solid material which has a volume resistivity of at least 10^{12} ohm-cm and is used for the purpose of resisting current flow between conductors.

Insulation Resistance Tester: An instrument or a function of an instrument capable of measuring resistance's in excess of 200 megohms. Usually employs a higher voltage power supply than used in ohmmeters measuring up to 200 megohms.

Leakage: AC or DC current flow through insulation and over its surfaces, and AC current flow through a capacitance. Current flow is directly proportional to voltage. The insulation and/or capacitance are thought of as a constant impedance, unless breakdown occurs.

Resistance: That property of a substance that impedes current and results in the dissipation of power, in the form of heat. The practical unit of resistance is the ohm. Symbol = **R**

Trip Point: A minimum or maximum parameter set point that will cause an indication of unacceptable performance during a run test.

Voltage: Electrical pressure, the force which causes current through an electrical conductor.
Symbol = **V**

1.3 Safety

This product and its related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal). Before applying power verify that the instrument is set to the correct line voltage (100 - 120V±10% or 200 - 240±10%) and the correct fuse is installed.

WARNING A Hipot produces voltages and currents that can cause **harmful or fatal electric shock.** To prevent accidental injury or death, these safety procedures must be strictly observed when handling and using the test instrument.

1.3.1 Service and Maintenance

User Service

To prevent electric shock do not remove the instrument cover. There are no user serviceable parts inside. Routine maintenance or cleaning of internal parts is not necessary. Avoid the use of cleaning agents or chemicals on the instrument, some chemicals may damage plastic parts or lettering. Any external cleaning should be done with a clean dry or slightly damp cloth. Schematics, when provided, are for reference only. Any replacement cables and high voltage components should be acquired directly from eec. Refer servicing to eec. customer support department.

Service Interval

The instrument, its power cord, test leads, and accessories must be returned at least once a year to eec customer support department for calibration and inspection of safety related components. eec will not be held liable for injuries suffered if the instrument is not properly maintained and safety checked annually.

User Modifications

Unauthorized user modifications will void your warranty. eec will not be responsible for any injuries sustained due to unauthorized equipment modifications or use of parts not specified by eec. Instruments returned to eec with unsafe modifications will be returned to their original operating condition at the customers expense.

1.3.2 Test Station

Location

Select an area away from the main stream of activity which employees do not walk through in performing their normal duties. If this is not practical because of production line flow, then the area should be roped off and marked for **HIGH VOLTAGE TESTING**. No employees other than the test operators should be allowed inside.

If benches are placed back-to-back, be especially careful about the use of the bench opposite the test station. Signs should be posted: **"DANGER - HIGH VOLTAGE TEST IN PROGRESS - UNAUTHORIZED PERSONNEL KEEP AWAY."**

Work Area

Perform the tests on a non-conducting table or workbench, if possible. If you cannot avoid using a conductive surface, be certain that it is connected to a good earth ground and the high voltage connection is insulated from the grounded surface.

There should not be any metal in the work area between the operator and the location where products being tested will be positioned. Any other metal in the work area should be connected to a good ground, never left "floating".
Position the tester so the operator does not have to reach over the product under test to activate or adjust the tester. If the product or component being tested is small, it may be possible to construct guards or an enclosure around the device to be tested. Construct the guards of a non-conducting material such as clear acrylic, so that the item being tested is within the guards or enclosure during the test. If possible, the guards or enclosure should also contain safety switches that will not allow the tester to operate unless the guards are in place or the enclosure closed.

Keep the area clean and uncluttered. All test equipment and test leads not necessary for the test should be removed from the test bench and put away. It should be apparent to both the operator and to any observers, the product that is being tested and the product that is waiting to be tested, or has already been tested.

Do not perform Hipot tests in a combustible atmosphere or in any area where combustible materials are present.

Power
Dielectric Voltage-Withstand Test Equipment must be connected to a good ground. Be certain that the power wiring to the test bench is properly polarized and that the proper low resistance bonding to ground is in place.

Power to the test station should be arranged so that it can be shut off by one prominently marked switch located at the entrance to the test area. In case of an emergency, anyone can cut off the power before entering the test area to offer assistance.

1.3.3 Test Operator
Qualifications
This instrument generates voltages and currents that can cause **harmful or fatal electric shock** and must only be operated by a skilled worker trained in its use.

The operator should understand the electrical fundamentals of voltage, current, and resistance. They should recognize that the test instrument is a variable high-voltage power supply with the return circuit directly connected to earth ground, therefore, current from the high-voltage output will flow through any available ground path.

Rules
Operators should be thoroughly trained to follow all of the aforementioned rules, in addition to any other applicable safety rules and procedures. Defeating any safety system should be considered a serious offense with severe penalties such as removal from the Hipot testing job. Allowing unauthorized personnel in the area during a test should also be dealt with as a serious offense.

Dress
Operators should not wear jewelry that could accidentally complete a circuit.

Medical Restrictions
Personnel with heart ailments or devices such as pacemakers should be informed that the voltages and currents generated by the instrument are very dangerous. If contacted it may cause heart-related problems that a person of good health may not experience. Please have the test operator consult their physician for recommendations.

1.3.4 Instrument Connections

WARNING Never perform a hipot test on energized circuitry or equipment.

The instrument is equipped with a safety ground connection, be sure that this is connected to a good earth ground.

Always connect the return lead first, regardless of whether the item under test is a sample of insulating material, a component tested with the high voltage test lead, or a cord-connected device with a two or three prong plug. The return lead should be connected first for any type of hipot testing.

Plug in the high voltage test lead only when it is being used. Handle its clip only by the insulator---**never touch the clip directly.** Be certain that the operator has control over any remote test switches connected to the Hipot. Double check the return and high voltage connections from the Hipot and the Line, Neutral, Ground and Case connections from the Line Leakage tester to be certain that they are proper and secure.

1.3.5 Key Safety Points to Remember

- Keep unqualified and unauthorized personnel away from the test area.
- Arrange the test station in a safe and orderly manner.
- Never touch the product or connections during a test.
- In case of any problem, turn off the high voltage first.
- Properly discharge any item tested with DC before touching connections.

1.4 Key Features and Benefits: ESD

THE FIRST MANUAL GROUND BOND INSTRUMENT WITH AN ENHANCED GRAPHIC LCD	Provides the operator with an easy-to-use interface, eliminating the need to decipher cryptic abbreviations. The graphic display makes testing safer, easier and more reliable than ever before.
SECURITY ACCESS	Limit user access so that only authorized personnel with a security code can change test parameters.
STORAGE OF UP TO 10 DIFFERENT TEST PROGRAMS	Store test parameters and quickly recall them for each of the different products that need to be tested. Memories can also be linked to run multi-step tests.
INTERCONNECTION WITH 7100 SERIES	Connect a ESD and a 7100 series to form a complete test system. The test system can be configured to perform sequential Ground Bond

	and Dielectric Withstand tests, or run both simultaneously.
FOUR WIRE MEASUREMENT (KELVIN METHOD) AND MILLIOHM OFFSET CAPABILITY	The Kelvin four wire measurement technique eliminates test lead resistance. The milliohm offset function allows for the use of longer test leads without compromising the test results.
PLC REMOTE INPUTS AND OUTPUTS	Two standard 9 pin interfaces provide inputs and outputs for simple PLC relay control. Outputs include: PASS, FAIL, RESET and TEST IN PROCESS signals. Inputs include: TEST, INTERLOCK, RESET and remote recall of MEMORY 1, 2 and 3.
WITHSTAND PROCESSING INDICATOR	As a safety precaution, the enhanced graphic LCD indicates when the high voltage from the 7100 series is being applied to the device under test
SOFTWARE CALIBRATION CONTROL	ESD can be completely calibrated without removing any covers and exposing the technician to hazardous voltages.
NO LOAD SETUP OF OUTPUT CURRENT	Set output current parameters without activating the output.

2. Getting Started

This section contains information for the unpacking, inspection, preparation for use and storage of your eec product.

2.1 Unpacking and Inspection

2.1.1 Packaging

Your instrument was shipped in a custom foam insulated container. If the shipping carton is damaged, inspect the contents for visible damage such as dents, scratches or a broken display. If the instrument is damaged, notify the carrier and Associated Research, Inc.'s customer support department. **Please save the shipping carton and packing material for the carrier's inspection.** Our customer support department will assist you in the repair or replacement of your instrument. Please do not return your product without first notifying us.

- Please retain all of the original packaging materials.

Inside the carton should be the following:

DESCRIPTION	eec PART NUMBER
Instrument	ESD-140
Cable ASSY High Current Output	1137 Current with Kelvin
Cable ASSY High Current Return	1138 Return with Kelvin
Fuse	10 Amp, Slow Blow 250VAC
Power Cord	Standard
Interlock Connector	1505

WARNING Only accessories that meet the manufacturer's specifications shall be used.

2.1.2 Returning the Instrument

When it is necessary to return the instrument for servicing or calibration, repackage the instrument in its original container, please include all accessories and test leads. Indicate the nature of the problem or type of service needed. Also, please mark the container "FRAGILE" to insure proper handling.

If you do not have the original packaging materials, please follow these guidelines:

- Wrap the instrument in a bubble pack or similar foam. Enclose the same information as above.
- Use a strong double-wall container that is made for shipping instrumentation. 350 lb. test material is adequate.
- Use a layer of shock-absorbing material 70 to 100 mm (3 to 4 inch) thick around all sides of the instrument. Protect the control panel with cardboard.
- Seal the container securely.
- Mark the container "FRAGILE" to insure proper handling.

2.2 Installation

2.2.1 Work Area

WARNING Locate a suitable testing area and be sure you have read all safety instructions for the operation of the instrument and suggestions on the test area set-up in the Safety section. Make sure the work area you choose has a three-prong grounded outlet. Be sure the outlet has been tested for proper wiring before connecting the instrument to it.

2.2.2 Power Requirements

This instrument requires a power source of either 100 - 120V AC ± 10%, 50/60 Hz single phase or 200- 240V AC ± 10%, 50/60 Hz single phase. Please check the rear panel to be sure the proper switch setting is selected for your line voltage requirements before turning your instrument on. For operation at 120 and 240 Volts AC use a 10A, 250VAC slow-blow fuse. ESD-140 max. rated power is 850VA.

2.2.3 Basic Connections

Power Cable

The instrument is shipped with a line cord containing a protective earth ground. When the line cord is connected to an appropriate AC power source the cable will connect the chassis to earth ground.

WARNING The main plug shall only be inserted in a socket outlet with a protective ground (earth) contact. This protective ground **must not be defeated** by the use of an extension cord without a protective conductor.

CAUTION Do not replace the included line cord with an improperly rated cord. A UL listed and CSA labeled power cord must be used with the instrument in the United States and Canada. The power cord must include a NEMA5-15 style male plug, SVT or SJT cord sets, and be rated for at least 125VAC, 10A. Number 18 gauge wire or larger must be used.

Return Connection

CAUTION The output power supplies of this instrument are referenced directly to earth ground. Any conductor that completes a path between the high voltage and earth ground will form a completed circuit.

When the instrument Return is grounded, any internal and external stray leakage will be monitored due to currents that flow from High Voltage to earth ground (such as from HV to the chassis of the instrument). This current is inherent and will cause errors when trying to monitor very low leakage currents in the micoamp range.

2.2.4 Environmental Conditions

This instrument may be operated in environments with the following limits:

Temperature…… 0° - 40° C
Relative humidity ……20 - 80%
Altitude ……6,560 feet (2,000 meters)

Storage and Shipping Environment

This instrument may be stored or shipped in environments with the following limits:

Temperature.....-40°- 75°C

Altitude.....…….....25000 feet (7,620 meters)

The instrument should also be protected against temperature extremes that may cause condensation within the instrument.

Ventilation: Do not block any ventilation openings, insure that there is at least 6 inches (15 cm) of space from the rear panel to any wall or obstruction behind the unit.

3. Specifications and Controls

3.1 Specifications

MODEL		ESD-140			
GROUND BOND					
Output DC Current		1 - 40A			
Output DC Voltage		8V, Maximum			
SETTINGS					
Max / Min - Limit Resistance, mΩ	Range	0 - 600	0 - 200	0 - 150	
	DC Current	1.00 - 10.00A	10.01 - 30.00A	30.01 - 40.00A	
	Resolution	1 mΩ			
	Accuracy	Same as Resistance Measurement Accuracy			
Lead Resistance Offset	Range	0 - 100mΩ			
	Resolution	1 mΩ			
	Accuracy	± (2%% of setting + 2 counts)			
Dwell Time, second	Range	0, 0.5 - 999.9 (0 = continuous)			
	Resolution	0.1			
	Accuracy	± (0.1% + 0.05 sec)			
MEASUREMENT					
DC Current, A	Range	0.00 - 40.00			
	Resolution	0.01			
	Accuracy	± (3% of reading + 3 counts)			
Resistance, mΩ	Range	0 - 600	0 - 600	0 - 200	0 - 150
	DC Curren	1.00 - 5.99A	6.00 - 10.00A	10.01 - 30.00A	30.01 - 40.00
	Resolution	1 mΩ			
	Accuracy	± (3% of reading +3 counts)	± (2% of reading + 2 counts)		
GENERAL					
Input Voltage AC		100 - 120V±10%, 200 - 240V±10% auto-detection,50/60 Hz. 10 Amp, slow-blow 250 VAC			
PLC Remote Control		Input : Test, Reset, Interlock, Withstand Processing, Memory 1, 2, 3, Output : Pass, Fail, Test-in-Process, Start Out, and Reset Out			
Memory		10 memories, 3 steps / memory			
Display		128 x 64 Graphic LCD			
Security		Key Lock capability to avoid unauthorized access to all test parameters. Memory Lock capability to avoid unauthorized access to memory locations.			
Verification		Build-in software driven verification menu to test fault detection circuits			
Alarm Volume Setting		Range : 0 - 9; 0 = OFF, 1 is softest volume, 9 is loudest volume			
Interface		RS-232			
CE		YES			
Environment		0 - 40ºC, 20 - 80%RH			
Dimension (W x H x D), mm		215 x 89 x 370			
Net Weight		5.5Kg			
STANDARD ACCESSORIES					
Power Cord (10A)		× 1			

Fuses	× 2 (Including a spare contained in the fuse holder)
Interlock Disable Key (1505)	× 1
Ground Bond Test Lead 40A ,1.6m (1137)	× 1
Ground Bond Return Lead 40A ,1.6m (1138)	× 1

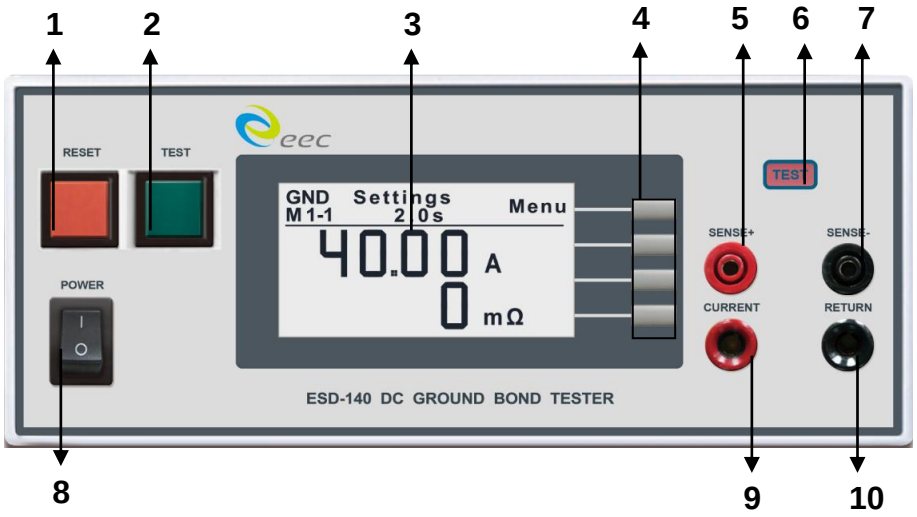
*product specifications are subject to change without notice.

【Ordering Information】

ESD-140 DC Ground Bond Tester (40A / 8V)
OPT.781 RS232 Interface

3.2 Instrument Controls

3.2.1 Front Panel Controls



1. **RESET BUTTON:** Momentary contact switch used to reset the instrument. If a failure condition occurs during a test, you will need to reset the system to shut off the alarm and signal the system that you are aware of a failure condition. The reset button must be pressed before you can proceed to the next test or change any of the set-up parameters. This switch also serves as an abort signal to stop any test in progress controlled by the Ground Bond Tester.

2. **TEST BUTTON:** Momentary contact switch used to start tests. Press the green button to activate the test that is set up in the test buffer shown on the display.

3. **GRAPHIC LCD:** 128 X 64 Monographic LCD.

4. **SOFT KEYS:** Multifunction parameter selection keys. Keys used to select screens and change parameters.

5. **SENSE+ JACK:** Connector used to attach the Current test lead or test fixture to the instrument. This connector provides a positive Kelvin voltage sensing for the instrument.

6. **TEST LED INDICATOR:** This red indicator flashes to warn the operator that current is present at the output terminal, and a test is in process.

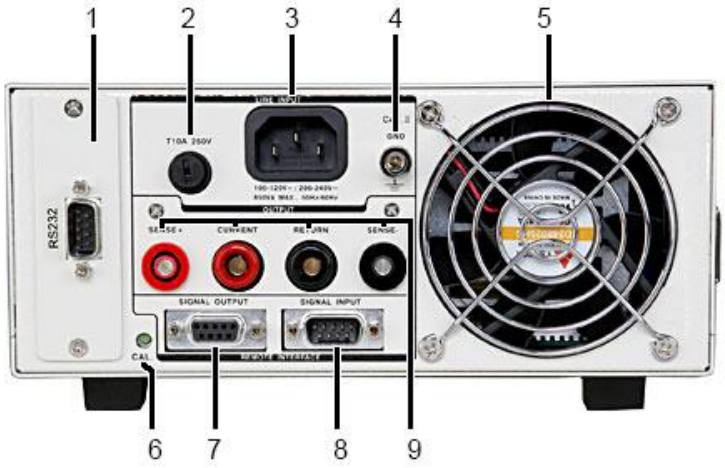
7. **SENSE- JACK:** Connector used to attach the Return test lead or test fixture to the instrument. This connector provides a negative Kelvin voltage sensing for the instrument.

8. **POWER SWITCH:** Rocker style power switch with international ON (|) and OFF (0) markings.

9. **CURRENT OUTPUT JACK:** Connector used to attach the Current test lead, adapter box, or test fixture to the instrument.

10. **RETURN OUTPUT JACK:** Connector used to attach the Return test lead, adapter box, or test fixture to the instrument.

3.2.2 Rear Panel Controls



1. **RS-232 CONNECTOR:** 9-Pin D subminiature connector for interconnection to RS-232 Bus interface.

2. **FUSE RECEPTACLE:** To change the fuse, unplug the power (mains) cord and turn the fuse receptacle counter-clockwise. The fuse compartment will be exposed. Please replace the fuse with one of the proper rating.

3. **INPUT POWER RECEPTACLE:** Standard IEC 320 connector for connection to a standard NEMA style line power (mains) cord.

4. **CHASSIS GROUND (EARTH) TERMINAL:** This terminal should be connected to a good earth ground before operation.

5. **THERMAL COOLING FAN:** Full time cooling fan.

6. **CALIBRATION BUTTON**: To put the instrument into the calibration mode, push this button and turn on the POWER switch simultaneously.

7. **REMOTE SIGNAL OUTPUT:** 9-Pin D subminiature female connector for monitoring PASS, FAIL, PROCESSING, and RESET output relay signals.

8. **REMOTE SIGNAL INPUT:** 9-Pin D subminiature male connector for remote control of TEST, RESET, and INTERLOCK functions, as well as remote program memory selection and withstand processing input.

9. **REAR PANEL OUTPUT CONNECTORS:** These connectors are in parallel with the front panel connectors.

4. Programming Instructions

4.1 Power Up

The ESD-140 automatically defaults to the Perform Tests screen upon power up.

The Perform Tests screen is the main operational screen of instrument. From this screen, all test parameters are monitored while the test is being performed. For more information refer to section **5.2. Perform Tests, Main Menu, and Results Screens**

4.1.1 Memory, Step, and Connected Step Indicator

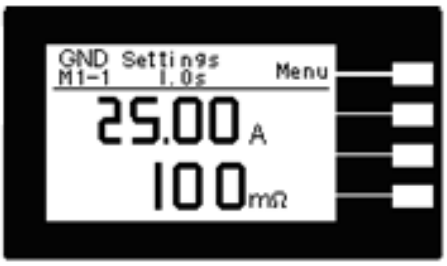
When in the Perform Tests screen, the ESD-140 will indicate the current memory location (M0–M9) and step number (1-3) in the upper-left part of the screen (i.e. M3-2).

The connected step indicator is an underscore symbol located directly next to the memory and test step number (i.e. M4-2_) and only will be displayed when the Connect function has been turned ON.

NOTE: There are only 3 programmable test steps per memory location. Step 3 of any memory location cannot be connected to another step.

4.1.2 Main Menu

From the Perform Tests screen, press the “Menu” soft key.



The Main Menu will now be displayed. From the Main Menu screen, three software controls may be accessed: Menu, Memory and Step. Pressing the “Exit” soft key at any time will return you to the Perform Tests screen.

Menu

Pressing the “Menu” soft key from the Main Menu will display the Results, Test and System selections. Please refer to section **5.2.3. Results, Test, and System Selections.**

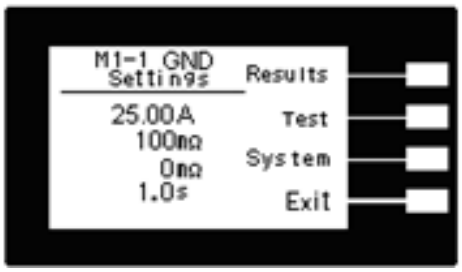
Memory

The ESD-140 has 10, 3-step programmable memory locations (M0-M9). Press the “Memory” soft key to increment the instrument to the desired memory location. As the “Memory” soft key is pressed, the parameters of the selected memory location are automatically loaded into the instrument.

Step
Each of the 10 memory locations in ESD-140 has 3 programmable test steps that may be connected together to create a multi-step test sequence. Press the “Step” soft key to increment the test step number.

4.1.3 Results, Tests and System Selections

From the Main Menu, press the “Menu” soft key.



From this screen, three software controls may be accessed: Results, Test and System. Pressing the “Exit” soft key at any time will return you to the Main Menu screen.

Results
Pressing the “Results” soft key from this menu will allow you to review the test results of the last test performed.

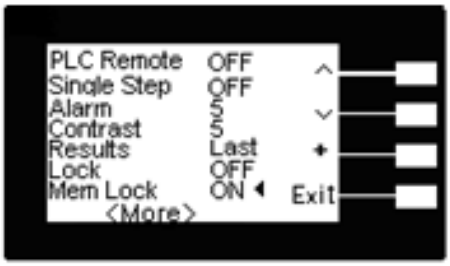
Test
Pressing the “Test” soft key from this menu will allow you to access the Parameter Review screen. For specific instructions for reviewing and editing test parameters, refer to section **4.3. Test Parameters**.

System
Pressing the “System” soft key from this menu will allow you to access the Setup System screen. For specific instructions for editing system parameters, refer to section **4.2. System Setup**.

4.2 System Setup

1. From the Perform Tests screen, press the “Menu” soft key. The Main Menu screen will now be displayed.
2. From the Main Menu screen, press the “Menu” soft key. Results, Test and System selections will now be displayed.
3. From this screen, press the “System” soft key. The Setup System Menu will now be displayed.

From the Setup System screen, fourteen different hardware and software controls may be accessed: PLC Remote, Single Step, Alarm, Contrast, Results, Lock, Mem Lock, Hipot Start, Cal-Alert, Cal Date, Cal Due, Alert, Date, and Time. Pressing the “Exit” soft key at any time will save all parameters and return to the Perform Tests screen.



4.2.1 System Setup Soft Keys

Directional soft keys ∧,∨, >
The "∧,∨, >" soft keys are used to scroll the cursor to the different system parameters.

+ key
The "+" soft key is used to increase numerical values or toggle settings ON and OFF.

Exit key
The "Exit" soft key is used to save the new system parameters and return to the Perform Tests screen.

4.2.2 System Parameters

Use the directional soft keys, "∨,∧, >", to navigate the system parameters during reviewing and editing. The directional soft keys will change depending on which parameter the cursor is pointing to.

PLC Remote
When the PLC remote is turned ON the front panel TEST button is disabled and a test may only be started through the rear panel I/O. If you attempt to start a test from the TEST button on the front panel when the PLC Remote function is turned ON, a pop-up message will be displayed.

Refer to the section **6. Connection of Remote I/O** for more details.

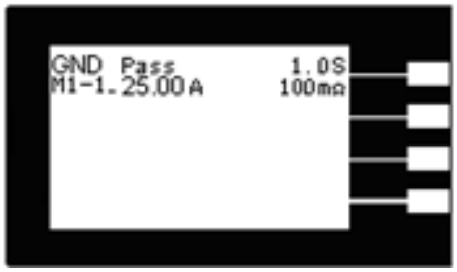
Single Step
This function is used to temporarily override the automatic connection feature. When the Single Step function is ON the instrument will pause after each test step is completed. To continue the test sequence, press the TEST button to execute the next connected test step. Each time the TEST button is pressed the next connected test step will execute. If you press the RESET button before completing all connected test steps, it will return you to the original starting test step. If a step fails and you wish to continue to the next test step press TEST.

Alarm Volume
The numbers 0 through 9 correspond to different volume settings, 0 meaning the volume is OFF and 9 meaning the volume is at the loudest setting. After the "+" soft key is pressed a momentary alarm chirp will occur to indicate the volume of the new setting.

LCD Contrast
The numbers 0 through 9 correspond to the different contrast settings, 0 meaning the lightest color of displayed characters and 9 meaning the darkest color of displayed characters. After the “+” soft key is pressed the display will automatically adjust to the new display setting.

Results
Selects the type of results you would prefer to have displayed at the end of a test or sequence of connected test steps. The available selections are: All, P/F and Last.

When All is selected, a Results Summary screen will be displayed at the end of the test or sequence of connected test steps displaying the results of all of the test steps. The Results Summary screen will appear as follows:



When P/F is selected, a Pass or Fail screen will be displayed at the end of the test. The Pass and Fail screens will appear as follows:

When P/F is selected, it is not possible to see the test results directly at the end of the test. In order to review the test results refer to section **4.2.3. Reviewing Test Results.** When Last is selected, the results of the last test step performed will be displayed on the Perform Tests screen. There will not be a change in appearance or special screen displayed in this mode.

Lock
Turning Lock ON restricts access to parameter and system settings. The level of security is determined by the Mem Lock function.

Mem Lock
Mem Lock is a sub-function of the Lock setting. In order for the Mem Lock function to work, the Lock must first be turned ON. Turning the Mem Lock OFF will allow the user to access all available memory locations but restricts access to memory and step editing capabilities. Turning the Mem Lock ON will allow the user to only run the

currently loaded memory.

Disabling Lock
Once the Lock function is activated, a special procedure is required to defeat the security. To defeat the security press the top soft key while powering up the instrument. Now you may access the system menu and turn the security function OFF.

Hipot Start
Scroll the cursor to the Hipot Start parameter using the directional soft keys. You may toggle the selection between G→W and G + W by pressing the "+" soft key.

The Hipot Start parameter is only used when connecting the Ground Bond Tester with an eec Hipot tester. If G→W is selected, the Hipot test will run after the Ground Bond Tester has completed its test. If G + W is selected, the Hipot test will run at the same time as the Ground Bond Tester.

The Hipot Start parameter directly controls the Start Output relay. Running in the G→W mode will momentarily close the Start Output relay at the end of the Ground Bond test. Running in the G + W mode will momentarily close the Start Output relay at the start of the Ground Bond test.

Cal-Alert (Calibration Alert)
The Cal-Alert feature alerts the user that the instrument is due for calibration. Turning this parameter ON will activate the Cal-Alert function and when the date matches the Alert Date, the instrument will display the Cal-Alert warning screen upon power up. If the "Show this screen again?" function has been turned OFF at the Cal-Alert Warning screen, this parameter will automatically be set to OFF.

Cal Date(Calibration Date)
Cal Date is a non-editable parameter that indicates the last date that calibration was performed on the instrument. This parameter is updated at the time of calibration.

Cal Due (Calibration Due Date)
After a calibration is performed, the Cal Due Date is automatically set for 1 year after the calibration date. This parameter may be overwritten to any date desired. Within the Cal Due Date parameter are three separate fields, month, day, and year. Use the ">" soft key to select the field within the date you want to edit then use the "+" soft key to change the numeric value. Once you change the value it is automatically stored.

NOTE: It is recommended that calibration should be performed at least once a year.

Alert (Alert Date)
The Alert Date is like an alarm clock that will warn you in advance of the actual Calibration Due Date. After a calibration is performed, the Alert Date is automatically set for 11 months after the calibration date. For example, if the calibration is performed on 12/15/2002 the Alert Date will automatically be set to 11/15/2003.

This parameter may be overwritten to any advanced date desired. Within the Alert Date parameter are three separate fields, month, day, and year. Use the ">" soft key

to select the field within the date you want to edit. Use the "+" soft key to change the numeric value. Once you change the value it is automatically stored.

Date
Within the Set Date parameter are four fields, date format (mdy / dmy), month, day, and year. Use the ">" soft key to select the field within the date you want to edit. Use the "+" soft key to change the numeric value. Once you change the value it is automatically stored.

Time
Within the Set Time parameter are three fields: hours, minutes, and Military or Standard time. Use the ">" soft key to select the field within the time parameter you want to edit. Use the "+" soft key to change the numeric value. Once you change the value it is automatically stored.

At the Cal-Alert Warning screen "Show screen again?" will be displayed along with the options "Yes" or "No." The question must be answered by toggling between the words "Yes" and "No" using the corresponding soft key and then pressing the "OK" soft key. Selecting "No" will disable the Cal-Alert function. Selecting "Yes" will exit the Cal-Alert Warning screen and go to the standard introduction screen without disabling the Cal-Alert function.

If security is enabled this screen will not appear.

It is possible to quickly bypass the security of the Cal-Alert by powering up the instrument while pressing the soft key that is second from the top of the instrument. This will temporarily start the instrument in an unsecured state. The Cal-Alert Warning screen will be displayed and Cal-Alert may be disabled by selecting "No" and then pressing the "OK" soft key. This type of security override only affects the Cal-Alert screen. It is not necessary to restart the instrument to activate the security setting.

4.2.3 Default System Parameters

Setup System	PLC Remote	OFF
	Single Step	OFF
	Alarm	5
	Contrast	5
	Results	Last
	Lock	OFF
	Mem Lock	OFF
	Hipot Start	G→W
	Date Format	mdy (month, day, year)
	Cal Alert	ON
	Alert Date	Cal Date + 11 months

4.2.4 Memory, Step, and Default System Parameter Restore

WARNING Restoring the instrument's System parameters will overwrite all memories and steps with ACW default parameters!

Press the two bottom soft keys and power the instrument at the same time, then press the soft key next to the word "Yes". All memories and steps will be loaded with the ACW default parameters and the system parameters will be set to the factory defaults.

The following System parameters will not be affected by the system initialization:

Setup System	Cal Alert	No change
	Cal Date	No change
	Cal Due	No change
	Alert	No change
	Date m/d/y	No change
	Time	No change

4.3 Test Setup

1. From the Perform Tests screen, press the "Menu" soft key. The Main Menu screen will now be displayed.
2. From the Main Menu screen, press the "Menu" soft key. Results, Test and System selections will now be displayed.
3. From this screen, press the "Test" soft key. The Test Parameter Review screen will now be displayed.
4. From this screen all relevant test parameters may be edited and saved. Refer to section **4.3.4. Default Test Parameters** for a complete list of test parameters.

4.3.1 Test Setup Soft Keys

Directional soft keys ∧,∨, >
The "∧,∨, > " soft keys are used to scroll the cursor to the different system parameters.
+/- keys

The "+" and "-" soft keys are used to increase or decrease numerical values or toggle settings ON and OFF.

Enter key
The "Enter" soft key is used to store a specific value for each test parameter.

Edit key
The "Edit" key is used to access a specific parameter and allow it to be changed.

Esc key
The "Esc" key is used to return to the Test Parameter Review screen during parameter editing without saving the new parameter value.

Exit key
The “Exit” soft key is used to return to the Test Parameter Review screen and the Perform Tests screen.

4.3.2 Test Parameters

Use the directional soft keys, “∨, ∧” to navigate the test parameters during reviewing and editing. The directional soft keys will change depending on which parameter the cursor is pointing to.

Current: The Current that is applied between the Current and Return lead during a ground bond test.

Max-Limit: A maximum resistance threshold that when exceeded triggers a failure.

Min-Limit: A minimum resistance threshold that when not exceeded triggers a failure.

Dwell Time: A length of time that is allowed for the set point current to be applied.

Connect: This function when turned ON will connect or link the current step to the next step. The third step in a Memory will not have this function because it is the last step of the Memory location.

Offset: The Offset function may be used to compensate for test lead and test fixture resistance during the test. Using the up and down arrow keys, scroll the cursor to the Offset parameter and press the “Edit” soft key. You may now manually or automatically set an Offset value.

To manually set the Offset, use the “+” and “-” soft keys to increase and decrease the resistance value. Press the “Enter” soft key to accept the new value or press the “Esc” soft key to escape from the edit.

To automatically set an Offset value, set the current and frequency to the values that will be used on the DUT and connect the test cables or test fixture with fixturing to the instrument. Next, short circuit the ends of the test cables and press the TEST button. The instrument will now read the lead resistance and update Offset parameter automatically. Press the “Enter” soft key to accept the new value or press the “Esc” soft key to escape from the edit.

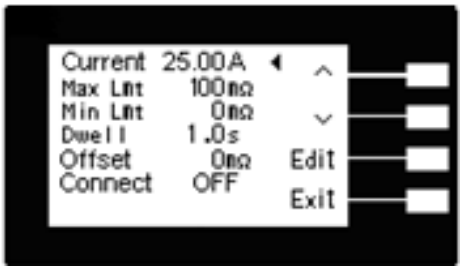
4.3.3 Default Test Parameters

The following table is a listing of the Default Parameters in the ESD. These parameters may be programmed to all of the memories and steps by pressing the two bottom soft keys and powering the instrument at the same time. The Default Parameters are as follows:

PARAMETER	VALUE
Current	25.00A
Max Lmt (current)	100mΩ
Min Lmt (current)	0mΩ
Dwell	1.0s
Offset	0mΩ
Connect	OFF

4.3.4 Setting Up a Test

From the Test Parameters Review screen scroll the cursor using the "∧" and "∨" soft keys to the Current parameter. Press the "Edit" soft key. Increase or decrease the Current parameter using the up and down arrow keys. Press the "Enter" soft key to accept the parameters or press the "Esc" soft key return to exit without saving.



From the Parameter Review screens the following parameters may be selected for editing: Current, Max Lmt, Min Lmt, Dwell, Frequency, Offset, and Connect.

5. Operating

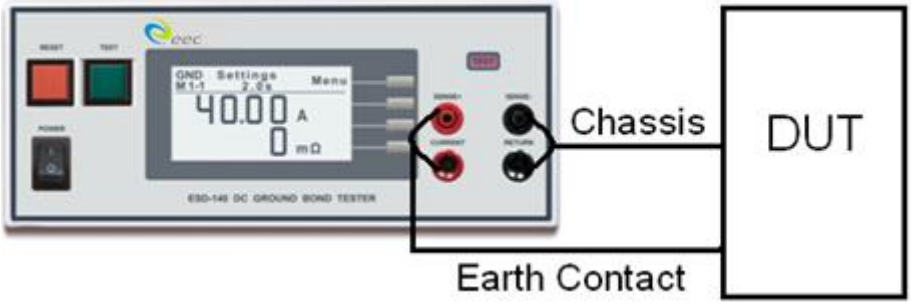
5.1 Instrument Connections

5.1.1 Test Leads

The test leads provided are designed specifically for use with this instrument. The red High Current lead will mate with the red Current jack. The black Return lead will mate with the black Return jack.

Connecting the Test Leads on ESD-140

The ESD-140 Current and Return leads are equipped with high current locking connectors that should be pushed into their mating receptacle until seated against the rubber grommet. Avoid excessive force. If the grommet becomes compressed, the lock feature may not activate. To release the lock and remove the leads, push the lead in towards the instrument compressing the grommet then pull back on the lead to remove.



Connect the High Current lead to the Current receptacle on the ESD-140, then connect the Kelvin lead (smaller gauge wire captured in the same sleeve) to the SENSE+ receptacle. Next, connect the other end of the leads to the earthing contact (usually the ground conductor connection point for the Line cord inlet).

Connect the Return lead to the Return receptacle on the ESD-140, then connect the Kelvin lead (smaller gauge wire captured in the same sleeve) to the SENSE- receptacle. Next, connect the other end of the lead to chassis ground.

5.1.2 Interlock Connector

Ground Bond Tester is equipped with a Remote Interlock feature. Remote Interlock utilizes a set of closed contacts to enable the instrument's output. If the Remote Interlock contacts are open the output of the instrument will be disabled. To disable the Remote Interlock feature connect the Interlock Key into the Signal Input port located on the back of the tester.

5.2 Performing a Test

1. From the Main Menu, select the memory and step you wish to perform then press the “Exit” soft key to return to the Perform Tests screen.
2. Attach the appropriate load or DUT to the instrument. Refer to section 5.1. Instrument Connections for instrument connections.
3. Press the TEST button.
4. The instrument will now perform the test or sequence of connected tests. If a test is started from any step other than 01, it will continue to start from that selected test step when you press the RESET or TEST buttons.

5.3 Test Metering

The Ground Bond Tester Perform Test screen will display Current, Time, and Resistance during a test.

5.4 Results Screens

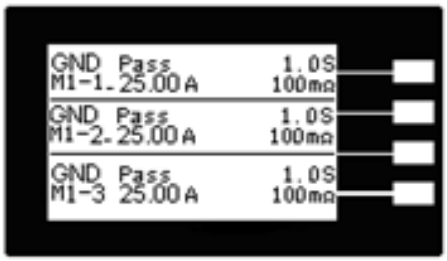
The Ground Bond Tester may be configured to display one of three different types of Results screens (see section **4.2. Setup System** for more information). To access the results screen use one of the following methods:

Method 1, Hot key

Pressing the bottom soft key at the Perform Tests screen will display the Results screen.

Method 2, Menu Selection

1. From the Perform Tests screen, press the “Menu” soft key. The Main Menu will now be displayed.
2. From the Main Menu screen, press the “Menu” soft key. The Results, Test and System selections will now be displayed.
3. From this screen, press the “Result” soft key. The Results screen will now be displayed. The Results screen will appear as follows:



NOTE: For multi-step tests, use the “∧” and “∨” soft keys to scroll through the results.

5.5 Error Messages

While performing tests a number of messages will be displayed to indicate the test state or test results. These messages are displayed in the status area of the screen located on the first line at the top of the LCD. These messages are also used on other screens where test results are displayed.

Abort: This message appears on the display, if the test in process is aborted with the RESET button or remote Reset control.

Max-Fail: This message appears on the display if the measured reading exceeds the Max Lmt current setting of the Ground Bond test, or Max Lmt resistance setting of the Insulation Resistance test.

Min-Fail: This message appears on the display if the measured reading drops below the Min Lmt current setting of the Ground Bond test, or Min Lmt resistance setting of the Insulation Resistance test.

Short: This message appears on the display, if the DUT current is well beyond the metering range of the test.

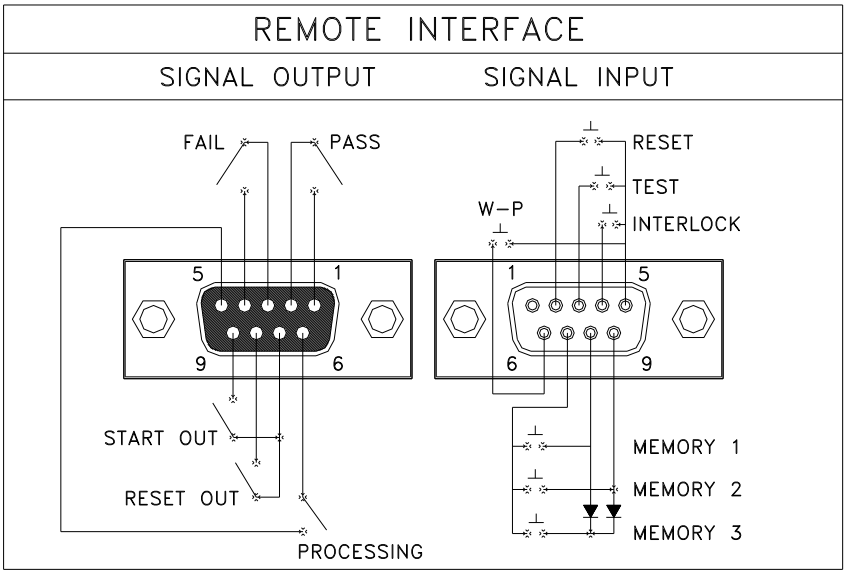
Interlock Open: This message appears on the display if the Remote Interlock feature is activated before or during a test. See section **6.2. Remote Signal Inputs and Memory Access** for more information.

Out-Error: This message appears on the display if the instrument has an internal problem and the TEST button is pressed. The RESET button is not active while this screen is displayed. To clear this screen and return to test mode press the “Exit” soft key. When the “Exit” soft key is pressed the instrument will continue with its normal failure indication process. The failure light and Alarm can then be cleared by pressing the RESET button.

Note: If the instrument continues to power up in this condition it should be sent in for service or repair.

6. Connection Remote I/O

Two 9 pin D-type connectors mounted on the rear panel provide REMOTE-INPUT-OUTPUT control and information. These connectors mate with a standard 9 pin D-type subminiature connector provided by the user. The output mates to a male (plug) connector while the input mates to a female (receptacle) connector. For best performance, a shielded cable should be used. To avoid ground loops the shield should not be grounded at both ends of the cable. Suggested AMP part numbers for interconnecting to the Remote I/O are shown below:



6.1 Remote Signal Outputs

The rear panel connector provides three output signals to remotely monitor PASS, FAIL, and PROCESSING conditions. The monitoring signals are provided by three normally open internal relays that toggle ON and OFF to indicate the condition of the tester. The RESET OUT pulse signal and the START OUT pulse signal are also provided by a normally open internal relay. The RESET OUT gives a signal whenever the RESET function is activated. This can be used to abort a Hipot test while the units are interfaced as a test system. The START OUT gives a momentary output pulse that can be used to start a Hipot test. These are normally open free contacts and will not provide any voltage or current. The ratings of the contacts are 1 AAC / 125 VAC (0.5 ADC / 30 VDC). The signal outputs are provided on the 9 pin female D-type connector. Below is a list that indicates what conditions activate each pin. When a terminal becomes active the relay closes thereby allowing the external voltage to operate an external device.

Pins 1 and 2 provide the PASS signal.
Pins 3 and 4 provide the FAIL signal.
Pins 5 and 6 provide the PROCESSING signal.
Pins 7 and 8 provide the RESET OUT signal.
Pins 7 and 9 provide the START OUT pulse signal.

The following describes how the relays operate for each test condition.

PROCESSING – The relay contact closes the connection between pin (5) and pin (6) while the instrument is performing a test. The connection is opened at the end of the test.

PASS – The relay contact closes the connection between pin (1) and pin (2) after detecting that the item under test passed all tests. The connection is opened when the next test is initiated or the reset function is activated.

FAIL – The relay contact closes the connection between pin (3) and pin (4) after detecting that the item under test failed. The connection will open when the next test is initiated or the reset function activated.

RESET OUT – The relay contact closes the connection between pin (7) and pin (8) while the reset function is activated. This is only a continuous closure dependent on the length of time the reset button is held in an active state.

START OUT - The relay contact closes the connection between pin (7) and pin (9). The Hipot Start parameter directly controls the Start output relay. G→W will momentarily close the start output relay at the end of the Ground Bond test and G + W will momentarily close the start output relay at the start of the Ground Bond test.

The Hipot Start parameters main purpose is to control the sequential timing between Ground Bond Tester and a connected eec Hipot. The parameter controls if the Hipot will run after the Ground Bond Tester has completed its test, G→W, or if the Hipot will run at the same time as the Ground Bond Tester, G + W.

6.2 Remote Signal Inputs and Memory Access

The Ground Bond remote connector enables remote operation of the TEST, RESET, and REMOTE INTERLOCK functions, and allows the operator to select Memory Location 1, 2, and 3.

When the PLC Remote mode is on, the Ground Bond will respond to simple switch or relay contacts closures. A normally open momentary switch can be wired across pins 3 and 5 to allow remote operation of the TEST function. A minimum pulse width or contact closure of 20mS is required to guarantee a test start. A normally open momentary switch can be wired across pins 2 and 5 to allow remote operation of the RESET function. A minimum pulse width or contact closure of 50mS is required to guarantee that a running test will abort. When the PLC remote function is (ON) the TEST switch on the front panel will be disabled to prevent a test from being activated through this switch. For safety, the front panel RESET switch remains active even when a remote reset switch is connected so that high voltage can be shut down from either location.

The Remote File Select function gives the user the capability to quickly change parameters and initiate a test remotely. Three internal memory programs can be accessed by connecting terminals 7, 8, and 9 in different combinations. The memory

select bits should be set simultaneously and remain set for a minimum of 20ms to guarantee that the correct memory will be selected.

WARNING ACTIVATING MEMORY PROGRAM FUNCTIONS THROUGH THE REMOTE CONNECTOR, SELECTS THE PROGRAM AND STARTS THE TEST WHICH IS PREPROGRAMMED INTO THAT MEMORY

CAUTION DO NOT CONNECT VOLTAGE OR CURRENT TO THE SIGNAL INPUTS, THIS COULD RESULT IN DAMAGE TO THE CONTROL CIRCUITRY.

Memory Location 1 – Momentarily connecting terminal 7 to 8 signals the instrument to immediately begin the test program that is stored in Memory Location 1.

Memory Location 2 – Momentarily connecting terminal 7 to 9 signals the instrument to immediately begin the test program that is stored in Memory Location 2.

Memory Location 3 – Momentarily connecting terminal 7 to terminals 8 and 9 signals the instrument to immediately begin the test program that is stored in Memory Location 3.

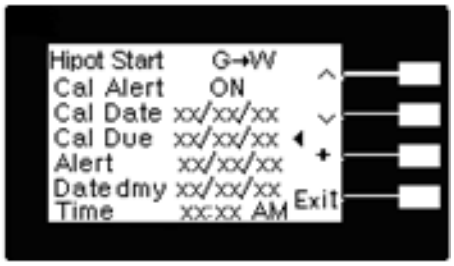
Remote Interlock

Ground Bond is equipped with a Remote Interlock feature. Remote Interlock utilizes a set of closed contacts to enable the instrument's output. If the Remote Interlock contacts are open the output of the instrument will be disabled. Remote Interlock could also be referred to as a remote system lockout, utilizing "fail when open" logic. If the Remote Interlock contacts are open and the TEST button is pushed, a pop-up message will be displayed on the screen for two seconds. The message will appear as follows:

If the Remote Interlock contacts are opened during a test, the pop-up message will be displayed and the test will abort. The hardware and has been configured to provide the interlock connections on pins 4 and 5 of the Remote Interface, Signal Input port. The instrument can still be used without the external interlock device as long as the Interlock Disable Key (38075 provided with unit) is plugged into the Remote Interface, Signal Input port. If there is nothing connected to the Remote Interface, Signal Input port to provide a connection to the Remote Interlock, the instrument will not perform tests.

Withstand Processing
When a Ground Bond is integrated with a 7100 series as a test system, the processing signal from the Hipot tester will be sent across pin (6) and pin (7) of the Ground Bond Tester Remote Signal Input. This signal will activate the front panel "Withstand Processing" indicator that notifies the operator that high voltage is enabled.

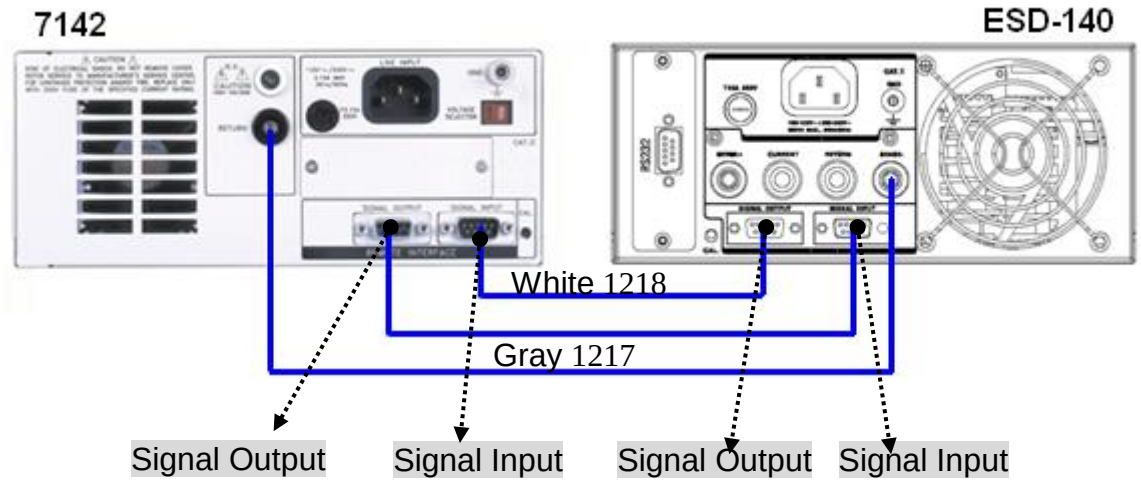
If the Hipot start is set to G→W (sequential) then the "Withstand Processing" indicator will appear as the following pop-up message:



If the Hipot start signal is set to G+W then a small "W-T" indicator will appear in the upper right of the display.

PLC Remote Pop-up message
If you attempt to start a test from the front panel TEST button and the PLC remote function is turned "ON", a pop-up message will be displayed.

Ground Bond Tester Connected to HIPOT Tester
The following illustration and should be used to configure the ESD-140 for integrated operation with 7142:



When HIPOT Tester is connected to Ground Bond Tester, the HIPOT Tester should have PLC remote turned on. In this configuration, you will only be able to start and reset the Ground Bond Tester from the Ground Bond Tester. It is possible to reset or abort the HIPOT Tester from both instruments.

Hipot Start parameter

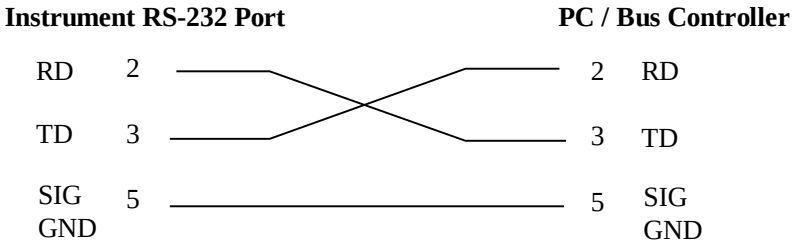
The Hipot Start parameter, found in the System Menu screen, controls whether the Hipot test will run sequentially after the Ground Bond test or simultaneously with the Ground Bond test. Please refer to section **4.1 Setup System** for instructions on how to set this parameter.

The Hipot Start parameter is only used when connecting the Ground Bond Tester with an eec HIPOT Tester. The parameter determines if the Hipot will run after the Ground Bond Tester has completed its test, G→W, or if the Hipot will run at the same time as the Ground Bond Tester, G + W.

The Hipot Start parameter directly controls the Start output relay. Setting the Hipot start parameter to G→W will momentarily close the start output relay at the end of the Ground Bond test. Setting the Hipot start parameter to G + W will momentarily close the start output relay at the start of the Ground Bond test

7. Bus Remote Interface

RS-232 Interface
The RS-232 cabling should be configured as follows for a 9-pin serial port interface:



The COM port should have the following configuration:

19200 baud
8 data bits
1 stop bit
No parity

This interface does not support XON/XOFF protocol or any hardware handshaking. The controller should be configured to ignore the handshaking lines DTR (pin 4), DSR (pin 6) CTS (pin 8) and RTS (pin 7). If the port cannot be configured through software to ignore these lines the handshake lines should be jumpered together in two different sets. Pins 4 and 6 should be jumpered together and pins 7 and 8 should be jumpered together at the controller end of the cable.

Sending Data
Once a command is sent to the instrument over the RS-232 bus the instrument will send one of two responses. If the transfer was recognized and completed the instrument will return with 06 hex or 6 decimal, the Acknowledge (ACK) ASCII control code. If there is an error with the command string that is sent, the instrument will respond with 15 hex or 21 decimal, the Not Acknowledge (NAK) ASCII control code. The ACK or NAK response allows for software handshaking to monitor and control data flow.

Receiving Data
When requesting data from the instrument it will automatically send the data back to the controller input buffer. The controller input buffer will accumulate data being sent from the instrument, including the ACK and NAK response strings, until it has been read by the controller.

RS-232 Interface Command List
The RS-232 bus will automatically send any response back to the controller's input buffer. Note that the commands are case sensitive and must be typed in capital letters. Each command string should be terminated by the ASCII control code, New Line <NL>, or OAh.

The following conventions are used to describe the commands syntax for the Ground

Bond Tester. Braces ({ }) enclose each parameter for a command string. Triangle brackets (< >) indicate that you must substitute a value for the enclosed parameter. The Pipe (|) is used to separate different parameter options for a command. The command and the parameter data must be separated with a space. All commands that end with a question mark (?) are query commands.

Test Execution Commands
The following commands are used to control actual output voltage and current from the instrument. Please observe all safety precautions.

COMMAND	DESCRIPTION
TEST	Execute a Test
RESET	Abort a Test in Process or Reset Failures
AOFF	Auto Set Offset

TEST
Starts the test sequence at the selected step loaded into memory (RAM).

RESET
Stop or abort a test. Also used to reset a latched failure condition.

AOFF
Set the offset for the ground bond test. The cables and any test fixture should be connected before executing the command. This command will perform an actual test and all safety precautions should be observed when using this command.

File Editing Commands
The following commands are used to create or modify Test Setup Files.

COMMAND	DESCRIPTION	VALUE
MSS <*memory number step number*>	Memory Step Select	*memory number* = 1-10 *step number* 1-3
SALL<*memory+step,p1,p2,p3…*>	Add all Parameters of a Test	

MSS<memory number step number>
Load a file by memory and step number. The first digit is the memory number and the second digit is the step number. Example: MSS 11 = memory 1 step 1

SALL <memory+step, p1, p2, p3… >
This command edits all parameters in a memory and step. Parameters will be edited at the step location that has been selected. Example: SALL<*11,10.00,100,0…*>

The parameter <*memory+step*> indicated the memory and step number. The parameters <*p1,p2*> etc. indicate the individual settings for each test. All parameters

must be included with the command and should appear in the same order that is shown in the table below. Also, like the individual parameter editing commands, the unit should not be included with the value. Only the numeric value should be included in the command string. The list of parameters can also be found in the default parameters section of the manual, or refer to the Test Parameter Editing commands section for the proper values. The parameter values should use complete text and not use the coded values that are eec with the individual parameter setting commands such as "ON" and "OFF" for toggle field.

	GND
1	Memory + Step
2	Current
3	Max Limit
4	Min Limit
5	Dwell
6	Frequency
7	Offset
8	Connect (ON/OFF)

Test Parameter Editing Commands

These commands are used to modify the test parameter within each step. These commands require a parameter value to be included with the command. The writing of the parameter requires that the unit not be included with the value, only the numeric value should be included with the command.

COMMAND	NAME	VALUE
CONN {1|0}	Connect ON/OFF	1=On, 0=Off
CURR <*value*>	Edit Current	1.00-40.00A
DDT <*value*>	Dwell Time	0, 0.5-999.9sec
MAXL <*value*>	Edit Max Limit	0-510mΩ
MINL <*value*>	Edit Min Limit	0-510mΩ
FREQ {50|60}	Edit Frequency	50 or 60Hz
COFF <*value*>	Offset	0-100mΩ

System Parameter Editing Commands and Companion Queries

These commands are used to modify the system parameters for the instrument. These commands require a parameter value to be included with the command.

COMMAND	NAME	VALUE
PLC {1|0}	PLC Remote ON/OFF	1=On, 0=Off
SSTP {1|0}	Single Step ON/OFF	1=On, 0=Off
ALAR <*value*>	Alarm Level	0-9, 0=Off, 9=High
CNTR <*value*>	Contrast Level	0-9, 9=High
RLT {L|A|P}	Result Setting	L=Last, A=All, P=P/F
HS {1|0}	Hipot Start	0=G→W, 1=G+W

Query Commands
These query commands will retrieve data from the instrument. These commands include functions for retrieving test data, test results and remote hardware.

COMMAND	NAME	VALUE
TD?	List Testing Data	Data from test in Process
RD <*step number*>?	Result Data Query	1-3
SALL?	List Step Parameters	Response: SALL memory+step,p1,p2,p3…
RR?	Read Reset Query	1=Open, 0=Closed
RI?	Read Interlock Query	1=Open, 0=Closed

TD?
Read the active data being displayed on the LCD display while the test is in process. It will also read the last data taken when the test sequence has completed. Each parameter is separated by commas and includes step number, test status, and metering. The syntax for this command response is {memory - step, status, meter 1, meter 2, meter 3}.
For example: M1-1,Pass,25.00A,100mΩ,1.0s

RD <step number>?
Read the results for an individual step. The step number is the actual step number that has been saved within the file, not the order of which the steps were executed. For example if the test was executed starting from step 2 and ending with step 3 then the first step test results will be found in location 2 not in location 1. Each parameter is separated by commas and includes step number, test status, and metering. The syntax for this command response is {memory - step, status, meter 1, meter 2, meter 3}. For example: M1-1,Pass,25.00A,100mΩ,1.0s

SALL?
Lists all the step parameters for the step currently selected. Each parameter is separated by commas and includes memory with step number and parameter values. The syntax for this command response is SALL memory+step, current, max limit, min limit, dwell, offset, connect.

RR?
Read the remote Reset input signal. When the remote reset has be activated by closing the
contacts the query will return a value of 0 to indicate the instrument is being Reset.

RI?
Read the remote Interlock input signal. When the remote Interlock has be activated by opening the contacts the query will return a value of 1 to indicate the instrument is in the Interlock state and will not be able to generate output voltage or current.

8. Instrument Verification

Verification is the process by which an instrument's failure detectors are proven to be functioning properly by performing basic tests in open and short circuit conditions. Verifying the failure detection circuitry of the electrical safety tester is required by safety agencies such as CSA, UL, and TUV.

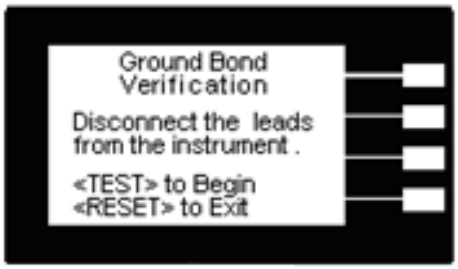
NOTE: Verification should be performed at the beginning of each day or each shift, before testing has begun.

8.1 Verification Initialization

Power up the tester. The initialization screen will appear with a message at the bottom indicating press TEST for verification. You now have the option to press the TEST button and activate the Verification Menu. The option to activate verification expires approximately 3 seconds after power-up.

8.2 Verification Menu

From the Initialization screen (first start up screen), press the TEST button. The Verification Menu will now be displayed.



NOTE: During the verification process, all Remote control output signals except the FAIL output are disabled.

Ground Bond Verification

From the Verification screen, press the TEST button to begin the verification process.

At the end of the Verification process, a message will appear indicating the outcome of the process. If the instrument passes the Verification (test failure, indicating the fail detectors are working properly) the RESET button will illuminate, the alarm will sound and the following message will appear:

If the instrument fails the Verification (test pass, indicating the fail detectors are not working properly) the following message will appear:

9. Calibration Procedure

You will find in this manual a copy of the "Certificate of Calibration". It is recommended that you have this instrument recertified at least once per year. eec recommends you use "Calibration Standards" that are NIST traceable or traceable to agencies recognized by NIST to keep this instrument within published specifications. Unless necessary, do not recalibrate the instrument within the first 12 months.

End user metrology standards or practices may vary. These metrology standards determine the measurement uncertainty ratio of the calibration standards being used. Calibration adjustments can only be made in the Calibration mode and calibration checks or verifications can only be made while operating in Test mode.

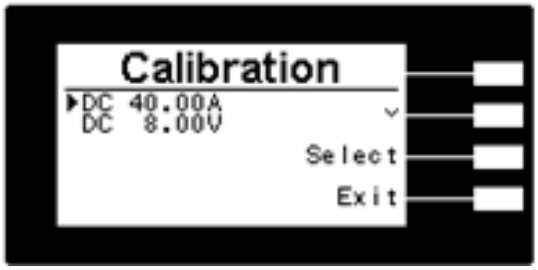
NOTE: Verification should be performed before and after calibration. Calibration effects will only be noticeable after exiting calibration mode.

Required Calibration Equipment

- 40 Amp DC Ammeter.
- 10 VDC Voltmeter.

9.1 Calibration Initialization

Press and hold the Calibration key on the rear panel with a pen, pencil or small screwdriver while powering ON the Ground Bond Tester. The Ground Bond Tester enters the calibration mode after the power on sequence is complete. The Calibration screen will appear as follows:



9.1.1 Calibration of Parameters

From the Calibration screen, use the "∨ " soft key to scroll the cursor to the parameter you wish to calibrate. Once the cursor is pointing to the parameter you wish to calibrate, press the "Select" soft key. A calibration prompt screen will now appear.

The following is a list of the calibration parameters and an example of the prompt screen with the details that will be displayed for each parameter (screen shown at left). Once you press the TEST button, the Calibration Data Entry screen will appear. Adjust the numeric value of the parameter using the "+" and "-" soft keys and press the "Enter" soft key to accept the new parameter or press RESET to escape the edit.

9.1.2 Calibration of Ground Bond DC Current