



SE Series  
**Electrical Safety Analyzer**  
Operation Manual

ER 1.00



## 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.



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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



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



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 ( $115\pm 15\%$  or  $230\pm 15\%$ ) 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 Device Under Test

**WARNING** Never touch the Device Under Test (DUT) or anything connected to it while high voltage is being applied by the hipot.

When testing with DC, always discharge the capacitance of the item under test and anything the high voltage may have contacted--such as test fixtures--before handling it or disconnecting the test leads.

**HOT STICK** probes can be used to discharge any capacitance in the device under test as a further safety precaution. A hot stick is a non-conducting rod about two feet long with a metal probe at the end that is connected to a wire. To discharge the device under test, two hot sticks are required. First, connect both probe wires to a good earth ground. Then touch one probe tip to the same place that the return lead was connected. While holding the first probe in place, touch the second probe tip to the same place where the high voltage lead was connected.

### 1.3.6 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. Introduction to Product Safety Testing

### 1.4.1 The Importance of Safety Testing

Product Safety Tests are specified during the design and development stages of a product as well as in the production of the products to insure that it meets basic safety requirements. These tests are designed to verify the safety of the electrical products in that they do not jeopardize the safety of the people, domestic animals, and property of anyone who may come in contact with these products. In an era of soaring liability costs, original manufacturers of electrical and electronic products must make sure every item is as safe as possible. All products must be designed and built to prevent electric shock, even when users abuse the equipment or by-pass built in safety features.

To meet recognized safety standards, one common test is the "dielectric voltage-withstand test". Safety agencies which require compliance safety testing at both the initial product design stage and for routine production line testing include: Underwriters Laboratories, Inc. (UL), the Canadian Standards Association (CSA), the International Electrotechnical Commission (IEC), the British Standards Institution (BSI), the Association of German Electrical Engineers (VDE) and (TÜV), the Japanese Standards Association (JSI). These same agencies may also require that an insulation resistance test and high current ground bond test be performed.

## 1.5. The Different Types of Safety Tests

### 1.5.1 Dielectric Withstand Test

The principle behind a dielectric voltage - withstand test is simple. If a product will function when exposed to extremely adverse conditions, it can be assumed that the product will function in normal operating circumstances.

#### **Common Applications of the Dielectric Withstand Test:**

- Design (performance) testing: Determining design adequacy to meet service conditions.
- Production Line testing: Detecting defects in material or workmanship during processing.
- Acceptance testing: Proving minimum insulation requirements of purchased parts.
- Repair Service testing: Determine reliability and safety of equipment repairs.

The specific technique used to apply the dielectric voltage - withstand test to each product is different. During a dielectric voltage - withstand test, an electrical device is exposed to a voltage significantly higher than it normally encounters, for a specified duration of time.

During the test, all current flow from the high voltage output to the return is measured. If, during the time the component is tested, the current flow remains within specified limits, the device is assumed safe under normal conditions. The basic product design

and use of the insulating material will protect the user against electrical shock. The equipment used for this test, a dielectric-withstand tester, is often called a "hipot" (for high potential tester). The "rule of thumb" for testing is to subject the product to twice its normal operating voltage, plus 1,000 volts. However, specific products may be tested at much higher voltages than 2X operating voltages + 1,000 volts. For example, a product designed to operate in the range between 100 to 240 volts can be tested between 1,000 to 4,000 volts or higher. Most "double insulated" products are tested at voltages much higher than the "rule of thumb".

Testing during development and prototype stages is more stringent than production run tests because the basic design of the product is being evaluated. Design tests usually are performed on only a few samples of the product. Production tests are performed on every item as it comes off the production line.

The hipot tester must also maintain an output voltage between 100% and 120% of specification. The output voltage of the hipot must have a sinusoidal waveform with a frequency between 40 to 70 Hz and has a peak waveform value that is not less than 1.3 and not more than 1.5 times the root-mean-square value.

### **Types of Failures only detectable with a Hipot test**

- Weak Insulating Materials
- Pinholes in Insulation
- Inadequate Spacing of Components
- Pinched Insulation

### **Dielectric Withstand Test; AC versus DC**

Please check with the Compliance Agency you are working with to see which of the two types of voltages you are authorized to use. In some cases, a Compliance Agency will allow either AC or DC testing to be done. However, in other cases the Compliance Agency only allows for an AC test. If you are unsure which specification you must comply with please contact our CUSTOMER SUPPORT DEPT.

Many safety agency specifications allow either AC or DC voltages to be used during the hipot test. When this is the case, the manufacturer must make the decision on which type of voltage to utilize. In order to do this it is important to understand the advantages and the disadvantages of both AC and DC testing.

### **AC testing characteristics**

Most items that are hipot tested have some amount of distributed capacitance. An AC voltage cannot charge this capacitance so it continually reads the reactive current that flows when AC is applied to a capacitive load.

### **AC testing advantages**

AC testing is generally much more accepted by safety agencies than DC testing. The main reason for this is that most items being hipot tested will operate on AC voltages.

AC hipot testing offers the advantage of stressing the insulation alternately in both polarities, which more closely simulates stresses the product will see in real use.

Since AC testing cannot charge a capacitive load the current reading remains consistent from initial application of the voltage to the end of the test. Therefore, there is no need to gradually bring up the voltage since there is no stabilization required to monitor the current reading. This means that unless the product is sensitive to a sudden application of voltage the operator can immediately apply full voltage and read current without any wait time.

Another advantage of AC testing is that since AC voltage cannot charge a load there is no need to discharge the item under test after the test.

### **AC testing disadvantages**

One disadvantage of AC testing surfaces when testing capacitive products. Again, since AC cannot charge the item under test, reactive current is constantly flowing. In many cases, the reactive component of the current can be much greater than the real component due to actual leakage. This can make it very difficult to detect products that have excessively high leakage current.

Another disadvantage of AC testing is that the hipot has to have the capability of supplying reactive and leakage current continuously. This may require a current output that is actually much higher than is really required to monitor leakage current and in most cases is usually much higher than would be needed with DC testing. This can present increased safety risks as operators are exposed to higher currents.

### **DC testing characteristics**

During DC hipot testing the item under test is charged. The same test item capacitance that causes reactive current in AC testing results in initial charging current which exponentially drops to zero in DC testing.

### **DC testing advantages**

Once the item under test is fully charged, the only current flowing is true leakage current. This allows a DC hipot tester to clearly display only the true leakage of the product under test.

Another advantage to DC testing is that the charging current only needs to be applied momentarily. This means that the output power requirements of the DC hipot tester can typically be much less than what would be required in an AC tester to test the same product.

### **DC testing disadvantages**

Unless the item being tested has virtually no capacitance, it is necessary to raise the voltage gradually from zero to the full test voltage. The more capacitive the item the more slowly the voltage must be raised. This is important since most DC hipots have failure shut off circuitry which will indicate failure almost immediately if the total current reaches the leakage threshold during the initial charging of the product under test.

Since a DC hipot does charge the item under test, it becomes necessary to discharge the item after the test.



DC testing unlike AC testing only charges the insulation in one polarity. This becomes a concern when testing products that will actually be used at AC voltages. This is an important reason that some safety agencies do not accept DC testing as an alternative to AC.

When performing AC hipot tests the product under test is actually tested with peak voltages that the hipot meter does not display. This is not the case with DC testing since a sinewave is not generated when testing with direct current. In order to compensate for this most safety agencies require that the equivalent DC test be performed at higher voltages than the AC test. The multiplying factor is somewhat inconsistent between agencies which can cause confusion concerning exactly what equivalent DC test voltage is appropriate.

#### 1.5.2 Insulation Resistance Test

Some "dielectric analyzers today come with a built in insulation resistance tester. Typically, the IR function provides test voltages from 500 to 1,000 volts DC and resistance ranges from kilohms to gigaohms. This function allows manufacturers to comply with special compliance regulations. BABT, TÜV and VDE are agencies that may under certain conditions, require an IR test on the product before a Hipot test is performed. This typically is not a production line test but a performance design test.

The insulation resistance test is very similar to the hipot test. Instead of the go/no go indication that you get with a hipot test the IR test gives you an insulation value usually in Megohms. Typically, the higher the insulation resistance value the better the condition of the insulation. The connections to perform the IR test are the same as the hipot test. The measured value represents the equivalent resistance of all the insulation which exists between the two points and any component resistance which might also be connected between the two points.

Although the IR test can be a predictor of insulation condition it does not replace the need to perform a dielectric withstand test.

#### 1.5.3 Ground Bond Test

The Ground Bonding test determines whether the safety ground circuit of the product under test can adequately handle fault current if the product should ever become defective. A low impedance ground system is critical in ensuring that in case of a product failure, a circuit breaker on the input line will act quickly to protect the user from any serious electrical shock.

International compliance agencies such as CSA, IEC, TÜV, VDE, BABT and others, have requirements calling out this test. This test should not be confused with low current continuity tests that are also commonly called out in some safety agency specifications. A low current test merely indicates that there is a safety ground connection. It does not completely test the integrity of that connection.

Compliance agency requirements vary on how different products are to be tested. Most specifications call for test currents of between 10 and 40 amps. Test voltages at these currents are typically required to be less than 12 volts. Maximum allowable resistance readings of the safety ground circuit are normally between 100 and 200 milliohms.

If you are testing a product that is terminated in a three-prong plug, you are required to perform a continuity or ground bond test on the ground conductor to the chassis or dead metal of the product.

#### 1.5.4 Run Test

All manufacturers of a product that runs on line power normally need to run the DUT (Device Under Test) after final safety testing so that they can verify the functionality of their products. In addition to running the DUT to test its basic functionality many customers also require some basic test data to be recorded while the DUT is powered up. A Run Test System allows the product to be powered up immediately after the safety tests are completed with a single connection to the DUT. Measurements that are commonly made while the DUT is running can include Amperage, Voltage, Watts and Power Factor.

#### 1.5.5 Touch Current Test

The Line Leakage test is one of many product safety tests that are normally specified for electrical products by safety testing agencies such as Underwriters Laboratories (UL) and the International Electrotechnical Committee (IEC). The line leakage specifications vary as well as the method in which the measurements are taken depending upon the application or function of a product and the standard to which the product is being tested.

Current Leakage or Line Leakage tests are general terms that actually describe three different types of tests. These tests are Earth Leakage Current, Enclosure Leakage Current, and Applied Part Leakage Current. The main differences in these tests are in the placement of the probe for the measuring device. The Earth Leakage Current is the leakage current that flows through the ground conductor in the line cord back to earth. The Enclosure Leakage Current is the current that flows from any enclosure part through a person back to ground if it were contacted by a person. The Applied Part Leakage Current or Patient Lead Leakage Current is any leakage that flows from an applied part, between applied parts or into an applied part. The Applied Part Leakage Current test is required only for medical equipment. All of these tests are used to determine if products can be safely operated or handled without posing a shock hazard to the user.

Line Leakage Testers provide the capability of meeting the line leakage test specified in the following standards; UL 544, IEC 950, UL 1950, IEC 601-1, UL 2601, UL 1563, UL 3101, IEC 1010 and others. The Line Leakage test, is a test which measures the leakage current of a product, through a circuit that is designed to simulate the impedance of the human body. The simulation circuit is called the Measuring Device (MD). The instrument has five different MD circuits, selectable through the menu, which are representative circuits designed to simulate the impedance of the human body under different conditions. The impedance of the human body will vary depending upon point of contact, the surface area of the contact and the path the current flows. For these reasons, the specifications of the Measuring Devices are different depending upon the type of test being performed as well as the maximum allowable leakage current. Leakage current measurements are performed on products under normal conditions and single fault conditions as well as reversed polarity. This simulates possible problems, which could occur if the product under test



is faulted or misused while the product is operating under high line conditions (110% of the highest input voltage rating of the product).

Line Leakage tests are normally specified as “Type Tests” or “Design Tests” which are performed during the development of the product. This helps verify that the design is safe but it does not guarantee the safety of the products being produced on the production line. The only way to be sure you are shipping safe products is to test each product at the end of the production line. The user may perform a Leakage Current test along with other common safety test such as Dielectric Withstand, Insulation Resistance, and Ground Bond on the production line with a single connection to the device under test.

## 1.6. Key Features and Benefits: SE Series

<b>1.CAL-ALERT™</b>	Alerts the operator that the machine is due for calibration in advance of the calibration due date.
<b>2.TWO CONTINUITY TEST MODES</b>	Two test modes allow for a basic Continuity test to be performed simultaneously with the Hipot test, or a stand-alone Continuity test to be performed independently for higher resistance and point-to-point applications.
<b>3.PATENTED SMARTGFI™</b>	SmartGFI™ disables the instrument’s output voltage in less than 1 millisecond if excessive leakage to ground is detected. If enabled, SmartGFI™ automatically detects if the DUT is floating or grounding and turns ON or OFF accordingly.
<b>4.SECURITY ACCESS</b>	Allows the operator to set different levels of access to the instrument’s setup programs. Users can setup passwords for restricting access to certain parts of the menu.
<b>5.EXPANDED TEST MEMORIES</b>	User can link up to 200 steps in a single test file with a total of 2000 steps available in memory.
<b>6.REAL CURRENT MEASUREMENT</b>	SE simultaneously monitors real and total current in AC Hipot mode on the same screen.
<b>7.EXCLUSIVE PROMPT AND HOLD FUNCTION</b>	SE allows operators to setup a user-configured message that is displayed in between test steps. This is a very convenient feature for applications where test leads need to be moved or when DUT switches need to be activated as part of the test cycle.
<b>8.DIGITALLY CONTROLLED ARC DETECTION SYSTEM</b>	Allows the operator to choose whether low-level arcs should be detected. The operator can select from multiple sensitivity levels.

<b>9.ELECTRONIC RAMPING (UP AND DOWN)</b>	Allows the operator to linearly increase or decrease the output voltage to the DUT over a specified period of time. Minimizes any damage to sensitive DUT's from quick high voltage changes.
<b>10.PLC REMOTE INPUTS &amp; OUTPUTS</b>	Two standard 9 pin interfaces provide outputs for PASS, FAIL, RESET and TEST IN PROCESS signals. Inputs include TEST, INTERLOCK, RESET and remote recall of MEMORIES 1 - 3. Provides the user with the ability to operate the SE through simple PLC relay control.
<b>11.FAIL-CHEK™</b>	Allows the operator to self-verify the instrument's failure detectors.
<b>12.PRO-VOLT™ *</b>	Allows the operator to set multiple dwell cycles at different voltages for ACW/DCW/IR so that test voltages can be raised and held in steps
<b>13.BARCODE SCANNING</b>	Connect a barcode scanner directly to the instrument front panel and perform the appropriate tests.
<b>14.USB STORAGE</b>	Transfer test data directly to a USB flash drive after performing the test.

#### \*Pro Volt Operational Rules

1. Provolt will only link tests of the same type.
2. If the previous step voltage is higher than next step voltage, it will ignore ramp up of next step.
3. If the previous step voltage is lower than next voltage, it will ignore ramp down of previous step.
4. Frequency changes in ACW are not allowed. If a test sequence has been created with frequency changes and the system is set to provolt and you attempt to run the file, it will warn you that there are frequency changes in the file and prevent the operation.

## 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 that complies with ASTM D4169-92a Assurance Level II Distribution Cycle 13 Performance Test Sequence

If the shipping carton is damaged, inspect the contents for visible damage such as dents, scratches or broken display. If the instrument is damaged, notify the carrier and eec's customer support department. Please save the shipping carton and packing material for the carriers 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.

#### 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 - 120 volts AC  $\pm$  10%, 50/60 Hz single phase or 200 - 240 volts AC  $\pm$  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 115 and 230 Volts AC use a 6.3A for SE 7430, SE 7440 and SE 7441. The max. rated power is 700VA. Use a 15A for SE 7450 and SE 7452, 250VAC fuse. The max. rated power is 1300VA.

#### **CAUTION**

Do not switch the line voltage selector switch located on the rear panel while the instrument is on or operating. This may cause internal damage and represents a safety risk to the operator.

### 2.2.3 Basic Connections

#### **Power Cable**

#### **WARNING**

Before connecting power to this instrument, the protective ground (Earth) terminals of this instrument must be connected to the protective conductor of the line (mains) power cord. The main plug shall only be inserted in a socket outlet (receptacle) provided with a protective ground (earth) contact. This protective ground (earth) **must not be defeated** by the use of an extension cord without a protective conductor (grounding).

The instrument is shipped with a three-wire power cable. When the cable is connected to an appropriate AC power source, the cable will connect the chassis to earth ground. The type of power cable shipped with each instrument depends on the country of destination.

#### **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 microamp 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. SE Functional Specifications

	ACW	DCW	IR	GND	CONT.	Built-in 8 Channels
SE 7430	V	V	V	-	Option	Option
SE 7440	V	V	V	V	-	-
SE 7441	V	V	V	V	-	V
SE 7450	V	-	V		Option	-
SE 7452	V	V	V	V	-	-

MODEL	SE 7430	SE 7440	SE 7441	SE 7450	SE 7452
<b>AC WITHSTAND VOLTAGE</b>					
Output Rating	5KVAC / 40mA	5KVAC / 40mA	5KVAC / 40mA	5KVAC / 100mA	5KVAC / 100mA
Output Rating (OPT.7015)	6KVAC / 30mA	6KVAC / 30mA	6KVAC / 30mA	6KVAC / 80mA	6KVAC / 80mA
	Range		Resolution	Accuracy	
Output Voltage, ACV	0 - 5000		1	± (1.5% of setting + 5V)	
Output Voltage, ACV (OPT.7015)	0 - 6000		1	± (1.5% of setting + 5V)	
Output Frequency	50Hz / 60Hz ± 0.1%, User selectable				
Output Waveform	Sine Wave, Crest Factor = 1.3 - 1.5				
Output Regulation	± (1% of output + 5V), From no load to full load				
<b>SETTINGS</b>					
Hi and Lo-Limit (Total) current, mA	Auto Range	0.000 - 9.999	0.001	± (2% of setting + 2 counts)	
		10.00 - 40.00 (for SE 7430, SE 7440 & SE 7441)	0.01		
		10.00 - 99.99 (for SE 7450 & SE 7452)		± (2% of setting + 6 counts)	
		100.0 (for SE 7450 & SE 7452)	0.1		
	Fixed Range	0.000 - 3.500	0.001	± (2% of setting + 2 counts)	
		3.51 - 40.00 (for SE 7430, SE 7440 & SE 7441)	0.01		
		3.51 - 99.99 (for SE 7450 & SE 7452)		± (2% of setting + 6 counts)	
		100.0 (for SE 7450 & SE 7452)	0.1		
Hi and Lo-Limit (Real) current, mA	Auto Range	0.000 - 9.999	0.001	± (3% of setting + 50µA)	
		10.00 - 40.00 (for SE 7430, SE 7440 & SE 7441)	0.01		
		10.00 - 99.99 (for SE 7450 & SE 7452)			

		100.0 (for SE 7450 & SE 7452)	0.1		
Ramp Up Timer, second	0.1 - 999.9		0.1	± (0.1% + 0.05s)	
Ramp Down Timer, second	0.0 - 999.9				
Dwell Time, second	0, 0.3 - 999.9 (0=continuous)				
Current Offset	0.000 - 40.00mA (Total current + current offset ≤ 40mA) for SE 7430 & SE 7440 & SE 7441 0.000 - 100.0mA (Total current + current offset ≤ 100mA) for SE 7450 & SE 7452				
Arc Detection	The range is from 1 - 9 (9 is the most sensitive)				
<b>DC WITHSTAND VOLTAGE (SE 7430, SE 7440, SE 7441 &amp; SE 7452 ONLY)</b>					
Output Rating	6KVDC / 10mA	6KVDC / 10mA	6KVDC / 10mA	-	6KVDC / 10mA
Output Rating (OPT.7015)	7.5KVDC / 10mA	7.5KVDC / 10mA	7.5KVDC / 10mA	-	7.5KVDC / 10mA
Output Voltage, Vdc	0 - 6000		1	± (1.5% of setting + 5V)	
Output Voltage, Vdc (OPT.7015)	0 - 7500		1	± (1.5% of setting + 5V)	
Output Ripple	< 4% (6KV / 10mA at Resistive Load)				
<b>SETTINGS</b>					
HI and LO-Limit, current, uA	Auto Range	0.0000 - 0.9999	0.0001	± (2% of setting + 10 counts) Low Range is ON.	
		1.000 - 9.999	0.001		
		10.00 - 99.99	0.01		
		100.0 - 999.9	0.1	± (2% of setting + 2 counts) Low Range is ON.	
		1000 - 10000	1		
		0.0 - 999.9	0.1		
	Fixed Range	1000 - 10000	1	± (2% of setting + 2 counts)	
		0.0000 - 0.3500	0.0001		
		0.351 - 3.500	0.001		
		3.51 - 35.00	0.01	± (2% of setting + 2 counts)	
		35.1 - 350.0	0.1		
		351 - 3500	1		
3501 - 10000	1				
Ramp Up Timer, second	0.4 - 999.9		0.1	± (0.1% + 0.05s)	
Ramp Down Timer, second	0.0, 1.0 - 999.9				
Dwell Time, second	0, 0.4 - 999.9 ,(0=continuous) and 0, 1.0 - 999.9 when it be selected low current range.				
Ramp-HI, current , uA	Low Range is ON	0.0000 - 0.9999	0.0001	± (2% of setting + 10 counts)	
		1.000 - 9.999	0.001		
		10.00 - 99.99	0.01		
		100.0 - 999.9	0.1	± (2% of setting + 2 counts)	

		1000 - 10000	1	
	Low Range is OFF	0.0 - 999.9	0.1	
		1000 - 10000	1	
Charge LO, current, uA	0.0 - 350.0 $\mu$ A DC or Auto Set, When current range is 3 ranges. 0 - 3500 nA DC or Auto Set, When current range is 6 ranges.			
Discharge Time	< 50 msec for no load, < 100 msec for capacitor load (all capacitance values in MAX load spec below)			
Maximum Capacitive Load DC Mode	1 $\mu$ F < 1KV, 0.75 $\mu$ F < 2KV, 0.5 $\mu$ F < 3KV, 0.08 $\mu$ F < 4KV, 0.04 $\mu$ F < 5KV, 0.015uF < 6KV			
Current Offset	0.0 - 10000uA (Total current + current offset $\leq$ 10mA)			
Arc Detection	The range is from 1 - 9 (9 is the most sensitive)			
<b>INSULATION RESISTANCE</b>				
Output Rating	6KVDC / 50000M $\Omega$			
Output Voltage, Vdc	10 - 6000		1	$\pm$ (1.5% of setting + 5V)
HI and LO-Limit, resistance, M $\Omega$	0.10 - 99.99 (HI-Limit: 0 = OFF)		0.01	0.10 - 999.9, $\pm$ (2% of setting + 2 counts)
	1.00 - 999.9		0.1	1000 - 9999, $\pm$ (5% of setting + 2 counts)
	1000 - 50000		1	10000 - 50000, $\pm$ (15% of setting + 2 counts)
Ramp Up Timer, second	0.1 - 999.9		0.1	$\pm$ (0.1% + 0.05s)
Ramp Down Timer, second	0.0, 1.0 - 999.9			
Dwell Time, second	0, 0.5 - 999.9 (0 = continuous)			
Delay Timer, second	0.5 - 999.9			
Charge LO, current, uA	0.000 - 3.500, auto / manual set			
<b>GROUND BOND (SE 7440, SE 7441 &amp; SE 7452 ONLY)</b>				
Output Rating	32A / 600m $\Omega$ / 8V			
Output AC Current, A	1.00 - 32.00		0.01	$\pm$ (2 % of setting + 2 counts)
Output AC Current, A (OPT.799)	1.00 - 40.00		0.01	$\pm$ (2 % of setting + 2 counts)
Output Voltage, Vac Open Circuit Mode	3.00 - 8.00		0.01	$\pm$ (2 % of setting + 3 counts) O.C.
Output Frequency, Hz	50Hz / 60Hz $\pm$ 0.1%, User selectable			
Output Regulation	$\pm$ (1% of output + 0.02A), Within maximum load limits, and over input voltage range.			
Maximum Loading	1.00 - 10.00A / 0 - 600m $\Omega$ , 10.01 - 32.00A / 0 - 200m $\Omega$			
<b>SETTINGS</b>				
Lead Resistance Offset, m $\Omega$	0 - 200		1	$\pm$ (2% of setting + 2 counts) at current > 3A
HI and LO-Limit	0 - 200 (10.01 - 32.00A)		1	$\pm$ (2% of setting + 2 counts)



Resistance, mΩ	0 - 600 (6.00 - 10.00A)		± (3% of setting + 3 counts) at current > 3A	
	0 - 600 (1.00 - 5.99A)			
Dwell Timer, second	0, 0.5 - 999.9 (0 = continuous)		0.1 ± (0.1% + 0.05s)	
<b>MEASUREMENT</b>				
	Range		Resolution Accuracy	
Voltage, KV(AC/DC)	0.00 - 7.50		0.01 ± (1.5% of reading) ≥ 500V ± (1.5% of reading + 1 count) < 500V	
Voltage, Vdc (IR only)	0 - 1000		1 ± (1.5% of reading + 2 counts)	
	1001 - 6000		1 ± (2% of reading + 5V)	
AC Current (Total), mA	AUTO range	0.000 - 3.500	0.001	± (2% of reading + 3 counts)
		3.00 - 40.00 (for SE 7430, SE 7440 & SE 7441)	0.01	
		3.00 - 99.99 (for SE 7450 & SE 7452)	0.01	± (2% of reading + 6 counts)
		100.0 (for SE 7450 & SE 7452)	0.1	
	Fixed range	0.000 - 3.500	0.001	± (2% of reading + 2 counts)
		0.00 - 40.00 (for SE 7430, SE 7440 & SE 7441)	0.01	± (2% of reading + 2 counts) Additional error when reading < 6% of range. ± (0.1% of range)
0.00 - 99.99 (for SE 7450 & SE 7452)		0.01	± (2% of reading + 2 counts) Additional error when reading < 3% of range. ± (0.1% of range)	
AC Current (Real), mA	0.000 - 9.999		0.001	± (3% of reading + 50μA) All Ranges PF > 0.1 , V > 250VAC
	10.00 - 99.99		0.01	
DC Current, nA	AUTO range	0.0 - 350.0	0.1	± (2% of reading + 10 counts) Low Range is ON.
	Fixed range	0.0 - 350.0	0.1	
DC Current, μA	AUTO range	0.300 - 3.500	0.001	
		3.00 - 35.00	0.01	
		30.0 - 350.0	0.1	
	Fixed range	0.000 - 3.500	0.001	
		0.00 - 35.00	0.01	± (2% of reading + 10 counts) Low Range is ON. Additional error when reading < 6% of range. ± (0.1% of range)
		00.0 - 350.0	0.1	
DC Current, mA	AUTO range	0.300 - 3.500	0.001	± (2% of reading + 2 counts)
		3.00 - 10.00	0.01	
	Fixed range	0.000 - 3.500	0.001	± (2% of reading + 2 counts) Additional error when reading < 6% of range. ± (0.1% of range)
		0.00 - 10.00	0.01	± (2% of reading + 2 counts) Additional error when reading < 6% of range. ± (0.2% of range)

AC Current, A (G.B)	0.00 - 40.00		0.01	± (3% of reading + 3 counts)	
Resistance, MΩ (IR)	10 - 499V	500 - 6000V		10 - 29V	
	0.100 - 1.999	0.100 - 9.999 (1.000 - 9.999 V setting > 1000V)	0.001	0.05 - 999.9, ± (15% of reading + 2 counts)	
	2.00 - 19.99	10.00 - 99.99	0.01	30 - 499V	
	20.0 - 199.9	100.0 - 999.9	0.1	0.05 - 999.9, ± (7% of reading + 2 counts)	
	200 - 50000	1000 - 50000	1	500 - 6000V	
Resistance, mΩ (GB)	0 - 600		1	0.05 - 999.9, ± (2% of reading + 2 counts)	

GENERAL					
Input Voltage AC	100 - 120Vac / 200 - 240V ± 10% auto range, 50 / 60Hz ± 5%, max. current 6.3A for SE 7430, SE 7440 & SE 7441 100 - 120Vac / 200 - 240V ± 10% auto range, 50 / 60Hz ± 5%, max. current 15A for SE 7450 & SE 7452				
PLC Remote Control	Input: Test, Reset, Interlock, Recall File 1 through 3(Standard), Recall File 1 through 7 (Option) Output: Pass, Fail, Test-in-Process				
Memory	2000 steps, allow the user create different memories and steps. But each memory limit max. 200 steps and results				
Display	4.3" Color Display (Touch Panel)				
Calibration	Build-in software and external calibrated meters				
Alarm Volume Setting	Range: 0 - 9; 0 = OFF, 1 is softest volume, 9 is loudest volume				
Built-in Scanner Module	OPTION	-	YES	-	-
External Scanner Port	YES	YES	YES	YES	YES
USB & RS232 Interface	YES	YES	YES	YES	YES
GPIB Interface	OPTION	OPTION	OPTION	OPTION	OPTION
Multinational Language	The operating screen can select different language including English / Traditional Chinese / Simplified Chinese / Japanese				
CE Compliance	YES				
Environment	0 - 40°C, 20 - 80%RH				
Dimension (W × H × D), mm	430 × 88.1 × 400	430 × 88.1 × 400	430 × 133 × 400	430 × 88.1 × 400	430 × 88.1 × 400
Weight	17.6Kg	18.6Kg	20Kg	21Kg	23.4Kg

\*product specifications are subject to change without notice.

\*1 SE 7450 and SE 7452 short circuit current > 200mA

### Ordering Information

SE 7430 Electrical Safety Analyzer (ACW, DCW, IR)

SE 7440 Electrical Safety Analyzer (ACW, DCW, IR, GB)

SE 7441 Electrical Safety Analyzer with build-in 8 Channels Scanner (ACW, DCW, IR, GB)

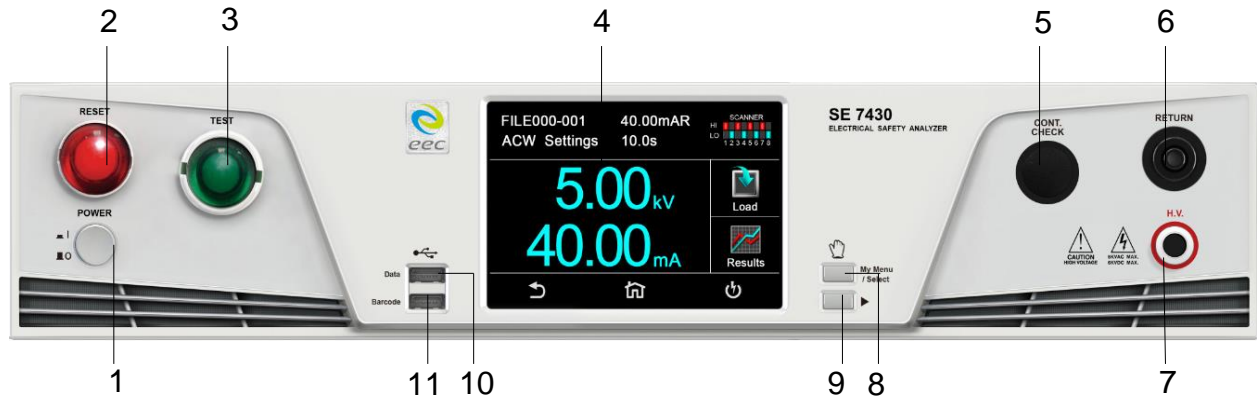
SE 7450 500VA Electrical Safety Analyzer (ACW, IR)

SE 7452 500VA Electrical Safety Analyzer (ACW, DCW, IR, GB)  
Opt.799 GB Output 40A for SE 7440, SE 7441, SE 7453  
Opt.7002 DC Continuity Test Function for SE 7430, SE 7450  
Opt.7003 Built-in Scanner 4W for SE 7430  
Opt.7004 Built-in Scanner 8W for SE 7430  
Opt.7005 Built-in Scanner 4W + 4 Cont. for SE 7430  
Opt.7006 Built-in Scanner 8W + 8 Cont. for SE 7430  
Opt.7009 JigA / JigB  
Opt.7015 6KVAC / 7.5KVDC Output  
Opt.7017 GPIB Interface Card  
Opt.7018 Ethernet Card

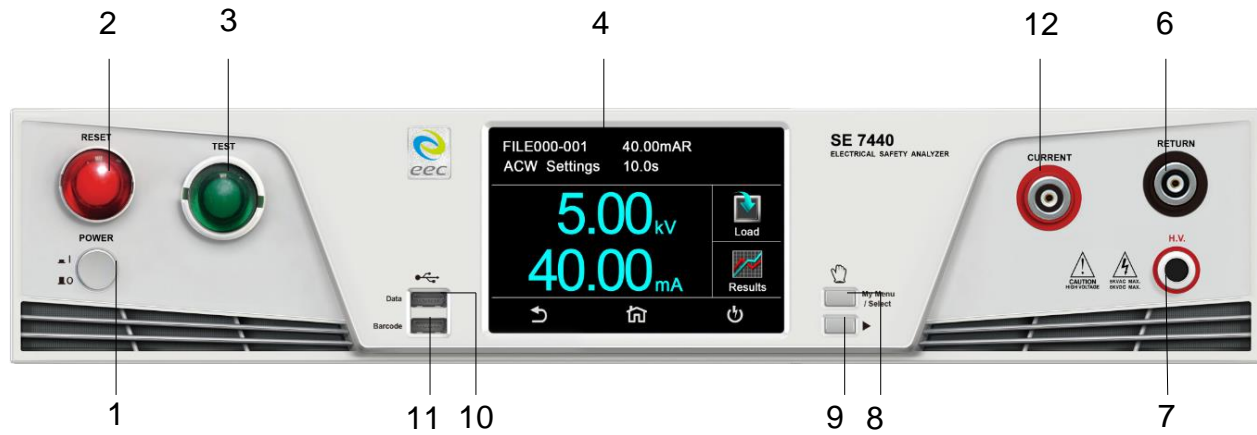
## 3.2. Instrument Controls

### 3.2.1 Front Panel Controls

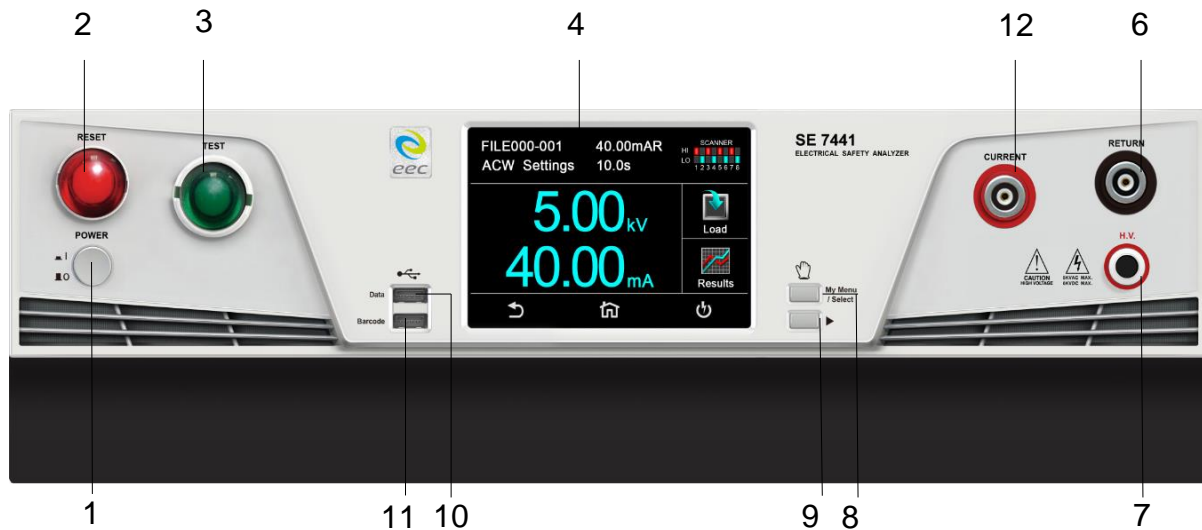
#### SE 7430 and SE 7450



#### SE 7440 and SE 7452



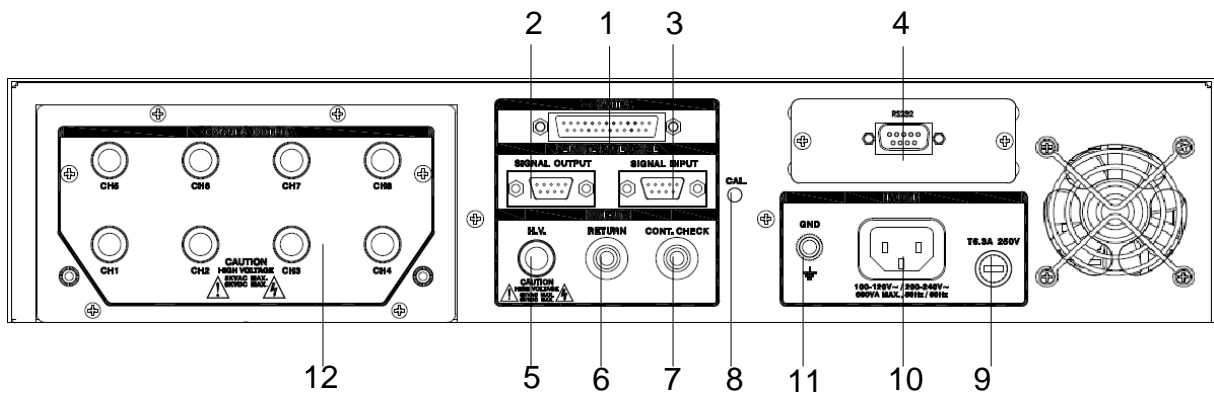
#### SE 7441



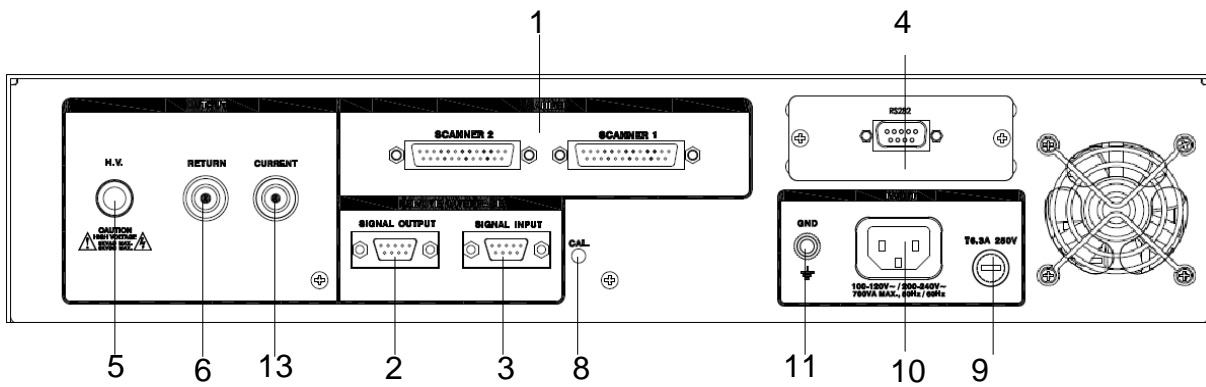
1. **POWER SWITCH:** Powers the test instrument ON or OFF.
2. **RESET BUTTON:** Resets the instrument. If a failure condition occurs during a test, pressing this button will reset the system, shut off the alarm and clear the failure condition. The Reset button must be pressed before performing another test or changing any of the setup parameters. This button also serves as an abort signal to stop any test in progress.
3. **TEST BUTTON:** Starts a test.
4. **TOUCH SCREEN GRAPHIC LCD:** Displays all the information and allows full control of the instrument.
5. **(OPTION) CONTINUITY OUTPUT TERMINAL:** Connector used to attach the return test lead, adaptor box return lead, or test fixture return lead used during Continuity testing.
6. **RETURN TERMINAL:** Connector used to attach the return test lead, adapter box return lead or test fixture return lead to the instrument. This connection provides the return current path.
7. **HIGH VOLTAGE OUTPUT TERMINAL:** Connector used to attach the high voltage test lead, adapter box high voltage lead or test fixture high voltage lead to the instrument. This connection provides the high voltage used during a Hipot test.
8. **MY MENU:** Allows the user to customize the interface.
9. **TOGGLE:** This button allows the user to toggle between test files if the user is wearing gloves since the touch screen will not respond to gloves.
10. **DATA USB PORT:** This USB style port allows for connecting a USB flash drive to extract test data.  
Note:  
Support brand: ADATA, Apotop, Ridata, SanDisk, Team,  
Interface: USB 2.0  
Capacity limit: under 16GB  
Format: FAT 16 or FAT 32
11. **BARCODE USB PORT:** This USB style port allows for connecting a barcode scanner.
12. **CURRENT OUTPUT TERMINAL:** Connector used to attach the high current output lead, adapter box high current lead or test fixture high current lead to the instrument. This connection provides the output current for the ground bond and continuity.

### 3.2.2 Rear Panel Controls

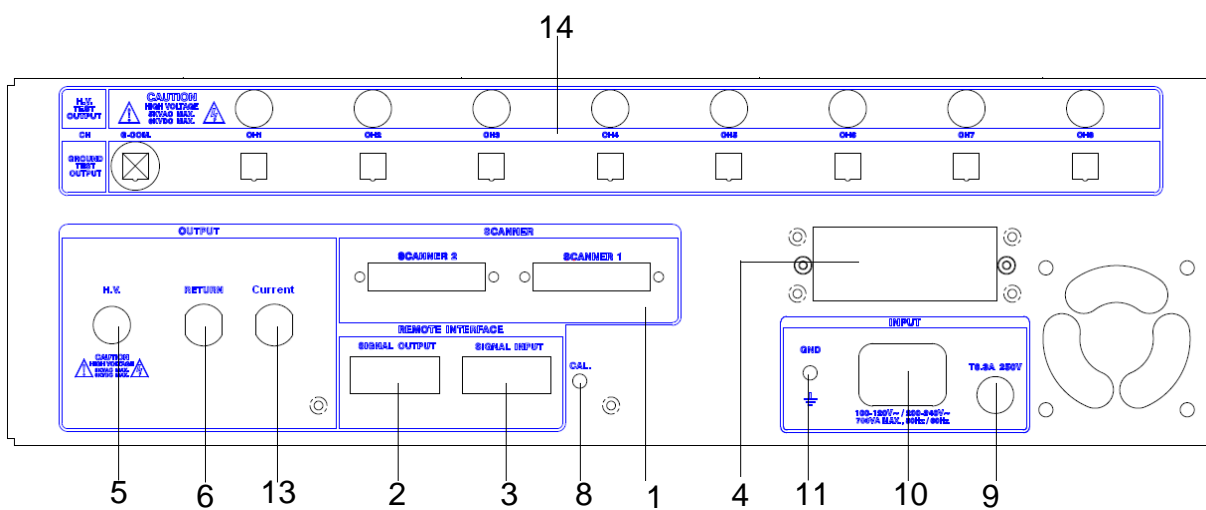
#### SE 7430



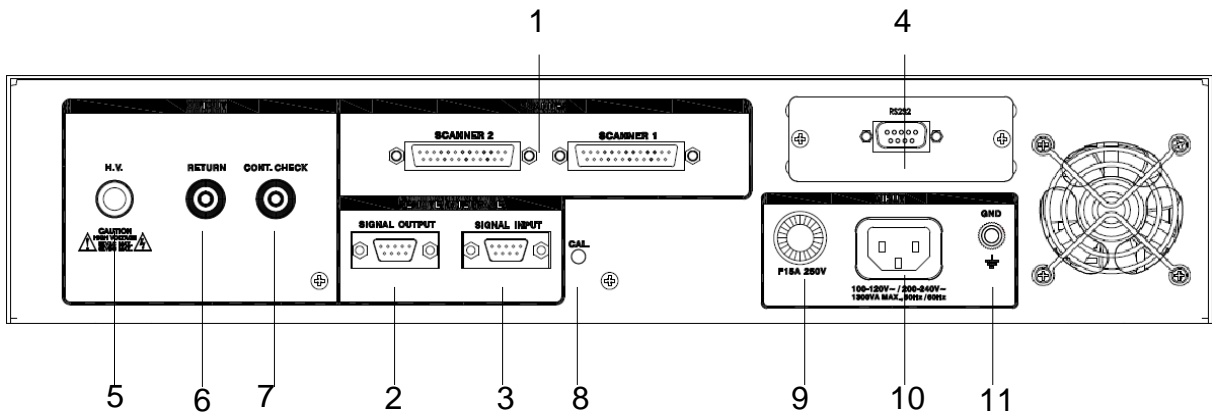
#### SE 7440



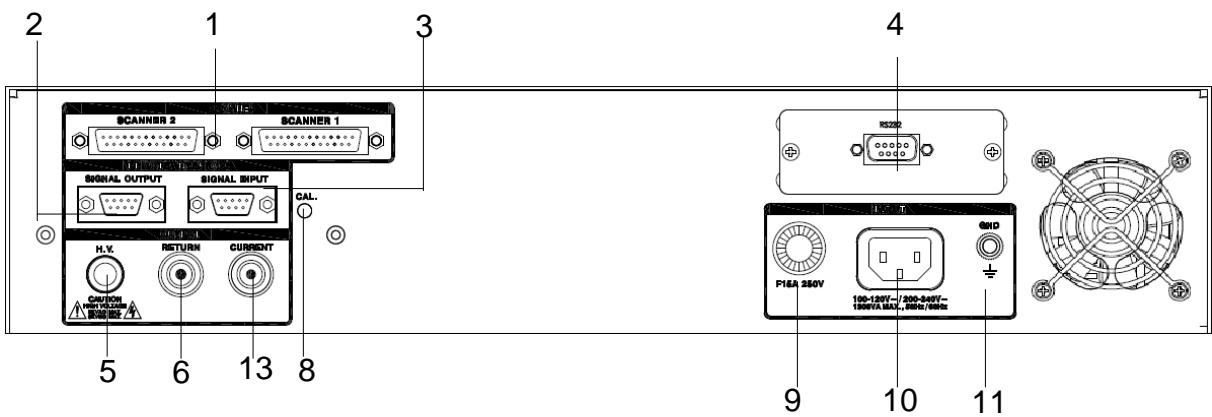
#### SE 7441



## SE7450



## SE 7452



1. **SCANNER CONNECTOR:** For connection of optional external Scanner.
2. **REMOTE SIGNAL OUTPUT:** 9-Pin D sub-miniature female connector for monitoring PASS, FAIL, and PROCESSING output relay signals.
3. **REMOTE SIGNAL INPUT:** 9-Pin D subminiature male connector for remote control of TEST, RESET, and REMOTE INTERLOCK DISABLE functions, as well as MEMORY SELECTION
4. **BUS INTERFACE:** Standard connector for interconnection to the RS-232 Bus interface. Optional IEEE 488, Ethernet, USB interface may be substituted for the RS-232.
5. **REAR PANEL HIGH VOLTAGE OUTPUT TERMINAL:** 2<sup>nd</sup> high voltage output connector in parallel with the front panel connector.
6. **REAR PANEL RETURN TERMINAL:** 2<sup>nd</sup> return output connector in parallel with the front panel connector.

7. **REAR PANEL CONTINUITY OUTPUT TERMINAL:** 2<sup>nd</sup> continuity output connector in parallel with the front panel output.
8. **CALIBRATION BUTTON:** To put the instrument into the calibration mode push this button and turn on the power switch simultaneously.
9. **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.
10. **INPUT POWER RECEPTACLE:** Standard IEC 320 connector for connection to a standard NEMA style line power (mains) cord.
11. **CHASSIS GROUND (EARTH) CONNECTION:** This terminal should be connected to a good earth ground before operation.
12. **SCANNER OUTPUTS:** Optional scanner matrix that provides 8 HV/Return connections. Please refer to the Options section of this manual for additional connection information.
13. **REAR PANEL CURRENT TERMINAL:** 2<sup>nd</sup> current output connector in parallel with the front panel connector.
14. **SCANNER OUTPUTS:** Provides 8 HV/Return connections and 8 Ground Bond connections.



## 4. Programming Instructions

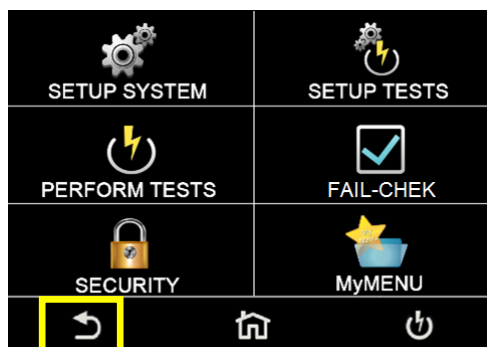
### 4.1 Using the Touch Screen

The touch screen display of the SE provides full control of the instrument. The touch screen will be used to setup system and test parameters as well as security setup and calibration. SE's touch screen functions just like any other touch screen.

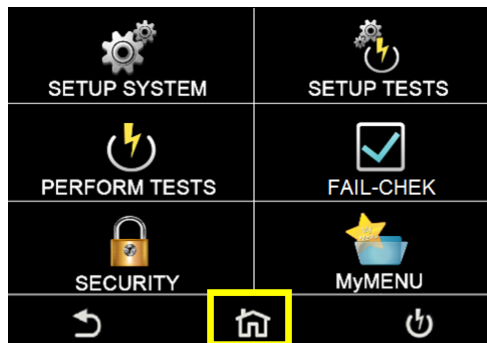
#### Soft Keys

The SE touch screen has 3 soft keys: Back, Home and Perform Tests.

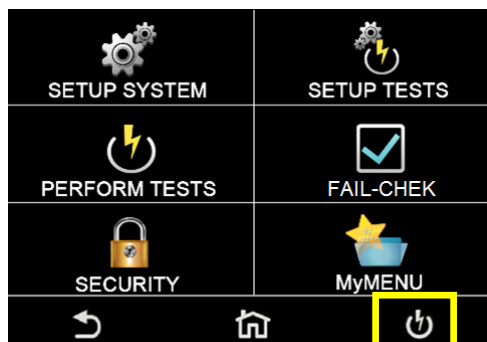
Use the Back key to return to a previous menu:



Use the Home key to return to the Main Menu:

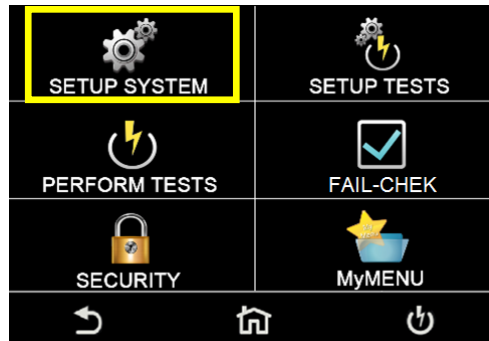


Use the Perform Tests key to navigate to the Perform Tests screen:



## Touch

The various screens of the SE will display icons and parameters. Touch the appropriate icon or parameter with the fingertip as shown in the image below:



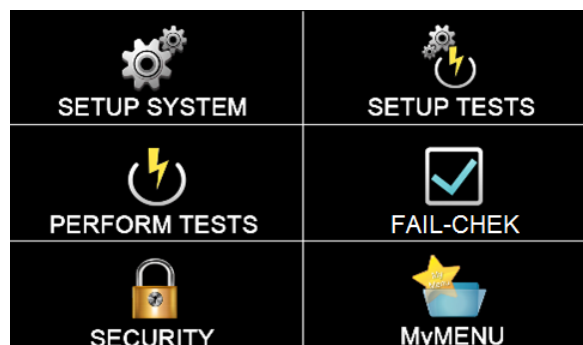
## Scroll and Swipe

A scroll bar on the right side of the screen indicates that there are additional parameters or features. To scroll up and down between parameters touch the screen anywhere scroll upward or downward. Swipe left to right in order to change parameters when setting up test or system values:



## 4.2 Main Menu

The SE automatically defaults to the main menu screen upon power up. The main menu screen will appear as follows:



The default screen is the main menu screen of the instrument. From this screen all the functions and settings of the instrument can be accessed:

**Setup System** – instrument global parameters such as time and date, calibration and hardware.

**Perform Tests** – navigate to the Perform Tests screen in order to run a test sequence.

**Security** – access instrument lockout and security features

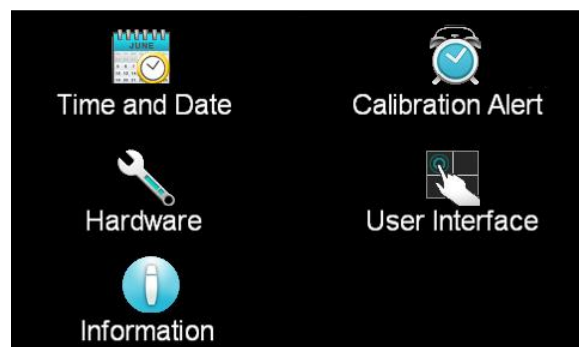
**Setup Tests** – create test files

**FAIL-CHEK** – check the instruments failure detectors

**MyMENU** – user customized menu

### 4.3 Setup System

From the default main menu touch the Setup System icon to enter the Setup System sub menu. This is where all System Parameters are edited:



#### 4.3.1 Time and Date

The next parameter in the System Setup is the Time and Date parameter. Touch the screen on the Time and Date icon and the following screen will appear:

Set Date 01/23/2014	Set Time 12:42:29
Date Format mm,dd,yy	Time Format 24hr

From this screen the time and date can be set and the display format can be edited.

##### 4.3.1.1 Set Date

Use the touchscreen numeric keypad to enter the desired value for the date, month and year. Upon entering a value the enter key (↵) will appear. Touch the enter key to

save the value and move to the next field. The < (back arrow) key can be used to toggle between date, month and year. The Prev and Next arrows can be used to toggle between different fields under the Time and Date menu.

#### 4.3.1.2 Set Time

Use the touchscreen numeric keypad to enter the desired value for the hour, minute and second. Upon entering a value the enter key (↵) will appear. Touch the enter key to save the value and move to the next field. The < (back arrow) key can be used to toggle between hour, minute and second. The Prev and Next arrows can be used to toggle between different fields under the Time and Date menu.

#### 4.3.1.3 Date Format

Touch the desired date format and the enter key (↵) will appear. Press the enter key to save the value and move to the next parameter under the Time and Date menu. The Prev and Next arrows can be used to toggle between different fields under the Time and Date menu.

#### 4.3.1.4 Time Format

Touch the desired time format and the enter key (↵) will appear. Press the enter key to save the value and move to the next parameter under the Time and Date menu. The Prev and Next arrows can be used to toggle between different fields under the Time and Date menu.

#### 4.3.2 Calibration Alert

Calibration Alert is a feature that allows the instrument to give an advanced alert that the calibration for the instrument is coming due.

Turning this parameter ON will activate the Cal Alert function and when the date matches the Alert Date, the instrument will display the Calibration Alert Warning screen upon power up.

The Calibration Alert settings can be found in the Setup System screen. Click on the Calibration Alert icon and the following screen will appear:

Calibration Alert OFF	Calibration Date 10/12/2013
Calibration Due 10/12/2014	Alert Date 09/12/2012

The first field under the Calibration Alert screen allows the user to set the Calibration Alert to ON or OFF.

Touch the desired value and the enter key (↵) will appear. Press the enter key to save the value and move to the next parameter under the Calibration Alert menu. The Prev and Next arrows can be used to toggle between different fields under the Calibration Alert menu.

#### **4.3.2.1 Calibration Due Date and Alert Date**

It is recommended that calibration should be performed at least once a year. It is recommended that the Calibration Due Date not be set greater than one year from the Calibration Date displayed. After a calibration is performed, the Calibration Due Date is automatically set 1 year after the calibration date.

This parameter defaults to one year after the calibration date but may be overwritten to any date desired.

The Calibration Due Date and Alert Date can be set by selecting the appropriate fields on the touchscreen. The following screens will appear when the Calibration Due Date and Alert Date fields are selected.

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 11 months after the Calibration Date. For example, if the calibration is performed on 12/15/2014 the Alert Date will automatically be set to 11/15/2015.

This parameter defaults to 11 months after the Calibration Date but may be overwritten to any advanced date desired. Use the numeric keypad to change the values in the date fields and press the enter key (↵) to accept the new number or press EXIT to cancel and return to the original number.

Use the touchscreen numeric keypad to enter the desired value for the date, month and year. Upon entering a value the enter key (↵) will appear. Touch the enter key to save the value and move to the next field. The < (back arrow) key can be used to toggle between date, month and year. The Prev and Next arrows can be used to toggle between different fields under the Time and Date menu.

Calibration Date is a non-editable parameter that indicates the date when calibration was last performed on the instrument. This parameter automatically updates after calibrating the instrument.

#### **4.3.3 Hardware**

The Hardware menu contains important system parameters which must be set prior to performing tests. Touch the Hardware icon and the following screen will appear:

Smart GFI 0.0mA	PLC Remote OFF
Single Step OFF	Fail Stop ON
Measurement Average	Baudrate 9600

The touchscreen can be scrolled downward to see the remaining Hardware parameters. Upon scrolling down the remaining items appear as follows:

ProVOLT OFF	Control mode SE
Barcode	Result Setup

#### 4.3.3.1 Smart GFI

The high voltage power supply of the SE is internally referenced to earth ground. Since the leakage current measuring circuit of the instrument monitors only current that flows through the return lead the possibility exists for current to flow directly from the high voltage output to earth ground without being measured. The SmartGFI (Ground Fault Interrupt) circuit monitors the current between the high voltage output and earth ground. Therefore, if the operator touches the high voltage lead and earth ground, the instrument will detect this hazardous condition and shut off immediately.

SmartGFI goes beyond a standard GFI circuit by automatically determining the return configuration of the DUT (grounded or floating) and enabling or disabling depending on the situation. When the SE's Return lead is floating, the SmartGFI circuit enables, protecting the test operator from electric shock. When the SE's Return lead is earth grounded, the SmartGFI circuit disables and the instrument operates in a grounded return mode of operation. If the GFI were to remain active in this state, the tester would continuously fail since all current is returning through earth ground. By disabling the SmartGFI circuit and operating in a grounded return mode, SE allows the user to perform tests on devices that have their chassis's earth grounded by the test fixture or test environment.

The Smart GFI is an adjustable function ranging from 0.5 - 5.0mA. Setting the Smart GFI value to 0mA will simply turn the function OFF. To set the Smart GFI enter the desired value using the touchscreen keypad and touch the enter key (↵) to save the value and move on to the next parameter. To clear the entered value the ← key should be used. To exit back to the previous menu use the "X" key.

#### **4.3.3.2 PLC Remote**

The PLC Remote function can be set to ON or OFF. To set the PLC Remote function, touch the ON/OFF key. To save the setting touch the enter key (↵) and move to the next parameter.

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 front panel TEST button when the PLC Remote function is turned “ON”, a pop-up message will be displayed.

#### **4.3.3.3 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 step is completed. To continue the test sequence, press the Test button to execute the next connected step. Each time the TEST button is pressed the next connected step will execute. If you press the RESET button before completing all connected steps, it will return you to the original starting step. If a step fails and you wish to continue to the next step, do not press RESET.

The Single Step function can be set to ON or OFF. To set the Single Step, touch the ON/OFF key. To save the setting touch the enter key (↵) and move to the next parameter.

#### **4.3.3.4 Fail Stop**

Fail Stop is a function that will stop a sequence if a failure occurs. If this function is turned off, the sequence of tests will continue to the end of the sequence regardless of whether or not a failure has occurred. If the Fail Stop is OFF and a failure occurs during the test sequence, the RESET button will light and a short alarm will sound but the sequence will continue to the end.

At the end of the test sequence the RESET button will light and alarm will sound indicating failure during the sequence. Pressing the RESET button will silence the alarm. Pressing the RESET button a second time will reset the instrument.

The Fail Stop function can be set to ON or OFF. To set the Fail Stop function touch the ON/OFF key. To save the setting touch the enter key (↵) and move to the next parameter.

#### **4.3.3.5 Measurement**

The Measurement function can be set to either True RMS or Average. Touch the screen to select the desired value and the enter key (↵) to save the selection and move to the next parameter.

#### 4.3.3.6 Baudrate

The transmission speed of RS232 can be set, it has 9600, 19200, 38400, 57600 and 115200 selectable.

Note: the faster the transmission speed setting will be interference.

#### 4.3.3.7 ProVOLT

The ProVOLT function allows for maintaining, stepping up or stepping down the voltage output between steps without the voltage dropping to 0V. If ProVOLT = ON, the output voltage will not drop to 0V between test steps.

Additional notes on the ProVOLT function:

- Test steps must be of the same test type (ACW, DCW). For example if an ACW test is followed by a DCW test, the ProVOLT function will not operate.
- If stepping up the voltage between steps, the ramp down parameter is ignored.
- If stepping down the voltage between steps, the ramp up parameter is ignored.

#### 4.3.3.8 Control mode

The Control mode function can be set to SE, 7730 or 7400.

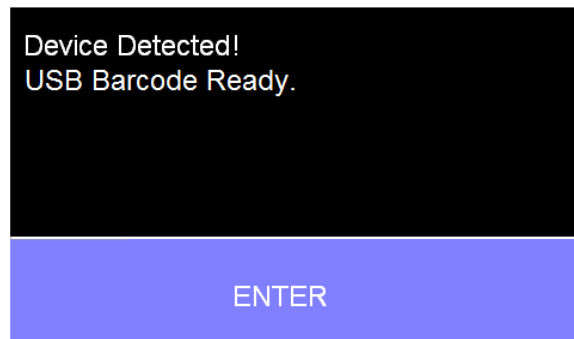
The format and command will compatible to 7730 or 7400 series when the Control mode is 7730 or 7400.

Note: the instrument will can't use USB and Barcode function and Chinese and Japanese interface when the Control mode is 7730 or 7400.

#### 4.3.3.9 Barcode

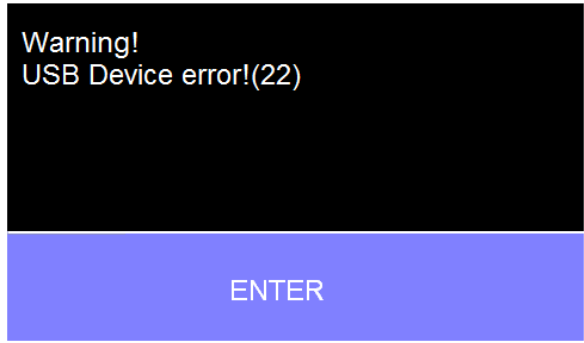
The Barcode function allows the user to connect a barcode scanner directly to the front panel of the instrument's barcode port. This is utilized to enter product and serial number information for testing.

To use this function, the user will need to plug a USB type barcode reader into the barcode port on the front panel of the instrument. Once a USB barcode is plugged in, the instrument will notify the user a reader has been detected:

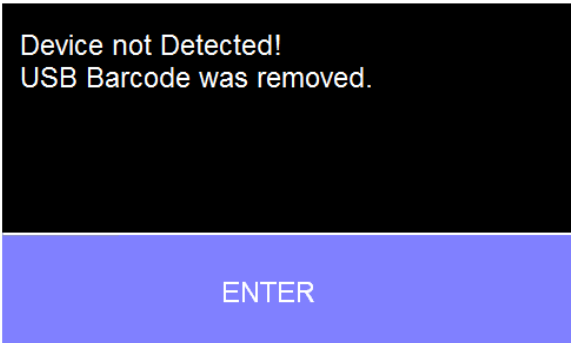


If there is a problem with the connection to the barcode reader or an incompatible device is plugged into the USB barcode port, the following message will appear:



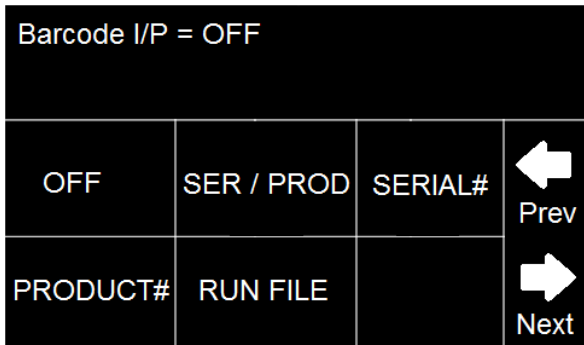


If the USB barcode device is removed while the instrument is powered on, the following message will appear:



There are two options under Barcode, Barcode I/P and Autostart.

Touch the Barcode I/P icon and the following screen will appear:

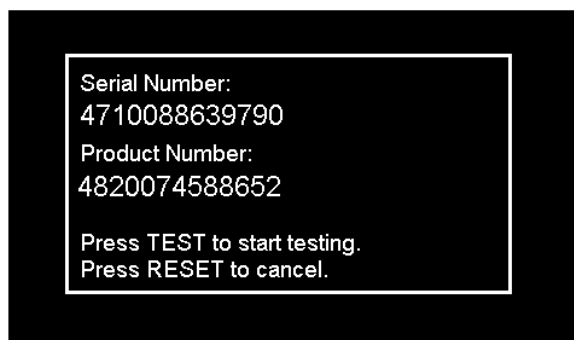
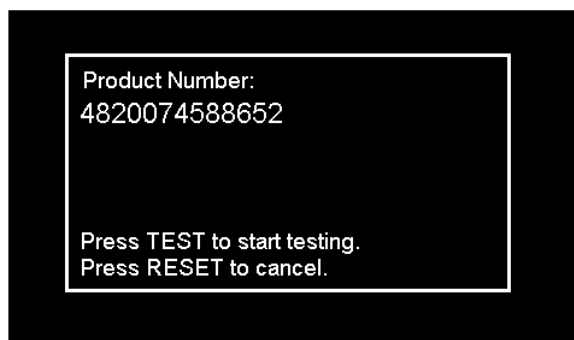
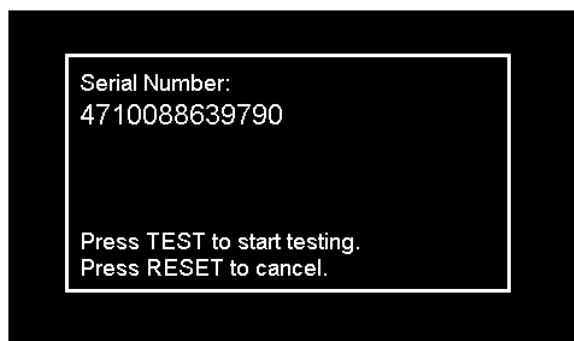


The Barcode I/P function can be set to OFF, SER/PROD, SERIAL #, PRODUCT # or RUN FILE.

Touch the desired icon to set the Barcode I/P. For example if the user touches the SERIAL # input another screen will appear:

Barcode I/P = SERIAL#			
OFF	SER / PROD	SERIAL#	X
PRODUCT#	RUN FILE		←

When the setting is SERIAL#, PRODUCT# or SER/PROD the user can scan barcodes in the Perform Tests screen before the test is started. When the barcode is scanned, one of the following messages will appear on the display:



After the barcodes are scanned, pressing TEST will initiate the test sequence. Pressing RESET will abort the TEST sequence. The barcode function allows for the re-scanning of barcodes if the previously scanned barcode was incorrect. Re-scanning is available in the SERIAL#, PRODUCT# and SER/PROD modes. Any time before a

test is initiated; the user can re-scan a barcode. If the user decides to re-scan barcodes when the Barcode I/P setting is set to SER/PROD, the barcode function will first replace the data in the Serial Number field, and if the user re-scans another barcode, the barcode function will replace the data in the Product Number field.

The RUN FILE selection gives the user the ability to automatically load a test file based on what barcode is scanned from the Perform Tests screen.

To completely enable this feature, the user must name the desired test file for a particular product the exact alpha-numeric code that is on the product's barcode label. For example, if Product A has barcode "123456789", then the test file that the user would like to run when testing Product A must be named "123456789". Upon scanning the barcode, the SE will immediately load the test associated with that barcode. The test file name is limited to 10 characters. However, if the user names a test file with the maximum 10 characters, this function will still initiate a test when a product's barcode begins with those first 10 characters, even if the barcode has more than 10 characters.

When using certain features of barcoding, the instrument's response to the TD? and RD x? commands will differ slightly to an instrument that is not utilizing this function. For all types of tests (ACW, DCW, IR, CONT) two fields are added to the end of the standard response when the Barcode I/P setting is set to SERIAL#, PRODUCT# or SER/PROD.

The first field contains the Serial Number information and the second field includes the Product Number information. Both fields are included regardless of which of these three modes are selected. The Data Storage Card will simply substitute a "0" for the field if it is not applicable to the setting. For example, if a user had their Barcode I/P setting set to SERIAL#, and scanned a Serial Number with the value "123456789", the TD? response for an ACW test could be:

```
01,ACW,Pass,1.24,1.000,0.900,1.0,123456789,0
```

Note that there is a "0" in the Product Number field because the Barcode I/P setting is SERIAL#. When the Barcode I/P setting is RUN FILE or OFF, these fields are not included in the TD? and RD x? responses.

This is where the selection can be saved by pressing the enter key (↵) and move to the previous screen.

The Autostart function works in tandem with the Barcode RUN FILE function to automatically start a test sequence once the product and serial number have been scanned.

## **WARNING**

Using the Autostart = ON and RUN FILE feature will enable the instrument's output once the barcode is scanned. Do not touch the DUT at any time when using this feature in order to avoid potential shock or serious injury.

The Autostart function can be set to ON or OFF. To set the Autostart function touch

the ON/OFF key. To save the setting touch the enter key (↵) and move to the previous screen.

#### 4.3.3.10 Result Setup

From the Setup System menu touch the Results Setup icon and the following screen will appear:

#### 4.3.4 User Interface

Results LAST	Touch Sound ON
Alarm Volume 5	Language English
Animation CONTINUE	Home Screen Menu

Scroll downward to see the remaining options under the User Interface:

Hardware Key ON	Auto Save ON
Color States Vivid	

#### 4.3.4.1 Results

The next parameter under User Interface is Results. This allows the user to set the desired results display after a test sequence has been run. The Results function can be set to ALL, LAST or P/F (Pass/Fail).

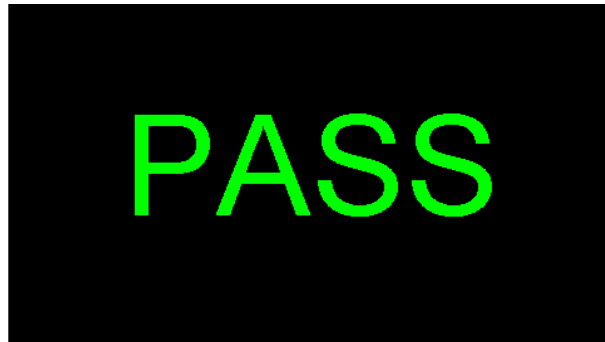
When ALL is selected, a Results summary screen will be displayed at the end of the test or sequence of connected steps displaying the results of all of the steps. The Results summary screen will appear as follows:

001 ACW PASS 5.00KV 0.001mA 10.0s 0.000mAR	002 IR PASS 500V >50.00GΩ 5.0s

When Last is selected, the results of the last 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:

EXTECH-001 40.00mAR ACW PASS 10.0s	
5.00 <sub>kV</sub> 40.00 <sub>mA</sub>	 Results

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:



Touch the screen to select the desired value and the enter key (↵) to save the selection and move to the next parameter.

#### 4.3.4.2 Touch Sound

Select Touch Sound icon on and choose between ON and OFF. If Touch Sounds = ON, the instrument will emit a short audible beep anytime the screen is touched.

#### **4.3.4.3 Alarm Volume**

Select Alarm Volume using the touchscreen and use the numeric keypad to enter a value. The numbers corresponding to the different volume settings are 0 through 9, 0 meaning the volume is off, and 9 being the loudest setting.

Upon selecting a value, a momentary alarm chirp will occur to indicate the volume of the new setting, and the enter key (↵) will appear. Touch the enter key to save the value and move to the next field.

#### **4.3.4.4 Language**

Select Language from the touchscreen and choose the desired language. The available languages on the SE instrument are English, Chinese, Simplified Chinese and Japanese.

#### **4.3.4.5 Animation**

Select Animation using the touchscreen display and select between CONTINUE or PAUSE. If PAUSE is selected, the instrument will stop on the animation screen during power up. The user must touch the screen to continue to the Main Menu. If CONTINUE is selected, the instrument will automatically navigate to the Main Menu after the animation screen.

#### **4.3.4.6 Home Screen**

This allows the user to set the default screen upon instrument power up. Select Home Screen on the touchscreen display and choose between Perform Test, Menu or My Menu.

If Perform Test is selected, the instrument will automatically navigate to the Perform Tests screen upon power up. If Menu is selected, the instrument will automatically navigate to the Main Menu upon power up. If My Menu is selected, the instrument will automatically navigate to the user's My Menu setup upon power up.

#### **4.3.4.7 Hardware Key**

This function applies to the test operators need to wear gloves.

Press My Menu / Select and ► key to adjust the output voltage when user has wear gloves.

When the Hardware Key is turned ON, the My Menu / Select key is increment voltage, ► key is decrease voltage at during output.

#### **4.3.4.8 Auto Save**

Select Auto Save from the touchscreen keypad and choose between ON and OFF.

#### **4.3.4.9 Color States**

Select the Dull and the following screen will appear:



Select the Vivid and the following screen will appear:



#### 4.3.5 Information

This gives the user the ability to view all instrument information including: Model Number, Serial Number, Calibration Date, Company Information and Firmware Version.

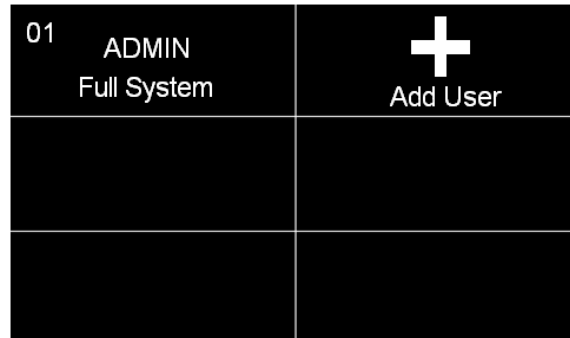
#### 4.4 SECURITY

From the Main Menu select Security and the following screen will appear:

Security OFF	User Setup

The first option under Security allows the user to set Security to ON or OFF. Select Security using the touchscreen keypad and choose between ON or OFF.

The next option under security is User Setup where multiple users can be added and assigned different privileges. To add a user select User Setup from the Security screen and the following screen will appear:



1. To add a user, select the Add User icon and the following screen will appear where an alpha-numerical user ID can be entered and saved.
2. After the User ID is entered, the next screen will ask for entering a Password for the newly added User ID.
3. Using the numeric keypad enter a password for the newly created User ID. After the password is entered another screen will appear to confirm the Password.

Once the Password is confirmed the next screen will display the Security Level options for the newly added User ID. Use the touch screen display to select between Run Only, Recall Setup, Edit Setup or Full System

The security level descriptions are as follows:

Security Level	Description
Full System	In this mode the user has full access level to all instrument setup parameters as well as system configuration and security levels. Access at this level should be restricted to System Administrators
Edit Setup	In this mode the user can load files and edit test parameters.
Recall Setup	This mode allows the user to load previously configured test files but it does not allow any editing of the parameters. In this mode the user is restricted from access to the "Setup Test Parameters" screen.
Run Only	This is the most restricted mode of user access. The user can only initiate a test, reset a failure or abort a test from the Perform Tests screen.  <b>NOTE:</b> whenever a user's security level is Run Only, "Single Step" and "Fail Stop" soft keys will be disabled at the Perform Test screen.  <b>NOTE:</b> whenever a user's security level is Run Only, you may only start at test step 1.



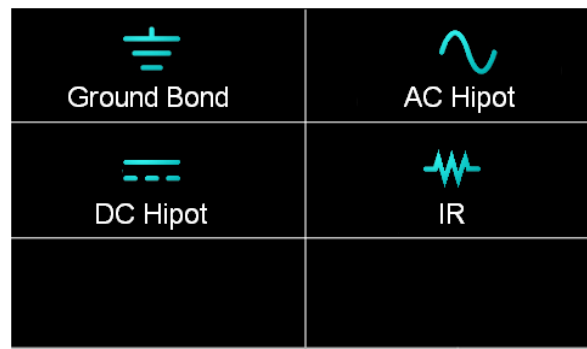
Once a user has been successfully added the User Setup screen will display the newly added user. From this screen the user settings can be edited:

## 4.5 FAILCHEK

FAILCHEK is the process by which an instrument's failure detectors are proven to be functioning properly. Checking the failure detection circuitry of the electrical safety tester is required by safety agencies such as CSA, UL, and TÜV.

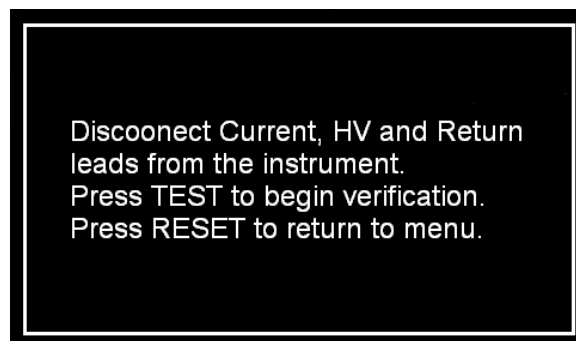
- **NOTE:** this process should be performed at the beginning of each day or each shift, before testing has begun.

Select the FAILCHEK icon from the main menu and the following screen will appear:

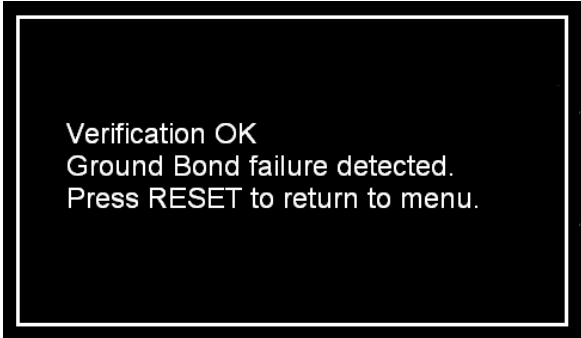


### 4.5.1 Ground Bond FAILCHEK

To perform Ground Bond FAILCHEK, touch the Ground Bond icon and the following screen will appear:




Follow the instructions on the screen. Press the Test button on the front panel of the instrument to start the test. If the FAILCHEK test passes, the following screen will appear:



Verification OK  
Ground Bond failure detected.  
Press RESET to return to menu.

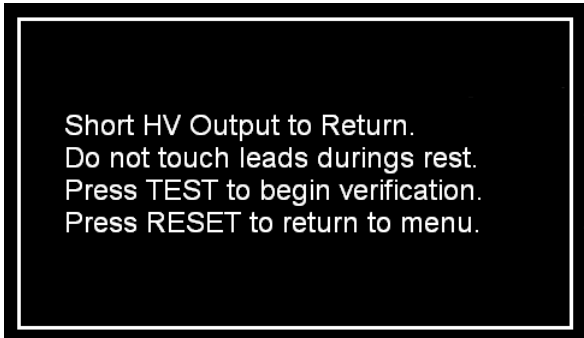
If the FAILCHEK test fails, the following screen will appear:



Verification Error  
Ground Bond failure not detected.  
Check connections or call EXTECH  
local distributor.  
Press RESET to return to menu.


#### 4.5.2 AC Hipot FAILCHEK

To perform an AC Hipot FAILCHEK, touch the AC Hipot icon and the following screen will appear:




Short HV Output to Return.  
Do not touch leads during rest.  
Press TEST to begin verification.  
Press RESET to return to menu.

Follow the instructions on the screen. Press the Test button on the front panel of the instrument to start the test. If the FAILCHEK test passes, the following screen will appear:



Verification OK  
AC Hipot failure detected.  
Press RESET to return to menu.

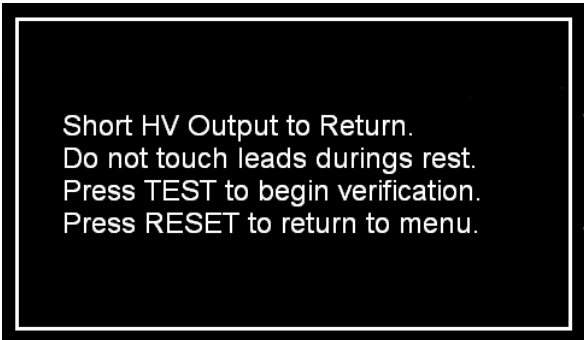
If the FAILCHEK test fails, the following screen will appear:



Verification Error  
AC Hipot failure not detected.  
Check connections or call EXTECH  
local distributor.  
Press RESET to return to menu.


#### 4.5.3 DC Hipot FAILCHEK

To perform a DC Hipot FAILCHEK, touch the DC Hipot icon and the following screen will appear:




Short HV Output to Return.  
Do not touch leads during rest.  
Press TEST to begin verification.  
Press RESET to return to menu.

Follow the instructions on the screen. Press the Test button on the front panel of the instrument to start the test. If the FAILCHEK test passes, the following screen will appear:



Verification OK  
DC Hipot failure detected.  
Press RESET to return to menu.

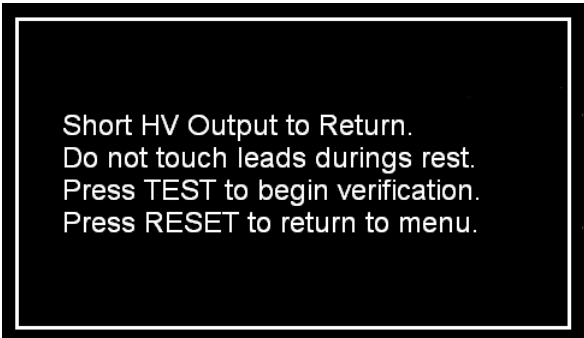
If the FAILCHEK test fails, the following screen will appear:



Verification Error  
DC Hipot failure not detected.  
Check connections or call EXTECH  
local distributor.  
Press RESET to return to menu.

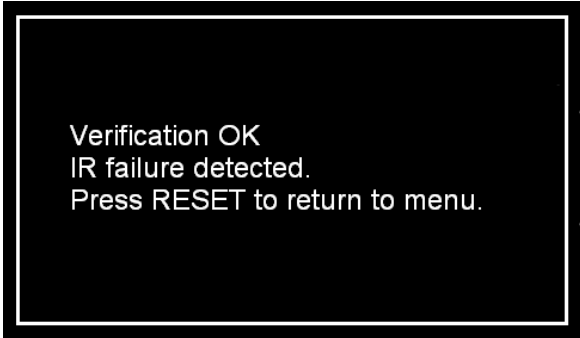
#### 4.5.4 IR FAILCHEK

To perform an IR FAILCHEK, touch the IR icon and the following screen will appear:




Short HV Output to Return.  
Do not touch leads during rest.  
Press TEST to begin verification.  
Press RESET to return to menu.

Follow the instructions on the screen. Press the Test button on the front panel of the instrument to start the test. If the FAILCHEK test passes, the following screen will appear:



Verification OK  
IR failure detected.  
Press RESET to return to menu.

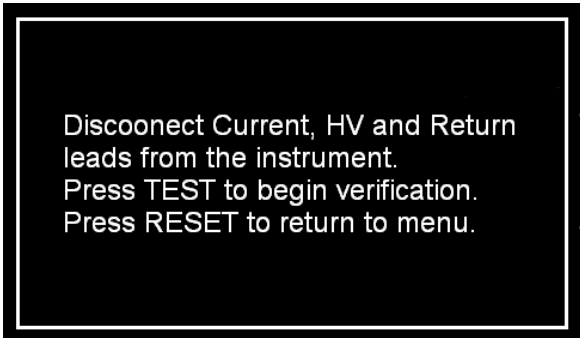
If the FAILCHEK test fails, the following screen will appear:



Verification Error  
IR failure not detected.  
Check connections or call EXTECH  
local distributor.  
Press RESET to return to menu.

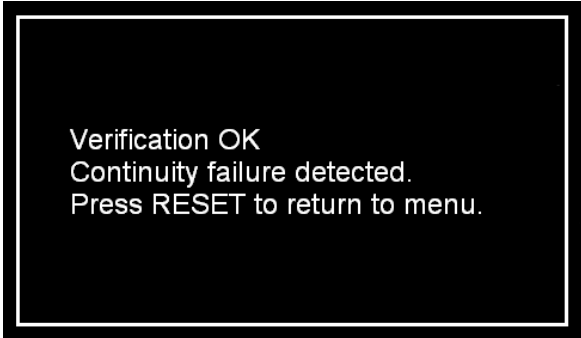
#### 4.5.5 Continuity FAILCHEK (Option)

To perform Continuity FAILCHEK, touch the Continuity icon and the following screen will appear:



Disconnect Current, HV and Return  
leads from the instrument.  
Press TEST to begin verification.  
Press RESET to return to menu.

Follow the instructions on the screen. Press the Test button on the front panel of the instrument to start the test. If the FAILCHEK test passes, the following screen will appear:



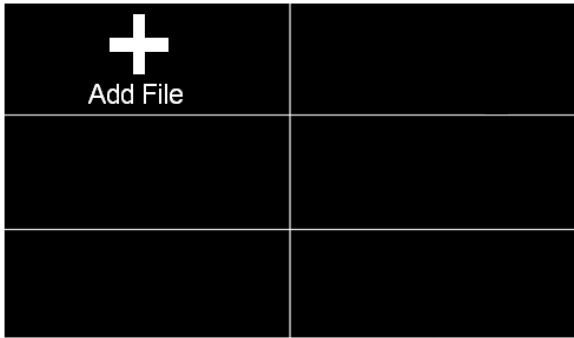
If the FAILCHEK test fails, the following screen will appear:



### 4.6 Test Parameters

This section details the various test parameter descriptions. For information on setting up test sequences, refer to section [4.7. Setup Tests](#).

From the Main Menu select Setup Tests and the following screen will appear:



#### 4.6.1 Description of Test Parameters

This section details each test parameter and test parameter description.

**Voltage:** The voltage that is applied to the high voltage and return terminals during a test.

**Max Lmt T:** ACW test only. Total current maximum limit. The maximum current threshold that triggers a failure when exceeded.

**Max Lmt R:** ACW test only. Real current maximum limit. The maximum current or resistance threshold that triggers a failure when exceeded.

**Min Lmt T:** ACW test only. Total current minimum limit. The minimum current or resistance threshold that triggers a failure when not exceeded.

**Min Lmt R:** ACW test only. Real current minimum limit. The minimum current or resistance threshold that triggers a failure when not exceeded.

**Max Lmt:** The maximum current or resistance threshold that triggers a failure when exceeded.

**Min Lmt:** The minimum current or resistance threshold that triggers a failure when not exceeded.

**Ramp Up:** The length of time that is allowed for the test voltage to climb from 0 to the programmed test voltage.

**Dwell:** The length of time that is allowed for the programmed test voltage to be applied.

**Delay:** The length of time that the programmed test voltage is applied but no judgment of the set parameters is made. Judgment of the parameters is not made until the end of the delay time.

**Ramp Down:** The length of time that is allowed for the test voltage to decay from programmed test voltage to 0.

**Arc Sense:** The maximum allowable threshold for arcing. The numbers 0 through 9 correspond to the different arc sensitivity levels, 1 meaning the maximum threshold of allowable arcing, 9 meaning the minimum threshold of allowable arcing, and 0 being OFF. Arc detection is not required for testing.

**Frequency:** This parameter is available in AC testing only and may be toggled between 50 and 60 Hz (also can toggle between 400/800Hz if this option is installed).

**Continuity:** This function checks for a connection between the Cont. Check and Return lead. This is a basic DC continuity check that measures the continuity value but does not display it. Continuity may be turned ON or OFF.

**Offset:** Used during the Continuity test to factor out test lead and fixturing resistance. For information on how to set the offset value, refer to section [4.6.2 Additional Parameter Notes and Functions](#).

**Scanner or EX Scanner:** (This parameter will only be seen on units equipped with a scanner). This parameter allows for setup of multiple Scanner channels. The three different selectable Scanner states are L (scanner channel set to the return point), H (scanner set to the high voltage point) and O (OFF).

### **Prompt**

The Prompt function allows you to insert a short line of text in a step. The Prompt will

appear on the screen before the step is initiated and remains on the screen until the TEST button is pressed. After the TEST button is pressed, the Prompt will clear and the step will initialize.

## 4.6.2 Additional Parameter Notes and Functions

### Real Current

The AC Real Current function allows the user to monitor only the real portion of the leakage current and ignore any reactive components due to capacitance in the device under test. It is important to recognize that the total current is the vector sum of the reactive and real current, not the direct addition of the two components. As in a right triangle, the total current is the square root of the sum of the squares of the real and reactive currents.

Since the real component is usually much smaller than the reactive current, a doubling of the real current increases the total current by only a small amount. Unless the two components are separated, a doubling of the real leakage current can go virtually undetected by a total current measurement.

Because Real Current is installed in SE, additional parameter selections are added to the ACW test parameters. The additional test parameters are Max Lmt R (Real Current Maximum limit), Min Lmt R (Real Current Minimum Limit) and Display. The standard total current limits have a "T" next to them indicating total current.

The AC Real Current function allows the operator to view both real and total current simultaneously. The Display parameter allows you to select which meter will display the real and total current. When the display parameter is set for Total, the large current meter will display the total current and the real current will be displayed in the small current meter below the memory location name. The opposite is true when the display parameter is set for Real.

### Ramp-HI

The Ramp-HI function is active during the Ramp period only. Ramp-HI will allow current higher than the normal Max-Lmt current setting of the DC Withstand Voltage test to avoid false failure due to charging current.

### Charge-LO

The Charge-LO function is used to check if the cables are connected properly at the beginning of a test. A capacitive DUT will draw charging current on the DC Withstand test when the Output is activated. If the charging current is lower than the setting, the test cables may not be connected properly. The instrument can set the Charge-LO parameter manually or automatically. To manually set the Charge-LO current, use the

**WARNING**

**Please be aware that the program will activate high voltage on the output connector while the TEST button is pressed.**

The program will read the charging current of the DUT and set the Charge-LO current



at approximately one half (1/2) of the reading. The instrument will beep and the new value will automatically be updated in the field. You do not need to press the ENTER key for the new parameter to be accepted.

### Continuity

The Continuity test is generally used to test the ground conductor of a line cord. If the resistance exceeds Max-Lmt trip point or drops below the Min-Lmt trip point the SE will signal a continuity failure. If you are testing products with two prong plugs, do not activate the continuity circuit.

### Offset

This function allows the instrument to compensate for lead and test fixture resistance during a Continuity test

To manually set an Offset value enter a  $m\Omega$  value via the numeric keypad and then press the ENTER key to accept the new value or press the EXIT key to escape from the edit.

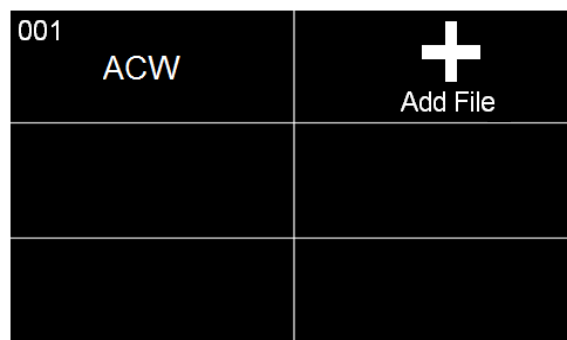
To automatically set an Offset value, set the output voltage, current, and frequency to the values that will be used on the DUT and connect the test cables, test fixture, or Scanner channel with fixturing to the instrument. Next, short the ends of the test cables and press the TEST button. The instrument will beep and the new value will automatically be updated in the field. You do not need to press the ENTER key for the new parameter to be accepted.

**NOTE:** do not connect the DUT to the instrument when performing an offset. This will create erroneous results when a test is performed.

### Setup Tests

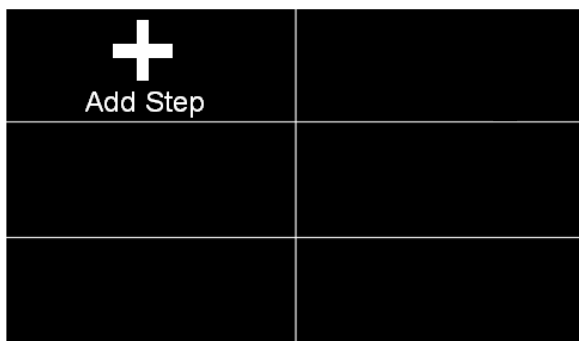
This section of the manual details how to setup a test sequence.

From the Main Menu select Setup Tests and the following screen will appear:



Touch the Add File icon and enter a name for the new file using the touchscreen keypad and use the enter key (↵) to save the name and move to the next screen.

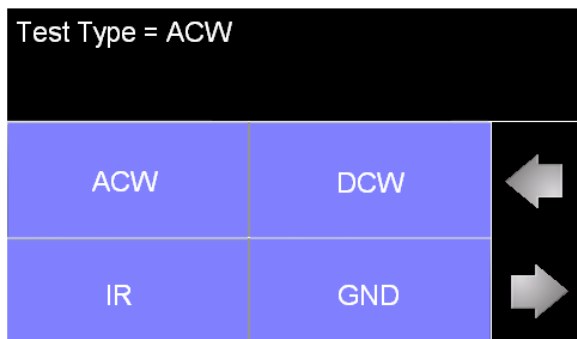
Next, add a test to the newly created test file:



Touch the Add Step icon to enter the test parameters screen. In this screen, the test type is selected and all the relevant test parameters are programmed and saved:

Test Type ACW	Voltage 1240V
HI-Limit Total 10.00mA	LO-Limit Total 0.000mA
HI-Limit Real 10.00mA	LO-Limit Real 0.000mA

Touch Test Type icon and the following screen will appear:



#### 4.7.1 ACW

Touch ACW for the test type and use the enter key (↵) to save the Test Type and move to the next test parameter:

Test Type ACW	Voltage 1240V	Ramp Up 0.1s	Dwell Time 1.0s
HI-Limit Total 10.00mA	LO-Limit Total 0.000mA	Ramp Down 0.0s	Arc Detect OFF
HI-Limit Real 10.00mA	LO-Limit Real 0.000mA	Arc Sense 5	Offset 0.000mA

Frequency 60Hz	Range Auto
Prompt	Defaults

Note: The Offset value can only be set by performing the auto offset. To perform an auto offset disconnect the DUT and leave all the test leads open. Press the test button on the front panel. Reading will be displayed on the screen when the instrument is performing the auto offset. Once the instrument is has finished performing the auto offset the numeric value will be displayed on the screen and will be automatically saved to be used when the actual test is performed.

#### 4.7.2 DCW

Select DCW for the test type and use the enter key (↵) to save the Test Type and move to the next test parameter:

Test Type DCW	Voltage 1200V	Ramp Down 0.0s	Charge-Lo 0.0uA
HI-Limit 10000uA	LO-Limit 0.0uA	Arc Detect OFF	Arc Sense 5
Ramp Up 0.3s	Dwell Time 1.0s	Offset 0.0uA	Ramp-HI 0.0uA

Range Auto	Low Range OFF
Prompt	Defaults

Note:

1. Charge-Lo: The parameter can be set automatically or manually. To perform an auto Charge-Lo, connect the DUT and all the test leads as needed to perform a real test. Press the test button on the front panel. Reading will be displayed on the screen when the instrument is performing the auto Charge-Lo. Once the instrument is has finished performing the auto Charge-Lo the numeric value will be displayed on the screen and will be automatically saved to be used when the actual test is performed.
2. Offset: To perform an auto offset disconnect the DUT and leave all the test leads open. Press the test button on the front panel. Reading will be displayed on the screen when the instrument is performing the auto offset. Once the instrument is has finished performing the auto offset the numeric value will be displayed on the screen and will be automatically saved to be used when the actual test is performed

### 4.7.3 IR

Select IR for the test type and use the enter key (↵) to save the Test Type and move to the next test parameter:

Test Type IR	Voltage 500V	Dwell Time 0.5s	Ramp Down 0.0s
HI-Limit 0.00MΩ	LO-Limit 0.10MΩ	Charge-Lo 0.000uA	Prompt
Ramp Up 0.1s	Delay Time 0.5s	Defaults	

Note: Charge-Lo: The parameter can be set automatically or manually. To perform an auto Charge-Lo connect the DUT and all the test leads as needed to perform a real test. Press the test button on the front panel. Reading will be displayed on the screen when the instrument is performing the auto Charge-Lo. Once the instrument is has finished performing the auto Charge-Lo the numeric value will be displayed on the screen and will be automatically saved to be used when the actual test is performed.

### 4.7.4 GND

Select GND for the test type and use the enter key (↵) to save the Test Type and move to the next test parameter:

Test Type GND	Current 25.00A	Frequency 60Hz	Offset 0mΩ
Voltage 8.00V	HI-Limit 100mΩ	Prompt	Defaults
LO-Limit 0mΩ	Dwell Time 1.0s		

### 4.7.5 Continuity (Option)

Select Continuity for the test type and use the enter key (↵) to save the Test Type and move to the next test parameter:

Test Type CONT.	HI-Limit 1000Ω	Defaults	
LO-Limit 0.000Ω	Dwell Time 1.0s		
Offset 0.00Ω	Prompt		

### 4.7.6 View Test Files





Once all tests have been programmed and saved, navigate to the Main Menu. Select the Setup Tests icon and select the test file that was previously created. The screen should display all tests that have been programmed in this test file.

For example:

001 ACW 1.0s 1240V 10.00mAT	002 DCW 1.0s 1200V 10000uA
003 IR 0.5s 500V 0.00MΩ	+ Add Step

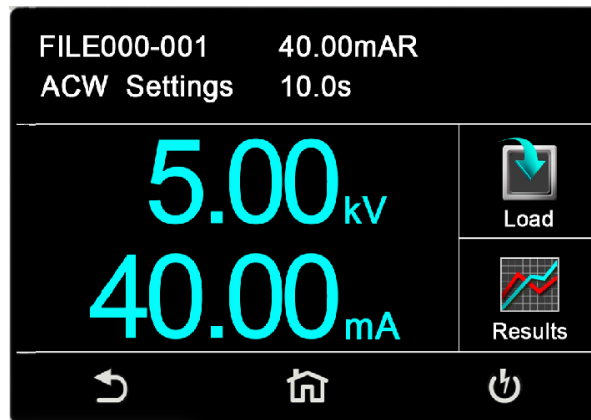
### 4.7.7 Edit Test Files

Once multiple test files have been programmed and saved the user can edit these files from the Setup Test menu. From the main menu select Setup Test.

 Save	 Save As	 Rename	 Delete
001 EXTECH	002 EEC		
003 TEST			

## 4.8 PERFORM TESTS

From the main menu select the Perform Test icon and the following screen will appear:



This screen will display the first test that was saved in the test file. If there are multiple test files saved in the instrument select the Load icon and all the test files will be displayed:

001 EXTECH	002 EEC
003 TEST	

The user can select the desired test file and the first test step in the selected test file will be displayed.

### Meters

The Perform Test screen of the SE has several different meters depending on the type of test being performed. These meters can be arranged as desired by the user and can also be tied to the user security setup. The drag and drop feature of the instrument allows the user to set large and small meters. For example the following screenshot shows the Perform Test screen of the ACW test:



In the image above, the two large meters display the ACW test voltage and the Hi Limit Total. The two small meters on the top of the screen display the Hi Limit Real and Dwell Time. Touch any of the parameters and drag it on to the location of a different parameter and the two meters will be swapped. For example in the next screen the Hi Limit Total is the smaller meter and the Hi Limit Real is the bigger meter.



### Default System Parameters

SE comes from the factory with the following system presets:

SYSTEM PARAMETERS		
Setup	PLC Remote	OFF
	Single Step	OFF
	Fail Stop	ON
	Alarm	5
	Results	Last
	Address (GPIB only)	8
	Smart GFI	ON
	Results	Last
	Cal Alert	ON
Security	Password from Factory	0
	Security based on Password	OFF

#### 4.1.2. Memory, Step, and Default System Parameter Initialization

**WARNING** Initializing the instrument will overwrite all memories and steps with ACW default parameters!

All memories and steps will be loaded with the ACW default parameters and the System parameters will be set to the factory defaults. The default system parameters are as follows:



Setup	PLC Remote	OFF
	Single Step	OFF
	Fail Stop	ON
	Results	Last
	Address (GPIB only)	8
	Smart GFI	ON
	Results	Last
	Cal Alert Date	ON mdy

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

Setup	Cal Date	No change
	Cal Due	No change
	Alert	No change
	Date	No change
	Time	No change
Security	Password	No change
	Security	No change

## 5. Test Connections

### 5.1 Connecting the Test Leads

The instrument comes with all cables necessary for performing a Hipot and Continuity test. Plug the red alligator clip into the HV receptacle on the SE. Connect one of two black alligator clip leads to the Return receptacle and the other to the Cont. Check receptacle.

### 5.2 Connecting the Adaptor Box

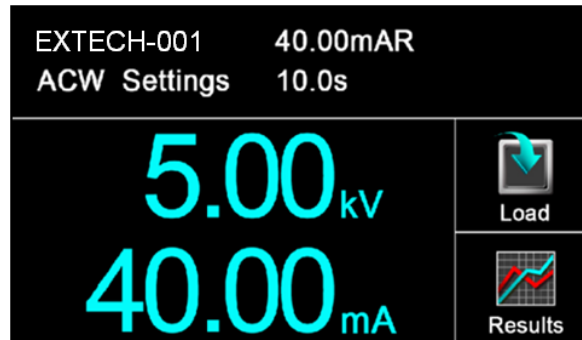
The adaptor box provides an easy way to connect a line cord-terminated DUT to the SE.

### 5.3 Interlock Connector

SE 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 can also be referred to as a remote system lockout, utilizing "fail when open" logic. To disable the Remote Interlock feature connect the Interlock Key into the Signal Input port located on the back of the tester.

## 6. Results Screens

After a test has completed the Results icon will be available on the screen. For example:



The Results screen allows the user to view the results of the last test step that was performed and the results of the previously performed steps.

001 ACW PASS 5.00KV 0.001mA 10.0s 0.000mAR	002 IR PASS 500V >50.00Ω 5.0s

### 6.1 Error Messages and Fail Messages

If there is an error during testing, the error description will be displayed on the screen. Below is a list of error messages that the SE reports:

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

**Hi-Limit:** This message appears on the display if the DUT measurement exceeds the Hi-Limit setting of any parameter.

**Lo-Limit:** This message appears on the display if the DUT measurement drops below the Lo-Limit.

**CONT-Fail:** This message appears on the display if the DUT fails the basic continuity check performed during an AC/DC Withstand test (if Continuity is selected "ON").

**Arc-Fail:** This message appears on the display if the DUT arcing current exceeds the Arc Sense limit and Arc function is active (Arc Sense = 1...9) of the AC/DC Withstand test.

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

**Charge-LO:** This message appears on the display if the leakage current during Ramp-up falls below the Charge -LO setting.

**Breakdown:** This message appears on the display if the DUT current is well beyond the metering range of the test and the arcing condition beyond the arc sense limit.

**GND-Fault:** This message appears on the display if the GFI threshold is exceeded during the test.

**Interlock Open:** This message appears on the display if the Remote Interlock feature is activated before or during a test. The Remote Interlock feature utilizes a set of closed contacts which will disable the instrument's output if they are opened before or during a test. Remote Interlock could also be referred to as a remote system lockout, utilizing "fail when open" logic. The Remote Interlock feature may be disabled by plugging the "Interlock Disable Key" provided into the Signal Input connector. See section **6.2. Remote Signal Inputs and Memory Access** for more information.

**Output Error:** This message appears on the display, if the instrument's output reading does not match the setting. This message will only be seen if the EXIT key is pressed at the Output Error screen. If the instrument has an output problem when the TEST button is pressed, the Output Error screen will appear as follows:

The RESET button is not active in this situation. Only the EXIT key will allow you to return to the Perform Test screen.

**Fatal Error:** If the instrument has a Fatal Error failure then the following screen will appear:

All of the buttons and keys are not active in this situation. You should contact eec to receive further instruction.

Fatal Error identification number will represent type of the failure that occurs.

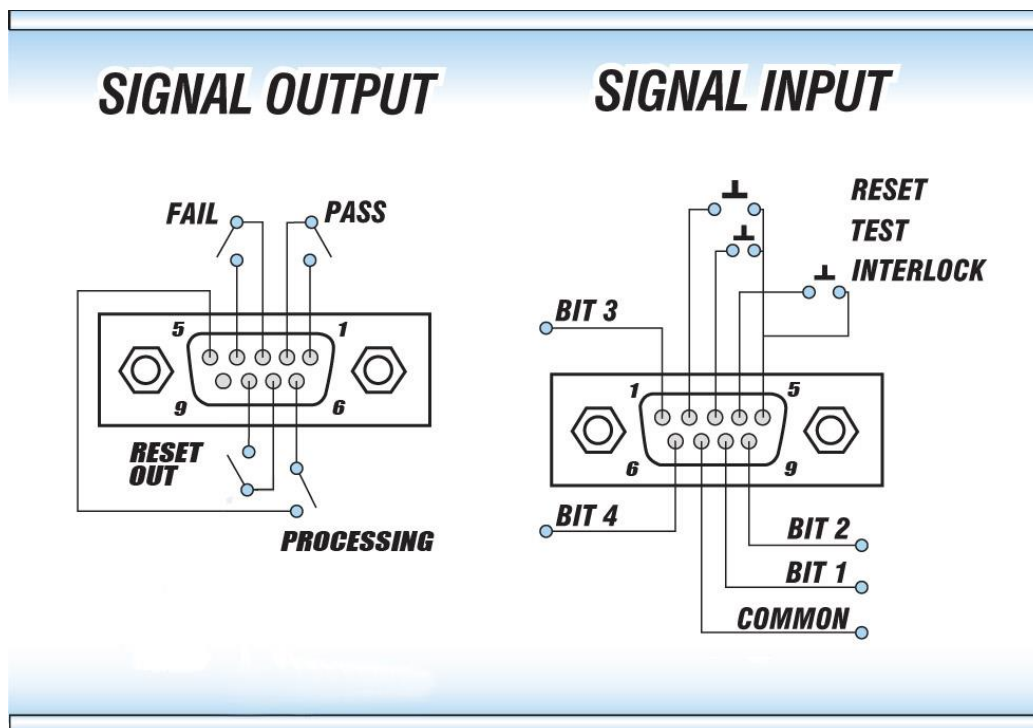
**Error number of 9002** will appear on the display, if the instrument's System data or Model/Option/Serial Number data are corrupted and does not match the setting.

**Error number of 9003** will appear on the display, if the instrument's Calibration data is corrupted.

Error code	Explain
USB device error.(9)	Read barcode error
USB device error.(10)	Open file error
USB device error.(11)	Load file error
USB device error.(12)	File write error
USB device error.(13)	File read error
USB device error.(14)	Files written to content error
USB device error.(15)	File closed error
USB device error.(16)	Read the file size error
USB device error.(17)	Reading USB disk directory error
USB device error.(18)	Read DISK remaining capacity error
USB device error.(19)	Read DISK format error
USB device error.(20)	Read the byte position error
USB device error.(22)	DATA hole insert unrecognized DISK, or BARCODE hole insert unrecognized BARCODE
USB device error.(23)	Search HU4 file error
USB device error.(24)	Delete file error
USB device error.(26)	USB device error
Does not support this USB device.(61)	DISK format error. It support FAT16 and FAT32
EE ERROR	Abnormal code read when during reading step
MEMORY ERROR	Program is not functioning properly

## 7. Connection of 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-sub-miniature 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:



### 7.1 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. 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 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.

## 7.2 Remote Signal Inputs and Memory Access

The SE remote connector enables remote operation of the TEST, RESET, and REMOTE INTERLOCK functions, and allows the operator to select one of 10 pre-programmed test files.

When the PLC Remote mode is on, the SE 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. Ten pre-programmed test files can be accessed by connecting pins 1, 6, 8 and 9 to the common pin 7, 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. However, the memory select bits may be set in sequential manner, provided that the time delay between each bit is less than 4ms. When the desired bit pattern has been established it should remain set for a minimum of 20ms to guarantee that the correct memory will be selected. The **Remote File Select Truth Table** (binary) shows the different combinations of momentary switch (relay) closures, and which memory programs that will be selected as the result. It may be necessary to "OR" the momentary switches (relay contacts) to prevent incorrect program selection due to timing errors.

REMOTE FILE SELECT TRUTH TABLE				
BIT 4	BIT 3	BIT 2	BIT 1	FILE #
0	0	0	1	01
0	0	1	0	02
0	0	1	1	03
0	1	0	0	04
0	1	0	1	05
0	1	1	0	06
0	1	1	1	07
1	0	0	0	08
1	0	0	1	09
1	0	1	0	10
1= Momentary Contact closure between BIT and COMMON				
0= No Contact closure between BIT and COMMON				

When you want to recall the file 3 that the signal of BIT4 to BIT1 are 0011.

## WARNING

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

ACTIVATION DES FONCTIONS DE MÉMOIRE PROGRAMME VIA LE CONNECTEUR REMOTE , SÉLECTIONNE LE PROGRAMME ET LANCE LE TEST QUI EST PRÉPROGRAMMÉ DANS CETTE MÉMOIRE

## CAUTION

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

NE PAS CONNECTER TENSION OU DE COURANT AUX ENTRÉES DE SIGNAL, CELA POURRAIT PROVOQUER DES DOMMAGES AU CIRCUIT DE CONTRÔLE

### Remote Interlock

SE series 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.



## 8. Bus Remote Interface GPIB / USB / RS-232

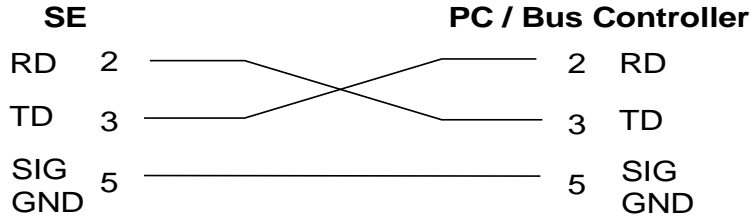
This section provides information on the proper use and configuration of bus remote interface. The USB / RS-232 remote interface is standard on SE series but the GPIB (IEEE-488) interface option can be substituted for the USB / RS-232 interface. Please refer to the Option section of this manual for details on the SE SERIES options. The USB / RS-232 interface also uses the same command set as the GPIB interface for setting of test parameters. However there are many functions of the GPIB 488.2 interface that are not available through USB / RS-232. The IEEE-488 interface included with SE SERIES conforms to the requirements of the IEEE-488.2 standard.

### 8.1. RS-232 Interface

This interface provides all of the control commands and parameter setting commands of the GPIB interface with the exception of some of the 488.2 Common Commands and SRQ capability. All commands can be found in section **8.4. USB / RS-232/GPIB Command List**. The identification command \*IDN and the Status Reporting commands are also available through RS-232.

#### 8.1.1. RS-232 Connector

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



#### 8.1.2. Communications Port Configuration

The COM port should have the following configuration:

- 9600 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.

#### 8.1.3. Sending and Receiving Commands

## 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.

## 8.2 GPIB Interface

This interface is optional on the SE and provides all of the control commands and parameter setting commands of the USB/RS-232 interface along with 488.2 Common Commands and SRQ capability. All commands can be found in section **8.4. USB/RS-232/GPIB Command List**.

### 8.2.1 GPIB Connector

Connection is usually accomplished with a 24-conductor cable with a plug on one end and a connector at the other end. Devices may be connected in a linear, star or a combination configuration.

The standard connector is the Amphenol or Cinch Series 57 Microribbon or AMP CHAMP type. The GPIB uses negative logic with standard transistor-transistor logic (TTL) levels. When DAV is true, for example, it is a TTL low level ( $\leq 0.8$  V), and when DAV is false, it is a TTL high level ( $\geq 2.0$  V).

#### Restrictions and Limitations on the GPIB

- A maximum separation of 4 m between any two devices and an average separation of 2 m over the entire bus.
- A maximum total cable length of 20 m.
- No more than 15 device loads connected to each bus, with no less than two-thirds powered on. For example 1 GPIB controller and a maximum of 14 GPIB instruments.
- **NOTE:** A bus extender, which is available from numerous manufacturers, is available to overcome these limitations.

### 8.2.2 GPIB Address

Each device on the GPIB (IEEE-488) interface must have a unique address. You can set the address of the SE to any value between 0 and 30. The address can only be set from the front panel. The address is stored in non-volatile memory and does not change when the power has been off or after a remote reset.

- The address is set to 8 when the instrument is shipped from the factory.

### 8.3 Interface Functions

The capability of a device connected to the bus is specified by its interface functions. These functions provide the means for a device to receive, process, and send messages over the bus. The interface functions are listed in the chart below.

#### GPIB 488.1 INTERFACE FUNCTIONS

INTERFACE FUNCTION	SUBSET	DESCRIPTION
Source Handshake	SH1	Complete Source handshake capability
Acceptor Handshake	AH1	Complete Acceptor handshake capability
Talker	T6	Talker functions (unaddress if MLA)
Listener	L4	Listener functions (unaddress if MTA)
Service Request	SR1	Complete Service request capability
Remote Local	RL0	No remote/local capability
Parallel Poll	PP0	No parallel poll capability
Device Clear	DC1	Complete Device clear capability
Device Trigger	DT0	No device trigger capability
Controller	C0	No controller capability
Electrical Interface	E2	Three-state drivers
Controllable Items	Test and Reset control.	
	Setting of test parameters for tests.	
	Reading of instrument status and test results.	
Data Codes	ASCII	
Delimiter	NL (+ EOI)	

### 8.4 USB/RS-232 / GPIB Interface Command List

Echo and Response Considerations

#### USB/RS-232 Responses

The USB/RS-232 bus will automatically send any response back to the controller's input buffer.

#### GPIB Queries and Responses

The SE GPIB bus will not send any data to the controller without being queried. A GPIB read command must be sent after a command string to retrieve any data from a query command (?).

#### 8.4.1 Rules for Sending Commands to the Instrument

The following conventions are used to describe the commands syntax for SE:

- 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.
- Each command string should be terminated by the ASCII control code, New Line (NL), (OAh) or the end of line (EOL) message for GPIB.
- All commands that end with a question mark (?) are query commands and required an IEEE-488 read command to retrieve the data from the device's output buffer.

#### 8.4.2 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
SAO	Set Auto-Offset
SACG	Set Auto-Charge-LO

##### 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.

##### SAO

Set the offset for the Continuity 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.

##### SACG

Set the Charge-LO parameter for the DCW or IR test. The cables and any test fixture should be connected before executing the command. The test parameters that are set for the step will be used when performing the auto setting. This command will perform an actual test and all safety precautions should be observed when using this command.

#### 8.4.3 File Editing Commands

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

- Commands should be separated from parameters by a space.
- If multiple parameters are entered, they should be separated by commas.

COMMAND	DESCRIPTION	VALUE
FL <memory number>	File Load	memory number = 001-200
FN nn,xxxx	File Name	nn=01-2000, xxxx=name

COMMAND	DESCRIPTION	VALUE
FD	File Delete	<i>Current file in use</i>
FD nn	File Delete nn	<i>nn=1-200</i>
FS	File Save	<i>Current file in use</i>
FSA nn,xxxx	File Save As	<i>nn=1-200, xx=Name</i>
FT?	File Total	
ST?	Step Total	
SS <step number>	Step Select step number	<i>step number = 1-200</i>
SS?	Step Select ?	
SAA	Step Add ACW test	
SAD	Step Add DCW test	
SAD-	Step Add DCW- test	
SAI	Step Add IR test	
SAG	Step Add GND test	
SAC	Step Add CONT test	
ADD2 <n,p1,p2,p3...>	Add all parameters of a test step	<i>n=test type, p=parameters</i>
SD	Step Delete current	
SD nn	Step Delete nn	<i>nn=01-200</i>
SP <prompt message>	Step Prompt Create	<i>prompt message = Valid ASCII (1) maximum 32 characters</i>
SP	Step Prompt Delete	
LP?	List Prompt	
LP nn	List Prompt current	

(1) "Valid ASCII" is the character set that is available from the front panel LCD user interface. Consisting of upper case alphabet (A-Z), numbers (0-9) and decimal point (.), asterisk (\*), dash (-), under bar (\_), tilde (~) and space (SP).

FL <memory number>

Load a file by memory number from non-volatile memory into random access memory RAM.

FN < file name>

Creates a new file name for the active memory loaded into RAM.

SS <step number>

Selects the active selected step to load into RAM. The step must first be selected before any specific parameters can be edited.

SAA, SAD, SAI, SAG, SAC

These commands add the appropriate test type within the memory at the step location that has been selected. The parameters of the previous test type will be deleted and

the default values for the new test type will be recalled. If the same test type is selected that already exists, the default values will replace the previous parameters.

ADD2 <n, p1,p2,p3...>

This command edits all parameters in a step. Parameters will be edited at the step location that has been selected. See the command summary tables below to see the specific test type for each of these commands

The parameter <n> indicates the test type. The values ACW, DCW, IR, GND, or CONT must be used. The parameters <p1,p2> etc. indicate the individual settings for each parameter of the 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. When the scanners are being used they should be appended to the end of the string, with the internal scanner first if installed, followed by the external scanner if connected to the rear panel scanner control port.

The list of parameters can also be found in the default parameters section of the manual, or refer to Section 7.4.5 Test Parameter Editing Commands and Companion Queries for the proper values.

The parameter values for file editing commands should use complete text (i.e. "ON" and "OFF" or "Real" and "Total") and not use the coded values that are associated with the test parameter setting commands discussed in Test Parameter Editing Commands and Companion Queries. The LS? companion command will also list all parameters in complete text in the order as they appear in the following table, preceded by the step number. The following table shows examples of the ADD2 and LS2 commands:

ADD2 all parameters for one STEP	n=type, p=parameters
<b>ADD2 ACW</b> ,Voltage,HI-Limit T,LO-Limit T,Ramp Up,Dwell Time, Ramp Down,Arc Sense,HI-Limit R,LO-Limit R,Offset, Frequency,Arc Dectect,Continuity,Range,Scanner Setup	SCANNER install, Scanner Setup parameter exise
<b>ADD2 DCW</b> ,Voltage,HI-Limit,LO-Limit,Ramp Up,Dwell Time, Ramp Down,Charge LO,Arc Sense,Offset,Ramp-HI,Arc Dectect,Continuity,Range,Low Range,Scanner Setup	SCANNER install, Scanner Setup parameter exise
<b>ADD2 DCW-</b> ,Voltage,HI-Limit,LO-Limit,Ramp Up,Dwell Time, Ramp Down,Charge LO,Arc Sense,Offset,Ramp-HI,Arc Dectect,Continuity,Range,Low Range,Scanner Setup	SCANNER install, Scanner Setup parameter exise
<b>ADD2 IR</b> , Voltage,HI-Limit,LO-Limit,Ramp UP,Dwell Time,Delay Time,Ramp Down,Charge LO,Scanner Setup	SCANNER install, Scanner Setup parameter exise
<b>ADD2 GND</b> ,Current,Voltage,HI-Limit,LO-Limit,Dwell Time, Offset,Frequency,Scanner Channel	SCANNER install, Scanner Channel parameter exise



<b>ADD2 CONT.</b> ,HI-Limit,LO-Limit,Dwell Time,Offset,Scanner Channel	SCANNER install, Scanner Channel parameter exist When Continuity delay option is off.
<b>LS2? &amp; LS2 nn?</b> Response Data format	
<b>Step number,ACW</b> ,Voltage,HI-Limit T,LO-Limit T,Ramp UP,Dwell, Ramp Down,Arc Sense,HI-Limit R,LO-Limit R,Offset, Frequency,Arc Detect,Continuity,Range,Scanner Setup	SCANNER install, Scanner Setup parameter exist
<b>Step number,DCW</b> ,Voltage,HI-Limit,LO-Limit,Ramp Up,Dwell Time, Ramp Down,Charge LO,Arc Sense,Offset,Ramp-HI, Arc Detect,Continuity,Range,Low Range,Scanner Setup	SCANNER install, Scanner Setup parameter exist
<b>Step number,-DCW</b> ,Voltage,HI-Limit,LO-Limit,Ramp Up,Dwell Time, Ramp Down,Charge LO,Arc Sense,Offset,Ramp-HI, Arc Detect,Continuity,Range,Low Range,Scanner Setup	SCANNER install, Scanner Setup parameter exist
<b>Step number, IR</b> ,Voltage,HI-Limit,LO-Limit,Ramp UP,Dwell Time, Delay Time,Ramp Down,Charge LO,Scanner Setup	SCANNER install, Scanner Setup parameter exist
<b>Step number, GND</b> ,Current,Voltage,HI-Limit,LO-Limit,Dwell Time, Offset,Frequency,Scanner Channel	SCANNER install, Scanner Setup parameter exist
<b>Step number,CONT.</b> ,HI-Limit,LO-Limit,Dwell Time,Offset, Scanner Setup	SCANNER install, Scanner Channel parameter exist When Continuity delay option is off.
<b>Step number,CONT</b> ,HI-Limit,LO-Limit,Dwell Time,Offset, Scanner Channel	SCANNER install, Scanner Channel parameter exist When Continuity delay option is on.

### SP <prompt message>

Adds or edits a prompt message for the active step.

### SP

Removes or deletes the prompt that had been created for the active step.

### 8.4.4 Test Parameter Editing Commands and Companion Queries

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 companion query command will read the parameter. 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. Also, when the query commands are used the response will not include the unit's characters. Many of the commands will function the same way for multiple test types; however, the input range may be different and therefore used a different possible set of values.



COMMAND	NAME	TEST TYPES	VALUE
ED {1 0} ED?	Edit Current Meter Display	ACW	1 = Real, 0 = Total
EV <value> EV?	Edit Voltage	ACW DCW IR GND	1 - 5000V 1 - 6000V 1 - 6000V 3.00 - 8.00V
EC <value> EC?	Edit Current	GND	1.00 - 32.00A
ECG <value > ECG?	Edit Charge-Lo	DCW IR	0.0 - 350.0uA 0.000 - 3.500uA
ECT {1 0} ECT?	Edit Continuity	ACW DCW	1= On, 0=Off
ERU <value> ERU?	Edit Ramp-Up	ACW DCW IR	0.1 - 999.9s
ERD <value > ERD?	Edit Ramp-Down	ACW DCW IR	0.0 - 999.9s 0, 1.0 - 999.9s 0, 1.0 - 999.9s
ERH n ERH?	Edit Ramp-Hi n	DCW	n=0-10000uA
EDW <value > EDW?	Edit Dwell	ACW DCW IR GND CONT	0, 0.4 - 999.9s 0, 0.4 - 999.9s 0, 0.5 - 999.9s 0, 0.5 - 999.9s 0, 0.3 - 999.9s
EDE <value > EDE?	Edit Delay	IR	0.5 – 999.9s
EO <value > EO?	Edit Offset	ACW DCW GND CONT	0 0.0 -10000uA 0 - 200mΩ 0.0 -10.00Ω
EA <value > EA?	Edit Arc	ACW DCW	1 – 9
EAD {1 0} EAD?	Edit Arc-Detect	ACW DCW	1= On, 0=Off
EHT <value > EHT?	Edit Hi-LIMIT-T	ACW	by Model
EHR <value > EHR?	Edit Hi-LIMIT-R	ACW	by Model
EH <value > EH?	Edit Hi-LIMIT	DCW IR GND CONT	0.0 - 10000uA 0, 0.05 - 50000MΩ 0, 0 - 600mΩ 0, 0.00 - 2000Ω
ELT <value > ELT?	Edit Lo-LIMIT-T	ACW	by Model

COMMAND	NAME	TEST TYPES	VALUE
ELR < value > ELR?	Edit Lo-LIMIT-R	ACW	by Model
EL < value > EL?	Edit Lo-LIMIT	DCW IR GND CONT	0.0 - 10000uA 0.05 - 50000MΩ 0, 0 - 600mΩ 0.0 - 2000 Ω
EF n EF?	Edit Frequency	ACW GND	n=0-3, 0=50Hz, 1=60Hz, 2=400Hz, 3=800Hz
ES xxxxxxxx.... ES?	Edit Scanner-HLO xxxx	ACW DCW IR CONT	xxxxxxx=H,L,O
ESN nn ESN?	Edit Scanner	GND	nn=1~16 or 24 by Model
ERG n ERG?	Edit Range	ACW DCW	n=0-1 0=Auto, 1=Fixed
ELG n ELG?	Edit Low Range	DCW	n=0-1 0=Off, 1=On

#### 8.4.5 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. The companion query command will read the parameter using the same value that is used for setting the parameter.

COMMAND	NAME	VALUE
SPR {1 0} SPR?	PLC Remote	1= On, 0=Off
SSI {1 0} SSI?	Single Step	1= On, 0=Off
SF {1 0} SF?	Fail Stop	1= On, 0=Off
SAL < value > SAL?	Alarm Volume	0-9
SL {1 0} SL?	Lock	1= On, 0=Off
SSG2 n SSG2?	Smart GFI	n=0, or 0.4 - 5mA
SR {2 1 0} SR?	Results	0=LAST, 1=ALL, 2=P/F
SCA {1 0} SCA?	Cal Alert	1= On, 0=Off
SCDA < value > SCDA?	Cal Date	0=ymd, 1=mdy, 2=dmy
SCDU < value >	Cal Due	0=ymd, 1=mdy, 2=dmy

COMMAND	NAME	VALUE
SCDU?		
SA < value > SA?	Alert Date	0=ymd, 1=mdy, 2=dmy
SDT < value > SDT?	System Date	0=ymd, 1=mdy, 2=dmy
SDF < value > SDF?	Date Format	0=ymd, 1=mdy, 2=dmy
STM < value > STM?	Time	hh,mm (24hr) hh,mm,AM or hh,mm,PM (12hr) according to STF setting
STF {1 0} STF?	Time Format	0=12hr, 1=24hr
SPID nnnnnnn SPID?	Device ID	0 - 9999999
SPD n SPD?	System Display ID	n=0-1 0=Off, 1=On
SPRE {1 0} SPRE?	Prn Result n	n=0-1 0=FAIL, 1=ALL
SPS {1 0} SPS?	Prn Setting n	1= On, 0=Off
SFF {1 0} SFF?	Form Feed n	1= On, 0=Off
SIS	Import System	
SIF nnnnnnnn	Import File	nnn=name
SIAF nnnnnnnn	Import All File	nnn=name
SIAD nnnnnnnn	Import All Data	nnn=name
SRF?	Read USB.HU4 File	
SRAF?	Read USB.AF File	
SRAD?	Read USB.AFS File	
SES	Export System	
SEF n	Export File	nnn=name
SEAF nnnnnnnn	Export All File	nnn=name
SEAD nnnnnnnn	Export All Data	nnn=name
SMM n SMM?	Home Screen	n=0-2, 0= Menu, 1= Perform Tests, 2=My Menu
SAN n SAN?	Animation	n=0-1 0=Continue, 1=Pause
SLA n SLA?	Language	n=0-2, 0=English, 1=Traditional Chinese 3=Simplified Chinese
SAV n SAV?	Auto Save	n=0-1 0=Off, 1=On
STS n STS?	Touch Sound	n=0-1 0=Off, 1=On

COMMAND	NAME	VALUE
SHK n SHK?	Hardware Key	n=0-1 0=Off, 1=On
SPV n SPV?	ProVOLT	n=0-1 0=Off, 1=On
SGP n SGP?	GPIB Address	n=0-30
SCT n SCT?	Color States	1=Vivid,0=Dull
SBR n SBR?	Baud rate	0=9600,1=19200,2=38400,3=57600 4=115200
STR n STR?	Test Results	n=0-3 0=None, 1=Fail, 2=Pass, 3=All
SRL n SRL?	Results Limit	n=0-100000
STL n STL?	Time Limit	n=0-99
SRN nnnnnnnn SRN?	Results Name	nnn=name
SJAB n SJAB?	JigA/JigB	n=0-1 0=Off, 1=On
SSC n SSC?	Scanner	n=0-1 0=4W+4W, 1=8W+8W
SMS n SMS?	Memory	n=0-2f 0=SE, 1=7730, 2=7400
SUL n?	User	n=0-5 Name, Password, Level
SUA p,p,p,p	User Add	SUA Pointer,Name,Password,Level Pointer: 1-5 Name: 8 character max Password: 8 number max Level: 0=Run Only, 1=Recall Setup, 2=Edit Step, 3=Full System
SUD n	User Delete	n=1-5
SUE p,p,p,p	User Edit	SUA Pointer,Name,Password,Level Pointer: 1-5 Name: 8 character max Password: 8 number max Level: 0=Run Only, 1=Recall Setup, 2=Edit Step, 3=Full System
SM n	Measurement	n=0-1

COMMAND	NAME	VALUE
SM?		0=True RMS, 1=Average
SBI n SBI?	Barcode IP Format	n=0-4 0=Off, 1=Ser/Prod, 2=Serial#, 3=Product#, 4=Run File
SAS n SAS?	Auto Start Format	n=0-1 0=Off, 1=On

#### 8.4.6 Query Commands

These query commands will retrieve data from the instrument. The GPIB bus application requires an IEEE-488 read command to be sent after the query command. These commands include functions for retrieving test data, test results and remote hardware status as well as setup file information.

COMMAND	NAME	VALUE
TD?	List Testing Data	Test In Process
RDM?	Read Max Current	ACW: Total current, Real Current DCW: current
RD <step number>?	List Results Data	<i>step number = 1-200</i>
RR?	Read Remote Reset	1=Open, 0=Closed
RI?	Read Remote Interlock	1=Open, 0=Closed
RS?	Read Scanner Status	0=None, 1=Int, 2=Ext 1, 3=Int+Ext 1, 4=Ext 2, 5=Int+Ext 2, 6=Ext 1+Ext 2, 7=Int+Ext 1+Ext 2
RU?	Read USB Stick	0=NO, 1=YES
FR nnnn	File Rename	nnn=name
LF?	List File Name	Active selected memory
LF nn?	List File Name	Active selected file
LP?	List Prompt	Active selected Step
LP <step number>?	List Prompt by step number	<i>step number = 1-200</i>
LS2?	List Step Parameters	
LS2 <step number>?	List Step Parameters by step number	<i>step number = 1-200</i>

#### TD?

Read the active data being displayed on the LCD display while the test is in process. Will also read the last data taken when the test sequence has completed. Each parameter is separated by commas and includes step number, test type, test status, and metering. The syntax for this command response is {step, test type, status, meter 1, meter 2, meter 3}. ACW test displays 4 meters. Each meter will contain only the value and not the units. In the case of DCW current where both uA and mA are used

on the display, the command response will always indicate the current in uA for example 2.0mA will respond with 2000 for 2000uA.

**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 3 and ending with step 5 then the first step test results will be found in location 3 not in location 1. Each parameter is separated by commas and includes step number, test type, test status, and metering. The syntax for this command response is {step, test type, status, meter 1, meter 2, meter 3}. ACW test displays 4 meters. Each meter will contain only the value and not the units. In the case of DCW current where both uA and mA are used on the display the command response will always indicate the current in uA for example 2.0mA will respond with 2000 for 2000uA.

**RR?**

Read the remote Reset input signal. When the remote reset has been activated by closing the contacts the query will return a value of 1 to indicate the instrument is being Reset.

**RI?**

Read the remote Interlock input signal. When the remote Interlock has been activated by opening the contacts the query will return a value of 0 to indicate the instrument is in the Interlock state and will not be able to generate output voltage or current.

**RS?**

Read Scanner Status command will respond with a value that identifies the number of scanners installed or connected to the instrument. Values 0 – 4 will indicate if there are no scanners connected, one Internal or External scanner, or if both an Internal and an External scanner are connected.

**LF?**

Lists the file name of the memory loaded into active memory (RAM).

**LFN?**

Lists the memory number of the active memory file loaded into active memory (RAM).

**LF <memory number>?**

List the file name of any of the 50 memories.

**LP?**

Lists the prompt that is created for the selected step within active memory (RAM).

**LP <step number>?**

Lists the prompt that has been created for a particular step of the file within active memory (RAM).

**LS?**

Lists all the parameters for the individual step that is currently selected. See the ADD command for the list of parameters. A comma (,) will separate each parameter and will be preceded with the step number.

### LS <step number>?

Lists all the parameters for the individual step indicated by *step number* = 1-30. See the ADD command for the list of parameters. A comma (,) will separate each parameter and will be preceded with the step number.

### 8.4.7 IEEE 488.2 Common Commands

These commands are required by the IEEE-488.2 standard with the exception of \*PSC, \*PSC?. Most of these commands are not available over the USB/RS-232 bus except for the \*IDN? command which can be used to retrieve the instrument identification information, and the four status reporting commands \*ESR?, \*ESE, \*ESE? and \*STB?

COMMAND	NAME	DESCRIPTION
*IDN?	Identification Query	eec, Model Number, Serial Number, Firmware Revision
*RST	Reset Command	Resets SE series
*TST?	Self-Test Query	00H=OK 01H=TEST EEPROM ERROR
*CLS	Clear Status Command	Clear Standard Event Status Register Clear Service Request Register
*OPC	Operation Complete Command	When all selected pending operations complete, ESR BIT0=1
*OPC?	Operation Complete Query	When all selected pending operations complete, Output Queue=1
*WAI	Wait-to-Continue Command	
*PSC {1 0}	Power-on Status Clear Command	1 = Power-on clear enable registers 0 = Power-on load previous enable registers
*PSC?	Power-on Status Clear Query	
*ESR?	Standard Event Status Register Query	0 - 255
*ESE <value>	Standard Event Status Enable Command	value = 0 - 255
*ESE?	Standard Event Status Enable Query	0 - 255
*STB?	Read Status Byte Query	Read Status Byte
*SRE <value>	Service Request Enable Command	value = 0 - 255
*SRE?	Service Request Enable Query	0 - 255

### \*IDN?

Read the instrument identification string. Company = eec

**\*RST**

Reset the instrument to original power on configuration. Does not clear Enable register for Standard Summary Status or Standard Event Registers. Does not clear the output queue. Does not clear the power-on-status-clear flag.

**\*TST?**

Performs a self-test of the instrument data memory. Returns 0 if it is successful or 1 if the test fails.

**\*CLS**

Clears the Status Byte Summary register and Event registers. Does not clear the Enable registers.

**\*OPC**

Sets the operation complete bit (bit 0) in the Standard Event register after a command is completed successfully.

**\*OPC?**

Returns an ASCII "1" after the command is executed.

**\*WAI**

After the command is executed, it prevents the instrument from executing any further query or commands until the no-operation-pending flag is TRUE.

**\*PSC {1|0}**

Sets the power-on status clear bit. When set to 1 the Standard Event Enable register and Status Byte Enable registers will be cleared when power is turned ON. 0 setting indicates the Enable registers will be loaded with Enable register masks from non-volatile memory at power ON.

**\*PSC?**

Queries the power-on status clear setting. Returns 0 or 1.

**\*ESR?**

Queries the Standard Event register. Returns the decimal value of the binary-weighted sum of bits.

**\*ESE <value>**

Standard Event Enable register controls which bits will be logically OR'd together to generate the Event Summary bit 5 (ESB) within the Status Byte.

**\*ESE?**

Queries the Standard Event enable register. Returns the decimal value of the binary-weighted sum of bits.

**\*STB?**

Read the Status Byte. Returns the decimal value of the binary-weighted sum of bits.



**\*SRE <value>**

Service Request Enable register controls which bits from the Status Byte should be used to generate a service request when the bit value = 1.

**\*SRE?**

Queries the Service Request enable register. Returns the decimal value of binary-weighted sum of bits.

**8.4.8 Status Reporting**

The status reporting system is configured using two types of registers. An Event register and a Summary register. The Summary register is known as the Status Byte register and records high-level summary information acquired by the Event registers.

An Event register report defines conditions or messages at each bit. The bits are latched and remain at an active state until the register is either Read or Cleared. Reading the Event register automatically clears the register and sets all bits to inactive state or 0. When querying an Event register the information is returned as a decimal number representing the binary-weighted sum of all bits within the register.

The Enable registers bits represent the selection of bits that will be logically OR'd together to form the summary bit in the Status Byte. The \*CLS command will not clear the Enable registers and if you wish to clear the register you must set it to a value of 0. Like the Event register, the enable register is represented as a decimal number that equals the binary-weighted sum of all bits.

The Enable register will clear to value a of 0 at power up unless the \*PSC 0 command had been executed before power-off. The \*PSC command tells the device whether or not it should clear the Enable registers at power-on. Using this command will allow SQRs to function immediately after power-on.

Bit	Binary weight	EVENT REGISTER		STATUS BYTE REGISTER	
		Event Register	Enable Register	Summary Register	Enable Register
0	1	Operation Complete		ALL PASS	
1	2	not used		FAIL	
2	4	Query Error		ABORT	
3	8	Device Error		TEST IN PROCESS	
4	16	Execution Error		Message Available (MAV)	
5	32	Command Error		Event Summary Bit (ESB)	
6	64	not used		Request Service (RQS) or Master Summary Status (MSS)	not used
7	128	Power On		PROMPT	

\*ESR?

\*ESE  
\*ESE?

\*STB? | SPOLL

\*SRE  
\*SRE?

#### 8.4.9 GPIB Service Request

The service request capability is not available with the USB/RS-232 interface. The SRQ line will be activated only after one or more of the service request functions have been enabled using the Status Byte Enable register command \*SRE.

The Status Byte bit assignments are as described in the previous section for status reporting. When the instrument has requested service, the enabled bit or bits and the RQS bit 6 will be active or 1. Bits 4, 5, and 7 are not used and will be set to false, or 0 for all Status Byte reads.

After the serial poll (SPOLL) is executed the RQS bit will be cleared to 0, and the remaining bits will remain unchanged. The Status Byte will not change value until the event register is read and cleared for the corresponding Status Byte bit.

For example after the All Pass SRQ has been enabled, when the test(s) have finished with pass indications the instrument will set the hardware SRQ line and output the Status Byte of 41 hex. This means that bit 6 and bit 0 are set to a value of 1. After reading the Status Byte the Status Byte value will change to 01 hex.

## 9. CALIBRATION

This instrument has been fully calibrated at the factory in accordance to our published specifications. It has been calibrated with standards traceable to the National Institute Standards & Technology (NIST). You will find in this manual a copy of the "Certificate of Calibration". It is recommended that you have this instrument re-calibrated and a safety check done 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.

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.

### 9.1 Warranty Requirements

eec offers a standard one-year manufacture's warranty. This warranty can be extended an additional four years provided that the instrument is returned each year to eec for it's annual calibration. In order to be eligible for the extended warranty instruments must be returned to eec for calibration service at least once every twelve months.

#### Required Calibration Equipment

- 0 - 5 KV AC/DC Metered Voltage Divider.
- 40 mA AC, 10 mA DC Ammeter.
- 30 AAC Current Shunt
- 20 $\Omega$ , 0.25 watt resistor, 250 volt.
- 200 $\Omega$ , 0.25 watt resistor, 250 volt.
- 2000 $\Omega$ , 0.25 watt resistor, 250 volt.
- 50M $\Omega$ , 0.25 watt resistor, 1000 volt.
- 500M $\Omega$ , 0.25 watt resistor, 1000 volt.
- 100K $\Omega$ , 250 watt resistor, 5000 volt.
- 1M $\Omega$ , 20 watt resistor, 5000 volt.

### 9.2 Calibration Initialization

Press and hold the calibration key on the rear panel with a pen, pencil, or small screwdriver while powering ON the SE. The SE 7440 enters calibration mode after the power on sequence is complete. When the calibration is initialized the calibration screen will display each calibration point and appear as follows:

01	ACW VOLTS	04	DCW VOLTS
05	ACT 30.00mA	06	ACT 3.500mA
09	DCW 9.99mA	10	DCW 3.500mA

Scroll down on the screen to view the next page which will appear as follows:

11	DCW 350.0uA	12	DCW 35.00uA
13	DCW 3.500uA	14	DCW 350.0nA
15	GND 8.00V	16	GND 30.00A

Scroll down on the screen to view the next page which will appear as follows:

23	GFI 5.0mA	Calibration Date 11/05/2014

### 9.3 Calibration of Parameters

From the Calibration screens, use the touchscreen to select the parameter you wish to calibrate. A calibration prompt screen will now appear that describes the necessary load and connection information for the parameter being calibrated.

Once you press TEST, the Calibration data entry screen will appear for the selected parameter. Read the measurement from your standard and enter it using the numeric keypad. Once a value is entered the screen for the next step will appear.

- **Calibration of AC Hipot Voltage**

1. Connect the standard 5KVAC kilovolt meter from H.V. to Return.
2. When the standard voltmeter is connected, press TEST to start the calibration process.
3. Enter Standard Voltage Reading.

- **Calibration of DC Hipot Voltage**

1. Connect the standard 6KVDC kilovolt meter from H.V. to Return.
2. When the standard voltmeter is connected, press TEST to start the calibration process.
3. Enter Standard Voltage Reading.

- **Calibration of 30mA AC Total Current Range**

1. Connect the 100K $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 3.5mA AC Total Current Range**

1. Connect the 100K $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 9.99mA DC Current Range**

1. Connect the 100K $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 3.500mA DC Current Range**

1. Connect the 100K $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 350uA DC Current Range**

1. Connect the 1M $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 35uA DC Current Range**

1. Connect the 50M $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 3.5uA DC Current Range**

1. Connect the 100M $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 350nA DC Current Range**

1. Connect the 1G $\Omega$  load in series with the standard current meter.
2. When the load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration of 8V AC Voltage Range**

1. Connect the standard 8.00VAC meter from Current to Return terminal.
2. When the leads are shorted, press TEST to start the calibration process.
3. Enter Standard Voltage Reading.

- **Calibration of 30A AC Current Range**

Step1

1. Connect the standard current meter and series 100m $\Omega$  load from Current to Return.
2. When the standard current meter is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

Step2

1. Connect the Current and Return terminal.
2. When the leads are shorted, press TEST to start the calibration process.
3. Automatic calibration processing.

- **Calibration of GFI 5.0mA**

Step1

1. Connect the standard 200k $\Omega$  with the standard AC current meter from H.V. to Case.
2. When the standard load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

Step2

1. Connect the standard 200k $\Omega$  with the standard DC current meter from H.V. to Case.
2. When the standard load is connected, press TEST to start the calibration process.
3. Enter Standard Current Reading.

- **Calibration Date 11/05/2014**

Enter the date of Calibration.