OPERATION AND SERVICE MANUAL

Hypot® III

MODEL 3705 (AC ONLY HIPOT WITH GROUND CONTINUITY CHECK)
MODEL 3765 (AC/DC HIPOT WITH GROUND CONTINUITY CHECK)
MODEL 3770 (AC/DC HIPOT WITH IR AND GROUND CONTINUITY)
MODEL 3780 (500VA AC ONLY HIPOT WITH GROUND CONTINUITY CHECK)

SERIAL NUMBER

Models
3705/3765/3770/3780

© Associated Research, Inc., 2014
13860 West Laurel Drive
Lake Forest, Illinois, 60045-4546
U.S.A.

Item 39011   *Ver 1.32*   Printed June 6th, 2016

CE

DECLARATION OF CONFORMITY

Manufacturer: Associated Research, Inc.

Address: 13860 W. Laurel Dr.
Lake Forest, IL 60045
USA

Product Name: Hypot® III Dielectric Withstand
Voltage Tester

Model Number: 3705/3765/3770

Conforms to the following Standards:

Safety: UL 61010-1:2012, UL 61010-2-030:2012
CAN/CSA-C22.2 NO. 61010-1-12
CAN/CSA-C22.2 NO. 61010-2-030-12
EN 61010-1:2010, EN 61010-2-030:2010
EN 61010-031:2002+A1
IEC 61010-1:2010, IEC 61010-2-030:2010
IEC 61010-31:2002+A1

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

Supplementary Information

*The product herewith complies with the requirements of the **Low Voltage Directive 2014/35/EU** and the **EMC Directive 2014/30/EU**.*

Last two digits of the year the CE mark was first affixed: 08

The technical file and other documentation are on file with Associated Research, Inc.

Joseph Guerriero
President / General Manager
Associated Research, Inc.
Lake Forest, Illinois USA
April 18, 2016

CE DECLARATION OF CONFORMITY

Manufacturer:	Associated Research, Inc.
Address:	13860 W. Laurel Dr. Lake Forest, IL 60045 USA
Product Name:	Hypot® III Dielectric Withstand Voltage Tester
Model Number:	3780

Conforms to the following Standards:

Safety:
UL 61010-1:2012, UL 61010-2-030:2012
CAN/CSA-C22.2 NO. 61010-1-12
CAN/CSA-C22.2 NO. 61010-2-030-12
EN 61010-1:2010
EN 61010-2-030 :2010

EMC:
EN 61326-1:2013,
EN 55011 :2009+A2 :2010 Group 1 Class A,
EN 61000-3-3:2013, IEC 61000-3-3 :2013
EN 61326-1:2013 (industrial locations)
EN 61000-4-2:2009, IEC 61000-4-2:2008,
EN 61000-4-3:2006+A1:2007+A2:2010
IEC 61000-4-3:2006+A1:2007+A2:2010
EN 61000-4-4:2012, IEC 61000-4-4:2012,
EN 61000-4-5:2006, IEC 61000-4-5:2005
EN 61000-4-6:2014, IEC 61000-4-6:2013,
EN 61000-4-8:2010, IEC 61000-4-8:2009,
EN 61000-4-11:2004, IEC 61000-4-11:2004

Supplementary Information

*The product herewith complies with the requirements of the **Low Voltage Directive 2006/95/EC** and the **EMC Directive 2004/108/EC**.*

Last two digits of the year the CE mark was first affixed: 11

The technical file and other documentation are on file with Associated Research, Inc.

Joseph Guerriero
President / General Manager
Associated Research, Inc.
Lake Forest, Illinois USA
August 31, 2015

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1. INTRODUCTION

1.1. Warranty Policies

Associated Research, Inc., certifies that the instrument listed in this manual meets or exceeds published manufacturing specifications. This instrument was calibrated using standards that are traceable to the National Institute of Standards and Technology (NIST).

Your new instrument is warranted to be free from defects in workmanship and material for a period of (3) year from the date of shipment. You must complete the online registration at http://www.asresearch.com/support/register/login.aspx or call 1-800-858-TEST (8378) ext. 0 to register over the phone.

<u>5-Year Program</u>
All Associated Research instruments include the opportunity to extend the standard warranty for up to a period of 5 years. Returning instruments to Associated Research for their annual calibration and inspection will extend the instrument's warranty for an additional year. This warranty is extendable for up to five years and annual returns must be made in succession starting one year after the original purchase date. There are no additional costs for the 5 year product warranty. The only annual costs to the customer are the standard calibration fees and shipping costs. This extended warranty is non-transferable and is offered only to the original purchaser. A return material authorization (RMA) must be obtained from Associated Research, Inc. before returning this instrument for warranty service. Please contact our customer support center at 1-800-858-TEST (8378) to obtain an RMA number. It is important that the instrument is packed properly for safe transport. Please contact our customer support center for proper instructions on packaging. Damages sustained as a result of improper packaging will not be honored. Transportation costs for the return of the instrument for warranty service must be prepaid by the customer. Associated Research, Inc. will assume the return freight costs when returning the instrument to the customer. The return method will be at the discretion of Associated Research, Inc.

Operator Modifications

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

Associated Research, Inc. will not be responsible for any injuries sustained due to unauthorized equipment modifications or use of parts not specified by Associated Research, Inc. Instruments returned to Associated Research, Inc. with unsafe modifications will be returned to their original operating condition at the customer's expense.

1.2. Safety Symbols

1.2.1. 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.

1.2.2. Caution and Warning Symbols

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

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

1.3. Glossary of Terms

(As used in this manual)

Alternating Current, AC: Current that reverses direction on a regular basis. Utility power is usually generated in the form of a sinusoid at a frequency of 60 times per second in the United States and 50 times per second in other countries.

Arc: A partial momentary breakdown due to the force of a strong electric field on closely spaced conductors, sometimes evidenced by corona or a luminous flashover.

Breakdown: The failure of insulation to effectively prevent the flow of current. If the test voltage is gradually raised, breakdown will begin suddenly at a certain voltage level and current flow will not be directly proportional to voltage. Once a breakdown occurs, especially for a period of time, the next gradual application of voltage will often cause a breakdown to begin at a lower voltage.

Conductor: A solid or liquid material which permits the flow of electrons. A material which has a volume resistivity of no more than 10^3 Ω-cm.

Current: The movement of electrons through a conductor. Current is measured in amperes (A), milliamperes (mA), microamperes (uA). 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.

Frequency: The number of cycles an AC waveform repeats over time. Usually given in Hertz (Hz).

Ground: Refers to the point of low potential in a circuit to which all other voltages are referenced. May or may not be tied to the earth. Also referred to as Earth.

Hot: Used to refer to the test lead or output side of an instrument that is at high potential.

Impedance: The property of capacitive or inductive items to limit certain frequencies.

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

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

Neutral: The point of low potential in a circuit to which all other voltages are referenced. Also known as Common.

Peak Current: The maximum amplitude of an AC current waveform. For a sinusoid, 1.414 x the RMS value.

Power: The amount of work performed by an energy source over time, given in Watts (W).

PF (Power factor): Power Factor = W/VA where W =Watts (Real Power) and VA =Volts x Amps (apparent power). It is important to note that the closer the power factor is to "1" the more resistive the DUT is. The closer the power factor is to 0 the more reactive (inductive or capacitive) the DUT is.

Reactive Current: The current component due to the reactive impedance of a load. Also called imaginary current.

Real Current: The current component due to the resistance of a load.

Resistance: The 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* (Ω). Symbol = **R**

Return: The path by which current returns to a source.

RMS: The Root Mean Squared value of a voltage or current waveform. An RMS waveform delivers the same amount of energy to a load as a DC waveform of the same value. For a sinusoid, the RMS value is .707 x the peak value.

Total Current: The vector sum of the real current component and the reactive current component produced by an applied voltage.

VA: A rating of instantaneous power found by multiplying an instrument's maximum output current by its maximum output voltage.

Voltage: The force which causes current through an electrical conductor, given in volts (V). Symbol = **V**

1.4. 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 or 230) and the correct fuse is installed.

This product carries an NRTL (Nationally Recognized Testing Laboratory) and comes equipped with an audible and visual failure indicator.

WARNING
The Hypot III 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.

1.4.1. Service and Maintenance

User Service
To prevent electric shock do not remove the instrument cover. There are no internal user serviceable parts. Routine maintenance or cleaning of internal parts is not necessary. Avoid the use of cleaning agents or chemicals on the instrument, as 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. Refer servicing and certification to an Associated Research, Inc. authorized service center.

SAFETY
This instrument meets UL requirements for audible and visual failure indication.

ASSOCIATED RESEARCH, INC. 13860 WEST LAUREL DRIVE LAKE FOREST, IL 60045-4546 U.S.A.	☎PHONE: 1 (847) 367-4077 **1 (800) 858-TEST (8378)** FAX: 1 (847) 367-4080 E-MAIL: info@asresearch.com

Service Interval
Associated Research, Inc. will not be held liable for injuries suffered if the instrument is not properly maintained and safety checked annually. See section **1.1. Warranty Policies** for more information.

1.4.2. Test Station

Location

Select an area away from the mainstream of activity where employees do not walk while 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 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

When possible, use the instrument on a non-conducting table or workbench. 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".

Keep the area clean and uncluttered. All test equipment and unnecessary test leads should be removed from the test bench and put away. It should be apparent to both the operator and to any observers which product is under test, which product is waiting to be tested and which product has already been tested

ESD TESTING
Electrical safety tests should not be performed in or around ESD testing areas. ESD methods should not be employed during electrical safety testing, as this could cause a hazardous condition for equipment and test operators.

Power

The outlet used to supply power to the instrument should be easily accessible. 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 should be able to cut off the power before entering the test area to offer assistance.

More Information

For more information on setting up a safe work station, please visit the Events and Training section of our website at http://www.asresearch.com/events-training/Default.aspx

1.4.3. Test Operator

WARNING	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.

WARNING	**Do not touch the device under test, high voltage test lead, alligator clip, or clip insulator once the test has been started.**

WARNING	**Do not touch the front panel when testing or after a malfunction has occurred.**

Rules
Operators should be thoroughly trained to follow all national safety standard guidelines for electrical safety testing in the workplace. Defeating any safety system should be considered a serious offense with severe penalties. Allowing unauthorized personnel in the area during a test should also be dealt with as a serious offense. Test operators should be familiar with methods to properly discharge a device under test in case test leads become disconnected during testing. If the instrument is used in a manner not specified by Associated Research, Inc. the protection provided by the instrument may be impaired.

Refer to the following standards for more information:

- NFPA 70E
- OSHA 1910 subpart (S)
- EN50191

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

WARNING	ESD protocols should not be observed while

performing electrical safety tests. Intentionally grounding the test operator could lead to a **harmful or fatal electric shock**.

Medical Restrictions
Personnel with heart ailments or devices such as pacemakers should be informed that the voltages and currents

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.
- In case of any problem, turn off the high voltage first.

generated by the instrument are very dangerous.   If contacted, the instrument may cause heart-related problems. Please have the test operator consult a physician for recommendations.

1.5. Key Features of the HYPOT III

PATENTED SMARTGFI™	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.
10 PROGRAMMABLE MEMORY LOCATIONS	Each Memory Location can be configured to store and perform up to 3 test steps. Test steps can be linked and run in any order for easy touch-and-go test routines.
DIGITALLY CONTROLLED ARC DETECTION SYSTEM	Allows the operator to choose whether low-level arcs should be detected. The operator can select from multiple sensitivity levels.
PLC REMOTE INPUTS AND OUTPUTS	Two standard 9 pin interfaces provide inputs and outputs for simple PLC relay control. Outputs include: PASS, FAIL, RESET and TEST IN PROCESS signals. Inputs include: TEST, INTERLOCK, RESET and remote recall of MEMORY 1, 2 and 3.
ELECTRONIC RAMPING (UP & DOWN)	Allows the operator to increase or decrease the output voltage linearly over a specified period of time. Minimizes any damage to sensitive DUT's from quick high voltage changes.
SEPARATE HIGH AND LOW LIMIT FAILURE DETECTORS	Allows the operator to create an acceptable leakage current window. Excessive or minimal leakage current readings will cause a test failure.
SINGLE STEP FEATURE	Allows the operator to perform multiple test steps in a Memory Location with one button push, or requires that the operator initiate each test step in a Memory Location. User selectable.
CAL-ALERT™	Alerts the operator that the machine is due for calibration in advance of the calibration due date.
PROGRAMMABLE CONTINUITY TEST WITH OFFSET	Low current Continuity test may be performed simultaneously with an AC/DC Hipot test. Passing the Continuity test is required to continue with Hipot testing.
VERI-CHEK™	Allows the operator to self-verify the instrument's failure detectors.
MULTIPLE RESULTS DISPLAYS	Allows the user to configure the tester to display results in either Pass/Fail, Last or All conditions.
SECURITY ACCESS	The Lock and Memory Lock features limit operator access to test setup screens so only authorized users can configure or change test parameters.

2. GETTING STARTED

Introduction
This section contains information for the unpacking, inspection, preparation and storage of your Associated Research, Inc., product.

2.1. Unpacking and Inspection

2.1.1. Packaging
Your instrument was shipped in a custom foam insulated container. If the shipping carton is damaged, inspect the contents for visible damage such as dents, scratches or a broken display. If the instrument is damaged, notify the carrier and Associated Research, Inc.'s customer support department. **Please save the shipping carton and packing material for the carrier's inspection.** Our customer support department will assist you in the repair or replacement of your instrument. Please do not return your product without first notifying us and receiving an RMA (return material authorization) number. To receive an RMA number, please contact our customer support department at 1-800-858-TEST (8378).

Safe Lifting and Carrying Instructions
Proper methods of lifting and carrying can help to protect against injury. Follow the recommendations below to ensure that instruments are handled in a safe manner.

- Determine if the instrument can be lifted by one individual or requires additional support.

- Make sure that your balance is centered and your feet are properly spaced, shoulder width apart behind the instrument.

- Bend at the knees and make sure your back is straight.

- Grip the instrument with your fingers and palms and do not lift unless your back is straight.

- Lift up with your legs, not your back.

- Keep the instrument close to your body while carrying.

- Lower the instrument by bending your knees. Keep you back straight.

2.1.2. Contents of the Carton

Inside the carton should be the following:

Description	AR Part Number
Hypot III Instrument	37XX
High Voltage Cable	04040A-08
Return Cable	02100A-13 (Qty. 2)
Fuse (3705,3765,3770)	37880, 3.15 Amp, fast acting 250VAC
Fuse (3780)	38430, 115Vac, 230VAC - 15A/250VAC Slow-Blow
RS-232 Cable	37863
Line Cord* (3705,3765,3770)	33189 – Standard 10A Cord
Line Cord* (3780)	38071 – 15A Cord
Adapter Box*	36544 Standard
Interlock Disable Key	38075

⚪ **NOTE**: The Adapter Box (universal US polarity) and line cord listed are American. Other combinations of line cord and Adapter Box are available upon request.

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

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 setup in section **1.4. Safety**. Make sure the work area you choose has a three-prong grounded outlet capable of supplying the necessary input current to the power source. Be sure the outlet has been tested for proper wiring before connecting the instrument to it.

WARNING The mains plug is used as the disconnecting device and shall remain readily operable. The socket-outlet shall be installed. Near the equipment and shall be easily accessible.

2.2.2. Power Requirements

This instrument requires a power source of either 115 volts AC ± 10%, 50/60 Hz single phase or 230 volts AC ±10%, 50/60 Hz single phase. Before applying power verify that the instrument is set to the correct line voltage (115 or 230 volts). Adjust the voltage select switch to 115 for use with a 115 volt input. Adjust the voltage select switch to 230 for use with a 230 volt input. See section **3.2.2. Rear Panel Controls** for an image of the rear panel.

CAUTION Do not replace the power supply cord with an improperly rated cord. For North American: A UL listed and CSA labeled power cord must be used with the instrument in the United States and Canada. The power cord must include a NEMA5-15 style male plug, SVT or SJT cord sets, and be rated for at least 125VAC, 10A, number 16 gauge (or 125VAC, 15A, number 14 gauge) wire or larger, and the length of the cord does not exceed 2 m must be used. For European: A certified power supply cord not lighter than light PVC sheathed flexible cord according to IEC 60227, designation H03 VV-F or H03 VVH2-F (for equipment mass not exceeding 3 kg), or H05 VV-F or H05 VVH2-F2 (for equipment mass exceeding 3 kg), and be rated for at least 3G 0.75 mm² (for rated current up to 10 A) or 3G 1.0mm² (for rated current over 10 A up to 16 A) wire or larger, and the length of the cord does not exceed 2 m must be used.

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.

WARNING The Hypot III must be connected to a good ground. Be certain that the power wiring is properly polarized and that the proper low resistance bonding to ground is in place.

2.2.3. Basic Connections

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

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

Return Connection
When the instrument's 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 high voltage to the chassis of the instrument). These currents are inherent and will cause errors when trying to monitor very low leakage currents in the microamp range.

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.

2.2.4. Environmental Conditions
This equipment is intended for indoor use only. The equipment has been evaluated according to Installation Category II and Pollution Degree 2 as specified in IEC 60664.

This instrument may be operated in environments with the following limits:
        Temperature…................... 41° - 104° F (5° - 40°C)
        Relative humidity…............. 0 – 80%
        Altitude…........................ 6560 feet (2,000 meters)

WARNING Keep the ventilation slits uncovered during operation. Failure to do so could cause the instrument to overheat and may damage internal components.

Storage and Shipping Environment
This instrument may be stored or shipped in environments with the following limits:
        Temperature…................... -40° - 167° F (-40° - 75°C)
        Altitude…........................ 50,000 feet (15,240 meters)

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

CAUTION	Failure to operate this instrument within the specified conditions could result in damage.

If the instrument is used in a matter not specified by the manufacturer, the protection provided by the instrument may be impaired.

More Information
For more information on test operator and workstation safety please visit the Events and Training section of our website at http://www.asresearch.com/events-training/Default.aspx

3. SPECIFICATIONS AND CONTROLS

3.1. 3705, 3765, 3770 Functional Specifications

INPUT		
Voltage	115/230 VAC $\pm$ 10%, user selectable	
Frequency	50/60 Hz $\pm$ 5%	
Fuse	3.15 Amp, fast acting 250VAC	
DIELECTRIC WITHSTAND TEST MODE		
Output Rating	5000V @ 20 mA AC	
	6000V @ 7.5 mA DC	
Voltage Setting	Range:	0 – 5.00KV AC
		0 – 6.00KV DC
	Resolution:	0.01KV
	Accuracy:	$\pm$ (2% of setting + 5V) (Adjustable during operation. Disabled when key lockout is active.)
Maximum Limit AC	Range:	0.00 – 20.00 mA
	Resolution:	0.01 mA
DC	Range:	0 – 7500 μA
	Resolution:	1μA
	Accuracy:	AC and DC $\pm$ (2% of setting + 2 counts)
Minimum Limit AC	Range:	0.000 – 9.999 mA
	Resolution:	0.001 mA
DC	Range:	0.0 – 999.9 μA
	Resolution:	0.1 μA
	Accuracy:	AC and DC $\pm$ (2% of setting + 2 counts)
Arc Detection	Range:	0 – 9, 0 disabled
Failure Detector	Audible and Visual	
Ground Fault Interrupt	GFI Trip Current: 450μA max (AC or DC) HV Shut Down Speed: <1ms	
Voltage Display	Range:	0.00 – 5.00KV AC 0.00 – 6.00KV DC
	Resolution:	0.01KV
	Accuracy:	$\pm$ (2% of reading + 0.01KV)

DIELECTRIC WITHSTAND TEST MODE

Current Display	Auto Range		
AC	Range 1:	0.000mA – 3.500mA	
	Resolution:	0.001mA	
	Range 2:	3.00 – 20.00 mA	
	Resolution:	0.01 mA	
DC	Range 1:	0.0 μA – 350.0 μA	
	Resolution:	0.1 μA	
	Range 2:	0.300 mA – 3.500 mA	
	Resolution:	0.001 mA	
	Range 3:	3.00 mA – 7.50 mA	
	Resolution:	0.01 mA	
Accuracy:	All Ranges	± (2% of reading + 2 counts)	
DC Output Ripple	≤ 5% Ripple RMS at 6 KV DC @ 7.5 mA, Resistive Load		
Discharge Time	≤ 200 ms The maximum capacitive load vs output voltage :		
	0.20 μF --- < 1KV 0.10 μF --- < 2KV 0.06 μF --- < 3KV	0.050 μF --- < 4KV 0.040 μF --- < 5KV 0.015 μF --- < 6KV	
AC Voltage Wave Form	Sine Wave, Crest Factor = 1.3 – 1.5		
Output Frequency	Range:	50 or 60 Hz, User Selectable	
	Accuracy:	± 0.1%	
Output Voltage Regulation	± (1 % of output + 5 volts) from no load to full load and over input voltage range.		
Dwell Timer	Range:	AC: 0, 0.3 – 999.9 sec (0 = Constant) DC: 0, 0.4 – 999.9 sec (0 = Constant)	
	Resolution:	0.1 sec	
	Accuracy:	± (0.1% of reading + 0.05 sec)	
Ramp Timer	Range:	Ramp-Up: 0.1 – 999.9 sec Ramp-Down: AC 0.0 – 999.9 sec DC 1.0 – 999.9 sec 0=OFF	
	Resolution:	0.1 sec	
	Accuracy:	± (0.1% of reading + 0.05 sec)	
Ground Continuity Current	DC 0.1 A ± 0.01A, fixed		
Ground Continuity	Range:	0.0Ω - 1.50Ω	
Maximum Limit	Resolution:	0.01Ω	
Minimum Limit	Accuracy:	± (3% of setting + 0.02Ω)	
Ground Continuity	Range:	0.0Ω - 0.50Ω	
Auto Offset	Resolution:	0.01Ω	
	Accuracy:	± (3% of setting + 0.02Ω)	

INSULATION RESISTANCE TEST MODE

Voltage Setting	Range:	30 – 1000V DC
	Resolution:	1V
	Accuracy:	$\pm$ (2% of setting + 5 volts)
Voltage Display	Range:	0 – 1000 V
	Resolution:	1V
	Accuracy:	$\pm$ (2% of reading + 2 counts)
Resistance Display	Range:	1 – 9999 MΩ (4 Digit, Auto Ranging)
	Resolution:	500VDC - 1000VDC MΩ — MΩ 0.001 — 1.000 - 9.999 0.01 — 10.00 - 99.99 0.1 — 100.0 - 999.9 1 — 1000 - 9999
	Accuracy:	$\pm$ (2% of reading + 2 counts) at test voltage 500 – 1000V and 1 – 999.9 MΩ $\pm$ (5% of reading + 2 counts) at test voltage 500 – 1000V and 1000 – 9999 MΩ $\pm$ (8% of reading + 2 counts) at test voltage 30 – 500V and 1 – 1000 MΩ
Maximum Limit	Range:	0,1 – 9999 MΩ (0 = Off)
	Resolution	1MΩ
	Accuracy	Same as Resistance display
Minimum Limit	Range:	1 – 9999 MΩ
	Resolution	1MΩ
	Accuracy	Same as Resistance display
Short Circuit Current	Maximum:	9mA-peak
Ramp Timer	Range:	Ramp-Up: 0.1 – 999.9 sec Ramp-Down: 1.0 – 999.9 sec 0=OFF
	Resolution:	0.1 sec
	Accuracy:	$\pm$ (0.1% of reading + 0.05 sec)
Delay Timer	Range:	0, 0.5 – 999.9 sec (0 = Constant)
	Resolution:	0.1 sec
	Accuracy:	$\pm$ (0.1% of reading + 0.05 sec)
Ground Fault Interrupt	GFI Trip Current: 450μA max HV Shut Down Speed: <1ms	

3.2. 3780 Functional Specifications

INPUT		
Voltage	115/230 VAC $\pm$ 15%, automatically selected	
Frequency	50/60 Hz $\pm$ 5%	
Fuse	15 Amp, slow-blow 250VAC	
DIELECTRIC WITHSTAND TEST MODE		
Output Rating	5000V @ 100 mA AC	
Voltage Setting	Range:	0 – 5.00KV AC
	Resolution:	0.01KV
	Accuracy:	$\pm$ (2% of setting + 0.01KV) (Adjustable during operation. Disabled when key lockout is active.)
Maximum Limit AC	Range:	0.00 – 99.99 mA
	Resolution:	0.01 mA
Minimum Limit AC	Range:	0.000 – 9.999 mA
	Resolution:	0.001 mA
	Accuracy:	$\pm$ (2% of setting + 6 counts)
Arc Detection	Range:	0 – 9, 0 disabled
Failure Detector	Audible and Visual	
Ground Fault Interrupt	GFI Trip Current: 450μA max HV Shut Down Speed: <1ms	
Voltage Display	Range:	0.00 – 5.00KV AC
	Resolution:	0.01KV
	Accuracy:	$\pm$ (2% of reading + 0.01KV)

DIELECTRIC WITHSTAND TEST MODE

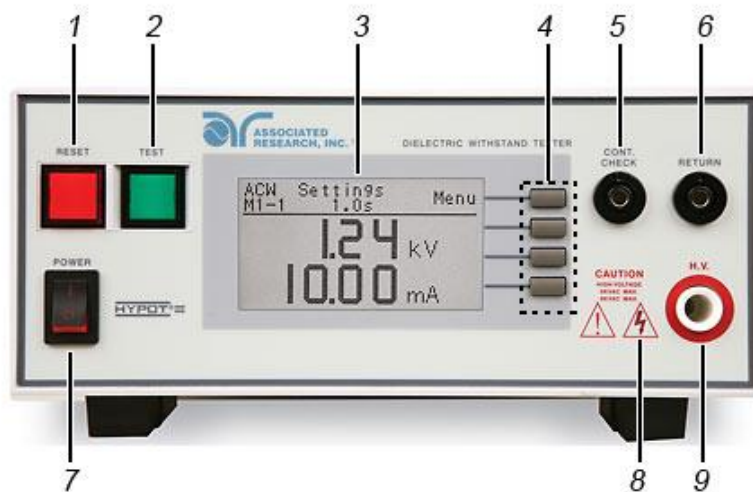|		
Current Display	Auto Range	
AC	Range 1:	0.000mA – 3.500mA
	Resolution:	0.001mA
	Accuracy:	$\pm$ (2% of setting + 2 counts)
	Range 2:	3.00 – 99.99 mA
	Resolution:	0.01 mA
	Accuracy:	$\pm$ (2% of setting + 6 counts)
AC Voltage Wave Form	Sine Wave, Crest Factor = 1.3 – 1.5	
Output Frequency	Range:	50 or 60 Hz, User Selectable
	Accuracy:	$\pm$ 0.1%
Output Voltage Regulation	$\pm$ (1 % of output + 5 volts) from no load to full load and over input voltage range.	
Dwell Timer	Range:	0, 0.3 – 999.9 sec (0 = Constant)
	Resolution:	0.1 sec
	Accuracy:	$\pm$ (0.1% of reading + 0.05 sec)
Ramp Timer	Range:	Ramp-Up: 0.1 – 999.9 sec Ramp-Down: AC 0.0 – 999.9 sec
	Resolution:	0.1 sec
	Accuracy:	$\pm$ (0.1% of reading + 0.05 sec)
Ground Continuity Current	DC 0.1 A $\pm$ 0.01A, fixed	
Ground Continuity	Range:	0.0Ω - 1.50Ω
Maximum Limit	Resolution:	0.01Ω
Minimum Limit	Accuracy:	$\pm$ (3% of setting + 0.02Ω)
Ground Continuity	Range:	0.0Ω - 0.50Ω
Auto Offset	Resolution:	0.01Ω
	Accuracy:	$\pm$ (3% of setting + 0.02Ω)
Output Short Circuit Current	> 200mA	

Why use the term "Counts"?
Associated Research publishes some specifications using COUNTS which allows us to provide a better indication of the tester's capabilities across measurement ranges. A COUNT refers to the lowest resolution of the display for a given measurement range. For example, if the resolution for voltage is 1V then 2 counts = 2V.

| GENERAL	
Remote Input-Output Control	The following input and output signals are provided through two 9 pin D-type connectors: 1. Remote control: Test, Reset, and Remote Interlock. 2. Remote recall of memory program 1, 2 and 3 3. Outputs: Pass, Fail, Test-in-Process, and Reset
Program Memory	10 memories, 3 steps per memory, all steps within a memory are linkable.
Security	Key Lock capability to avoid unauthorized access to all test parameters. Memory Lock capability to avoid unauthorized access to memory locations.
Ground Fault Interrupt	Built-in Smart GFI circuit
Display	128 x 64 dot resolution with front panel contrast setting.
Alarm Volume Setting	Front panel adjustable volume setting with 10 set points.
Line Cord	Detachable 7 ft. (2.13m) power cable terminated in a three prong grounding plug.
Terminations	Detachable 5ft.(1.52m) high voltage and return leads (2) with clips and a standard U.S. style (NEMA 5-15) remote receptacle box for testing items terminated with a line cord. International receptacles also available. Front and Rear outputs standard.
Mechanical	Tilt up front feet. Dimensions: (W x H x D) (215 x 89 x 370 mm) (3705,3765,3770) Dimensions: (W x H x D) (430 x 133 x 350 mm) (3780) Weight: 20.96 lbs. (9.53Kgs) (3705,3765,3770) Weight: 49lbs. (22.23Kgs) (3780)
Environmental	Operating Temperature : (0° - 40°C) Relative Humidity - 0 to 80%
Calibration	Traceable to National Institute of Standards and Technology (NIST). Calibration controlled by software. Adjustments are made through front panel keypad in a restricted access calibration mode. Calibration information stored in non-volatile memory.

3.3. Instrument Controls

3.3.1. Front Panel Controls

1. **RESET BUTTON:** Resets the instrument. If a failure condition occurs during a test, pressing this button will reset the system and shut off the alarm. Pressing the button a second time will 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.

2. **TEST BUTTON:** Starts a test.

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

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

5. **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 OUTPUT 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. **POWER SWITCH:** Turns the Hipot tester ON or OFF.

8. **HIGH VOLTAGE INDICATOR:** This indicator flashes to warn the operator that high voltage is present at the high voltage output terminal.

9. **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.

3.3.2. Rear Panel Controls
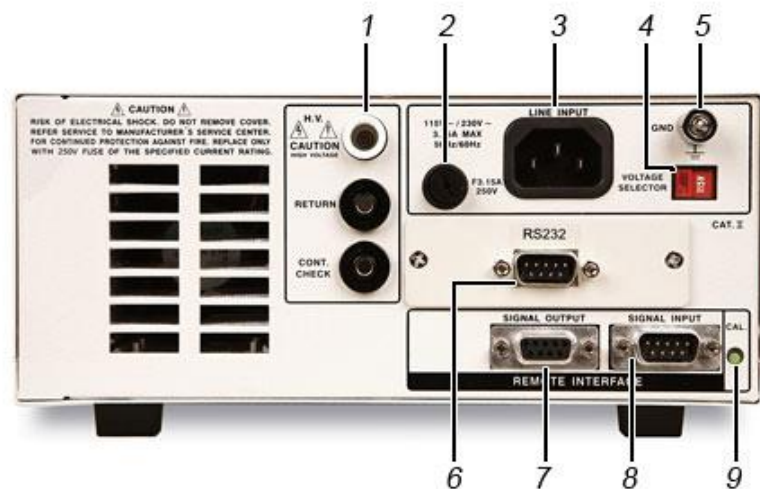
1. **REAR PANEL OUTPUT TERMINALS:** Second set of output connectors in parallel with the front panel connectors.

2. **FUSE RECEPTACLE:** To change the fuse, unplug the power (mains) cord and turn the fuse receptacle counter-clockwise. The fuse compartment will be exposed. Please replace the fuse with one of the proper rating (250 VAC, 15 A).

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

4. **INPUT POWER SWITCH:** Sets the line voltage configuration of the instrument. In the left position it is set for 115 volt operation, in the right position it is set for 230 volt operation.

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

6. **BUS INTERFACE:** Standard connector for interconnection to the RS-232 Bus interface.

7. **REMOTE SIGNAL OUTPUT:** 9-Pin D-type subminiature female connector for monitoring PASS, FAIL, and PROCESSING output relay signals (See section **6. Connection of Remote I/O** for more detailed information).

8. **REMOTE SIGNAL INPUT:** 9 pin D-type subminiature male connector for remote control of TEST, RESET, and REMOTE INTERLOCK DISABLE functions, as well as MEMORY SELECTION (See section **6. Connection of Remote I/O** for more detailed information).
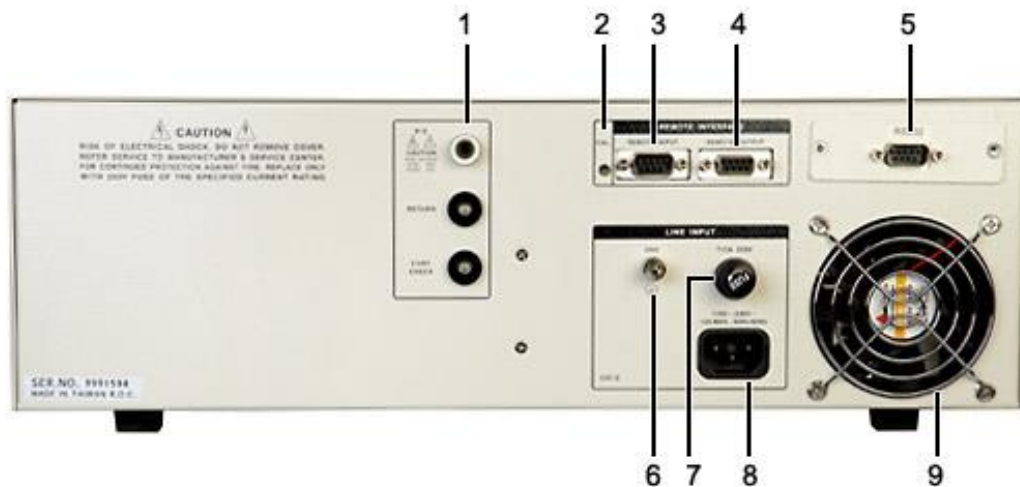
9. CALIBRATION BUTTON: To put the instrument into the calibration mode push this button and turn on the power switch simultaneously.

3.3.3. Front Panel Controls (3780)

1. **RESET BUTTON:** Resets the instrument. If a failure condition occurs during a test, pressing this button will reset the system and shut off the alarm. Pressing the button a second time will 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.

2. **TEST BUTTON:** Starts a test.

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

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

5. **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 OUTPUT 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. **POWER SWITCH:** Turns the Hipot tester ON or OFF.

8. **HIGH VOLTAGE INDICATOR:** This indicator flashes to warn the operator that high voltage is present at the high voltage output terminal.

9. **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.

3.3.4. Rear Panel Controls (3780)

1. **REAR PANEL OUTPUT TERMINALS:** Second set of output connectors in parallel with the front panel connectors.

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

3. **REMOTE SIGNAL OUTPUT:** 9-Pin D-type subminiature female connector for monitoring PASS, FAIL, and PROCESSING output relay signals (See section **6. Connection of Remote I/O** for more detailed information).

4. **REMOTE SIGNAL INPUT:** 9 pin D-type subminiature male connector for remote control of TEST, RESET, and REMOTE INTERLOCK DISABLE functions, as well as MEMORY SELECTION (See section **6. Connection of Remote I/O** for more detailed information).

5. **BUS INTERFACE:** Standard connector for interconnection to the RS-232 Bus interface.

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

7. **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 (250 VAC, 3.15 A).

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

9. THERMAL COOLING FAN: Full time cooling fan.

4. PROGRAMMING INSTRUCTIONS

4.1. Power Up

The Hypot III automatically defaults to the Perform Tests screen upon power up. The Perform Tests screen will appear as follows:
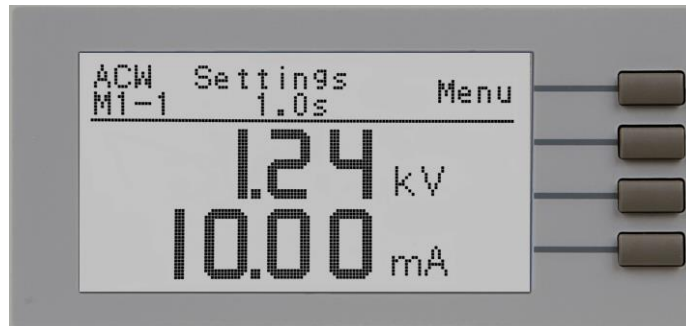
The Perform Tests screen is the main operational screen of instrument. From this screen, all test parameters are monitored while the test is being performed. For more information refer to section **5.2. Perform Tests, Main Menu, and Results Screens**

4.1.1. Memory, Step, and Connected Step Indicator

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

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

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

4.1.2. Main Menu

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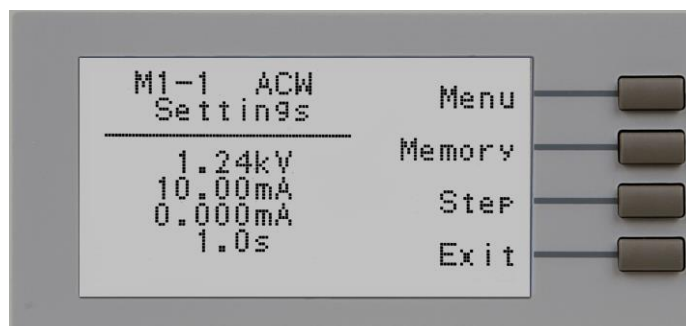
The Main Menu will now be displayed. From the Main Menu screen, three software controls may be accessed: Menu, Memory and Step. Pressing the "Exit" soft key at any time will return you to the Perform Tests screen.

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

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

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

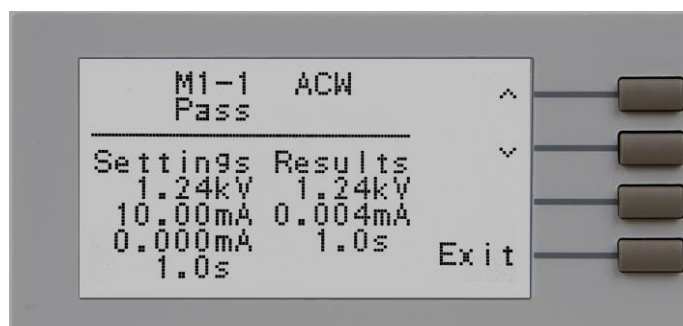### 4.1.3. Results, Tests and System Selections
From the Main Menu, press the "Menu" soft key.
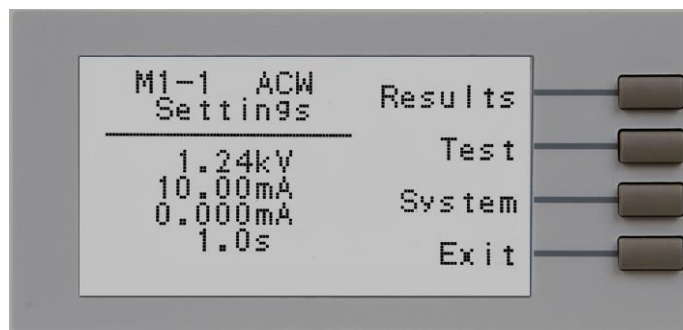
From this screen, three software controls may be accessed: Results, Test and System. Pressing the "Exit" soft key at any time will return you to the Main Menu screen.

Results
Pressing the "Results" soft key from this menu will allow you to review the test results of the last test performed. An example of a Results screen is shown below.

Test

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

System

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

4.2. System Setup

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

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

4.2.1. System Setup Soft Keys

Directional soft keys ∧,∨, >

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

+ key

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

Exit key

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

4.2.2. System Parameters

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

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

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

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

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

LCD Contrast
The numbers 0 through 9 correspond to the different contrast settings, 0 meaning the lightest color of displayed characters and 9 meaning the darkest color of displayed characters. After the "+" soft key is pressed the display will automatically adjust to the new display setting.
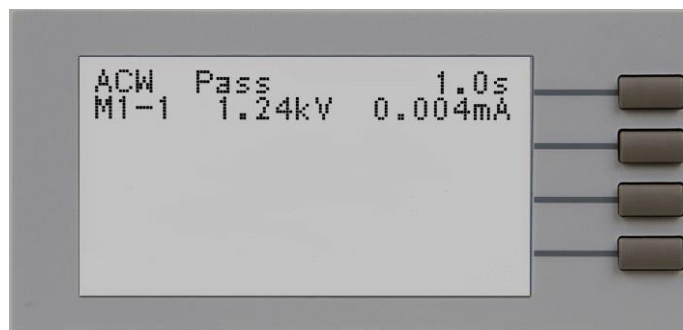
Results
Selects the type of results you would prefer to have displayed at the end of a test or sequence of connected test steps. The available selections are: All, P/F and Last.

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

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

When P/F is selected, it is not possible to see the test results directly at the end of the test. In order to review the test results refer to section **4.2.3. Reviewing Test Results.**

When Last is selected, the results of the last test step performed will be displayed on the Perform Tests screen. There will not be a change in appearance or special screen displayed in this mode.

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

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

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

Smart GFI
The high voltage power supply of the Hypot III 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 Hypot III's Return lead is floating, the SmartGFI circuit enables, protecting the test operator from electric shock. When the Hypot III'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, Hypot III allows the user to perform tests on devices that have their chassis's earth grounded by the test fixture or test environment.

Cal-Alert (Calibration Alert)
The Cal-Alert feature alerts the user that the instrument is due for calibration. Turning this parameter ON will activate the Cal-Alert function and when the date matches the

Alert Date, the instrument will display the Cal-Alert warning screen upon power up. If the "Show this screen again?" function has been turned OFF at the Cal-Alert Warning screen, this parameter will automatically be set to OFF.

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

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

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

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

This parameter may be overwritten to any advanced date desired. Within the Alert Date parameter are three separate fields, month, day, and year. Use the ">" soft key to select the field within the date you want to edit. Use the "+" soft key to change the numeric value. Once you change the value it is automatically stored.

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

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

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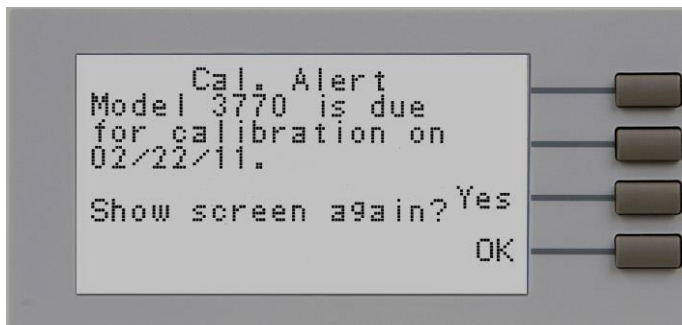
At the Cal-Alert Warning screen "Show screen again?" will be displayed along with the options "Yes" or "No." The question must be answered by toggling between the words "Yes" and "No" using the corresponding soft key and then pressing the "OK" soft key. Selecting "No" will disable the Cal-Alert function.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

If security is enabled this screen will not appear.

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

4.2.3. Default System Parameters

Setup Sys.		
	PLC Remote	OFF
	Single Step	OFF
	Alarm	5
	Contrast	5
	Results	Last
	Lock	OFF
	Mem Lock	ON
	Smart GFI	ON

4.2.4. Memory, Step, and Default System Parameter Restore

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

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

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

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

4.3. Test Setup

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

4.3.1. Test Setup Soft Keys

Directional soft keys $\wedge,\vee,>$
The " $\wedge,\vee,>$ " soft keys are used to scroll the cursor to the different system parameters.

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

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

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

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

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

4.3.2. Test Parameters
Use the directional soft keys, " $\vee,\wedge$ " to navigate the test parameters during reviewing and editing. The directional soft keys will change depending on which parameter the cursor is pointing to.

Voltage: The voltage that is applied to the High Voltage and Return Terminals during a test.

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 Dn: 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 being the least sensitive, 9 being the most sensitive, and 0 being OFF. After the "+" or "-" soft keys are pressed, the arc sensitivity will automatically adjust to the new setting. Arc detection is not required for testing, but may be used as a diagnostic tool. Contact Associated Research, Inc. or visit our website for more information.

Frequency: This parameter is available in AC testing only and may be toggled between 50 and 60 Hz.

> ## DID YOU KNOW?
>
> Associated Research, Inc provides detailed whitepapers and articles on our website. Check out the following link for more information on Arc Sensitivity:
> http://www.asresearch.com/events-training/articles.aspx

Continuity: This function checks for a connection between the Cont. Check and Return Terminals. 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.

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

4.3.3. Default Test Parameters

Each of the test types (ACW, DCW and IR) have specific default test parameters that automatically load when test type is selected from the Test Parameters Review screen. The following table is a listing of the default parameters for each of the different types of tests that the Hypot III can perform. The default parameters are as follows:
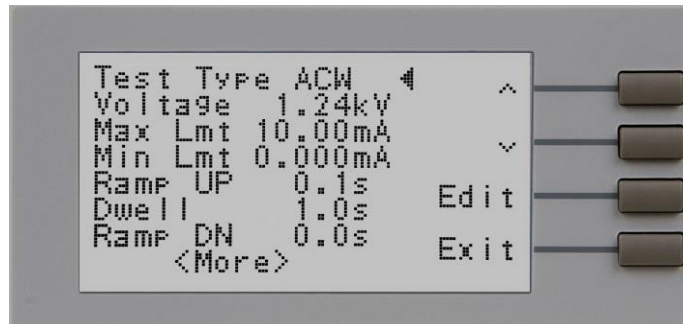
Test Type	Parameter	Value
ACW	Voltage	1.24kV
	Max Lmt (current)	10.00mA
	Min Lmt (current)	0.000mA
	Ramp UP	0.1s
	Dwell	1.0s
	Ramp DN	0.0s
	Arc Sense	0
	Frequency	60Hz
	Continuity	OFF
	Max Lmt (Continuity)	1.00Ω
	Min Lmt (Continuity)	0.00Ω
	Offset (Continuity)	0.00Ω
	Connect	OFF
DCW	Voltage	1.50kV
	Max Lmt (Current)	5000μA
	Min Lmt (Current)	0.0μA
	Ramp UP	0.1s
	Dwell	1.0s
	Ramp DN	0.0s
	Arc Sense	0
	Continuity	OFF
	Max Lmt (Continuity)	1.00Ω
	Min Lmt (Continuity)	0.00Ω
	Offset (Continuity)	0.00Ω
	Connect	OFF
IR	Voltage	1.00kV
	Max Lmt	0MΩ
	Min Lmt	10MΩ
	Ramp UP	0.1s
	Delay	1.0s
	Ramp DN	0.0s
	Connect	OFF

4.3.4. Setting Up a Test

AC Withstand

From the Test Parameters Review screen scroll the cursor using the "∧" and "∨" soft keys to the Test Type parameter. Press the "Edit" soft key. Select the AC Withstand parameter using the "+" and "-" soft keys and press the "Enter" soft key. The default
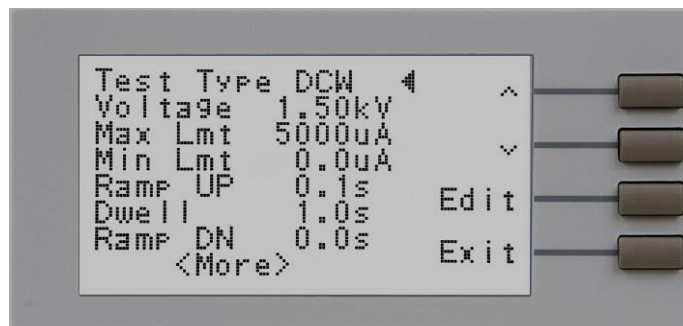
AC Withstand parameters will now be loaded into the currently selected memory and step. Press the "Enter" soft key to accept the parameters or press the "Esc" soft key return to exit without saving.

```
Test Type ACW  ◀      ∧
Voltage   1.24kV
Max Lmt 10.00mA       ∨
Min Lmt 0.000mA
Ramp UP   0.1s
Dwell     1.0s     Edit
Ramp DN   0.0s
     <More>        Exit
```

From the AC Withstand Parameter Review screens the following parameters may be selected for editing: Voltage, Max-Limit, Min-Limit, Ramp Up, Dwell Time, Ramp Down, Arc Sense, Frequency, Arc Detect (ON/OFF), Continuity selection (ON/OFF), Continuity Max-Limit, Continuity Min-Limit, and Continuity Offset.

DC Withstand (Models 3765 and 3770)

From the Test Parameter Review screen scroll the cursor using "∧" and "∨" soft keys to the Test Type parameter. Press the "Edit" soft key. Select the DC Withstand parameter using the "+" and "-" soft keys and press the "Enter" soft key. The default DC Withstand parameters will now be loaded into the currently selected memory and step. Press the "Enter" soft key to accept the parameters or press the "Esc" soft key to exit without saving.

```
Test Type DCW  ◀      ∧
Voltage   1.50kV
Max Lmt   5000uA      ∨
Min Lmt    0.0uA
Ramp UP   0.1s
Dwell     1.0s     Edit
Ramp DN   0.0s
     <More>        Exit
```

From the DC Withstand Setting screen the following parameters may be controlled: Voltage, Max-Limit, Min-Limit, Ramp Up, Dwell Time, Ramp Down, Arc Sense, Arc Detect (ON/OFF), and Continuity (ON/OFF).

Offset

When the Continuity feature is turned ON, the Offset function may be used to compensate for lead and test fixture resistance during the Continuity test. Using the "∧" and "∨" soft keys scroll the cursor to the Offset parameter and press the "Edit" soft key. You may now manually or automatically set an Offset value.

To manually set the Offset use the "+" and "-" soft keys to increase and decrease the resistance value. Press the "Enter" soft key to accept the new value or press the "Esc" soft key to return to the previous screen without saving.

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 and all test fixturing to the instrument. Next, connect the ends of the test cables together and press the TEST button. The instrument will now read the lead resistance and update Offset parameter automatically. Press the "Enter" soft key to accept the new value or press the "Esc" soft key to exit without saving.

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

Insulation Resistance (Model 3770 only)
From the Test Parameter Review screen scroll the cursor using the "∧" and "∨" soft keys to the Test Type parameter. Press the "Edit" soft key. Select the IR parameter using the "+" and "-" soft keys and press the "Enter" soft key. The default IR parameters will now be loaded into the currently selected memory and step. Press the "Enter" soft key to accept the parameters or press the "Esc" soft key to exit without saving. The IR Parameter Review screen will appear as follows:
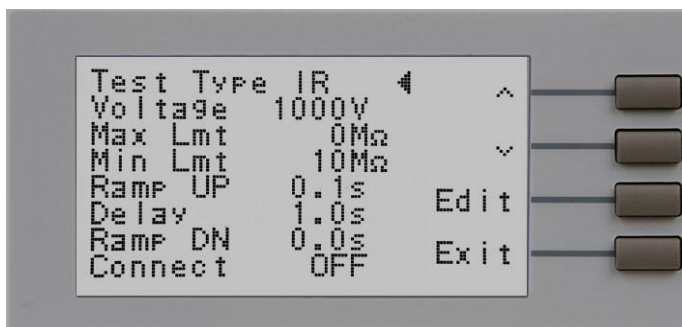
From the Insulation Resistance Parameter Setting screen the following parameters may be selected for editing: Voltage, Max-Limit, Min- Limit, Ramp Up, Delay Time, and Ramp Down.

5. OPERATING INSTRUCTIONS

5.1. Instrument Connections
The test leads and the adaptor box may be connected to the jacks located on the front or back of Hypot III. These receptacles are wired in parallel and either set can be used depending on the specific application.

5.1.1. Connecting the Test Leads
The instrument comes with all cables necessary for performing a Hipot, IR or Continuity test. Plug the red alligator clip into the High Voltage Terminal on the Hypot III. Connect one of two black alligator clip leads to the Return Terminal and the other to the Cont. Check Terminal.
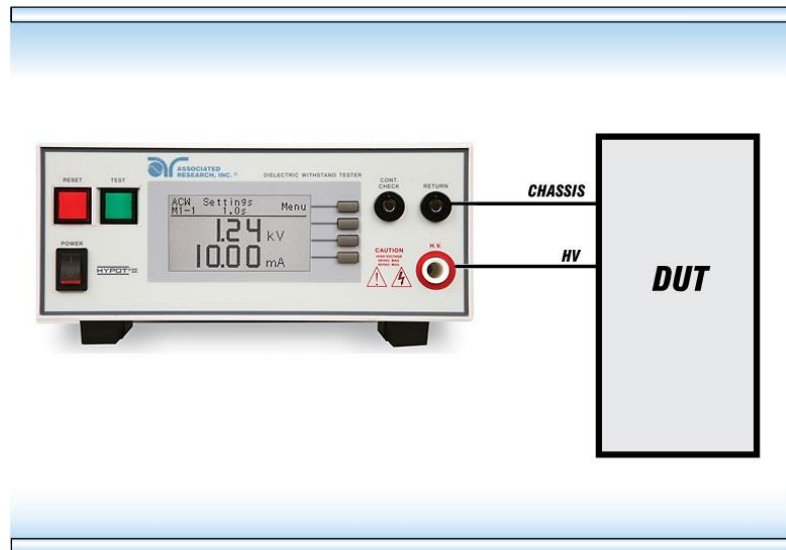
5.1.2. Connecting the Adapter Box
The adapter box provides an easy way to connect a line cord-terminated DUT to the Hypot III. The following diagram shows how to connect the adapter box to the Hypot III and to the DUT.
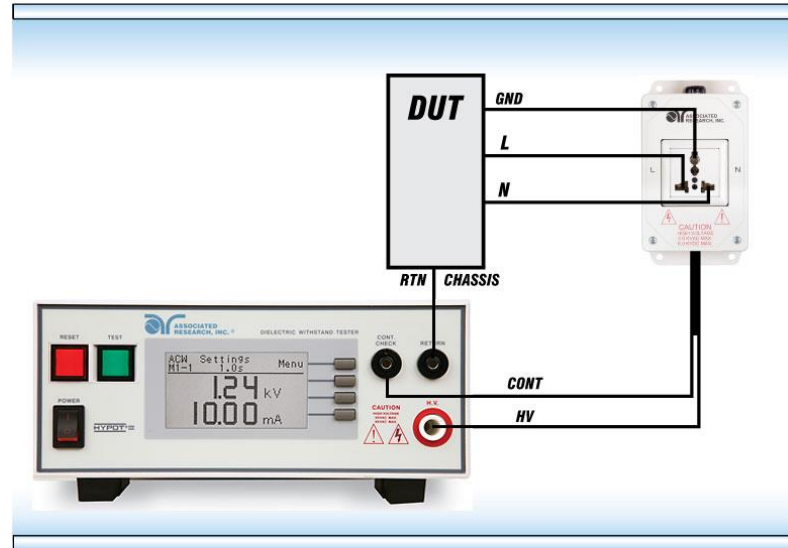
5.1.3. Interlock Connector

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


5.2. Performing a Test

1. From the Main Menu, select the memory and step you wish to perform then press the "Exit" soft key to return to the Perform Tests screen.
2. Attach the appropriate load or DUT to the instrument. Refer to section **5.1. Instrument Connections** for instrument connections.
3. Press the TEST button.
4. The instrument will now perform the test or sequence of connected tests.

> 🌐 **NOTE:** If the test is started from a step other than 01, it will always return to the originally selected step when you push RESET or TEST buttons.

Manual Voltage Adjustment
When Hypot III is performing a test, "+" and "-" soft key selections will appear. These soft keys may be used to adjust the output voltage while performing a test.
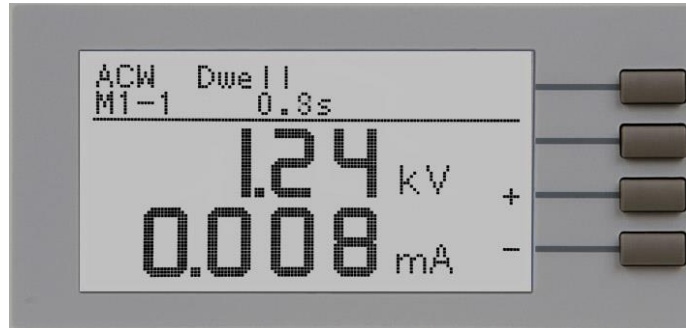
Pressing the "+" soft key will increase the output voltage and pressing the "-" soft key will decrease the output voltage. Manual voltage adjustment temporarily overrides the voltage setting and only remains in effect until the test is terminated by Pass, Fail, or Abort conditions.

When the Lock parameter is ON in the System Menu, manual voltage adjustment is disabled. You will not see the "+" and "-" soft key selections in this case.

5.3. Test Metering
Each test performed by the Hypot III contains a unique set of parameters and therefore requires specialized metering for each test. The following table describes the meters displayed for each of the different tests.

| TEST TYPE	CURRENT	VOLTAGE	TIME	RESISTANCE
AC Withstand	X	X	X	-
DC Withstand	X	X	X	-
IR	-	X	X	X

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

Method 1, Hot key
Pressing the bottom soft key at the Perform Tests screen will display the Results screen.

Method 2, Menu Selection
1. From the Perform Tests screen, press the "Menu" soft key. The Main Menu will now be displayed.
2. From the Main Menu screen, press the "Menu" soft key. The Results, Test and System selections will now be displayed.
3. From this screen, press the "Result" soft key. The Results screen will now be displayed. The Results screen will appear as follows:
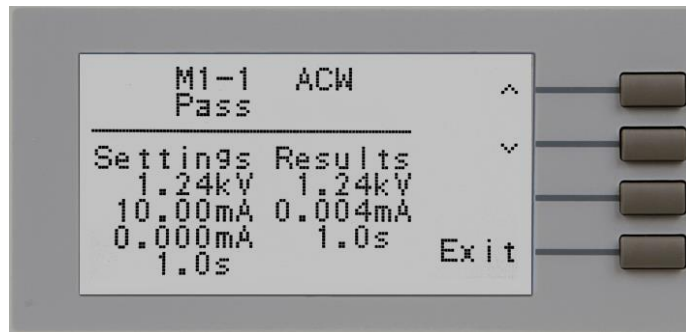
🔵 **NOTE:** For multi-step tests, use the "∧" and "∨" soft keys to scroll through the results.

5.5. Error Messages

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

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

Max-Fail: This message appears on the display if the measured reading exceeds the Max Lmt current setting of the AC/DC Withstand test or Max Lmt resistance setting of the Insulation Resistance test.

Min-Fail: This message appears on the display if the measured reading drops below the Min Lmt current setting of the AC/DC Withstand test or Min Lmt resistance setting of the Insulation Resistance test.

Cont. Max: This message appears on the display during the AC/DC Withstand test if the measured reading exceeds the Max Lmt continuity resistance setting (Continuity function must be turned ON).

Cont. Min: This message appears on the display during the AC/DC Withstand test if the measured reading drops below the Min Lmt continuity resistance setting (Continuity function must be turned 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) during the AC/DC Withstand test.

Short: This message appears on the display if the instrument detects a short circuit condition

Breakdown: This message appears on the display if the DUT current is well beyond the metering range of the test and the arcing condition is 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. See section **6.2. Remote Signal Inputs and Memory Access** for more information.

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

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

WARNING: Voltage detected at return : This message appears on the display if external voltage or current is detected on the front or rear RETURN terminals on the instrument. The 3700 series instruments have a resettable fuse installed on the return in the event external line voltage is applied to the return terminals. This circuit will cut the return off from the internal components in order to avoid damage to the instrument. If this message is shown on the display, check all connections and remove the fault. Note that there is a 5 second wait time on this error message. The fuse must reset before a test can be run again.

6. 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-type subminiature connector provided by the user. The output mates to a male (plug) connector while the input mates to a female (receptacle) connector. For best performance, a shielded cable should be used. To avoid ground loops the shield should not be grounded at both ends of the cable. Suggested AMP part numbers for interconnecting to the Remote I/O are shown below:

205204-4	PLUG SHELL WITH GROUND INDENTS
205203-3	RECEPTACLE SHELL
745254-7	CRIMP SNAP-IN PIN CONTACT (for plug)
745253-7	CRIMP SNAP-IN SOCKET CONTACT (for receptacle)
745171-1	SHIELDED CABLE CLAMP (for either plug or receptacle)
747784-3	JACKSCREW SET (2)
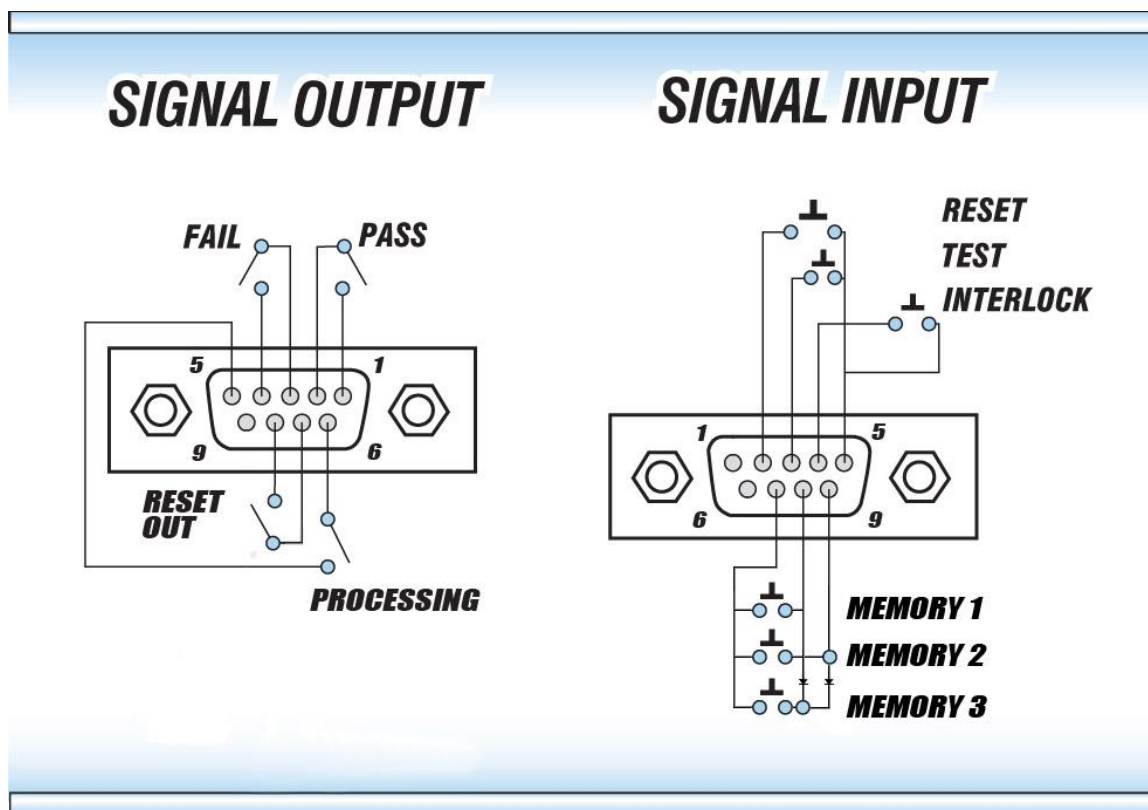
6.1. Remote Signal Outputs

The rear panel connector provides three output signals to remotely monitor PASS, FAIL, and PROCESSING conditions. The monitoring signals are provided by three normally open internal relays that toggle ON and OFF to indicate the condition of the tester. These are normally open free contacts and will not provide any voltage or current. The ratings of the contacts are 1 AAC /

125 VAC (0.5 ADC / 30 VDC). The signal outputs are provided on the 9 pin female D-type connector. Below is a list that indicates what conditions activate each pin. When a terminal becomes active the relay closes thereby allowing the external voltage to operate an external device.

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

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.

6.2. Remote Signal Inputs and Memory Access

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

When the PLC Remote mode is on, the Hypot III 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

DID YOU KNOW?
The Remote Signal Input connector may be used with various accessories, including light curtains, foot switches, and safety probes. Contact Associated Research, Inc. for more information.

remains active even when a remote reset switch is connected so that high voltage can be shut down from either location.

The Remote File Select function gives the user the capability to quickly change parameters and initiate a test remotely. Three internal memory programs can be accessed by connecting terminals 7, 8, and 9 in different combinations. The memory select bits should be set simultaneously and remain set for a minimum of 1ms to guarantee that the correct memory will be selected.

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

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

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

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

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

Remote Interlock
Hypot III 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:
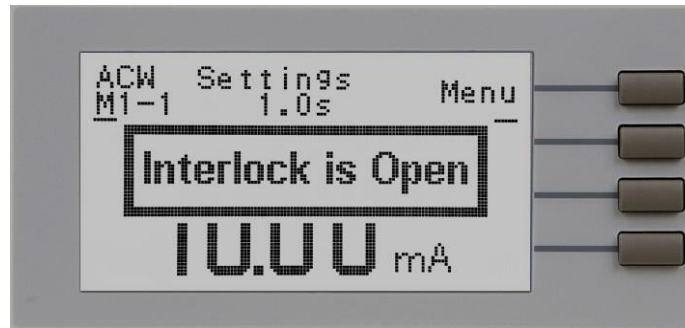
If the Remote Interlock contacts are opened during a test, the pop-up message will be displayed and the test will abort. The hardware and has been configured to provide the interlock connections on pins 4 and 5 of the Remote Interface, Signal Input port. The instrument can still be used without the external 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.

7. BUS REMOTE INTERFACE

This section provides information on the proper use and configuration of bus remote interface. The RS-232 remote interface is standard on all 3700 series models.

7.1. RS-232 Interface
This interface is standard on Hypot III. This interface provides all of the control commands and parameter setting commands. All commands can be found in the command list, section 7.2.1 to 7.2.5 of this manual.

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

Instrument RS-232 Port		PC / Bus Controller
RD	2	2 RD
TD	3	3 TD
SIG GND	5	5 SIG GND
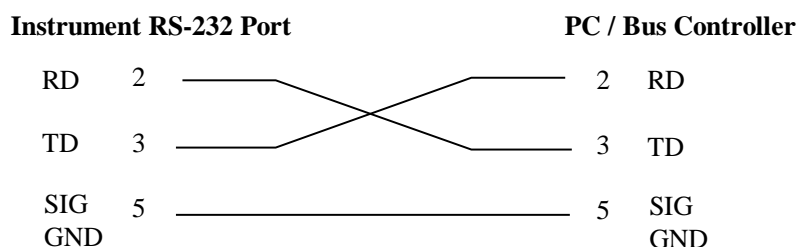
7.1.2. Communications Port Configuration
The COM port should have the following configuration:

- 19200 baud
- 8 data bits
- 1 stop bit
- No parity

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

7.1.3. 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.

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

The following conventions are used to describe the commands syntax for the Hypot III. Braces ({ }) enclose each parameter for a command string. Triangle brackets (< >) indicate that you must substitute a value for the enclosed parameter. The Pipe (|) is used to separate different parameter options for a command. The command and the parameter data must be separated with a space. All commands that end with a question mark (?) are query commands and require an IEEE-488 read command to retrieve the data from the device's output buffer.

7.2.1. 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
CAOF	Continuity Auto Offset

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

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

CAOF
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.

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

Command	Description	Value
MSS <*memory number step number*>	Memory Step	*memory number* = 1-10

	Select	*step number* 1-3
ACW	Step Add ACW test	
DCW	Step Add DCW test	
IR	Step Add IR test	
SALL<*memory+step,type,p1,p2,p3…*>	Add all Parameters of a Test	

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

ACW, DCW, IR
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.

SALL <memory+step, type, p1, p2, p3… >
This command edits all parameters in a memory and step. Parameters will be edited at the step location that has been selected. See the command summary tables to see the specific test type for each of these commands. Example:
SALL<*01,ACW,1.24,10.00…*>

 The parameter <*memory+step*> indicated the memory and step number. The parameter <type> indicated the test type. The values ACW, DCW, or IR must be used. The parameters <*p1,p2*> etc. indicate the individual settings for each test. All parameters must be included with the command and should appear in the same order that is shown in the table below. Also, like the individual parameter editing commands, the unit should not be included with the value. Only the numeric value should be included in the command string. The list of parameters can also be found in the default parameters section of the manual, or refer to the Test Parameter Editing commands section for the proper values. The parameter values should use complete text and not use the coded values that are associated with the individual parameter setting commands such as "ON" and "OFF" for toggle field.

	ACW	DCW	IR
1	Voltage	Voltage	Voltage
2	Max Limit	Max Limit	Max Limit
3	Min Limit	Min Limit	Min Limit
4	Ramp Up	Ramp Up	Ramp Up
5	Dwell	Dwell	Delay
6	Ramp Down	Ramp Down	Ramp Down
7	Arc Sense	Arc Sense	Connect (ON/OFF)

8	Frequency	Continuity (ON/OFF)	
9	Continuity (ON/OFF)	Continuity Max Limit	
10	Continuity Max Limit	Continuity Min Limit	
11	Continuity Min Limit	Continuity Offset	
12	Continuity Offset	Connect (ON/OFF)	
13	Connect (ON/OFF)		

7.2.3. Test Parameter Editing Commands

These commands are used to modify the test parameter within each step. These commands require a parameter value to be included with the command. The values for ACW and DCW tests are sent in kV while the values for an IR test are sent in V. 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. 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
CONN {1|0}	Connect ON/OFF	ALL	1=On, 0=Off
VOLT <i>value</i>	Set Voltage Level	ACW DCW IR	0-5kV 0-6kV 0-1000V
RUP <i>value</i>	Edit Ramp Up	ALL	0.1-999.9sec
RDN <i>value</i>	Edit Ramp Down	ACW DCW IR	0.1-999.9sec 0, 1.0-999.9sec 0, 1.0-999.9sec
DDT <i>value</i>	Dwell/Delay Time	ACW DCW IR	0, 0.3-999.9sec 0, 0.4-999.9sec 0, 0.5-999.9sec
ARC <i>value</i>	Arc Detect Level	ACW DCW	1-9
MAXL <i>value</i>	Edit Max Limit	ACW DCW IR	0.00-20.0mA (3705,3765,3770) 0.00-99.99mA (3780) 0-7500uA 0, 1-9999MOhms
MINL <i>value</i>	Edit Min Limit	ACW DCW IR	0.000-9.999mA 0.0-999.9uA 1-9999MOhms
FREQ {50|60}	Edit Frequency	ACW	50 or 60Hz
CONT {1|0}	Continuity ON/OFF	ACW DCW	1=On, 0=Off
CMAL <i>value</i>	Continuity Max Limit	ACW DCW	0.00-1.50Ohms
CMIL <i>value</i>	Continuity Min Limit	ACW DCW	0.00-1.50Ohms

COFF <*value*>	Continuity Offset	ACW DCW	0.00-0.50Ohms

7.2.4. System Parameter Editing Commands and Companion Queries

These commands are used to modify the system parameters for the instrument. These

commands require a parameter value to be included with the command.

Command	Name	Value
PLC {1|0}	PLC Remote ON/OFF	1=On, 0=Off
SSTP {1|0}	Single Step ON/OFF	1=On, 0=Off
SGFI {1|0}	Smart GFI	1=On, 0=Off
ALAR <*value*>	Alarm Level	0-9
CNTR <*value*>	Contrast Level	0-9
RLT {L|A|P}	Result Setting	L=Last, A=All, P=P/F

7.2.5. Query Commands

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

Command	Name	Value
*IDN?	Identification Query	Associated Research Inc., Model Number, Serial Number, Firmware Revision
TD?	List Testing Data	Data from test in Process
RD <*step number*>?	Result Data Query	1-3
SALL?	List Step Parameters	Response: SALL memory+step,type,p1,p2,p3…
RR?	Read Reset Query	1=Open, 0=Closed
RI?	Read Interlock Query	1=Open, 0=Closed

*IDN?
Read the instrument identification string. Company = Associated Research Inc.

TD?
Read the active data being displayed on the LCD display while the test is in process. It will also read the last data taken when the test sequence has completed. Each parameter is separated by commas and includes step number, test type, test status, and metering. The syntax for this command response is {memory - step, test type, status, meter 1, meter 2, meter 3}. ACW test displays 4 meters. Each meter will contain both the value and 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 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 {memory - step, test type, status, meter 1, meter 2, meter 3}. ACW test displays 4 meters. Each meter will contain both the value and 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 2000uA.

SALL?
Lists all the step parameters for the step currently selected. Each parameter is separated by commas and includes memory and step number, test type, and parameter values. The syntax for this command response is SALL memory+step, type, parameter 1, parameter 2, parameter 3…. 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 2000uA.

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

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

7.2.6. Query Commands and Displayed Messages
While performing tests, a number of messages will be displayed to indicate the test state or test results. These messages are displayed in the status area of the screen, located on the first line at the top of the LCD. Query commands are used to retrieve this information remotely. The following examples outline the syntax for various displayed messages using the TD? and RD X? query commands.

> 🔵 **NOTE:** the format for the TD? and RD X? query commands:
> **memory-step,test type,status,meter1,meter2,meter3**.

Below is an example response showing descriptions of the individual parameters for each test type:

Displayed Message	Example Query Response					
	Memory-Step	Test Type	Status	Meter 1 (Voltage)	Meter 2 (Leakage Current)	Meter 3 (Timer)
Dwell	M1-1	ACW	Dwell	0.30kV	0.296mA	0.5s
Dwell	M1-2	DCW	Dwell	1.00kV		
Dwell	M1-3	IR	Dwell	0.50kV		

For example, if a 3700 unit running an ACW test at 3800V and reading 2.3mA leakage current was queried with the TD? command 1.2sec into the dwell cycle, it would respond with:

M1-1,ACW,Dwell,3.80,2.30,1.2

The table below shows queries response examples for every displayed message type:

Displayed Message	Example Query Response
Dwell	M1-1 ,ACW,Dwell,0.30kV,0.296mA,0.5s
Delay	M1-1 ,ACW,Delay,0.30kV,0.192mA,0.2s
Ramp UP	M1-1 ,ACW,Ramp UP,0.15kV,0.090mA,0.1s
Ramp DN	M1-1 ,ACW,Ramp DN,0.10kV,0.122mA,10.0s
Pass	M1-1 ,ACW,Pass,1.00kV,0.296mA,2.0s
Abort	M1-1 ,ACW,Abort,0.30kV,0.291mA,0.4s
Max Fail	M1-1 ,ACW,Max Fail,0.30kV,0.296mA,0.2s
Min Fail	M1-1 ,ACW,Min Fail,0.30kV,0.296mA,0.2s
Cont Max	M1-1 ,ACW,Cont Max,0.30kV,0.296mA,0.2s
Cont Min	M1-1 ,ACW,Cont Min,0.30kV,0.296mA,0.2s
Arc Fail	M1-1 ,ACW,Arc Fail,1.97kV,0.613mA,1.2s
Short	M1-1 ,ACW,Short,1.23kV,0.720mA,0.5s
Breakdown	M1-1 ,ACW,Breakdown,0.30kV,0.300mA,10.0s
GND Fault	M1-1 ,ACW,GND Fault,0.40kV,0.290mA,11.0s

8. OPTIONS

Introduction

This section contains descriptions of available factory installed options at the time of this printing. The list of options contains an option code number that can be referenced on the data plate on the rear panel of the unit.

Option Label

On the rear panel of the instrument, you will find a label that contains the option code.

For example, your options code would appear as follows:
Fitted with option 01…..   OPT: 01
Fitted with option 01 and 02...   OPT: 0102

Hypot III Options

Option List

Code	Description
01	0.1 MOhm Resolution
02	5mA Output Current
03	5Ω Continuity
04	PLC Power Indicator
05	3mA Output Current

Description

01 0.1 MOhm Resolution (3770 only)

The 0.1 MΩ Resolution IR Limits option increases the resolution of the Max and Min trip point limits from 1MΩ to 0.1MΩ, in the range of 0.0 to 999.9MΩ.

The Max and Min Lmt set points automatically range while being edited according to the specification table below. This is unique only to this feature because this option has multiple ranges.

INSULATION RESISTANCE TEST MODE		
Maximum Limit	Range:	0.0 , 1.0 – 999.9 MΩ (0 = Off)
	Resolution	0.1 MΩ
	Range	1000 – 9999 MΩ
	Resolution	1 MΩ
	Accuracy	Same as Resistance display
Minimum Limit	Range:	1.0 – 999.9 MΩ
	Resolution	0.1 MΩ
	Range	1000 – 9999 MΩ
	Resolution	1 MΩ
	Accuracy	Same as Resistance display

02 5 mA Output (3705, 3765, 3770 only)
The 5 mA Output option limits the output current of the instrument using software control. The trip points are adjusted to a maximum of 5 mA and the software has been modified so the high-speed maximum current shutdown is fixed at 5 mA. The following specifications have been changed for this option:

DIELECTRIC WITHSTAND TEST MODE			
Output Rating			5000V @ 5 mA AC
			6000V @ 5 mA DC
Maximum Limit	AC	Range:	0.00 - 5.00 mA
	DC	Range:	0 - 5000 μA
Minimum Limit	AC	Range:	0.000 - 0.500 mA
	DC	Range:	0.0 - 50.0 μA

03 5Ω Continuity (all models)
The 5Ω Continuity option increases the Ground Continuity maximum limit from 1.5Ω to 5Ω and increases the Ground Continuity offset range from 0.0Ω – 0.50Ω to 0.0Ω – 0.99Ω. The following specifications have been changed for this option.

DIELECTRIC WITHSTAND TEST MODE		
Ground Continuity Maximum Limit Minimum Limit	Range: Resolution Accuracy	0.0Ω – 5.00Ω 0.01Ω Ω (3% of setting + 0.02Ω)
Ground Continuity Auto Offset	Range: Resolution Accuracy	0.0Ω - 0.99Ω 0.01Ω Ω (3% of setting + 0.02Ω)

Calibration
The Calibration Procedure varies slightly with this option installed. The changes to the calibration procedure are as follows:

○   **NOTE:** For Continuity, the instrument should be calibrated to a standard 5.0Ω resistor rather than a 1.0Ω resistor. This change is reflected on the display during calibration of continuity.

All other items in the Calibration Procedure remain unchanged. Please refer to the section **9. Calibration Procedure** for details.

04 PLC Power Indicator (all models)
The PLC Power Indicator option creates a signal that acts as an instrument power-on indicator. The signal is available through the Remote I/O output connector which is located on the back of the instrument. This option closes the relay contact between pin (1) and pin (2) on the output connector once the instrument is powered on. The PLC Power Indicator signal replaces the Pass signal that is present on the standard instrument.

It should be noted that the term "Indicator" in "PLC Power Indicator" only implies that the instrument is powered on. To perform a test, it should be verified that an interlock device is used or the interlock disable connector that was provided with the instrument is installed, and that there are no failure indicators active on the instrument. For more information on the Remote I/O signals/connections and Remote Interlock refer to section **7. Connection of Remote I/O.**

05 3 mA Output (3705, 3765, 3770 only)
The 3 mA Output option limits the AC output current of the instrument using software control. The trip points are adjusted to a maximum of 3 mA and the software has been modified so the high-speed maximum current shutdown is fixed at 3 mA. The following specifications have been changed for this option:

DIELECTRIC WITHSTAND TEST MODE			
Output Rating		5000V @ 3 mA AC	
Maximum Limit	AC	Range:	0.00 - 3.00 mA
Minimum Limit	AC	Range:	0.000 - 3.000 mA

9. INSTRUMENT VERIFICATION

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

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

9.1. Verification Initialization

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

9.2. Verification Menu

From the Initialization screen (first start up screen), press the TEST button. The Verification Menu will now be displayed. From the Verification screen, four different verification processes may be accessed: Continuity, AC Hipot, DC Hipot, and IR.

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

9.2.1. Continuity Verification

From the Verification screen, press the "∧" and "∨" soft keys to select "Continuity."
Then press the "Select" soft key. An instructional prompt will now be displayed. The
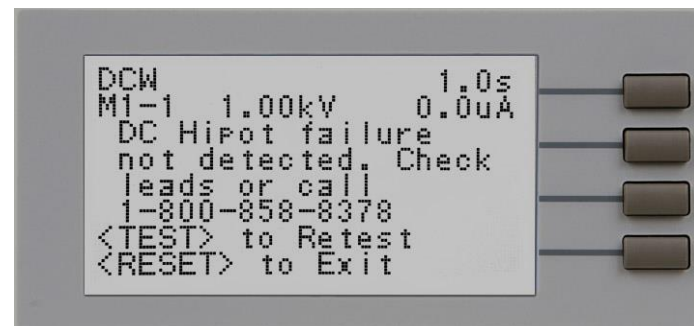prompt will appear as follows:

```
   Cont. Verification

Open DUT connection
between Cont. and
Return. Unplug H.V.
from the instrument.
<TEST> to Begin
<RESET> to Exit
```

Follow the instructions given in the prompt and then press TEST to begin the
verification process.

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

```
ACW                0.0s
M1-1  -.--kV  --.--mA
  Verification OK
  Continuity failure
  detected


<RESET> to Exit
```

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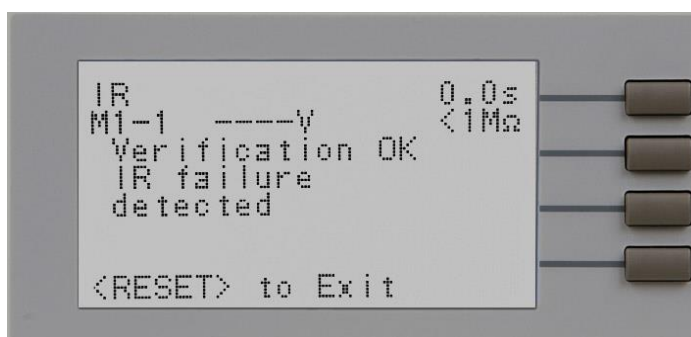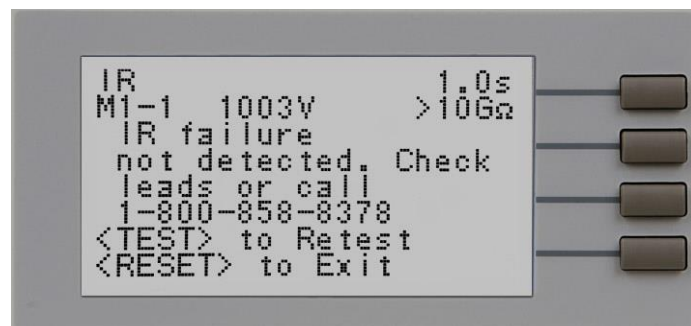working properly) the following message will appear:

```
ACW                1.0s
M1-1  0.00kV   0.00mA
  Continuity failure
  not detected. Check
  leads or call
  1-800-858-8378
<TEST> to Retest
<RESET> to Exit
```
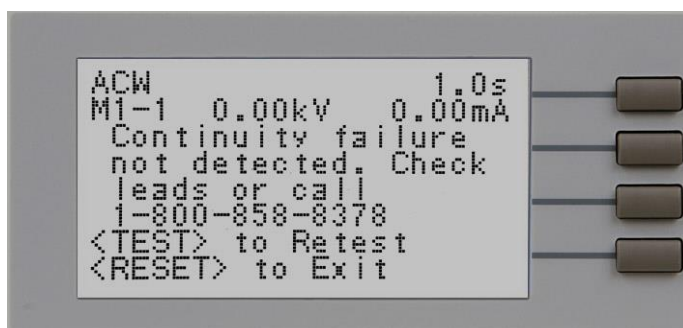
9.2.2. AC Hipot Verification

From the Verification screen, press the "∧" and "∨" soft keys to select "AC Hipot."
Then press the "Select" soft key. An instructional prompt will now be displayed. The
prompt will appear as follows:

```
AC Hipot Verification

Short DUT connection
between H.V. and
Return. Do not touch
during test.
<TEST> to Begin
<RESET> to Exit
```

Follow the instructions given in the prompt and then press TEST to begin the
verification process.

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

```
ACW                0.0s
M1-1  -.--kV     >99mA
  Verification OK
  AC Hipot failure
  detected

<RESET> to Exit
```

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

```
ACW                1.0s
M1-1  0.99kV    0.00mA
  AC Hipot failure
  not detected. Check
  leads or call
  1-800-858-8378
<TEST> to Retest
<RESET> to Exit
```
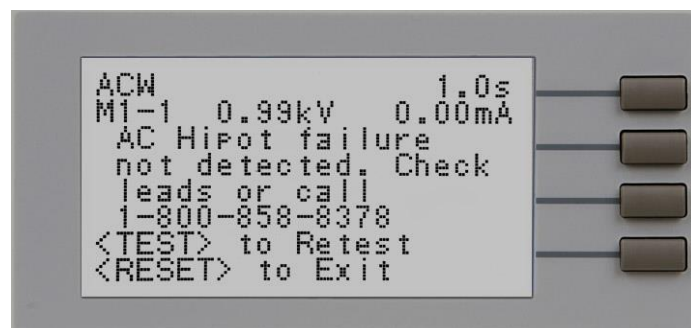
9.2.3. DC Hipot Verification (Models 3765 and 3770 only)

From the Verification screen, press the "∧" and "∨" soft keys to select "DC Hipot." Then press the "Select" soft key. An instructional prompt will now be displayed. The prompt will appear as follows:

```
DC Hipot Verification

Short DUT connection
between H.V. and
Return. Do not touch
during test.
<TEST> to Begin
<RESET> to Exit
```

Follow the instructions given in the prompt and then press TEST to begin the verification process.

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

```
DCW              0.0s
M1-1  -.--kV   >7.5mA
 Verification OK
 DC Hipot failure
 detected


<RESET> to Exit
```

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

```
DCW              1.0s
M1-1  1.00kV   0.0uA
 DC Hipot failure
 not detected. Check
 leads or call
 1-800-858-8378
<TEST> to Retest
<RESET> to Exit
```

9.2.4. IR Verification (Model 3770 only)

From the Verification screen, press the "∧" and "∨" soft keys to select "IR." Then press the "Select" soft key. An instructional prompt will now be displayed. The prompt will appear as follows:

```
        IR Verification

Short DUT connection
between H.V. and
Return. Do not touch
during test.
<TEST> to Begin
<RESET> to Exit
```

Follow the instructions given in the prompt and then press TEST to begin the verification process.

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

```
IR                    0.0s
M1-1   ----V         <1MΩ
  Verification OK
  IR failure
  detected


<RESET> to Exit
```

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

```
IR                    1.0s
M1-1  1003V         >10GΩ
  IR failure
  not detected. Check
  leads or call
  1-800-858-8378
<TEST> to Retest
<RESET> to Exit
```

10. CALIBRATION

DID YOU KNOW?

This instrument has been fully calibrated at the factory in accordance to our published specifications and with standards traceable to the National Institute of Standards & Technology (NIST).

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

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

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

10.1. Warranty Requirements

Associated Research, Inc. offers a standard three-year manufacturer's warranty. This warranty can be extended an additional two years provided that the instrument is returned each year to Associated Research, Inc. for its annual recertification. In order to be eligible for the extended warranty instruments must be returned to Associated Research, Inc. for certification service at least once every twelve months.

A return material authorization number (RMA) must be obtained from Associated Research, Inc. before returning this instrument for calibration. To obtain an RMA number or for information regarding our warranty, please contact our customer support representatives at 1-800-858-TEST (8378) or setup an RMA online at http://www.asresearch.com/support/RMA-request.aspx.

Required Calibration Equipment
- 0 - 5 KV AC/DC Metered Voltage Divider.
- 20 mA AC, 10 mA DC Ammeter.
- 1Ω, 0.25 watt resistor, 250 volt.
- $50M\Omega$, 0.25 watt resistor, 1000 volt.
- $500M\Omega$, 0.25 watt resistor, 1000 volt.
- $100K\Omega$, 175 watt resistor, 4000 volt.
- $1M\Omega$, 20 watt resistor, 4000 volt.

10.2. Warranty Requirements

Associated Research, Inc. offers a standard 1-Year manufacturer's warranty. This warranty can be extended an additional (4) years provided that the instrument is returned each year to Associated Research, Inc. for its annual recertification. In order to be eligible for the extended warranty instruments must be returned to Associated Research, Inc. for certification service at least once every twelve months.

A return material authorization number (RMA) must be obtained from Associated Research, Inc. before returning this instrument for calibration. To obtain an RMA number or for information regarding our warranty, please contact our customer support representatives at 1-800-858-TEST (8378) or setup an RMA online at http://www.asresearch.com/support/RMA-request.aspx

10.3. Calibration Initialization

Press and hold the Calibration key on the rear panel with a pen, pencil or small screwdriver while powering on the Hypot III. The Hypot III enters calibration mode after the power on sequence is complete. The Calibration screen will appear as follows for the 3705, 3765 and 3770:
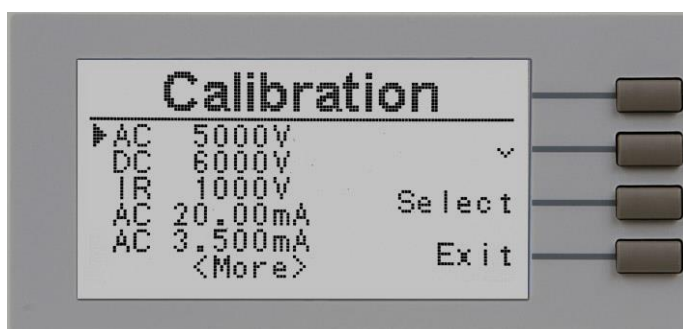
The Calibration screen will appear as follows for the 3780:
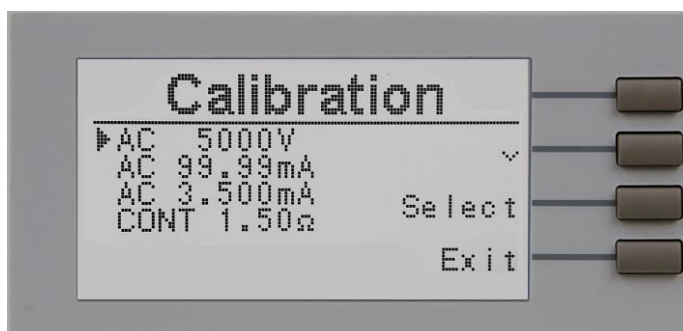
Calibration of Parameters

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

that describes the necessary load and connection information for the parameter being calibrated.

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

Calibration of AC Hipot Voltage
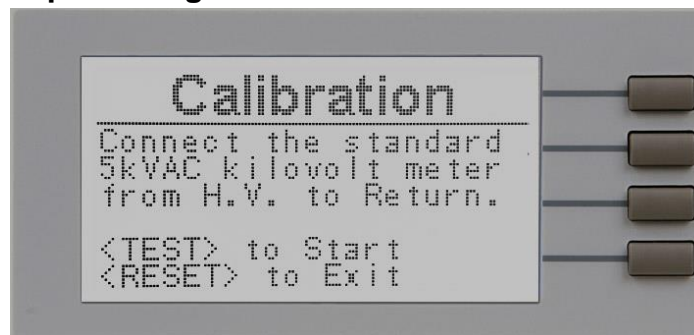
Calibration of DC Hipot Voltage
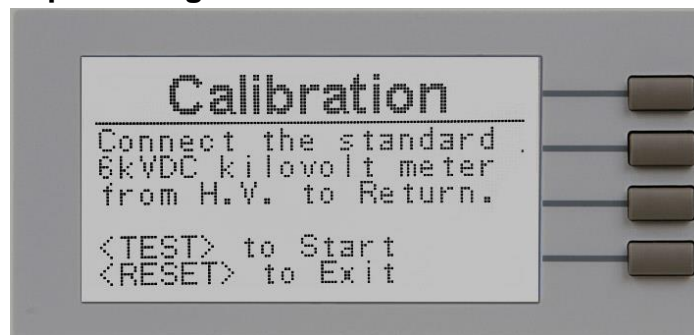
Calibration of IR DC Voltage
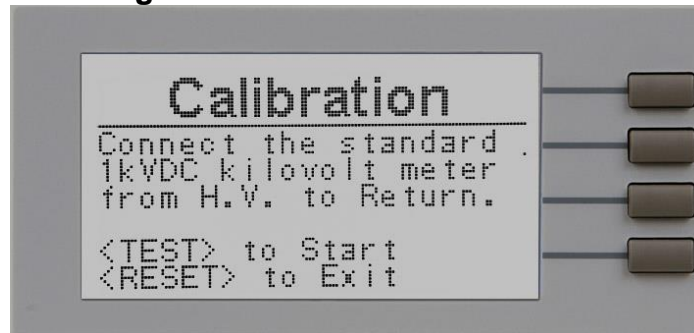
Calibration of AC Current 20.00mA range
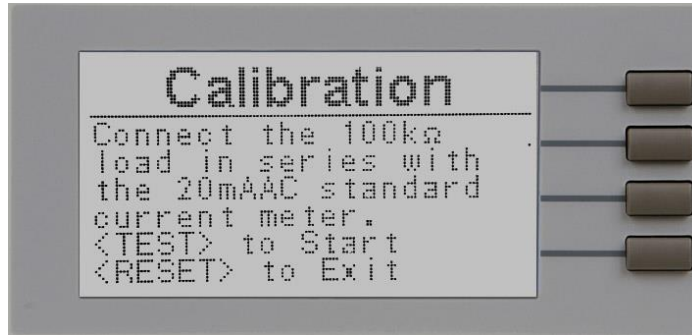
Calibration of AC Current 99.99mA range (3780 Only)
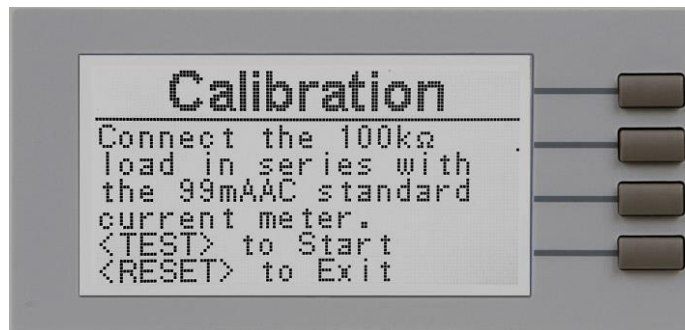
Calibration of AC Current 3.50mA range
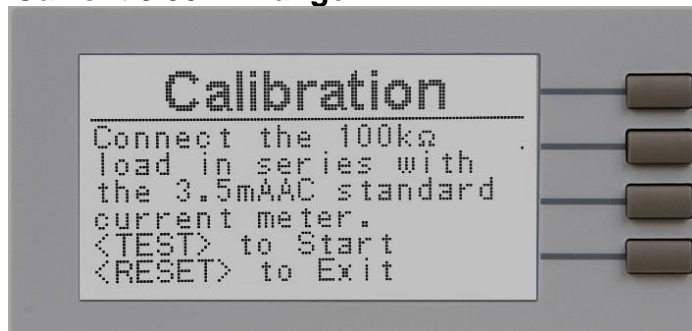
Calibration of DC Current 7.50mA range
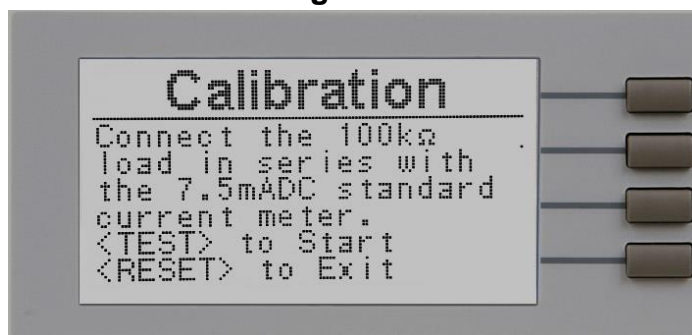
Calibration of DC Current 3.50mA range

Calibration

Connect the 100kΩ
load in series with
the 3.5mADC standard
current meter.
<TEST> to Start
<RESET> to Exit

Calibration of DC Current 350μA range

Calibration

Connect the 1MΩ load
in series with the
350uADC standard
current meter.
<TEST> to Start
<RESET> to Exit
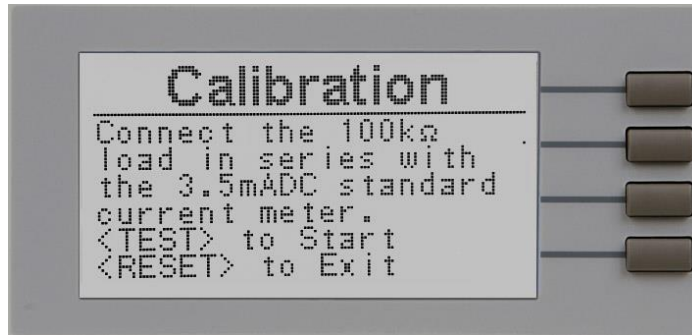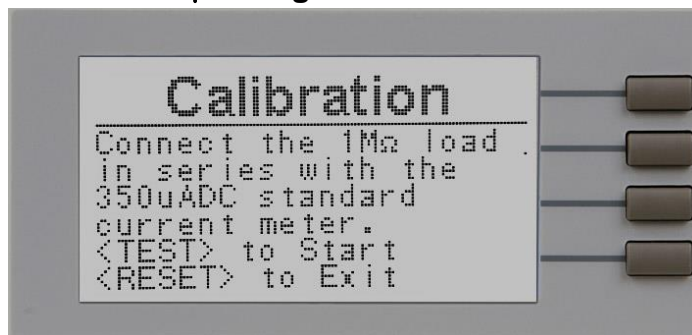
Calibration of IR 999.9MΩ and 9999MΩ Ranges

Calibration

Connect the standard
50MΩ load from H.V.
to Return.

<TEST> to Start
<RESET> to Exit

Calibration

Connect the standard
50MΩ load from H.V.
to Return.

<TEST> to Start
<RESET> to Exit
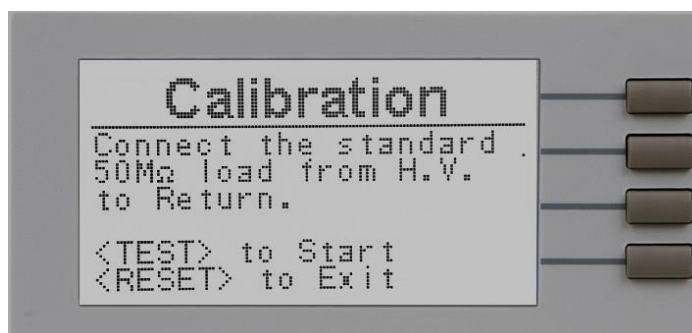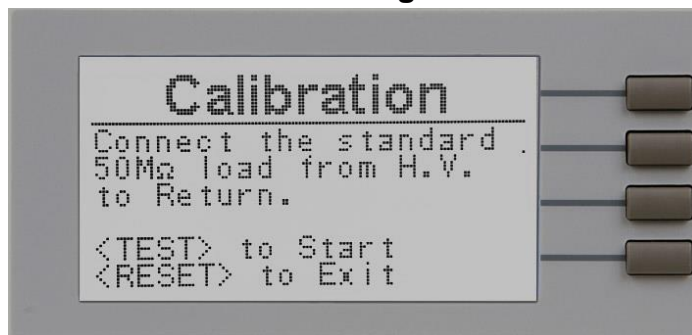
Calibration of Continuity, Step 1
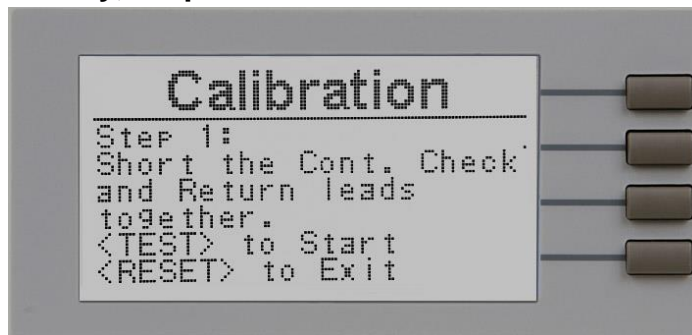
Calibration of Continuity, Step 2
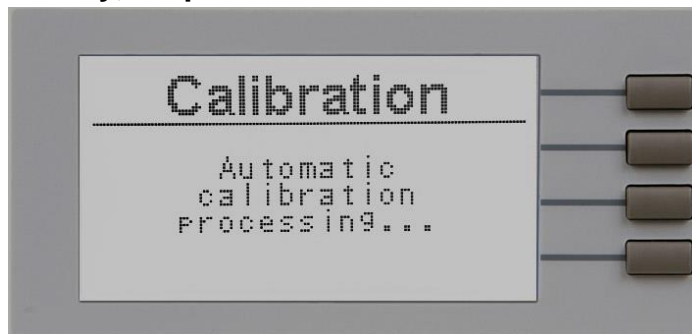
Calibration of Continuity, Step 3
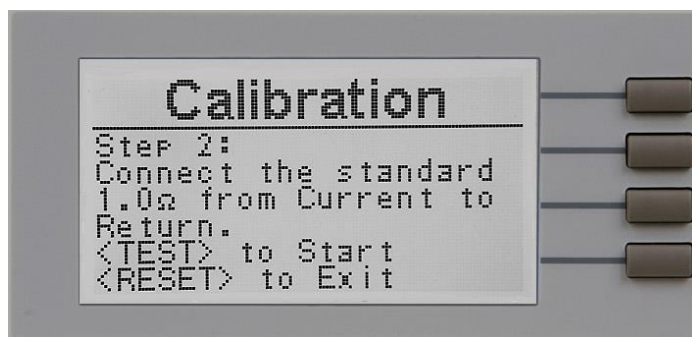
11. REPLACEMENT PARTS LIST

ECO: 5611 Rev.H 5-6-2013

Part Number	Qty.	Reference Designator	Description
38787[2]	2	-	3U Rack Mount Handle
38788[2]	2	-	3U Rack Mount Bracket
39714[2]	4	-	Screw for Rack Mount Handle/Bracket
35999	4	-	Black Banana Jacks
37497	1	-	Reset Switch, Red
37555[1]	1	-	Power Switch 2P 10A/250V
37571	1	-	Earth Connector
39391	1	Test/Pass	Replacement Bulb
39392	1	Reset/Fail	Replacement Bulb
37673	1	-	Switch Test, Green
37783	1	RY1	Relay Gunther 3390-1290-246
37784	1	RY2	Relay Gunther 3392-1290-246
37880[1]	1	-	3.15 Amp, fast acting 250VAC
38430[2]	1	-	115Vac, 230VAC - 15A/250VAC Slow-Blow
37863	1	-	RS-232 Cable
33189[1]	1	-	Cable Input Cordset USA
38071[2]		-	Cable Input Cordset USA 15A
38075	1	-	Interlock Connector
38101	1	-	Feet Kit w/o Rubber Inserts
38102	4	-	Rubber Insert for Feet
36544	1	-	Adapter Box
38262[3]	1	IC19	Microcontroller 78E516B PLCC
39350	1	IC 19	Microcontroller 59128 PLCC
38367[1]	1	CON 3670	Main Control Board
39267[2]	1	CON 3670	Main Control Board
38264[1]	1	HV 3670	High Voltage Board
39268[2]	1	HV 3670	High Voltage Board
38265[2]	1	HRY 3670	HV Relay Board
38266[1]	1	AMP 3670	Power Amplifier Board
39266[2]	1	AMP 3780	Power Amplifier Board
38267	1	KEY 3670	Keypad Board
38268[1]	1	PWR 3670	Input Voltage Select PCB
39269[2]	1	REM 3780	Remote Board
38271	1	-	High Voltage Connector w/10cm cable
38272	1	-	High Voltage Connector w/10cm cable
38287	1	T1	Input Transformer

38288[1]	1	T2	Output High Voltage Transformer
39277[2]	1	T2	Output High Voltage Transformer
38320	1	-	128 x 64 Graphic Display
04040A-08	1	-	High Voltage Output cable
02100A-13	2	-	Return cable

[1]3705, 3765, 3770 Only
[2]3780 Only
[3]3705, 3765, 3770 Firmware 1.04 and below

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