OPERATION AND SERVICE MANUAL

MODEL 905D RUNCHEK™

SERIAL NUMBER

Model
905D

13860 West Laurel Drive
Lake Forest, Illinois, 60045-4546
U.S.A.

Item 38087 ***Ver 1.08***

Printed July 7, 2005

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 (1) year from date of shipment. You must complete the on-line registration at www.asresearch.com/register or call 1-800-858-TEST ext. 210 to register over the phone

5-Year Program

AR recommends that your instrument be calibrated on a twelve-month cycle. Instruments purchased and used in North America only, may have their warranty extended in one year increments to a maximum of **(5) years** provided they are returned to AR at least **annually** for calibration and inspection. The annual calibration and inspection must be performed annually every year following receipt of instrument. Any instrument not calibrated and inspected annually will not be eligible for extended warranty status. This extended warranty is non-transferable and is offered only to the original purchaser. A return material authorization (RMA) must be obtained from AR 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 in its original container for safe transport. If the original container in not available 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. AR will assume the return freight costs when returning the instrument to the customer. The return method will be at the discretion of Associated Research.

3-Year Program

A 3-Year warranty is also available for instruments purchased and used in North America. All costs for this warranty are paid with the initial purchase and include warranty coverage, annual calibration and standard ground return freight for three years. However, unlike our 5-year program annual calibration and inspection by Associated Research is not required.

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

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

TABLE OF CONTENTS

SECTION 1
OPERATORS MANUAL

SAFETY PRECAUTIONS REQUIRED FOR HIGH VOLTAGE TESTING!

GENERAL:
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 (110 or 220) and the correct fuse is installed.

SAFETY SYMBOLS:

INSTRUCTION MANUAL SYMBOL. PLEASE REFER TO THE INSTRUCTION MANUAL FOR SPECIFIC WARNING OR CAUTION INFORMATION TO AVOID PERSONAL INJURY OR DAMAGE TO THE PRODUCT

INDICATES HAZARDOUS VOLTAGES MAY BE PRESENT.

CHASSIS GROUND SYMBOL.

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.

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

SERVICE AND MAINTENANCE

User Service

To prevent electric shock do not remove the instrument cover. There are no user serviceable parts inside. Routine maintenance or cleaning of internal parts is not necessary. Any external cleaning should be done with a clean dry or slightly damp cloth. Avoid the use of cleaning agents or chemicals to prevent any foreign liquid from entering the cabinet through ventilation holes or damaging controls and switches, also some chemicals may damage plastic parts or lettering. Schematics, when provided, are for reference only. Any replacement cables and high voltage components should be acquired directly from Associated Research, Inc. Refer servicing to an Associated Research, Inc. authorized service center.

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
www.asresearch.com

Service Interval

The instrument and its power cord test leads, and accessories must be returned at least once a year to an Associated Research authorized service center for calibration and inspection of safety related components. Associated Research will not be held liable for injuries suffered if the instrument is not returned for its annual safety check and maintained properly.

User Modifications

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

TEST STATION

Location

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

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

Power

Dielectric Voltage-Withstand Test Equipment must be connected to a good ground. Be certain

that the power wiring to the test bench is properly polarized and that the proper low resistance bonding to ground is in place.

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

Work Area

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

There should not be any metal in the work area between the operator and the location where products being tested will be positioned. Any other metal in the work area should be connected to a good ground, never left "floating".

Position the tester so the operator does not have to reach over the product under test to activate or adjust the tester. If the product or component being tested is small, it may be possible to construct guards or an enclosure, made of a non-conducting material such as clear acrylic, such that the item being tested is within the guards or enclosure during the test, and fit them with switches so that the tester will not operate unless the guards are in place or the enclosure closed.

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

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

TEST OPERATOR

Qualifications

This instrument generates voltages and currents, which can cause **harmful or fatal electric shock** and must only be operated by a skilled worker trained in its use.

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

Safety Procedures

Operators should be thoroughly trained to follow these and all other applicable safety rules and procedures before they begin a test. Defeating any safety system should be treated as a serious offense and should result in severe penalties, such as removal from the Hipot testing job. Allowing unauthorized personnel in the area during a test should also be dealt with as a serious

offense.

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

Medical Restrictions
This instrument should not be operated by personnel with heart ailments or devices such as pacemakers.

TEST PROCEDURES
!NEVER PERFORM A HIPOT TEST ON ENERGIZED CIRCUITRY OR EQUIPMENT!
The Line Leakage test and Hipot test should always be performed sequentially and never performed simultaneously. If the instrument has an external safety ground connection be sure that this is connected. Then, connect the return lead **first** for any test regardless of whether the item under test is a sample of insulating material tested with electrodes, a component tested with the high voltage test lead, or a cord-connected device with a two or three prong plug.

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

WARNING **NEVER TOUCH THE ITEM UNDER TEST OR ANYTHING CONNECTED TO IT WHILE HIGH VOLTAGE IS PRESENT DURING THE HIPOT TEST OR LINE VOLTAGE IS PRESENT DURING THE LINE LEAKAGE TEST.**

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

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

KEY SAFETY POINTS TO REMEMBER:

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

GLOSSARY OF TERMS

(as used in this manual)

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

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

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

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

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

Dielectric: An insulating material which 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 which flows in one direction only. The source of direct current is said to be polarized and has one terminal which is always at a higher potential than the other.

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

Hypot®: Registered trademark of Associated Research, Inc., for its dielectric-withstand test equipment.

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

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

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

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

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

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

INTRODUCTION

Product Safety Testing

The importance of testing... User safety

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

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

Run Testing

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

Line Leakage Testing

The Line Leakage test is one of many product safety tests which are normally specified for electrical products by safety testing agencies such as Underwriters Laboratories (UL) and the International Electrotechnical Committee (IEC). The line leakage specifications vary as well as the method in which the measurements are taken depending upon the application or function of a product and the standard to which the product is being tested. Current Leakage or Line Leakage tests are general terms that actually describe three different types of tests. These tests are Earth Leakage Current, Enclosure Leakage Current, and Applied Part Leakage Current. The main differences in these tests are in the placement of the probe for the measuring device. The Earth Leakage Current is the leakage current that flows through the ground conductor in the line cord back to earth. The Enclosure Leakage Current is the current that flows from any enclosure part through a person back to ground if it were contacted by a person. The Applied Part Leakage Current or Patient Lead Leakage Current is any leakage that flows from an applied part, between applied parts or into an applied part. The Applied Part Leakage Current test is required only for medical equipment. All of these tests are used to determine if products

can be safely operated or handled without posing a shock hazard to the user.

The Model 520L LINECHEK Line Leakage Tester provides the capability of meeting the line leakage test specified in the following standards; UL 544, IEC 950, UL 1950, IEC 601-1, UL 2601, UL 1563, UL 3101, IEC 1010 and others. The Line Leakage test, is a test which measures the leakage current of a product, through a circuit that is designed to simulate the impedance of the human body. The simulation circuit is called the Measuring Device (MD). The instrument has five different MD circuits, selectable through the menu, which are representative circuits designed to simulate the impedances of the human body under different conditions. The impedance of the human body will vary depending upon point of contact, the surface area of the contact and the path the current flows. For these reasons the specifications on the Measuring Devices differ depending upon the type of test being performed as well as the maximum allowable leakage current. Leakage current measurements are performed on products under both normal conditions and single fault conditions as well as reversed polarity. This simulates possible problems, which could occur if the product under test is faulted or misused while the product is operating under high line conditions (110% of the highest input voltage rating of the product).

Line Leakage tests are normally specified as “Type Tests” or “Design Tests” which are performed during the development of the product. This helps verify that the design is safe but it does not guarantee the safety of the products being produced on the production line. The only way to be sure you are shipping safe products is to test each product at the end of the production line. The built in switching matrix interface allows the 520L LINECHEK to be interconnected with other AR safety testers to form a complete safety testing system. The user may perform a Leakage Current test along with other common safety test such as Dielectric Withstand, Insulation Resistance, and Ground Bond on the production line with a single connection to the device under test.

The Dielectric Withstand (Hipot) Test

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

The most common applications of the dielectric-withstand test are:

- Design (performance) Testing.... determining design adequacy to meet service conditions.
- Production Line Testing.... detecting defects in material or workmanship during processing.
- Acceptance Testing.... proving minimum insulation requirements of purchased parts.
- Repair Service Testing.... determine reliability and safety of equipment repairs.

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

During the test, all "stray" current flow to ground is measured. If, during the time the component is tested, stray current flow remains within specified limits, the device is assumed to be safe under normal conditions. The basic product design and use of the insulating material will protect the user against electrical shock.
The equipment used for this test, a dielectric-withstand tester, is often called a "hipot" (for high potential tester). The "rule of thumb" for testing is to subject the product to twice its normal operating voltage, plus 1,000 volts.

However, specific products may be tested at much higher voltages than 2X operating voltages + 1,000 volts. For example, a product designed to operate in the range between 100 to 240 volts, can be tested between 1,000 to 4,000 volts or higher. Most "double insulated" products are tested at voltages much higher than the "rule of thumb".

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

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

Advantages and Disadvantages of AC Testing and DC Testing....
Please check with the Compliance Agency you are working with to see which of the two type of voltages you are authorized to use. In some cases a Compliance Agency will allow either AC or DC testing to be done. However in other cases the Compliance Agency only allows for an AC test. If you are unsure which specification you must comply with please contact our CUSTOMER SUPPORT GROUP at 1-800-858-TEST (8378).

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

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

<u>AC testing advantages</u>
1. AC testing is generally much more accepted by safety agencies than DC testing. The main reason for this is that most items being hipot tested will operate at AC voltages and AC hipot testing offers the advantage of stressing the insulation alternately in both polarities which more closely simulates stresses the product will see in real use.
2. Since AC testing cannot charge a capacitive load the current reading remains consistent

from initial application of the voltage to the end of the test. Therefore, there is no need to gradually bring up the voltage since there is no stabilization required to monitor the current reading. This means that unless the product is sensitive to a sudden application of voltage the operator can immediately apply full voltage and read current without any wait time.

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

AC testing disadvantages

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

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

DC testing characteristics

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

DC testing advantages

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

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

DC testing disadvantages

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

3. DC testing unlike AC testing only charges the insulation in one polarity. This becomes a concern when testing products that will actually be used at AC voltages. This is a key

reason that some safety agencies do not accept DC testing as an alternative to AC.

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

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

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

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

TYPES OF FAILURES DETECTABLE ONLY WITH A HIPOT TEST

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

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

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

Compliance agency requirements vary on how different products are to be tested. Most specifications call for test currents of between 10 and 30 amps. Test voltages at these currents are typically required to be less than 12 volts. Maximum allowable resistance readings of the safety ground circuit are normally between 100 and 200 milliohms.

IF YOU SHOULD HAVE ANY QUESTIONS RELATING TO THE OPERATION OF YOUR INSTRUMENT CALL 1-800-858-TEST(8378) IN THE U.S.A.

Model 905D Functional Specifications

Unless otherwise stated, accuracies are relative to a laboratory standard measurement.

905D INPUT	
Voltage	115 / 230V selectable, ± 10 % variation
Frequency	50/60 Hz ± 5%
Fuse	115 VAC, 230VAC - 1A slow-blo 250VAC
DUT POWER	
Voltage	0.0 - 300.0 VAC Single Phase Unbalanced
Current	0.0 - 10.0A AC max continuous
Voltage Display	Range: 30 - 300VAC Full Scale Resolution: 0.1V Accuracy: ± (1% of reading + 0.2V)
DUT Watts	3000 W max
Short Circuit Protection	20 Amps AC Response time < 1s
DELAY and DWELL TIMER SETTINGS	
Delay time setting	Range: 0.2 - 999.9 seconds Resolution: 0.1 second Accuracy: ± (0.1% + 0.05 sec)
Dwell time setting	Range: 0.0 - 999.9 seconds 0 = continuous Resolution: 0.1 second Accuracy: ± (0.1% + 0.05 sec)
TRIP POINT SETTINGS	
Voltage: Volt-Hi Volt-LO	Range: 0.0 - 300.0 VAC Resolution: 0.1 V Accuracy: ± (1.5% of setting + 0.2 V)
Current: Amp-HI Amp-LO	Range: 0.1 - 10.00 AAC Resolution: 0.01 A Accuracy: ± (2.0% of setting + 0.02A)
Watts: Watt-HI Watt-LO	Range: 0 - 3000 W Resolution: 1 W Accuracy: ± (5.0% of setting + 3W)
Power Factor: PF-HI PF-LO	Range: 0.000 - 1.000 Resolution: 0.001 Accuracy: ± (8% of setting + 2 Counts)
Leakage Current: Leak-HI Leak-LO	Range: 0.00 - 10.00 mA 0 = OFF Resolution: 0.01 mA Accuracy: ± (2% of setting + 0.02mA) Leakage current measuring resistor MD=2KΩ ± 1%

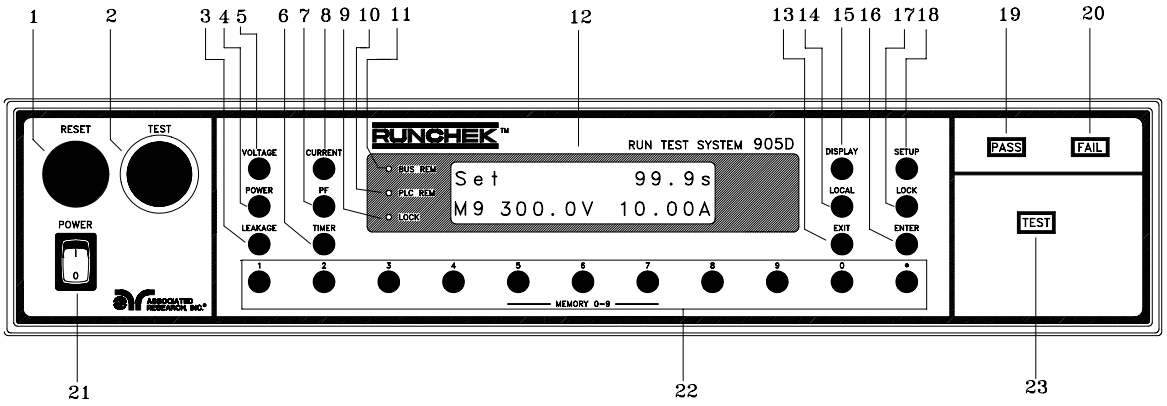
METERING	
Voltmeter	Range: 0.0 - 300.0 VAC Resolution: 0.1 V Accuracy: ± (1.5% of reading + 0.2 V)
Ammeter	Range: 0.1 - 10.00 AAC Resolution: 0.01 A Accuracy: ± (2.0% of reading + 0.02A)
Wattmeter	Range: 0 - 3000 W Resolution: 1 W Accuracy: ± (5% of reading + 3 W)
Power Factor	Range: 0.000 - 1.000 Resolution: 0.001 Accuracy: ± (8% of reading + 2 Counts)
Leakage Current	Range: 0.00 - 10.00 mA Resolution: 0.01 mA Accuracy: ± (2% of reading + 0.02 mA) Leakage current measuring resistor MD = 2KΩ ± 1%
Timer display	Range: 0.0 - 999.9 seconds Resolution: 0.1 second Accuracy: ± (0.1% of reading + 0.05 seconds)
GENERAL SPECIFICATIONS	
PLC Remote Control	The following input and output signals are provide 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 and Test in Process
Memory	Allows storage of up to 10 different test programs.
Bus Remote Interface	GPIB (IEEE-488) remote interface is standard but may be substituted by an RS-232 interface option. The RS-232 interface uses the same command list as the GPIB with the exception of the SRQ functions
Security	Programmable password lockout capability to avoid unauthorized access to test set-up program.
LCD Contrast Setting	9 ranges set by the numeric keys on the front panel.
Volume Setting	10 ranges set by the numeric key on the front panel.
Line Cord	Detachable 7 ft. (2.13m) power cable terminated in a three prong grounding plug.
Switch Matrix	The switching matrix allows for the interconnection of an Electrical Safety Analyzer to the Run Test System. The run test may be started after the pass signal is received from the Safety Analyzer

Terminations	A standard U.S. style (NEMA 5-15) remote receptacle box for testing items terminated with a line cord. International receptacles also available.
Mechanical	Bench or rack mount (2U height) with tilt up front feet Dimensions: (w x h x d) 17 x 4.1 x 12.0 in. (432 x 103 x 305mm) Weight: 12.86 lbs. (5.84 kgs.)
Environmental	Operating Temperature : 32° - 104°F (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.

KEY FEATURES & BENEFITS SUMMARY: MODEL 905D

FEATURES	BENEFITS
Measures input power requirements and the power factor of the DUT.	Accurately measures DUT input Voltage, Amperage, Power(Watts) and Power factor.
Measures earth leakage current	Accurately measures leakage current from the enclosure of the DUT, to the neutral of the input power.
Programmable security password system	Avoids tampering with settings by only allowing authorized personnel with a user programmable security password to change test parameters.
Front panel calibration	All calibration is done through a simple user interface from the front panel. No need to open the instrument.
PLC, RS-232 or GPIB Control	Provides flexibility for semi-automatic or automatic operation with a choice of communication protocols which provides the capability for easy test data storage.
Microprocessor control with software menus	Microprocessor control allows for many advanced features such as automatic testing, memories and software control.
Separate trip points for each test	The 905D is capable of testing for several "windowed" minimum and maximum trips points simultaneously: DUT voltage, current, wattage, power factor, and earth leakage current.
10 Memories for test storage	Storage of test set-ups so parameters only need to be entered once then memorized.
Complete with software driver	National Instruments LabVIEW® software driver is provided for automated applications to ease the testing process.
Built in H.V. switching matrix	Allows the user to perform safety tests and then run the DUT with a single connection.

FRONT PANEL CONTROLS



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

2. **TEST BUTTON:** This is a momentary contact switch. Press the green button to activate the test that is set up in the memory location shown on the display.

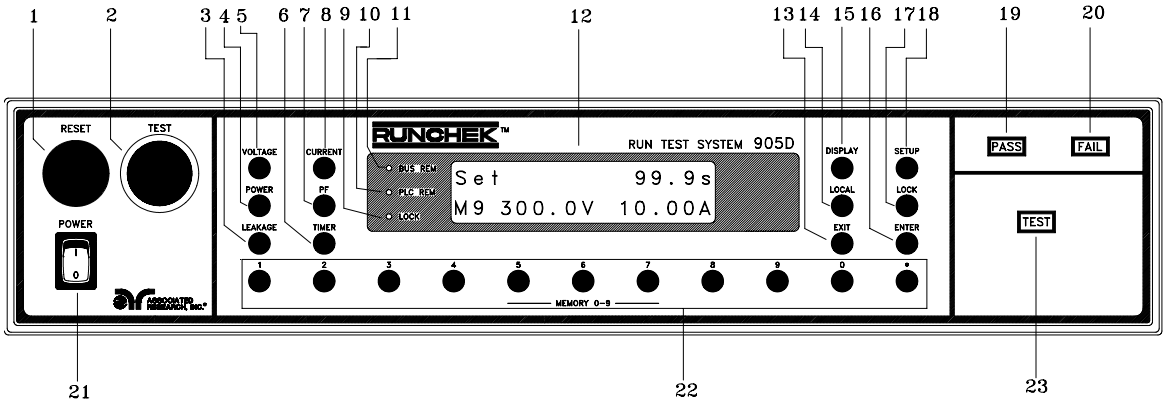
3. **LEAKAGE:** Use this key to toggle between the Leak-Hi and Leak-LO trip point settings. The numeric value keys (22) are used to enter the new value. The enter key (16) is used to save the new value. In the Leak-HI trip point menu 0 = Off, which connects the DUT ground to the 905D's case ground, disabling the earth leakage test.

4. **POWER:** Use this key to toggle between the Watt-HI and Watt-LO trip point settings. The numeric value keys (22) are used to enter the new value. The enter key (16) is used to save the new value.

5. **VOLTAGE:** Use this key to toggle between the Volt-HI and Volt-LO trip point settings. The numeric value keys (22) are used to enter the new value. The enter key (16) is used to save the new value.

6. **TIMER:** Use this key to toggle between the Delay timer, the Dwell timer and **CONNECT** memory mode. The numeric value keys (22) are used to enter the new value for the Delay timer and Dwell timer. The enter key (16) is used to save the new value of the Delay and Dwell. This key is also used to switch memory Connect to On/Off. When the Connect = ON, the display will indicate M1_. The underbar indicates that memory 1 is connected to the memory 2.

7. **PF:** Use this key to toggle between the PF-HI and PF-LO trip point settings. The numeric value keys (22) are used to enter the new value. The enter key (16) is used to save the new value.



8. **CURRENT:** Use this key to toggle between the Amp-HI and Amp-LO trip point settings. The numeric value keys (22) are used to enter the new value. The enter key (16) is used to save the new value.

9. **LOCK LED:** When the Lock LED is on, the "password" software lockout has been enabled. This means that the users will be unable to access the "program" mode of the instrument to change any settings. When Memory Lock is OFF the user can change memory locations.

10. **PLC REMOTE LED:** When the PLC REM LED is on, the Remote setting has been enabled from the setup menu key (18). In this mode, the instrument can be controlled through the 9-pin dsub signal input connector located on the rear panel of the instrument. While in this mode, the instrument may not be controlled from the front panel with the exception of the reset button.

11. **BUS REMOTE LED:** This indicator will illuminate when the instrument is being controlled through the interface bus. When the BUS Remote LED is ON the instrument is able to send and receive signals across the GPIB or RS-232 bus.

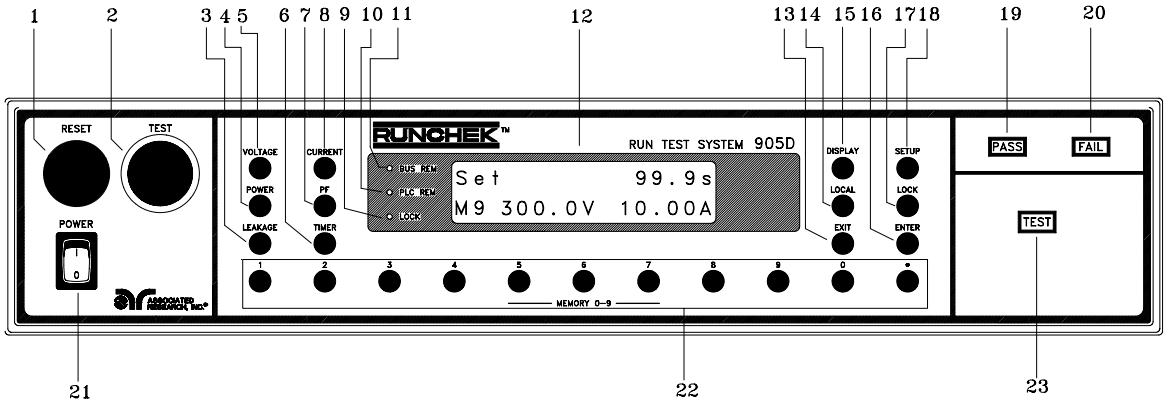
12. **LCD DISPLAY:** The Liquid Crystal Display is the main readout for the operator and programmer of the test settings and test result.

13. **EXIT KEY:** The exit key is used to clear numeric information from a test parameter and exit a test setup to enter the **Run Mode.**

14. **LOCAL:** Use this key when you wish to switch from Bus remote to local operation of the instrument.

15. **DISPLAY:** Use this key to toggle between the two LCD display screens. LCD display screen 1: Memory number, Dwell timer, Volts, and Amps. LCD display screen 2: Memory number, Watts, Leakage current, and Power factor.

16. **ENTER KEY:** Use the enter key after entering new data through the keypad to save it. This key also used to toggle ON/OFF functions.



17. LOCK KEY: Used to enter the security lock menu. This menu may or may not ask for a password depending on how the Lock function was configured in the lock configuration hidden menu.

18. SETUP: This key is used to control the miscellaneous functions of the instrument. The follow is a list of the functions controlled by this key: PLC Remote control On/Off, Display contrast, Alarm volume, GPIB address, Fail Stop On/Off, Single Step On/Off. The SETUP key is also used to control Password Setting and Memory Lock, when depressed simultaneously while powering the instrument.

19. PASS LED INDICATOR: This indicator lights at the end of a test if no failure has occurred during the test.

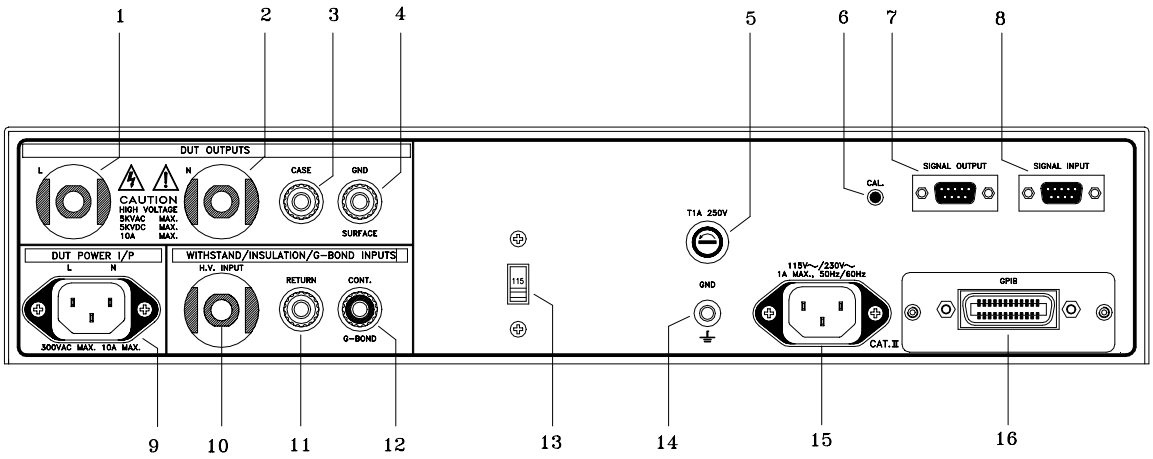
20. FAIL LED INDICATOR: When a failure occurs during a run test this indicator will light and the LCD meter will display the type of failure which occurred during the test.

21. POWER SWITCH: Rocker-style switch with international ON (|) and OFF (0) markings.

22. DATA ENTRY NUMERIC KEYPAD: For numeric entry or change of testing parameters during the "Setup" mode. Keypad entry is unavailable if the "Lock" indicator on the front panel is on. Press and hold one of these keys (until the second tone is heard) to store parameters in memory. Also used to recall test parameters stored in memory.

23. TEST LED: This indicator will illuminate when the DUT has voltage applied to it, and the Run test is active.

REAR PANEL CONTROLS



1. **L:** This output terminal is where the LINE power connection from the adapter box is plugged into the RUNCHEK. Line power is supplied to the DUT during the run test through this terminal. If the 905D is linked with a safety tester, then high voltage is supplied to the DUT through this terminal during a dielectric withstand or insulation resistance test. Output terminals "N" and "L" are shorted together when the RUNCHEK is idle.

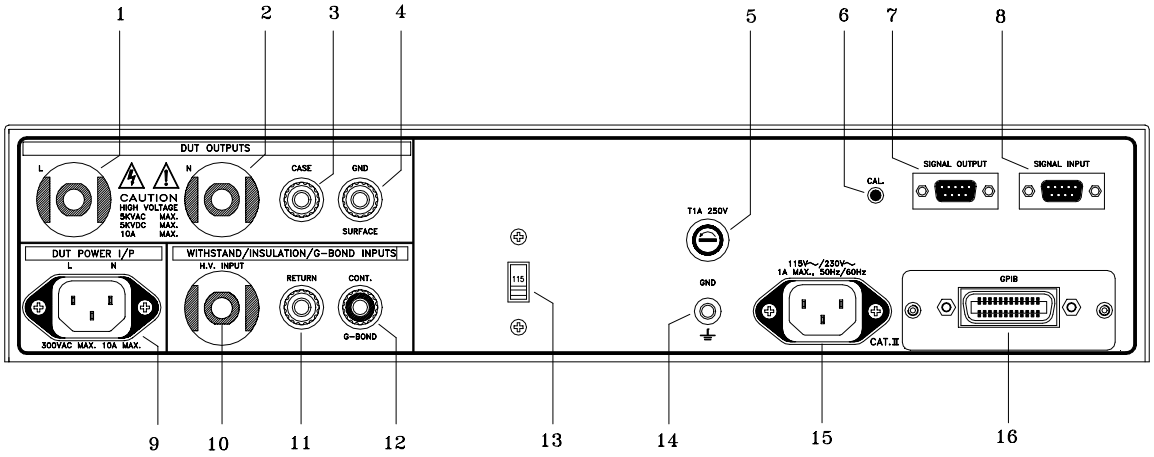
2. **N:** This output terminal is where the Neutral power connector from the adapter box is plugged into the RUNCHEK. Line power is supplied to the DUT during the run test through this terminal. If the 905D is linked with a safety tester, then high voltage is supplied to the DUT through this terminal during a dielectric withstand or insulation resistance test. Output terminals "N" and "L" are shorted together when the RUNCHEK is idle.

3. **CASE:** This terminal is connected to the DUT case or dead metal and provides the return for the Ground Bond, Dielectric Withstand, and Insulation Resistance tests

4. **GND:** This terminal is where the Ground or Earth terminal from the receptacle is connected. During the earth leakage test, this terminal is connected to the DUT neutral through a 2K precision resistor for metering. If the Leak-HI = 0 then the case of the 905D is connected to the ground of the DUT.

5. **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.

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



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

8. **REMOTE SIGNAL INPUT:** 9-Pin D subminiature male connector for remote control of test, reset, and interlock functions, as well as program memory selection 1, 2, or 3.

9. **DUT POWER INPUT TERMINAL:** The terminal is the LINE and NEUTRAL input power connections. An external single phase unbalanced AC power supply with a single Hot or Line conductor should be connected here, to supply power to the DUT while performing the leakage test. This input is rated for 0-300 volts, 10 A maximum.

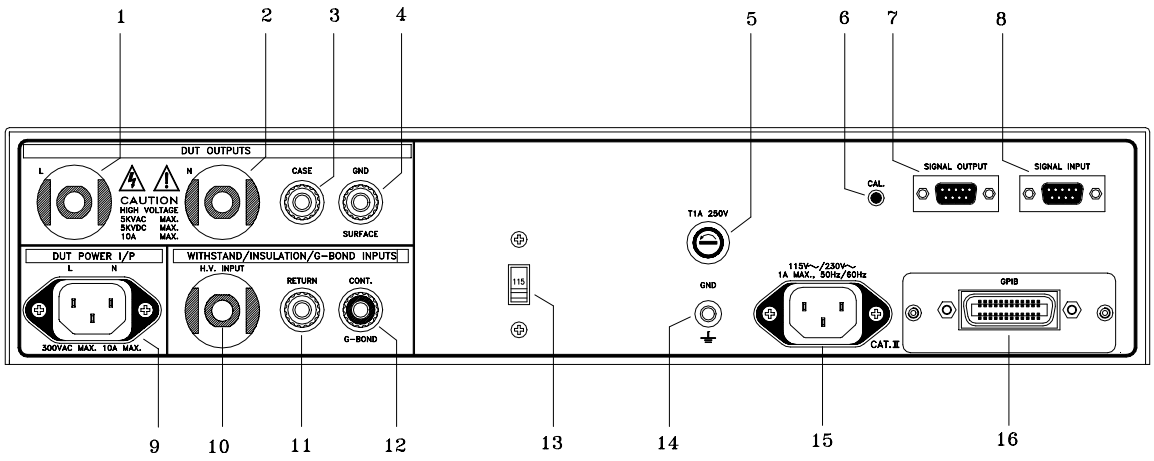
10. **H.V. INPUT TERMINAL:** This is the High Voltage Input to the switch matrix, which allows you to connect the High Voltage Output of either a Dielectric Withstand Tester or an Insulation Resistance Tester to the DUT input power circuit.

11. **RETURN:** This is the Return terminal input connection for the AR safety tester. This connector allows you to connect the return lead of the Dielectric Withstand Tester or the Insulation Resistance Tester through the switch matrix to the DUT.

12. **CONT./G-BOND:** This is the continuity input to the switch matrix from the Ground Bond Tester. This terminal is connected to the Ground Lead of the DUT to perform a Ground Bond Test through the switch matrix.

13. **INPUT POWER SWITCH:** Line voltage selection is set by the position of this switch. In the down position it is set for 115 volt operation, in the up position it is set for 230 volt operation.

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



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

16. GPIB: Standard connector for interconnection to the GPIB interface. Optional RS-232 interface can be substituted for this interface.

INSTALLATION

Introduction

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

Unpacking and Inspection

Your instrument was shipped in a custom foam insulated container that complies with ASTM D4169-92a Assurance Level II Distribution Cycle 13 Performance Test Sequence.

If the shipping carton is damaged, inspect the contents for visible damage such as dents, scratches or broken meters. If the instrument is damaged, notify the carrier and the Associated Research customer support department immediately. Please save the shipping carton and packing material for the carriers inspection. Our customer support department will assist you in the repair or replacement of your instrument. Please do not return your product without first notifying us and receiving an RMA (return material authorization) number.

PREPARATION FOR USE

Power Requirements and Line Voltage Selection

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. Please check the rear panel to be sure the proper switch setting is selected for your line voltage requirements before turning your instrument on.

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.

NOTE: For operation at 115 and 230 Volts AC use a 1A slow-blow fuse.

Power Cable

WARNING **BEFORE CONNECTING POWER TO THIS INSTRUMENT, THE PROTECTIVE GROUND (EARTH) TERMINALS OF THIS INSTRUMENT MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR OF THE LINE (MAINS) POWER CORD. THE MAIN PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET (RECEPTACLE) PROVIDED WITH A PROTECTIVE GROUND (EARTH) CONTACT. THIS PROTECTIVE GROUND (EARTH) MUST NOT BE DEFEATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).**

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

Operating Environment
This instrument may be operated in temperatures from 32° - 104° F (0° - 40° C).
Relative humidity of 0 to 80%.
Altitude up to 15,000 feet (4,600 meters).

STORAGE AND SHIPMENT

Environment
This instrument may be stored or shipped in environments with the following limits:
Temperature..... -40° to +75°C
Altitude..... 7,620 meters (25,000 feet)
The instrument should also be protected against temperature extremes which may cause condensation within the instrument.

Packaging
Original Packaging: Please retain all original packaging materials that you originally received. If you are returning your instrument to us for servicing please repackage the instrument in its original container. Contact our customer support department (1-800-858-8378) for a RMA (return material authorization) number. Please enclose the instrument with all options, accessories and test leads. Indicate the nature of the problem or type of service needed. Also, please mark the container "FRAGILE" to insure proper handling. Upon receipt, your instrument will be issued an AR service number. Please refer to this number in all correspondence.

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

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

Field Installation Of Options
There are no field installable options on this instrument.

QUICK START

This quick start guide assumes the operator has some familiarity with automated Run testing and desires to use the **"default"** settings on the instrument. The default settings shown will remain in memory unless you choose to override them with your own test program. The instrument default settings are as follows:

Master Defaults for all memory locations

Voltage	Volt-HI = 300.0V	Volt-LO = 0.0V
Current	Amp-HI = 10.00A	Amp-LO = 0.00A
Power	Watt-HI = 3000W	Watt-LO = 0W
PF (Power Factor W/VA)	PF-HI = 1.000	PF-LO = 0.000
Leakage	Leak-HI = 10.00mA	Leak-LO = 0.00mA
Timer	Delay = .2 Sec	Dwell = 1.0 Sec
	Connect = OFF	
Setup	Remote = OFF	Address = 9
	Volume = 5	Contrast = 5
	Fail Stop = ON	Single Step = OFF

Quick Start Instructions Cont.:

1. Unpack the instrument from its special shipping container. Be sure to save all packaging materials in case you need to return it to the factory for service.

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

   WARNING

3. Check to be sure the correct input line voltage has been selected on the rear panel. Either 115 volts AC or 230 volts AC. Connect the power input plug into its socket on the rear panel of the instrument. Connect the male end of the plug to the outlet receptacle. Please be sure that the safety ground on the power line cord is not defeated and that you are connecting to a grounded power source.

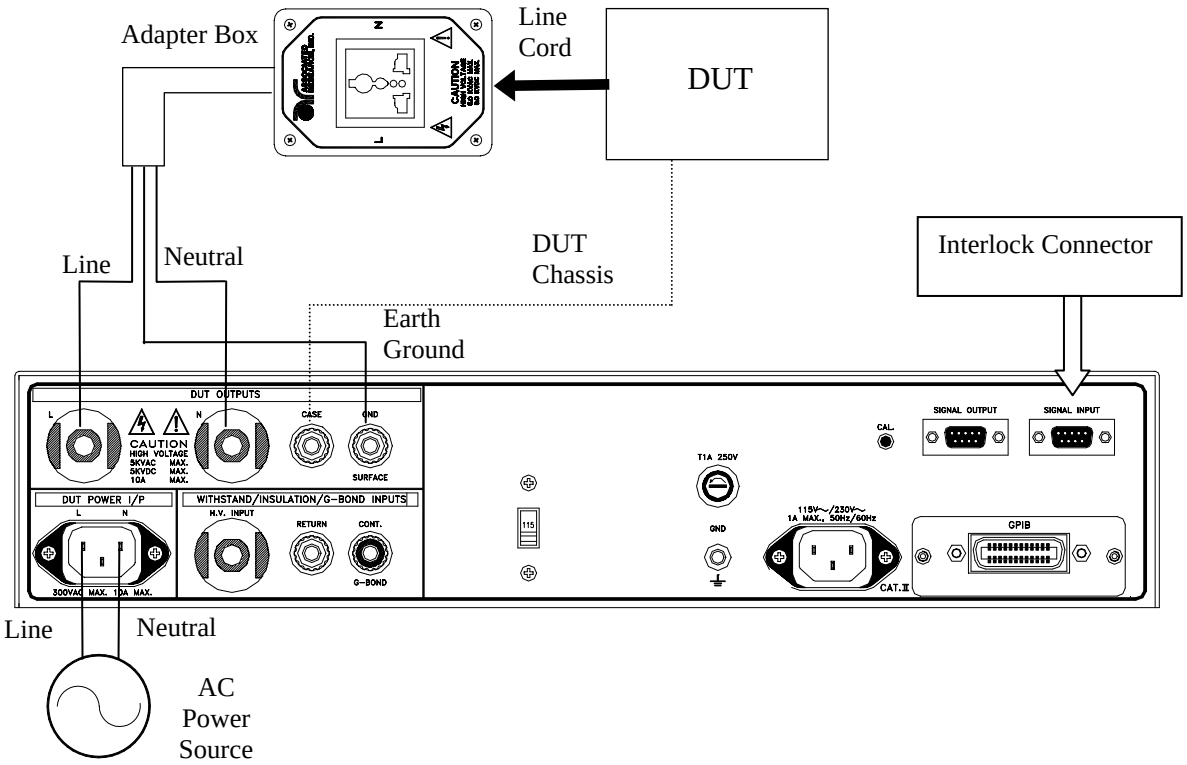
   CAUTION

4. Connect the adapter box to the device under test (DUT) or test fixture. Connect the DUT power input to a AC Power Source that will provide line power to the DUT. The Power Source must be an unbalanced single phase supply. This means that there is only one HOT or LINE conductor and the other conductor of the power source must be at low voltage reference potential. Be sure that the hot lead of the power source is connected to the L (line) terminal and the reference or low voltage lead is connected to the N (neutral) terminal.

   Connect the adapter box to the appropriate terminal of the DUT outputs on the rear panel. Plug the three prong line cord of the DUT into the adapter box. Be sure to connect the safety ground to a suitable known good ground before energizing this instrument.

5. Connect the Interlock Connector (P/N 38075) to the 9-pin D subminiature SIGNAL INPUT connector on the rear panel of the instrument to disable the remote interlock feature.

   The DUT is now connected properly to perform the Run test that is configured into memory.



6. Turn on the POWER switch located on the lower left hand side of the front panel. Upon powering up the instrument, all LEDs on the front panel will be lit for visual inspection. If the instrument default parameters are not acceptable, refer to the OPERATION section for detailed instructions on setting up testing parameters.

WARNING DO NOT TOUCH THE DEVICE UNDER TEST ONCE THE TEST HAS BEEN STARTED.

7. Please check your connections to be sure they are making good contact. Clear the area of any debris that may create a hazardous situation and ask any unnecessary personnel to leave the area. To initiate the test press the GREEN test button on the front panel. This is a momentary button and does not need to be held in the pressed position during the test. The instrument will then initiate a test using the parameters of the selected memory location. If a failure occurs you will hear a continuous audible alarm and see the red failure indicator light up. To stop the alarm you must press the RED button marked "RESET." This will silence the alarm, clear the red fail light, and reset the instrument to begin another test. The instrument will provide a memory of the test results on the display that will remain until the next test is initiated. Pressing the RESET button after a failure, will prepare the instrument for the next test but will not clear the display until the next test is started or another reset is executed. The RESET button may also be used to quickly ABORT a test and cut off the power to the DUT. When a Run test is being preformed, a RED TEST indicator located in the lower right side of the front panel will illuminate until the Run test is finished. If the DUT PASSED the test, you will hear a brief BEEP indicating the DUT passed and that the test is complete.

1. Instrument Connections

1.1 DUT Power

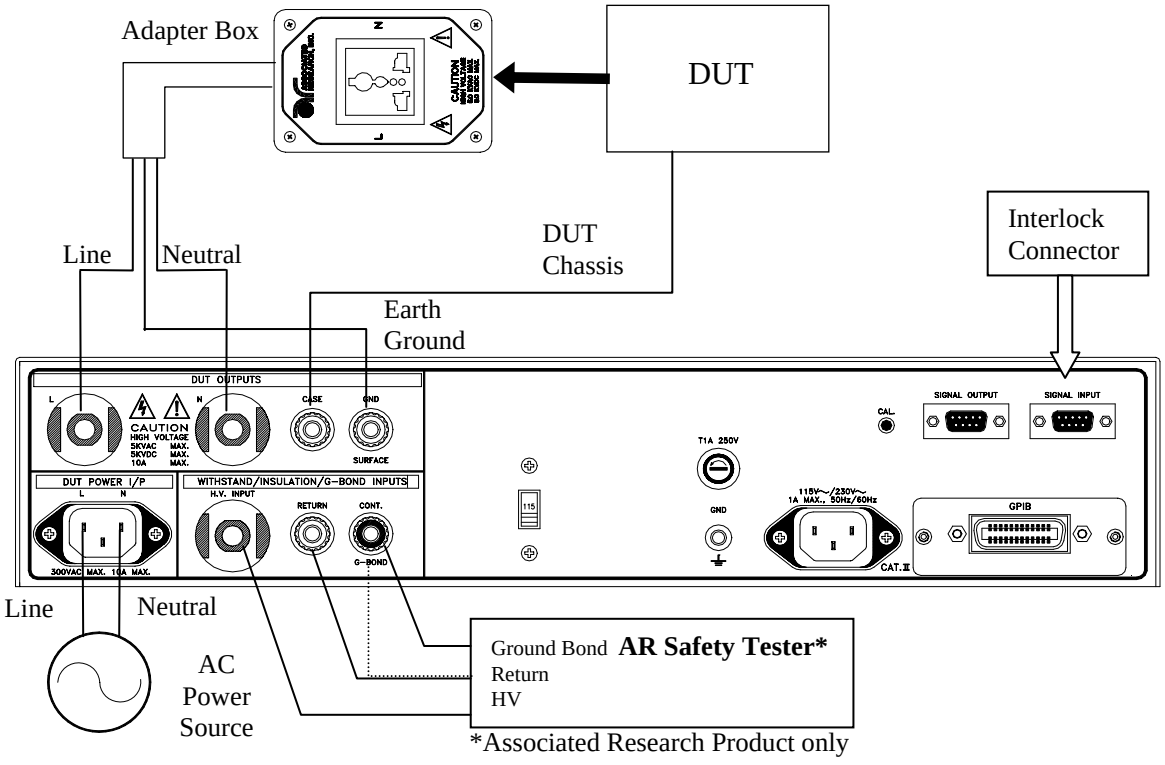
WARNING

The Power Source to the DUT inputs must be an unbalanced single phase supply. This means that there is only one HOT or LINE conductor and the other conductor of the power source must be at a low voltage reference potential. This low voltage reference does not need to be physically earth grounded but should not carry any large voltage potential. The 220 - 240V US style line power **IS NOT** suitable to be connect to the DUT inputs. This style of power distribution is a balanced type with two HOT or LINE conductors. **DO NOT** connect a line conductor to the N or Neutral terminal of the DUT inputs. This condition can be very dangerous to the RUNCHEK user.

Be sure to connect the appropriate test leads to the device under test (DUT) or test fixture, as shown in the diagram below. Please be sure to use a Power Source, which has only one line conductor that is of the balanced type as stated previously. Be sure to connect the safety ground terminal (on the rear panel) to a suitable known good ground before energizing this instrument.

1.2 Basic Integrated System Connections

The following illustration generically shows how the RUNCHEK may be connected with other Associated Research safety compliance testers.



1.2.1 Special Connections for <u>All</u> Integrated Systems

If a Dielectric Withstand test or Insulation Resistance test is needed but the Continuity or Ground Bond tests are not needed and you wish to run either test without using a separate CASE test lead, then the Return lead of the safety tester must be connected to the CONT./G-BOND input to perform a proper test through the switch matrix as shown by the dotted line.

The line at the CASE output illustrates the connection for an EARTH LEAKAGE TEST required by the agencies while the Return of the ARI Safety Tester is connected to the RETURN of the 905D and Ground Bond is connected to the G-BOND. If the DUT has an ungrounded (2 wires) line cord, then the chassis of the DUT must be connected to the CASE as shown above. The CASE connection is also used when performing the Continuity or Ground Bond test from the ARI Safety Tester.

1.2.2 PLC Control Cables

The correct 9-pin D-subminiature control cable must be connected between the PLC remote control I/O connectors of the two (or three, depending on the system) instruments. Many different cables are available from Associated Research (refer to section 1.3 for specific system cables). It is possible to invert some of the cable connections so be careful to connect it properly (NOTE: if the cable is connected in reverse no damage will occur). A special color-coding scheme has been derived to help insure proper connections of the PLC cables. Red is used for Hypot connections, blue is used for Hyamp connections and yellow is used for RUNCHEK connections. Be sure that the PLC Remote function of the 905D is set to ON so that the pass signal from the safety tester will activate the 905D.

1.2.3 Remote Interlock

Standard PLC cables for 905D integrated systems have the Test, Interlock and Pass signals wired in parallel. The reason that the cable is configured this way is to provide a reset to the 905D from the safety tester. Anytime that an Associated Research PLC cable is plugged into the 905D, there must be a pass signal from the safety tester in order for the 905D to perform a test. If you wish to start a test from the 905D (with the PLC Remote set to OFF) and still leave the PLC remote cable connected to the instruments, the safety tester must have PASSED its last test in order for the 905D to perform a stand-alone test. For stand-alone operation of the 905D, it is necessary (if no PLC cable is connected to the remote input) to disable the remote interlock function by plugging the 38075 interlock connector into the 905D's remote input.

To use an external interlock device while the 905D is connected to an integrated system with a PLC cable, it is necessary to modify the PLC cable to accept the interlock device.

- **PLC cable modification to accept an interlock device:** Remove the two screws holding the clamshell around the 9-pin female d-sub that connects to the remote input of the 905D (labeled with a yellow wire marker). Unsolder and remove the connection between pins 3 and 4. Solder a stranded 22-gauge wire to both pins 3 and 4 and route the wires parallel to existing gray cable. Replace the clamshell be careful not to crush the new wires. These two wires will now provide the connection points for your interlock device.

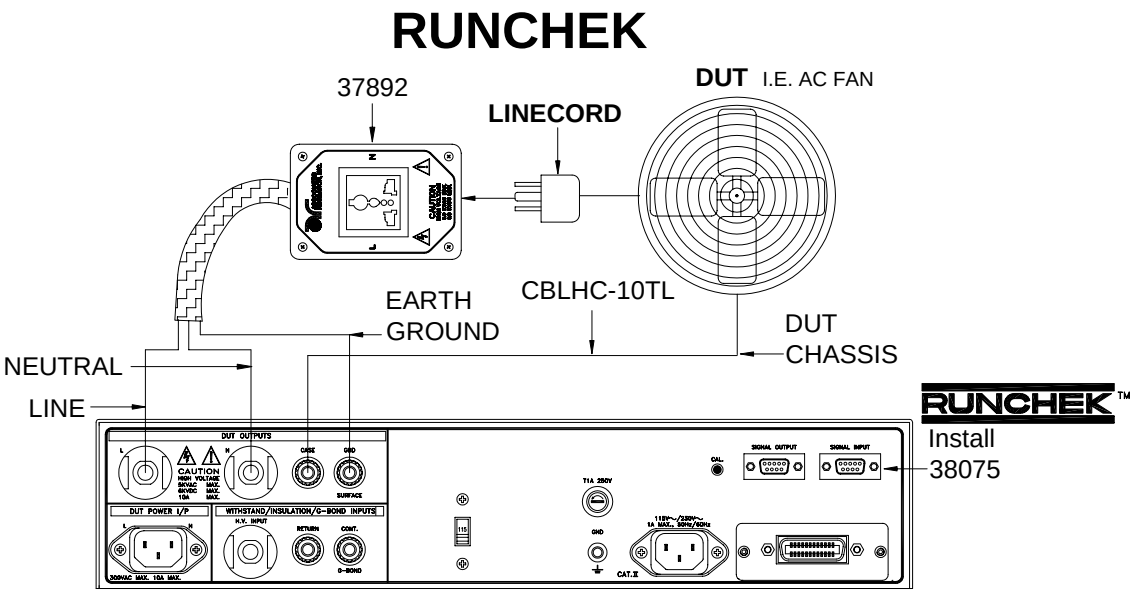
1.3 Specific Integrated Systems Connections

For specific integrated system connections and cable charts, please refer to the specific sections listed in the table:

Integrated System	Section Number
RUNCHEK Stand-Alone	1.3.1
RUNCHEK with QUADCHEK II or HypotULRA II	1.3.2
RUNCHEK with HypotPLUS II	1.3.3
RUNCHEK with HYPOT II	1.3.4
System 3000, RUNCHEK with HYPOT II and HYAMP jr.	1.3.5
System 5000, RUNCHEK with HypotPLUS II and HYAMP II	1.3.6
RUNCHEK Integrated with HYPOT III and HypotULTRA III	1.3.7
RUNCHEK Integrated with HYPOT III and HYAMP III, 3130	1.3.8

1.3.1 905D Only

The following illustration and cable listing should be used to configure the 905D for stand-alone operation:



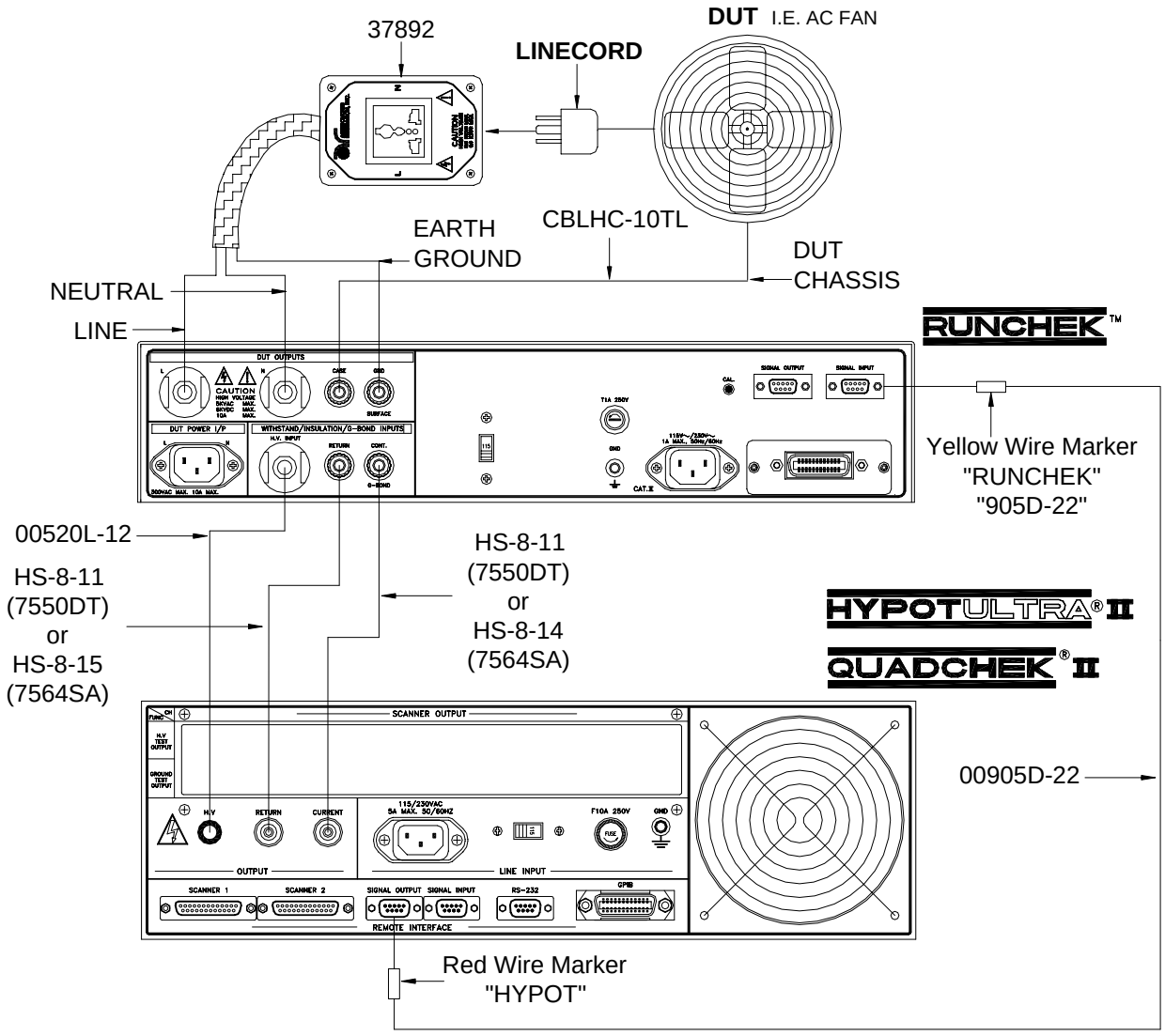
- For stand-alone operation, it is necessary to disable the remote interlock function by plugging the 38075-interlock connector into the 905D's remote input. If no interlock device is plugged into this connector, the instrument will not function.

905D Stand-Alone System	
Description	A.R. Part number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
Interlock Connector	38075

1.3.2 905D Integrated with QUADCHEK II or HypotULRA II

The following illustration and cable listing should be used to configure the 905D for integrated operation with HypotULRA II or QUADCHEK II:

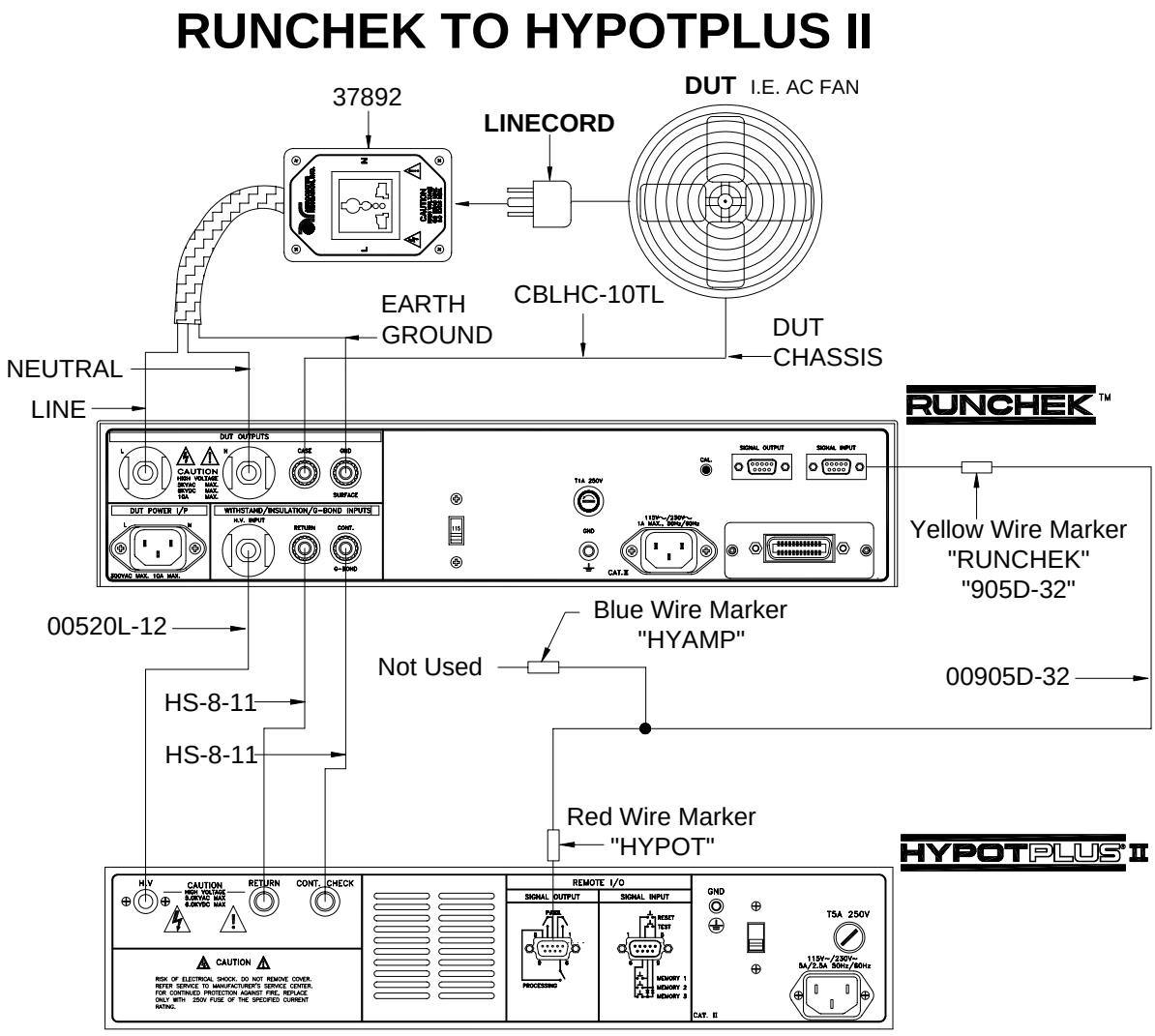
RUNCHEK TO QUADCHEK II OR HYPOTULTRA II



905D Integrated with HypotUltra or Quadchek	
Description	A.R. Part Number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
High Voltage Cable Assembly	00520L-12
Cable Assembly Return	HS-8-11(Qty.2)
Cable Assembly Ground Bond Output	HS-8-14
Cable Assembly Ground Bond Return	HS-8-15
Cable Assembly R/P Interface	00905D-22

1.3.3 905D Integrated with HypotPLUS II

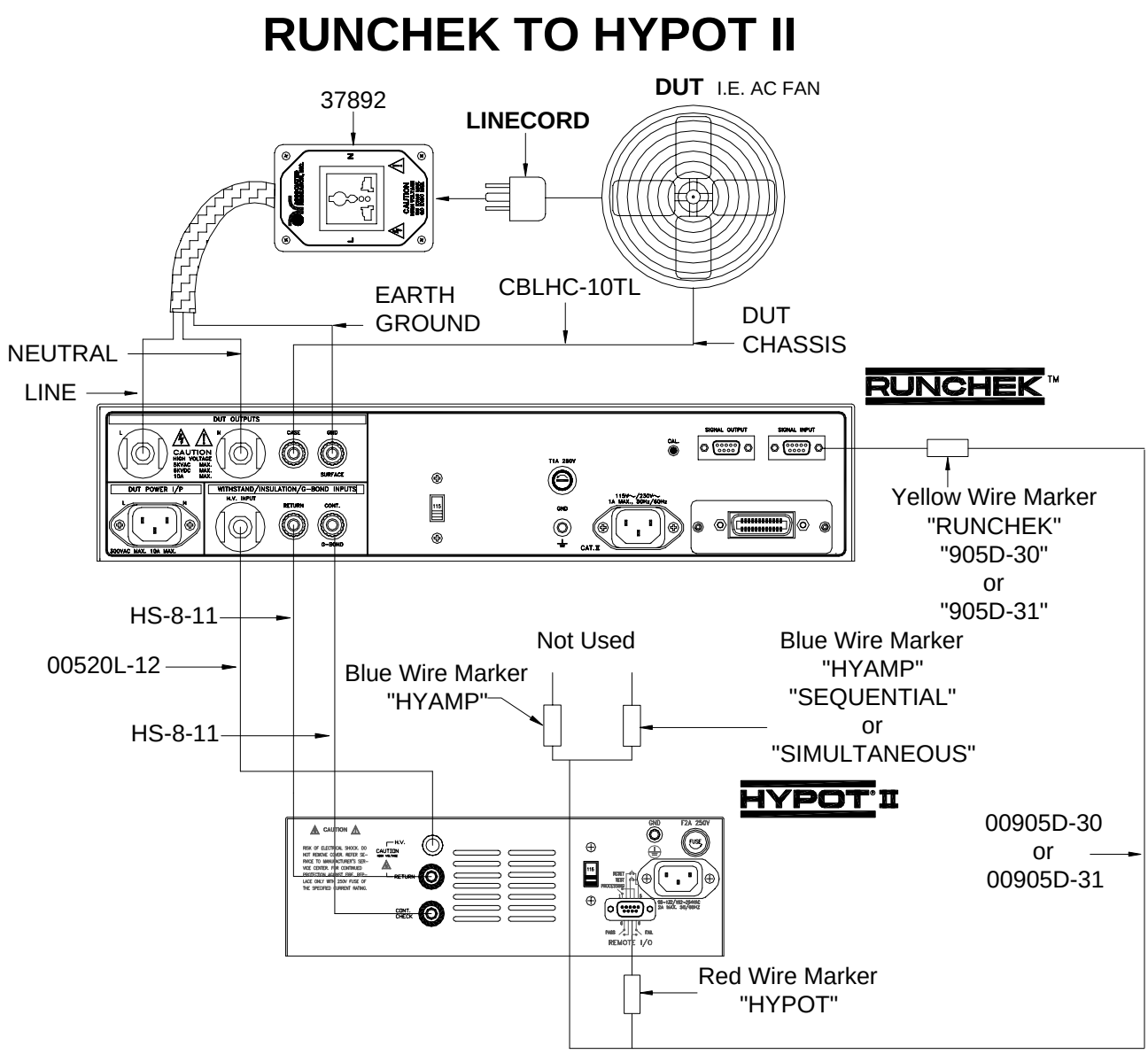
The following illustration and cable listing should be used to configure the 905D for integrated operation with HypotPLUS II:



905D Integrated with HypotPLUS II	
Description	A.R. Part Number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
High Voltage Cable Assembly	00520L-12
Cable Assembly Return	HS-8-11(Qty.2)
Cable Assembly R/P Interface Common	00905D-32

1.3.4 905D Integrated with HYPOT II

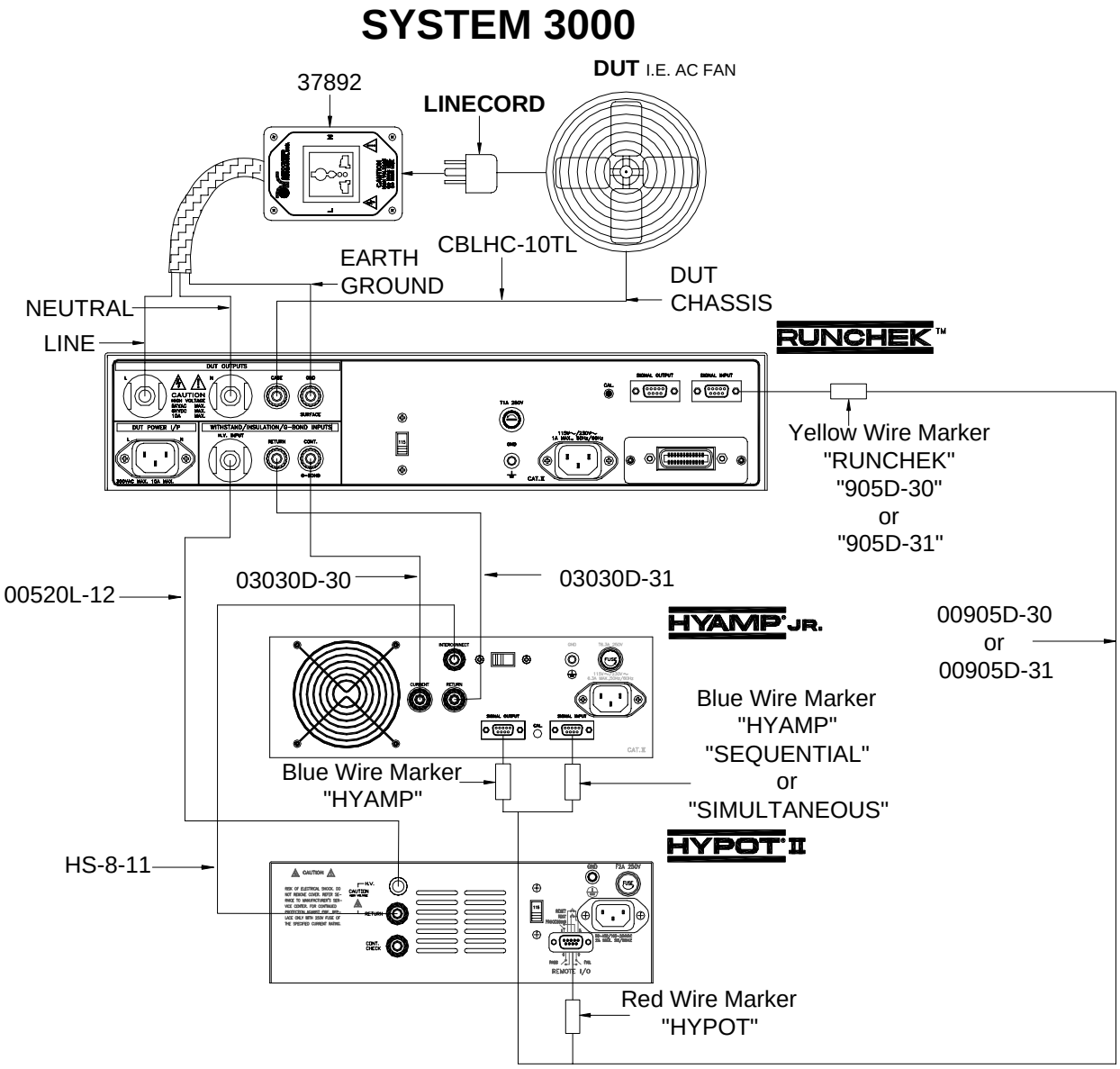
The following illustration and cable listing should be used to configure the 905D for integrat`ed operation with HYPOT II:



905D Integrated with HYPOT II	
Description	A.R. Part Number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
High Voltage Cable Assembly	00520L-12
Cable Assembly Return	HS-8-11(Qty.2)
Cable Assembly R/P Interface Sequential	00905D-30
Cable Assembly R/P Interface Simultaneous	00905D-31

1.3.5 System 3000, 905D Integrated with HYPOT II and HYAMP jr.

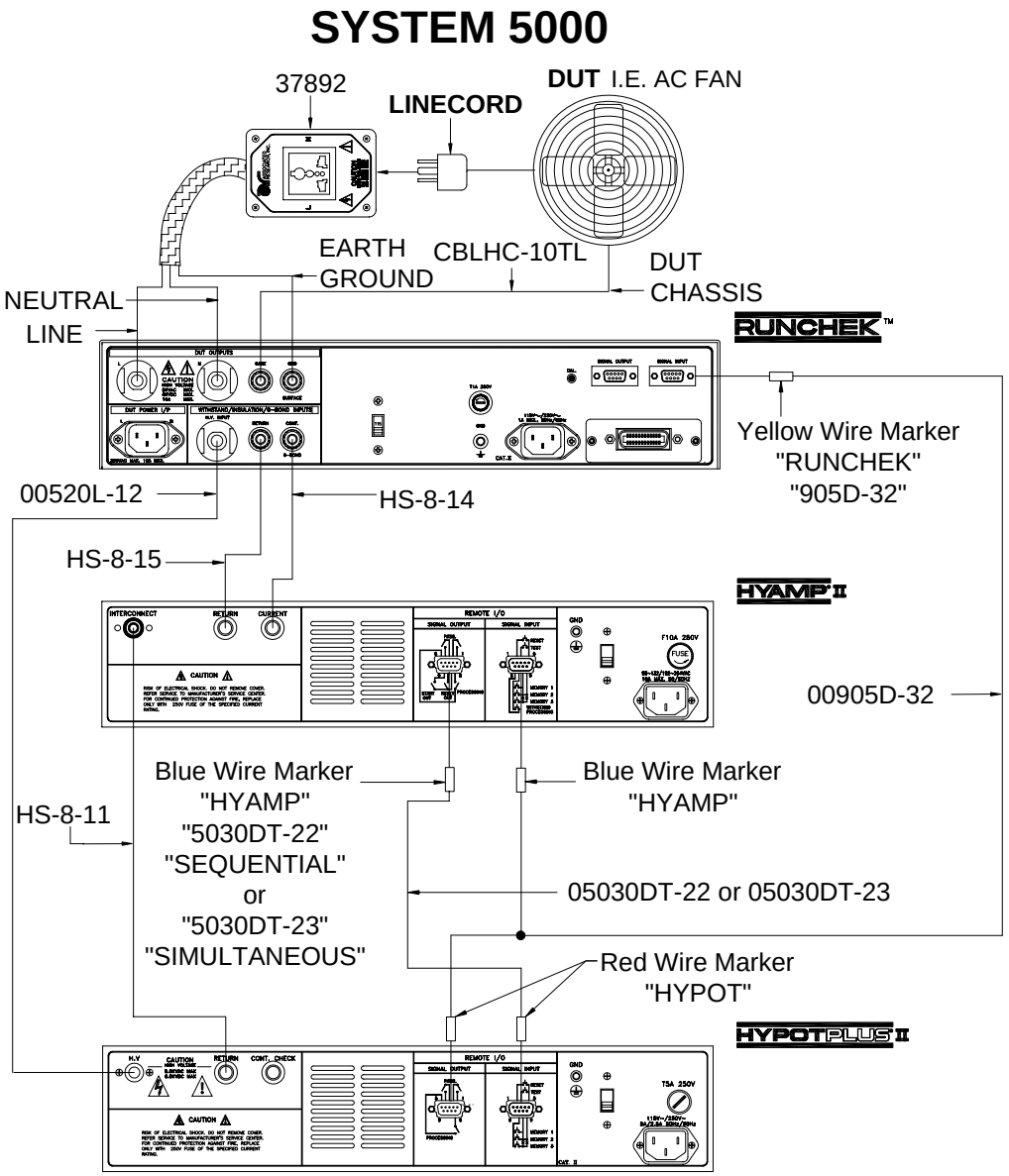
The following illustration and cable listing should be used to configure the 905D for integrated operation with HYPOT II and HYAMP jr.:



System 3000, 905D Integrated with HYPOT II and HYAMP jr.	
Description	A.R. Part Number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
Cable Assembly Return	HS-8-11
High Voltage Cable Assembly	00520L-12
Cable Assembly Ground Bond Output	03030D-30
Cable Assembly Ground Bond Output	03030D-31
Cable Assembly R/P Interface Sequential	00905D-30
Cable Assembly R/P Interface Simultaneous	00905D-31

1.3.6 System 5000, 905D Integrated with HypotPLUS II and HYAMP II .

The following illustration and cable listing should be used to configure the 905D for integrated operation with HYPOT II and HYAMP jr.:

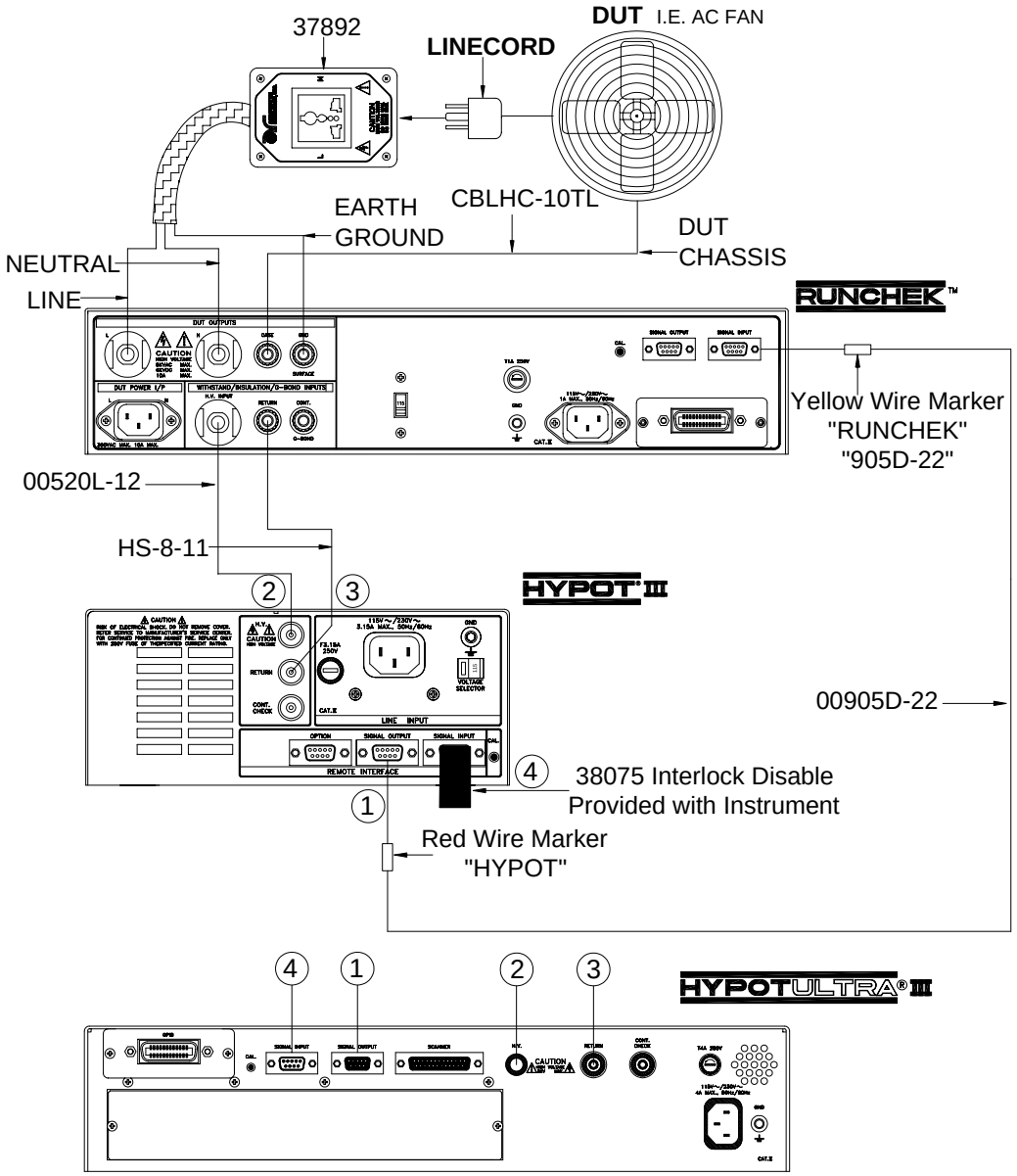


System 5000, 905D Integrated with HypotPLUS II and HYAMP II	
Description	A.R. Part Number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
High Voltage Cable Assembly	00520L-12
Cable Assembly Return	HS-8-11
Cable Assembly Ground Bond Output	HS-8-14
Cable Assembly Ground Bond Return	HS-8-15
Cable Assembly R/P Interface Common	00905D-32
Cable Assembly R/P Interface Sequential	05030DT-22
Cable Assembly R/P Interface Simultaneous	05030DT-23

1.3.7 905D Integrated with Hypot III and HypotULTRA III

The following illustration and cable listing should be used to configure the 905D for integrated operation with HYPOT III and HypotULTRA III:

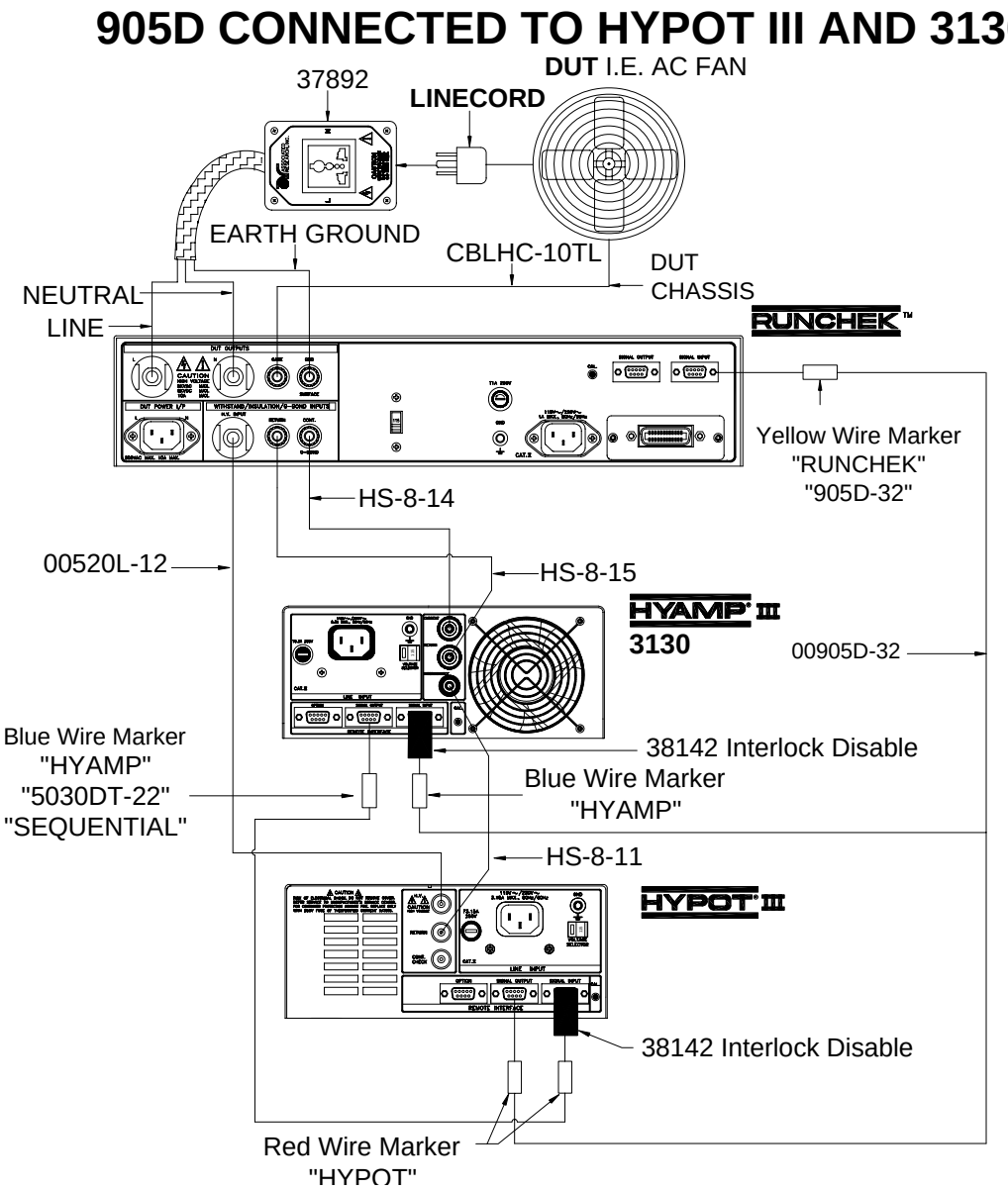
RUNCHEK TO HYPOT III OR HYPOTULTRA III



905D Integrated with Hypot III or HypotULTRA III	
Description	A.R. Part Number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
High Voltage Cable Assembly	00520L-12
Cable Assembly Return	HS-8-11
Cable Assembly R/P Interface Common	00905D-22

1.3.8 905D Integrated with Hypot III and Hyamp III, 3130 .

The following illustration and cable listing should be used to configure the 905D for integrated operation with HYPOT III and HYAMP III, 3130:



905D Integrated with Hypot III and HYAMP III, 3130	
Description	A.R. Part Number
Adapter Box	37892(C)
10 ft. High Current Test Lead	CBLHC-10TL
High Voltage Cable Assembly	00520L-12
Cable Assembly Return	HS-8-11
Cable Assembly Ground Bond Output	HS-8-14
Cable Assembly Ground Bond Return	HS-8-15
Cable Assembly R/P Interface Common	00905D-32
Cable Assembly R/P Interface Sequential	05030DT-22
Interlock Disable	38142 (Qty. 2)

2. General Setup Procedures

2.1 Password Setting and Memory Lock

Press and hold the SETUP key while powering up the instrument, the program will select the Lock Configuration menu. The display will show:

P.W.# = 0 0 - 9999 0 = Disable	or	P.W.# = XXXX 0 - 9999 0 = Disable

The Password can be any four (4) digit number. If the Password is set to 0, the keyboard lock out will be selected by the LOCK key on the front panel without a Password. The Password default is preset to 0 at the factory. The password will be saved automatically when the ENTER key is pressed and the instrument will advance to the memory lock screen. The display will show:

Memory Lock = OFF Enter to Select	or	Memory Lock = ON Enter to Select

Use the enter key to toggle between the Memory Lock = ON and Memory Lock = OFF. Press the Exit key to save the selection and the instrument will return to its normal operating mode. If the Memory Lock function is set to ON, the Memory selection keys will be disabled. If the Memory Lock is set to OFF, the Memory selection keys will be enabled. Different memories can be recalled but the test parameters or steps cannot be changed. The Memory Lock default is preset to OFF at the factory.

2.2 Key Lock

Press the LOCK key. If the Password is enabled, the display will show:

P.W.# =

Use the Numeric Keys to enter the password and then press the ENTER key. The program will switch the Key Lock function from LOCK to UNLOCK or UNLOCK to LOCK mode and advance the program to operation mode automatically. If the wrong password is entered, the program will give a warning beep and the display will momentarily show ERROR and then return to the previous screen to allow a new password entry.

P.W.# =ERROR

Press the EXIT key to return to the operation mode.
If the Password is Disabled (Password is set 0), the display will show:

Lock =ON ENTER to Select	or	Lock =OFF ENTER to Select

Use the ENTER key to select the Key Lock mode, then press the EXIT key. The program will switch the Key Lock function from LOCK to UNLOCK or UNLOCK to LOCK mode and advance the program to the operation mode automatically.

If the Memory Lock function is set to ON, the Memory selection keys will be disabled. If the Memory Lock is set to OFF, the Memory selection keys will be enabled . Different memories can be recalled but the test parameters or steps cannot be changed. The Memory Lock default is preset to OFF at the factory. Please refer to the Password Setting and Memory Lock section, to set the Memory Lock mode.

3. Test Parameter Setup Procedures

Before going to setup the Test Parameters, make sure that the key lock function is set to Unlock mode, then follow this procedures to setup the Test Parameters.

3.1 Voltage Trip points, Volt-HI and Volt-LO

The Volt-HI trip limit is used to program the maximum allowable voltage at the DUT Power Input Terminal before failure. The Volt-LO trip limit is used to program the minimum allowable voltage at the DUT Power Input Terminal before failure.
Press the VOLTAGE key once to display the Volt-HI screen or press it twice to display the Volt-LO screen:

Volt-HI= XXX.X V Range: 0.0-300.0	Volt-LO= XXX.X V Range: 0.0-300.0

Use the Numeric Keys to enter the Volt-HI trip value, and then press the ENTER key. The program will store this value and advance to the Volt-LO Trip parameter automatically. Use the Numeric Keys to enter the Volt-LO trip value and then press Enter key.

3.2 Current Trip points, Amp-HI and Amp-LO

The Amp-HI trip limit is used to program the maximum allowable current flow through the DUT before failure. The Amp-LO trip limit is used to program the minimum allowable current through the DUT before failure.
Press the CURRENT key once to display the Amp-HI screen or press it twice to display the Amp-LO screen:

Amp-HI =XX.XX A Range: 0.00-10.00	Amp-LO =XX.XX A Range : 0.00-10.00

Use the Numeric Keys to enter the Amp-HI trip value, and then press the ENTER key. The program will store this value and advance to the Amp-LO Trip parameter automatically. Use the Numeric Keys to enter the Amp-LO trip value and then press

Enter key.

3.3 Power Trip points, Watt-HI and Watt-LO

The Watt-HI trip limit is used to program the maximum allowable Power being used by the DUT before failure. The Watt-LO trip limit is used to program the minimum allowable Power being used by the DUT before failure.
Press the Power key once to display the Watt-HI screen or press it twice to display the Watt-LO screen:

Watt-HI =XXXX W Range :0-3000	Watt-LO =XXXX W Range: 0-3000

Use the Numeric Keys to enter the Watt-HI trip value, and then press the ENTER key. The program will store this value and advance to the Watt-LO Trip parameter automatically. Use the Numeric Keys to enter the Watt-LO trip value and then press Enter key.

3.4 PF (Power Factor) Trip points, PF-HI and PF-LO

- NOTE: 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.

The PF-HI trip limit is used to program the maximum allowable Power Factor of the DUT before failure. The PF-LO trip limit is used to program the minimum allowable power factor of the DUT before failure.
Press the PF key once to display the PF-HI screen or press it twice to display the PF-LO screen:

PF-HI =1.000 W Range: 0-1.000	PF-LO =1.000 W Range: 0-1.000

Use the Numeric Keys to enter the PF-HI trip value, and then press the ENTER key. The program will store this value and advance to the PF-LO Trip parameter automatically. Use the Numeric Keys to enter the PF-LO trip value and then press Enter key.

3.5 Leakage Trip points, Leak-HI and Leak-LO

- NOTE: Leakage in the 905D refers to the amount of current, which flows from the enclosure (case) of the DUT, to the neutral side of the line input.

The Leak-HI trip limit is used to program the maximum allowable earth leakage current of the DUT before failure. The Leak HI trip limit also controls the earth leakage configuration as shown in FIG.1.

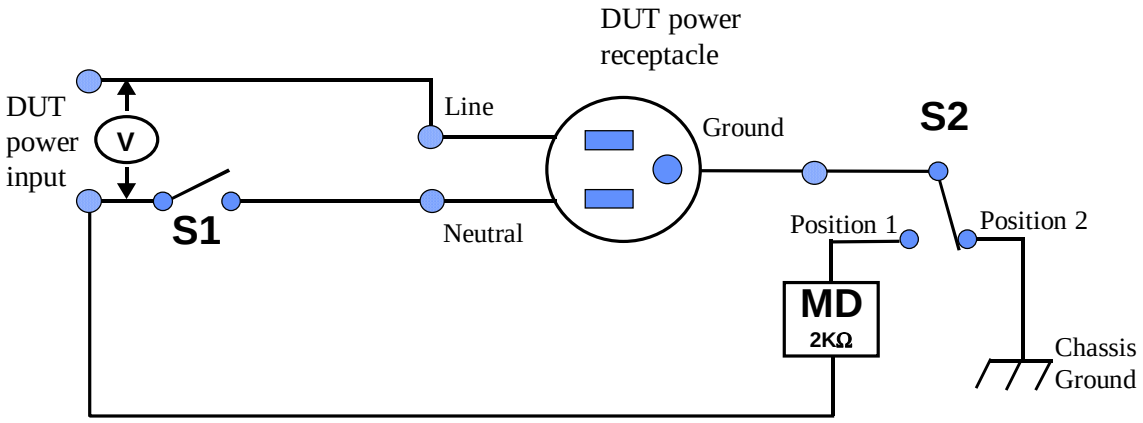


Figure 1

When the Leak-HI trip limit is set to 0, **S2** is placed in position 2 which disables the earth leakage test and connects the chassis ground of the 905D to the ground of the DUT. The Leak-LO trip limit is used to program the minimum allowable earth leakage current of the DUT before failure.

Press the Leakage key once to display the LEAK-HI screen or press it twice to display the LEAK-LO screen:

Leak-HI= 10.00mA 0.00-10.00 0=OFF	Leak-LO= 0.00 mA Range: 0.00-10.00

Use the Numeric Keys to enter the Leak-HI trip value, and then press the ENTER key. The program will store this value and advance to the Leak-LO Trip parameter automatically. Use the Numeric Keys to enter the Leak-LO trip value and then press Enter key.

3.6 Timer, Delay Time and Dwell Time

The Delay Time setting is used to program the amount of time that may be needed to delay the HI and LO limit detectors until the DUT has reached proper operating conditions. The over current judgment is activated at the end of the Delay Time. The instrument will not indicate that the over current limit has been exceeded until the Delay Time period has expired. The Dwell time setting is used to program the duration that the DUT will remain powered.

Press the Timer key once to display the Delay-T screen or press it twice to display the Dwell-T screen:

Delay-T = 0.2s Range: 0.2-999.9	Dwell-T = 1.0 s 0.1-999.9 0=OFF

Use the Numeric Keys to enter the Delay time value, and then press the ENTER key. The program will store this value and advance to the Dwell-T parameter automatically. Use the Numeric Keys to enter the Dwell time value and then press the Enter key.

- NOTE: When the Dwell timer is set to 0, the instrument will operate in a continuous ON mode when the test button is depressed and released.

3.7 Memory Programs, Store and Recall

RUNCHEK is equipped with a total of 10 memory programs numbered 0 to 9. This makes it possible to store all the various test parameters required, and quickly recall them for each of the different products that need to be tested. Program memories can also be accessed through the remote control (PLC) port so that a manufacturer can quickly toggle through the various programs without going into the setup menu.

1. Storage of Memory Program

Once you have entered all the test parameters such as Volt-HI, Volt-LO, Watt-HI, Watt-LO, etc., as outlined in the above procedures, you may store your setup into one of the 10 memories. The display will show:

Set 1.0s M_ 300.0V 10.00A	or
Set 10.00mA M_ 3000W 1.000PF	

Select one of the memory positions 0 to 9 to store the data that was just entered. This is done by pressing and holding a Numeric key in for approx., 2 seconds. RUNCHEK will respond with two beep tones, one short tone when you select the key and one longer tone when the data is stored into that memory position. Please select the correct memory position as you may inadvertently overwrite a previously stored program.

2. Recall of a Memory Program

Please press the Numeric key of the Memory Program that you wish to recall. The instrument will respond with a short beep tone and the display will indicate the test parameters stored in that program. To start a test, press the “TEST” key.

3.8 Connect memory mode.

All 10 memory programs can be connected sequentially to the next consecutive test/memory number. Last memory (number 9) can not be connected to the first memory (number 0).

If Connect is set to ON, the next memory in the sequence will be executed. If Connect is set to OFF, the test sequence will stop at this memory.

Press the TIMER key three times, the display will show:

Connect =ON ENTER to Select	or
Connect =OFF ENTER to Select	

Use the ENTER key to select the Connect parameter, then press the EXIT key to exit from the Connect selection to the operation mode or press the TIMER key to advance again to the Delay/Dwell setting.

If memory Connect is set to ON, the display will show:

Set 1.0s M_ _ 300.0V 10.00A	or	Set 10.00mA M_ _ 3000W 1.000PF

Second underbar character on the display just after the memory symbol indicates that the next memory after the active memory will run immediately when the test of the active memory is completed.

The Program will not store the selection of Connect memory mode automatically. To store selected parameter press and hold a Numeric key like describe in previous paragraph (Memory Programs, Store and Recall). Then display will show:

Set 1.0s Mx_ 300.0V 10.00A	or	Set 10.00mA Mx_ 3000W 1.000PF

The underbar character indicates that the Connect memory mode is set to ON for the Memory number X. If the Connect memory mode is set to OFF, the display will show:

Set 1.0s Mx 300.0V 10.00A	or	Set 10.00mA Mx 3000W 1.000PF

4. System Parameter Setup

Use the SETUP key to progress through the menu of System Parameters. Successive key presses will advance the menu forward. The sequential forward menu items are PLC Remote, Contrast, Volume, and Address.

The setting of system parameters affect the operating conditions of the instrument and are separate from the functional settings. The system settings are also global and are not specific to any memory location.

4.1 PLC Remote

Press the SETUP key to advance to the Remote parameter. The display will show:

PLC Remote =ON ENTER to Select	or	PLC Remote =OFF ENTER to Select

Use the ENTER key to select the PLC Remote Control mode.

After selecting PLC Remote mode, press the SETUP key to advance to the contrast setting, or press the EXIT key to exit from the PLC Remote selection to the operation mode. The instrument will store the selection of Remote automatically.

If the PLC Remote Control is set to ON, the test function will be controlled by the Remote Control via the remote connectors located on the rear panel. The TEST button on the front panel is disabled but the RESET button is still enabled.

The remote Memory Program recall functions can be performed only when the PLC Remote is set ON. In addition, when the PLC remote is set to ON the remote TEST signal input is active while in the Bus Remote Mode.

If the PLC Remote Control is set to OFF, the operation of the instrument will be controlled by the local TEST and RESET buttons on the front panel.

4.2 LCD Contrast

Press the SETUP key to advance the menu to the Contrast parameter. The display will show:

```
Contrast = X
Range1-9    9=High
```

Use the numeric keys to enter the LCD Contrast level. The program will change the LCD Contrast immediately when the key is pressed, so the setting can be viewed. Change the LCD Contrast again, press the SETUP, or ENTER key to advance to the Volume setting, or press the EXIT key to exit from the LCD Contrast setting to the operation mode. The program will store the Contrast setting automatically.

The LCD Contrast range is from 1 - 9, with nine different levels. Level 1 is the lowest contrast and level 9 is the highest contrast.

4.3 Audible Alarm Volume

Press the SETUP key to advance the menu to the Volume parameter. The display will show:

```
Volume = X
0-9 0=OFF  9=High
```

The Audible Alarm Volume range is from 0 - 9, a total of 10 levels. Level 0 is used to disable the Audible Alarm. Level 1 is the lowest volume and level 9 is the loudest.

Use the numeric keys to enter the Audible Alarm level. The program will provide a sample sound for checking immediately when the numeric key is pressed. Change the Volume again, press the SETUP, or ENTER key to forward to address setting if the GPIB interface card is installed on this instrument. If this instrument does not have the GPIB interface card, the program will advance to the PLC Remote selection program, or

press the EXIT key to exit from the Audible Alarm setting to the operation mode. The program will store the Volume setting automatically.

4.4 GPIB Address

If the GPIB interface card is not installed on this instrument, this setup program will not appear on the setup menu.

Press the SETUP key to advance the menu to the address parameter. The display will show:

Address = X Range : 0 - 30

Use the numeric keys to enter the GPIB Address number, then press the ENTER key. The program will store the address setting automatically and advance to the PLC Remote selection.

If the wrong address is entered, press the EXIT key to erase last input and return to previous address. Press the EXIT key second time to exit from the address setting to the operation mode or press the SETUP key to advance to the PLC Remote selection.

4.5 Fail to Stop/Continue.

Press the SETUP key to advance the menu to the Fail Stop parameter. The display will Show:

Fail Stop =ON ENTER to Select

or

Fail Stop =OFF ENTER to Select

Use the ENTER key to select the mode of Fail Stop.

After the selection of Fail Stop mode, press the SETUP key to advance to the Single Step selection program, or press the EXIT key to exit from the Fail Stop selection to the operation mode. The Program will store the selection of Fail Stop automatically.

This function is used when multiple memory have been connected. If the Fail Stop mode is set ON, the test process will stop at the memory that fails, or at the end of test process. When there are unfinished memories to be completed, pressing the TEST button will continue the test process at the next memory. Pressing the RESET button and then the TEST button will start the test process from the first active memory.

If the Fail Stop is set to OFF, the instrument will continue to complete the entire test process even if there were failed memories during the test. The display will show the results of each memory at the end of test process, as follows:

Test	P	F	P	F	P	F	P	F	P	F
Mem	0	1	2	3	4	5	6	7	8	9

The pass fail status is indicated by the letter F (Fail) or P (Pass).

4.6 Single Step

Press the SETUP key to advance the menu to the Single Step parameter. The display will show:

Single Step =ON ENTER to Select	or	Single Step =OFF ENTER to Select

Use the ENTER key to select the Single Step mode.

After the selection of Single Step mode, press the SETUP key to advance again to the PLC Remote parameter, or press the EXIT key to exit from the Single Step selection to the operation mode. The Program will store the selection of Single Step automatically.

This function is used to temporarily override the automatic connection feature. When the Single Step function is ON the instrument will pause after each memory is completed. To continue the test sequence, press the Test button to execute the next connected memory. Each time the Test button is pressed the next connected memory will execute. The first memory of the sequence will execute, when the Test button is pressed after the last memory of the sequence has completed.

5. Operation Procedure

5.1 Setup

Before the operation of this instrument, make sure that all Test Parameters have been set properly according to the Test Parameters Setup Procedures. Also, check the system setting of Remote Control, LCD Contrast, and Alarm Volume.

Check your connections to be sure they are making good contact. Clear the area of any debris that may create a hazardous situation and ask any unnecessary personnel to leave the area.

WARNING **DO NOT TOUCH THE DEVICE UNDER TEST ONCE THE TEST HAS BEEN STARTED.**

5.2 Power Up

Turn on the Input Power Switch. All status LEDs will light up, then the display will show the Trade Mark, Model Number and Version Number first, as follows:

```
ARI  RUNCHEK
905D      VER: XX
```

The program will then recall the Memory that was last executed.

5.3 LCD Settings Display Screens

The LCD settings display screen will show parameter settings of the test that will be performed and the memory locations where they are stored. Because the 905D tests for many different parameters it requires two LCD settings display screens (refer to the screen illustrations below) to display all of the parameters. To toggle between the two screens simply press the Display button.

```
Set              1.0s
Mx 300.0V  10.00A
```

```
Set          10.00mA
Mx 3000W 1.000PF
```

5.4 LCD Results Display Screens

The LCD results display screens may be accessed after a test is aborted, after a pass condition by pressing the RESET button, or after a test failure by pressing the RESET button twice. The test results will be displayed after a test is completed or when a failure occurs. The left side of the second line always indicates the Memory that has been selected. To toggle between the two LCD results display screens simply press the display button.

For examples of how the LCD results display screens appear, refer to sections 5.2 - 5.14 in this manual.

6. Displayed Messages

Note: The numbers shown in the displays below are for example only, the numbers you will actually see will be different based on your test conditions and parameters.

6.1 Test In Process

After pressing the test button to initialize the test, the TEST light on the right side of the instrument will illuminate. The instrument will indicate the test is processing as follows:

Delay	10.00mA	Delay	1.0s
Mx 3000W	1.000PF	Mx 300.0V	10.00A

or

After the delay time has expired, the display will switch to:

Dwell	10.00mA	Dwell	1.0s
Mx 3000W	1.000PF	Mx 300.0V	10.00A

or

6.2 Abort

If the RESET button is pressed during the test cycle the test will be aborted and the display indicate that the test has been aborted as follows:

Abort	10.00mA	Abort	1.0s
Mx 3000W	1.000PF	Mx 300.0V	10.00A

or

6.3 Pass

When the test cycle has completed successfully without detecting any failures, you will hear a short audible beep to let you know the test has completed successfully. The display will also indicate that the test has passed as follows:

Pass	10.00mA	Pass	1.0s
Mx 3000W	1.000PF	Mx 300.0V	10.00A

or

6.4 Volt-HI

If the voltage exceeds the Volt-HI Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Volt-HI	10.00mA	Volt-HI	1.0s
Mx 3000W	1.000PF	Mx 300.0V	10.00A

or

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.5 Volt-LO

If the voltage drops below the Volt-LO Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Volt-LO	10.00mA	Volt-LO	1.0s
Mx 3000W	1.000PF	Mx 0.0V	0.00A

or

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.6 Amp-HI

If the current exceeds the Amp-HI Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

If the Amp-HI current setting is less than 10 amps and trips:

Amp-HI	10.00mA	Amp-HI	1.0s
Mx 3000W	1.000PF	Mx 300.0V	9.00A

or

If the Amp-HI current setting is 10 amps and trips:

Amp-HI	10.00mA	Amp-HI	1.0s
Mx 3000W	1.000PF	Mx 300.0V	>10A

or

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.7 Amp-LO

If the current drops below the Amp-LO Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Amp-LO	10.00mA	Amp-LO	1.0s
Mx 3000W	1.000PF	Mx 300.0V	0.00A

or

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.8 Amp-OC

If the 20 Amp < 1 s, short circuit protection is tripped, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Amp-OC 10.00mA Mx 3000W 1.000PF	or	Amp-OC 1.0s Mx 300.0V >10A

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.9 Watt-HI

If the DUT input wattage exceeds the Watt-HI Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Watt-HI 10.00mA Mx 3000W 1.000PF	or	Watt-HI 1.0s Mx 300.0V 10.00A

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.10 Watt-LO

If the DUT input wattage drops below the Amp-LO Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Watt-LO 0.00mA Mx 0W 0.000PF	or	Watt-LO 1.0s Mx 300.0V 10.00A

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.11 PF-HI

If the Power Factor exceeds the PF-HI Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

PF-HI	0.00mA		PF-HI	1.0s
Mx 3000W	1.000PF	or	Mx 300.0V	10.00A

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.12 PF-LO

If the Power Factor drops below the PF-LO Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

PF-LO	10.00mA		PF-LO	1.0s
Mx 3000W	1.000PF	or	Mx 300.0V	10.00A

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.13 Leak-HI

If the enclosure to neutral leakage current exceeds the Leak-HI Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Leak-HI	10.00mA		Leak-HI	1.0s
Mx 3000W	1.000PF	or	Mx 300.0V	10.00A

To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

6.14 Leak-LO

If the enclosure to neutral leakage current drops below the Leak-LO Trip setting, the unit will indicate the failure by illuminating the FAIL indicator and activating the alarm. All relays will be deactivated to disable voltage to the DUT. The display will indicate failure as follows:

Leak-LO	0.00mA		
Mx 3000W	1.000PF		

or

Leak-LO	1.0s
Mx 300.0V	10.00A

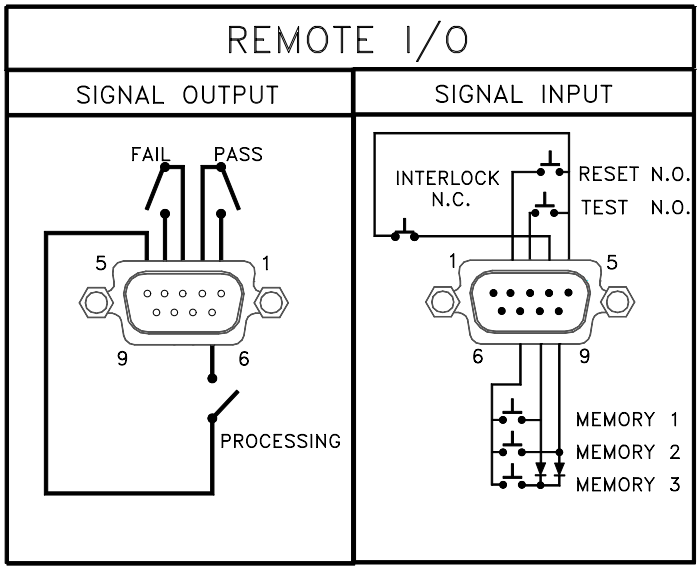
To clear the failure light and alarm, press the RESET button. The alarm and light will be turned off but the display will continue to indicate the type of failure until a second reset is activated.

7. Connection of Remote I/O

Two 9 pin "D" type connectors are mounted on the rear panel which provide REMOTE-INPUT-OUTPUT control and information. These connectors mate with standard 9 pin D-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)

Remote Interface Rear Panel:



7.1 Signal Outputs on Remote I/O

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 switch on to indicate the current condition of the tester. These are normally open free contacts and will not provide any voltage or current. The ratings of the contacts are 1A / 250 VAC (0.5 ADC). The signal outputs are provided on the 9 pin female type D connector. Below is a listing 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.
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 any test. The connection is opened when the next test is initiated or the reset function activated.

7.2 Signal Inputs of Remote I/O and Memory Programs

The RUNCHEK remote connector enables remote operation of the TEST, RESET and REMOTE INTERLOCK functions, or allows the operator to select one of three pre-programmed tests. 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 the test switch. A normally open momentary switch can then be wired across pins 3 and 5 to allow remote operation of the TEST function. A normally open momentary switch can also be wired across pins 2 and 5 which allows remote operation of the RESET function.

Remote Interlock is a feature that inverts the present reset logic on the instrument from normally opened (must close contacts to activate the reset) to normally closed (must open contacts to activate the reset). Hardware and software have been configured to provide the interlock connections on pins 4 and 5 of the Remote Interface, Signal Input port. This reset scheme is designed for use with an external safety interlock device that utilizes a "Fail-When-Open" configuration on its output interface. The instrument can still be used without the external reset device as long as the Interlock Connector (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 interlock (reset), then the instrument will not function.

For safety, the front panel RESET switch remains active even when a remote reset switch is connected so that high voltage can be shut down from either location.

The RUNCHEK also allows access to three MEMORY PROGRAMS through the remote control connector. This gives the user the capability to quickly change parameters and initiate a test remotely. The RUNCHEK basically operates in a PLC mode by responding to simple switch or relay contact closures. The built in memory programs of the instrument are used to accomplish this. Three internal memory programs can be accessed. By connecting terminals 7, 8 and 9 in different combinations the user can select the correct memory program.

WARNING ACTIVATING MEMORY PROGRAM FUNCTIONS THROUGH THE REMOTE CONNECTOR, SELECTS THE PROGRAM AND STARTS THE

TEST WHICH IS PRE-PROGRAMMED INTO THAT MEMORY.

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

MEMORY 1 - Momentarily connecting terminal 7 to 8 signals the instrument to immediately begin the test program that is stored in memory 1.
MEMORY 2 - Momentarily connecting terminal 7 to 9 signals the instrument to immediately begin the test program that is stored in memory 2.
MEMORY 3 - Momentarily connecting terminal 7 to terminals 8 and 9 signals the instrument to immediately begin the test program that is stored in memory 3.

8. Bus Remote Interface GPIB / RS-232

This section provides information on the proper use and configuration of bus remote interface. The GPIB (IEEE-488) remote interface is standard on model 905D but the RS-232 interface option can be substituted for the GPIB interface. The RS-232 interface also uses the same command list as the GPIB with the exception of the SRQ functions. Please refer to the Option section of this manual for details on the 905D options.

8.1 A Brief History of IEEE-488....

Hewlett-Packard designed in 1965 the Hewlett-Packard Interface Bus (HP-IB) to connect their line of programmable instruments to computers. This bus had high transfer rates (nominally 1 Mbytes/s), and thus quickly gained acceptance. Later, it was accepted as the IEEE Standard 488-1975 and has since evolved into ANSI/IEEE Standard 488.1-1987.

IEEE-488 has expanded over the years and is used with many more types of computers and instruments than just HP. Because of this it is usually referred to as the General Purpose Interface Bus, (GPIB).

8.2 GPIB Messages

There are typically two types of messages that GPIB devices use to communicate with other interconnected GPIB devices;

Interface messages: Often called commands or command messages and Device dependent messages often called data or data messages.

Data Messages: Contain information such as programming instructions or measurement results. Command Messages perform functions such as initializing the bus and addressing and unaddressing devices.

8.3 Functions

A GPIB device can be a Listener, Talker and/or Controller. A Talker sends data messages to one or more Listeners, which receive data. A Controller manages the information flow on the GPIB by sending commands to all devices. The GPIB bus is much like a computer bus except a computer has circuit cards connected via a backplane and the GPIB has stand-alone devices connected via a cable.

8.4 Signals and Lines

The GPIB consists of 16 signal lines and 8 ground-return or shield drain lines. The 16 signal lines are grouped into 8 data lines, 3 handshake lines and 5 interface management lines.

Data Lines: The eight data lines, DI01 through DI08 carry data and command messages. The 7-bit ASCII or ISO code set is used and the eighth bit DI08 is unused.
Handshake Lines: The transfer of message bytes between devices is done via three asynchronously control lines. Referred to as three-wire interlocked handshake. This guarantees that message bytes on the data lines are sent and received without transmission error.

NRFD (not ready for data) indicates when a device is ready or not ready to receive a message byte.

NDAC (not data accepted) indicates when a device has or has not accepted a message byte.

DAV (data valid) tells when the signals on the data lines are stable (valid) and can be accepted safely by devices.

Interface Management Lines: Five lines are used to manage the flow of information across the interface.

ATN (attention) ATN is driven true by the controller when it uses the data lines to send commands, and drivers ATN false when a Talker can send data messages.

IFC (interface clear) IFC is driven by the system controller to initialize the bus and become CIC.

REN (remote enable) The REN line is driven by the controller which is used to place devices in remote or local program mode.

SRQ (service request) The SRQ line can be driven by any device to asynchronously request service from the Controller.

EOI (end or identify) This line has two purposes- the Talker uses this line to mark the end of a message string, and the Controller uses it to tell devices to identify their response in a parallel poll.

8.5 GPIB Connector

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

The standard connector is the Amphenol or Cinch Series 57 Microribbon or AMP CHAMP type. The GPIB uses negative logic with standard transistor-transistor logic (TTL) levels. When DAV is true, for example, it is a TTL low level (≤ 0/8 V), and when DAV is false, it is a TTL high level (≥ 2.0 V).

Restrictions and Limitations on the GPIB

A maximum separation of 4 m between any two devices and an average separation of 2 m over the entire bus. A maximum total cable length of 20 m.

No more than 15 device loads connected to each bus, with no less than two-thirds powered on.

Note: A bus extender, which is available from numerous manufacturers, is available to overcome these limitations.

8.6 GPIB Address

Each device on the GPIB (IEEE-488) interface must have a unique address. You can set the address of the 905D to any value between 0 and 30. The address is set to 9 when the instrument is shipped from the factory. The address can only be set from the front panel. The address is stored in non-volatile memory and does not change when the power has been off or after a remote interface reset.

8.7 Interface Functions

The capability of a device connected to the bus is specified by its interface functions. These functions provide the means for a device to receive, process, and send messages over the bus. The interface functions are listed in the chart below. All functions may be controlled over the bus except input voltage which is Selectable on the rear panel.

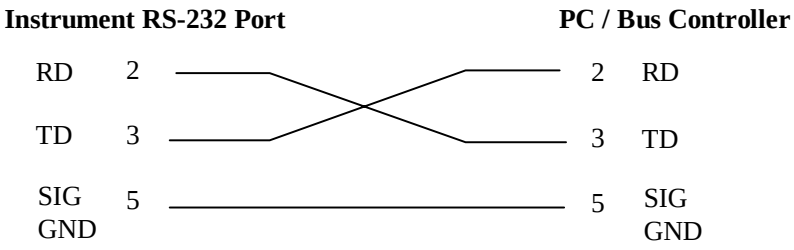
GPIB INTERFACE FUNCTIONS

IEEE-488 INTERFACE	Complete handshake capability Talker/Listener functions Service request capability No remote/local capability No parallel poll capability No device clear capability No device trigger capability No controller capability 3 state driver
CONTROLLABLE ITEMS	Test/Reset control Setting of test status/parameters for test LCD Display Reading
DATA CODES	ASCII
DELIMITER	CR + LF (+ EOI)

8.8 RS-232 Interface

This interface may be substituted for the standard GPIB interface on model 905D. This interface provides all of the control commands of the GPIB interface with the exception of the SRQ commands. All commands can be found in the command list portion of the Operation section 7.9 of this manual.

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



The COM port should have the following configuration. 9600 baud, 8 data bits, 1 stop bit, no parity. This interface does not support XON/XOFF protocol or any hardware handshaking. The controller should be configured to ignore the handshaking lines DTR (pin 4), DSR (pin 6) CTS (pin 8) and RTS (pin 7). If the port can not be configured through software to ignore the lines then the handshake lines should be jumpered together in two different sets. Pins 4 and 6 jumpered together and pins 7 and 8 jumpered together at the controller end of the cable.

When sending command over the RS232 bus the instrument will echo a response string identical to the string that was sent if the transfer was recognized and accepted by the instrument. This allows for software handshaking, to monitor and control data flow. If there is an error with the command string that is sent, the instrument will respond with 15h or the "NAK" ASCII control code. When requesting data from the instrument, it automatically send the data to the controller input buffer. The controller input buffer will accumulate data being sent from the instrument including the echo response string, until it is read by the controller.

8.9 905D GPIB Interface Command List

When the GPIB controller sends a correct command beginning with an "S" or "F" the instrument will echo back the identical command string. A GPIB read command must be sent after the command string to view this echo response.

If an error occurs when a command is sent, or the instrument does not recognize the command then the instrument will respond with a value of ASCII "NAK" (15hex), after the read command is sent. Each string should be terminated by ASCII <LF> and <CR>. ALL commands are case sensitive.

8.9.1 Parameter Selection Commands

The following commands are used to toggle ON/OFF functions or menu selection items. No other values or additional parameters are needed to execute these commands.

System Settings and Commands	
Command	Function
FA	Test
FB	Reset
FQ	Connect On
FR	Connect Off
FS	Fail Stop On
FT	Fail Stop Off
FC	Single Step On
FD	Single Step Off

8.9.2 Parameter Data Input Commands

The following commands require a numeric value to follow the command string.

Parameter Setting			
Command	Function	Value	Unit
SA	Voltage High Limit	0.0 - 300.0	V
SB	Voltage Low Limit	0.0 - 300.0	V
SC	Current High Limit	0.00 - 10.0	A
SD	Current Low Limit	0.00 - 10.0	A
SE	Power High Limit	0 - 3000	W
SF	Power Low Limit	0 - 3000	W
SG	Power Factor High Limit	0 - 1.000	PF
SH	Power Factor Low Limit	0 - 1.000	PF
SI	Leakage High Limit	0.00 - 10.00	mA
SJ	Leakage Low Limit	0.00 - 10.00	mA
SK	Delay Time	0.1 - 999.9	S
SL	Dwell Time	0.2 - 999.9	S
S4	Memory Store	0 - 9	NONE
S5	Memory Recall	0 - 9	NONE

8.9.3 Data Retrieval Commands

The following commands are used to retrieve information from the RUNCHEK. After the command is sent a GPIB read command must follow to retrieve the data from the instrument in GPIB operation. In RS-232 operation the RUNCHEK will automatically send the results to the data buffer at the controller.

Query Commands		
Command	Description	Bytes Returned
?K	LCD READ used for active polling of LCD Display screen 1 (Seconds, Volts, Amps) during or after the test.	32 bytes
?L	LCD READ used for active polling of LCD display screen 2 (Leakage, Power, and Power factor) during or after the test.	32 bytes
?D	Read the status of the Interlock input. ON Implies, that the Interlock is active and the instrument is disabled.	1 byte 0 = OFF 1 = ON

8.9.4 GPIB Service Request

SRQ Configuration Settings	
F0	Enable "All Pass" SRQ
F1	Disable "All Pass" SRQ
F2	Enable "Fail" SRQ
F3	Disable "Fail" SRQ
F4	Enable "Abort" SRQ
F5	Disable "Abort" SRQ
F6	Enable "Error Command" SRQ
F7	Disable "Error Command" SRQ

The service request capability is not available with the RS-232 interface. The service request status byte can be read from the instrument only after one or more of the service request functions have been enabled. The status byte bit assignments are as follows.

BIT	7	6	5	4	3	2	1	0
Function	na	RQS	na	na	ERROR	ABORT	FAIL	PASS

The bit will be active or 1 when the SRQ function has been enabled and the condition is true. Bit 6 is the RQS bit and will be active when the instrument has detected that an enabled SRQ has been met and therfore has requested service. Bit 4, 5, and 7 are not used and will be set to false or 0 for all status reads.

After the status byte has been read from the instrument the RQS bit will be cleared to 0 and the remaining bits will be unchanged. The remaining bit will be unchanged until the next time service is requested.

For example, after the All Pass SRQ has been enabled, when the test(s) have finished with pass indications the instrument will set the hardware SRQ line and output the status byte of 41 hex. This means that bit 6 and bit 0 are set to a value of 1. After reading the status byte the status byte value will change to 01 hex and remain at 01 hex until next time service is requested.

8.10 Example of Communicating Over the GPIB bus

To write commands over the GPIB bus you must enter the code that is specific to the software language you are using. Then follow the example below:

To set the Leakage High Current Trip across the GPIB bus at 2.00 mA do the following. First select the memory that you wish to change, then send the string **"SI 2.00"**. A string is a list of ASCII characters, octal or hex bytes or special symbols.
If you wish to set the Delay time of the test across the GPIB bus at 10 seconds, do the following, send the string **"SK 10.00"**. This tells the instrument to set the Delay Time at 10.0 seconds for the Memory that has been selected.

To read the 2 x 16 display, that displays Seconds, Volts and Current first send the string **"?K"** then send the GPIB command to read 32 bytes. The instrument will send 32 bytes, one byte for each character on the display, including spaces.

8.11 Non Volatile Memory

The instrument saves each parameter in non-volatile memory when the **"S4 x"** is used to save the data. The non-volatile memory has a limited write cycle life, therefore for programmers who wish to send all parameters before executing each test the **"S4 x"** command should not be used. The parameters will be stored in the CPU's Random Access Memory (RAM) until another memory location is selected. However, settings written to RAM from GPIB/RS-232 mode will be lost when power is shut down. Parameter changes to RAM are unlimited and will not effect the life of the internal non-volatile memory chip.

FOR MORE INFORMATION ON IEEE (GPIB) PLEASE CONTACT:

The Institute of Electrical and Electronic Engineers, Inc.
345 East 47th Street,
New York, NY 10017
☎ 1-212-705-7018 (Communications Society of IEEE)
Internet: www.ieee.org

9. Model 905D OPTIONS

9.1 Introduction

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

9.2 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

9.3 905D Option List

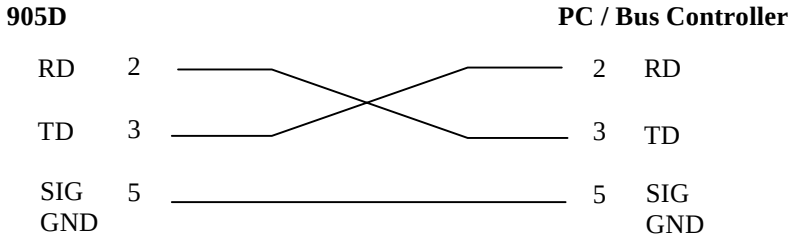
Option List

Code	Description
01	RS232 Interface
02	15 Amp Output
03	Continuous Output

01 RS232 Interface

This option may be substituted for the standard GPIB interface. This option provides all of the command control of the GPIB interface with the exception of the SRQ commands. All commands can be found in the GPIB portion of the Operation section of this manual.

The RS232 cabling should be configured as follows for a 9 pin serial port interface:



The COM port should have the following configuration. 9600 baud, 8 data bits, 1 stop bit, no parity. This interface does not support XON/XOFF protocol or any hardware handshaking. The controller should be configured to ignore the handshaking lines DTR (pin 4), DSR (pin 6) CTS (pin 8) and RTS (pin 7). If the port can not be configured through software to ignore the lines then the handshake lines should be jumpered together in two different sets. Pins 4 and 6 jumpered together and pins 7 and 8 jumpered together at the controller end of the cable.

When sending command over the RS232 bus the 905D will echo a response string identical to the string that was sent if the transfer was recognized and accepted by the instrument. This allows for software handshaking, to monitor and control data flow. If there is an error with the command string that is sent, the instrument will respond with 15h or the "NAK" ASCII control code. When requesting data from the instrument, it automatically sends the data to the controller input buffer. The controller input buffer will accumulate data being sent from the instrument including the echo response string, until it is read by the controller.

02 15 Amp Output

This option increases the maximum output current of the 905D from 10 Amps to 15 Amps. The option also increases the maximum power output of the 905D to 4500 Watts.

15 Amp Current Trip points, Amp-HI and Amp-LO

The Amp-HI trip limit is used to program the maximum allowable current flow through the DUT before failure. The Amp-LO trip limit is used to program the minimum allowable current through the DUT before failure.

Press the CURRENT key once to display the Amp-HI screen or press it twice to display the Amp-LO screen:

Amp-HI =XX.XX A Range: 0.00-15.00	Amp-LO =XX.XX A Range : 0.00-15.00

Use the Numeric Keys to enter the Amp-HI trip value, and then press the ENTER key. The program will store this value and advance to the Amp-LO Trip parameter automatically. Use the Numeric Keys to enter the Amp-LO trip value and then press Enter key.

4500 Watt Power Trip points, Watt-HI and Watt-LO

The Watt-HI trip limit is used to program the maximum allowable Power being used by the DUT before failure. The Watt-LO trip limit is used to program the minimum allowable Power being used by the DUT before failure.

Press the Power key once to display the Watt-HI screen or press it twice to display the Watt-LO screen:

Watt-HI =XXXX W Range :0-4500	Watt-LO =XXXX W Range: 0-4500

Use the Numeric Keys to enter the Watt-HI trip value, and then press the ENTER key. The program will store this value and advance to the Watt-LO Trip parameter automatically. Use the Numeric Keys to enter the Watt-LO trip value and then press Enter key.

The displayed messages remain the same with the exception of the increase in current and wattage. Please refer to Operation; section 5 for a completes list of displayed messages.

The specifications for the 15 Amp Option are as follows:

- All other specifications remain the same. Refer to the Specifications section of this manual, for a complete list of all specifications.

DUT POWER		
Current	0.0 - 15.0 AAC max continuous	
DUT Watts	4500 W max	
Short Circuit Protection	23 Amps AC Response time < 3s	
TRIP POINT SETTINGS		
Current: Amp-HI Amp-LO	Range: Resolution: Accuracy:	0.1 - 15.00 AAC 0.01 A ± (2.0% of setting + 0.02A)
Watts: Watt-HI Watt-LO	Range: Resolution: Accuracy:	0 - 4500 W 1 W ± (5.0% of setting + 3W)
METERING		
Ammeter	Range: Resolution: Accuracy:	0.1 - 15.00 AAC 0.01 A ± (2.0% of reading + 0.02A)
Wattmeter	Range: Resolution: Accuracy:	0 - 4500 W 1 W ± (5% of reading + 3 W)

03 Continuous Output

This option allows the user to test the DUT which is sensitive to interruption of the input voltage between tests.

Like on the standard instruments, all 10 memory programs can be connected sequentially to the next consecutive test/memory number. If Connect is set to ON, the next memory in the sequence will be executed. If Connect is set to OFF, the test sequence will stop at this memory. When Connect is set to ON the DUT will be connected to the power during and between tests. DUT Outputs Line and Neutral are disconnected from Power source only after multiple tests are completed, RESET button is pushed, or a failure occurs.

The Single Step function is used to temporarily override the automatic connection feature. When the Single Step = ON the instrument will pause after each memory is completed, and this option provides continuous output voltage on the DUT during the pause.

WARNING **DO NOT TOUCH THE DEVICE UNDER TEST BECAUSE POWER REMAINS ON.**

If the trip point failure occurs, then the output voltage to the DUT will be interrupt immediately.

All other specifications remain the same. Refer to the Specifications section of this

manual, for a complete list of all specifications.

This page is intentionally left blank.

SECTION 2
SERVICE MANUAL

10. CALIBRATION PROCEDURES

This instrument has been fully calibrated at the factory in accordance to our published specifications. It has been calibrated with standards traceable to the National Institute Standards & Technology (NIST). You will find in this manual a copy of the "Certificate of Calibration". It is recommended that you have this instrument recalibrated and a safety check done at least once per year. AR recommends you use "Calibration Standards" that are NIST traceable, or traceable to agencies recognized by NIST to keep this instrument within published specifications.

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

10.1 Calibration Initialization

Press and hold the calibration key on the rear panel with a pen, pencil or small screw driver while powering ON the 905D. The 905D enters calibration mode after the power on sequence is complete. The initial screen will show:

```
CAL Mode
1=V 2=A 3=W 4=LC
```

10.2 Calibration Parameters

1. Calibration of Voltage

Required Equipment: STANDARD A.C. VOLTMETER capable of measuring 300VAC.

Remove the DUT power from the DUT I/P connector and remove the DUT from the DUT outputs. Push the "1" key, this sets the unit up to self calibrate the zero voltmeter offset.

The display will show:

```
0V   Auto  Offset
 <TEST>    to   start
```

Press test to complete the 0-volt auto offset calibration.

The display will now show:

```
Voltage=              V
Enter   STD    V-out
```

Apply between 200 and 300 volts A.C. to the DUT I/P connector and parallel the 300VAC voltmeter with this connection. Key in the voltage reading from the 300VAC meter.

2. Calibration of Current

Required Equipment: STANDARD A.C. CURRENT METER

Current=	A
Enter STD	A-out

Apply A.C. power to the DUT I/P connector between 120 and 300 volts. Series the standard current meter with a load large enough to generate 8 to 10 amps on the DUT output. Push the "2" key and then key in the current reading from the standard current meter.

3. Calibration of Wattage

Required Equipment: WATTMETER capable of measuring 3000W.

Power=	W
Enter STD	W-out

Apply A.C power to the DUT I/P connector between 200 and 300 volts. Connect the Wattmeter (make sure the v-sense of the wattmeter is near the DUT I/P connector) to a load capable of drawing between 2000 and 3000 Watts on the DUT outputs. Push the "3" key and key in the reading from the wattmeter.

4. Calibration of Earth Leakage Current

Required Equipment: STANDARD A.C. CURRENT METER

Current=	mA
Enter STD	A-out

Apply 18 volts A.C. in series with the standard current meter between the Neutral and Ground of the DUT output connectors. Push the "4" key and then key in the reading from the standard current meter.

11. 905D Fuse Replacement

11.1 Introduction

This section contains specific instructions for the replacement of the DUT input line fuse. Also contained within this section are helpful hints to prevent the line fuse from blowing.

11.2 Purpose of the Fuse

The primary purpose of the fuse is to protect the operator and instrument in the instance of a line to ground fault in the DUT. The secondary purpose of the fuse is to prevent damage to the HV relay during a DUT line to neutral short while running a test.

11.3 Hints to Preventing the Fuse from Blowing

The best way to prevent the fuse from blowing is to Hipot test the DUT prior to performing a Run Test. Hipoting the DUT's line and neutral connections to ground will detect shorts before applying line voltage to the DUT.

Although the standard Hipot test will detect these faults before executing the RUN test, you may also want to consider using and isolation transformer on the DUT input to buffer or isolate the earth ground connection. In situations where the DUT power is reference to earth ground (such as using the standard 120V wall receptacle power) the fuse may blow due to Line to Earth ground faults in the DUT or fixture. The transformer will prevent current from flowing from the Line to Earth Ground, in a Line to Ground fault situation. The isolation transformer will also provide an increased level of safety for the operator. If the operator accidentally contacts the Line conductor of the DUT and any Earth Ground conductor present in the work environment, they could be shocked. The transformer will prevent hazardous current from flowing through the operator to Earth Ground.

If possible, avoid live switching of the DUT. In other words, do not start the Run Test first then turn on the power switch of the DUT. If there is a short in the DUT, this will cause the fuse to blow. To avoid this situation it is best have the DUT power switch in the ON position prior to starting the Run Test.

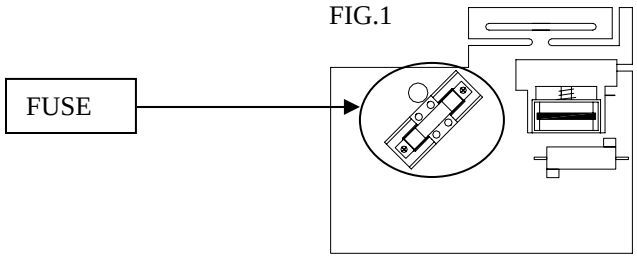
Avoid switching speeds during a test. Many DUT's have multiple speeds or high/low settings and both settings need to be tested. It is best to perform two separate tests rather than switching the speed during the test. The reason for this is that while the first speed setting may not have a short, the second speed setting might be shorted. In this case when you switch the speed the fuse will blow.

The 905D is equipped with high-speed short circuit (line to neutral) detector that is capable of quickly shutting down the instrument at the very beginning of a test if there is a line to neutral short. If a short occurs at the very beginning of the test the instrument will shut down and give an Amp-OC indication on the display, sound the alarm and give the red light on the RESET button. In this situation, the fuse **will not** blow; this is why it is best never to live switch the DUT.

Replacing the fuse

WARNING **Disconnect the line cord to the instrument then disconnect the DUT power to the instrument. Do not attempt to remove the fuse when any power cords are connected to the instrument.** Remove the seven screws retaining the top cover then remove the top cover. Refer to FIG.1 below and locate the fuse on the switching board.

FIG.1



The fuse holder uses strong fuse clips to hold the fuse in place. The fuse can be removed by hand but the aide of a tool may be necessary. A screwdriver or pen can be used to pry up one end of the fuse. Grab the end of the fuse that is sticking up with your fingers and remove the fuse from the fuse block.

Snap the replacement fuse into the fuse block.

WARNING **Use only the following recommended fuses for replacements:**
Associated Research part number 38379
Little Fuse part number L50S15
Bussmann part number FWH-15A14F

Using non-recommended fuse replacements is dangerous and may void your warranty.

Replace the top cover on the instrument.

Model 905D Replacement Parts List

Rev.B 07/07/05 ECO 5040-9

Part Number	Qty.	Reference Designator	Description
38091	1	CSW-07	PCB Assembly Input Protection Board
38092	1	CSW-905	Switching Board
38097	1	905	Main Control Board
37550	1	CKB-01	PCB Assembly Keypad Board
37745	1	CGP-03	PCB Assembly GPIB Interface Board
37858	3	-	Connector High Voltage/ High Current
37876	2	-	Relay, High Voltage, High Current
37921	1	IC43	Microprocessor IC89C738
37554	1	-	LCD Display
38069	1	-	Switch Power 2P/15A
37571	1	-	Earth Connector
37882	3	-	Terminal Post 1 KV Black
37883	1	-	Terminal Post 1 KV Red
37802	23	-	Grey Keypad Buttons
37556	1	-	Test Switch
37557	1	-	Reset Switch
38093	1	T-905-T1	Transformer
38098	1	-	Fuse, 1A/Slow Blow/TUV
37781	1	-	Fuse Holder 20mm
38101	1	-	Feet Kit Plastic without Rubber Insert
38102	4	-	Rubber Insert
37564	2	-	2U Rack Mount Bracket
37563	2	-	2U Rack Mount Handle
33189	1	-	Input Power Cable 10A/7Ft.
38075	1		Interlock Connector
37892	1	-	Adapter Box

- For safety tester interconnect cables, refer to INSTRUMENT CONNECTIONS; section 1.3 Specific Integrated System Connections

SCHEMATIC INDEX

Drawing Number	Description	Reference Designator	Pages
S00905D	Wiring Diagram 905D	-	1
S38097	Main Control Board	905	4
S38091	Input Protection Board	CSW-07	1
S38092	Switching Board	CSW-905	1
S37550	Keypad Board	CKB-01	1
S37745	GPIB Interface Board	CGP-03	1
S37814	RS-232 Interface Board	RS232	1