OPERATION AND SERVICE MANUAL

Model 4320, 4520

MODEL 4320 (AC/DC HIPOT WITH IR AND GROUND BOND TESTERS)
MODEL 4520 (500VA AC/DC HIPOT WITH IR AND GROUND BOND TESTERS)

SERIAL NUMBER

Models

4320, 4520

Item 99-10319-01 Ver 1.10

28105 N. Keith Drive
Lake Forest, Illinois, 60045-4546
U.S.A.

Printed October 31st, 2012

DECLARATION OF CONFORMITY

Manufacturer: Slaughter Company, Inc.

Address: 28105 N. Keith Drive
Lake Forest, IL 60045
USA

Product Name: 4320 Electrical Safety Compliance Analyzer

Model Number: 4320

Conforms to the following Standards:

Safety: EN 61010-1:2001
EN 61010-031:2002

EMC: EN 61326:1997/A1:1998
(EN 55022:1998/A1:2000 Class A,
EN 61000-4-2:1995, EN 61000-4-3:1996,
EN 61000-4-4:1995, EN 61000-4-5:1995,
EN 61000-4-6:1996, EN 61000-4-8:1993,
EN 61000-4-11:1994)

Supplementary Information

*The product herewith complies with the requirements of the **Low Voltage Directive 73/23/EEC as amended by 93/68/EEC** and the **EMC Directive 89/336/EEC as amended by 92/31/EEC**.*

The CE marking has been affixed on the device according to article 10 of the EMC Directive 8/336/EEC.

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

_____

Joseph Guerriero
Vice President / General Manager

Slaughter Company, Inc.
Lake Forest, Illinois USA
February 18, 2005

DECLARATION OF CONFORMITY

Manufacturer: Slaughter Company, Inc.

Address: 28105 N. Keith Drive
Lake Forest, IL 60045
USA

Product Name: 4520 Electrical Safety Compliance Analyzer

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Conforms to the following Standards:

Safety: EN 61010-1:2001
EN 61010-031:2002+A1:2008

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

Supplementary Information

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

The CE marking has been affixed on the device according to article 10 of the EMC Directive 8/336/EEC.

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

Joseph Guerriero
Vice President / General Manager

Slaughter Company, Inc.
Lake Forest, Illinois USA
January 16, 2012

Warranty Policy

Slaughter Company, 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 return the "Owners Registration Card" provided within (15) days from receipt of your instrument.

Slaughter Company recommends that your instrument be calibrated on a twelve-month cycle. A return material authorization (RMA) must be obtained from Slaughter Company. Please contact our Customer Support Center at 1-800-504-0055 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. Slaughter Company will assume the return freight costs when returning the instrument to the customer. The return method will be at the discretion of Slaughter Company.

Except as provided herein, Slaughter Company 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 Slaughter Company manufacture. Parts used must be parts that are recommended by Slaughter Company as an acceptable specified part. Use of non-authorized parts in the repair of this instrument will void the warranty.

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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 (115 or 230) and the correct fuse is installed.

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.

A Hipot produces voltages and currents which 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 Slaughter Company, Inc. Refer servicing to a Slaughter Company, Inc. authorized service center.

SLAUGHTER COMPANY, INC.
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1 (800) 504-0055
FAX: 1 (847) 932-3665
E-MAIL : support@hipot.com
www.hipot.com

Service Interval

The instrument and its power cord, test leads, and accessories must be returned **at least once a year** to a Slaughter Company authorized service center for calibration and inspection of safety related components. Slaughter Company 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. Slaughter Company will not be responsible for any injuries sustained due to unauthorized equipment modifications or use of parts not specified by Slaughter Company. Instruments returned to Slaughter Company 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 the event 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.

There should not be any metal in the work area between the operator and the location where products being tested will be positioned.

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. The outlet which is used to provide power to the instrument should be easily accessible.

Keep the area clean and uncluttered. All test equipment and test leads not absolutely 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. If the instrument is used in a matter not specified by Slaughter Company, Inc. the protection provided by the instrument may be impaired.

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.

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 which 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!

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 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.**

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 which 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 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 times per second, in other countries 50 times per second.

Breakdown: The failure of insulation to effectively prevent the flow of current, sometimes evident 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, a repeated 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.

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 which 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: The minimum current flow required to cause an indication of unacceptable performance during a dielectric voltage-withstand test.

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

INTRODUCTION

The importance of testing.... User safety

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 bypass 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), the Japanese Standards Association (JSI). These same agencies may also require that an insulation resistance test and high current ground bond test be performed.

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 varies with each product, but basically, during a dielectric voltage - withstand test, an electrical devise is exposed to a voltage significantly higher than it normally encounters. The high voltage is continued for a given period.

If, during the time the component is tested, stray current flow remains within specified limits, the device is assumed safe under normal conditions. The basic product design and use of the insulating material will protect the user against electrical shock.

The equipment used for this test, a dielectric-withstand tester, is often called a "hipot" (for high potential tester). The "rule of thumb" for testing is to subject the product to twice its normal operating voltage, plus 1,000 volts.

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

Testing during development and prototype stages is more stringent than production run tests because the basic design of the product is being evaluated. Design tests usually are performed on only a few samples of the product. Production tests are performed on each and 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 types of voltages you are authorized to use. In some cases, a Compliance Agency will allow either AC or DC testing to be done. However, in other cases the Compliance Agency only allows for an AC test. If you are unsure which specification you must comply with please contact our **CUSTOMER SUPPORT GROUP at 1-800-504-0055**.

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.

AC testing advantages

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 Component
- Pinched Insulation

Why Perform a Ground Bond Test….

Ground bond testing is done to insure that a low resistance path exists between the safety ground pin of a three-wire line cord and exposed metal of the item under test. If a live wire inside the item under test came loose and contacted the chassis, the fault current would flow through the low resistance safety ground, and protect the user.

The need for high current bonding (i.e. 30A or 60A) as apposed to low current go-no go type testers, results from the nature of line voltage breakers' high current characteristics. Safety Grounding circuits must withstand the line voltage breaker' current rating in order to maintain safe voltage potentials on the chassis of the faulty device. Verifying the integrity of the grounding circuit at high currents insures that the line breaker will open before the grounding circuit wires fail. This insures that the power will be de-energized at the device while maintaining safe voltage levels on the chassis.

IF YOU SHOULD HAVE ANY QUESTIONS RELATING TO THE OPERATION OF YOUR INSTRUMENT CALL 1 (800) 504-0055 IN THE U.S.A.

Model 4320 Functional Specifications

Unless otherwise stated, accuracy's are relative to a laboratory standard measurement.

INPUT	
Voltage	115 / 230V selectable, ± 10 % variation
Frequency	50 / 60 Hz ± 5%
Fuse	6.3 A slow blow 250V AC
DIELECTRIC WITHSTAND TEST MODE	
Output Rating	5 kV @ 20 mA AC 6 kV @ 5 mA DC
Voltage Setting	Range: 0.00 – 5.00 kV AC 0.00 – 6.00 kV DC Resolution: 0.01 kV Accuracy: ± (2 % of setting + 5 V)
Voltage Display	Range: 0.00 – 5.00 kV AC 0.00 – 6.00 kV DC Resolution: 0.01 kV Accuracy: ± (2 % of reading + 10 V)
Current Display	Range: 0.00 – 20.00 mA AC 0.00 – 5.00 mA DC Resolution: 0.01 mA Accuracy: ± (2 % of reading + 0.02 mA)
HI and LO-Limit	Range: 0.00 – 20.00 mA AC Resolution: 0.01 mA Accuracy: ± (2 % of setting + 0.02 mA) Range: 0.00 – 5.00 mA DC Resolution: 0.01 mA Accuracy: ± (2 % of setting + 0.02 mA)
Failure Detector	Audible and Visual
DC Output Ripple	≤ 5% Ripple RMS at 6 KV DC @ 5 mA, resistive load

DIELECTRIC WITHSTAND TEST MODE	
Discharge Time	≤ 200 ms
Maximum Capacitive Load in DC Mode	1 uF < 1 kV 0.75 uF < 2 kV 0.5 uF < 3 kV 0.08 uF < 4 kV 0.04 uF < 5 kV 0.01 uF < 6 kV
AC Output Waveform	Sine Wave, Crest Factor = 1.3 – 1.5
AC Output Frequency	Range: 60 or 50 Hz, User Selectable Accuracy: ± 0.1 %
Output Regulation	± (1 % of setting + 5 V) from no load to full load
Dwell Timer	Range: 0, 0.2 – 999.9 sec (0 = Continuous) Resolution: 0.1 sec Accuracy: ± (0.1 % + 0.05 sec)
Ramp Timer	Range: 0.1 – 999.9 sec Resolution: 0.1 sec Accuracy: ± (0.1 % + 0.05 sec)
INSULATION RESISTANCE TEST MODE	
Output Voltage	Range: 100 – 1000 V DC Resolution: 1 V Accuracy: ± (2 % of reading + 5 V)
Voltage Display	Range: 0 – 1000 V Resolution: 1 V Accuracy: ± (2 % of reading + 2 counts)

INSULATION RESISTANCE TEST MODE		
Resistance Display	Range:	1 - 1000 MΩ (4 Digit, Auto Ranging)
	Resolution:	500VDC 1000VDC MΩ MΩ MΩ 0.01 1.00 - 40.00 1.00 - 80.00 0.1 35.0 - 999.9 75.0 - 999.9
	Accuracy:	± (3% of reading + 2 counts) at test voltage > 500V ± (7% of reading + 2 counts) at test voltage ≤ 500V
HI and LO-Limit	Range:	1 – 1000 MΩ
	HI-Limit:	0 = OFF
	Accuracy:	Same as Resistance Display Accuracy.
Delay Timer	Range:	0, 0.5 – 999.9 sec (0 = Continuous)
	Resolution:	0.1 sec
	Accuracy:	± (0.1 % + 0.05 sec)
GROUND BOND TEST MODE		
Output Voltage	Range:	6 V AC, Fixed
Output Frequency	Range:	60 or 50 Hz, User Selectable
	Accuracy:	± 0.1 %
Output Current	Range:	3.0 – 30.0 A AC
	Resolution:	0.1 A
	Accuracy:	± (2 % of setting + 0.02 A)
Current Display	Range:	0.0 – 30.0 A AC
	Resolution:	0.1 A
	Accuracy:	± (3 % of reading + 0.1 A)

GROUND BOND TEST MODE		
HI and LO-Limit	Range:	0 – 510 mΩ for 3.0 - 10.0 A
		0 – 200 mΩ for 10.1 - 25.0 A
		0 – 150 mΩ for 25.1 - 30.0 A
	Resolution:	1 mΩ
	Accuracy:	± (2 % of setting + 2 mΩ)
Dwell Timer	Range:	0, 0.5 – 999.9 sec (0 = Continuous)
	Resolution:	0.1 sec
	Accuracy:	± (0.1 % + 0.05 sec)
Milliohm Offset	Range:	0 – 100 mΩ
	Resolution:	1 mΩ
	Accuracy:	± (2 % of setting + 2 mΩ)
GENERAL SPECIFICATIONS		
PLC Remote Control	Input:	Test, Reset, Interlock, Recall Memory 1 - 6
	Output:	Pass, Fail, Test-in-Process
Memory	6 memories, 6 steps per memory All steps are linkable Single step mode	
Security	Key Lock capability to avoid unauthorized access to all test parameters. Memory Lock capability to avoid unauthorized access to memory locations.	
Line Cord	Detachable 6 ft (1.8 m) power cable terminated in a three-prong grounding plug.	
Terminations	6 ft (1.8 m) high voltage and return leads (2) with clips. An optional remote receptacle box may be purchased for testing items terminated with a line cord. International receptacles are also available.	
Mechanical	Tilt up front feet. Dimensions: (WxHxD) 11x 3.5 x 17 inches (280 x 89 x 430 mm) Weight: 33 lbs (15 Kg)	

GENERAL SPECIFICATIONS		
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.	

Model 4520 Functional Specifications

Unless otherwise stated, accuracy's are relative to a laboratory standard measurement.

INPUT	
Voltage	115 / 230V Auto Range, ± 15 % variation
Frequency	50 / 60 Hz ± 5%
Fuse	15 A slow blow 250V AC
DIELECTRIC WITHSTAND TEST MODE	
Output Rating	5 kV @ 100 mA AC 6 kV @ 10 mA DC
Voltage Setting	Range: 0.00 – 5.00 kV AC 0.00 – 6.00 kV DC Resolution: 0.01 kV Accuracy: ± (2 % of setting + 5 V)
Voltage Display	Range: 0.00 – 5.00 kV AC 0.00 – 6.00 kV DC Resolution: 0.01 kV Accuracy: ± (2 % of reading + 10 V)
Current Display	Range: 0.00 – 99.99 mA AC 0.00 – 10.00 mA DC Resolution: 0.01 mA Accuracy: ± (2 % of reading + 6 counts)
HI and LO-Limit	Range: 0.00 – 99.99 mA AC Resolution: 0.01 mA Accuracy: ± (2 % of setting + 6 counts) Range: 0.00 – 10.00 mA DC Resolution: 0.01 mA Accuracy: ± (2 % of setting + 6 counts)
Failure Detector	Audible and Visual
DC Output Ripple	≤ 5% Ripple RMS at 6 KV DC @ 10 mA, resistive load

DIELECTRIC WITHSTAND TEST MODE	
Discharge Time	≤ 200 ms
Maximum Capacitive Load in DC Mode	1 uF < 1 kV 0.75 uF < 2 kV 0.5 uF < 3 kV 0.08 uF < 4 kV 0.04 uF < 5 kV 0.01 uF < 6 kV
AC Output Waveform	Sine Wave, Crest Factor = 1.3 – 1.5
AC Output Frequency	Range: 60 or 50 Hz, User Selectable Accuracy: ± 0.1 %
Output Regulation	± (1 % of setting + 5 V) from no load to full load
Dwell Timer	Range: 0, 0.2 – 999.9 sec (0 = Continuous) Resolution: 0.1 sec Accuracy: ± (0.1 % + 0.05 sec)
Ramp Timer	Range: 0.1 – 999.9 sec Resolution: 0.1 sec Accuracy: ± (0.1 % + 0.05 sec)
INSULATION RESISTANCE TEST MODE	
Output Voltage	Range: 100 – 1000 V DC Resolution: 1 V Accuracy: ± (2 % of reading + 2 counts)
Voltage Display	Range: 0 – 1000 V Resolution: 1 V Accuracy: ± (2 % of reading + 2 counts)

INSULATION RESISTANCE TEST MODE		
Resistance Display	Range:	1 - 1000 MΩ (4 Digit, Auto Ranging)
	Resolution:	500VDC 1000VDC MΩ MΩ MΩ 0.01 1.00 - 40.00 1.00 - 80.00 0.1 35.0 - 999.9 75.0 - 999.9
	Accuracy:	± (3% of reading + 2 counts) at test voltage > 500V ± (7% of reading + 2 counts) at test voltage ≤ 500V
HI and LO-Limit	Range:	1 – 1000 MΩ
	HI-Limit:	0 = OFF
	Accuracy:	Same as Resistance Display Accuracy.
Delay Timer	Range:	0, 0.5 – 999.9 sec (0 = Continuous)
	Resolution:	0.1 sec
	Accuracy:	± (0.1 % + 0.05 sec)
GROUND BOND TEST MODE		
Output Voltage	Range:	6 V AC, Fixed
Output Frequency	Range:	60 or 50 Hz, User Selectable
	Accuracy:	± 0.1 %
Output Current	Range:	3.0 – 30.0 A AC
	Resolution:	0.1 A
	Accuracy:	± (2 % of setting + 0.02 A)
Current Display	Range:	0.0 – 30.0 A AC
	Resolution:	0.1 A
	Accuracy:	± (3 % of reading + 0.1 A)

GROUND BOND TEST MODE		
HI and LO-Limit	Range:	0 – 510 mΩ for 3.0 - 10.0 A
		0 – 200 mΩ for 10.1 - 25.0 A
		0 – 150 mΩ for 25.1 - 30.0 A
	Resolution:	1 mΩ
	Accuracy:	± (2 % of setting + 2 mΩ)
Dwell Timer	Range:	0, 0.5 – 999.9 sec (0 = Continuous)
	Resolution:	0.1 sec
	Accuracy:	± (0.1 % + 0.05 sec)
Milliohm Offset	Range:	0 – 100 mΩ
	Resolution:	1 mΩ
	Accuracy:	± (2 % of setting + 2 mΩ)
GENERAL SPECIFICATIONS		
PLC Remote Control	Input:	Test, Reset, Interlock, Recall Memory 1 - 6
	Output:	Pass, Fail, Test-in-Process
Memory	6 memories, 6 steps per memory All steps are linkable Single step mode	
Security	Key Lock capability to avoid unauthorized access to all test parameters. Memory Lock capability to avoid unauthorized access to memory locations.	
Line Cord	Detachable 6 ft (1.8 m) power cable terminated in a three-prong grounding plug.	
Terminations	6 ft (1.8 m) high voltage and return leads (2) with clips. An optional remote receptacle box may be purchased for testing items terminated with a line cord. International receptacles are also available.	
Mechanical	Tilt up front feet. Dimensions: (WxHxD) 16.9 x 5.2 x 15.7 inches (430 x 133 x 400 mm) Weight: 54 lbs (24.5 Kg)	

GENERAL SPECIFICATIONS		
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 OF MODELS 4320/4520

1. Tamper proof front panel controls.

This makes it possible to limit user access to the setup screens so that only authorized personnel can change test parameters.

2. Multiple Test Memories.

The 4320/4520 provides six test memories with six steps per memory. This is beneficial for manufacturers testing multiple products on one production line.

3. Low-current sense.

The low current sense feature monitors the minimum level of current flow, thus ensuring that the DUT is properly connected and that the Hipot test is being performed.

4. Simple Menu Control.

All parameters for the setups can be adjusted through a simple menu driven program. The easy to follow setup screens ensure that the operator correctly sets up all test parameters.

5. Electronic dwell settings.

The electronic dwell control helps keep test results consistent by ensuring that the test duration is the same for each product tested.

6. Electronic ramping.

Electronic ramping provides a gradual and timed method to increase output voltage to the DUT, minimizing any damage from quickly over-applying high voltage to sensitive DUTs.

7. Front panel LCD.

A front panel LCD allows the operator to monitor the test. The display holds the results after a test item failure so that the operator can easily review the test results. Failure indications are clearly displayed.

8. No load setup of trip current and output voltage.

This provides the operator with an easy and safe way to set trip currents and output voltages since parameters are set without the high voltage present.

9. Storage of test program.

The 4320/4520 powers-up with the same parameters that were used during the last test to avoid operator set-up errors.

10. Output voltage fine adjustment.
To make the 4320/4520 usable in all types of applications, the operator can manually bring the voltage up or down in 10 volt increments by simply pressing the up and down arrow keys. This makes it very easy to adjust the output voltage even while the instrument is in the dwell mode so you can analyze test results at different voltages.

11. Software calibration control.
The 4320/4520 is calibrated through the front panel keypad. All calibration information is stored in non-volatile memory. This allows the instrument to be completely calibrated without removing any covers and exposing the technician to hazardous voltages.

12. Current monitoring.
The LCD display allows monitoring of current down to 10 microamps AC and 10 microamps DC. This allows the 4320/4520 to be used even when test requirements only allow a very low level of acceptable leakage current.

13. Line and load regulation.
This system maintains the output voltage to within 1% from no load to full load and over the line voltage range to ensure that test results remain consistent and within safety agency requirements.

14. PLC remote inputs and outputs.
The standard 9- pin interfaces provide outputs for Pass, Fail, and Test in Process.. Inputs include Test, Reset, Interlock, and Memory Recall. This gives the user all the basic remotes required to configure the Hipot through simple PLC relay control.

15. Flashing high voltage indicator.
A flashing LED located directly over the high voltage terminal clearly indicates when high voltage is active to provide maximum operator safety.

16. Single Step Test Mode.
In this mode, the 4320/4520 can be configured to perform each test individually as a single step. This provides the manufacturers flexibility in configuring their testing procedure.

17. Insulation Resistance and Ground Bond Test Modes.
This allows the operator to perform an Insulation Resistance or Ground Bond tests with the Dielectric Withstand (Hipot) test, thus eliminating the need for a separate pieces of test equipment when IR and Ground Bond testing is required.

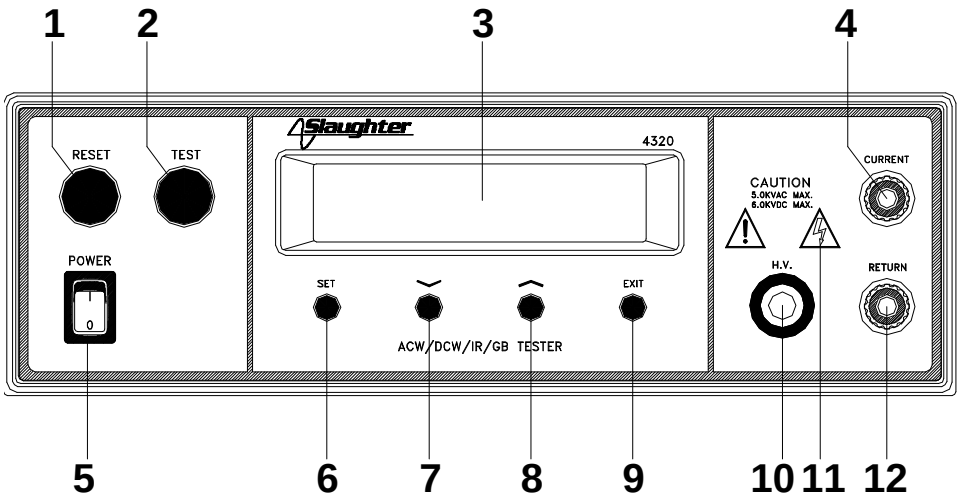
18. Continuous Duty Cycle Ratings.
An advantage over other instruments in its class, the 4320/4520 does not have any requirement to be shut down during the day even when used at full output.

19. Milliohm Offset Capability.
This feature minimizes the effect of test lead or test fixture resistance.

20. Adjustable Output Current and Milliohm Trip Currents.
The 4320/4520 is versatile enough to meet a wide variety of safety agency specifications.

21. Fail Stop ON/OFF Mode.
This allows the 4320/4520 to be configured to continue testing after detecting a failure. All pass/fail results are displayed at the completion of the test cycle.

FRONT PANEL CONTROLS



1. **RESET BUTTON:** This is a momentary contact switch used to reset the instrument. If an out-of-range reading is detected during a test, the red failure lamp within the button will light. To reset the system for the next test, press and release this button. This button may also be used to abort a test in progress.

2. **TEST BUTTON:** This is a momentary contact switch used to start a test. Press the green button to turn on the high voltage output when in test mode. The indicator lamp within the button will light when test expires with pass condition.

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

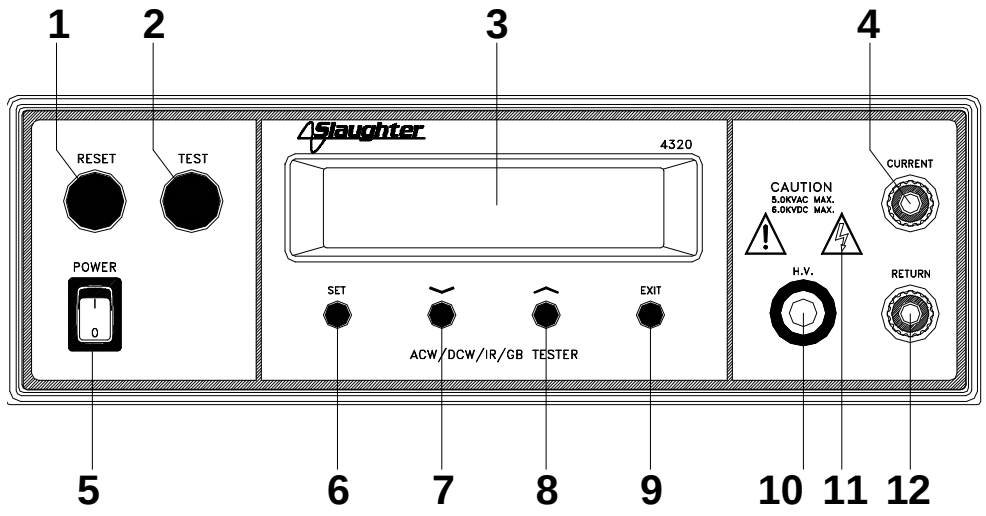
4. **CURRENT OUTPUT JACK:** This jack uses for the connection of the detachable 5-foot (1.52 m) red high current test lead or adapter box. This jack is always used when performing a Ground Bond test. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test**.**

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

6. **SET KEY:** Use this key to advance forward through the setup menus.

7. **DOWN ARROW (∨):** Use this key to decrement numeric values in the setup mode. This key also used to toggle ON/OFF functions. Also may be used to decrease output voltage during a test in 10-volt increments.

FRONT PANEL CONTROLS



8. **UP ARROW (∧):** Use this key to increment numeric values in the setup mode. This key also used to toggle ON/OFF functions. Also may be used to increase output voltage during a test in 10-volt increments.

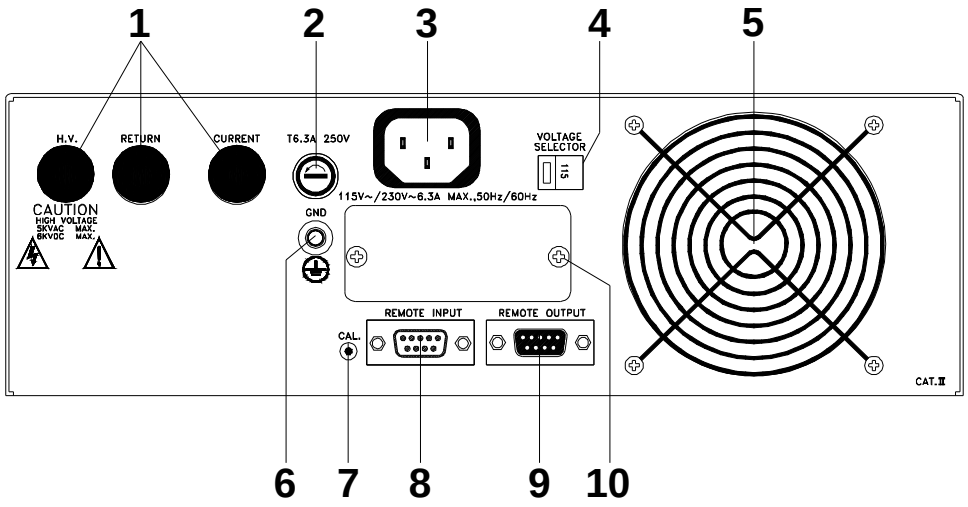
9. **EXIT KEY:** Use this key when you desire to enter the test mode to initiate a test. Also the key uses to enter the System menu parameters and to exit from the System menu.

10. **HIGH VOLTAGE OUTPUT JACK:** For the connection of the detachable 6-foot (1.8 m) red high voltage test lead. The silicone rubber insulation is flexible for easy handling and is rated at 30KVDC. The jack is recessed for safety when this lead is not being used.

11. **HIGH VOLTAGE ARROW (LED INDICATOR):** This indicator flashes to warn the operator that high voltage is present at the high voltage output terminal.

12. **RETURN OUTPUT JACK:** For the connection of the detachable 5 foot (1.52 m) black return test lead or three-prong receptacle adapter box. This jack is always used when performing a test. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test.

4320 REAR PANEL CONTROLS



1. **POSITION FOR OPTIONAL REMOTE OUTPUT JACKS:** Please refer section Optional Rear Panel Controls for details.

2. **FUSE RECEPTACLE:** To change the fuse unplug the power (mains) cord and turn the fuse cap counter clockwise to remove the fuse.

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

4. **INPUT POWER SWITCH:** Line voltage selection is set by the position of the switch. In the left position, it is set for 115-volt operation, in the right position it is set for 230-volt operation.

5. **THERMAL FAN:** To cool the instrument.

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

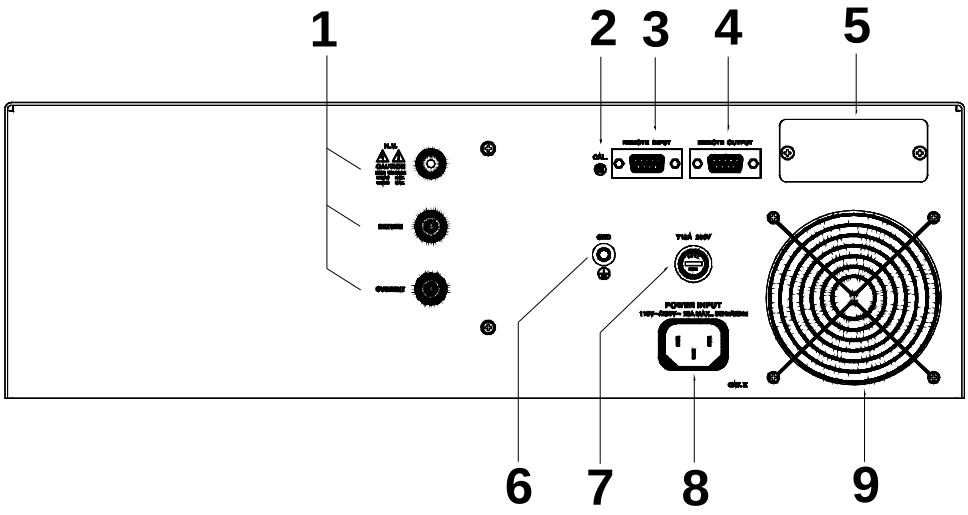
7. **CALIBRATION ENABLE KEY:** To enter the calibration mode press this key while the instrument is being powered ON.

8. **REMOTE INPUT:** 9 pin D subminiature male connector for remote control of test, reset, and interlock functions as well as remote memory tests selection.

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

10. **BUS INTERFACE:** Optional connector for interconnection to RS-232 bus interface.

4520 REAR PANEL CONTROLS



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9. **THERMAL FAN:** To cool the instrument.

INSTALLATION

Introduction

This section contains information for the unpacking, inspection, preparation for use and storage of your Slaughter Company, 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 Slaughter Company customer support department immediately. Please save the shipping carton and packing material for the carrier's inspection. Our customer support department will assist you in the repair or replacement of your instrument. Please do not return your product without first notifying us and receiving an RMA (return materials authorization) number.

Contents of the Carton

Inside the carton should be the following:

Description	SLA Part Number
43XX Series Instrument	43XX Hipot, Ground Bond, IR Tester
High Voltage Probe	102-050-913
High Voltage Cable	102-055-913
High Current Return Lead	99-10008-01
High Current Output Lead	99-10009-01
Fuse	99-10106-01, 6.3 Amp, slow blow, 250VAC
Interlock Connector	99-10040-01
Line Cord*	125-013-001 Standard

*The Line Cord listed is American. Other combinations of the Line Cord are available upon request.

Preparation for Use

Power Requirements and Line Voltage Selection

This instrument requires a power source of either 115 volts AC ± 10%, 47-63 Hz single phase or 230 volts AC ±10%, 47-63 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 (model 4320 only). In addition, please be sure the correct fuse is selected and installed while the instrument is in the off position.

CAUTION

Do not switch the line voltage selector switch located on the rear panel while the instrument is on or operating (model 4320 only). This may cause internal damage and represents a safety risk to the operator.

NOTE

For operation at 115 Volts AC and 230 Volts AC use a 6.3 A slow blow fuse (model 4320).

For operation at 115 Volts AC and 230 Volts AC use a 15 A slow blow fuse (model 4520).

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 instruments depends on the country of destination.

Operating Environment

This equipment is intended for indoor use only. The equipment has been evaluated according to Installation Category II and Pollution Degree 2 as specified in IEC 664.

This instrument may be operated within the following environmental conditions:

Temperature…….32° - 104° F (0° - 40° C)

Relative humidity …….0 - 80%

Altitude ……6,560 feet (2,000 meters)

Ventilation: When choosing a bench location, or in rack mount applications, insure that there is at least 6 inches (15 cm) of space from the rear panel to any wall or obstruction behind the unit.

STORAGE AND SHIPMENT

Environment

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

Temperature.....-40° - 167° F (-40° - 75°C)

Altitude..... 50,000 feet (15,240 meters)

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

Packaging

Original Packaging: Please retain all original packaging materials if you do not have an alternate method of repackaging. If you are returning your instrument to us for servicing please repackage the instrument in its original container or use an alternate packaging solution. Please do not reuse the original packing material if there appears to be damage or missing packing material. Contact our customer support department (1-800-504-0055) for an RMA (return materials 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. Please refer to the RMA number for 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 ship models 4320/4520 via Federal Express or UPS air.

7). Please refer in all correspondence to your RMA number.

Field Installation of Options

There are no field installable options on the model 4320/4520.

QUICK START

This quick start guide assumes the operator has some familiarity with automated hipot 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:

DEFAULTS

Input Voltage: 115 or 230 volts AC country specific (rear panel switch selectable)

System parameters:

- **PLC Remote:** OFF
- **Single Step:** OFF
- **Fail Stop:** ON
- **Lock:** OFF
- **Memory Lock:** ON

Test Parameters:

- **Memory Position:** 1
- **Step Position:** 1
- **Test Mode:** **AC**
- **Voltage:** **1.24 kV**
- **HI-Limit:** **10.00 mA**

- **LO-Limit:** **0.00 mA**
- **Ramp:** **0.1 s**
- **Dwell:** **1.0 s**
- **Freq.:** **60 Hz**
- **Connect:** **OFF**

a). Unpack this 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.

WARNING b). 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 of this manual. Locate a three prong grounded outlet. Be sure the outlet has been tested for proper wiring before connecting the instrument to it.

CAUTION c). 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.

d). Turn on the POWER switch located on the lower left hand side of the front panel. Upon powering the instrument up a POWER ON SELF TEST (POST) will automatically be performed. This test will check for the condition of the ram chips, pcb's and other critical components. In addition, you will see the Slaughter Company name, Model Number, and current software version briefly appear on the LCD readout and then clear itself.

SLAUGHTER	
4320	VER:X.XX

SLAUGHTER	
4520	VER:X.XX

You should then see the default parameters on the LCD meter as follows:

1 – 1 Set	1.0s
1.24kVAC	10.00mA

These abbreviated parameters stand for the following:

1 - 1: Indicates the memory and step location of the current settings.
Set: This is the parameter settings review screen
1.0s: The dwell timer is set to a test duration of 1 second.
1.24kVAC: The test voltage is set to 1,240 volts AC.
10.00mA: The high leakage current trip point is set to 10 milliamps.

If you wish to not use any one of these parameters you must change your parameters. Please refer to the Operation Instructions section in this manual for further details.

e). If the instrument defaults are acceptable then be sure to connect the appropriate test leads to the device under test (DUT) or test fixture. Be sure to connect this safety ground to a suitable known good ground before energizing this instrument and then connect the return lead first (black) to the test fixture or item followed by the high voltage output lead.

f). Please check your connections to be sure they are making good contact and that the test station or area is clear of debris and other personnel.

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

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 cycle ON and begin the test using the defaults. If a failure occurs, you will HEAR an audible alarm go off. To stop the alarm you must depress the RED button marked RESET. This will silence the alarm and reset the instrument to begin another test. This RESET button may also be used as a safety button to quickly ABORT a test and cut off the HIGH VOLTAGE.

When HIGH VOLTAGE is present, a RED flashing indicator located above the HV receptacle will remain flashing until the HIGH VOLTAGE is OFF. If the device under test PASSED the test then no audible alarm will sound. You will hear a brief BEEP to let you know the item was successfully tested and it PASSED. In the case of a FAIL condition, the instrument will provide a memory of the test condition results on the LCD display that will remain until the next test is initiated. Depressing the RESET button will reset the instrument alarm while keeping the last test results on the display. Depressing the RESET button a second time will clear the display.

OPERATION INSTRUCTIONS FOR Model 4320/4520

A. POWER UP:

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.

CAUTION 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. Also, connect the rear panel chassis ground for additional safety.

Turn on the POWER switch located on the lower left hand side of the front panel. Upon powering the instrument up, a POWER ON SELF TEST (POST) will be automatically performed. This test will check for the condition of the ram chips, pcb's and other critical components. In addition the display will show the following message, with the actual model number and software version number.

SLAUGHTER
4320 VER:X.XX

SLAUGHTER
4520 VER:X.XX

Then the instrument will recall the last memory program that was active and the display will show the parameters that were programmed into that memory. The instrument is now ready for operation.

B. SETUP PROCEDURE:

1. Memory configuration

The model 4320/4520 is equipped with 6 memory programs numbered 1 through 6. Each memory location contains 6 separate steps that can be connected sequentially to the next consecutive step. Each step contains 4 separate locations, one for each function. Only one function can be selected for each step, but the other three function parameters remain

stored in the memory. The following memory map illustrates the separate location for each function.

Memory 1	Step 1	Step 2	Step 3…Step 5	Step 6
	AC	AC	AC	AC
	DC	DC	DC	DC
	IR	IR	IR	IR
	GND	GND	GND	GND

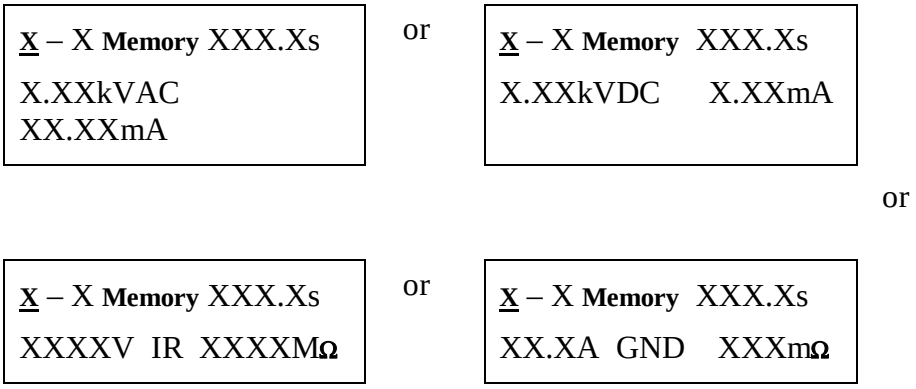
Memory 2…5	Step 1	Step 2	Step 3…Step 5	Step 6
	AC	AC	AC	AC
	DC	DC	DC	DC
	IR	IR	IR	IR
	GND	GND	GND	GND

Memory 6	Step 1	Step 2	Step 3…Step 5	Step 6
	AC	AC	AC	AC
	DC	DC	DC	DC
	IR	IR	IR	IR
	GND	GND	GND	GND

To recall of a memory program please press the SET key, then press the Up (∧) or Down (∨) arrow keys until the specific memory you wish to recall is displayed. Please see procedures below for details. Pressing the EXIT key will activate selected memory position. To start a test, press the TEST button.

2. To select the Memory location

Please press the SET key once. The under score blinking symbol appears directly under digit that represents memory location. The blinking cursor indicates that the parameter is being edited. The display shows:

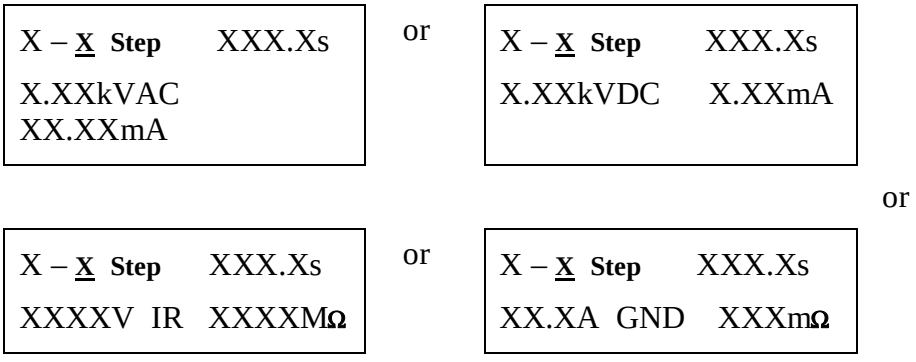


Please use the Up (∧) or Down (∨) arrow keys to select memory locations 1 through 6.

After selecting the memory, press the SET key to view the settings that have been recalled from memory or to make any changes to these settings. Once you have entered all the test data such as test function and parameters of that function, as outlined in the below procedures, press the EXIT key to store any changes and return to the test mode.

3. To select the Step location

Please press the SET key twice. The under score blinking symbol appears directly under digit that represents step location. The blinking cursor indicates that the parameter is being edited. The display shows:



Please use the Up (∧) or Down (∨) arrow keys to select step locations 1 through 6, then press the EXIT key to store the current setting and return to the test mode, or press the SET key to advance to the next parameter.

4. To set the test type

To change the Test type on the model 4320/4520, please press the SET key three times until the display shows:

Mode = **AC**	or	Mode = **DC**

or

Mode = **IR**	or	Mode = **GND**

Press the Up (∧) or Down (∨) arrow keys to toggle the test selection between AC, DC, IR, and GND modes; then press the EXIT key to store the setting and return to the selected test mode or press the SET key if the parameters of the selected test desire to be changed.

5. AC and DC dielectric withstand test modes setting

5.1. To set the Output Voltage

Press the SET key until the display shows:

Voltage = X.XX kV

Please use the Up (∧) or Down (∨) arrow keys to enter the desired test voltage, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. The maximum voltage which may be entered is 5.00kV AC or 6.00kV DC. Any attempt to set the value above this limits will produce two short beeps as an ERROR message. Pressing the Down (∨) arrow key when Voltage = 0.00kV also will produce two short beeps as an ERROR message.

5.2. To set the High Leakage Current Limit

Please press the SET key until the display shows:

HI-Limit = XX.XXmA

Use the Up (∧) or Down (∨) arrow keys to enter the leakage current high limit setting, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. The unit of measure is in milliamperes with

20.00mA AC and 5.00mA DC as the maximum setting for the 4320 and 100.00mA AC and 10.00mA DC as the maximum setting for the 4520. Both instruments include 0.00mA AC and DC as minimum setting. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message.

5.3. To set the Low Leakage Current Limit

Please press the SET key until the display shows:

LO-Limit = XX.XXmA

Use the Up (∧) or Down (∨) arrow keys to enter the leakage current low limit setting, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. The unit of measure is in milliamperes with 20.00mA AC and 5.00mA DC as the maximum setting for the 4320 and 100.00mA AC and 10.00mA DC as the maximum setting for the 4520. Both instruments include 0.00mA AC and DC as minimum setting. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message.

5.4. To set the Ramp time

Please press the SET key until the display shows:

Ramp = XXX.Xs

Use the Up (∧) or Down (∨) arrow keys to enter the ramp time setting, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. The minimum ramp time setting is 0.1 seconds, the maximum ramp time setting is 999.9 seconds. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message

5.5. To set the Dwell time

Please press the SET key until the display shows:

Dwell = XXX.Xs

Use the Up (∧) or Down (∨) arrow keys to enter the desired dwell time, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. If the dwell time is set to 0.0s, the instrument will operate in a continuous ON mode when the TEST button is depressed and released. It will stop when the DUT (Device Under Test) goes into failure or the manual RESET button is pressed. The actual minimum dwell time setting is 0.2 seconds. The maximum dwell time setting is 999.9 seconds. Any attempt to set the value more than 999.9s or less than 0.0s will produce two short beeps as an ERROR message.

5.6. To set the Frequency 50/60 Hz (For AC mode only)

Please press the SET key until the display shows:

Freq. = 60Hz	or	Freq. = 50Hz

Press the Up (∧) or Down (∨) arrow keys to toggle the frequency setting to 50 or 60 Hertz, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter.

5.7. To set the Connect mode ON/OFF

Please press the SET key until the display shows:

Connect = OFF	or	Connect = ON

Press the Up (∧) or Down (∨) arrow keys to toggle the connect mode to ON or OFF, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the first parameter (memory number) again. If Connect is set to ON the next step in the sequence will be executed. If Connect is set to OFF the test sequence will stop at this step. If step 6 is set to ON the test process will be connected to the first step of the next memory. Step 6 of the memory 6 does not have Connect ON/OFF option.

6. IR insulation resistance test mode setting
6.1. To set the Output Voltage

Please press the SET key until the display shows:

Voltage = XXXXV

Please use the Up (∧) or Down (∨) arrow keys to enter the desired test voltage, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. The maximum voltage which may be entered is 1000 Volts DC and the minimum voltage is 100Volts DC. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message.

6.2. To set the High Resistance Limit

Please press the SET key until the display shows:

HI-Limit = XXXXMΩ

Use the Up (∧) or Down (∨) arrow keys to enter the desired resistance high limit setting, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. The unit of measure is in megohms with 0MΩ - 1000MΩ range of setting. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message. A measured value above the High Limit setting will result in a failure condition at the end of the Delay time setting. A setting of 0MΩ disables the high limit feature.

6.3. To set the Low Resistance Limit

Please press the SET key until the display shows:

LO-Limit = XXXXMΩ

Use the Up (∧) or Down (∨) arrow keys to enter the desired resistance low limit setting, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. The unit of measure is in megohms with 1MΩ -

1000MΩ range of setting. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message. A measured value below the Low Limit setting will result in a failure condition at the end of the Delay time setting.

6.4. To set the Delay time

Please press the SET key until the display shows:

Delay = XXX.Xs

Use the Up (∧) or Down (∨) arrow keys to enter the desired delay time, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. If the delay time is set to 0.0s, the instrument will operate in a continuous ON mode when the TEST button is pressed and released. The test will stop only when the manual RESET button is pressed or the OFL detected. The actual minimum delay time setting is 0.5 seconds. The maximum delay time setting is 999.9 seconds. Any attempt to set the value more than 999.9s or less than 0.0s will produce two short beeps as an ERROR message.

Note: The Delay timer in the IR mode differs from the Dwell timer in the Hipot mode. A judgment is not made until the Delay time has elapsed. In the Hipot mode a Pass / Fail judgment is made a soon as the leakage limits are exceeded. Therefore, when the Delay time is set to zero Pass and Fail judgment or indications will not be made.

6.5. To set the Connect mode ON/OFF

Please press the SET key until the display shows:

Connect = OFF	or	Connect = ON

Press the Up (∧) or Down (∨) arrow keys to toggle the connect mode to ON or OFF, then press the EXIT key to store the setting and return to the test mode or press the SET key to advance to the next parameter. If Connect is set to ON the next step in the sequence will be executed. If Connect is set to OFF the test sequence will stop at this step. If step 6 is set to ON the test process will be connected to the first step of the next memory. Step 6 of the memory 6 does not have Connect ON/OFF option.

7. GND Bond test mode setting
7.1. To set the Output Current

Please press the SET key until the display shows:

Current = XX.XA

Please use the Up (∧) or Down (∨) arrow keys to enter the desired output current setting, then press the EXIT key to store the current setting and return to the test mode, or press the SET key to advance to the next parameter. The unit of measure is in amperes with 3A – 30A range of setting. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message.

7.2. To set the High or Low Limits

Please press the SET key until the display shows:

HI-Limit = XXXmΩ

or

LO-Limit = XXXmΩ

Please use the Up (∧) or Down (∨) arrow keys to enter the desired value of the High or Low Limits resistance trip point then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the next parameter. The unit of measure is in milliohms with a range of 0mΩ - 510mΩ at current 3.0A – 10.0A, 0mΩ - 200mΩ at current 10.1A – 25.0A, and 0mΩ – 150mΩ at current 25.1A – 30.0A. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message.

7.3. To set the Dwell time

Please press the SET key until the display shows:

Dwell = XXX.Xs

Use the Up (∧) or Down (∨) arrow keys to enter the desired dwell time, then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the next parameter. If the dwell time is set to 0.0s, the instrument will operate in a continuous ON mode when the TEST button is depressed and released. It will stop when the manual RESET button is pressed or the DUT goes into failure. The actual minimum dwell time setting is 0.5 seconds. The maximum dwell time setting is 999.9 seconds. Any

attempt to set the value more than 999.9s or less than 0.0s will produce two short beeps as an ERROR message.

7.4. To set the Offset

Please press the SET key until the display shows:

Offset = XXXmΩ
TEST to Auto Set

Please use the Up (∧) or Down (∨) arrow keys to adjust the setting of the offset manually, then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the next parameter. To set the Offset automatically, press the TEST button when the test leads or test fixture is connected across the instrument Return and Current outputs. The instrument will measure the resistance that is present and enter this value into the Offset setting. This offset will be automatically subtracted from the actual resistance reading before the reading is displayed. The unit of measure is in milliohms with a range of 0mΩ - 100mΩ. Any attempt to set the value outside this limits will produce two short beeps as an ERROR message.

7.5. To set the Frequency

Please press the SET key until the display shows:

Freq. = 60Hz	or	Freq. = 50Hz

Press the Up (∧) or Down (∨) arrow keys to toggle the frequency setting to 50 or 60 Hertz, then press the EXIT key to store the frequency setting and return to the test mode, or press the SET key to advance to the next parameter.

7.6. To set the Connect mode ON/OFF

Please press the SET key until the display shows:

Connect = OFF	or	Connect = ON

Press the Up (∧) or Down (∨) arrow keys to toggle the connect mode to ON or OFF, then press the EXIT key to store the setting and return to the test mode or press the SET key to

advance to the next parameter. If Connect is set to ON the next step in the sequence will be executed. If Connect is set to OFF the test sequence will stop at this step. If step 6 is set to ON the test process will be connected to the first step of the next memory. Step 6 of the memory 6 does not have Connect ON/OFF option.

System menu parameters setting

7.7. To set the PLC Remote ON/OFF

Please press EXIT key once. The display shows:

PLC Remote = OFF	or	PLC Remote = ON

Use the Up (∧) or Down (∨) arrow keys to change the PLC Remote setting, then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the next system parameter. When the PLC Remote is turned ON the front panel TEST button is disabled and a test may only be started through the rear panel I/O. If you attempt to start a test from the front panel TEST button when the PLC Remote function is turned ON the instrument will produce two short beeps and a following pop-up message will be displayed:

PLC Remote ON

Message will disappear after a few seconds or it can be cleared with the RESET button.

7.8. To set the Single Step ON/OFF

Please press EXIT key once then press the SET key until the display shows:

Single Step = OFF	or	Single Step = ON

Use the Up (∧) or Down (∨) arrow keys to change the Single Step setting, then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the next system parameter.

This function is used to temporary override the automatic connection feature. When the Single Step function is ON the instrument will pause after each step is completed, although step Connect function is set to ON. To continue the test sequence, press the TEST button to execute the next connected step. Each time the TEST button is pressed the next connected step will execute. If you press the RESET button before completing all connected steps, it will return the instrument to the original starting step. If a step fails and you wish to continue to the next step, do not press the RESET button, press the TEST button.

7.9. To set the Fail Stop ON/OFF

Please press EXIT key once then press the SET key until the display shows:

Fail Stop = OFF	or	Fail Stop = ON

Use the Up (∧) or Down (∨) arrow keys to change the Fail Stop setting, then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the next system parameter.

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

7.10. Key Lock or Memory Lock setting

The model 4320/4520 is equipped with two different lockout selections. The first selection is Key Lock. Within this selection, you can lockout all front panel control functions except TEST and RESET. The second selection is Memory Lock and is used in conjunction with the Key Lock. Within this selection, you can lockout all front panel control functions except TEST, RESET and memory select.

Use the following chart to set the Key Lock and Memory Lock for your application.

Key Lock	Memory Lock	Accessible keys
OFF	OFF	All
OFF	ON	All
ON	OFF	TEST, RESET, and SET/Up-Down arrows for memory selection
ON	ON	TEST and RESET

To set the key Lock ON please press EXIT key once and then press the SET key until the display shows:

Lock = OFF

Use the Up (∧) or Down (∨) arrow keys to change the Lock setting to ON, then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the Memory Lock screen. Once the EXIT key pressed key Lock function is activated.

Deactivation of the key Lock function is possible only from a power OFF state. Please turn the POWER switch to the OFF position then press and hold the SET key and turn the power ON. Then system menu (EXIT key) will be unlocked. Now you can press EXIT key once and then press the SET key until the display shows:

Lock = ON

Use the Up (∧) or Down (∨) arrow keys to change the Lock setting to OFF, then press the EXIT key to store the setting and return to the unlocked test mode, or press the SET key to advance to the next system parameter

Memory Lock function can be toggled when system unlocked or through the power OFF state described above. Please press EXIT key once then press the SET key until the display shows:

Memory Lock = OFF	or	Memory Lock = ON

Use the Up (∧) or Down (∨) arrow keys to change the Memory Lock setting, then press the EXIT key to store the setting and return to the test mode, or press the SET key to advance to the first system parameter (PLC Remote) again.

C. OPERATING PROCEDURES:

If the instruments defaults are acceptable then be sure to connect the appropriate test leads to the device under test (DUT) or test fixture. Be sure to connect the safety ground (on the rear panel) to a suitable known good ground before energizing this instrument. Then connect the return lead first to the test fixture or the DUT followed by the high voltage lead.

Check your connections to be sure they are making good contact and that the test station or area is clear of debris or other personnel.

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

Please follow the setup procedures above to set the desire parameters. The display will show the either the Dielectric Withstand test settings, the Insulation Resistance test settings or Ground Bond test setting depending on what has been selected, as follows:

X – X Set XXX.Xs X.XXkVAC XX.XXmA	or	X – X Set XXX.Xs X.XXkVDC X.XXmA

or

X – X Set XXX.Xs XXXXV IR XXXXMΩ	or	X – X Set XXX.Xs XX.XA GND XXXmΩ

The underbar character may be displayed after the step number, i.e. X – X_. This indicates that there is another configured test will execute after the displayed setup has completed. To view the next test setup please press the SET key twice then press the Up

arrow key. To return to the previous test please press the Down arrow key and then EXIT key to return to the test mode.

1. AC or DC Dielectric Withstand Test Mode

To initiate a test, press the TEST button on the front panel. The red High Voltage Arrow indicator will flash and the display will immediately show:

X – X Ramp XXX.Xs X.XXkVAC XX.XXmA	then	X – X Dwell XXX.Xs X.XXkVAC X.XXmA

or

X – X Ramp XXX.Xs X.XXkVDC X.XXmA	then	X – X Dwell XXX.Xs X.XXkVDC X.XXmA

The instrument will continue to output the desired voltage for the duration of the selected Ramp and Dwell times.

If the DUT has passed the test, the green TEST button will illuminate and a short audible beep tone will be activated. The display will show:

X – X Pass XXX.Xs X.XXkVAC XX.XXmA	or	X – X Pass XXX.Xs X.XXkVDC X.XXmA

The instrument is ready to perform another test.

If the operator elects to abort a test in process this can be accomplished by pressing the RESET button at anytime. The instrument will stop the test process immediately and the display will show:

X – X Abort XXX.Xs X.XXkVAC XX.XXmA	or	X – X Abort XXX.Xs X.XXkVDC X.XXmA

Please press the TEST button to initiate another test.

If the leakage current exceeds the high limit setting, but does not exceed the metering range, the red RESET button will illuminate and an alarm will activated. The display will show:

X – X HI-Lmt XXX.Xs X.XXkVAC XX.XXmA	or	X – X HI-Lmt XXX.Xs X.XXkVDC X.XXmA

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test.

If the leakage current does not exceed the low limit setting, the red RESET button will illuminate and an alarm will activated. The display will indicate:

X – X LO-Lmt XXX.Xs X.XXkVAC XX.XXmA	or	X – X LO-Lmt XXX.Xs X.XXkVDC X.XXmA

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test.

If there is a short circuit in the DUT during the test, the red RESET button will illuminate and an alarm will activated. The display will show:

X – X OFL XXX.Xs X.XXkVAC >20.0mA	or	X – X OFL XXX.Xs X.XXkVDC >5.00mA

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test.

If a flash over occurs in the DUT during the test, which results in an OFL condition due to the current exceeds the maximum metering range, the red RESET button will illuminate and an alarm will activated. The 4320 display will show:

X – X OFL	XXX.Xs	or	X – X OFL	XXX.Xs
X.XXkVAC	>20.0mA		X.XXkVDC	>5.00mA

The 4520 display will show:

X – X OFL	XXX.Xs	or	X – X OFL	XXX.Xs
X.XXkVAC	>100.0mA		X.XXkVDC	>10.00mA

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test.

If the leakage current exceeds the metering range and neither a short circuit nor flash over occurred, the red RESET button will illuminate and an alarm will activated. The 4320 display will show:

X – X HI-Lmt	XXX.Xs	or	X – X HI-Lmt	XXX.Xs
X.XXkVAC	>20.0mA		X.XXkVDC	>5.00mA

The 4520 display will show:

X – X HI-Lmt	XXX.Xs	or	X – X HI-Lmt	XXX.Xs
X.XXkVAC	>100.0mA		X.XXkVDC	>10.00mA

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test.

Insulation Resistance Test Mode

To initiate a test press the TEST button on the front panel. The red High Voltage Arrow indicator will flash and the display will immediately show:

X – X Delay	XXX.Xs
XXXXV IR	XXXXMΩ

If the DUT has passed the test, the green TEST button will illuminate and a short audible beep tone will be activated. The display will show:

X – X Pass	XXX.Xs
XXXXV IR	XXXXMΩ

The instrument is ready to perform another test.

If the operator elects to abort a test in process this can be accomplished by pressing the RESET button at anytime. The instrument will stop the test process immediately and the display will show:

X – X Abort	XXX.Xs
XXXXV IR	XXXXMΩ

Please press the TEST button to initiate another test.

If the insulation resistance exceeds the high limit setting, but does not exceed the metering range, the red RESET button will illuminate and an alarm will activated. The display will show:

X – X HI-Lmt	XXX.Xs
XXXXV IR	XXXXMΩ

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information on the screen will be cleared and the display will indicate the setting data of the executed test.

If the insulation resistance exceeds the high limit setting, and exceeds the metering range, the red RESET button will illuminate and an alarm will activated. The display will show:

X – X HI-Lmt XXX.Xs
XXXXV IR >1000MΩ

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information on the screen will be cleared and the display will indicate the setting data of the executed test.

If the leakage current does not exceed the low limit setting and is within the metering range the red RESET button will illuminate and an alarm will activated. The display will show:

X – X LO-Lmt XXX.Xs
XXXXV IR XXXXMΩ

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information on the screen will be cleared and the display will indicate the setting data of the executed test.

If the leakage current does not exceed the low limit setting and is not within the metering range the red RESET button will illuminate and an alarm will activated. The display will show:

X – X LO-Lmt XXX.Xs
XXXXV IR <1.00MΩ

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information on the screen will be cleared and the display will indicate the setting data of the executed test.

2. Ground Bond Test Mode

To initiate a test press the TEST button on the front panel. The instrument will continue to output the desired current for the duration of the selected dwell time. The display will indicate:

X – X Dwell	XXX.Xs
XX.XA GND	XXXmΩ

If the DUT has passed the test, the green TEST button will illuminate and a short audible beep tone will be activated. The display will indicate:

X – X Pass	XXX.Xs
XX.XA GND	XXXmΩ

The instrument is ready to perform another test.

If the operator elects to abort a test in process this can be accomplished by pressing the RESET button at anytime. The instrument will stop the test process immediately. The display will indicate:

X – X Abort	XXX.Xs
XX.XA GND	XXXmΩ

Please press the TEST button to initiate another test

If the resistance exceeds the metering range, the red RESET button will illuminate and the alarm will be activated. The display will show:

If current 3.0 – 10.0A

X – X HI-Lmt	XXX.Xs
XX.XA GND	>510mΩ

If current 10.1 – 25.0A

X – X HI-Lmt	XXX.Xs
XX.XA GND	>200mΩ

If current 25.1 – 30.0A

X – X HI-Lmt	XXX.Xs
XX.XA GND	>150mΩ

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test.

If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test. The display will show:

X – X Set	XXX.Xs
XX.XA GND	XXXmΩ

If the resistance exceeds the high limit trip setting, but do not exceed the metering range, the red RESET button will illuminate and the alarm will be activated. The display will show:

X – X HI-Lmt	XXX.Xs
XX.XA GND	XXXmΩ

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test.

If the resistance does not exceed the low limit setting, the red RESET button will illuminate and the alarm will be activated. The display will show:

X – X LO-Lmt	XXX.Xs
XX.XA GND	XXXmΩ

To stop the alarm, please press the RESET button once. The alarm will stop and the display will retain the failure information. The instrument is now ready for the next test. If the RESET button is pressed again, the failure information will be cleared and the display will indicate the setting data of the executed test.

3. Reviewing Test Result in multistep tests

The test results from the memories that are executed can be reviewing by pressing the Up (∧) or Down (∨) arrow keys. Successive key presses will continue advancing to the next result. The results of the last step in the process will be followed by the first step when scrolling through the results. Results can be reviewed at any time before the next test is executed. All results are cleared at the start of the next test cycle.

4. Output Error

This message appears on the display, if the instrument's output reading does not match the setting. When the instrument has an output problem and the TEST button is pressed, the Output Error screen will appear as follows:

OUTPUT ERROR !
EXIT to continue

The RESET button is not active in this situation. Only the EXIT key will allow you to return to the test mode. When the EXIT key is pressed the instrument will continue with its normal failure indication process. The failure light and Alarm can be cleared by pressing the RESET button. If Output Error occurs please call the Slaughter Company Customer Support Center at 1-800-504-0055 for assistance.

5. Fatal Error

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

FATAL ERROR 900X
Call 18005040055

All of the buttons and keys are not active in this situation. This type of failure permanently locks the instrument in the Fatal Error mode and required that the instrument be serviced by a Slaughter Company authorized service center. The customer should contact the Slaughter Company Customer Support Center at 1-800-504-0055 to receive further instruction.

The following Fatal Error identification numbers will represent the type of the failure that has occurred:

FATAL ERROR 9002 will appear on the display, if the instrument's System data or the Model/Option data are corrupted and do not match the setting.

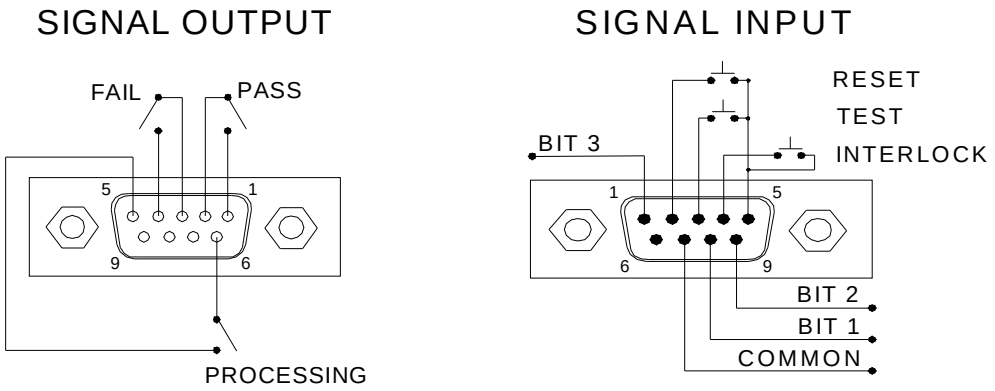
FATAL ERROR 9003 will appear on the display, if the instrument's Calibration data is corrupted.

D. CONNECTION OF REMOTE I/O:

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

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:



REMOTE INTERFACE REAR PANEL:

1. SIGNAL OUTPUTS ON REMOTE I/O

The rear panel connector provides output signals to remotely monitor PASS, FAIL, and PROCESSING conditions. These 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). 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.

2. SIGNAL INPUTS OF REMOTE I/O and PROGRAMMED TESTS

The model 4320/4520 remote connector enables remote operation of the TEST, RESET, and REMOTE INTERLOCK functions, and allows the operator to select one of 6 preprogrammed tests.

When the PLC Remote mode is ON, the instrument will respond to simple switch or relay contacts closures. A normally open momentary switch can then be wired across pins 3 and 5 to allow remote operation of the TEST function. When the PLC Remote function is ON the TEST button on the front panel will be disabled to prevent a test from being activated through this button. If you attempt to start a test from the front panel TEST button and the PLC Remote function is turned “ON”, a pop-up message will be displayed. The pop-up message will appear as follows:

PLC Remote ON

A normally open momentary switch can also be wired across pins 2 and 5 to allow remote operation of the RESET function. For safety, the front panel RESET button remains active even when a remote reset switch is connected so that high voltage can be shut down from either location.

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

Remote Tests Select Truth Table

BIT 3	BIT 2	BIT 1	TEST #
0	**0**	**1**	01
0	**1**	**0**	02
0	**1**	**1**	03
1	**0**	**0**	04
1	**0**	**1**	05
1	**1**	**0**	06

Where: **1** = Momentary Contact closure between BIT and COMMON
0 = NO Contact closure between BIT and COMMON

WARNING Activating test program functions through the remote connector selects the memory and starts the test that is pre-programmed into that memory.

CAUTION Do not connect voltage or current to the signal inputs. Applying voltage to the signal input could result in damage to the control circuitry.

3. REMOTE INTERLOCK

The model 4320/4520 is equipped with a featured referred to as “Remote Interlock”. Remote Interlock is a feature that utilizes a set of closed contacts to enable the instruments output. In other words, if the Interlock contacts open, the output of the instrument will be disabled. Remote Interlock could also be referred to as a remote system lockout, utilizing “Fail When Open” logic. If the Interlock contacts are open and the TEST button is pushed, a pop-up message will be displayed on the screen for few seconds. The message will appear as follows:

Interlock Open

If the Interlock contacts are opened during a test, the pop-up message will be displayed and the test will abort.

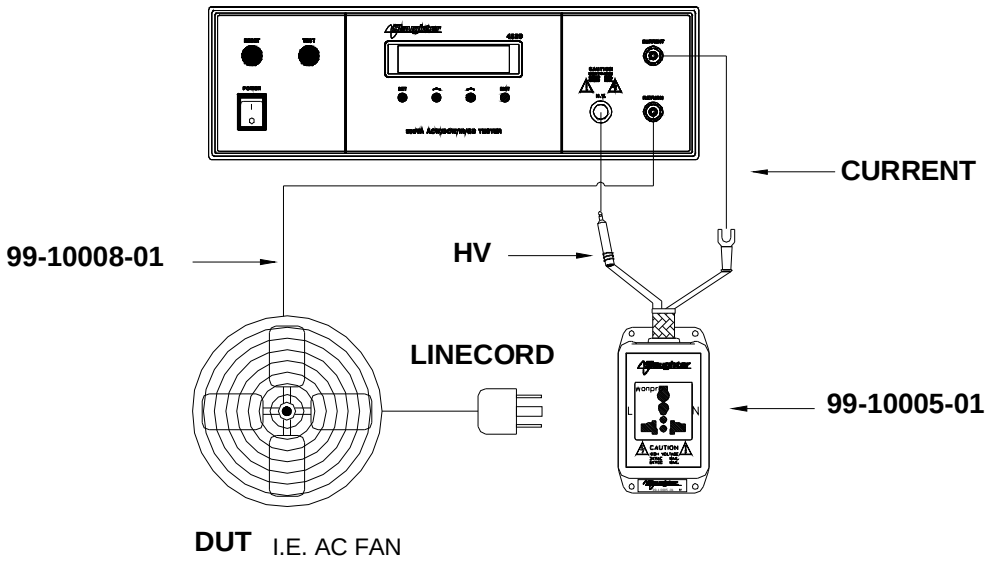
The hardware and software have been configured to provide the interlock connections on pins 4 and 5 of the Remote Interface, Signal Input port. This reset scheme is designed for use with an external safety interlock device that utilizes a "Fail-When-Open" configuration on its output interface The instrument can still be used without the external interlock device as long as the Interlock Connector (P/N # 99-10040-01 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, the instrument will not perform tests. Please refer to section D. CONNECTION OF REMOTE I/O for further information about the remote interface

E. ADAPTER BOX CONNECTION:

The adapter box is an optional accessory and is not provided as standard equipment with the model 4320/4520. If you would like to acquire an adapter box for use with your instrument, please contact The Slaughter Company using the contact information provided in the Safety section of this manual.

The following diagram shows how to connect the adapter box to the 4320/4520 and to the device under test.

WARNING Never connect the adapter box to the instrument while the high voltage outputs are energized.



The rear output connections may be used for connecting the adapter box

This adapter box allows the user an easy way to connect an item that is terminated in a three-prong line cord. If you are testing a product which is terminated in a three-prong plug, you are also required to perform a ground bond test on the ground conductor of the DUT to the chassis or dead metal of the product. The high current is wired to the ground pin of the receptacle box and from there the test is performed on the ground conductor of the DUT to the chassis or dead metal of the product. With the model 4320/4520, you can perform the hipot and ground bond tests sequentially.

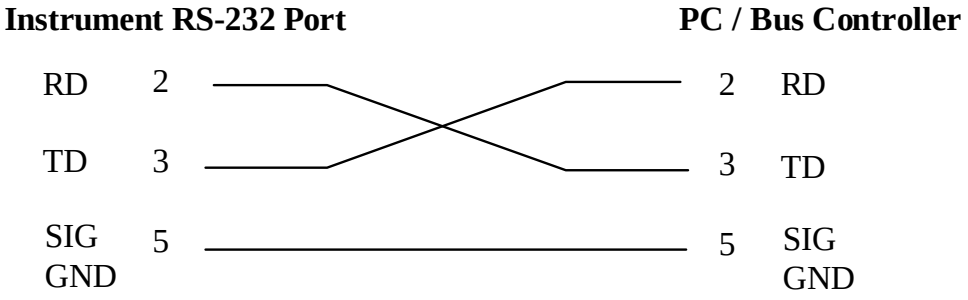
Remote BUS Interface: RS-232

This section provides information on the proper use and configuration of bus remote interface. The RS-232 remote interface is optional on all 4320/4520 models. Please see the OPTIONS section of the manual for details.

RS-232 Interface

This interface provides all of the control commands and parameter setting commands. All commands can be found in the command list 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 cannot 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 send a response string of 06 hex or 6 decimal, the Acknowledge (ACK) ASCII control code if the transfer was recognized and completed by the instrument. If there is an error with the command string that is sent, the instrument will respond with 15 hex or 21 decimal, the Not Acknowledge (NAK) ASCII control code. The ACK or NAK response allows for software handshaking, to monitor and control data flow. When requesting data from the instrument, it will automatically send the data back to the controller input buffer. The controller input buffer will accumulate data being sent from the instrument including the ACK and NAK response strings, until it has been read by the controller.

RS-232 Interface Command List

The RS-232 bus will automatically send any response back to the controller's input buffer. Note that the commands are case sensitive and must be typed in capital letters.

Each command string should be terminated by the ASCII control code, New Line <NL>, or OAh.

The following conventions are used to describe the commands syntax for the 4320/4520. Braces ({ }) enclose each parameter for a command string. Triangle brackets (< >) indicate that you must substitute a value for the enclosed parameter. The Pipe (|) is used to separate different parameter options for a command. The command and the parameter data must be separated with a space. All commands that end with a question mark (?) are query commands and require an IEEE-488 read command to retrieve the data from the device's output buffer.

Test Execution Commands

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

Command	Description
TEST	Execute a Test
RESET	Abort a Test in Process or Reset Failures
SAO	Set Auto Offset

TEST

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

RESET

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

SAO

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

File Editing Commands and Companion Queries

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

Command	Description	Value
FL <*file number*> FL?	File Load	*file number* = 1-6
SS <*step number*> SS?	Step Select	*step number* = 1-6
SAA	Step Add ACW test	
SAD	Step Add DCW test	
SAI	Step Add IR test	
SAG	Step Add GND test	

FL <*file number*>
Load a file from non-volatile memory into random access memory RAM.

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

The parameter values should use complete text and not use the coded values that are associated with the individual parameter setting commands. Such as "ON" and "OFF" and any toggle field that use words or phrases like "OPEN", "CLOSE". The LS? companion command will also list all parameters in complete text as they appear on the setting screen.

	ACW	DCW	IR
1	Voltage	Voltage	Voltage
2	Max Limit	Max Limit	Max Limit
3	Min Limit	Min Limit	Min Limit
4	Ramp Up	Ramp Up	Delay
5	Dwell	Dwell	DUT Output (ON/OFF)
6	Frequency	DUT Output (ON/OFF)	Connect (ON/OFF)
7	DUT Output (ON/OFF)	Connect (ON/OFF)	
8	Connect (ON/OFF)		

	GND
1	Current
2	HI-Limit
3	LO-Limit
4	Dwell
5	Offset
6	Frequency
7	Connect (ON/OFF)

Test Parameter Editing Commands

These commands are used to modify the test parameter within each step. These commands require a parameter value to be included with the command. The companion query command will read the parameter. The writing of the parameter requires that the unit not be included with the value, only the numeric value should be included with the command. Also when the query commands are used the response will not include the units characters. Many of the commands will function the same way for multiple test types however the input range may be different and therefore used a different possible set of values.

Command	**Name**	**Test Types**	**Value**
EA < *value* > EA?	Edit Arc	ACW DCW	1 - 9
EAD {1|0} EAD?	Edit Arc Detect	ACW DCW	1 =On, 0=Off
ECC {1|0} ECC?	Edit Step Connect	ALL	1= On, 0=Off
EC < *value* > EC?	Edit Current	GND	3.00 - 30.00A
EDE < *value* > EDE?	Edit Delay	IR	0.0, 0.5 - 999.9s 0.0 = Continuous
EDW < *value* > EDW?	Edit Dwell	ACW DCW GND	0.0, 0.5 – 999.9s 0.0, 0.5 – 999.9s 0.0, 0.5 – 999.9s 0.0 = Continuous
EF {1|0} EF?	Edit Frequency	ACW GND	1=60Hz, 0=50Hz

Command	Name	Test Types	Value
EH < *value* > EH?	Edit HI-Limit	ACW DCW IR GND	4320: 0.0 – 20,000uA 4520: 0.0 – 99,990uA 4320: 0.0 – 5,000uA 4520: 0.0 – 10,000uA 0 - 1000MΩ 0 - 510mΩ
EL < *value* > EL?	Edit LO-Limit	ACW DCW IR GND	0.0 – 20,000uA 0.0 – 5,000uA 0 - 1000MΩ 0 - 510mΩ
EO < *value* > EO?	Edit Offset	GND	0 - 100mΩ
ERU < *value*> ERU?	Edit Ramp-Up	ACW DCW	0.1 - 999.9s
EV <*value*> EV?	Edit Voltage	ACW DCW IR	1 – 5kV 1 – 6kV 100 - 1000V

System Parameter Editing Commands and Companion Queries

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

Command	Name	Value
SDH{1|0} SDH?	DUT HV Setup ON/OFF	1=On, 0=Off
SPR {1|0} SPR?	PLC Remote ON/OFF	1=On, 0=Off
SSI {1|0} SSI?	Single Step ON/OFF	1=On, 0=Off
SF {1|0} SF?	Fail Stop ON/OFF	1=On, 0=Off
SL {1|0} SL?	System Lock	1=On, 0=Off

SML {1|0} SML?	System Memory Lock	1=On, 0=Off

Query Commands

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

Command	Name	Value
TD?	List Testing Data	Data from test in Process
RD <***step number***>?	Result Data Query	1-3
RR?	Read Reset Query	1=Open, 0=Closed
RI?	Read Interlock Query	1=Open, 0=Closed
LS?	List Step Parameters	
LS <*step number*>?	List Step Parameters by step number	*step number* = 1-6

TD?

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

RD <step number>?

Read the results for an individual step. The step number is the actual step number that has been saved within the file, not the order of which the steps were executed. For example if the test was executed starting from step 3 and ending with step 5 then the first step test results will be found in location 3 not in location 1. Each parameter is separated by commas and includes step number, test type, test status, and metering. The syntax for this command response is {memory - step, test type, status, meter 1, meter 2, meter 3}. Each meter will contain both the value and the units.

RR?

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

RI?

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

LS?

Lists all the Parameters for the individual step that is currently selected.
The response will be formatted as follows; **<*step, test, p1, p2, p3…*>** Where <*step*> is the step number, <*test*> is the test type and <*p1,p2*> etc., indicates the parameters of the test.

LS <*step number*>?

Lists all the Parameters for the individual step indicated by *step number* = 1-30.

The response will be formatted as follows; <*step, test, p1, p2, p3…*> Where <*step*> is the step number, <*test*> is the test type and <*p1,p2*> etc., indicates the parameters of the test.

IEEE 488.2 Common Commands

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

Command	Name	Description
*IDN?	Identification Query	SLA, Model Number, Serial Number, Firmware Revision
*RST	Reset Command	Resets 4320/4520
*TST?	Self-Test Query	00H=OK 01H=TEST EEPROM ERROR
*CLS	Clear Status Command	Clear Standard Event Status Register Clear Service Request Register
*OPC	Operation Complete Command	When TEST command ok setting ESR BIT0 =1
*OPC?	Operation Complete Query	1 = TEST completed ok 0 = TEST in process
*WAI	Wait-to-Continue Command	
*PSC {1|0}	Power-on Status Clear Command	1 = Power-on clear enable registers 0 = Power-on load previous enable registers

*PSC?	Power-on Status Clear Query	
*ESR?	Standard Event Status Register Query	0 - 255
*ESE <*value*>	Standard Event Status Enable Command	*value* = 0 - 255
*ESE?	Standard Event Status Enable Query	0 - 255
*STB?	Read Status Byte Query	BIT 0, 01H,(1) Operation Complete BIT 1,02H,(2) Not Used BIT 2,04H,(4) Query Error BIT 3,08H,(8) Device Error BIT 4,10H,(16) Execution Error BIT 5,20H,(32) Command Error BIT 6,40H,(64) Not Used BIT 7,80H,(128) PROMPT
*SRE <*value*>	Service Request Enable Command	*value* = 0 - 255
*SRE?	Service Request Enable Query	0 - 255

***IDN?**
Read the instrument identification string. Company =SLA.

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

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

***CLS**
Clears the Status Byte summary register and event registers. Does not clear the Enable registers.

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

***OPC?**
Returns an ASCII "1" after the command is executed.

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

***PSC {1|0}**
Sets the power-on status clear bit. When set to 1 the Standard Event Enable register and Status Byte Enable registers will be cleared when power is turned ON. 0 setting indicates

the Enable registers will be loaded with Enable register masks from non-volatile memory at power ON.

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

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

***ESE <*value*>**
Standard Event enable register controls which bits will be logically ORed together to generate the Event Summary bit 5 (ESB) within the Status Byte.

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

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

***SRE <*value*>**
Service Request enable register controls which bits from the Status Byte should be use to generate a service request when the bit value = 1.

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

MODEL 4320/4520 OPTIONS

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 model option label on the rear panel of the unit when options are present.

Model 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

4320/4520 Options

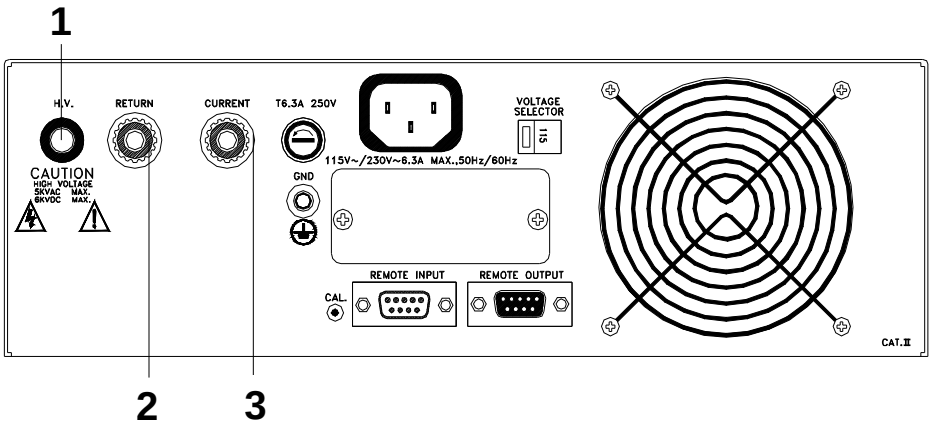
Option List

Code	Description
01	Rear Outputs
02	RS232 Interface

OPTIONAL REAR PANEL CONTROLS

Description

01 Rear Outputs (4320)



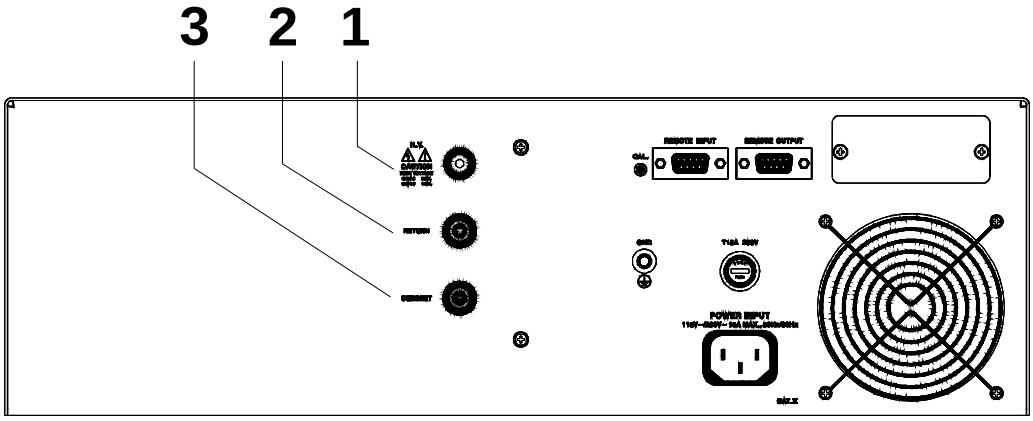
The Rear Outputs option gives the user the capability to access the High Voltage, Current and Return from the rear panel. The configuration and descriptions are as follows.

1. **HIGH VOLTAGE OUTPUT JACK:** For the connection of the detachable 6-foot (1.8 m) red high voltage test lead or three-prong receptacle adapter box. The jack is recessed for safety when this lead is not being used. This jack is always used when performing the Dielectric Withstand or Insulation Resistance tests. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test

2. **RETURN OUTPUT JACK:** For the connection of the detachable 5 foot (1.52 m) black return test lead or three-prong receptacle adapter box. This jack is always used when performing a test. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test.

3. **CURRENT OUTPUT JACK:** This jack uses for the connection of the detachable 5-foot (1.52 m) red high current test lead or adapter box. This jack is always used when performing a Ground Bond test. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test.

Option 01 Rear Outputs (4520)



1. **HIGH VOLTAGE OUTPUT JACK:** For the connection of the detachable 6-foot (1.8 m) red high voltage test lead or three-prong receptacle adapter box. The jack is recessed for safety when this lead is not being used. This jack is always used when performing the Dielectric Withstand or Insulation Resistance tests. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test

2. **CURRENT OUTPUT JACK:** This jack uses for the connection of the detachable 5-foot (1.52 m) red high current test lead or adapter box. This jack is always used when performing a Ground Bond test. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test.

3. **RETURN OUTPUT JACK:** For the connection of the detachable 5 foot (1.52 m) black return test lead or three-prong receptacle adapter box. This jack is always used when performing a test. Please refer section E. Adapter Box connection for details on connecting the adapter box between the instrument and the device under test.

Option 02 RS-232 Interface

This option may be added as a serial type communication protocol. This option provides all of the function control of the RS-232 interface. The 9-pin D-type subminiature connector labeled “RS-232” is for connection of the 4320/4520 to any compatible PC. When selecting RS232, the protocol for interfacing and communicating with a PC can be found on page 50: Bus Remote Interface RS232 of this manual.

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SECTION 2
SERVICE MANUAL

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 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. Slaughter 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 verification can only be made while operation in Test mode.

Calibration Equipment Required:

The following standard equipment will be needed to properly calibrate your instrument.

A Standard AC Voltmeter with 5,000 Volts range

A Standard AC Voltmeter with 6 Volts range

A Standard DC Voltmeter with 6,000 Volts range

A Standard DC Voltmeter with 1,000 Volts range

A Standard AC Ammeter with 30 A range

A Standard AC Milliammeter with 20 mA range

A Standard DC Milliammeter with 5 mA range

A Standard Resistor 100 kΩ/20Watt/1500VAC

A Standard Resistor 1 MΩ/0.25Watt/300VDC

A Standard Resistor 50 MΩ/0.25Watt/1000VDC

1. Calibration Initialization

To enter the calibration mode the instrument must be in the OFF position. Using a pen or small screwdriver, press and hold the recessed calibration key on the rear panel, then turn on the input POWER switch. The display will show:

1. AC 5000V

To calibrate AC voltage please follow procedure on next paragraph, to calibrate other parameters use Up (∧) or Down (∨) arrow keys to scroll to the desired calibration point, then follow procedure on relative paragraph below.

When the calibration process is completed successfully and the instrument accepts the entered calibration data it will output one short “beep” and advance to the next calibration point, otherwise the instrument will output two short “beeps” and will not advance to the next calibration point.

2. To calibrate AC Voltage

Please connect a standard 5000V AC Voltmeter to the HV and RETURN connectors.

Then press the TEST button on the front panel. The instrument will provide around 5000VAC on the output connectors and the display will show:

Voltage = XXXXV

Press the Up (∧) or Down (∨) arrow keys to enter the reading of the standard AC Voltmeter into the instrument. Then press SET key to store the voltage setting and to advance to the next calibration point or press the RESET button to return to the calibration menu without changing the calibration setting. Press the EXIT key to exit from the calibration mode and to return to the test mode.

3. To calibrate DC Voltage

Please connect a standard 6000V DC Voltmeter to the HV and RETURN connectors.

Press the Up (∧) or Down (∨) arrow keys until the display shows:

2. DC 6000V

Then press the TEST button on the front panel. The instrument will provide around 6000VDC on the output connectors and the display will show:

Voltage = XXXXV

Press the Up (∧) or Down (∨) arrow keys to enter the reading of the standard DC Voltmeter into the instrument. Then press SET key to store the voltage setting and to advance to the next calibration point or press the RESET button to return to the calibration menu without changing the calibration setting. Press the EXIT key to exit from the calibration mode and to return to the test mode.

4. To calibrate IR Voltage

Please connect a standard 1000V DC Voltmeter to the HV and RETURN connectors.

Press the Up (∧) or Down (∨) arrow keys until the display shows:

3. IR 1000V

Then press the TEST button on the front panel. The instrument will provide around 1000VDC on the output connectors and the display will show:

Voltage = XXXXV

Press the Up (∧) or Down (∨) arrow keys to enter the reading of the standard DC Voltmeter into the instrument. Then press SET key to store the voltage setting and to advance to the next calibration point or press the RESET button to return to the calibration menu without changing the calibration setting. Press the EXIT key to exit from the calibration mode and to return to the test mode.

5. To calibrate AC Current

Please connect a 100 kΩ resistor in series with the standard 20mA AC Milliammeter and connect these across the HV and RETURN connectors of the instrument.

Press the Up (∧) or Down (∨) arrow keys until the display shows:

4. AC 20.00mA Load = 100kΩ

Then press the TEST button on the front panel. The instrument will provide around 1000VAC on the output connectors and the display will show:

Current XX.XXmA

Press the Up (∧) or Down (∨) arrow keys to enter the reading of the standard AC Milliammeter into the instrument. Then press SET key to store the current setting and to advance to the next calibration point or press the RESET button to return to the calibration menu without changing the calibration setting. Press the EXIT key to exit from the calibration mode and to return to the test mode.

6. To calibrate DC Current

Please connect a 100 kΩ resistor in series with the standard 5mA DC Milliammeter and connect these across the HV and RETURN connectors of the instrument.

Press the Up (∧) or Down (∨) arrow keys until the display shows:

5. DC 5.00mA Load = 100kΩ

Then press the TEST button on the front panel. The instrument will provide around 500VDC on the output connectors and the display will show:

Current X.XXmA

Press the Up (∧) or Down (∨) arrow keys to enter the reading of the standard DC Milliammeter into the instrument. Then press SET key to store the current setting and to advance to the next calibration point or press the RESET button to return to the calibration menu without changing the calibration setting. Press the EXIT key to exit from the calibration mode and to return to the test mode.

7. To calibrate Insulation Resistance range

Please connect a 100kΩ standard resistor across the HV and RETURN connectors.

Press the Up (∧) or Down (∨) arrow keys until the display shows:

6. IR 0.99MΩ
Load = 100kΩ

Then press the TEST button on the front panel. The instrument will execute automatic calibration process. The process does not require data entry. The instrument will provide around 300VDC on the output connectors and the display will show:

Automatic

The instrument will output one short "beep" and advance to the next calibration point when the automatic process is completed successfully, otherwise the instrument will output two short "beeps" and will not advance to the next calibration point.

When previous calibration point was completed successfully display will show:

7. IR 9.99MΩ
Load = 1MΩ

Please connect a 1MΩ standard resistor across the HV and RETURN connectors.

Then press the TEST button on the front panel. The instrument will execute automatic calibration process. The process does not require data entry. The instrument will provide around 300VDC on the output connectors and the display will show:

Automatic

The instrument will output one short "beep" and advance to the next calibration point when the automatic process is completed successfully, otherwise the instrument will output two short "beeps" and will not advance to the next calibration point.

When previous calibration point was completed successfully display will show:

8. IR 99.99MΩ Load = 50MΩ

Please connect a 50MΩ standard resistor across the HV and RETURN connectors.

Then press the TEST button on the front panel. The instrument will execute automatic calibration process. The process does not require data entry. The instrument will provide around 1000VDC on the output connectors and the display will show:

Automatic

The instrument will output one short “beep” and advance to the next calibration point when the automatic process is completed successfully, otherwise the instrument will output two short “beeps” and will not advance to the next calibration point.

When previous calibration point was completed successfully display will show:

9. IR 999.9MΩ Load = 50MΩ

The 50MΩ standard resistor should be connected across the HV and RETURN connectors of the instrument.

Then press the TEST button on the front panel. The instrument will execute automatic calibration process. The process does not require data entry. The instrument will provide around 150VDC on the output connectors and the display will show:

Automatic

The instrument will output one short “beep” and advance to the next calibration point when the automatic process is completed successfully, otherwise the instrument will output two short “beeps” and will not advance to the next calibration point.

8. To calibrate Ground Bond test voltage

Please connect a standard 6V AC Voltmeter across the CURRENT and RETURN connectors of the instrument.

Press the Up (∧) or Down (∨) arrow keys until the display shows:

10. GND 6.00V

Then press the TEST button on the front panel. The instrument will generate an output of about 6 VAC and the display will show:

Voltage = X.XXV

Press the Up (∧) or Down (∨) arrow keys to enter the reading of the standard AC Voltmeter into the instrument. Then press SET key to store the voltage setting and to advance to the next calibration point or press the RESET button to return to the calibration menu without changing the calibration setting. Press the EXIT key to exit from the calibration mode and to return to the test mode.

9. To calibrate Ground Bond test current

Please connect the standard 30A AC Ammeter across the CURRENT and RETURN connectors of the instrument.

Press the Up (∧) or Down (∨) arrow keys until the display shows:

11. GND 30.0A

Then press the TEST button on the front panel. The display will show:

Current = XX.XA

Press the Up (∧) or Down (∨) arrow keys to enter the reading of the standard AC Ammeter into the instrument. Then press SET key to store the current setting and to advance to the next calibration point or press the RESET button to return to the calibration menu without changing the calibration setting. Press the EXIT key to exit from the calibration mode and to return to the test mode.

10. Exit Calibration Mode

When all calibration parameters are completed successfully the display will show:

Calibration
complete

Please press the EXIT key to exit from the calibration mode and to return to the test mode.

Replacement Parts List
Model 4320/4520

Rev: C

Part Number	Qty.	Reference Designator	Description
99-10320-01	1	CON4320	Main Control Board 4320
99-10639-01[1]	1	CON4320	Main Control Board 4520
99-10321-01	1	AMP4320	Amplifier Board 4320
99-10637-01[1]	1	AMP3780	Amplifier Board 4520
99-10322-01	1	HV4320A	HV Control Board 4320
99-10638-01[1]	1	HV4320H	HV Control Board 4520
99-10323-01	1	RY4320	HV AC/DC Switch Board 4320
99-10641-01[1]		RY4320	HV AC/DC Switch Board 4520
99-10324-01	1	CKB-06	Keypad Board
99-10572-01	1	RS232-M1	RS232 Interface Board
99-10573-01	1	-	RS232 Cable
99-10325-01[2]	1	PWR3670	Input Voltage Select Board 4320
99-10326-01	1	REM4320	Remote Board
99-10640-01[1]	1	OPT4520	Output Switch Board 4520
99-10016-01	1	-	Earth Connector
99-10018-01	1	-	High Voltage Connector
99-10112-01	1	-	Return Terminal
99-10113-01	1	-	Current Terminal
175-946-013	1	-	Feet Kit w/o Rubber Inserts
175-974-002	4	-	Rubber Insert
99-10106-01[2]	1	-	Fuse 6.3A, 250V, Slow Blow, 5x20mm

99-10656-01[1]	1	-	Fuse 15A, 250V Slow Blow
99-10297-01[2]	1	-	Fuse Holder 20mm
99-10650-01[1]	1	-	Fuse Holder 30mm
99-10355-01	1	-	LCD Display 16 x 2 Characters
99-10312-01[2]	1	-	Power Switch 2P 15A
330-118-001[1]	1	-	Power Switch 2P 250V 10A
330-113-001	1	-	Test Switch, Green
330-113-002	1	-	Reset Switch, Red
99-10333-01[2]	1	T1	Input Transformer
99-10334-01	1	T2	Output High Voltage Transformer
99-10653-01[1]	1	T2	Output 500VA HV Transformer
99-10654-01[1]	1	T3	Ground Bond Transformer
125-013-001	1	-	Input Power Cable 10A/6Ft.
102-050-913	1	-	High Voltage Probe
102-055-913	1	-	High Voltage Output cable
99-10008-01	1	-	Return cable
99-10009-01	1	-	Current cable
99-10028-01	11	Q…	Power Transistors on AMP4320
99-10029-01	1	RY1	Relay Gunther 3392-1290-246 on RY4320
99-10033-01	1	RY2	Relay Gunther 3390-1290-246 on RY4320
99-10303-01	1	IC2	Microcontroller 8 Bit W78E516B
99-10304-01	1	IC24	Microcontroller 8 Bit SM8951A
99-10030-01	1	IC50	12 Bit D/A Converter 7541
99-10032-01	1	IC20	8 Bit D/A Converter DAC 0800

Part Number	Qty.	Reference Designator	Description
99-10671-01	1	Test/Pass	Replacement Bulb
99-10672-01	1	Reset/Fail	Replacement Bulb

[1] 4520 Only

[2] 4320 Only

Schematic Index

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S99-10321	Amplifier Board 4320	1
S99-10637[1]	Amplifier Board 4520	5
S99-10322	HV Control Board	1
S99-10323[2]	HV AC/DC Switch Board	1
S99-10222	Keypad Board	1
S99-10325	Input Voltage Select Board	1
S99-10326	Remote Board	1
S99-10640[1]	Output Switch Board	1
S99-10572	Optional RS-232	1

[1] 4520 Only

[2] 4320 Only