4048A

OPERATORS MANUAL

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INSTRUCTION MANUAL
MODEL 04048A
ESD/HYPOT

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MODEL 4048 ESD/HYPOT TESTER SPECIFICATIONS

INPUT:	115 volts, 50/60 HZ through five foot-three conductor line cord terminated in three prong grounding type plug.
OUTPUT:	Continuously adjustable from zero to 5 KV DC with a maximum energy level of 64 millijoules for Electrostatic Discharge testing (2 milliamperes maximum current at maximum DC test voltage).
	Continuously adjustable from zero to 5 KV AC at 5 milliamperes for Dieelectric Withstand testing.
POWER SUPPLY:	High reactance (collapsing field) power supply limits short circuit current to approximately 15 MA DC for repetitive ESD testing and approximately 20 MA AC to prevent severe damage to insulation in event of failure during Dielectric Withstand testing.
CONTROLS & INDICATORS:	Power and high voltage ON-OFF switch and variable voltage control for controlling either AC or DC output, high voltage ON indicator light for presence of AC or DC high voltage at the terminals. Leakage indicator light with adjustable sensitivity from 300 microamperes to 5 milliamperes, and breakdown indicator light indicates excessive leakage current or arcing during Dielectric Withstand testing.
METERING:	4-1/2" AC-DC Kilovoltmeter measures output voltage thru a resistive voltage divider directly at the AC or DC output terminal. Accuracy is $\pm$ 3% of full scale for AC and $\pm$ 2% of full scale for DC.
HIGH VOLTAGE TERMINATION:	Recessed female terminals receive disconnectable High Voltage and Ground test leads. One eight foot high voltage test lead terminated in retractable tip safety test probe, one five foot high voltage test lead terminated in insulated clip, and one five foot ground test lead terminated in insulated clip are furnished with the equipment.
CABINET:	Instrument is housed in a steel cabinet with removeable hinged cover. Storage compartment in removeable cover for test leads and instruction manual.
SIZE & WEIGHT:	Unit measures 6" x 9" x 8-1/2" with cover and weighs approximately 20 lbs.

MODEL 4048 ESD/HYPOT TESTER

APPLICATION & OPERATING INSTRUCTIONS

THIS MANUAL, OF MODEL 4048, SHOULD BE USED WITH EXTREME CAUTION. IT IS AN ABSOLUTE NECESSITY THAT THIS MANUAL BE THOROUGHLY READ AND UNDERSTOOD.

INTRODUCTION:

The Model 4048 is a combination Electro-Static-Discharge (ESD) tester and AC Dielectric Withstand (Hypot®) tester, referred to as Model 4048 ESD/HYPOT® Tester. It serves as a field maintenance tool, a Q.C. tool, as well as an R and D tool. Its ESD capabilities provide for evaluating electronic equipment, particularly computer equipment, for susceptibility to static electricity. As an AC HYPOT, dielectric withstand (overvoltage) tests can be performed to check integrity of the electrical insulation system.

Static electricity - an accumulation of electric charges on an insulated body - results in an electro-static-discharge when that body nears or contacts another body of opposite polarity. ESD is indeed a prime suspect in the investigation of computer operating problems, ranging from dropped bits to complete system shut down. A static electric charge of several thousand volts can accumulate on a person's body after a short stroll across a wool or nylon carpet. As a systems operator, a mere touch to the keyboard or cabinet and a static discharge may find its way into the data system, corrupting or completely destroying irreplaceable data stored on a disk. This, many times can be traced to inadequate or ineffective grounding, bonding or shielding, or a combination of all. Static related failures are more prevalent during the cold, dry months of the year.

To reduce the possibility of such disasters as data destruction, the Model 4048, in its ESD mode, is used to simulate electro-static-discharges. Problems of this nature can be detected and dealt with before the equipment is initially placed in service, as well as after field servicing.

Although unrelated to ESD failures, failure of the insulation system is

the most common cause of electrical problems in electrically operated systems and equipment. During the production process, insulation can be accidentally nicked, scraped thin, or even burned away during a soldering operation. This weakens the insulation structure which makes it susceptible to breakdown should in service switching surges cause abnormal overvoltages in the system.

In service, insulation is subject to normal aging causing progressive deterioration, in particular, where it may be exposed to abnormal heating and cooling conditions. Eventually the insulation will become so marginal that failure, due to abnormal overvoltages, will be inevitable.

To address these potential problems, the Model 4048, in its AC HYPOT® mode, can be used to conduct a Dielectric Withstand (overvoltage) test to verify the integrity of the insulation system before the equipment is initially placed in service and after field servicing. A Dielectric Withstand test is the deliberate application of an overvoltage across the insulation system (circuit to ground). Its significance is to ensure that the insulation can withstand without breakdown, any reasonable overvoltage due to switching surges, lightning surges, etc., and to detect faulty workmanship or materials.

ESD TESTING:

Electro-Static-Discharge testing is performed while the equipment system is up and operating. It is important that the equipment is fully assembled with all covers and shields in place, all bonding properly and securely installed, and that it is securely connected to an effective low impedance, noise free earth ground.

As discussed earlier, the purpose of the ESD test is to ensure immunity of the equipment to deleterious effects of static electricity. Since most static related problems can be dealt with by proper shielding, bonding and grounding, the significance of the test is to evaluate the adequacy of these systems. It is, therefore, essential that simulated Electro-Static-Discharges

from the 4048 are made directly to the cabinet and frame parts ONLY, such as front panels, side panels, cable connectors, mounting screws, etc.

CAUTION:

1. DO NOT DISCHARGE THROUGH INTERNAL PARTS OR COMPONENTS. SERIOUS DAMAGE TO THE COMPUTER LOGIC SYSTEM COULD RESULT.

2. DO NOT USE PACKS OR DISKS THAT CONTAIN MASTER FILE DATA DURING THE ESD TEST. USE SCRATCH PACKS ONLY.

3. ENSURE THAT ALL INFORMATION HAS BEEN PROPERLY BACKED UP BEFORE PROCEEDING WITH THE TEST. SIGNIFICANT LOSS OF STORED DATA OR CORRUPTION OF DATA FILES COULD OCCUR SHOULD THE SYSTEM FAIL THE STATIC TEST.

ESD tests are usually made on all units that compose the system, such as CPU's, disk drives, work stations, printers, tape drives, etc. The high voltage prod of the 4048 is touched to various locations on the cabinets or frames of these units, such as panels, cable connectors, screws, etc. At least three discharges are typically made at each location while the system reaction is observed for abnormal performance. Generally, testing starts at a low voltage, such as 500 volts. After tests are complete on all units at the initial voltage (assuming no system hangup or failures have been observed) test voltage is raised to a higher level (usually twice the initial level) and the same tests repeated on all units at the same locations. This process continues as the voltage is increased in increments equal to the initial voltage level, until maximum recommended or specified test voltage and/or energy level is reached. Maximum test voltage and/or energy levels are usually established by a Standards Committee, the Engineering Department of the systems manufacturer, or similar recognized methods. Some manufacturers chose to use 2500 volts maximum, while others may test higher.

Energy level is a function of the square of the test voltage and capacitance value of the energy storage capacitor. The equation is $J=1/2\ CE^2$, where: J is Joules of energy, C is capacitance in microfarads of the energy storage capacitor (.005 mfd. for Model 4048) and E is adjusted test voltage in kilovolts.

1. With a scratch pack in place, bring the system up. Program a constantly changing screen so that system hang up can be monitored while data is sent up and down the disk cables.
2. Locate the 4048 convenient to the units to be tested.
3. Verify that the OUTPUT switch on the 4048 is OFF and plug the Line Cord into an appropriate power source.

CAUTION: IT IS ESSENTIAL THAT THE POWER GROUND OF THE RECEPTACLE WHERE THE LINE CORD IS CONNECTED, IS ELECTRICALLY THE SAME AS THE COMPUTER SYSTEM POWER GROUND. THIS CAN BE VERIFIED BY CHECKING FOR CONTINUITY WITH A LOW RESISTANCE OHMMETER.

4. Plug the black test lead into the GROUND receptacle of the 4048 and connect the clip to the power ground of the unit under test.
5. Plug the red high voltage test prod lead into the H.V. OUTPUT receptacles of the 4048, identified ESD.
6. Assure that the VOLTAGE control of the 4048 is at zero (full counter clockwise). While SAFELY holding the high voltage test prod by its handle, operate the OUTPUT switch to ESD position (the OUTPUT light will glow).
7. Slowly rotate the VOLTAGE control clockwise until the kilovoltmeter indicates the initial test voltage to be used (typically 500 volts as discussed above). Check performance of the tester by touching the high voltage prod tip to the latch on the 4048 cabinet. Repeat several times. As contact is made, the BREAK-DOWN indicator light should flash, the LEAKAGE indicator should light and the kilovoltmeter should drop off toward zero. This is the same indication that should be observed during testing of the equipment signifying discharge as the high voltage prod tip is touched at various locations on the cabinet. If none of the above indications are observed during the performance check or when testing the equipment, the cause must be investigated and corrective action taken before proceeding. A

prime suspect would be a discontinuity in the grounding system or no ground at all.

8. A. CPU - Touch the high voltage test prod on the cabinet at various locations such as side panels, front panels, panel screws, cable connectors, etc. Observe system reaction during each discharge.

B. DISK DRIVE - Touch the high voltage test prod to various locations on the cabinet of each disk drive, including panel screws, cable connectors, etc. Observe system for any evidence of failure.

C. WORKSTATIONS - Touch the high voltage test prod to the keyboard frame, cable connectors, panel screws, etc.

CAUTION: DO NOT DISCHARGE TO CONTROL KNOBS. DAMAGE TO THE CRT MAY OCCUR.

Observe for hang up or system failure.

D. PRINTERS - With the printer running, touch the high voltage test prod to various points on the cabinet, data cable connectors, screws, etc.

CAUTION: DO NOT DISCHARGE THROUGH ANY INTERNAL PARTS SUCH AS CARRIAGE ASSEMBLIES, PLATENS, ETC.

Check for proper printing or erroneous system operation.

E. TAPE DRIVES - While the tape drive is running, touch the high voltage test prod to various points on the cabinet, screws, etc.

CAUTION: DO NOT DISCHARGE THROUGH ANY INTERNAL PARTS.

Observe for proper tape and system operation.

F. OTHER UNITS - If the system consists of units other than those listed above, they should be tested in a similar manner, exercising similar cautions, and observing for proper performance.

The above tests are repeated as the test voltage is increased in increments as described earlier, until maximum recommended or specified test voltage is reached. If any failures occur at any time during the above tests, corrective action must be taken before proceeding.

HYPOT® TESTING:

Hypot testing is performed with the equipment shut down and electrically disconnected from service. The grounding system, however, need not be and should not be disconnected, from ground. Since the significance of the test is to check the integrity of the insulation, high voltage must be applied across the insulation system. Therefore, both sides of the AC input must be connected together and to the high voltage test lead while the ground test lead is connected to the ground system of the equipment.

There are precautions to be taken before performing a Hypot test. First of all, ALWAYS refer to Factory Testing Specifications and/or consult the Engineering Department BEFORE performing a Hypot test. Failure to comply could result in serious damage to the equipment. Of the many things to be considered, some of the more common are as follows:

1. DEPENDING ON THE TYPE OF EQUIPMENT TO BE TESTED AND ITS MODULAR CONSTRUCTION, HYPOT TESTS MAY OR MAY NOT BE RECOMMENDED ON EACH INDIVIDUAL UNIT THAT COMPOSES THE SYSTEM.
2. SURGE OR TRANSIENT PROTECTORS MAY BE CONNECTED LINE TO GROUND. IF THEY ARE NOT ADEQUATELY RATED FOR THE HYPOT TEST VOLTAGE, THEY MAY HAVE TO BE DISCONNECTED OR THE TEST VOLTAGE REDUCED.

3. INPUT FILTER CAPACITORS COMMONLY CONNECTED LINE TO GROUND ARE OFTEN NOT ADEQUATELY RATED FOR MAXIMUM HYPOT TEST VOLTAGE. THEY TOO MAY HAVE TO BE DISCONNECTED.
4. IT MAY BE NECESSARY TO REMOVE DISC OR DATA PACKS BEFORE PERFORMING A HYPOT TEST IF THERE IS A RISK OF DESTROYING DATA.
5. USUALLY A NUMBER OF INPUT POWER SWITCHES MUST BE ON IN ORDER TO PROPERLY COMPLETE THE HYPOT TEST ON THE PRIMARY CIRCUIT. ON THE CONTRARY, THERE MAY BE SOME SWITCHES THAT SHOULD NOT BE ON IF IT WOULD RISK DAMAGE TO COMPONENTS IN SOME PARTS OF THE CIRCUIT.
6. IN SOME CASES, CIRCUIT BOARD MODULES MAY HAVE TO BE REMOVED IF THERE IS ANY POSSIBILITY OF COMPONENT DAMAGE DURING THE HYPOT TEST.

Although it depends on the testing specifications being followed, Hypot test voltage is usually increased from zero to a maximum value of several times rated voltage and for many reasons, applied for a limited amount of time. The test voltage and duration is very important and must be obtained from the factory test specifications, the Engineering Department, U.L., CSA or other recognized sources. As a rough rule of thumb, factory test voltage is usually twice the equipment nameplate voltage plus 1000, with a duration ranging from one second to one minute. Generally for maintenance tests, test voltage is reduced to approximately 60% of the original factory test voltage.

When using the 4048 for Hypot testing, insulation failure is signified by a BREAKDOWN indicator light and a LEAKAGE indicator light. (For more details on the performance of these indicators refer to operator's manual 14405).

1. Assure the equipment to be tested has been disconnected from line power.

2. Verify that the OUTPUT switch on the 4048 is OFF and plug the line cord into an appropriate power source.

3. Plug the black test lead into the GROUND receptacle of the 4048 and connect the clip to the power ground of the unit under test.

4. Plug the red high voltage test lead (clip type termination) into the H.V. OUTPUT receptacle of the 4048, identified HYPOT. Connect the clip to the AC input line terminals of the equipment to be tested.

5. Assure that the VOLTAGE control is at zero (full counterclockwise), and operate the OUTPUT switch to HYPOT position (OUTPUT ON light will glow).

6. Slowly rotate the VOLTAGE control clockwise until maximum specified test voltage is reached (or until failure is evidenced by the failure indicators), hold for specified length of time.

7. After test, reduce voltage to zero and place OUTPUT switch in OFF position before disconnecting test leads.

Should failure be observed during the above test, its cause must be investigated and corrective action taken before the equipment is returned to service.

REPLACEMENT PARTS LIST

	SYMBOL	PART NUMBER	DESCRIPTION
	C-1	58168	Capacitor, .002 uF, 2000 V
*	C-2	35062	Capacitor, .005 uF, 6000 V
	CA	04045A-06	Cable Assembly, ground
	CA	04045A-05	Cable Assembly, HV (5 ft.)
	CA	04048A-06	Cable Assembly, HV (8 ft. with probe)
	CA-1	11649	Cable Assembly, input
	D-1,2	14503	Rectifier, diode
	I-1	15327	Indicator Assembly, red
	I-2,3	14160	Indicator Assembly, clear
	CN-1-3	14732	Banana jack, red
	CN-4	15495	Banana jack, black
	L-1	11155	Choke coil, RF
	M-1	04048A-05	Meter Assembly
	R-1	10586	Resistor, fixed 4.99 Meg., 1%, 5 W
	R-3	19012	Resistor, fixed, 9.1 k, 5%, ½ W
	R-4	32001	Resistor, variable 250 k, ½ W
	R-7	15260	Resistor, fixed, 470 ohm, 10%, ½ W
	R-8,10	16208	Resistor, variable, 1.5 k, 30%, 1/8 W
	R-9	58119	Resistor, fixed 2 k, 10%, ½ W
	R-11	15911	Resistor, fixed, 1 k, 5%, ½ W
	RT-3	16379	Rectifier, HV
	S-1	15497	Switch, toggle
	T-1	11654	Transformer, variable
	T-2	11147	Transformer, 5 kV

* To replace pigtail terminal type capacitor with screw type terminal capacitor: remove the acrylic stand-off; remove the lug and the screw and nut mounted on the printed circuit board and in place mount the new capacitor (fastened with 8-32 metal nut); connect the high voltage wire on top of the capacitor using a 8-32 metal nut.