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OPERATION AND SERVICE

MANUAL

ROD-L M25

25 AMP GROUND CONTINUITY TESTER

JULY, 1984

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INTRODUCTION

SECTION I

1-1 GENERAL

1-2 This publication, which provides operating and servicing instructions for the ROD-L Electronics 25 amp Ground Testers is divided into five sections. Sections I describes the Instrument and list its specifications. Section II contains Installation Instructions and Operating Procedures. Section III contains Theory of Operation. Section IV contains Service and Calibration Instructions. Section V contains Replacement Parts Information, Parts Location Diagrams and Schematics.

1-3 25amp Ground Testers are Low Voltage testers with ground continuity test capability for performance of ground tests in accordance with applicable B.S.I., V.D.E. and I.E.C. standards.

1-4 The 25 amp ground test is one of many tests required by certification agencies as proof of an instrument's ability to withstand power line spikes without becoming a hazard to itself or the user. For example, lighting, drastic load changes or power line outages can place short duration spikes on power lines of many times nominal line voltage. The gnd should be able to divert any leakage to the chassis without getting damaged.

1-5 GENERAL DESCRIPTION

1-6 The ROD-L Model 25amp Ground Testers apply low voltage to the device under test for a duration of time preset from one second to 90 seconds. The device under test is plugged into the front panel receptacle (or special rear panel connector on some models). Test limits for total resistance are preset by the user via a rear panel control. When the device under test is defective, automatic circuitry turns off the low voltage and meter, lights the FAIL lamp and activates an audible alarm. These audible and visual alarms must be manually reset at front panel or can be reset by remote control (see options).

1-7 All Models incorporate a rapid, automatic electronic shutdown circuit to turn off the low voltage within two milliseconds after a fault.

1-8 For operator use, the test cycle is fully automatic; accidental test initiation is prevented by use of a recessed start switch. If ground fails during the test, the Tester automatically activates failure operation, i.e., voltage is shut down and there is a visual and audible alarm.

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1-9 The ROD-L 25 amp Ground Testers are completely self contained rugged instruments designed for laboratory and production testing environments.

1-10 EQUIPMENT SUPPLIED

1-11 The ROD-L Ground Tester is comprised of the following:

a. Ground Tester, ROD-L Model 25amp Ground.

b. Six foot power cord, three pronged.

c. 18 inch Ground Cable

d. This Manual

e. Extra fuses

f. HV Interface Cable

1-12 IDENTIFICATION

1-13 The ROD-L 25amp Ground Testers are identified by a part number and a serial number (see Figure 2-2).

1-14 SPECIFICATIONS

Table 1-1 lists the most important electrical, environmental and physical specifications of the Ground Testers.

TABLE 1-1

SPECIFICATIONS

Test Voltage and Current	3 VAC RMS, 25 ARMS, 50/60 Hz at 0.1 ohms load No Load Voltage, 9VACRMS.
Voltage Shutdown	Within 2ms after a fault (electronic shutdown circuits).
Automatic Test Cycle	One second to 90 seconds
Initial Turn - On Period	Allow 5 minutes warm-up

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Ohm Meter	0-0.15 ohms Accurate to +5% F.S.
Ammeter	Up to 30amps accuracy to +5% F.S.
Input Power	120VAC, 50/60 Hz, 280 W max
Environmental Operating Condition	0°to 50°C (32°to 122°F)
Physical Color	Mint grey/Olive grey
Weight	35 lbs Net (13.5 Kg)
Dimensions	16 3/4 x 5¼ x 13¼ inches (43 x 13 x 34 cm)

SAFETY FEATURES

Sequenced design of operation. Loss of ground terminates test cycle. Recessed **START** button. Visual and audible alarm at failure. Voltage lockout requiring manual reset.

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INSTALLATION AND OPERATION

SECTION II

2-1 GENERAL

2-2 This section contains the recommended procedure for unpacking and inspection, installation, operation, storage and reshipment.

2-3 UNPACKING AND INSPECTION

2-4 Any shipping carton that appears damaged should be unpacked with carrier's agent present. Inspect the instrument for damage (scratches, dents, broken knobs or meters, etc). If the instrument is damaged or fails to meet specifications (see Performance Test, Section IV), notify ROD-L Electronics immediately, retain the shipping carton and the padding material for the carrier's inspection.

2-5 INSTALLATION

2-6 The ROD-L Model 25amp Ground Testers are suitable for either bench or rack mounting. To rack mount the instrument, use Rack Mounting Kit, part #M100-5001.

Rack Mounting Kits may be ordered from factory.

2-7 RACK MOUNTING

2-8 The procedure for installing Rack Mounting Kit, M100-5001 on the Tester is as follows:

a. Place the instrument on edge of bench as shown in Figure 2-1

b. Remove Trim Strip (#2) from both sides of instrument

c. Place L-Bracket (#3) and secure to chassis with two machine screws (#4) furnished with Mounting Kit.

d. Rotate Instrument on work bench and repeat steps "b" and "c". Check that screws and brackets are firmly secure

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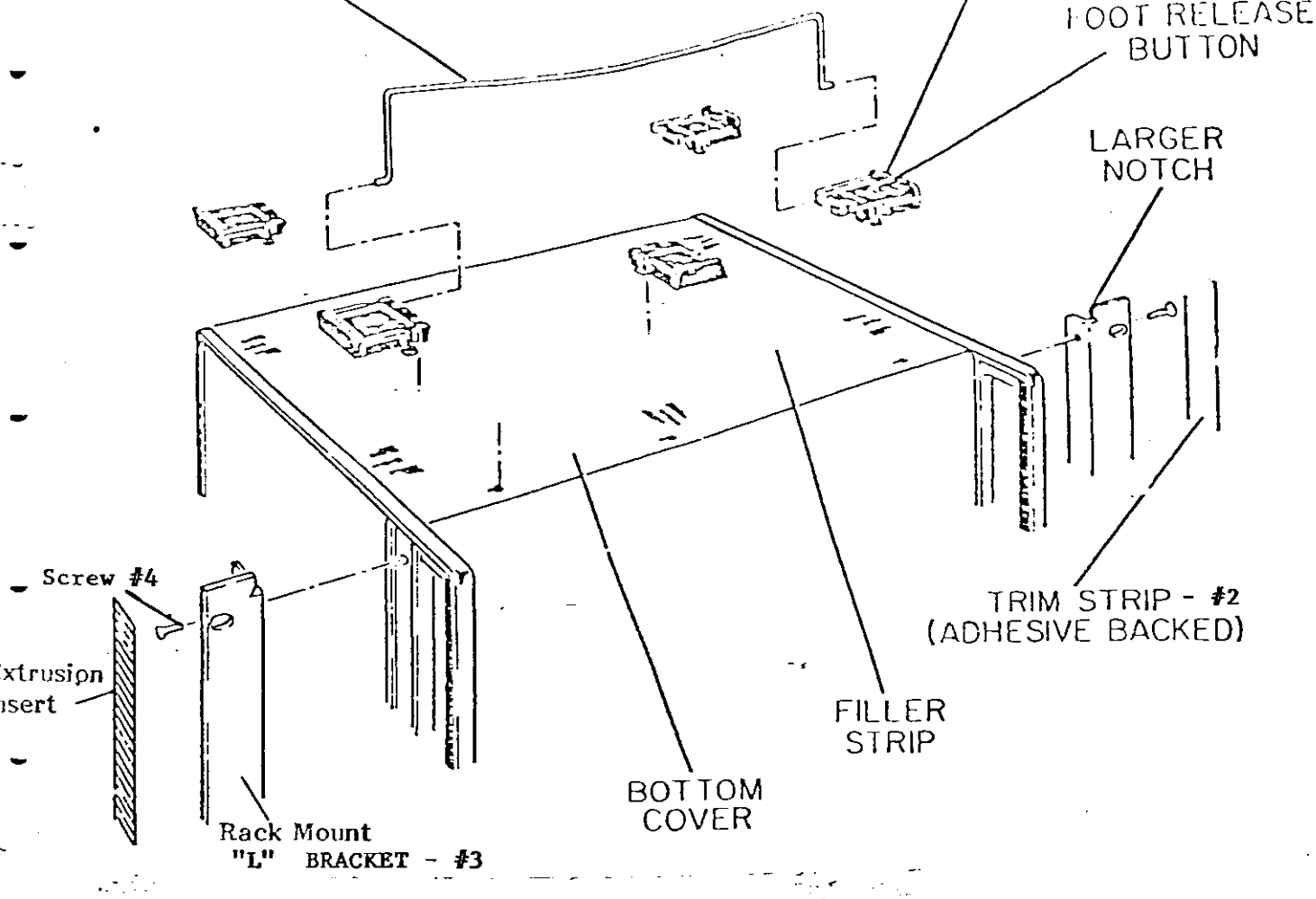


Figure 2-1

Rack Mounting Kit Installation

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2-9 POWER REQUIREMENTS

2-10 The Model 25amp Ground Tester requires a power source of 120 or 240 volts AC, single phase, 50 to 60 Hz. Insure that the power socket to which the instrument connects has a functioning safety ground.

2-11 POWER CABLE

2-12 To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three-conductor power cable which when plugged into an appropriate receptacle grounds the instrument. The offset pin on the three-prong connector is the ground pin.

2-13 INITIAL INSTALLATION AND TURN-ON

2-14 CAUTION

Prior to applying power to the instrument perform the following:

a. Turn-Off Power Switch on **ROD-L** Tester, set the rear panel AC Line 115/230V voltage switch to indicate the number that corresponds to the line voltage range being used. The number visible on the slide switch indicates the line voltage range for which the primary circuit is connected.

b. Set the OHMS TRIP control to full clockwise position.

c. With and AC voltmeter, check the primary power line for normal line voltage conditions.

d. Set VOLTAGE ADJ switch on rear panel to appropriate position (i.e. if input low line conditions exist, set to normal,8% low line, or 16% low line as appropriate).

e. With power switch off, check to be sure that the proper fuses are installed in accordance with markings on rear panel and in accorance with 115/230V line switch.

f. Connect the six foot power cord between instrument and power source. Operational Check procedure per paragraph 2-23.

2-15 STORAGE

2-16 It is strongly recommended that the equipment be packed as if for

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reshipment. Environmental conditions during storage and reshipment should be as follows:

a. Maximum temperature 167 degrees F(75 degrees C)

b. Minimum temperature -40 degrees F (-40 degrees C)

2-17 REPACKAGING FOR SHIPMENT

2-18 If possible, use the original shipping container and packing materials, or:

a. Wrap the instrument in heavy paper or plastic before placing it in the shipping container.

b. Use plenty of packing material around the instrument and protect the front panel with cardboard or plastic bubble packing. Protect the instrument with two inch rubberized foam pads placed along all surfaces of instruments, or with a layer of excelsior about six inches thick packed firmly against all surfaces of instrument.

c. Use a strong, well-sealed shipping container (350 lb/sq in. bursting test).

d. Mark the container "**FRAGILE - DELICATE INSTRUMENT.**"

2-19 Attach a tag to the instrument giving the following information:

a. Type of service required.

b. Return address

c. Instrument Model number

d. Full Serial Number

In any correspondence refer to the instrument by Model number and full serial number.

2-20 OPERATING CONTROLS

2-21 Figure 2-2 illustrates the front and rear panel controls for the Model 25amp Ground Testers Table 2-1 describes the functions of all the controls and indicators.

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TABLE 2-1 CONTROLS AND INDICATORS

FIG. 2-2 INDEX NO	CONTROL	FUNCTION
1	LINE POWER ON (S1)	This switch applies or removes power from the instrument.
2	ON LAMP (I 1)	When lit, indicates power is applied to the instrument
3	START Pushbutton (S2)	When depressed, the test sequence begins if the instrument is grounded properly and not already indicating a grounded test failure.
4	RESET Pushbutton (S3)	Resets a failure indication when depressed; also terminates a test early.
5.	FUNCTION Select Switch (S4)	Selects Ground Test only or ground test and Hipot Test sequence.
6	CHASSIS GROUND	Connect the chassis of the device under test to this terminal. The lead used should be of low resistance and preferably as short as possible.
7	Voltage Connector (J2)	An instrument to be tested for ground resistance is to be plugged into this outlet. Only three pronged AC line plugs for three-wire cords are to be inserted (unless adapter is required).

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TABLE 2-1 CONTROLS AND INDICATORS (continued)

FIG. 2-2 INDEX NO	CONTROL	FUNCTION
8	Ohms Meter (RMeter)	Provides a direct reading of the Resistance of the tested instruments ground loop.
9	Total Current Meter (I METER)	Indicates amount of AC current in (AMPS) flow during a test.
10	FAIL Indicator (I 4)	Displays a visual warning that test was a failure.
11	TESTING Indicator (I 3)	Indicates a test in progress.
12	READY Indicator (I 2)	Comes on a power up.
13	Audible Warning (SP1)	Emits a warning sound when a test results in a failure.
14	AC Line Voltage (A7)	Slide switch to select either 115 VAC or 230 VAC. The exposed number indicates the Line Voltage range selected.
15	AC Line power receptable (J1)	Connects to power cable supplied with instrument.
16	Line Fuse (F2)	Provide primary circuit protection from over-current conditions.
17	Line Supply Fuse (F1)	SAME AS ABOVE
18	Ohms Trip Pot (R5)	Calibrates Ohms Trip setting.
19	Low Line Switch (S5)	Compensate for input Low Line Voltage condition-normal, -8%, and -16%.
20	Serial/Model Code Label	Identifies Serial Number and Model number of tester.
21	Remote Control Connector(J3)	Allows Remote signal input and output.
22	Hipot Interface Connector (J4)	Allows interface with ROD-L Hipot tester.

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23	BP-2	Rear panel jack for chassis Gnd sense from ROD-L Hipot Tester.

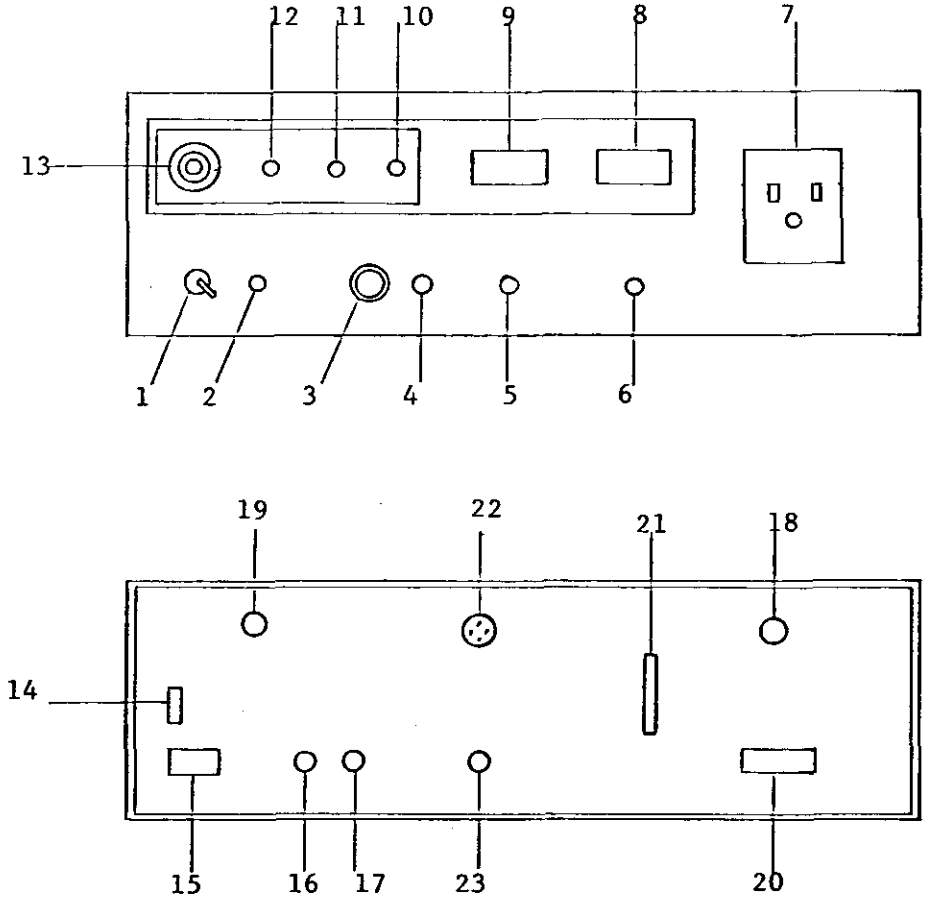


Figure 2-2 Controls and Indicators

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2-22 OPERATIONAL CHECK (25 AMP GROUND TESTER ONLY)

1. Check line voltage at outlet. Set rear panel voltage select switch to closest Line Voltage Range.

2. Connect 25 amp Ground Tester to Power outlet.

3. Turn AC On Switch to ON.

   a. AC on Lamp should light

   b. READY lamp should light

4. Insert 25amp banana plug cord into chassis ground plug. Connect 25amp clamp to any exposed metal part of the ground tester.

5. Insure that "OHM Trip" on rear panel is set to Maximum "10".

6. Depress START button:

   a. Testing Lamp should come on for approximately 5 seconds.

   b. Current Meter should read approximately 30A.

   c. OHM Meter should read approximately .005 OHMS (Record this reading)

7. Set "Total OHM Trip" pot to minimum "0".

   a. Depress START button.

      1. Sonalert should sound

      2. Red FAIL lamp should come on

   b. Depress RESET

      1. Sonalert should go off

      2. Red FAIL lamp should go off

If the above conditions are met the 25amp ground tester is operating properly and is ready for use. If your normal operating voltage is different from the specified refer to SET-UP procedure (4-5).

8. Total Resistance Trip Set

   a. BSI Standard states that the resistance to be measured shall not exceed (0.1 + R) OHMS, where R is the resistance of the supply cord. The 25amp grounding cable must also be considered, this resistance was measured in step 6C.

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b. Each division on the scale of the total current trip pot represents approximately .015 OHMS. Thus a dial setting of 7..0 would fail all devices under test with a total resistance of .105. A dial setting 9.0 would fail a resistance of .135 OHMS.

c. For more accurate failure points, a known value of resistance may be inserted in the loop and the trip point adjusted until a failure is indicated.

9. GROUND TEST

a. Plug power cord of device under test into the three pronged receptacle on the front panel of the 25amp ground tester.

b. Connect 25amp banana plug into banana jack (chassis ground) on front panel of tester.

c. Connect 25amp clamp to exposed metal part of chassis of device under test. Make sure connections are solid.

d. Depress START

1. Testing Light should come on

2. If the total resistance of the device under test does not exceed setting of trip pot, test will run approximately five seconds.

3. The Ammeter will indicate current thru the Ground Loop.

4. The OHM meter will indicate the resistance of the ground loop of the device under test.

5. If the total resistance of the device under test is higher than the Trip pot setting a failure indication will be given (Audible & Visual).

6. To test devices that do not have a three pronged supply cable, the user can make a suitable grounding cable by using three (3) layers of Beldon 8660 3/16" flat tinned copper braid and (2) Mueller #24a 25amp clamps. To perform a ground test under these conditions:

a. Connect banana plug to tester banana jack.

b. Connect clamp to the chassis of the device under test.

c. Connect one clamp of new cable made per above to device under test and other clamp to 25amp tester chassis. Proceed with Step 9d. (Remember to compensate Trip point for resistance of the newly made cable).

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2-23 TEST TIME ADJUSTMENT PROCEDURE

2-24 The Test Time Adjustment potentiometer is factory set for 5-7 seconds. The user should reset this control as necessary in accordance with the regulatory agency suggested test time for the device under test. To reset the test time duration, proceed as follows:

a. Turn OFF power to M25

b. Remove top cover and locate Test Time Adjustment potentiometer "R22" on board A22.

c. Reapply power to 25amp Ground Tester.

d. With top cover removed test a device for ground resistance using a stopwatch, time the duration the **TESTING** lamp remains lit. By adjusting the TEST Time Adjustment trimpot and timing the **TESTING** lamp duration with the stopwatch, you should be able to set any duration desired between one second and 90 seconds.

CAUTION

Do not touch any of the other potentiometers on the PC boards, otherwise the calibration of the instrument will be destroyed.

2-25 AUTOMATIC TEST PROCEDURES

2-26

The ground tester and hipot tester should be stacked with ground tester on top. (see Figure 2-3)

Connect remote control cable (25 pin connector) to ground tester and remote operating device (Figure 3) if Tester is equipped with option #01.

Connect ground tester hipot interface cable (4 pin LGH connector) to hipot and ground tester set.

Connect ground tester and hipot tester to the same AC Line Power source.

Turn AC power switch of ground tester on first*.

Turn AC power switch of hipot tester ON.

*If Hipot is turned on first, Hipot tester may immediately start test when ground tester is turned on and high voltage will appear on both output receptacles.

Device to be tested should be plugged into ground tester receptacle for sequential testing, i.e., 25amp test first and then Hipot test.

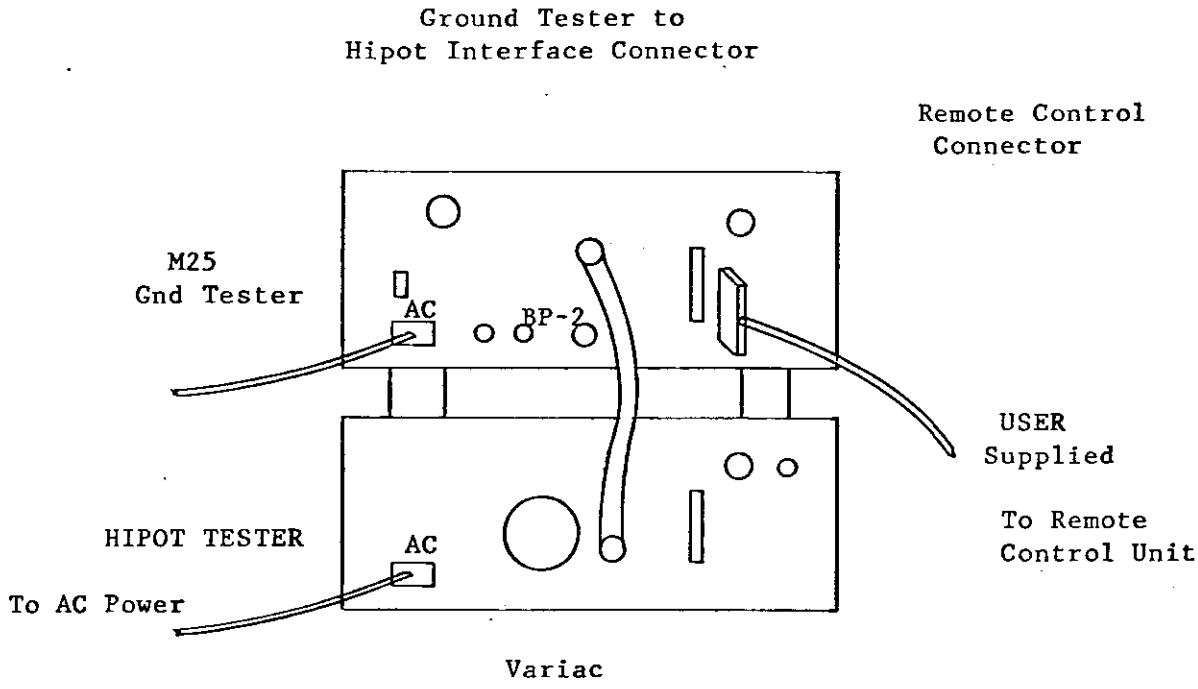
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Put front panel switch in Ground/HP position for sequential testing. If ground test only is performed placed switch in ground position. Sequential testing or ground only test will be initiated by starting ground tester. Hipot tester's chassis Gnd voltage must connect to BP-2 Rear Panel Banana Jack.

If Hipot test only is preferred, test must be initiated at Hipot tester. A failure of ground test will not allow Hipot test to start.

If failure occurs in ground test or Hipot test a reset must be initiated before any further testing. If failure occurs in Hipot test only, tester will automatically reset in 3 seconds if tester is equipped with automatic reset option. The Gnd Tester reset also resets the Hipo Tester.

If the Hipo tester's chassis Gnd voltage is not connected to BP-2 rear panel Banana Jack, the READY light of the Hipo Tester should be OFF and no Hipo Test can be initiated from the Gnd Tester. If the Hipo Tester's chassis Gnd voltage is connected to BP-2, the total safety Gnd return from the device under test up to the Hipo Tester is tested and the READY light should be on if the total resistance presented is less than the required (0.5 ohms standard). It is assumed that the Hipo tester controls are already set up according to the respective operations Manual.



25 AMP GROUND CONTINUITY TESTER/HIPOT INTERFACE

Figure 2-3

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PUSH START BUTTON

1. The READY light of the Hipo Tester should go off since the safety Gnd return test from the device under test is taken over by the M25 Gnd tester using the relays K1 and K2 (see Dwg. #00431-01). The safety Gnd return is connected to the Gnd tester chassis and the chassis Gnd voltage output thru BP-1 is connected to the High Current Transformer.

2. The test light of the M25 comes ON and the Gnd test is performed. Should a failure occur the M25 has to be manually reset and no Hipotester will be automatically started if that occurs.

3. If the test performs successfully the TEST light should go OFF after the preset time and the READY light in the Hipotester should go ON since the Hipotester is now taking over the safety Ground Return Test when the relays K1 and K2 in the M25 return to normal position, that is, connecting the safety Gnd return to the Hipotester chassis through HV return wire and connecting the chassis Gnd voltage output BP-1 to BP-2 where the chassis Gnd voltage of the Hipotester is connected to.

4. After about one second the Hipotester is started automatically from the M25. The test light of the Hipotester should come on. The Hipotester should perform as specified in the respective Manual. The M25 can at any given moment of time reset the Hipotester by manually depressing the RESET button on the M25.

2-27 25AMP GROUND TESTER WITH M488 TESTER SET UP

The ground tester and hipot tester should be stacked with ground on top as described before. The ground tester hipot interface cable, and the connection between the M488's chassis Gnd voltage and the Bp-2 rear Panel Banana Jack of M25, should be made in the same way as described before.

The M25 should be equipped with option #01 Remote Control Board and the Remote control cable (25 pin connector) must connect to both the M25 and the M488.

Turn AC power switch of M488 ON first.

Turn AC power switch of M25 ON.

Device to be tested should be plugged into M25 receptacle for sequential testing, i.e., 25amp test first and then hipot test. Ground only test will be initiated by starting the ground tester.

Sequential testing will be initiated by starting the M488 Hipotester according to the instructions described in the M488 operations Manual.

The Remote Board should be adjusted if needed for giving out 10 VDC when a 0.1 ohm load resistor is used,for monitoring the resistance valve in the M488 side. Refer to Options Section VI.

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THEORY OF OPERATION SECTION III

3-1 THEORY OF HIGH CURRENT GROUND TESTING

Three production line tests are required by most regular agencies. These basic stept are grounding continuity, dielectric strength, and leakage current.

3-2 GROUNDING CONTINUITY

The grounding of a product is one of the basic methods of protection required by both international and domestic safety agencies. Grounding is considered to be the second level of protection in a two-level system. The first level is the reliability of the functional insulation system and the second level is the grounding of all operator-accessible dead-metal parts.

In the event of an insulation failure, hazardous levels of voltage and current are shunted away through the grounding conductor to the "earth" ground point or the service ground. The reliability and the capacity of the grounding connector and the grounding systems should be capable of handling the most severe fault conditions.

In addition to safety of personnel and property, there is another benefit of the grounding system. The system shunts away to "earth" electrostatic charges and induced electromagnetic "eddy" currents from stray fields. The grounding system is an aid to preclude the malfunctioning of the logic and microelectronic circuits; that is, it assures the proper functioning of the product. Grounding coupled with EMC protective devices can reduce hazards to the customer and product.

Prototype testing for grounding was instituted in order to assure the inherent safety of the design of the grounding system. Type testing is a design tool in that it proves the validity of the basic design. It also established one essential aspect of reliability, namely, the current carrying capacity of the system should a fault occur. This is accomplished by the test current amplitude which is sufficiently high to effectively "burn out" weak spots as well as by the actual resistivity measurement to assure a sound path for current flow to ground.

Production line testing assures the continuity of the grounding system and the continuance of the good basic design. Production line tests can detect latent defects in workmanship, insulation materials, conductor size, and grounding connections. By applying the ground continuity test on the production line, each unit or product is tested for the absence of the vital second level of safety protection. The lack of which may be a substantial safety hazard. Production line tests are performed for customer safety, product reliabiltiy and manufacturer product liability protection.

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Grounding continuity tests are also required to assure the safety and protection of manufacturing personnel during the performance of subsequent dielectric strength tests and leakage current tests. The grounding test achieves a two-fold purpose: (1) It assures the satisfactory completion of subsequent tests, and (2) assures that the second test can be accomplished without undue hazard to the test operator. If grounding continuity were interrupted at any point, the dielectric strength test between the internal circuitry and the ungrounded segment would not be adequately tested if, in fact, there was any electrical stress applied to the associated insulation.

Similarly, if the grounding conductor were not contiguous to all "deal metal" parts of the product, the detectable leakage current would be substantially less; where in fact, the hazard is significant.

If the test operator should come in accidental contact with an "ungrounded" part, it is possible the operator may become the fault-current path to the earth ground point or service ground. For dielectric strength tests, it could be a high voltage injury. For leakage current, it could be a hazardous energy surge. Consequently, the application of the grounding continuity test is not only essential for accurate test results, but also very essential for protection of test personnel.

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3-3 INSTRUMENT FUNCTIONAL DIAGRAM

Functionally, the GND tester is divided into three sections: The High Current generator and the General Control. A remote control option can be added to the total system (as shown in Fig. 3-2).

3-4 The High Current generator consist of an AC transformer (50/60 Hz) specially designed to provide the current needed in the ground test. It is activated through a solid state optical isolated relay during an AC input line zero crossing after the correspondent signal is given by the General Control.

3-5 The General Control performs the coordination of the different activities and monitoring as shown in Fig. 3-1.

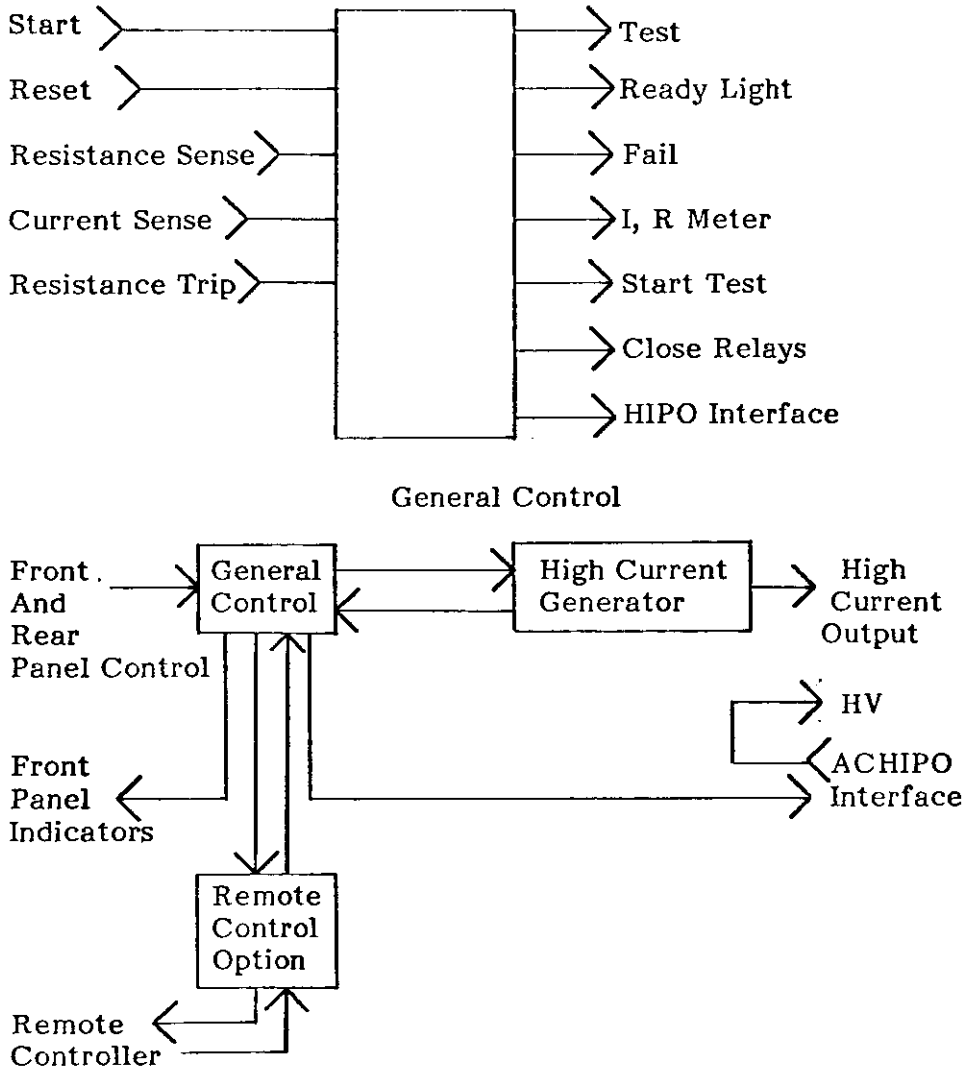


Fig. 3-1 Functional Diagram

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The General Control can be commanded from the different front and rear panel controls shown on the left side of the diagram. It takes care of coordinating the different activities and sensing the status of the operation. It provides continuous monitoring through the front panel lights, buzzer and meters shown on the right side of the diagram.

The remote option is an isolated interface for most of the control and monitor signals.

3-6 INSTRUMENT ASSEMBLY DIAGRAM

The instrument is divided in two major subassemblies as shown in Fig. 3-3.

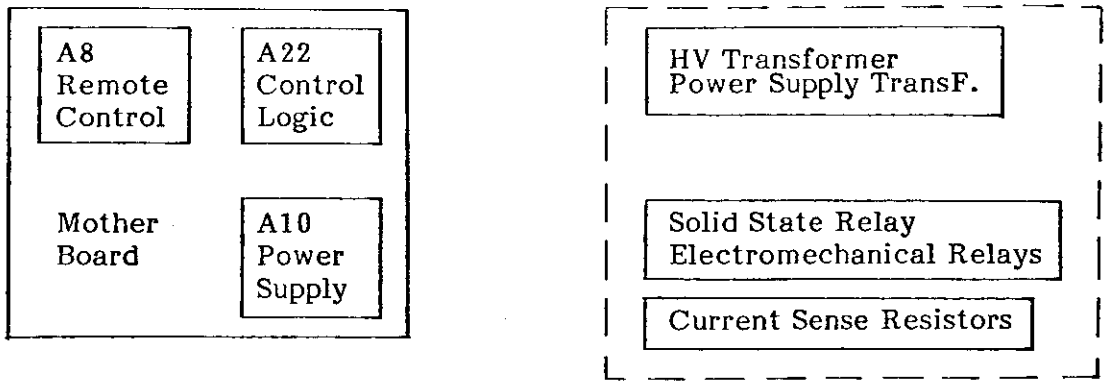


Fig. 3-2 Assembly Diagram

The left side subassembly is physically separated and contains a Mother Board, Control Logic and Power Supply Board and eventually the Remote Control Board as an option. The right side subassemblies contains the electrical transformers, relays and current sense resistors.

A more detailed diagram of the functions is shown in Fig. 3-4.

3-7 POWER SUPPLY CIRCUIT (A10)

3-8 The bias generated in the A10 assembly board consists of +15VDC and -15VDC for the analog circuits. The digital electronics requires +5VDC regulated. As seen in the squematic (DWG. 00459-01 Rev A).

The different AC voltages are full wave rectified by U1, 2 and 3, filtered and regulated byUR1, 2 and 3.

3-9 A22 CONTROL LOGIC BOARD

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3-10 TOTAL CURRENT DETECTOR

The A22 Board (Dwg. 446-01) receives the voltage across the current sense resistor set composed of 8 resistors of 2ohm 50W each giving a total resistance of 0.25 ohm.

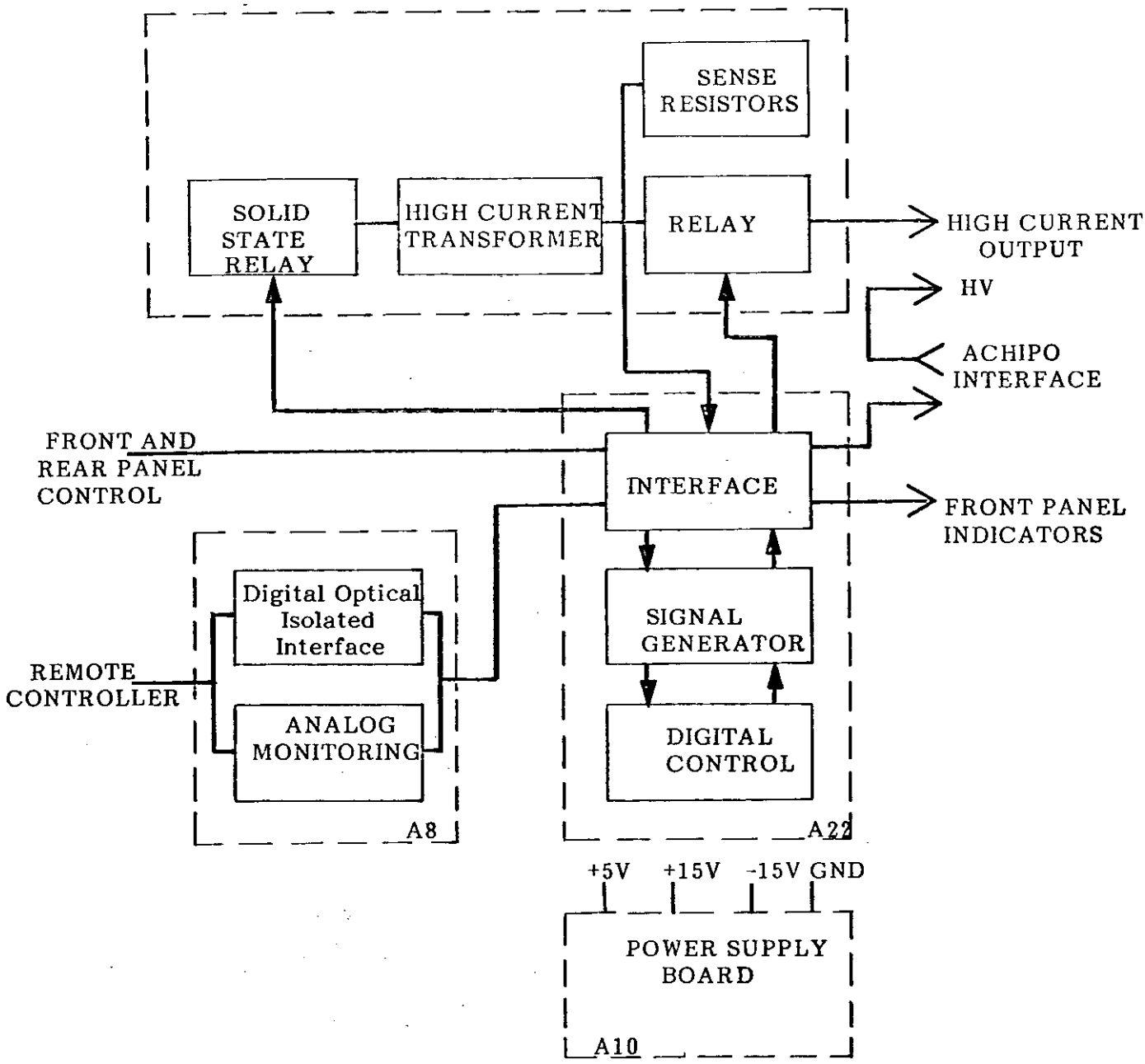


Fig. 3-3 DETAIL FUNCTIONAL DIAGRAM

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3-12 PROVISION FOR FUTURE REMOTE PROGRAMMING

The remote signal at pin C of the edge connector can activate the transistor Q2 when no remote programming is desired, connecting pin C of the edge connector to +5V. This will put a low level at pin 6 of U3 (contact C) and a high level at pin 12 of V3 (contact D), closing contact D and opening contact C. The opposite situation occurs when the pin C of the edge connector is tied to ground, selecting remote programming.

3-13 LOGIC CONTROL

3-14 The assembly receives all push button inputs and sense output from the fail comparator. The duration of the test is set by a timing circuit. In the event of an operator reset or fail condition, the test is aborted. If there is a failure, a warning is presented until manually reset by the user. This assembly includes a zero crossing detector, a start generator, a timer, set-reset latches with associated logic.

3-15 INPUT/OUTPUT LINES

There are three digital inputs: START, RESET and the FAILURE from the resistance comparator U9.

There are status an control outputs: TEST LIGHT, REMOTE TEST, FAIL, ACHIPO START and RESET, RELAYS and an optional pulsing tone drive output for the buzzer.

An analog input 18 VAC is used to determine the zero crossing of the AC input line.

3-16 STARTING A TEST

With the start input (pin 9 of the edge connector) two NAND gates of U5 and U6 provides a hysteresis buffer and the test latch composed by two NAND gates of U5 is set through pin 13. The output of the test latch (pin 11) drives the transistor Q1 to provide a REMOTE TEST signal for the A8 REMOTE BOARD option (as required by the M488 instrument interface) and drives through U7 pins 1 and 2 the RELAYS using the pin D of the edge connector.

The RELAYS are high current type and as shown in the wiring diagram #00431-01 when they are activated connect the high current transformer to the 25 ampere output and connect the HV return on the front panel block to the chassis of the M25 Gnd tester. When the relays are deactivated the 25 ampere output is connected back to 1.5 VAC chassis Gnd sense voltage of the AC Hipo tester when the M25 is interfaced with it, and also connect the Hv return back to the HV return of the AC Hipo tester. This enable us to perform during an AC Hipo tester interface operation a continuous chassis Gnd sense test from the Hipo to the DUT and to have a separate return for the high voltage test from the DUT to the AC Hipo tester.

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The start signal also triggers the DELAY timer U11 for getting the RELAYS set up and at the end of the delay the START PULSE timer is triggered. This pulse gates the zero crossing pulses produced by Q8 and trigger the TEST TIMER U11. The output of the test timer drives the TEST LIGHT through U8 and drives the analog switches in U3 for enabling the monitoring of current and resistance. The length of the time is controlled by the pot R22.

3-17 FAIL LATCH

The FAIL LATCH can be set by the output of the resistance comparator in U9, driving the FAIL signal through U7. The fail latch is composed by two NAND gates of U6. The latch can be reset by the RESET signal coming through pin 5 of the edge connector.

3-18 RESET

The fail latch also operates the system reset through pin 2 of U10. This gate gathers the different signals that can reset the system: The reset switch, the fail latch and the test signal from the test timer. The test signal is fed through a network that produces a pulse at pin 4 and 5 of U10 at the end of test, resetting all the timers and the test latch. The system reset is also transmitted to the AC Hipo Tester when interfaced through the optical isolator U2.

3-19 AC HIPO START

At the end of successful test, the signal from the pin 11 of U5 (the test latch) is fed through a network that produces a pulse at pin 8 of U12 triggering a delay timer needed for getting the AC HIPO set before a start signal is produced by U11. The delay timer triggers the TRIGGER timer U11 which produces the start signal to the AC HIPO though the optical isolator U1. These timers are reset by the system reset. C22 is larger than C10 to insure the generation of the AC HIPO START signal even if the system reset is generated by the end of test signal only.

3-20 OPTIONAL TESTING PULSING TONE

A timer in U12 can be used for generating a pulse train signal to drive the buzzer with Q5 through pin 1 of the edge connector, when the test latch is set. This provides a pulsing tone out of the instrument while we are performing a test.

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MAINTENANCE AND SERVICE

SECTION IV

4-1 INTRODUCTION

4-2 This section provides maintenance and service for the M25 Ground Tester. Included are: Tables of recommended test equipment, calibration procedures, Trouble shooting procedures, plus repair and adjustment data.

4-3 CALIBRATION

4-4 Five major calibration points are required for the M25 Ground Tester. They are :

1. Meters Mechanical zero
2. Ammeter Calibration
3. Resistance Meter Calibration
4. Test Time Calibration
5. Fail Pot Calibration

TABLE No. 4-1

TYPE	MFR	USE
AC/DC Digital Ammeter Voltmeter (floating input) RMS reading	Data Tech Model 31 or equivalent	General Purpose and Calibration of Voltmeter and ammeter
AC Variac	General Radio W8MT3VM or equivalent	AC line Voltage set-up
120-240 VACLine step up transformer		220/240 Tests

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TABLE No 4-1 Continued

Oscilloscope	HP 175 or -equivalent	General Purpose
AC Current Sensor	American Aerospace controls, INC 1003AMP-50	Ammeter Calibration
0.1 ohm 50W 1% Resistor	Dale RH50	Resistance Meter Calibration

4-5 **SET UP**

4-6 The equipment should be set up to insure testing at 120 VAC or 240 VAC plus or minus 1% (low line switch = NORMAL). Remember to set the line select switch to 115 or 230 VAC position depending on the AC input line value. Foreign users or users where the input line voltage are different from the ones first described may want to recalibrate on their standard voltage and frequencies.

4-7 **METER MECHANICAL ZERO**

4-8 With the M25 turned OFF, note the positions of the current and resistance meters pointers on the front panel. They should read zero plus or minus one minor division. If they do not, adjust the zero screw.

4-9 **AMMETER CALIBRATION**

4-10 Turn the M25 ON and note that the ammeter position is at zero (plus or minus one minor division). The READY light should be on. If not, trouble shoot the Power Supply Board or the READY light driver on the A22 Board. Insure that the calibration load is connected between the 25A output socket and the HV return on the front panel block (chassis handle could be also used) through the AC current sense as shown in Fig. 4-1. Turn the OHMTRIP potentiometer fully clockwise.

PUSH THE START BUTTON

The ammeter should deflect to about 25 amperes. The DVM connected with the AC current sensor should agree with the ammeter reading within 3% of full scale. If they do not, adjust the pot R25 on the A22 Board until they agree within 1%. See Dwg #00446-02 for pot location.

PUSH RESET BUTTON

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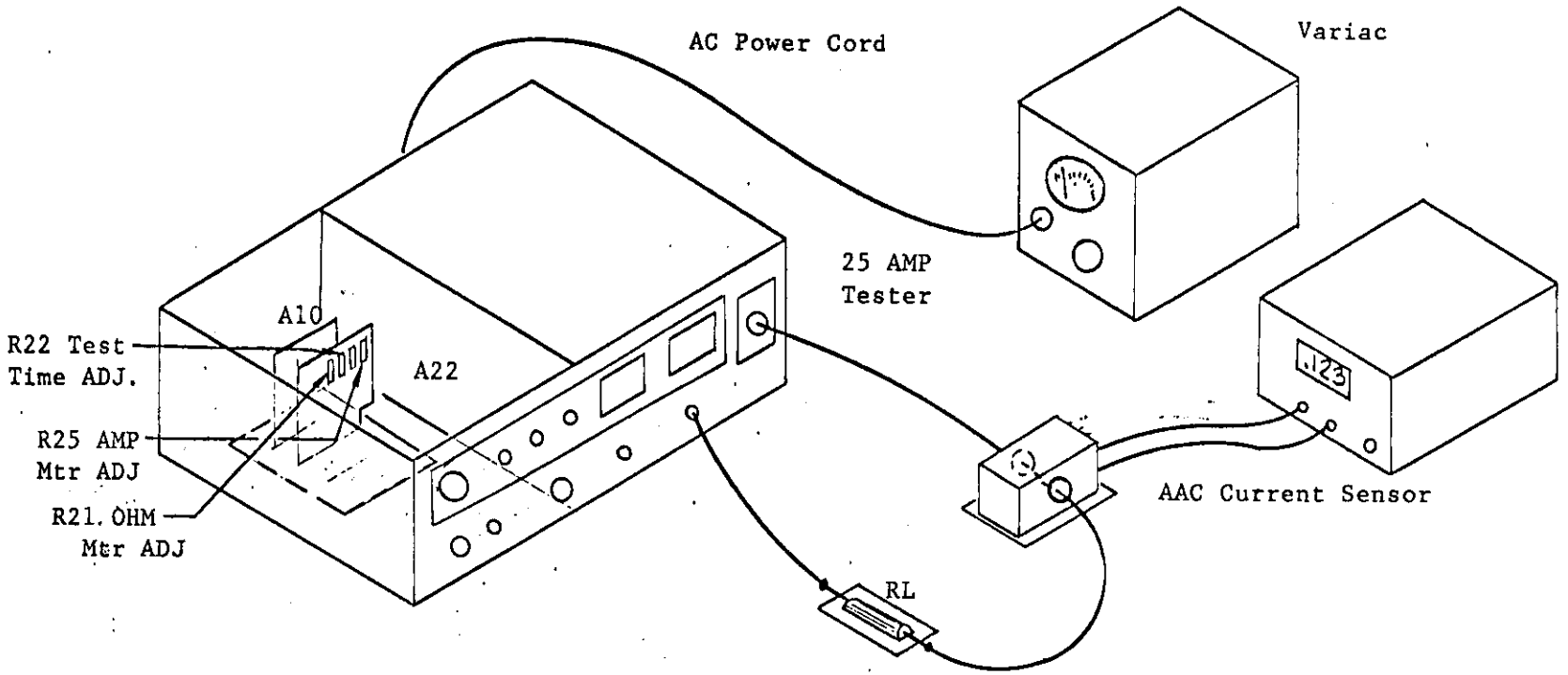


Figure 4-1. TEST SET-UP

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4-11 FAIL POTS CALIBRATION

4-12 Turn the OHM TRIP potentiomenter fully clockwise. With no load connected to the M25 output push the **START** button. The resistance meter should deflect to full scale and a failure mode produced, that is, constant buzzer sound and **FAIL** light on. **PUSH RESET.** Connect the calibration load to the M25 output as described in section 4-10. Push the **START** button. While the test light is **ON,** slowly turn the OHM TRIP pot counterclockwise until a failure mode is produced. **PUSH RESET.** If a max OHM TRIP point wants to be checked, use 0.15 ohms as a calibrating load with the OHM TRIP pot fully clockwise. Push the **START** button. The resistance meter should deflect to full scale and a failure mode produced, otherwise adjust R24 on the A22 board counterclockwise until the failure mode is produced. **PUSH RESET** and proceed with **RESISTANCE CALIBRATION.**

4-13 TEST TIME CALIBRATION

4-14 Set a specific test time per instruction of paragraph 2-24. To check test time limits, turn test time pot R22 on the A22 board to minimum (fully clockwise) and maximum. Minimum should be one second and maximum about 90 seconds. If not, troubleshoot timer or call **ROD-L** application Engineer for assistance.

4-15 RESISTANCE CALIBRATION

4-16 **PUSH THE START BUTTON**

The resistance meter should deflect to about 0.1 ohms within 3% of full scale. If it is not, adjust the pot R21 on the A22 board until it does deflect up to 0.1 ohms within 1%.

PUSH RESET BUTTON

This procedure is recommended to be done for the resistance tripping values of the particular application.

4-17 TROUBLESHOOTING

4-18 Equipment Required: The required equipment is the same as that listed in Table No.1.

4-19 TROUBLESHOOTING TREE PROBLEM LIST

4-20 The following is a list of problems and potential causes.

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A. NO AC POWER

1. Check fuses F1 and F2. They might be 3 amperes slow blow fuses for 120 VAC operation and 2 amperes slow blow fuses for 240 VAC operation.

RECOMMENDED FUSES:

LITTELFUSE MANUFACTURER

120 VAC	3AG SLO BLO	Type 313003
240 VAC	3AG SLO BLO	Type 313002

2. Check for bad AC Power Lamp (11), ON-OFF switch (S 1), Line Filter (LF-1).

3. Measure for line voltage between pin 1 or the SOLID STATE RELAY K3 and Neutral.

B. INSTRUMENT BLOWS FUSES

1. Are F1 and F2 slow blow fuses? Check for shorted varistors on the A7 board. (MOV-1, MOV-2).

2. Troubleshoot A10 board.

C. READY LAMP DOES NOT WORK

1. Check for burned out bulb.

2. Check for bad power supply board or driver on the A22 board.

D. NO HIGH CURRENT OUTPUT

1. Check for bad start switch

2. Check wiring harness for frayed wiring

3. Check the solid state relay K3 and the triggering signal from the A22 board pin 11.

E. NO HIGH CURRENT AND FAILURE INDICATION

1. Check OHM TRIP pot position

2. Check Load connection to the A25 output and the HV return.

3. Check relays closure before the High Current generation

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PARTS LIST

SECTION V

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ASSEMBLY DESCRIPTION: A10 POWER SUPPLY
ASSEMBLY NUMBER: 00459-02 REV.A

ITEM	REFERENCE	DESCRIPTION	RATING AND/OR MFR. NUMBER	QTY.
1	A10	PCB, RAW	00459-02 ROD-L	1
2	C4,C5	CAPACITOR, EL	470uf 35V	2
3	C1	CAPACITOR, EL	3300uf 16V	1
4	C2,C3,C6	CAPACITOR, EL	1uf 35V	3
5	U1-U3	DIODE BRIDGE	CSB05, COLLMER	3
6	VR1	5V REGULATOR	7805, CLM340T5	1
7	VR2	-15V REGULATOR	7915, LM320T-15	1
8	VR3	+15V REGULATOR	7815, LM340T15	1
9	CR1-CR3	DIODE	1N4002	3
10	F1	FUSE	275004	1

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ASSEMBLY DESCRIPTION: A22 CONTROL LOGIC BOARD
ASSEMBLY NUMBER:00446-02 REV.E

ITEM	REFERENCE	DESCRIPTION	RATING AND/OR MFR. NUMBER	QTY.
1	A22	RAW PCB	00446-02 ROD-L	1
2	C1-3,6	CAPACITOR, ELYTIC	10UF 25V TVA1104	4
3	C5,7-12,14,16, C17,19,23,25, C28,31	CAPACITOR, CERAMIC	.01UF 100V	16
4	C15	CAPACITOR, MONOLYTHIC	33UF 6V	1
5	C21	CAPACITOR, MONOLYTHIC	.10UF 35V	1
6	C27	CAPACITOR	10UF	1
7	C4,26,29	NOT USED		
8	R1	RESISTOR	470 OHM 1/4W 5%	1
9	R2	RESISTOR	36K 1/4W 5%	1
10	R3	RESISTOR	1.2K 1/4W 5%	1
11	R4,14	RESISTOR	1K 1/4W 5%	2
12	R5,6,15,33	RESISTOR	6.8K 1/4W 5%	4
13	R7,13	RESISTOR	100K 1/4W 5%	2
14	R8,9,28,31,32	RESISTOR	4.7K 1/4W 5%	5
15	R10	RESISTOR	100 OHM 1/4W 5%	1
16	R11,34	RESISTOR	20K 1/4W 5%	2
17	R12	RESISTOR	300K 1/4W 5%	1
18	R16,17,27	RESISTOR	15M 1/4W 5%	3
19	R18,19	RESISTOR	OPTIONAL	
20	R20	RESISTOR	1M 1/4W 5%	1
21	R21,25	POTENTIOMETER 10 TURN	10K BOURNES 3006P-1-103	2
22	R22,24	POTENTIOMETER 10 TURN	500K BOURNES 3006P-1-504	2
23	R26	RESISTOR	7.5K 1/4W 5%	1
24	R23,29	NOT USED		
25	R30	RESISTOR	10M 1/4W 5%	1
26	RP1	IN LINE RES. STRIP	2.2K DALE MSP08-A-03-222G	1
27	RP2,6	IN LINE RES. STRIP	4.7K DALE MSP08-A-03-472G	2
28	RP3	IN LINE RES. STRIP	47K DALE MSP08-A-03-473G	1
29	RP4,9,10	IN LINE RES. STRIP	10K DALE MSP08-A-03-103G	3
30	RP5	IN LINE RES. STRIP	20K DALE MSP08-A-03-203G	1
31	RP7	IN LINE RES. STRIP	22K DALE MSP08-A-03-223G	1
32	RP8	IN LINE RES. STRIP	3K DALE MSP08-A-03-30G	1
33	CR1-4,6,7,10, CR11,12,14	DIODE, SIGNAL	1N914 MOTOROLA	10
34	CR5	DIODE	1N4005 MOTOROLA	1
35	CR8,9	DIODE, ZENER	1N750 4.7V MOTOROLA	2
36	CR13	DIODE	1N4742	1
37	U1,2	IC	H11B1	2
38	U3	IC, QUAD ANALOG SW	MC14066 MOTOROLA	1
39	U4,9	IC, QUAD OP AMP	LM324N NATIONAL	2
40	U5,6	IC, 2 INPUT NAND	SN7400 NATIONAL	2
41	U7,8	IC, DUAL PERIPH DRIVR	SN75452BP TI	2
42	U10	IC, 4 INPUT NAND	SN7420 TI	1
43	U11	IC, TIMER	NE558 TI	1
44	U12	IC, TIMER	NE556 TI	1
45	Q1-4,8	TRANSISTOR, NPN	2N2222	5
46	Q5	OPTIONAL		
47	Q6,7	NOT USED		

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OPTIONS

SECTION VII

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A8 REMOTE CONTROL - REV G

FUNCTIONAL DESCRIPTION

The A8 Remote Control contains three options:

AUTOMATIC RESET

DIGITAL REMOTE CONTROL

ANALOG MONITORING

The AUTOMATIC RESET option is supposed to generate a short duration FAIL and RESET pulse after a failure is latched in the A22 Control Logic Board. At the end of the FAIL pulse the system is completely reset if no restart is attempted.

The DIGITAL REMOTE CONTROL option provides optical isolated control and monitoring of the main functions of the unit. The input are: START and RESET, SELECT A and the outputs are: READY, TEST and FAIL (ALARM). Input and Outputs are TT L compatible.

The ANALOG MONITORING option provides buffering and adjustable gain for the resistance and current signals. The resistance buffer gain is adjusted to get 10 VDC out of pin 10 of U11 for a load of 0.1 ohms.

CIRCUIT DESCRIPTION

AUTOMATIC RESET OPTION

While on TEST, a FAIL produces one shot negative pulse in U4. The falling edge produces one shot pulse U5, this pulse drives the alarm through pin B with Q2 and resets the system through the board pin 5 with U1. At the end of the pulse U5, the system is reset and the alarm is off. U1 also resets the system when remote reset is produced. If this option is not needed, A, B, and C, D jumpers are placed so that the FAIL signal drives the alarm as normal and the reset from the remote goes directly to the RESET line.

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OPTICAL ISOLATED CONTROL

This part provides three inputs: RESET, START, and SELECT "A" and three outputs: READY, TEST, and FAIL.

The input current requirement are:

Rev G

HIGH LEVEL	40 uA +5V
LOW LEVEL	1.6 mA for 0.4V

The output current capabilities are:

HIGH LEVEL	2.27mA @ +5V
LOW LEVEL	2.27mA max @=5V

When U3 is driven, a reset signal is produced at pin 5 of the board either directly through C, D jump or through U1 when the automatic reset option is in.

When U2 is driven, a start signal goes out through pin 9 of the board. U9 driving is used only in M100/500 Hipotester models.

When GROUND TEST signal through pin 10 is low, U6 is activated and a low level is available from pin L of the board to the remote connector.

When TEST is low, through pin 11, in other words, when a TEST is in progress U7 is activated and a low level is available from pin M to the remote connector.

When U8 is activated with the FAIL signal either from pin 12 or pin B when the automatic reset optionis used, a low level is available from pin N to the remote connector.

The remote controller's 5V and GND are fed through pins K and 15 respectively.

ANALOG MONITORING

U11 works as non-inverting buffer with adjustable gain. R26 is adjusted for getting 10VDC out of pin 10 for 0.1 ohms resistance. The resistance monitoring signal comes from the A22 board throug pin 7 of the edge connector.

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REMOTE CONTROL OPTION 25 PIN CONNECTOR ASSIGNMENT

1,16	GND (ISOLATED)	13	RESISTANCE
4	GND (CHASSIS)	15	AC/$\overline{\text{DC}}$
5	EXT V REF	17	REM
6	EXT I TRIP	18	RESET
7	EXT V TEST	19	START
8	EXT V RISE	20	+5V (REMOTE)
9	V OUT	21	$\overline{\text{READY}}$
10	I OUT	22	$\overline{\text{TEST}}$
11	EXT IR OUT	23	$\overline{\text{FAILURE}}$
12	IR OUT	25	SELECT A

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ASSEMBLY DESCRIPTION: A8 REMOTE CONTROL LOGIC W/ AUTO-RESET
ASSEMBLY NUMBER: 00445-02 REV. F

ITEM	REFERENCE	DESCRIPTION	RATING AND/OR MFR. NUMBER	QTY.
1	A8	RAW PCB	00445-02 ROD-L	1
2	C1,C2	CAPACITOR	10uf 25V TANT	2
3	C4	CAPACITOR	6.8uf 10V TANT	1
4	C5-C7	CAPACITOR	.01uf	3
5	C3	CAPACITOR	.1uf 10V TANT	1
6	U2,U3,U6,U7 U8,U9	IC IC	H11B1 OR H11B3	6
7	U4	IC	SN74122	1
8	U5	IC, TIMER 8 PINS	NE555	1
9	U10	IC, TTL HEX INVERTER	SN7416	1
10	U11	IC	747	1
11	U1	IC	7403	1
12	R4-R6	RESISTOR, CARBON	330 OHM 1/4W 5%	3
13	R7,R12	RESISTOR, CARBON	1K 1/4W 5%	2
14	R8-R10	RESISTOR, CARBON	100K 1/4W 5%	3
15	R1-R3	RESISTOR, CARBON	2K 1/4W 5%	3
16	R13,R17-R2	RESISTOR, CARBON	4.7K 1/4W 5%	7
17	R14	RESISTOR, CARBON	20K 1/4W 5%	1
18	R15	RESISTOR, CARBON	330K 1/4W 5%	1
19	R16	POTENTIOMETER	1M	1
20	R23,R24,R27 R29	RESISTOR, CARBON	10K 1/4W 5%	4
21	R25	POTENTIOMETER	10K	1
22	R11	RESISTOR, CARBON	2.2K 1/4W 5%	1
23	R26,R28	POTENTIOMETER	50K	2
24	Q1	TRANSISTOR	2N3904	1
25	Q2	TRANSISTOR NPN	2N2222	1
26	K1	RELAY	1495 DPDT 5VDC	1
27	CR1	DIODE	1N914	1

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