# USER'S GUIDE

MODEL: HC3-AT-AD

PART NO.: DS11-1133

Hipotronics inc.

*applied high voltage technology for industry utilities & science*

Hipotronics **POWER PRODUCTS DIV.** MILLERTON, NEW YORK 12546 (914) 279-8091 / TWX: 710-574-2420

# USER'S GUIDE

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## DANGER HIGH VOLTAGE

**WARNING:** This publication describes a product engineered and designed to supply HIGH VOLTAGE. Accordingly, maximum safeguards have been built into the equipment and the best safety techniques possible are set forth in the unit's operating instructions. These instructions contain cautions, warning the user to exercise great care in the use of certain controls and at appropriate points in the operating procedures. Despite these written warnings the operator of this equipment is nevertheless strongly advised to maintain a safety consciousness at all times. The following rules are particularly relevant and must be followed at all times.

**BEFORE CONNECTING INPUT POWER, GROUND CASE.**

**BEFORE UNGROUNDING CASE, DISCONNECT POWER.**

**NEVER APPROACH OR TOUCH A POTENTIALLY LIVE HIGH VOLTAGE CIRCUIT WITHOUT CONNECTING AN APPROPRIATE SOLID GROUND FIRST.**

MODEL NO: HC3-AT-AD
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Hipotronics, Inc.

# INSULATION TEST SET

## TABLE OF CONTENTS


1. Introduction....1

2. Features....1

3. Specifications....1

4. Description....3

5. Installation....5

   5.1 Bench Testing....5
   5.2 Rack Mounting....5

6. Operation....6

   6.1 Description of Front Panel Controls....6
   6.2 Manual Operation....6
   6.3 Automatic Operation....6
   6.4 Rear Panel Controls....7
   6.5 Local/Remote Switch....9

7. Test Fixture....10

   7.1 Description....10
   7.2 Operation....10

8. Circuit Theory....11

   8.1 Logic Assembly (A2)....11
   8.2 Motor Drive (A5)....13
   8.3 HV Assembly....13

9. Maintenance....14

   9.1 Main Unit....14
   9.2 Test Fixture....14

10. Calibration....15

11. Typical Test Station (Fig.1)....16

12. Parts List.... Rear Pocket

13. Schematic.... Rear Pocket

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Hipotronics, Inc.

# INSULATION TEST SET

## INTRODUCTION

The HC-AT Hipot Testers are a series of high voltage insulation test sets designed primarily for U.L. acceptance testing. Several design features make these units at home in the laboratory as well as on the production line. Different operating modes allow manual control of all parameters as well as fully automatic operation, all in one instrument.

The circuit design is a hybrid of solid state and electro-mechanical components combined to offer a maximum of reliability and durability. The best of both technologies is used to make the instrument safe and easy to operate. Safety devices allow output short circuits with no harmful effects.

## FEATURES

- One piece controller with optional test fixture.
- Programmable test parameter set points.
- Third wire ground continuity test.
- Manual or fully automatic modes of operation.
- Digital timer with indicator lamp.
- Visual and audible overload alarms.
- Arcing Indicator.
- Local remote switch for use with optional test fixture.

## SPECIFICATIONS

| | |
|---|---|
| Input Power | 115 V ac, 60 Hz, 100 vA Max. |
| Continuity Test | |
| Voltage | 6 V ac Open Circuit |
| Trip Level | Approx. 2 ohms |

# INSULATION TEST SET

## SPECIFICATIONS (Continued)

### Hipot Test

| | |
|---|---|
| Voltage | 0-4000 V dc / 0-3000 V ac |
| Current | 0-5 mA ac and dc |
| Rate of Rise | 100 to 500 Volts/Second |
| Test Timer | .1 to 99 seconds |
| Voltmeter | Single range, 0-4 kV, 4 1/2" |
| Current Meter | Dual Range, 4 1/2"<br>0-1 and 0-5 mA ac and dc |
| Dwell Timer | Pushbutton select, 2 digit |
| Overload Range | .1 to 5.5 mA, Instantaneous |
| Modes of Operation | Manual<br>Local Automatic<br>Remote Automatic |

### Dimensions

| | |
|---|---|
| Instrument Size | 8 3/4"H x 19"W x 15"D |
| Weight | 22 lbs. |
| Cabinet Size | 11 1/4"H x 21 1/4"W x 19 1/2"D |
| Weight | 27 lbs. |

# INSULATION TEST SET

## DESCRIPTION

The HC series of Hipot Testers is designed to test the ability of insulation systems to withstand voltage stresses that are higher than normal operating voltages. Although in normal use a standard line operated appliance or instrument may see a maximum of only 125 volts A.C., there are times when the line may contain voltage transients many times this value. The insulating materials must protect the device from possible failure due to arc-over. Also, for operator and equipment protection, the current leakage from the line to ground and line to operator-accessible points must be less than a value that would cause electrical shock or hazardous conditions. These instruments are designed to non-destructively test for these conditions.

These test sets are low power, high voltage power supplies with special metering and control functions. A hybrid of technologies is used to produce a cost effective, reliable instrument. The combination of solid state and electro-mechanical components offer features each alone can not. A majority of the control functions are solid state, providing long life for repetitive operations. The power devices and measuring devices, however, are electro-mechanical in nature. These devices are designed to stand up to overloads and transients and still operate reliably.

The instrument is housed in a deluxe bench top cabinet. It may be removed from this cabinet and mounted in a standard nineteen inch equipment rack if desired. No special power wiring is required. The unit will operate from a standard 115 Volt, 50 or 60 Hertz line.

A chassis ground position is located on the rear of the unit to ensure a solid ground point if needed. Chassis ground is used as the high voltage return path on these instruments. A three wire grounded power cord is supplied. **Do not operate them with a two wire adapter without securely grounding the chassis.** A good chassis ground is imperative for safe operation.

The unit is designed to be at home in the laboratory as well as the production line. All frequently used controls and indicators are logically grouped on the front panel for operator convenience. Set points and program selection controls are deliberatly less accessible on the rear panel for more tamper proof operation. This helps to keep the operator from altering test settings on a production line yet offers full programmability by qualified personnel. Also, high voltage and interwiring exit the unit from the rear for added safety.

INSULATION TEST SET

DESCRIPTION (Continued)

There are three modes of operation. In the Manual mode all controls and indicators are operational and the operator has full override on all functions. This mode is handy for exploratory testing. In the Local Automatic mode, limits may be preset,
DESCRIPTION (Continued)

within the capabilities of the instrument, and a complete test performed with little or no operator intervention. This mode is useful for standard testing where limits are set or where repetitive testing must be done. In the Remote-Automatic mode the same automatic preset testing may be performed but may now be initiated from a remote location. This is handy for completely automatic testing by operator or machine control on a production line. In this case, a test fixture is usually used at a remote site from the instrument.

This unit may be used with a manual test lead or with a remote test fixture. The latter provides safety for test personnel who will then not be exposed to any high voltage wiring. A prerequisite to obtain high voltage is an adequate ground connection to the unit under test. This is ensured automatically by the "third wire ground continuity check" circuit. A station ground is clipped to the case of the unit under test. If the ground lead in the power cord is not continuous, the high voltage cannot be turned on. A defeat switch is provided on the rear panel to allow testing of two wire double insulated units.

A current overload circuit may be preset so that it turns the high voltage off and warns the operator if that current level is exceeded. Immediately high voltage is automatically turned off to avoid damaging the test specimen. In addition an "arcing" indicator warns the operator of loose connections or heavy corona, events which may not draw enough current to fire the overload circuit. These conditions may or may not be degrading to the unit under test, but may require investigation.

# INSULATION TEST SET

## INSTALLATION

The unit you have received is a high quality piece of electronic instrumentation. It is designed to meet exacting electrical and mechanical requirements. With proper care and handling, it will provide you long and trouble free service.

A. Inspect the shipping container for visual signs of mishandling. A damaged container may indicate internal damage. Contact the carrier for instructions before unpacking if damage is observed.

B. Unpack the unit and inspect for visual signs of shipping damage. Contact the carrier if there is damage.

C. If all is in order, consult the operating instructions and check for proper electrical operation. Read all instructions carefully. If a problem arises, contact the Hipotronics' Service Department.

### Bench Testing

The unit is supplied in a deluxe bench top cabinet. It has no special power requirements other than a standard 115 volt A.C. power source. For maximum operator and equipment protection, a three wire system should be used. In addition, a station ground lead should be attached to the ground lug on the rear of the unit (See Figure 1.) If an external test fixture is used this also should be grounded. For appliance testing, a ground clip lead is needed to ground the exposed metal parts of the unit under test. This is mandatory for the continuity test.

A modified BNC connector, "HV OUT", is located in the rear of the unit for the high voltage output. For remote testing connector J2 must be used. Refer to the Test Fixture schematic for details. A set of double contact normally open pushbuttons must be wired according to this schematic for two hand operation.

### Rack Mounting

The instrument may be removed from its bench top cabinet for installation into a standard relay rack type cabinet. Remove the four corner screws in the front panel. Slide the instrument forward out of the cabinet while feeding the power cord in from the rear. The unit will mount in a rack by the front panel. Rear support is suggested if the unit will be exposed to excessive vibration or shock.

# INSULATION TEST SET

## OPERATION

### Description Of Front Panel Controls

The AC POWER ON turns on the 115 V AC power required to operate the unit. The hot line is fused with a type 3AG, 1 amp fuse. The fuse is marked F1 on the front panel. The indicator lamp next to the AC POWER ON switch will light when 115V is connected to the control circuits.

The GROUND CONTINUITY light will glow to indicate that a proper ground wire has been connected to the piece of equipment which is to undergo the hipot test. High voltage will not be possible unless ground continuity is established or the continuity circuit is defeated by means of a toggle switch on the rear panel.

The AC/DC switch selects the type of output voltage. **This switch should only be moved when the high voltage is OFF!**

The MODE (MANUAL/AUTOMATIC) switch selects which type of procedure will be used.

### Manual Operation

The H.V. ON pushbutton will permit power in the high voltage circuits as long as ground continuity and H.V. zero start conditions are satisfied. The indicator adjacent to it will light whenever these circuits are activated.

VOLTAGE CONTROL (RAISE/LOWER) pushbuttons allow the high voltage to be either raised or lowered by pressing the appropriate button.

The H.V. OFF pushbutton will turn off the high voltage instantly at any time. When high voltage is turned off, the high voltage circuitry will automatically reset itself for the next test.

The OFF ZERO light indicates that the high voltage output control variac is resetting (returning to zero.) High voltage cannot be regained until the off zero indicator has gone out.

### Automatic Operation

Once ground continuity has been established, pressing the HIGH VOLTAGE ON pushbutton will initiate the automatic test sequence.

The HIGH VOLTAGE ON indicator will light and the output high voltage will rise at a linear rate. When a pre-determined test voltage is reached, the TIMER ON indicator will light (GREEN) and the high voltage will stop rising.

INSULATION TEST SET

OPERATION (Continued)

Automatic Operation (Continued)

High voltage will remain at test voltage for the amount of time set on the pushbutton switches marked SECONDS. Timer range is 0-99 seconds.

At the end of the preset test time, the green indicator light will extinguish, the high voltage will ramp back down (at the same rate as it ramped up) to zero and the high voltage will turn off.

All circuits are now reset and a new test sequence can be started.

NOTE: VOLTAGE CONTROL PUSHBUTTONS ARE INACTIVE DURING AUTOMATIC TEST.

The OVERLOAD light will light up if too much current is drawn during a high voltage test. It will be accompanied by a warning buzzer inside the unit. The light (and buzzer) will remain on until the RESET button is pressed.

An OVERLOAD condition will automatically turn off the high voltage instantly and cause the high voltage circuitry to reset itself.

The ARCING indicator will light or flash if an intermittent overcurrent or arc is present on the test piece. This condition may not be severe enough to activate the overload circuitry.

The CURRENT RANGE (LOW/HIGH) switch controls the sensitivity of the current meter. The LOW range provides 1 mA full scale sensitivity and the HIGH range provides 5 mA full scale sensitivity.

Rear Panel Controls

The rear panel controls determine the functions of the automatic test sequence, which may not be of concern to the operator during production line testing.

The OVERLOAD SENSITIVITY pot determines the minimum output current level required to activate the overload circuity. Turning this control clockwise increases sensitivity, therefore, the overload will trip at a lower output current level.

INSULATION TEST SET

OPERATIONS (Continued)

Rear Panel Controls (Continued)

To set the OVERLOAD SENSITIVITY:

1. Turn the OVERLOAD SENSITIVITY control fully clockwise (MIN.)

2. Connect a 47 k ohm, 2 W resistor from the HV OUTPUT to ground (resistor value is typical.)

3. Switch unit to MANUAL MODE, turn on CONTINUITY DEFEAT switch.

4. Switch HV ON and raise voltage until desired CURRENT level is reached.

5. Slowly turn OVERLOAD SENSITIVITY pot counterclockwise until overload circuit is activated.

6. RESET overload and turn HV ON. Raise voltage again and watch to see that overload trips at the desired level.

The RATE OF RISE POT determines the linear rate of output voltage rise. Turning this control clockwise will provide a rate of <100 volts per second or turning it fully counterclockwise will provide a rate of >500 V/s. The rate selected will also determine the voltage fall after the timer times out and the high voltage circuitry returns to zero.

The CONTINUITY DEFEAT switch will allow a hipot test to be performed on an ungrounded test piece. Turning this switch on will light the front pannel indicator and bypass the ground continuity circuit.

The VOLTAGE SET POT (u/s) is used to select at which point the output stops rising and the timer starts timing. To set this control for automatic operation, do the following:

1. Turn VOLTAGE SET (u/s) pot fully counterclockwise (facing rear of unit.)

2. Switch unit into MANUAL MODE.

3. Turn HV ON and use voltage controls to set voltage to desired test level.

4. Slowly turn the VOLTAGE SET pot (u/s) clockwise until TIMER ON indicator (GREEN) just comes on.

INSULATION TEST SET

OPERATION (Continued)

Rear Panel Controls - Voltage Set Pot (Continued)

5. Press HV OFF and switch to AUTOMATIC MODE.

6. Press HV ON and watch to see that voltage rises to the correct level before stopping. Repeat this sequence if it is necessary to readjust.

Local/Remote Switch

This switch provides for a simplified testing procedure using a remote test fixture. **All previous instructions concerning controls refer to operations with this switch in the LOCAL position.** The REMOTE operation requires the use of an external test fixture which plugs into a connector on the rear of the chassis.

# INSULATION TEST SET

## TEST FIXTURE

### Description

The test fixture provides two high voltage test receptacles with third wire ground continuity check. Four indicator lights inform the operator of the status of the test.

### Operation

After setting up the rear panel controls as described previously, switch the unit into AUTOMATIC MODE and switch the LOCAL/REMOTE switch to the REMOTE position.

All testing is now carried out remotely as follows:

1. Plug the unit to be tested into the appropriate test socket. When good ground continuity has been established, the READY light will come on.

2. Press the external test pushbuttons and hold down. The buttons must be held for the entire test. The H.V. ON light (yellow) will light and the hipot tester will go through the automatic rise, dwell and fall test sequence.

When the test sequence is completed successfully, the PASS indicator (green) will light.

If an overload condition arises during test, the FAIL indicator (red) will light and the alarm will sound. High voltage will automatically shut off and the circuitry will reset.

Releasing the test pushbuttons will reset the overload circuitry.

# INSULATION TEST SET

## CIRCUIT THEORY

Most of the front panel control circuitry operates from the 115 V line and is not subject to electronic failure. Refer to the schematic for the operation of this circuitry.

Note that the power to the high voltage transformer is provided from a variable transformer. This insures a clean output waveform over the entire output voltage range. The output of the variable transformer goes through a set of normally open contacts (K1) to the high voltage transformer. An overload or a break in ground continuity or pressing the H.V. OFF switch will cause this relay to drop out and disconnect the high voltage section.

The N.O. (Normally Open) contacts RY1A will not allow K1 to be turned on unless the variable transformer is on zero. As a result, high voltage must always ramp up from zero at the beginning of a test.

The relay RY2 is energized by the charge stored on capacitor C1 when the variable transformer returns to zero after a high voltage test. This opens N.C. (Normally Closed) contacts RY2A and turns high voltage off in the AUTOMATIC MODE of operation.

In the REMOTE mode of operation, N.O. contacts RY2B would cause the K2 relay to pull in and latch itself. This causes a signal to go out of the rear connector to light the PASS indicator on the remote box. K2 is dropped out when the external test pushbuttons are released.

The high voltage section consists of a step up transformer and a series current limiting resistor. The low end is connected to the current meter then through the overload assembly to ground. Low end overvoltage protection is provided by a 130 volt varistor.

The output voltage is monitored through a voltage divider by the voltmeter circuit and a voltage sensing circuit on the logic assembly.

Meter protection is provided by neon lamps mounted on the meter circuit boards.

### Logic Assembly (A2)

The logic assembly, A2, consists of a $\pm$ 12 V dc power supply, a peak sample and hold circuit, a voltage comparator, a timer circuit and automatic control logic.

The Q3 transistor senses a positive going, zero crossing of the AC hot line, which feeds the high voltage circuit. IC6 is a dual

CIRCUIT THEORY (Continued)

Logic Assembly (A2) (Continued)

retriggerable monostable multivibrator, which turns on Q4, and consequently OPTO-FET IC2 at the peak. The 100 k ohm trim pot R17 adjusts the delay time from zero crossing until the peak sample pulse goes into IC-2. The proper setting for this time should be about 4 milliseconds (enough time for zero to peak on a 60 cycle line.) The sample pulse time should be fixed at approximately 500 microseconds.

Voltage feeds back through the voltmeter circuit and into the unity gain inverting amplifier IC1. Notice that this input signal must be 180° out of phase with the hot line which triggers Q3. This is achieved when the high voltage transformer primary is wired. Be sure to check for this phase difference if the high voltage transformer has to be replaced.

When the OPTO-FET IC2 turns on, the output of IC1 charges capacitor C2 rapidly to peak voltage. When IC2 is off, C2 stores the peak voltage.

IC3 is used to compare the voltage on C2 with a reference voltage from the VOLTAGE SET pot on the rear panel of the unit. When the voltage on C2 exceeds the reference voltage, the output of IC3 becomes negative.

Feedback through resistor R6 provides hysterisis to insure that a definite trip signal has been generated on the output of IC3. Transistor Q1 inverts this signal.

The Q output (Pin 12) of IC4 will become negative when the clock pulse is applied to pin 11 from Q1. The negative going pulse starts the timer. The Q output (Pin 13) of IC4 goes to a logical 1, which causes NOR gate IC7 to turn off the automatic raise signal.

Timer output Pin 3 becomes positive and remains positive for a time determined by the resistance set by the front panel pushbutton switches. Calibration of the timer is through the 10 k ohm trim pot R11. The positive output turns on Q2, which lights the front panel TIMER ON indicator. The timer output is also connected to IC4 (Pin 3) through an inverter (IC7) so that when IC5 times out and its output returns to a logical 0, Q output (Pin 1) becomes positive and activates the automatic lower signal.

When K1 (the high voltage relay) shuts off, $\overline{\text{ACT}}$ line goes high and ACT goes low. The timer IC5 and the two D-type flip-flops (IC4) are reset. Note that the automatic lower line will be held active when K1 is off.

INSULATION TEST SET

CIRCUIT THEORY (Continued)

Motor Drive (A5)

High voltage ramp up and ramp down is accomplished with a motor driven variable transformer. A stepper motor was selected to insure steady controllable rate of rotation and rapid braking without overshoot. The use of optical limit switches eliminates frictional forces usually associated with mechanical devices.

A simple unijunction relaxation oscillator is used to control the rate of rise. The frequency of the oscillator is set by the RATE OF RISE pot on the rear of the chassis (variable from approximately 10 Hz to approximately 100 Hz.) The oscillator is always running when the unit is on.

The Quad-Nand-Gate IC1 provides the STEP signal to Pin 15 and DIRECTION signal to Pin 3 of the motor driver IC2. Raise and lower signals into the circuit are active high. If both raise and lower signals are applied simultaneously, the motor will lower.

Activating the U.L. (Upper Limit) switch will stop raise rotation. Activating L.L. (Lower Limit) switch will stop lower rotation and will turn on Q1. Q1 provides an open collector output, which is used to pull in the on zero relay RY1.

Typical current for the motor drive board is about 200 mA.

HV Assembly

A high voltage relay selects either the A.C. transformer or the rectifier output. A second high voltage relay acts as a shorting solenoid to discharge the supply and the test sample at the end of the test.

# INSULATION TEST SET

## MAINTENANCE

The test set requires very little maintenance. The unit is conservatively designed for long trouble free life. However, periodic routine maintenance will insure long life by averting potential trouble areas.

### Main Unit

1. The controls should be kept as clean as possible, inside and out. A mild detergent and water may be used to clean outside surfaces. The inside should be cleaned with a vacuum cleaner. Dust is one of the biggest enemies of electrical contacts. Care has been taken to guard the components against dust - do not defeat these by leaving doors open and dust covers off.

2. Indicator lights may be replaced from the front panel. Refer to the parts list for their description.

3. The four function relays are dust sealed plug-in units. If a relay becomes erratic in operation, it should be replaced, not re-adjusted.

4. The meters should be checked for calibration on a regular schedule of six to twelve months. Refer to Circuit Theory for operation.

   The adjustment pots are located inside the unit to the side of each meter. A standard meter should be placed in the output circuit and used as a reference. There are two sets of adjustment pots. Calibrate the a.c. mode first and then the d.c.

### Test Fixture

The test fixture contains no adjustment controls. Cleanliness is important, as dirt can be conductive. A dirty test socket may cause erroneous readings. A test socket that becomes chipped or broken should be replaced as soon as possible in order to give correct readings and not be a shock hazard.

# INSULATION TEST SET

## CALIBRATION

A. Voltmeter: Internal calibration pots are located on the voltmeter printed circuit board (mounted on the rear of the meter.) Connect a suitable standard voltmeter from the high voltage output to ground. Adjust the A.C. mode first. Operate the unit in the manual mode and set output voltage to approximately 2.5 kV on standard meter. Adjust calibration pot until the two meters agree. Spot check at other voltages. Switch to D.C. and repeat.

B. Current Meter: Internal calibration pots are located on the current meter printed circuit board (mounted on the rear of the meter.) Connect a suitable standard current meter, in series with a 47 k ohm, 1 watt resistor, between the high voltage and ground. Operate the unit in the manual mode. Adjust the a.c. mode first. Adjust the output to read approximately three quarters of full scale. Ranging is accomplished by precision resistors; there are no adjustments. Switch to d.c. and repeat.

C. Dwell Time: The dwell timer must be checked by use of a stop watch. Set the pushbutton switches to the most frequently used setting or to 60 seconds. Operate the unit in the automatic mode and note the time the green indicator lamp extinguishes. An adjustment pot, R11, is located on the logic printed circuit board for tolerance correction.

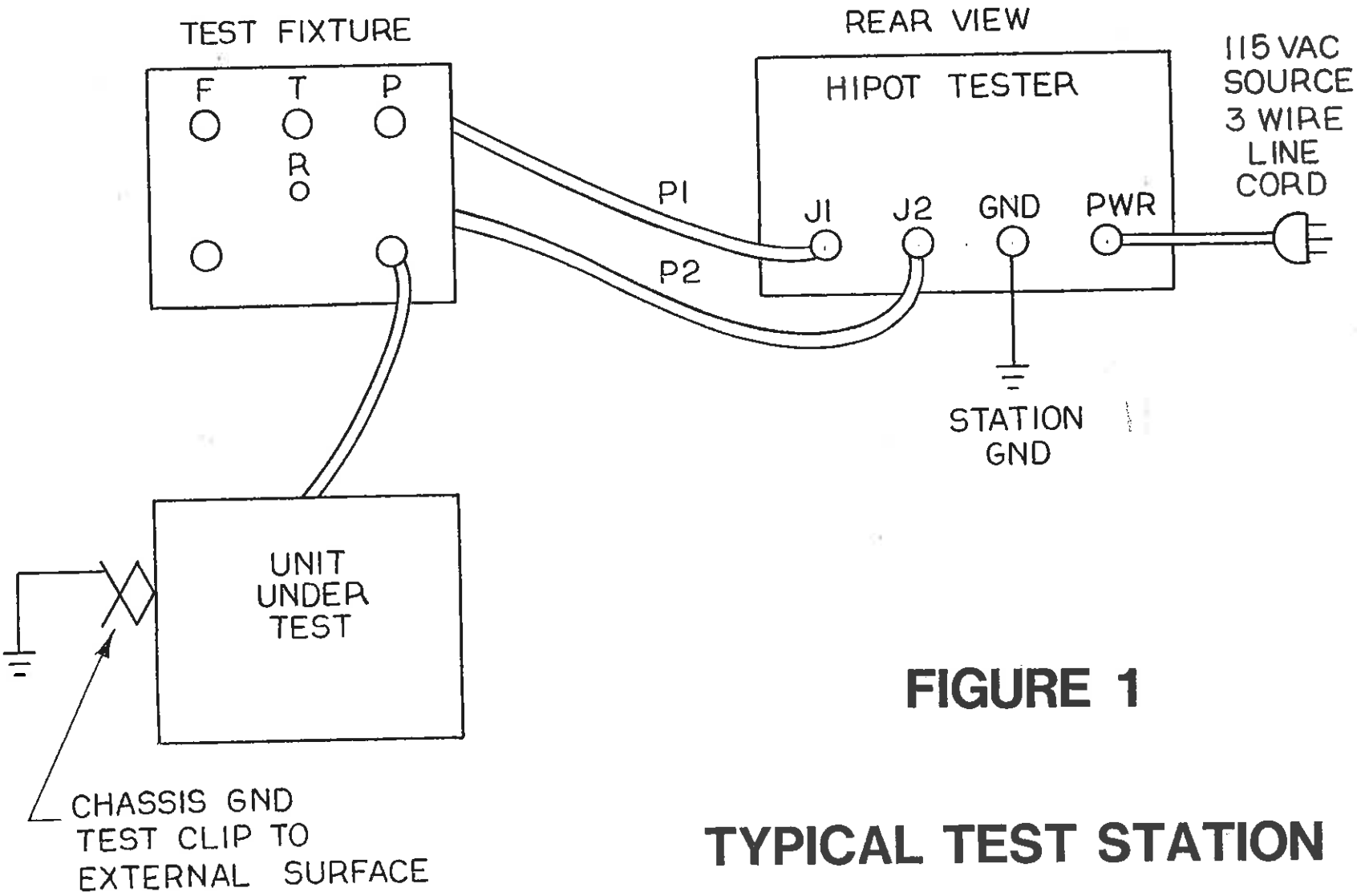



**FIGURE 1**

# TYPICAL TEST STATION

WARRANTY

HIPOTRONICS, INC. warrants to the orginal purchaser of any new merchandise that the merchandise is free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment. The obligation of Hipotronics, Inc. under this Warranty is limited, in its exclusive option, to repair, replace or issue credit for parts or materials which prove to be defective, and is subject to Purchaser's compliance with the Hipotronics, Inc. Warranty Claim Procedure as set forth below. The happening of any one or more of the following events will serve to void this Warranty and any defect or damage resulting therefrom is specifically excluded from Warranty coverage: (a) defects due to accident, negligence, alteration, modification, faulty installation by Purchaser or Purchaser's agents or employee, abuse or misuse; (b) attempted or actual dismantling, disassembling, service or repair by any person, firm or corporation not specifically authorized in writing by Hipotronics, Inc. (c) defects caused by or due to handling by carrier, or incurred during shipment, transshipment or other move.

This Warranty covers only those parts and/or materials deemed by Hipotronics, Inc. to be defective within the meaning of this Warranty. The liability of Hipotronics, Inc. shall be limited to the repair, replacement or issuance of credit for parts deemed defective within the meaning of this Warranty. Costs incurred by purchaser for labor or other expenses incidental to the inspection, repair, replacement or issuance of credit for such parts and/or material shall be the sole responsibility of purchaser. This Warranty shall not apply to any accessories, parts, or materials not manufactured or supplied by Hipotronics, Inc. and if, in the sole discretion of Hipotronics, Inc., Purchaser's claim relates to any materials or workmanship manufactured or performed by the supplier of a component part, or of the manufacturer of a device of which the defective part is a component, Hipotronics, Inc. reserves the right to disclaim liability under this Warranty and to direct that the Purchaser deal directly with such supplier or manufacturer. Hipotronics, Inc. agrees to assist the Purchaser in processing or settling any such claim without prejudicing its position as to liability.

WARRANTY CLAIM PROCEDURE

Compliance with the following Warranty claim Procedure is a condition precedent to the obligation of Hipotronics, Inc. under this Warranty:

a. Purchaser must notify Hipotronics, Inc. in writing by certified or registered mail, of the defect claimed within twelve months after date of original shipment. Said notice shall describe in detail the defect, the defective part, and the alleged cause of defect.

b. At the exclusive option of Hipotronics, Inc., Purchaser shall dismantle or disassemble at Purchaser's cost and expense and shall ship the defective part or material prepaid to Hipotronics, Inc., Brewster, New York 10509, for inspection, or permit an authorized service representative of Hipotronics, Inc. to inspect the defective part or material at Purchaser's premises. If Hipotronics, Inc. shall inspect the part or material at the Purchaser's premises, Purchaser shall provide facilities for, and at Purchaser's cost and expense, dismantle, disassemble, or otherwise make accessible the subject part or material whether or not same is a component of or installed in a device other than that manufactured or supplied by Hipotronics, Inc. If disclosure shows that the defect is not one for which Hipotronics, Inc. is liable, the Purchaser agrees to reimburse Hipotronics, Inc. for all expense incurred.

c. Upon receipt of the defective part or material, or after access to same, Hipotronics, Inc. shall inspect the part or material to determine the validity of Purchaser's claim.

The validity of any Warranty Claim, Purchaser's compliance with Hipotronics, Inc. Warranty Claim Procedure, the obligation to either repair, replace, or issue credit, or direct the purchaser to deal directly with a manufacturer or supplier are to be determined solely and exclusively by Hipotronics, Inc. and any determination so made shall be final and binding.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED ON THE PART OF HIPOTRONICS, INC., INCLUDING THE WARRANTIES OF MECHANTABILITY AND FITNESS FOR USE, AND CONSEQUENTIAL DAMAGES ARISING FROM ANY BREACH THEREOF AND HIPOTRONICS, INC. NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON, FIRM OR CORPORATION TO ASSUME ANY LIABILITY OR OBLIGATION IN CONNECTION WITH THIS SALE ON ITS BEHALF AND PURCHASER ACKNOWLEDGES THAT NO REPRESENTATIONS EXCEPT THOSE MADE HEREIN HAVE BEEN MADE TO PURCHASER.

## RETURNED MATERIAL

If, for any reason, it should become necessary to return the equipment described in this publication to the factory, the Warranty Service Department of Hipotronics must be contacted, at which time the following data must be given in order that we may identify the unit and determine the necessity for return. (Tel. (914) 279-8091) MODEL, SERIAL NO. and TYPE (Part No) is indicated on the black and silver tag affixed to the unit.

MODEL:
SERIAL NUMBER:
TYPE (Part No):
REASON FOR RETURN:
DEFECT:
ALLEGED CAUSE OF DEFECT:

If Hipotronics deems return of the unit appropriate, an "Authorization for Return" tag will be issued. This will instruct you as to the method of return. The pink copy is for your records, the hard copy to be affixed to the unit being returned. If return is not deemed advisable, other inspection arrangements will be made.

NOTE: Material received at this point without the proper authorization shall be held as "customer's property," with no service performed until such time as the proper steps have been taken.

Your cooperation is requested in order to ensure prompt service. Thank you.

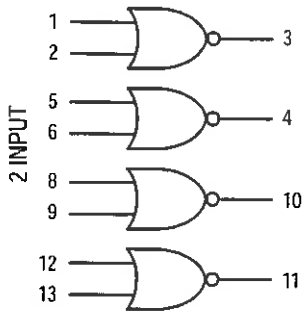
## PARTS ORDERING

To order replacement parts of this unit, please refer to the Parts List contained in the pocket of this publication. The number of the specific component is required, along with the TYPE (Part No) of the unit. The TYPE (Part No) is indicated on your Parts List, and on the black and silver tag affixed to the unit.

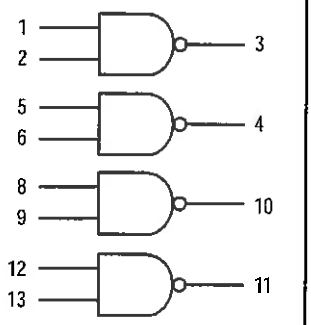
## LOGIC DIAGRAMS

NOR | NAND | OR | AND

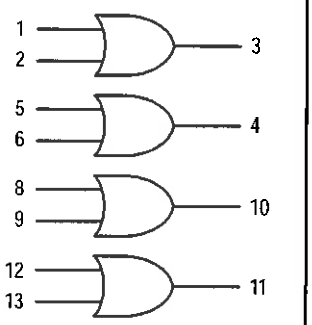
**MC14001B**
**Quad 2–Input NOR Gate**



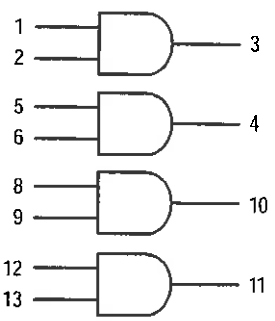

**MC14011B**
**Quad 2–Input NAND Gate**



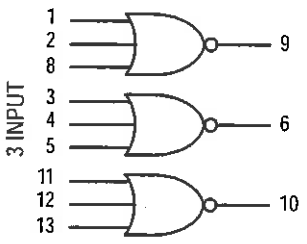

**MC14071B**
**Quad 2–Input OR Gate**



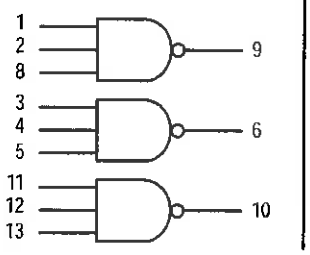

**MC14081B**
**Quad 2–Input AND Gate**



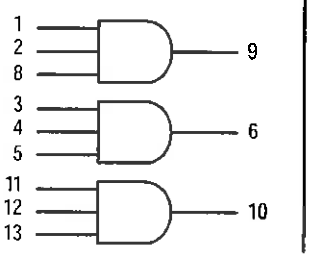

**MC14025B**
**Triple 3–Input NOR Gate**



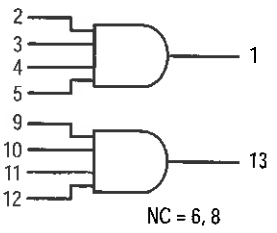

**MC14023B**
**Triple 3–Input NAND Gate**




**MC14073B**
**Triple 3–Input AND Gate**



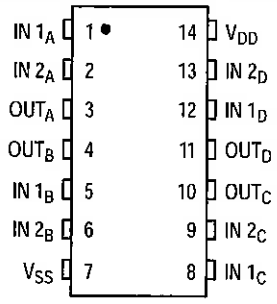

**MC14082B**
**Dual 4–Input AND Gate**



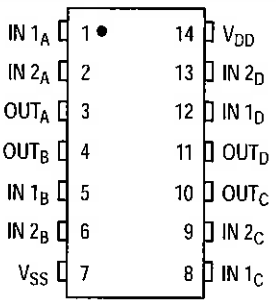

$V_{DD}$ = PIN 14
$V_{SS}$ = PIN 7
FOR ALL DEVICES

## PIN ASSIGNMENTS

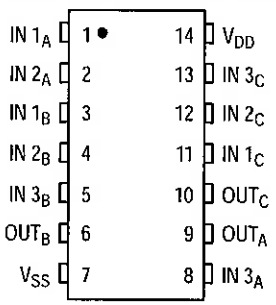
**MC14001B**
**Quad 2–Input NOR Gate**



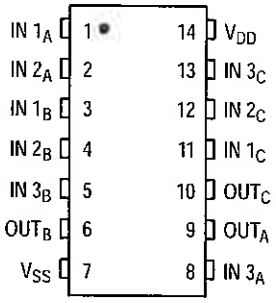

**MC14011B**
**Quad 2–Input NAND Gate**



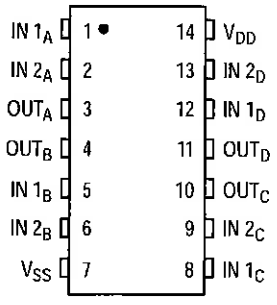

**MC14023B**
**Triple 3–Input NAND Gate**



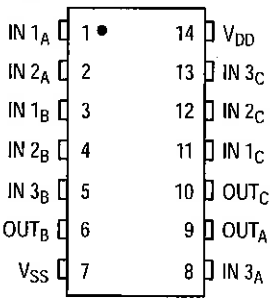

**MC14025B**
**Triple 3–Input NOR Gate**



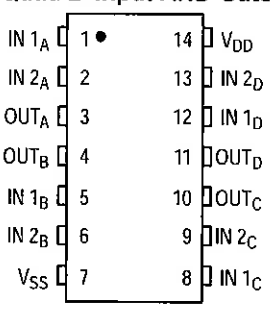

**MC14071B**
**Quad 2–Input OR Gate**



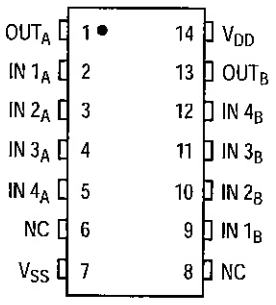

**MC14073B**
**Triple 3–Input AND Gate**




**MC14081B**
**Quad 2–Input AND Gate**




**MC14082B**
**Dual 4–Input AND Gate**




NC = NO CONNECTION