



INSTRUCTION MANUAL  
**SIT**  
Square Root Integrating  
Totalizer

Form 198-701-00J

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### 1.0 SCOPE OF MANUAL

This manual contains operating and maintenance information on the Square-root Integrating Totalizer (SIT), manufactured by MOORE INDUSTRIES INCORPORATED, Sepulveda, California. The manual consists of the following six sections:

**Section 1.** General Information, provides the physical and functional configuration for the unit. A model number explanation is also included.

**Section 2.** Calibration Procedures, provides information necessary for adjustment and calibration of the unit. This section contains a list of the tools necessary for adjusting the equipment. A test connection diagram is included.

**Section 3.** Installation and Operation, this section contains mechanical and electrical installation instructions, which include recommended wiring practices and electrical connections for the unit.

**Section 4.** Theory of Operation, describes the circuit operating principles based on a simplified schematic diagram.

**Section 5.** Maintenance and Troubleshooting, gives step-by-step procedures for maintaining and troubleshooting equipment.

**Section 6.** Unit Documentation, contains engineering drawings, specification data sheet, and installation and outline drawing.

The terms **NOTE**, **CAUTION**, and **WARNING** have specific meanings.

A **NOTE** provides additional information that makes it easier to perform a particular task. Failure to follow a note may result in some inconvenience or needless expense, but the unit will not be damaged, nor is the Instrument Technician likely to be injured.

A **CAUTION** stresses important details to follow when making electrical connections or cleaning PC board contacts. Failure to heed a caution may damage the unit, void the Moore Industries warranty, or cause minor physical injury to the Instrument Technician.

A **WARNING** provides vital safety information that must not be ignored. Warnings deal with proper grounding of equipment, use of solvents, etc. Ignoring warnings may damage the unit and risk personal injury or even death to the instrument technician.

### 1.1 DESCRIPTION

The Square-root Integrating Totalizer (SIT) is used in process control systems to provide square-root functions and summing for a wide range of physical quantities such as flow, ampere- and volt-hours, BTU, watts, etc. The input may be any standard process dc current or voltage proportional to the quantity whose total is desired. The input signal is converted to a dc voltage that controls a linear frequency converter. The output can be pulses for driving external counters, or actuation of an optional internal relay. The output pulse rate is proportional to the root of the input level.

The standard unit consists of four circuit boards with two smaller boards, PC2 and PC3, mounted on a main board, PC1. One of the smaller boards (PC2) contains voltage regulators, and the other one (PC3) contains circuits that determine the pulse rate of the output for a given input signal. The main board contains the remainder of the circuits except for the power inverter circuits. These circuits are mounted on a separate board (PC4) that is attached to the end plate.

The boards are enclosed in a protective housing, and the entire assembly may be installed in a number of ways. Specific details about each unit are outlined in this section, while the following paragraphs outline the physical differences of each option available for the units. Electrical connection information is given in Section 3, Installation and Operation.

### 1.2 SPECIFICATIONS

Refer to SECTION 6.0 for complete specifications for the SIT. This specification sheet provides information on input, output, performance capability, and housing and electrical options.

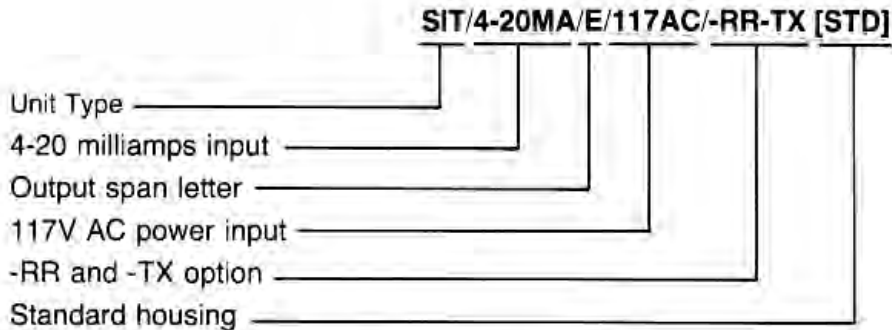
### 1.3 MODEL NUMBER EXPLANATION AND USE

MOORE INDUSTRIES model number identify the instrument type, functional characteristics, operating parameters, and any options ordered. If the documentation is missing, the model number can be used to obtain technical information on the unit. See Table 1-1.

On standard units and with units with -CP and -AB options, the model number is located at the upper end of the terminal block stamped on a stainless steel tag. Plug-in units (-PC) have the model number labeled on the inside of the grip extension to the front panel. Standard plug-in transmitter (PST) units have the model number labeled on top of the transmitter case. Explosion proof (-Ex) units have the model number stamped on a stainless steel tag on top of the enclosure and on an identification label inside the housing. Panel mounted (-PM) units have the model number stamped on a stainless steel tag that is visible when the rear safety cover is removed. To expose the model number on all NEMA enclosure, open the box and remove the safety cover of the unit.

#### 1.4 SERIAL NUMBER USE AND LOCATION

MOORE INDUSTRIES keeps a complete history on each unit sold. This historical information is keyed to the serial number. If service is required on a unit, it is necessary to provide the factory with the serial number as well as the model number. This identification is usually located with the model number as described in paragraph 1.3. Plug-in units have the serial number engraved into the printed circuit board.



**TABLE 1 MODEL NUMBER EXAMPLE**

### 2.0 CALIBRATION PROCEDURES

This section provides information for unit adjustment and calibration. Each unit is adjusted and checked for proper performance at the factory before shipping. However, input and output values for each unit should be checked on site by the user before the equipment is placed into service. See paragraph 1.3 and the Specification Data Sheet in Section 6.0 for minimum and maximum inputs and outputs.

#### 2.1 GENERAL INFORMATION

After a Square-root Integrating Totalizer is unpacked, general operating level checks are recommended using the calibration procedures in this section. If units are ordered with factory calibration (-FC) option, an exact calibration is performed at the factory and red caps are put over the controls. Adjustments should not be made in the field to the units with red caps unless a new range of input or output signals is desired.

#### 2.2 CONTROL DESCRIPTION AND LOCATION

ZERO and SPAN adjustments are located on the front panel of the SIT. The external controls are 20-turn potentiometers that are adjusted with a blade screwdriver.

#### CAUTION

SCREWDRIVER BLADE MUST NOT BE MORE THAN 0.1 INCH (2.54MM) WIDE. USE OF A WIDE BLADE MAY PERMANENTLY DAMAGE THE POTENTIOMETER MOUNTING.

#### 2.3 TEST EQUIPMENT AND TOOLS REQUIRED

The test equipment and tools required for calibrating the SIT are described in Table 2-1; they are not supplied and must be provided by the customer at the installation test site.

#### 2.4 TEST EQUIPMENT SET-UP

The test equipment set-up required to calibrate a SIT unit is shown in Figure 2-1. For plug-in units, the printed circuit board connections are shown in parentheses.

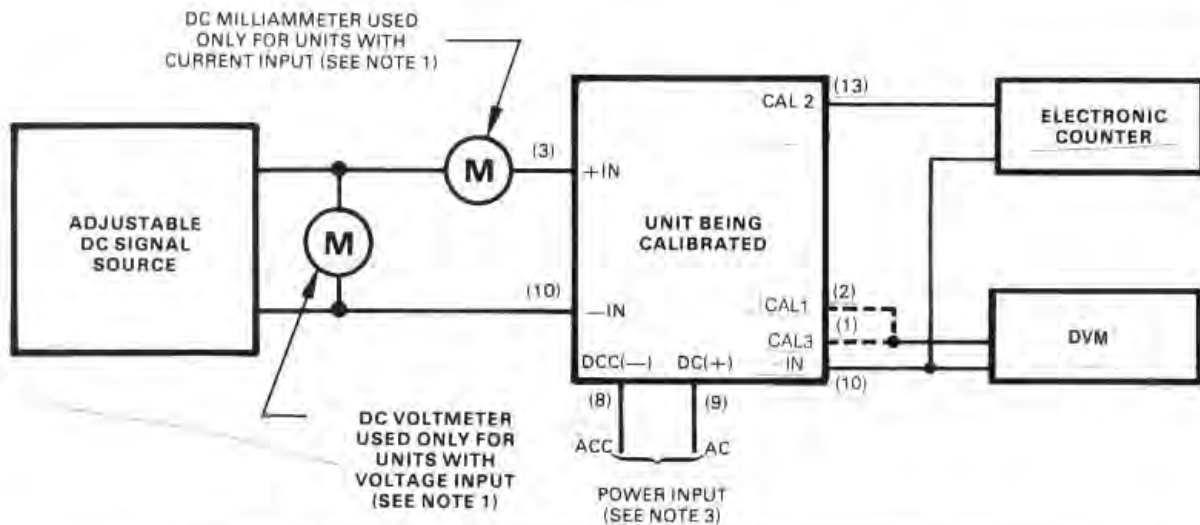
#### NOTE

IN THE EXPLOSION-PROOF (-Ex) OPTION HOUSING, THE PROTECTIVE HOUSING MUST BE OPENED AND THE UNIT REMOVED TO EXPOSE THE CONNECTION BLOCK.

SIMILARLY, UNITS WITH -PT OPTION MUST BE UNPLUGGED FROM THE CONNECTION BLOCK FOR BETTER ACCESS.

| Equipment or Tool           | Characteristic   | Purpose                                       |
|-----------------------------|--|---|
| Screwdriver (blade)         | Blade not wider than 0.1 inch (2.54mm)   | Front panel control adjustment                |
| Adjustable DC Signal Source | Must be capable of producing signal ranges defined by INPUT level requirements of purchased unit (see Table 1-1) | Simulate input signal                         |
| DC Voltmeter                | Must be accurate to within $\pm 0.05\%$ or better  | Input signal monitoring (voltage inputs only) |
| DC Milliammeter             | Must be accurate to within $\pm 0.05\%$ or better  | Input signal monitoring (current inputs only) |
| Electronic Counter          | HP Model 523D or equivalent  | Output signal monitoring                      |

**TABLE 2-1. TEST EQUIPMENT AND TOOLS REQUIRED**



**NOTES:**

1. Input and output monitoring devices must be accurate to within  $\pm 0.05\%$  or better.
2. Numbers in ( ) refer to plug-in units terminals (see Figure 3-13).
3. Either ac power or dc power is supplied, but not both.
4. Do not connect DVM to CAL1 and CAL3 simultaneously.

*Figure 2-1. Test Equipment Set-Up*

## 2.5 CALIBRATION

SIT units are calibrated and checked for proper performance at the factory before they are shipped. However, unless calibration was requested to a specific set of input/output values, the performance of the unit should be checked by the user before the module is placed in service.

Calibration consists of simulating the operative signal input and adjusting the unit to obtain the specified output.

**NOTE**

ADJUSTMENTS SHOULD NOT BE MADE IN THE FIELD TO UNITS THAT ARE CALIBRATED AT THE FACTORY TO CUSTOMER'S SPECIFICATIONS. UNITS CALIBRATED IN THIS MANNER HAVE PROTECTIVE RED CAPS OVER THE SPAN AND ZERO POTENTIOMETERS.

An adjustable signal source and input monitoring device are required for calibration. An electronic counter is also required to determine the output pulse rate.

### 2.5.1 CALIBRATION OF UNIT WITHOUT -RR OPTION

To facilitate adjustment and calibration of the SIT module, three test points are brought out to the external terminal board. They are identified as CAL1, CAL2, CAL3, and are referenced to the -IN terminal.

CAL1 is monitored with the dc volt meter while making the initial ZERO potentiometer setting to obtain approximately +7mv at this terminal with a 0% input signal. (This biases the analog signal input to the first integrator at the zero level to compensate for the live zero input.)

CAL2 brings out the  $\pm 10V$  pulse count signal ahead of the divider which scales the pulse rate to appropriate engineering units for the output signal. (Note: Monitor the events counter for internal display. This gives a faster and more accurate test reading than monitoring the output directly.)

CAL3 provides access to the count dropout comparator ( $\pm 10V$  binary signal). This facilitates monitoring the count dropout potentiometer when adjusting for a specific input level.



**Full Scale Output Count Rate:** Connect the Model SIT and test equipment as shown in Figure 2-1. The Full Scale Output Count is defined by the user (refer to your SIT model number and paragraph 1.3 for further explanation). The appropriate range is selected by moving the range jumper as indicated in Table 2-2.

**Initial Setting of the ZERO Potentiometer:** Connect the dc voltmeter (DVM) between CAL1 and the -IN terminal. Set the input signal to 0%. Adjust the ZERO potentiometer to produce a reading of approximately +7mV.

**Initial Setting of the SPAN Potentiometer:** Connect the electronic counter between CAL2 and the -IN terminal. Set the input signal to 100%. Using the appropriate scale factor from Table 2-3, determine the equivalent full scale count at CAL2 in counts/second. Divide this number into one (1) to get the correct period/count in milliseconds. Set the counter for "period" and adjust the SPAN potentiometer until the counter displays the correct period as calculated above.

**Final Setting of the ZERO and SPAN Potentiometers:** Set the input to 25% of full SPAN and calculate the correct interval as:  $1/\sqrt{.25}$  x full scale counts per second. Since  $\sqrt{.25} = .5$ , the output =  $1/.5$  x full scale counts per second. Readjust the ZERO potentiometer to generate this interval on the counter display. Repeat the full scale and 25% of full scale input settings to the ZERO and SPAN potentiometers until no further adjustments are necessary.

**Input and Output Tracking:** Input and output tracking can be verified at any desired intermediate point by calculation the following relationship:

$$\text{output count rate} = \frac{100\% \text{ output count rate} \times \sqrt{\% \text{ input}}}{100}$$

$$\text{output period} = \frac{1}{(100\% \text{ output count rate}) \times (\sqrt{\% \text{ input}})}$$

### NOTE

MULTIPLY THE READING BY THE APPROPRIATE FACTOR IN TABLE 2-3 BEFORE CONVERTING TO THE COUNT RATE AT THE OUTPUT. THE CALCULATED COUNT RATES SHOULD FALL WITHIN THE PARAMETERS IN TABLE 2-4.

The output should follow the calculated values within 0.1% of the full scale.

While monitoring the CAL3 terminal, decrease the input signal amplitude until the unit stops counting (this is indicated by the CAL3 voltage dropping to -10Vdc). Observe the level at which this occurs. Adjust the input signal to the desired count dropout level and adjust the count dropout potentiometer to obtain -10Vdc at this level.

After all the preceding steps have been successfully completed, remove the input signal source and turn off the power to the unit.

### 2.5.2 CALIBRATION OF UNIT WITH -RR OPTION

To calibrate an SIT that includes the -RR option, connect the test set-up as shown in Figure 2-1 and perform the calibration procedures from paragraph 2.5.1.

### 2.5.3 CALCULATING CALIBRATION VALUES

To calculate correct calibration values, use the following example.

#### EXAMPLE

The input span is 4-20mA (0%-100%) and the output span is 0-7922 counts/hour. Proceed as follows:

1. Determine the signal period (frequency at +OUT) in seconds/counts.

$$\text{A. counts/min} = \frac{\text{counts/hr}}{60 \text{ mins}} = \frac{7922}{60} = 132.2$$

$$\text{B. counts/sec} = \frac{\text{counts/min}}{60 \text{ secs}} = \frac{132.2}{60} = 2.2200$$

$$\text{C. secs/count} = \frac{1}{\text{counts/sec}} = \frac{1}{2.2} = 45443$$

2. Determine the signal period (frequency) at CAL2 in milliseconds/count.

A. Refer to Table 2-4 for range at 7922 counts/hour. The range is G.

- B. Refer to Table 2-3 for the divisor for range G. The divisor is 4.
- C.  $\text{secs/counts} = \frac{\text{secs/count at +OUT}}{4}$   
 $= \frac{.45443}{4} = .11361$
- D.  $\text{milliseconds/count} = .11361 \times 1000 = 113.61$
- Refer to Table 2-2 and install jumper in G range and adjust the count dropout to minimum for CDX options; for other options, turn the count dropout potentiometer @ the maximum amount counter-clockwise.
  - Turn on the power, connect an oscilloscope or digital volt meter (DVM) between CAL1 and -IN, and set the ZERO potentiometer for +7mV, with 0% at -IN.
  - Connect a counter/timer instrument between CAL2 and -IN.

- Set the input at 100% (20mA) and set the SPAN potentiometer for 113.61 milliseconds (calculated in step2).
- Set the input at 25% (8mA) and set the ZERO potentiometer for 227.22 milliseconds (at CAL2 the count period will be twice as much at 25% input as at 100% input; thus,  $2 \times 113.61 = 227.22$ ).
- Repeat steps 6 and 7 until no further adjustment is needed.

To ensure that calibration is accurate over all, also set the inputs between CAL2 and -IN at 50% and 75%. At 50% input the rate is 160.668 milliseconds; at 75% input, the rate is 131.185 milliseconds.

### 2.6 OUTPUT PULSE RATE RANGE

The output pulse rate can be changed in the field by modifying the jumper connections on the Pulse Rate printed circuit board (PC3 for standard units, PC2 for plug-in units) and the main board (PC1). See Table 2-2.

| OUTPUT PULSE RATE RANGES | STD CIRCUIT MODIFICATIONS (PC3) * |      |      |      |      |      |      |      |      |      |
|--------------------------|-----------------------------------|------|------|------|------|------|------|------|------|------|
|                          | J300                              | J301 | J302 | J303 | J304 | J305 | J306 | J307 | J308 | J309 |
| A1                       |                                   |      |      |      |      |      |      |      | USED |      |
| A                        |                                   |      |      |      |      |      |      | USED |      |      |
| B                        |                                   |      |      |      |      |      | USED |      |      |      |
| C                        |                                   |      |      |      |      | USED |      |      |      |      |
| D                        |                                   |      |      |      | USED |      |      |      |      |      |
| E                        |                                   |      |      | USED |      |      |      |      |      |      |
| F                        |                                   |      | USED |      |      |      |      |      |      |      |
| G                        |                                   | USED |      |      |      |      |      |      |      |      |
| H                        | USED                              |      |      |      |      |      |      |      |      |      |
| J                        |                                   |      |      |      |      |      |      |      |      | USED |

BLANK SPACES: JUMPERS NOT USED OR COMPONENTS UNAFFECTED.

\*Jumpers located on PC2 in Plug-in version

**TABLE 2-2. CIRCUIT MODIFICATIONS TO CHANGE OUTPUT PULSE RATE RANGES**

# SECTION 2

## CALIBRATION PROCEDURES

**TABLE 2-3. OUTPUT FULL SCALE COUNT RATES vs. COUNT RATES AT CAL 2 TERMINAL**

| OUTPUT RANGE | TO OBTAIN OUTPUT COUNT RATE, DIVIDE COUNT RATE AT CAL 2 BY: |
|--------------|---|
| A1           | 512   |
| A            | 256   |
| B            | 128   |
| C            | 64  |
| D            | 32  |
| E            | 16  |
| F            | 8   |
| G            | 4   |
| H            | 2   |
| J            | 1   |

| RANGE | COUNTS/HR |        | COUNTS/MIN |        | COUNTS/SEC |         | PERIOD/COUNT |      |         |
|-------|-----------|--------|------------|--------|------------|---------|--------------|------|---------|
|       | MIN       | MAX    | MIN        | MAX    | MIN        | MAX     | MIN.         | MAX  |         |
| A1    | 50        | 100    | 0.83       | 1.66   | 0.01388    | 0.02777 | 72.0         | sec. | 36.0    |
| A     | 100       | 200    | 1.66       | 3.33   | 0.02777    | 0.05555 | 36.0         | sec. | 18.0    |
| B     | 200       | 400    | 3.33       | 6.66   | 0.05555    | 0.1111  | 18.0         | sec. | 9.0     |
| C     | 400       | 800    | 6.66       | 13.33  | 0.1111     | 0.2222  | 9.0          | sec. | 4.5     |
| D     | 800       | 1,600  | 13.33      | 26.66  | 0.2222     | 0.4444  | 4.5          | sec. | 2.25    |
| E     | 1,600     | 3,200  | 26.66      | 53.33  | 0.4444     | 0.8888  | 2.25         | sec. | 1.125   |
| F     | 3,200     | 6,400  | 53.33      | 106.66 | 0.8888     | 1.7777  | 1.125        | sec. | 0.5625  |
| G     | 6,400     | 12,800 | 106.66     | 213.33 | 1.7777     | 3.5555  | 562.5        | ms.  | 281.25  |
| H     | 12,800    | 25,600 | 213.33     | 426.66 | 3.5555     | 7.1111  | 281.25       | ms.  | 140.625 |
| J     | 25,600    | 51,200 | 426.66     | 853.33 | 7.1111     | 14.2222 | 140.625      | ms.  | 70.3125 |

**TABLE 2-4 FULL SCALE COUNT RATES AND COUNTER PERIOD FOR VARIOUS RANGES**



### 3.0 INSTALLATION AND OPERATION

#### 3.1 MECHANICAL INSTALLATION

The Model SIT is available in several physical configurations. Installation details can be found on the Outline and Installation drawing contained in Section 6.0. Observe any special procedures and precautions given with the illustration.

Although the unit is designed for convection cooling, it is advisable to mount the unit on a surface made of material that can serve as a heat sink. The unit should be located in an area that is protected from dust, moisture, and corrosive atmospheres.

#### 3.2 ELECTRICAL CONNECTIONS

Special wire or cable is not required for signal connections to the unit. To avoid transients and stray pick-ups, it is recommended that twisted conductors be used where they run close to other services (such as power wiring). Electrical connections fall into two major categories: connections to all standard units with terminal blocks, and connections to plug-in units.

**Standard Units:** Standard units with terminal strips or terminal blocks have terminals supplied with 6-32 screws long enough to accommodate three spade-lug connectors. Standard units with snap-off plastic covers have an opening at the bottom of the cover; put all wires to and from the terminals through this opening. Spade-lug connectors are recommended for all wire terminations. See Table 3-1 for terminal nomenclatures.

**NEMA Enclosures:** Units mounted in NEMA boxes are standard units. Oil tight (-OT) or water tight (-WT) options do not have conduit holes, fittings or knockouts. Conduit access must be provided by fittings such as Myer Scru-Tite or equivalent. General purpose (-GP) enclosures have conduit knockouts from 1/2 to 1-inch. Corrosion-proof (-FG) enclosures require special attention with ground connections. Because the enclosure material is polyester resin, ground continuity may be obtained in two different ways. If a metal panel is used, ground can be made between the metal conduit locknut and the panel. If the enclosure is used without a back panel, a jumper between the conduit entry and exit is necessary to maintain ground continuity. Remove snap-off plastic cover to access terminal strips.

**Plug-in Units:** Plug-in units and card rack electrical connections are made to terminals on the mating connector for the unit or card rack terminal strips. See Table 3-2 for the terminal nomenclature.

#### 3.2.1 POWER CONNECTIONS

SIT units operate from either a dc or an ac power source. Refer to your model number on the unit and paragraph 1.3 to determine type of power required.

**DC Powered Units:** The DC terminal is connected to the + (positive) side of the power source; the DCC terminal is connected to the - (negative) side. The dc source should be regulated to within  $\pm 10\%$  of the nominal voltage and should be capable of delivering 5 watts.

**AC Powered Units:** The AC terminal is connected to the ungrounded or "hot" side of the power source; the ACC terminal is connected to common or neutral. The GND terminal is the mechanical case connection. These units require 117Vac,  $\pm 10\%$ , 50/60Hz at 5Vac of nominal power or 220/240Vac optionally.

**Rack Power Connections:** Connect power input wires to the appropriately labeled terminals of the 3-terminal connector strip. The third terminal on the strip is chassis ground.

#### 3.2.2 CONNECTIONS OF UNITS WITH THE -SC OPTION

For units with the selectable current option (-SC), connect the input selectable current resistor to the +IN and -IN terminals. The current range is marked on the body of each resistor. If provided, the selectable current resistors for a plug-in unit should be mounted externally either at the terminal block of the card rack or soldered to the appropriate terminals on the PC connector. See Table 3-2 for correct connections.

#### 3.2.3 CONNECTIONS ON UNITS WITH THE -TX OPTION

For units with the -TX option, connect the positive output lead from the external equipment to the +TX terminal on this unit. Connect the minus output lead from the external equipment to the +IN input on this unit.

| Options                | Terminal Positions (See Note) |          |          |     |    |     |     |     |     |     |      |      |
|------------------------|-------------------------------|----------|----------|-----|----|-----|-----|-----|-----|-----|------|------|
|                        | 1                             | 2        | 3        | 4   | 5  | 6   | 7   | 8   | 9   | 10  | 11   | 12   |
| NONE                   | CAL<br>1                      | CAL<br>2 | CAL<br>3 | DCC | DC | GND |     |     | +IN | -IN | +OUT | -OUT |
| AC                     | CAL<br>1                      | CAL<br>2 | CAL<br>3 | ACC | AC | GND |     |     | +IN | -IN | +OUT | -OUT |
| SC (input)<br>(Note 2) |                               |          |          |     |    |     |     |     |     |     |      |      |
| TX                     |                               |          |          |     |    |     | +TX |     |     |     |      |      |
| RR                     |                               |          |          |     |    |     | NO  | COM |     |     |      |      |
| RRNC                   |                               |          |          |     |    |     | COM | NC  |     |     |      |      |

**NOTES:**

1. Labeling shown here may be combined. The combination may include standard labeling and one or more options. Combinations of options may cause labeling positions to change, but nomenclature will remain as shown.
2. SC resistor is connected across  $\pm$  IN terminals.

|         |     |                 |           |                             |
|---------|-----|-----------------|-----------|-----------------------------|
| Legend: | DC  | +DC Power Input | +TX       | External Excitation         |
|         | DCC | -DC Power Input |           | Power Output                |
|         | GND | Chassis Ground  | $\pm$ OUT | Signal Output               |
|         | AC  | AC Power Input  | SC        | Selectable Current Resistor |
|         | ACC | AC Power Return | RR        | Internal Relay Normally     |
|         | COM | Relay Common    |           | Open Contact                |
|         |     |                 | RRNC      | Internal Relay Normally     |
|         |     |                 |           | Closed Contact              |

**TABLE 3-1 TERMINAL NOMENCLATURE**

# SECTION 3

## INSTALLATION & OPERATION

| Options                  | Terminal Position |          |     |      |     |   |      |     |    |     |    |    |          |    |    |
|--------------------------|-------------------|----------|-----|------|-----|---|------|-----|----|-----|----|----|----------|----|----|
|                          | 1                 | 2        | 3   | 4    | 5   | 6 | 7    | 8   | 9  | 10  | 11 | 12 | 13       | 14 | 15 |
| NONE                     | CAL<br>3          | CAL<br>1 | +IN | +OUT |     |   | —OUT | DCC | DC | —IN |    |    | CAL<br>2 |    |    |
| SC (Input)<br>(See Note) |                   |          |     |      |     |   |      |     |    |     |    |    |          |    |    |
| TX                       |                   |          |     |      | +TX |   |      |     |    |     |    |    |          |    |    |
| RR                       |                   |          |     | NO   |     |   | COM  |     |    |     |    |    |          |    |    |
| RRNC                     |                   |          |     | NC   |     |   | COM  |     |    |     |    |    |          |    |    |

Keyways

**NOTE:** SC Input resistor is mounted across —IN and +IN terminals.

|                |     |                                  |      |                              |
|----------------|-----|----------------------------------|------|------------------------------|
| <b>Legend:</b> | DC  | +DC Power Input                  | ±IN  | Signal Input                 |
|                | DCC | —DC Power Input                  | ±OUT | Signal Output                |
|                | GND | Chassis Ground                   | SC   | Selectable Current Resistor  |
|                | +TX | External Excitation Power Output | CAL1 | Calibration Resistance Input |
|                |     |                                  | CAL2 |                              |

**TABLE 3-2 CONNECTOR PINS AND TERMINAL ASSIGNMENTS FOR PLUG-IN UNIT AND CARD RACKS**

### 4.0 THEORY OF OPERATION

This section describes the operation of Model SIT. The functional description is based on the unit block diagram, Figure 4-1.

#### 4.1 FUNCTIONAL DESCRIPTION

The input signal for the Model SIT is first converted to a dc voltage proportional to the amplitude of the applied input signal. The voltage is then applied to a linear frequency converter, which produces output pulses at a rate linearly proportional to the amplitude of the input signal.

#### 4.2 POWER SUPPLY CIRCUIT DESCRIPTION

Units are usually supplied for use with either an ac or dc power input. On units for use with an ac power input, the power supply typically develops a 24-volt dc output that is applied to the input of the power inverter. On units intended for a dc power input, the power is applied directly to the input of the power inverter, with diode protection to prevent damage to the power inverter components if the dc power input is accidentally connected with reversed polarity.

#### 4.3 POWER INVERTER CIRCUIT DESCRIPTION

The power inverter produces a number of outputs from the dc applied to its input. Two separate square-wave outputs at approximately 3KHz are developed. A set of regulated positive and negative dc outputs are reduced and used as operating voltages for the unit. The inverter also produces a positive dc output as the operating voltage for the power amplifier. A 400 milliamp fuse (-FU option) placed in series with the +DC input protects the unit from damage where dc voltage may fluctuate enough to cause excessive current drain on the unit.

#### 4.4 RECTIFIER AND REGULATOR CIRCUITS

The rectifiers accept the outputs from either the ac power supply or the power inverter and produce unregulated positive and negative voltages (of equal value with respect to ground). Two regulators reduce these voltages to the required operating values and regulate them against changes with load or line voltage variations. Another rectifier produces a higher unregulated output used as operating voltages for the -TX option.

#### 4.5 INPUT NETWORK AND ZERO ADJUST CIRCUITS

The input signal is provided with the proper termination by the input network and is combined with the voltage from the zero adjust circuit. The zero adjust circuit adds an adjustable positive voltage to cancel the live zero of the basic input signal. With a low value of input signal applied, the zero adjust circuit is adjusted so the voltage added to the applied input signal results in a zero count rate. Zero adjust voltage is provided to the inverting input amplifier while the incoming signal is connected directly to the non-inverting input to the amplifier.

#### 4.6 INPUT AMPLIFIER CIRCUIT

The input amplifier increases the level of the composite input signal. No inversion takes place in this amplifier. The output of the amplifier drives the next stage, which is an inverter. The output is also applied to one input of the coupling network that supplies the signal to the integrator. High stability of the amplifier is achieved through the use of feedback.

#### 4.7 INVERTER CIRCUIT

The output from the input amplifier is applied to the inverter, which has a gain of unity and produces an output with a polarity opposite to that of the input applied to this stage. The inverter provides one of the two signals of opposite polarity required by the coupling network that applies a signal to the integrator (the other signal to the network is provided by the input amplifier). Feedback is used in the inverter to achieve high stability and also to establish the gain.

#### 4.8 DOUBLE INTEGRATOR-COMPARATOR CIRCUITS

The double integrator-comparator combination produces, as the comparator output, pulses at a rate proportional to the amplitude of the input signal.

#### 4.9 FREQUENCY DIVIDER CIRCUIT

The frequency divider receives pulses at the basic pulse rate if the desired full scale pulse-rate output from the unit is lower than range J (25,600 to 51,200 counts per hour). The frequency divider then produces one output pulse for every N pulses applied to its input, where N is the number by which the basic pulse rate must be divided to obtain the desired output pulse from the unit.

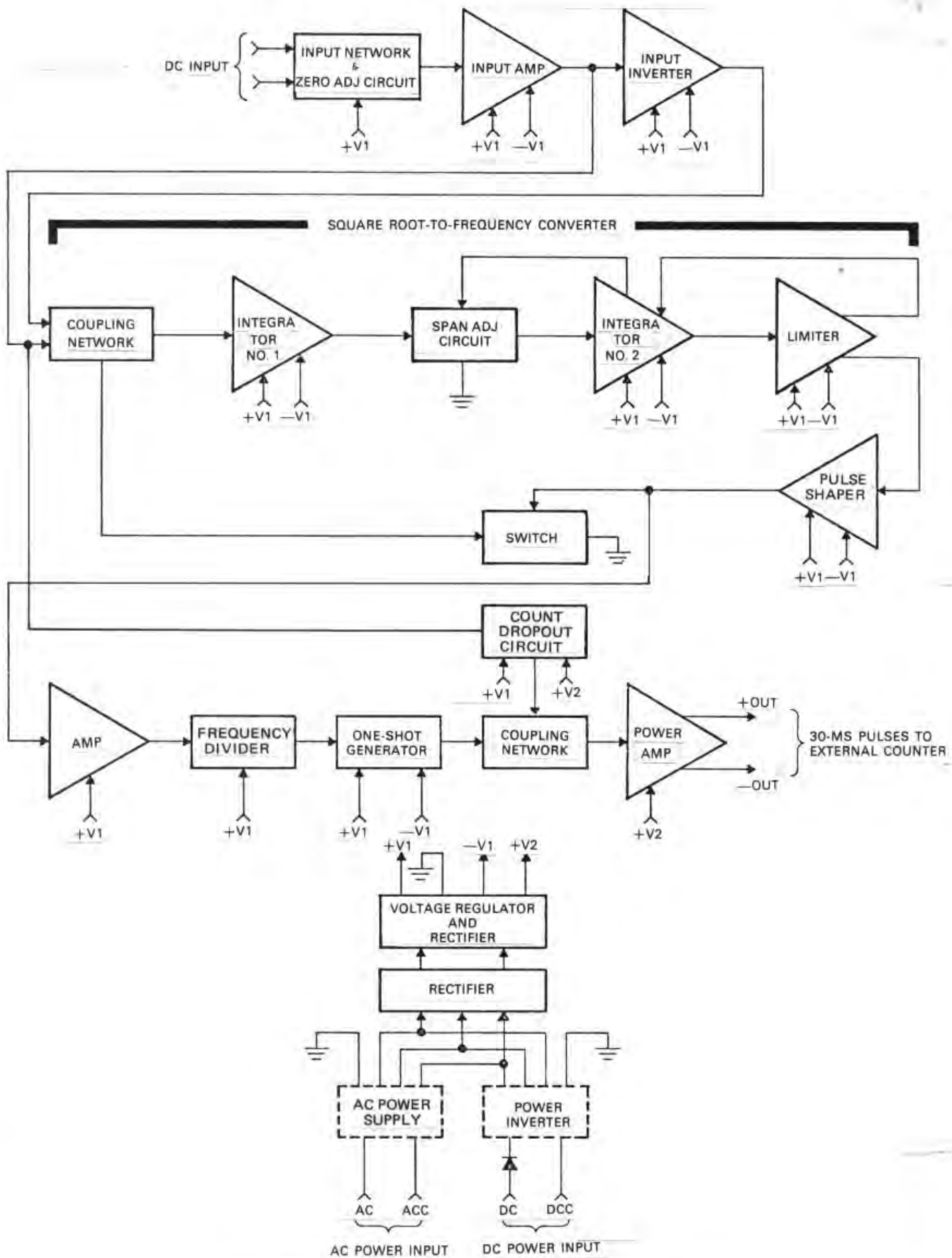


FIGURE 4-1. SIT BLOCK DIAGRAM



## 4.10 ONE-SHOT GENERATOR CIRCUIT

Since the duration of the pulses produced by the comparator varies with the pulse rate, a stage is used to convert these pulses to an output of constant duration regardless of pulse rate. The one-shot generator accepts the basic or divided pulses and produces a 30 millisecond output pulse for each pulse received.

## 4.11 POWER AMPLIFIER CIRCUIT

The one-shot generator produces output at a low power level. To drive a counter or a relay, the power of these pulses must be amplified. A two-stage power amplifier produces output pulses with enough power to drive either an external counter or the optional internal relay.

## 5.0 MAINTENANCE AND TROUBLESHOOTING

All units found to be performing below specifications should be returned to the factory for service in accordance with the instructions found on the inside back cover of this manual.

In an emergency, the user may contact the Customer Service department for verbal assistance in diagnosing and repairing a totalizer problem.

### 5.1 MAINTENANCE

The design of the Model SIT limits maintenance primarily to keeping the input and output terminals and conductors clean and tight while maintaining a heat conduction path to a suitable heat sink. A thorough cleaning of terminal blocks for standard units and contacts of the plug-in modules requires complete disassembly and should only be done at the factory. It is recommended that the user check the terminations once during every six months of service to verify that they are secure and free of oxidation.

### 5.2 TROUBLESHOOTING

If a problem is suspected with the Model SIT, review the following procedures:

1. Verify that all electrical connections are clean and tight.
2. Verify that the measuring instrument used for input voltage or current is of the proper range and accuracy.
3. Verify that the output circuit is electrically isolated from the input circuit.

If the problem still exists, the unit might be defective and should be returned to the factory for repair in accordance with the instructions found on the inside back cover of this manual.

# SECTION 5

## MAINTENANCE & TROUBLESHOOTING

| TEST POINT | WAVE FORM AND VOLTAGE LEVEL |                                   |       |
|------------|-----------------------------|-----------------------------------|-------|
| 1          |                             |                                   |       |
| 2          |                             |                                   |       |
| 3          |                             |                                   |       |
| 4          |                             |                                   |       |
| 5          |                             |                                   |       |
| 7          |                             |                                   |       |
| TEST POINT | WAVE FORM                   | POWER INPUT & WAVE FORM AMPLITUDE |       |
|            |                             | 24VDC/<br>117VAC/220VAC           | 45VDC |
| A          |                             | 48V                               | 90V   |

**NOTES:**

1. TP6 has been omitted intentionally.
2. T.P.A. is collector of Q401 and Q402 and referenced to DCC (COM) DC only.

# Specifications - SIT

## SIT-Squared Input Totalizer

**INPUT:** Squared current or voltage signals from  $\Delta P$  transmitters.

**Current:**

- 1-5mA into 200 ohms nominal
- 4-20mA into 50 ohms nominal
- 10-50mA into 20 ohms nominal

**Voltage:**

- 0-5V, 1-5V standard
- 0.5 megohm minimum input impedance
- Other voltages optional

**FRONT PANEL ADJUSTMENTS:** Adjustable with 22-turn potentiometers

**Span:** With maximum selected input, output adjustable within a selected output span.

**Zero:** For an input of  $\pm 10\%$  of maximum input range, adjusts output to 0% of selected output span.

**OUTPUT:** 24 volt, 35 ms pulse compatible with external standard electronic or electro-mechanical totalizers.

Optional relay contact output (-RR Option) available.

**Output Spans:**

- A1 0 to 50 through 100 counts/hour
- A 0 to 100 through 200 counts/hour
- B 0 to 200 through 400 counts/hour
- C 0 to 400 through 800 counts/hour
- D 0 to 800 through 1600 counts/hour
- E 0 to 1600 through 3200 counts/hour
- F 0 to 3200 through 6400 counts/hour
- G 0 to 6400 through 12,800 counts/hour
- H 0 to 12,800 through 25,600 counts/hour
- J 0 to 25,600 through 51,200 counts/hour
- A1-J All the above ranges, selected by internal dip switch

**Count Dropout:** 0.5% to 20% of input full scale (adjustable).

### PERFORMANCE:

**Calibration Capability:**  $\pm 0.1\%$  of span (linearity)

**Repeatability:**  $\pm 0.01\%$  of span

**Ambient Temperature:**

**Range:**  $-18^{\circ}\text{C}$  to  $+72^{\circ}\text{C}$  ( $0^{\circ}\text{F}$  to  $+165^{\circ}\text{F}$ )

**Effect:**  $\pm 0.01\%$ / $^{\circ}\text{F}$  over above range

**Isolation:** Isolation between power input and input-output is standard. Input-output isolation is achieved by specifying the optional relay output.

### POWER INPUT:

24Vdc, 45Vdc,  $\pm 10\%$

117Vac, 220Vac, 240Vac, 50/60Hz,  $\pm 10\%$

5 watts nominal

**Line Voltage Effect:** ac or dc:  $\pm 0.005\%/1\%$  line voltage change

### OPTIONS:

- FS Front panel switch selected output ranges (A1-J)
- IT Integral bracket mounted, 6-digit manual or non-reset totalizer (electro-mechanical)
- PR Solid-state power relay-5A at 117Vac only inductive
- RR SPST relay contact output-1A at 28Vdc non-inductive (NO standard, specify NC if required)
- TX Two-wire transmitter excitation-35Vdc at 25mA max. to power 4-20mA two-wire field transmitter.

- ET Electronic totalizer drive
- RF Patented filter assembly for RFI/EMI protection exceeding SAMA standard PMC 33.1 1978 Class 2, a, b, c.
- ED6 Integral bracket mounted, 6 digit electronic counter manual or electric reset; Solid-state LCD counter
- ED8 Integral bracket mounted, 8 digit electronic counter electric reset only; Solid-state LCD counter

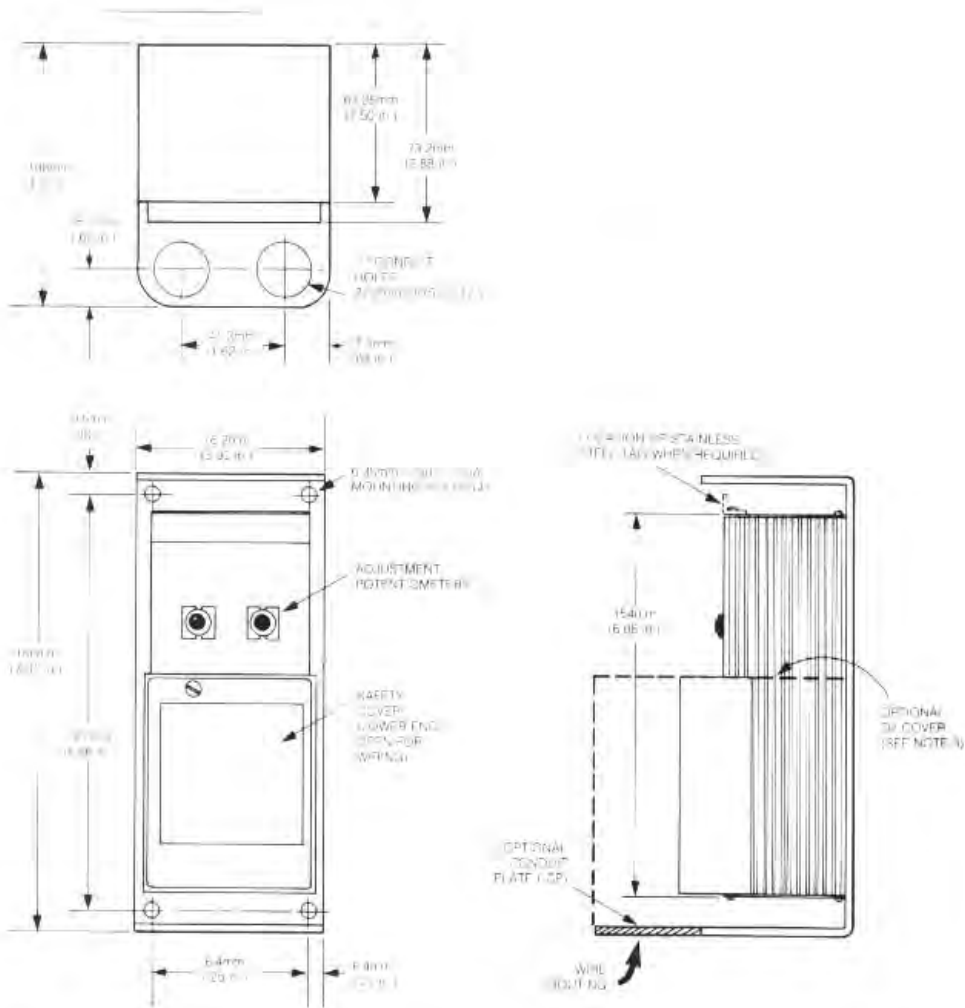
For other options, see Housings, Options & Accessories brochure

### HOUSING:

- STD Standard enclosures as illustrated
- AB Angle bracket mounting
- CP Conduit plate for use with standard units
- EUR High-density plug-in Euro Card (international specs)
- EX Explosion-proof enclosure, Single Unit-Div. 1
- GP General purpose enclosure, Single Unit-NEMA 1
- OT Oiltight enclosure, Single Unit-NEMA 12
- PC Plug-in card
- PM Panel mount enclosure
- WT Watertight enclosure, Single Unit-NEMA 4
- TCE Transparent cover enclosure

**CERTIFICATION:** CSA

**WEIGHT:** Approximately 2 lbs. (908 grams)

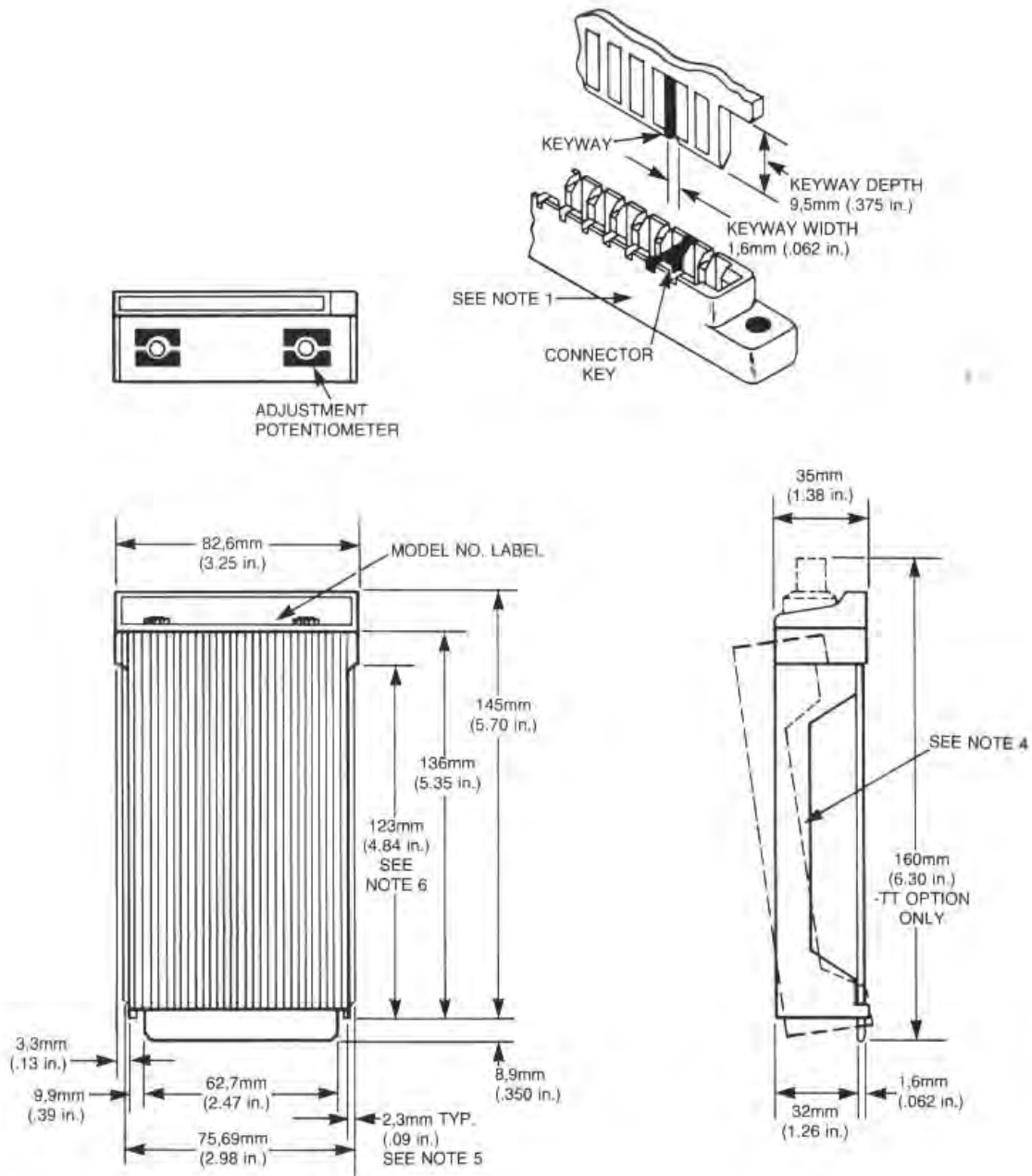


#### NOTES

1. Complete Model No. and Serial No. are permanently marked on the identification plate located at the upper end of the terminal blocks.
2. When extra-compact mounting is required for rack or portable installation, the C-shaped mounting bracket may be removed and the two threaded inserts (located 4.00 inches apart) may be used for mounting, using 6-32NC machine screws.
3. Meets Class 1, Group D, Division 2 with optional D2 cover & CP bracket.
4. When rear inserts are used for mounting, be sure that the mounting screws do not protrude more than  $\frac{1}{8}$  inch into the unit.

**Figure 6-1. STD Installation and Outline Dimensions**





**NOTES:**

1. Connectors must have contacts on 3,96mm (.156 in.) centers, with contacts for both surfaces of board (recommended type: Viking part no. 2VK155/1-2).
2. Maximum card insertion depth in connector is 8,89mm (.350 in.).
3. Minimum width of connector insertion slot is 62,70mm (2.470 in.).
4. Removable plastic safety cover, 71,12mm (2.80 in.) wide. To remove safety cover, spread forward locking feet and lift front end approximately 1/4" inch; then slide cover to rear to disengage from card.  
**CAUTION: DO NOT LIFT FRONT END HIGHER THAN 1/4" OR TABS AT CONTACT END WILL BREAK.**
5. Maximum card edge-guide insertion depth is 2,29mm (.09 in.). Guides must be non-conductive.
6. Card edge-guides cannot extend beyond point indicated.
7. Card extender part No. 350-513-00 is available for testing transmitter while in operating position.
8. Certified: CSA
9. All PC units are dc powered.

**Figure 6-2. PC Installation and Outline Dimensions**

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Sepulveda, California 91343

**DO NOT SCALE DRAWING**

TOLERANCES  
UNLESS NOTED

DRAWN: *[Signature]* 1/6/82

CHECKED: \_\_\_\_\_

DESIGNED: \_\_\_\_\_

SCALE: \_\_\_\_\_

# STANDARD SIT

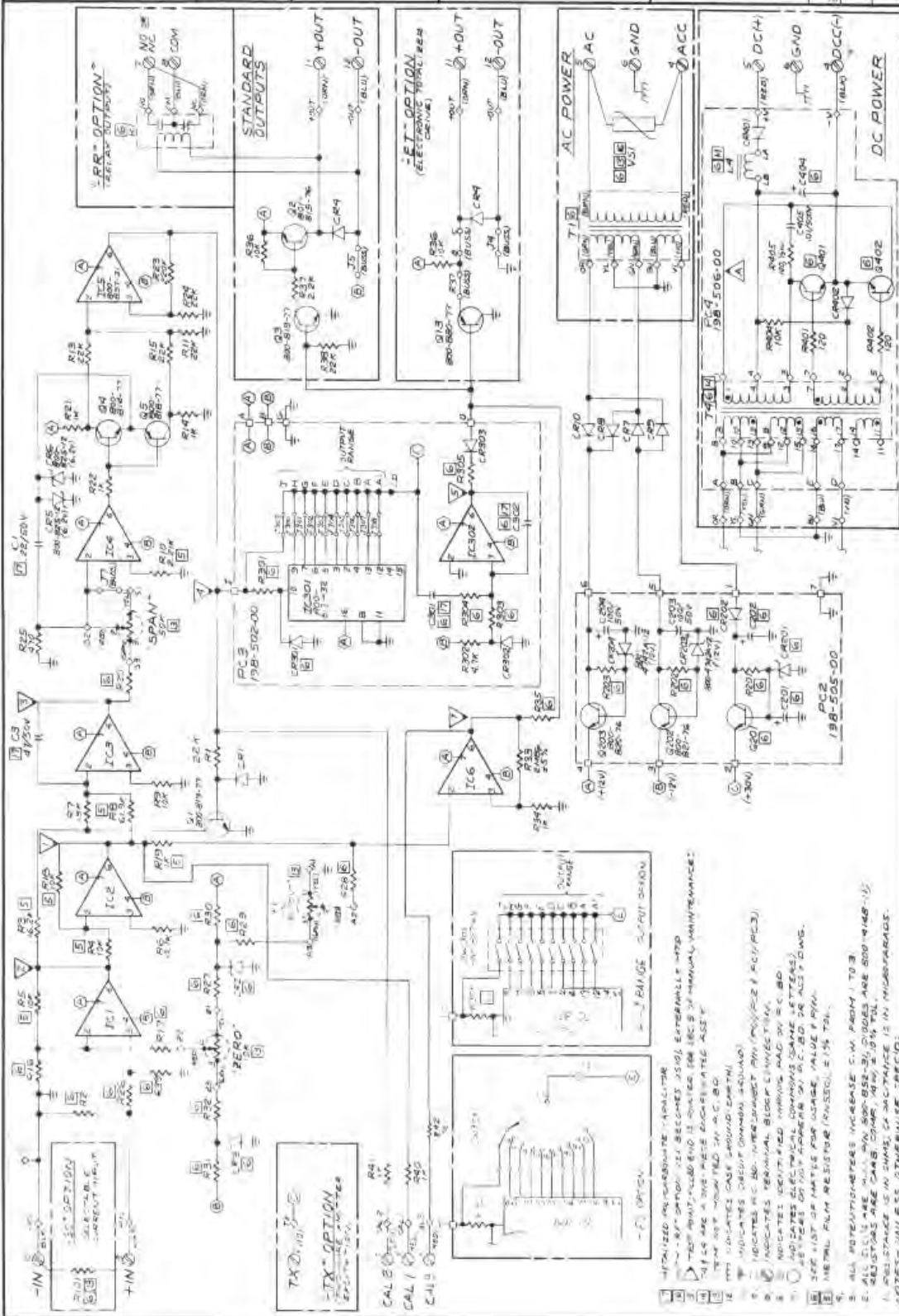
REVISION NUMBER: **198-401-00**

DATE: \_\_\_\_\_ BY: \_\_\_\_\_ APPROVAL: \_\_\_\_\_

REVISION: **W**

DESCRIPTION: **SCHEMATIC**

REVISED BY: **ECO # 5932**





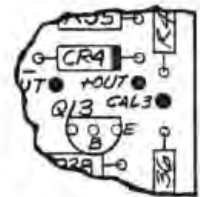
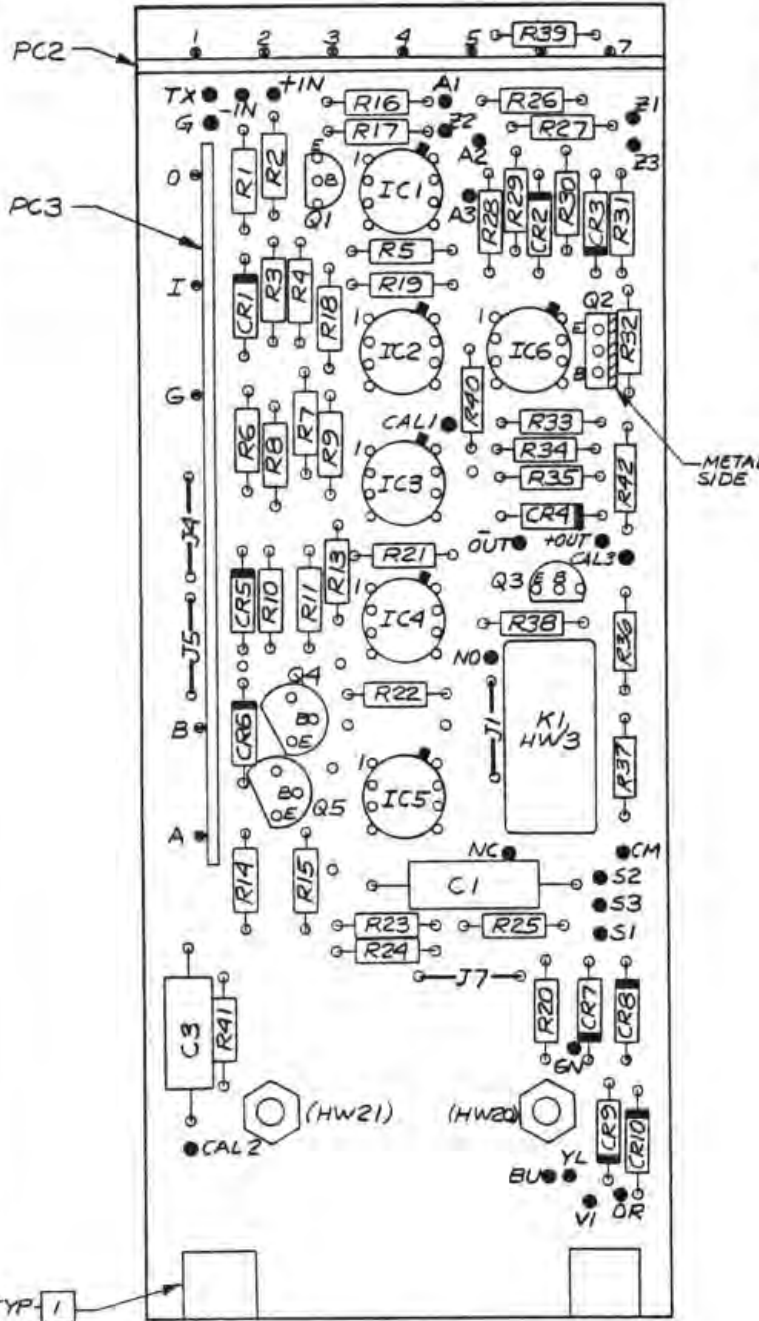
**MOORE INDUSTRIES**  
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Sepulveda, California 91343

DO NOT SCALE DRAWING

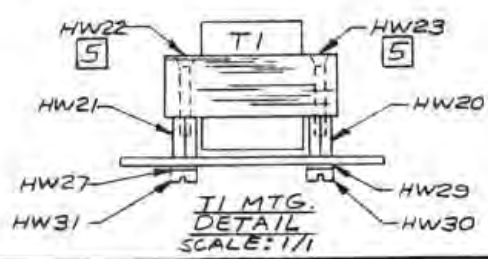
|                         |              |
|-------------------------|--------------|
| TOLERANCES UNLESS NOTED | DATE 12/1/84 |
| X ± .1                  | DESIGNER     |
| XX ± .03                | CHECKER      |
| XXX ± .010              | SCALE 2/1    |
| ANGLES ± 30°            |              |

STANDARD  
**SIT,  
PCI**

|                |            |        |
|----------------|------------|--------|
| DRAWING NUMBER | 198-501-00 | REV. 1 |
| CATEGORY       | ASSEMBLY   |        |
| DESIGNED BY    | ECO 5732   | DATE   |
|                |            | BY JMO |



Q13 LOCATION



- 5 APPLY 'LOCKTITE' TO THREADS OF HW20 & HW21.
- 4. SEE PG. 2 FOR MTG. OF V51, V5101 & R101.
- 3. ALL LEADS & TERMINALS MUST BE SOLDERED TO PADS
- 2. ALL JUMPERS ARE 22AWG BUS9, TEFLON SLEEVED AS REQ'D.
- 1. INSTALL MTG. BLOCKS BEFORE STARTING BD. ASSY; SEE CASE ASSY FOR LOCATION.

NOTES -



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DO NOT SCALE DRAWING

TOLERANCES  
UNLESS NOTED  
X ±.1  
XX ±.03  
.XXX ±.010  
ANGLES ±30'

DATE: 1/9/82  
SCALE: 2/1

P.C. BD. ASSY,  
STANDARD  
SIT  
(PC3)

DRAWING NUMBER  
198-502-00

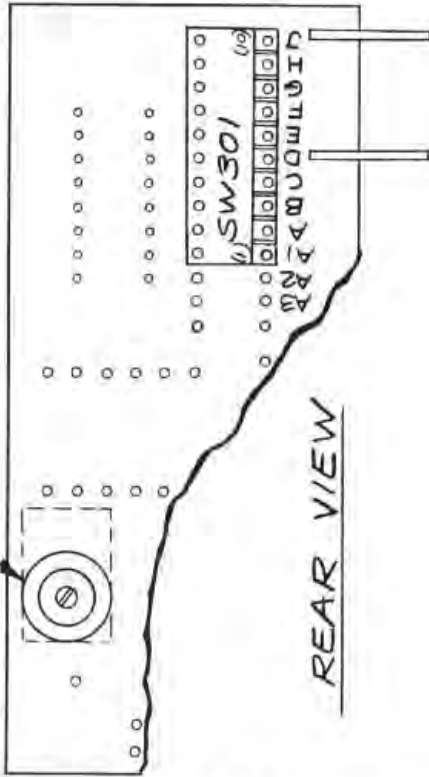
REV. 01  
P

CATEGORY  
ASSEMBLY

DESIGNED BY  
ECO 6671

DATE: 1/9/82  
BY: JWW  
APPROVAL: [Signature]

MOUNT "COUNT DROPOUT"  
POT. HERE

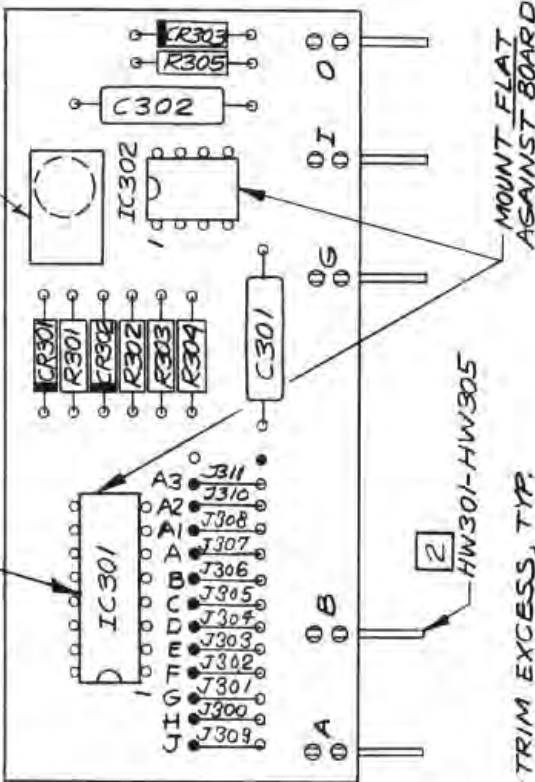


"PPI" CASE ASS'Y

RELOCATE SW301 IF "COUNT DROPOUT"  
POT. AS SHOWN IF UNIT GOES IN A  
"PPI" CASE ASS'Y.

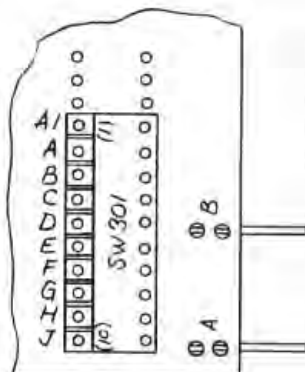
**WARNING**

-SEE NOTE 1  
"COUNT DROPOUT"



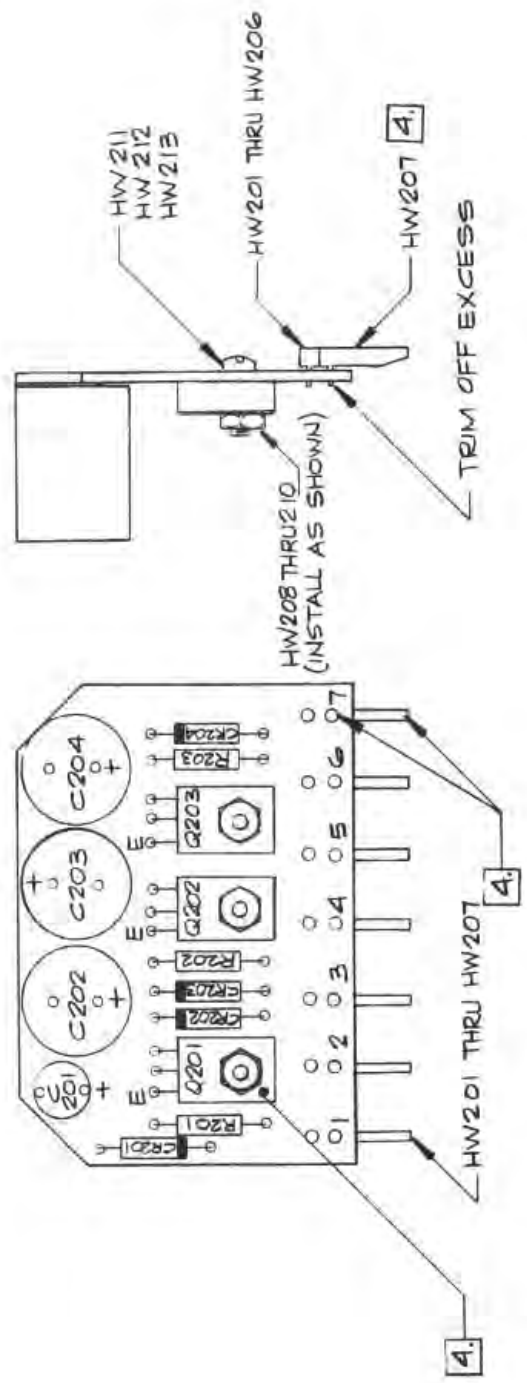
HW301-HW305

TRIM EXCESS, TYP.



- 2 INSTALL HW301-HW305 FLAT ON BOARD.  
1. DO NOT TOUCH LEADS OF IC301 WITH FINGERS UNTIL SOLDERED TO BOARD. USE A LOW-VOLTAGE GROUNDED SOLDERING IRON.

NOTES -



1. CUT HW207 BETWEEN TWO SOLDER PINS & REMOVE UPPER PORTION PRIOR TO INSERTING & SOLDERING IN BOTTOM HOLE. KEEP TOP HOLE FREE OF SOLDER.
  2. FOR SCHEMATIC SEE DRAWING 198-401-00.
  3. METAL SIDE OF Q201, Q202 & Q203 TO FACE UP; (AWAY FROM BOARD).
1. ALL LEADS MUST BE SOLDERED TO PADS.
- NOTES: UNLESS OTHERWISE SPECIFIED



REVISION **E**

DRAWING NUMBER **198-506-00**

CATEGORY **ASSEMBLY**

DATE **9/24/82** BY **C.A.M.** APPROVAL

REVISED BY **ECO 4577**

**DC/AC INVERTER,  
STD. SIT  
(PCA)**

DO NOT SCALE DRAWING

DRAWN **C. FIEDERER** 12/11/81

CHECKED

ENGINEER

SCALE **2/1**

TOLERANCES UNLESS NOTED

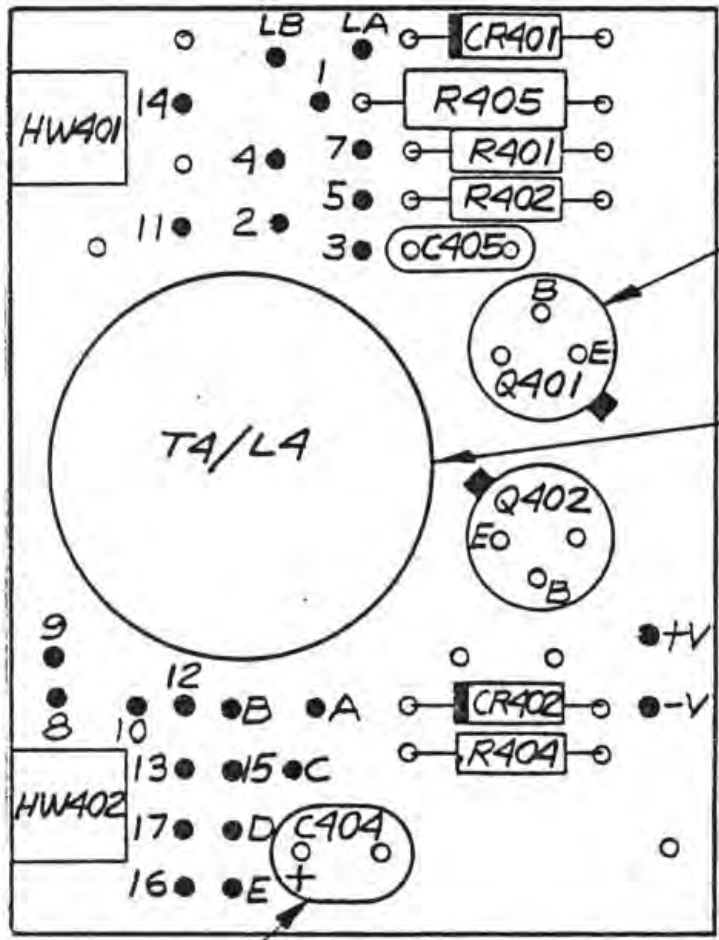
.X ±.1

.XX ±.03

.XXX ±.010

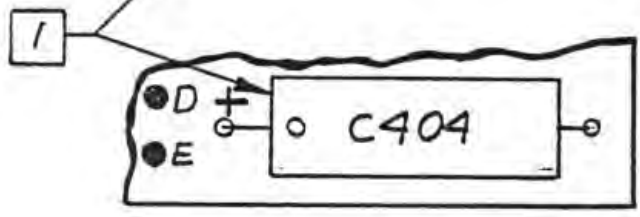
ANGLES ±30'

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Sepulveda, California 91343



SLEEVE WITH CLEAR SHRINK TUBING

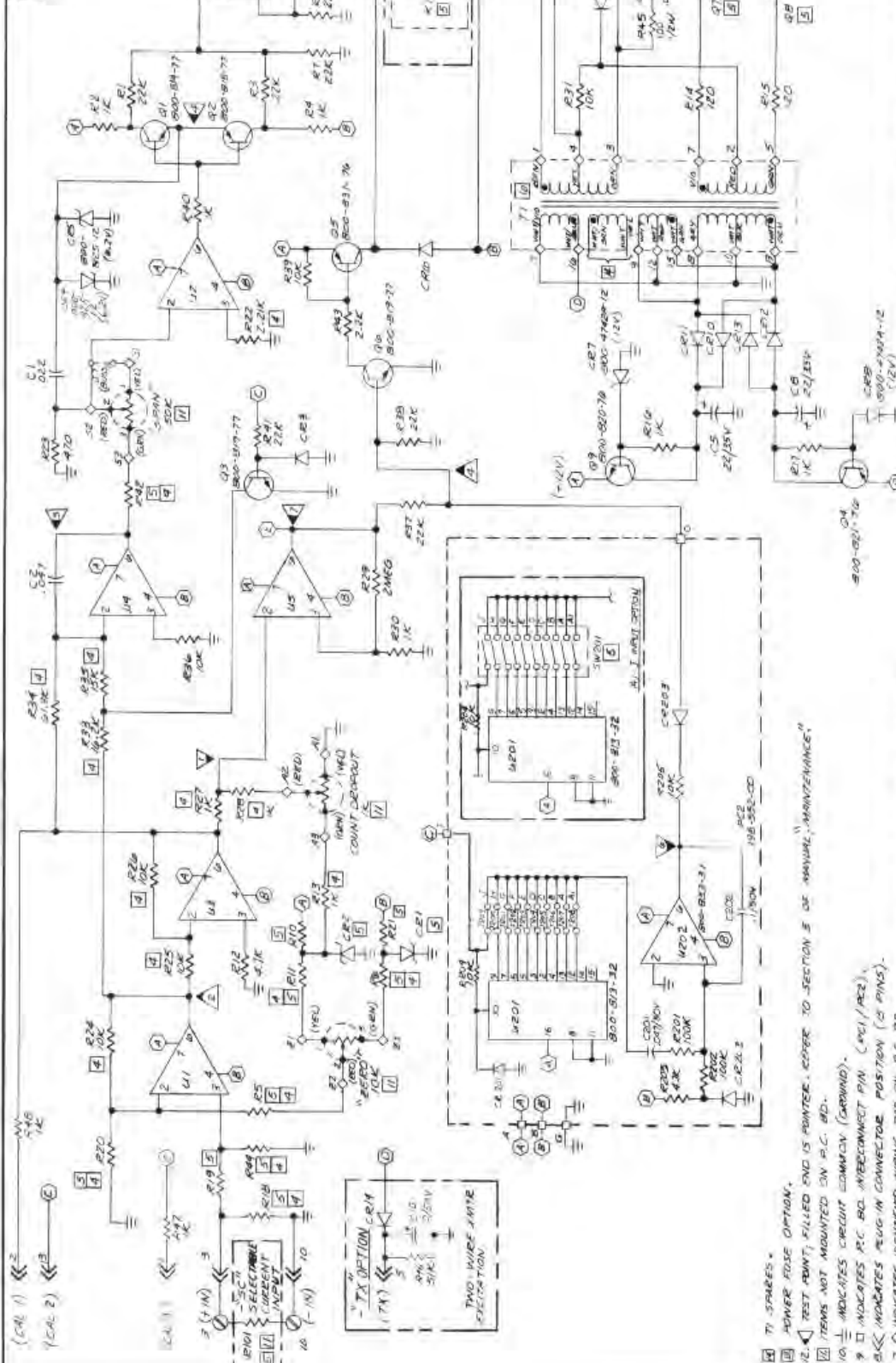
MOUNT WITH HW403 & HW404



1. CHOOSE MTG. POS'N WHICH MATCHES PART.

NOTES -

|     |             |         |    |
|-----|-------------|---------|----|
| REV | DESCRIPTION | DATE    | BY |
| 1   | A           | 5-20-67 |    |



|     |             |         |    |
|-----|-------------|---------|----|
| REV | DESCRIPTION | DATE    | BY |
| 1   | A           | 5-20-67 |    |

|     |             |         |    |
|-----|-------------|---------|----|
| REV | DESCRIPTION | DATE    | BY |
| 1   | A           | 5-20-67 |    |

|     |             |         |    |
|-----|-------------|---------|----|
| REV | DESCRIPTION | DATE    | BY |
| 1   | A           | 5-20-67 |    |

SCHEMATIC  
PLUG-IN  
LDC POWERED  
51 T  
50 BIT SCALE DRAWING  
198-455-00 AL

- 7) SPARES
- 8) POWER FUSE OPTION.
- 12) REST POINT, FILLED END IS POINTER. REFER TO SECTION 3 OF MANUAL, "MAINTENANCE."
- 13) TERMS NOT MOUNTED ON P.C. BD.
- 14) INDICATES CIRCUIT COMMON (GROUND).
- 9) □ INDICATES P.C. BD. INTERCONNECT PIN (PC1/PC2).
- 10) □ INDICATES PLUG-IN CONNECTOR POSITION (S PINS).
- 11) ○ INDICATES IDENTIFIED WIRING AND ON P.C. BD.
- 12) ○ INDICATES ELEC. COMMONS (SAME LETTERS). LETTERS DO NOT APPEAR ON P.C. BD. OR ASSY DWG.
- 13) □ FOR USAGE, VALUE AND PIN SEE 2/AM.
- 14) ○ METAL FILM RESISTOR (INVERSE) ± 1%.
- 15) ○ ALL POTENTIOMETERS INCREASE CLOCKWISE FROM 1 TO 3.
- 16) ○ ALL INTG. CAPS ARE M.I.H. PIN 800-852-31, DIODES ARE 800-4148-11 RESISTORS ARE MICRO-HEADS.
- 17) ○ RESISTOR VALUES ARE IN OHMS, CAPACITANCE IN MICROHEADS.

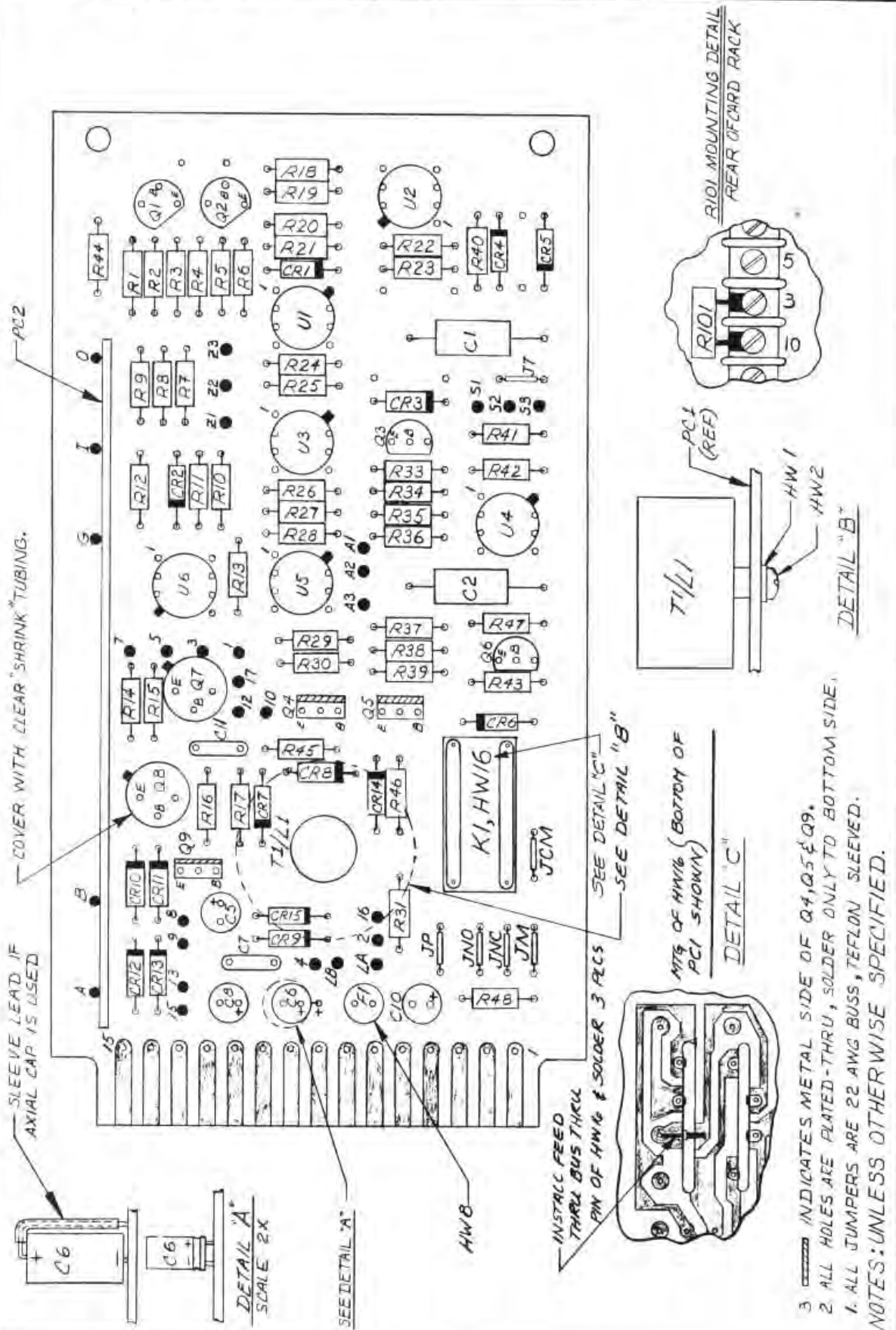
NOTE: UNLESS OTHERWISE SPECIFIED

**DO NOT SCALE DRAWING**

|                         |                               |                    |
|-------------------------|-------------------------------|--------------------|
| TOLERANCES UNLESS NOTED | DRAWN <i>George A. Nathan</i> | DATE <i>4/2/76</i> |
| A = ±.1                 | CHECKED                       |                    |
| XX = ±.05               | ENGINEER                      |                    |
| XX = ±.010              |                               |                    |
| ANGLES ±.30°            |                               |                    |
| HOLE PER SAE STANDARD   |                               |                    |
| DIMENSIONS IN INCHES    | SCALE <b>2X</b>               |                    |

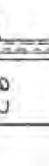
CATEGORY **P.C.1 ASSEMBLY**  
 TITLE **P.C.1 BOARD ASSEMBLY**  
**SIT PLUG-IN**

|  |                    |
|--|--------------------|
| DRAWING NUMBER <b>198-555-00</b>   | REVISION <b>A</b>  |
| REVISED BY <b>REVISED &amp; REDRAWN</b>  | DATE <i>6/1/76</i> |
| ENGINEER <b>ECO 5627</b>   | BY <i>ECO</i>      |
| NOTICE RE PROPRIETARY INFORMATION: This drawing and the information contained herein are the proprietary property of Moore Industries, Incorporated, Inc. 1981 and should not be reproduced or disclosed to any third party without the written consent of an authorized officer of MOI. |                    |



COVER WITH CLEAR SHRINK TUBING.

SLEEVE LEAD, IF AXIAL CAP IS USED

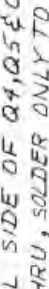
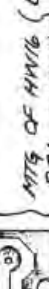
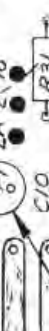


INSTALL FEED THRU BUS THRU PIN OF HW16 & SOLDER 3 PLS

SEE DETAIL "C"  
SEE DETAIL "B"

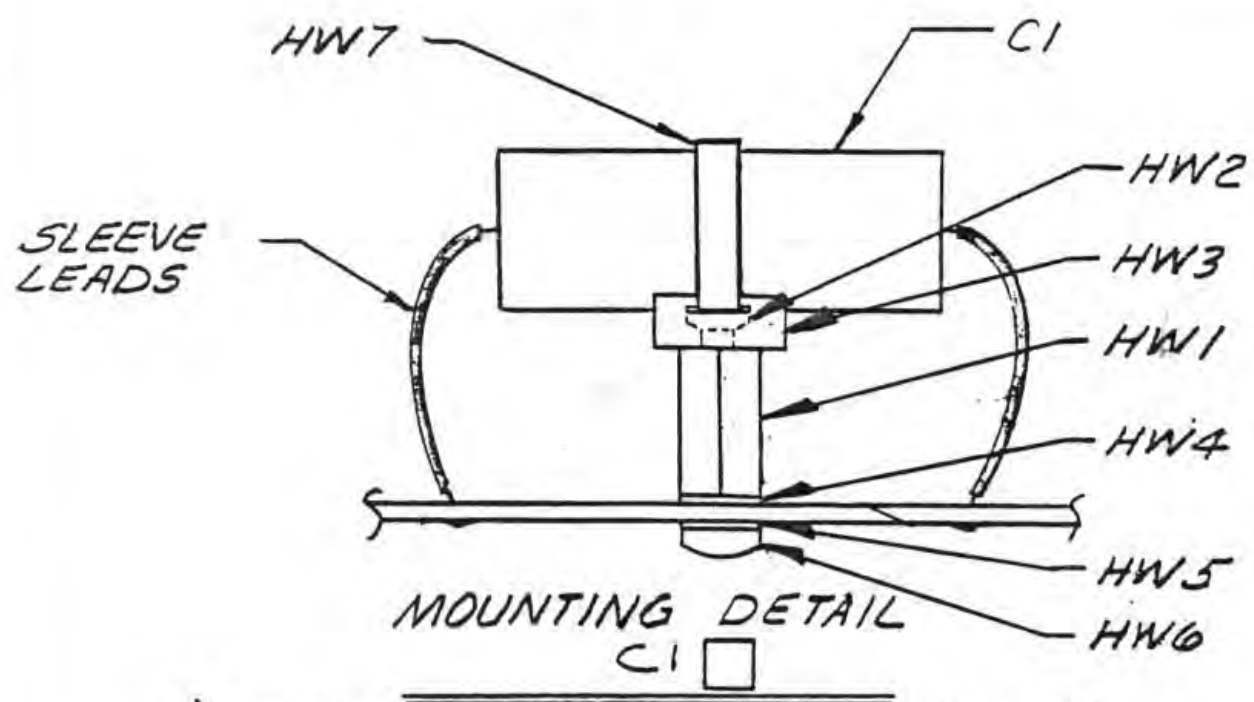
MFG OF HW16 (BOTTOM OF PCI SHOWN)  
DETAIL "C"

MOI MOUNTING DETAIL REAR OF CARD RACK

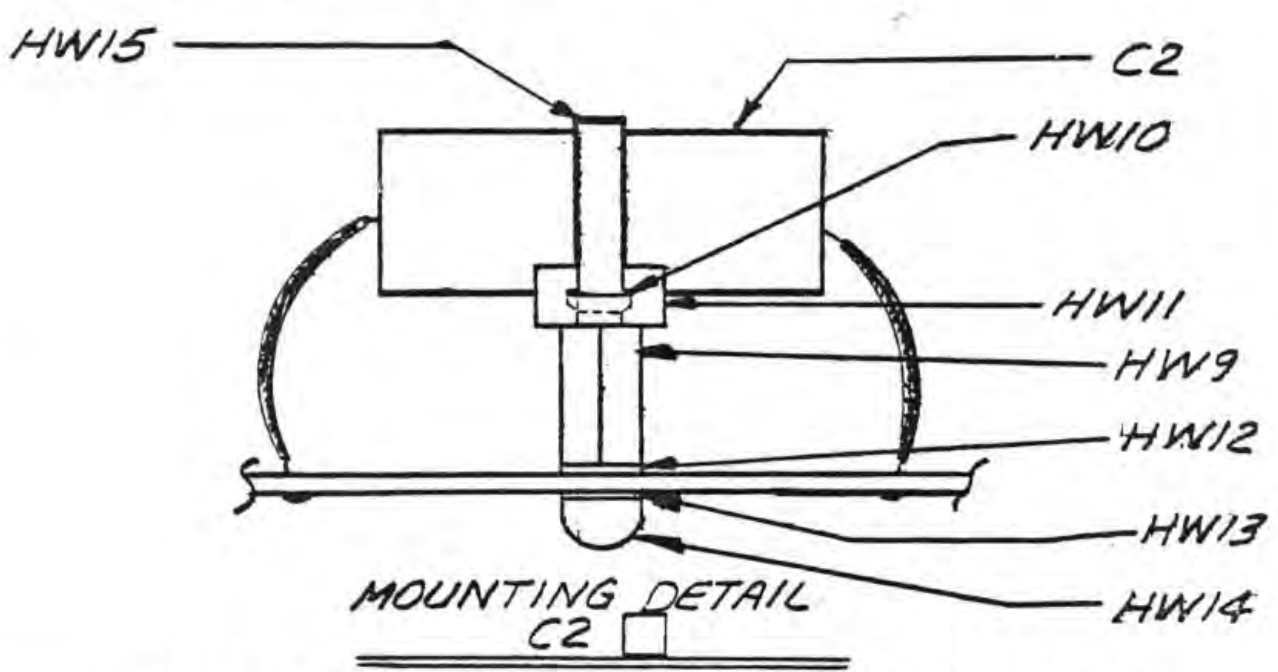


- INDICATES METAL SIDE OF Q1, Q5 & Q9.
- ALL HOLES ARE PLATED-THRU, SOLDER ONLY TO BOTTOM SIDE.
- ALL JUMPERS ARE 22 AWG BUSS, TEFLON SLEEVED.

NOTES: UNLESS OTHERWISE SPECIFIED.



LEADS FROM C1 GO TO PCI-CA & CB



LEADS FROM C2 GO TO PCI-CC & CD

5 DO NOT USE TY-RAP GUN WHEN ADDING TY-RAP TO C1 & C2

|  |             |                    |         |   |
|--|-------------|--------------------|---------|---|
| DIMENSIONS ARE IN INCHES UNLESS NOTED OTHERWISE<br>TOLS. UNLESS NOTED:<br>.X = ±.10<br>.XX = ±.050<br>.XXX = ±.010<br>ANGLES = ± 30° | DRAWN       | <i>[Signature]</i> | 3-19-74 | MOORE INDUSTRIES INC.<br>VAN NUYS ■ CA. |
|  | CHECKED     | <i>[Signature]</i> |         |   |
| DO NOT SCALE DRAWING   | PROJ. ENGR. | <i>[Signature]</i> | 4/1/74  | P.C. BOARD ASS'Y<br>PLUG-IN SIT         |
| SCALE: 2/1   | CUSTOMR.    |                    |         |   |



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DO NOT SCALE DRAWING

TOLERANCES  
UNLESS NOTED  
X ± 1  
XX ± 03  
XXX ± 010  
ANGLES ± 30°

DESIGNED BY De Santis  
CHECKED BY J. C. 10/82  
DRAWN BY  
SCALE 2/1

SIT  
PLUG-IN  
PC2

DRAWING NUMBER

198-552-00

REVISED

CATEGORY

ASSEMBLY

REVISED BY

ECC 5627

DATE

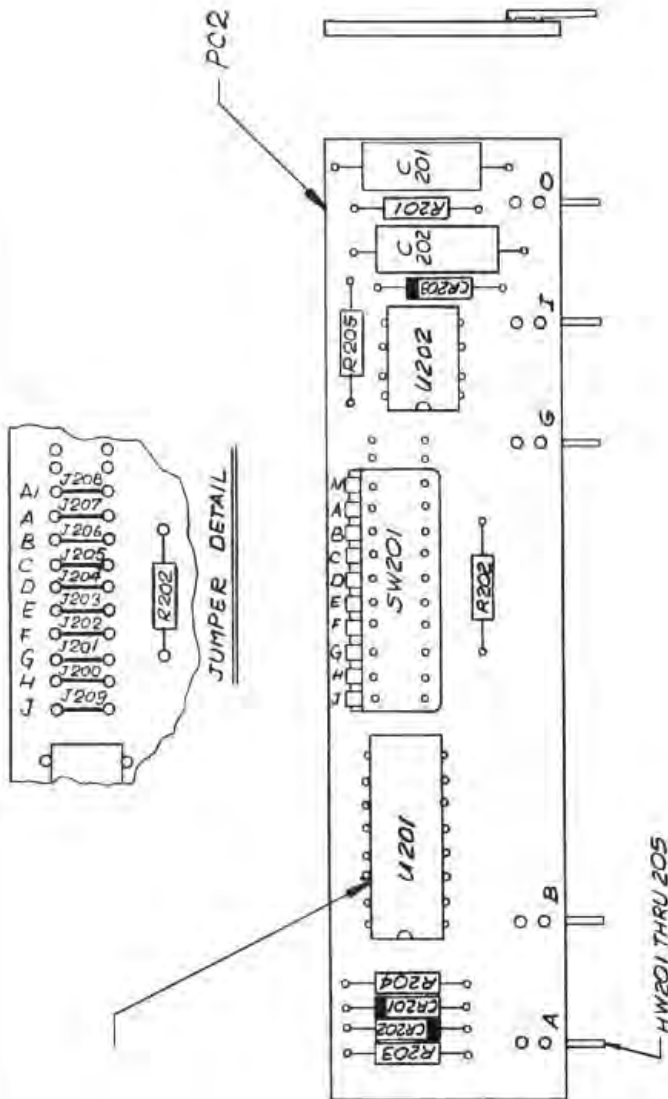
OCT 82

BY

D

APPROVAL

[Signature]



3. MOUNT HW201 THRU 205 FLAT ON PC BOARD.  
2 DO NOT TOUCH LEADS OF U201 WITH FINGERS UNTIL SOLDERED TO BOARD. USE LOW VOLTAGE GROUNDED SOLDERING IRON.

1. SOLDER ALL LEADS TO PADS ON FAR SIDE ONLY.  
NOTES:



# RETURN PROCEDURES

## To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

### Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

### Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
  - a) A note listing the symptoms that indicate the unit needs repair
  - b) Complete shipping information for return of the equipment after repair
  - c) The name and phone number of the person to contact if questions arise at the factory
3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

### WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES, BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

### RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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