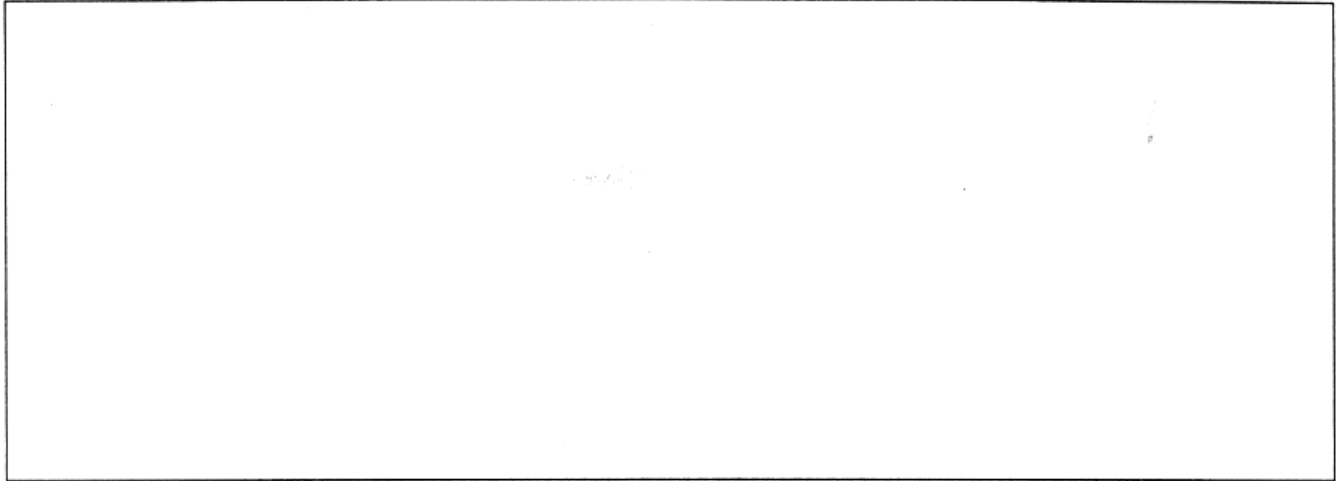




INSTRUCTION MANUAL
PSM
Pulse Summing Module

Form 144-701-00B

January 1982



1.1 SCOPE OF MANUAL

This manual contains operating and maintenance information on the Pulse Summing Module (PSM) manufactured by MOORE INDUSTRIES INC., Sepulveda, California. The manual consists of six sections as follows:

Section 1, General Information, introduces the equipment function and describes the equipment physical appearance, the equipment specifications, and options available for the unit. The introduction also provides information on the use and description of the MOORE IND. model numbering system.

Section 2, Calibration, provides all the information necessary to calibrate the unit before installation. This section contains a list of the tools necessary for calibrating the equipment; and illustrates the test setups essential to perform that task. The section also lists the various procedures required for calibration of the units in any configuration.

Section 3, Installation and Operation, supplies all the information needed to install and operate the equipment. The section contains figures that specify the installation requirements for the units, and text that informs the user on recommended wiring practices for equipment as well as defines the electrical connections for each unit regardless of physical modifications. A brief outline of periodic observations required during the equipment operation is also included here.

Section 4, Theory of Operation, gives the maintenance personnel a detailed explanation of the internal function of the unit. The circuit theory is based on a block diagram that shows the functional elements of the unit. Each element operation is then described, first in relation to the other element, then independently where its major components' use and purpose are described.

Section 5, Maintenance, offers complete disassembly procedures for all unit configurations available. Troubleshooting information is also provided in this section as well as component replacement techniques to aid the technician in the repair of the equipment.

Section 6, Unit Documentation, acquaints the user with the MOORE IND. computerized

parts listing and identification system. The section also provides a recommended spare parts list. All schematics and parts assembly drawings referred to by the text are located in the back of Section 6.

1.2 EQUIPMENT DESCRIPTION

The Pulse Summing Module (PSM) accepts pulse inputs or contact closures having a peak amplitude within the range of 5 to 25 volts. The unit adds these signals and produces output pulses that are proportional to the sum of the inputs.

The processing circuits consist of input wave shaping components, control logic, binary counters and a comparator as well as the output stage to produce output pulse information capable of driving electromechanical totalizing counters.

1.3 PHYSICAL DESCRIPTION

The unit is available in several physical configurations. In general, the standard unit consists of a main circuit board which contains the input circuits, signal processing components, and the output driver. When the DC option is selected, a second board is used to provide the power inverter circuit.



Standard (STD) Unit

PSM PULSE SUMMING MODULE
144-701-00B

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 is 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.

1.3.1 CONDUIT PLATE OPTION (CP) DESCRIPTION

This option consists of an extension of the standard bracket lower mounting flange. The additional surface is cut with two mounting holes to accommodate ½-inch electrical conduit. This option is illustrated in the next section outline and dimension drawings.



Unit with Angle Bracket (AB) Option

1.3.2 ANGLE BRACKET (AB) OPTION DESCRIPTION

This option consists of two angle brackets, one on the top and the other on the bottom of the unit. These brackets are used to mount the unit in applications where the standard U-bracket will not apply. The brackets are provided with two #10 screw clearance holes for ease of mounting.

1.3.3 NEMA BOXES OPTIONS DESCRIPTION

Units equipped with angle brackets (AB) option may be enclosed in NEMA boxes to ensure protection against harsh environments that may be damaging to the unit. Four configurations are available for this purpose.

Oil Tight (OT) NEMA Box Option. This enclosure consists of a NEMA 12 box construction, with two cover-holding screw clamps, mounted opposite to the hinged side of the cover (right side). These enclosures are oil and dust tight only. Conduit holes, fittings, or knockouts are not provided on these boxes. Suggested fittings are "Myer's Scrutite." The units are mounted on a drilled and tapped mounting plate at the back of the box.

Water Tight (WT) NEMA Box Option. This enclosure consists of a NEMA4 box construction equipped with three cover-holding screw clamps, one on each of the three non-hinged sides of the box. These enclosures are watertight, in addition to oil and dust tight. Unit mounting and electrical connections are made in the same manner as the OT option enclosures.

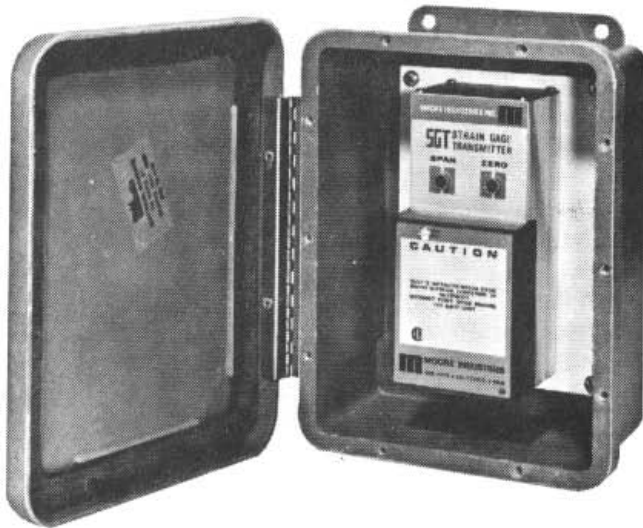


Unit in Water Tight (WT) Enclosure

Fiber Glass (FG) Option Enclosures. This enclosure is molded from pigmented polyester resins, using 302 stainless steel for all exposed hardware. A one-piece neoprene jacket provides additional sealing protection against corrosive environments. Boxes are normally hinged on the long side. The cover is secured by four slot-head screws accessible at the top of the cover and located on each side of the top and bottom cover corners opposite the hinge side. Conduit holes may be cut with a hole punch, and special precautions must be taken with ground connections, since the box material is non-conductive. Refer to Section 3 for wiring information. Units are mounted into the enclosure in the same way as in the OT enclosures.

SECTION 1

GENERAL INFORMATION



Corrosion Resistant Fiber Glass (FG) Enclosure

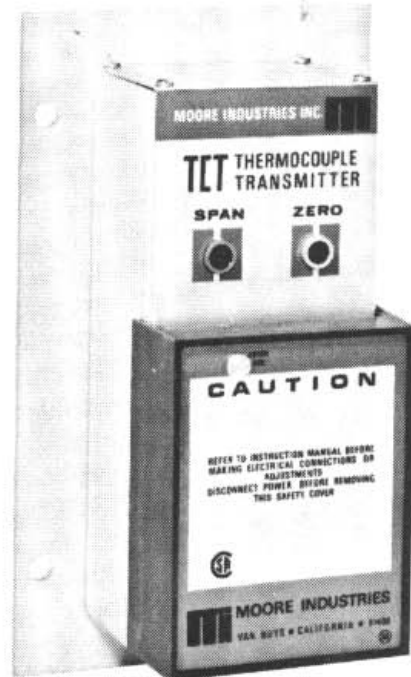
General Purpose (GP) Options Enclosures. This enclosure consists of a general purpose steel construction box with knock-outs for various size electrical conduits ($\frac{1}{2}$, $\frac{3}{4}$, or 1 inch). The cover is hinged and spring locked. Units are secured into the enclosure on four studs and four 10-32 nuts. The complete enclosure can be secured through four mounting holes provided on the box back cover.



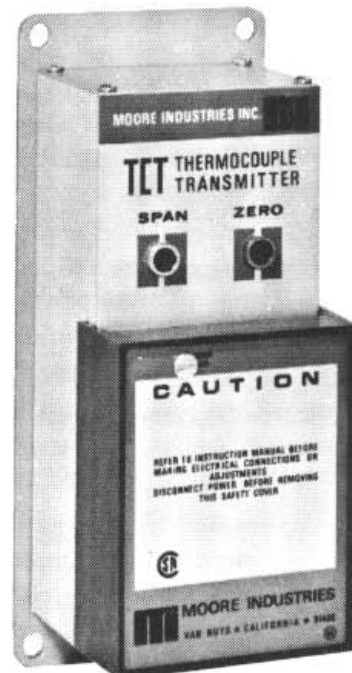
General Purpose (GP) Enclosure

1.3.4 RAA AND RAT OPTIONS DESCRIPTION

These options consist of special mounting hardware attached to MOORE units to replace obsolete instrumentation of other manufacture.



Replacement Mounting (RAA) Option



Replacement Mounting (RAT) Option

1.3.5 PLUG-IN (PC) UNITS DESCRIPTION

The plug-in unit is electrically similar to the standard unit and consists of one main board (PC1) on which the power supply and the signal processing components are mounted.

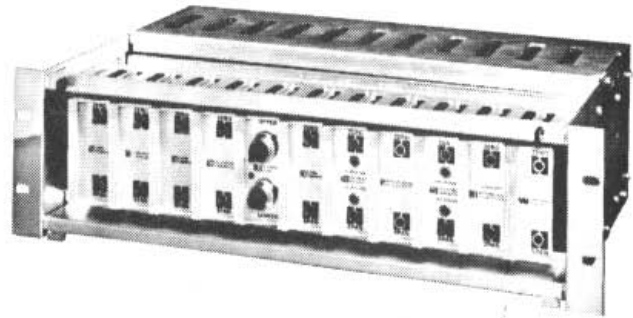
The printed circuit board is keyed to identify the unit and ensure proper connection mating. A removable plastic safety cover protects the printed circuit board and components from normal environmental hazards. When the PC unit is purchased alone, the user must provide a 15 pin connector, such as Viking part No. ZVK155/1-2 or equivalent. Several mounting options are available for the plug-in unit.



Plug-In (PC) Unit

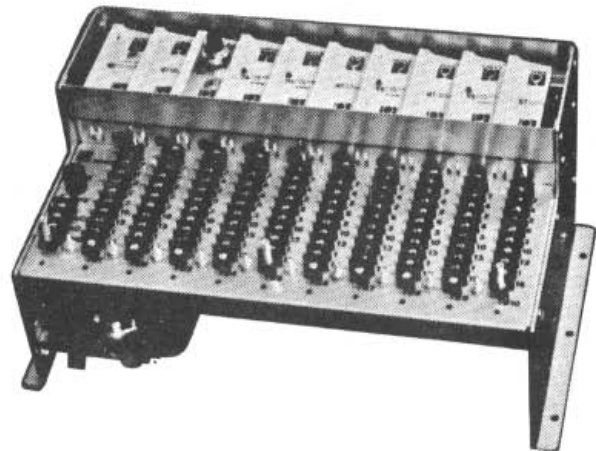
Rack Mounted (RMR) Card Racks. These enclosures are designed to flush-mount in standard 19 and 24-inch relay racks, respectively. The enclosures are provided with standard EIA hole patterns. Eleven and fifteen position RMR racks are available. These are pre-wired from the module PC connector to the screw-type barrier strip, which are rear-accessed for rack-wiring convenience. All power connections from the PC connectors are bussed together to a separate 3 terminal barrier-strip for external power input. Electrical connections to the card rack are detailed in Section 3, Installation and Operation. Modules are front loaded and a dust cover is provided to minimize the effects of environmental hazards. Module connectors are keyed to assure that units are plugged into their proper position; keying, however, may be altered in the field if the system configuration changes. Filler cards are available for positions not used by a module.

Surface Mounted (SMR) Card Rack. These rack enclosures are designed to accommodate as few as five and up to 15 modules. Mounting flanges



Card Rack Enclosure for Relay Racks (RMR)

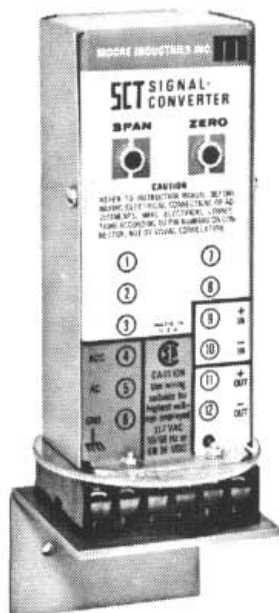
are located in the rear of the side panel which allows for surface mounting or for NEMA box mounting. These enclosures are electrically identical in construction to the RMR racks. Terminal strips for external connections, however, are front-accessed for wiring convenience whenever the rack is mounted into a NEMA box or against a wall.



Surface Mounted Card Racks (SMR)

1.3.6 STANDARD PLUG-IN OPTION

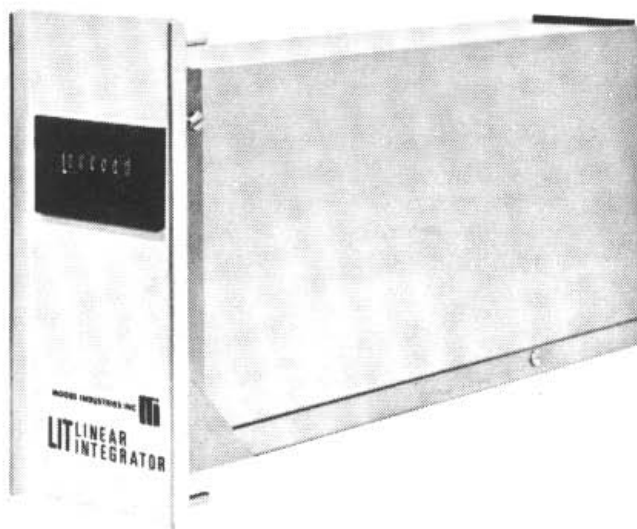
The standard plug-in module consists of a standard enclosure as described in paragraph 1.3 except that connections are not provided on the face of the unit. Instead, the unit is attached physically and electrically to a circular interconnect card with plug-in pins, keyed to eliminate errors in connections. The mating connector consists of a bracket-mounted square terminal block. External electrical connections are made to screw terminals located on the periphery of the connector block. A plug-in receptacle arrangement is located in the center of the block to accommodate the keyed interconnect card plug-in pins. The mounting bracket secured to the terminal block is pre-drilled with clearance holes for 10-32 screws. When the assembly is removed, the terminal block screw connections are easily accessible.



Plug-In Standard Unit (PST)

1.3.7 PANEL MOUNTED (PM) OPTION

This option is electrically similar to the standard unit of paragraph 1.3, except that the enclosure and terminals locations are different. Instead of the standard enclosure, the printed circuit boards are enclosed in a metal frame equipped with a blank panel. Electrical connections are accessible to the rear of the enclosure by removing a cover. The bottom of the frame is provided with two holes to accommodate 1/2-inch electrical conduit.



Panel Mounted Unit (PM)

1.3.8 EXPLOSION PROOF OPTION (EXT, EX & EXX)

The explosion-proof enclosure option consists of a PST option unit described in paragraph 1.3.6 enclosed into a two-piece cast aluminum alloy enclosure. The two pieces consist of a screw-type cover and a connector housing. When the cover is removed, the PT type unit is easily accessible. With the PT unit unplugged, the terminal block is clearly visible and connections are made with ease. No mounting bracket is used on the terminal block as with the PT option. Instead, the terminal block is secured flush with the bottom of the housing. Electrical conduit hubs are provided for external electrical wiring through electrical conduits. Several configurations of conduit inputs are available. Refer to Section 3 for detailed description of conduit configurations.



Explosion Proof Housing (EX Shown Only)

1.4 SPECIFICATIONS

The specifications for the unit are listed in Table 1-1.

1.5 MODEL NUMBER EXPLANATION AND USE

MOORE INDUSTRIES' model numbers describe an instrument's type, functional characteristics, operating parameter, and include option identification. If all accompanying documentation of a unit is missing, the model number may be used to obtain technical information on the unit by following the example of Table 1-2. The model number for standard units, and units with CP and AB options, is located at the upper end of

1.6 SERIAL NUMBER USE AND LOCATION

the terminal block stamped on a stainless steel tag. Plug-in units have their model number labeled on the inside of the grip extension to the front panel. PT units have the model number on top of the case. For explosion-proof units, the model number is stamped on a stainless steel tag on top of the enclosure and on the identification label on the unit within the enclosure. PM units model numbers are stamped on a stainless steel tag, visible when the rear safety cover is removed. To expose the model number on all NEMA box enclosures, open the box and remove the safety cover of the unit.

A complete history is kept on every MOORE INDUSTRIES unit. This information is keyed to the serial number. Whenever service data is required on a unit, it is necessary to provide the factory with a serial number as well as a model number. This identification is usually located with the model number (see paragraph 1.5 for location and on equipment) except for plug-in units and explosion proof where the serial number is engraved into the PC board or stamped on a stainless steel tag respectively, and is usually preceded by the letter E.

**TABLE 1-1
UNIT SPECIFICATIONS**

INPUT: 5-25 volt peak or Dry circuit contact closure. CC option
Input Number: 2, 3 or 4

FRONT PANEL ADJUSTMENT:
Calibration: None

OUTPUT: 24 volt 30 ms pulse compatible with external standard electromechanical totalizers. 15 pulses per second maximum

Function:
 Output 2X=W=A+B
 3X=X=A+B+C
 4X=Y=A+B+C+D

PERFORMANCE:
Calibration Capability: ±1 input count (linearity and repeatability)

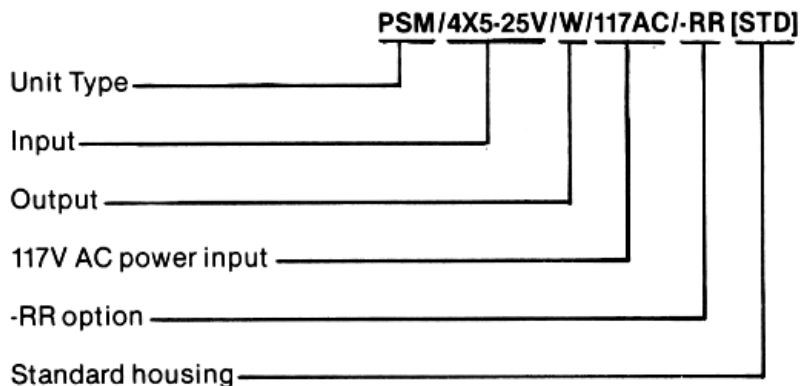
Ambient Temperature:
 Range: -18°C to +74°C (0°F to +165°F)
 Effect: No change in output over above temperature range
 Isolation: Power input isolation is maintained on both ac and dc powered models. Input to output isolation may be achieved by using the relay output option

POWER INPUT:
 24 Vdc, ±10% standard
 117 Vac, 240 Vac, 50/60 Hz, ±10% Optional
 5 watts nominal

Line Voltage Effect: No change in output over above voltage range

CERTIFICATION: Canadian Standards Association
WEIGHT: Approximately 2 lbs. (908 grams)

**TABLE 1-2
MODEL NUMBER EXAMPLE**



**TABLE 1-3
ELECTRICAL OPTIONS**

OPTION DESCRIPTION	CODE
Input attenuation for signal voltage exceeding specification—specify voltage (200V max)	AT
Contact closure input—provides capability to process relay contact closure signals	CC
High speed 15 Vdc pulse rated at 500 μ sec. 1000 Hz max. Required when output is connected to pulse input circuit of PAM or another PSM	ET
Modified pulse width time (1.0 msec to 1.0 sec fixed)	PDX
SPST relay output 1A @ 28Vdc non-inductive	RR
RF filter assembly—prevents radio frequency energy from entering	RF

2.1 GENERAL INFORMATION

This section provides information about unit calibration. Units with standard input and output levels are normally calibrated at the factory. After the unit is unpacked, general operating level checks of units is recommended. Usually these checks, specified in this section under calibration procedures, require little or no adjustments. If units are ordered with factory calibration option (FC), an exact calibration is performed at the factory, and red caps are placed on the controls. Adjustments should not be made in the field on these units unless a new range of input or output signal level is desired. Red caps should not be removed as a precaution against accidental adjustments.

2.2 CONTROLS DESCRIPTION AND LOCATION

The PSM uses digital circuits that do not require calibration or adjustment. Incorporation of options by the using facility, requires component changes which should be followed by the general operating level test as outlined in paragraph 2.5.

2.3 TEST EQUIPMENT AND TOOLS REQUIRED

Test equipment and tools required for calibration of the unit are described in Table 2-1; they are not supplied and must be provided by the customer at the installation or test site.

2.4 TEST EQUIPMENT SETUPS

Off-line testing for all units require the same test equipment setups regardless of option or physical configuration. The hookup requirements and physical preparations may vary on some units. The following paragraphs define the general test setup and identify the units that require special attention for test preparation and connections.

2.4.1 GENERAL TEST EQUIPMENT SETUPS

The test equipment setup required for calibration of all units is identical except for connection identification. Figure 2-1 show the general test setup configuration. Connection nomenclature refer to terminal markings on the standard units with CP, AB, RAA, RAT, PM, and NEMA boxes mechanical options.

2.4.2 PLUG-IN UNITS TEST EQUIPMENT SETUP

Plug-in units equipment test setup is the same as the one shown in Figures 2-1, except that printed circuit board connections are identified in that figure by numbers in parentheses. Connection identification numbers are etched in the component side of the PC board. Plug-in units inserted in a rack also use the test setup shown in Figure 2-1 with card terminal connections identified by numbers in parentheses. These include either the rack mount (RMR) or the surface mounted (SMR).

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

Equipment or Tool	Characteristic	Purpose
Pulse or Contact Closure Input Device	Must be capable of producing signal ranges defined by INPUT level requirements of purchased unit (see Table 1-1)	Simulate input signal levels
DC Voltmeter	Must be accurate to within $\pm 0.05\%$ or better	Signal monitoring
Oscilloscope	Tektronix model T935 or equivalent	Pulse monitoring
Count Totalizer	Moore Ind. model MFS043 or equivalent	Output signal monitoring

2.4.3 Explosion-Proof (EX) and PB Option Test Setup

Note that in the explosion proof configuration the protective housing must be opened and the unit removed to expose the connection block. Similarly, units with the PB configuration must be unplugged from the connection block in order to access the connections more effectively.

2.5 CALIBRATION

Units are checked for proper performance at the factory before they are shipped. However, the unit performance should be checked by the user before the unit is placed in service. Calibration consists of simulating the operative signal input to obtain the specified output.

A pulse signal source, with an appropriate pulse repetition rate and with a pulse duration that can be varied, is required to calibrate the unit. A PSM driven by an analog signal that can be varied in the required manner, may be used to supply the pulse signal. Or, the signal may be supplied by a pulse generator with the required range and with an adjustable pulse width. The accuracy of the pulse duration of the input signal (in terms of percent of pulse repetition period) must be $\pm 0.01\%$ or better. If the PSM has the CC (contact closure) option, the external contacts are used instead of the signal generator. Appropriate adjustable drive must be supplied to the contact closure device (e.g., relay). An output monitoring device with an accuracy within $\pm 0.05\%$ or better is also required.

To test a unit, proceed as follows:

- Connect unit and test equipment as shown in Figure 2-1.
- Apply power input to the unit.
- Adjust the pulse signal source (or drive to the contact closure device) to produce a pulse period (i.e., frame time) the same as that to be applied to the unit when it is installed. For conciseness, the pulse signal source or the contact closure device, whichever is used, will be referred to hereafter as the input signal source.
- Reset the totalizer, or note the initial count before performing step e.
- Apply one or more input pulses to the +S1 terminal, and verify that the output count equals the number of inputs applied.
- Apply one or more pulses to the remaining inputs, and verify that the proper number of output counts are produced.
- After step f has been completed, remove the input signal source and disconnect the power.

2.6 OSCILLATOR OUTPUT CHANGE

The output of the oscillator may be changed to obtain a pulse period of 500 microseconds. Table 2-2 shows the components and the values required to change the output.

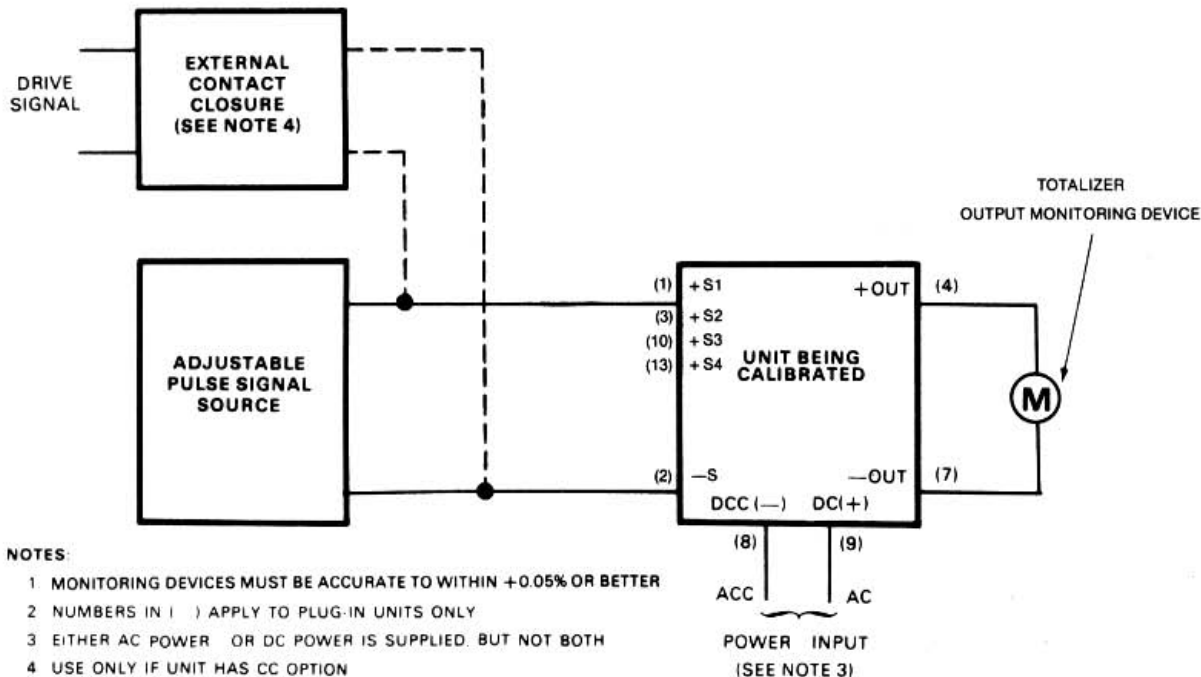


Figure 2-1.
Test Equipment Setup

SECTION 2

CALIBRATION PROCEDURES

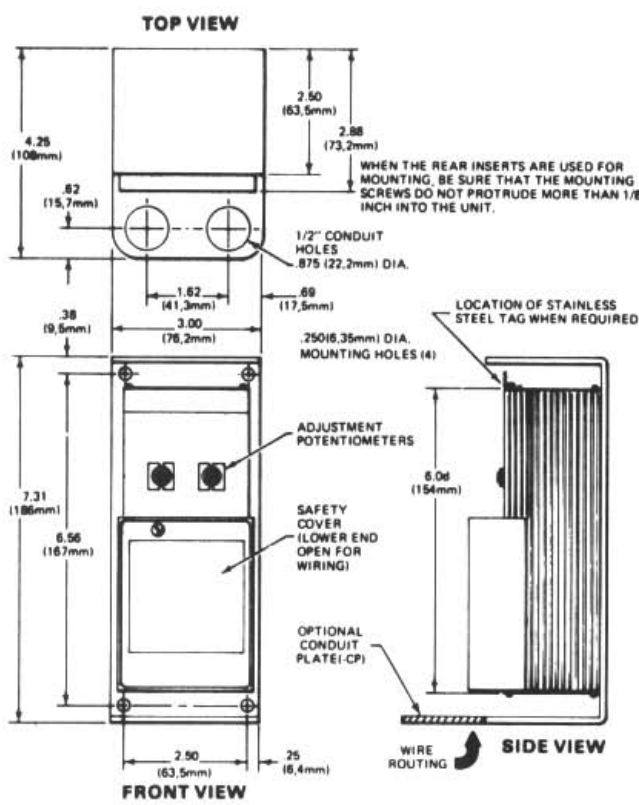
TABLE 2-2
OSCILLATOR OUTPUT

	R18 (R19)	R19 (R20)	C10 (C13)
STD	14.3K	14.3K	1 uf @ 35 Vdc
ETOPTION	34.8K	14.3K	.01 uf @ 35 Vdc

Note: Resistors should be metal film, $\pm 1\%$

3.1 MECHANICAL INSTALLATION

Units may be obtained in various physical configurations. Figures 3-1 through 3-11 show the outline dimensions and other installation requirements for the available configurations. Select the proper outline and dimension figure applicable to the unit purchased. Be sure to observe the applicable special procedures and precautions given with the illustration. Although the units are designed to operate in free air at quite a high ambient temperature, it is advisable, if possible, to mount the unit on a surface made of material that can serve as a heat sink. For a plug-in unit mounted in a rack, be sure that the rack has adequate ventilation.



- NOTES:**
1. Complete Model No. and Serial No. are permanently marked on identification plate located at upper end of terminal blocks.
 2. When extra-compact mounting is required for rack or portable installation, C-shaped mounting bracket may be removed and two threaded inserts (located 4.00 inches apart) may be used for mounting, using 6-32NC machine screws.

Figure 3-1. Standard Unit and Unit with CP Option, Outline and Dimensions

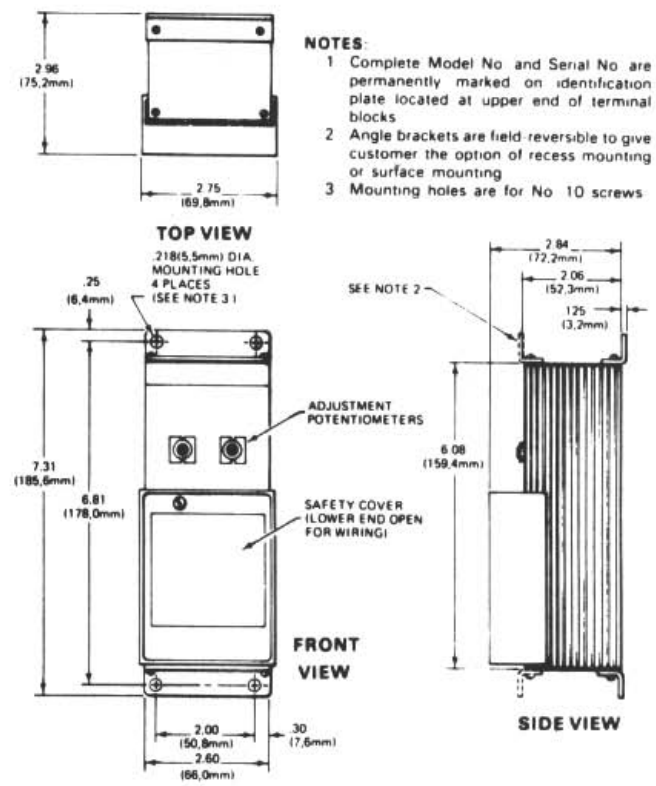


Figure 3-2. Standard Unit With Angle Brackets (AB) Option, Outline and Dimensions

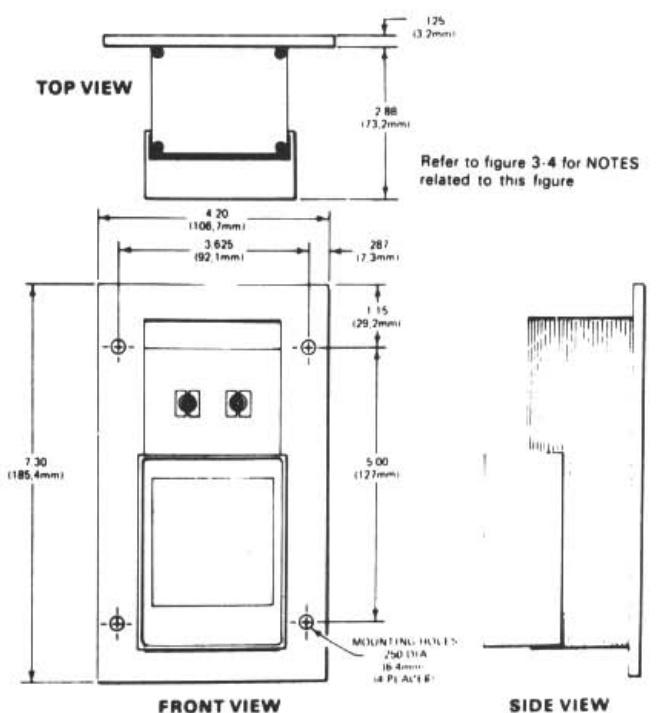
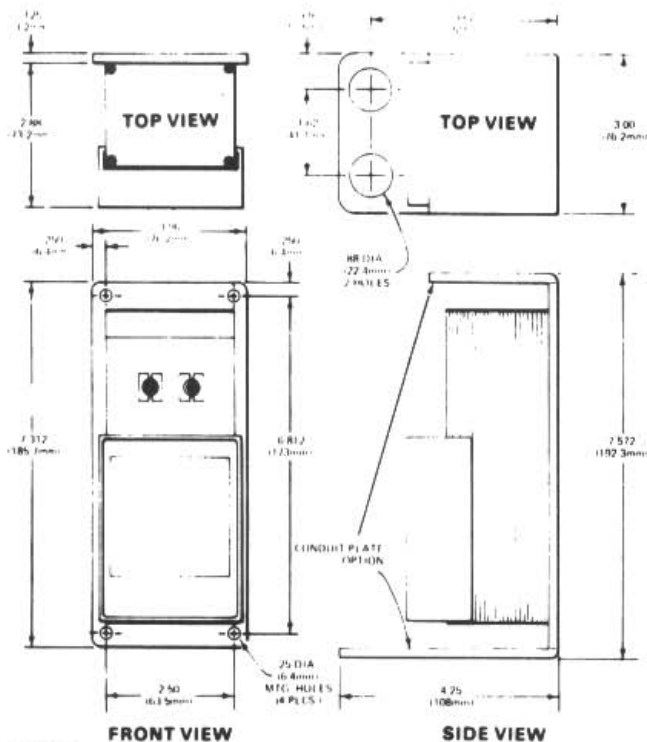


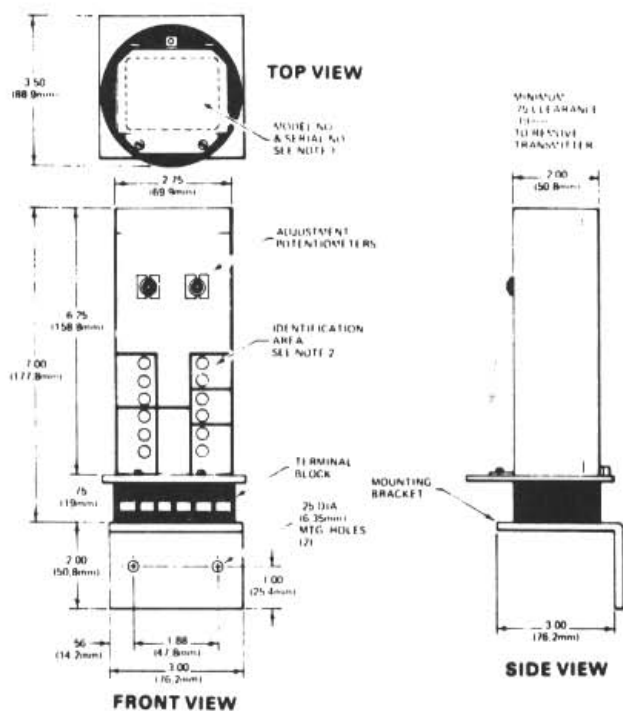
Figure 3-3. Standard Unit With Adaptor Plate (RAA) Option, Outline and Dimensions



NOTES:

- 1 Use two threaded inserts (located 4.00 inches apart on back of standard transmitter) for mounting adapter plate to transmitter. Use 6-32 NC machine screws
- 2 Unit to adapter plate mounting screws should not protrude more than 1/8" into the unit

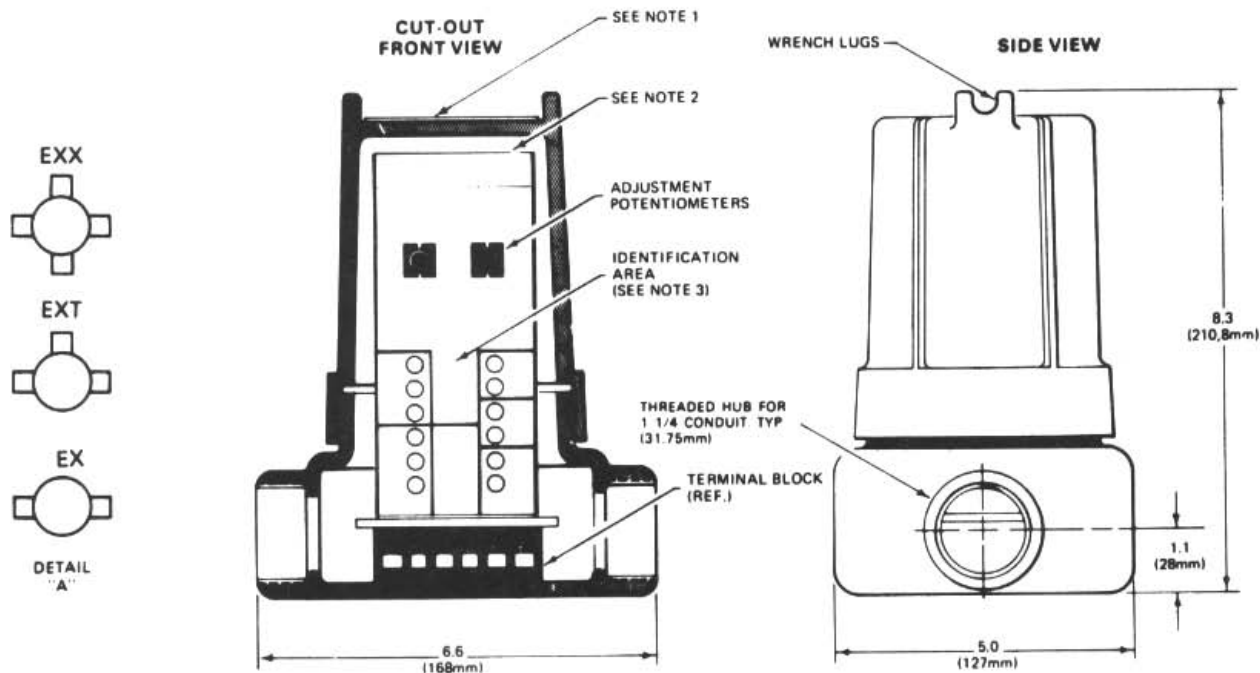
Figure 3-4. Standard Unit, With Adapter Plate (RAT) Option, Outline and Dimensions



NOTES:

- 1 Identification area on top of unit case carries complete model number and serial number
- 2 Identification area on front of transmitter case gives electrical connection information

Figure 3-5. Standard Unit With Plug-In STD Transmitter (PST) Option, Outline and Dimensions



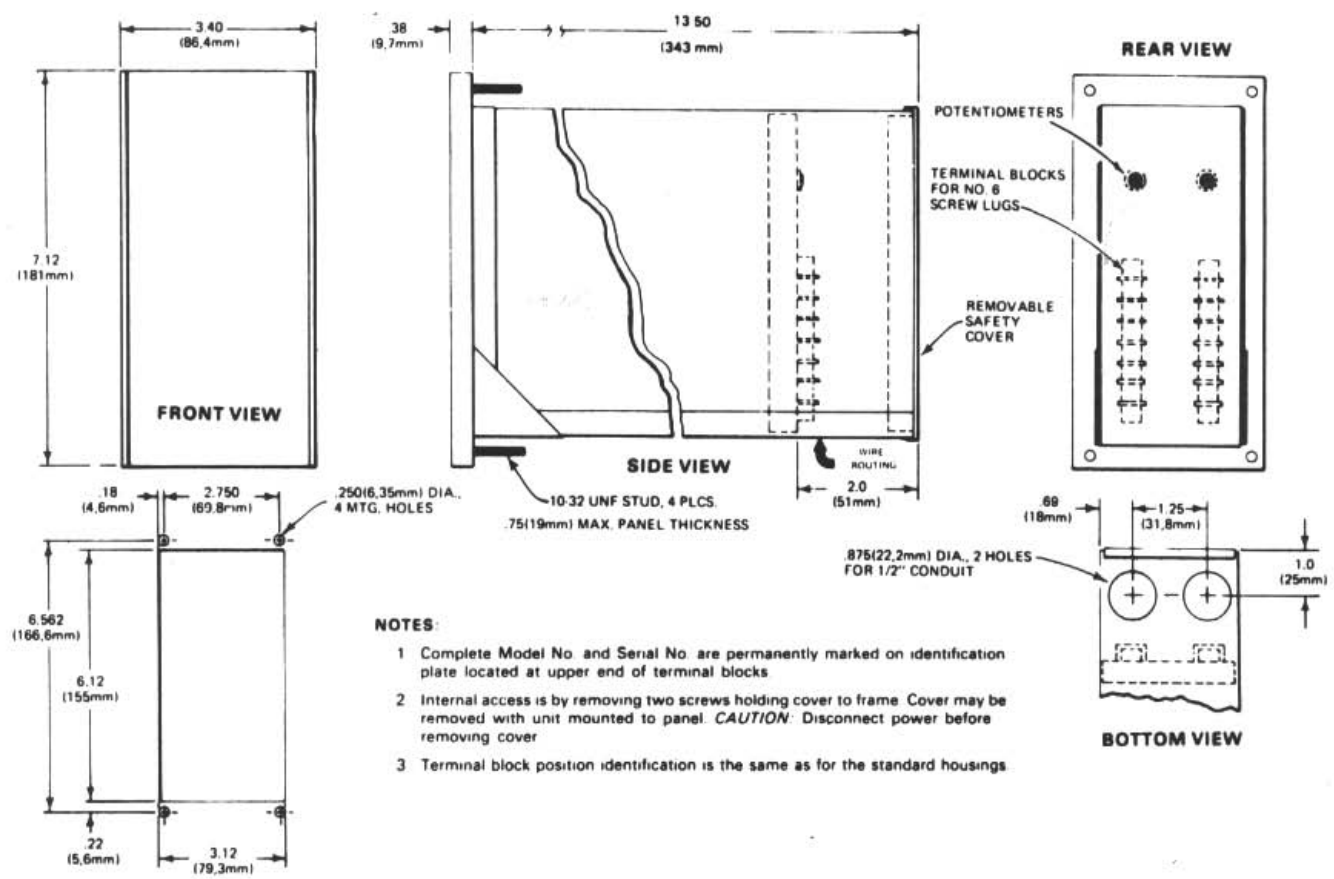
NOTES:

- 1 Top of cover has metal label carrying unit type (e.g. TCT, MVT) and equipment number (if any)
- 2 Identification area on top of unit case carries complete model number and serial number
- 3 Identification area on front of unit case gives electrical connection information
- 4 "EX" housing (two conduit hubs) is shown above. Similar housings with three or four hubs is illustrated in detail A. Housings are cast aluminum alloy and meet NEMA specifications for Class I, Groups C and D and Class II, Groups E, F, and G

Figure 3-6. Standard Unit in Explosion-Proof Enclosure, Outline and Dimensions

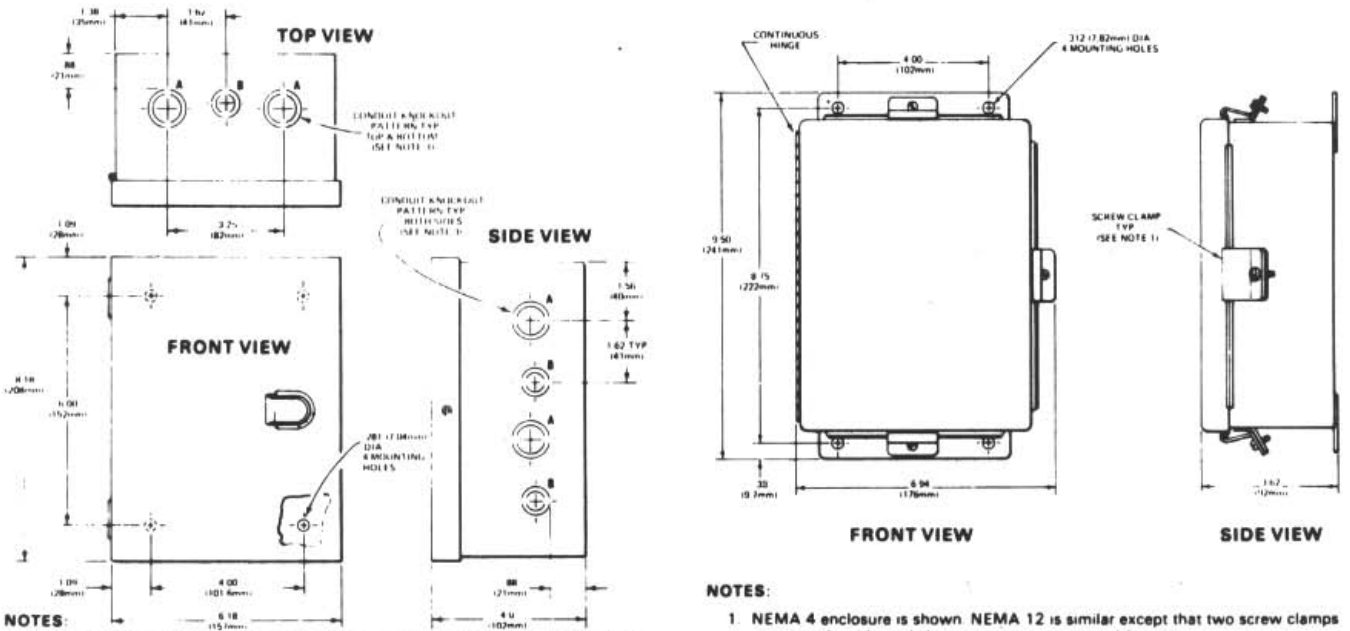
SECTION 3

INSTALLATION & OPERATION



- NOTES:**
- 1 Complete Model No. and Serial No. are permanently marked on identification plate located at upper end of terminal blocks
 - 2 Internal access is by removing two screws holding cover to frame. Cover may be removed with unit mounted to panel. **CAUTION:** Disconnect power before removing cover
 - 3 Terminal block position identification is the same as for the standard housings

Figure 3-7. Standard Unit with Panel Mount Enclosure (PM) Option, Outline and Dimensions



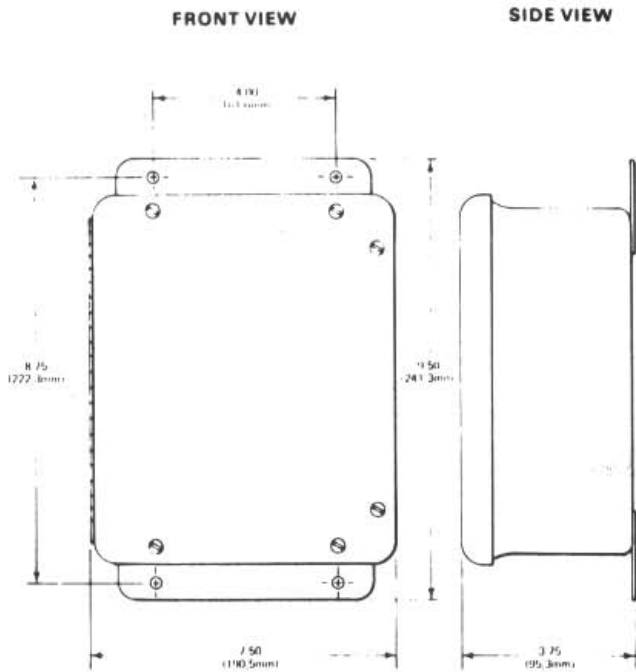
- NOTES:**
- 1 NEMA 4 enclosure is shown. NEMA 12 is similar except that two screw clamps are on right side and there are none at top and bottom
 - 2 NEMA 12 enclosures are only oil and dust tight, whereas NEMA 4 enclosures are also water tight
 - 3 Wiring access to terminal blocks is provided by open lower end of safety cover

a. General Purpose (GP) Enclosure

b. Water and Oil-Tight (WT/OT) Enclosures

Figure 3-8. Standard Unit in NEMA Boxes, Outline and Dimensions

PSM PULSE SUMMING MODULE

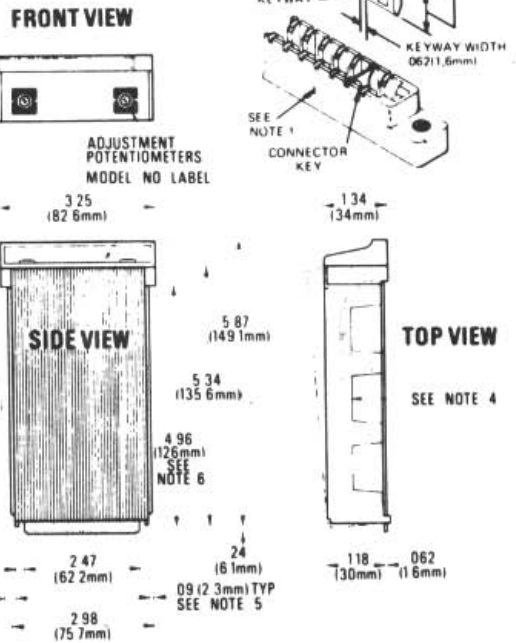


NOTES:

- 1 All exposed metal hardware is type 302 stainless steel. Boxes are hinged on the long side unless otherwise specified.
- 2 All boxes include a one piece closed cell neoprene gasket.
- 3 Standard color is machine tool grey. Boxes are molded from pigmented polyester resins with the color throughout the box wall for a maintenance-free installation.

c. Corrosion-Proof (FG) Enclosure

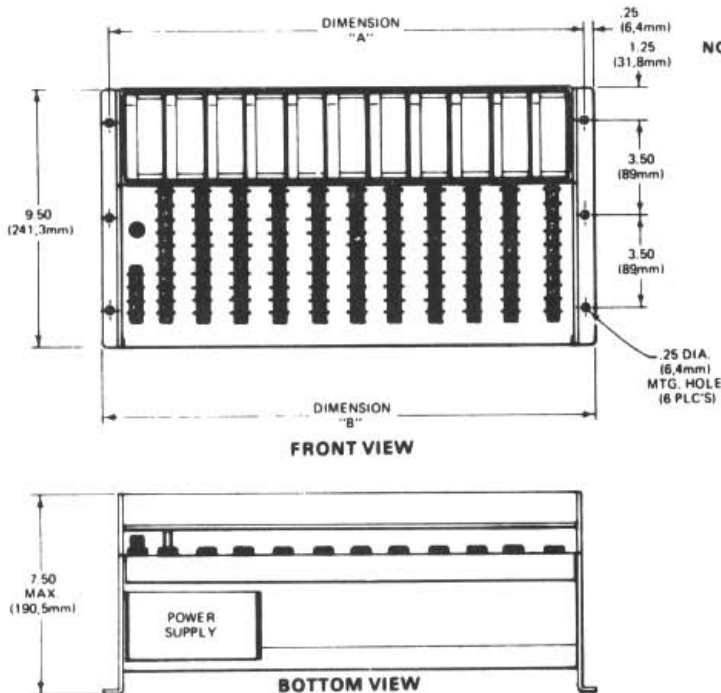
Figure 3-8. Standard Unit in NEMA Boxes, Outline and Dimensions (Cont.)



NOTES:

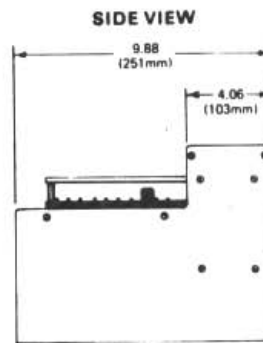
- 1 Connectors used must have contacts on 156 (3.96mm) centers, with contacts for both surfaces of board (recommended type Viking part no 2VK155/1-2).
- 2 Maximum card insertion depth in connector is 350 (8.89mm).
- 3 Minimum width of connector insertion slot is 2.470 (62.70mm).
- 4 Removable plastic safety cover, 2.800 (71.12mm) wide.
- 5 Maximum card edge-guide insertion depth is .09 (2.29mm). Guides must be non-conductive.
- 6 Card edge-guides cannot extend beyond here.
- 7 Card extender part no 350-513-00 is available for testing unit while in operating position.

Figure 3-9. Plug-In Unit, Outline and Dimensions



NOTES:

- 1 11 I surface mounted card rack accommodates as few as 5, and as many as 15 plug-in units.
- 2 Empty positions may be closed by means of filler cards. P/N 350-213-00.
- 3 Connections are keyed to assure units will be plugged into proper position. Keying may be changed in the field if the system configuration changes.
- 4 Eleven position card rack is illustrated. Dimensions for mounting larger or smaller racks may be found in the table.
- 5 24V power supply, shown, is capable of powering all models in card rack. Input specification, 117 VAC \pm 10%, 50/60 Hz, approximately 40 watts.

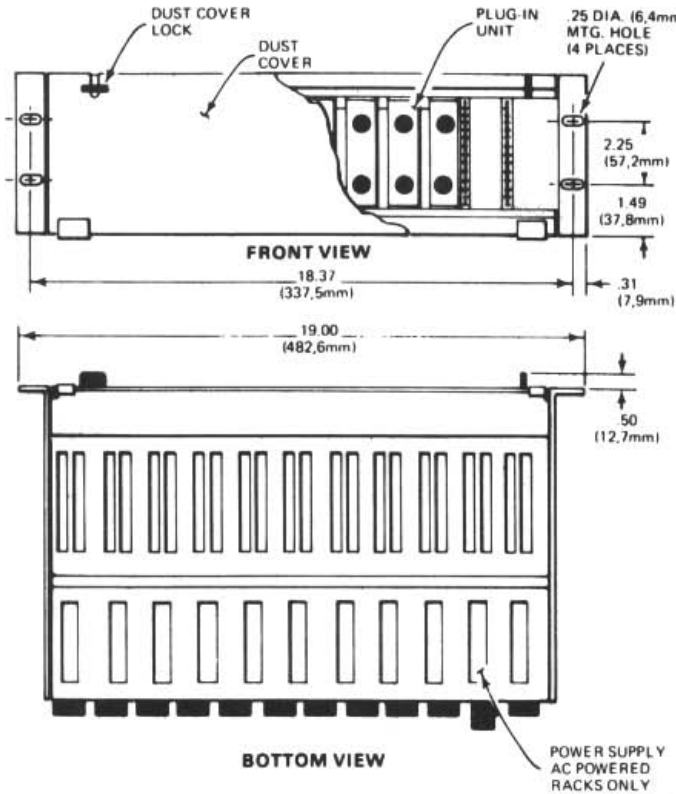


NUMBER OF POSITIONS	DIMENSION			
	A	mm	B	mm
5	9.19	233.4	9.69	246.1
6	10.62	269.7	11.12	282.4
7	12.06	306.3	12.56	319
8	13.50	342.9	14.00	355.6
9	14.94	379.5	15.44	392.2
10	16.38	416	16.88	428.8
11	17.81	452.4	18.31	465
12	19.25	489	19.75	501.7
13	20.69	525.5	21.19	538.2
14	22.12	561.8	22.62	574.5
15	23.56	598.4	24.06	611.1

Figure 3-10. Surface Mounted Card Racks (SMR), Outline and Dimensions

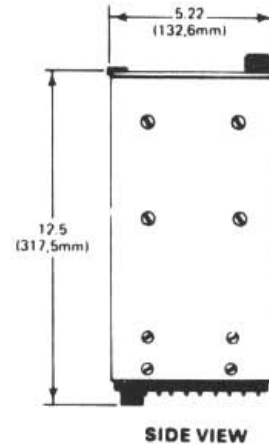
SECTION 3

INSTALLATION & OPERATION

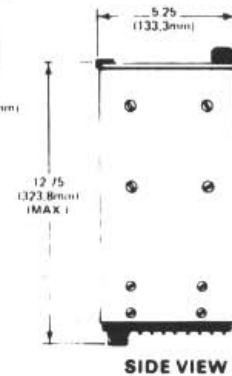
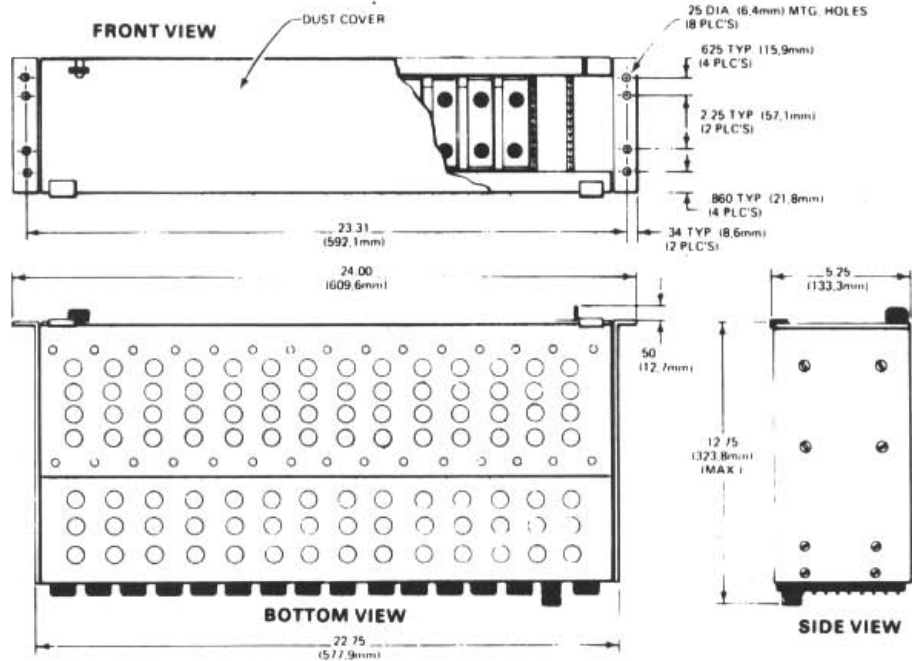


NOTES:

- 1 Connectors are keyed to assure units will be plugged into proper position. Keying may be changed in the field should the system configuration change.
- 2 This enclosure is designed to mount in a standard 19-inch rack with EIA hole pattern.
- 3 Surface mounting card racks for use in NEMA type enclosures are also available. Contact factory for further details of card racks and card rack assemblies.
- 4 Barrier strip connectors are CSA approved.
- 5 Empty positions may be closed by means of filler cards, Part No. 350-213-00, which must be ordered individually in quantity required.
- 6 24 volt power supply furnished capable of powering a typical complement of up to fifteen modules. Input specification 117 volts \pm 10% 50/60 Hz approximately 40 watts.



a. Eleven-Position Card Rack



b. Fifteen-Position Card Rack

Figure 3-11. Rack-Mounted Card Racks (RMR) Enclosure, Outline and Dimensions

PSM PULSE SUMMING MODULE

3.2 ELECTRICAL CONNECTIONS

All electrical connections to standard units are made to the terminal blocks on the unit. On plug-in units, the electrical connections are made to terminals on the mating connector for the unit. Terminals used for standard units and their options are defined in the following paragraph.

3.2.1 General Wiring Information

No special wire or cable is required for signal connections to the unit. To avoid transients and stray pickups, it is recommended that twisted conductors be used where they are run close to other services (such as power wiring). Electrical connections to the units fall into two major categories: connections to all standard units with terminal blocks, and connections to plug-in units and their associated enclosures.

Wiring Information for All Standard Units With Terminal Strips and Blocks. Standard units with terminal strips or terminal blocks have terminals supplied with 6-32 screws long enough to easily accommodate three spade-lug connectors. Standard units with snap-off plastic covers have an opening in the bottom of the cover. Dress all wiring to and from the terminals through this opening. Spade lug connectors are recommended for all wire terminations. Figure 3-12 illustrates the

terminal strip locations and identification for the standard units and the terminal block identifications for the explosion proof and PST configurations. Table 3-1 provides the complete labeling nomenclature for standard unit and any available electrical options. Terminal labeling appears next to the terminal it identifies on standard units. For PST and explosion proof units, terminal labeling is marked on the front of the unit housing with the referenced terminals identified numerically.

Wiring Information for All Units in NEMA Boxes.

Units mounted in NEMA boxes are standard units with or without the options listed in Table 3-1. NEMA boxes for OT or 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 for various sizes of conduits from 1-inch down to 1/2-inch. Corrosion-proof (FG) enclosures require special attention with ground connections. Since enclosure material is polyester resin, conduit cutouts may be cut with a punch or hole saw. 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 at enclosure entry

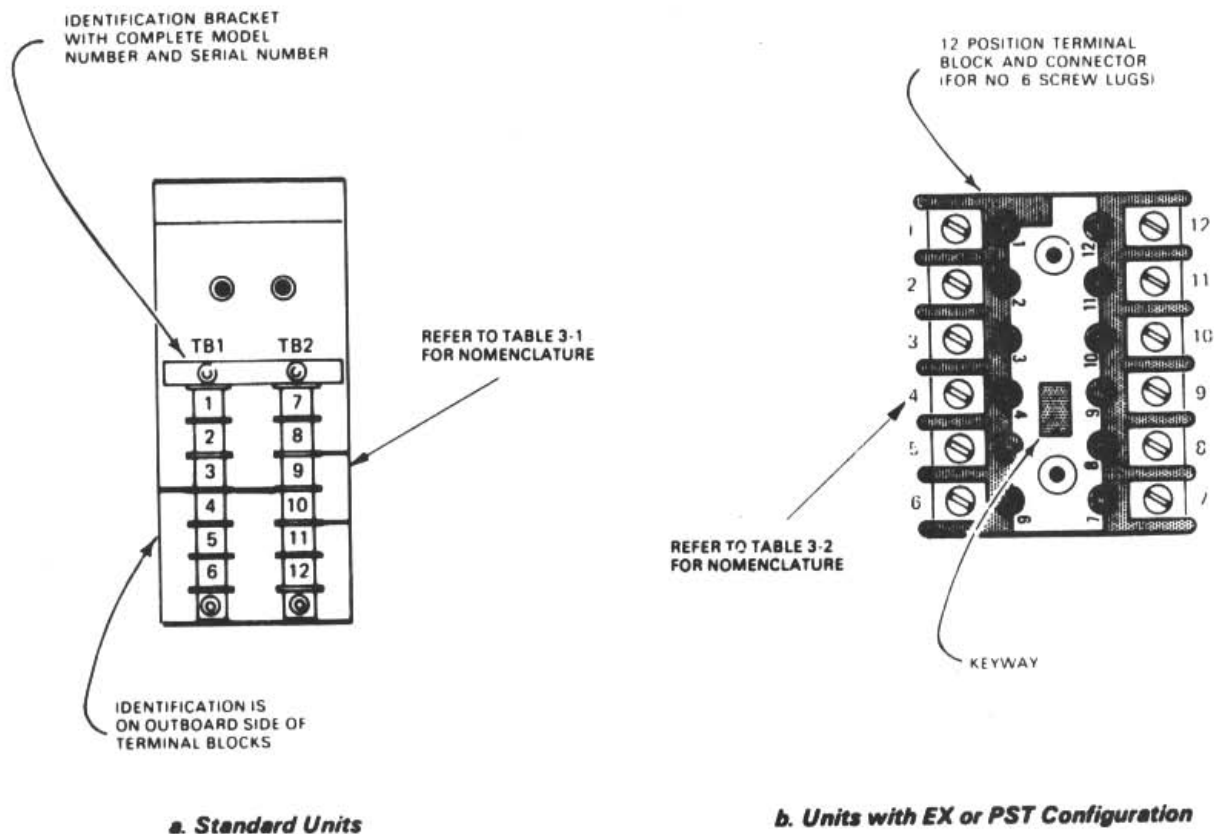


Figure 3-12. Terminal Strips and Terminal Blocks Identification

and exit. If the enclosure is used without the 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.

Wiring Information for Plug-In Units. Plug-in units and card rack electrical connections are made to terminals on the mating connector for the unit or the card rack terminal strips. Figure 3-13 illustrates the terminal strip connections and their numerical reference designator. Table 3-2 provides a complete terminal nomenclature for both Plug-In and Rack assemblies.

3.2.2 POWER CONNECTIONS

Units are designed to operate from either a DC or AC power source. Refer to paragraph 1.5 for information on how to use the model number to determine the type of power required.

DC-Powered Units. On these units the DC terminal is connected to the + (positive) side of the source, and 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. These units require 117 volts AC $\pm 10\%$, 50/60 Hz at 5 VA of nominal power or 220

or 240V AC optionally. The AC terminal should be connected to the ungrounded or "hot" side of the supply, if possible, and the ACC terminal is connected to the common or neutral. The GND terminal is the mechanical case connection.

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.

3.3 OPERATION AND PERIODIC OBSERVATION

Once calibrated and installed, the unit may be operated unattended. Because the circuit uses highly reliable solid-state components with no moving parts, the unit should operate virtually maintenance-free for a long period of time. However, if a malfunction should occur, refer to Section 5 for maintenance information.

A periodic check of input and output connections is recommended every six months to ensure continued dependability of operation.

A unit may become warm during operation, especially where the ambient temperature is rather high. This is perfectly normal and should not be a cause for alarm unless a malfunction is also observed.

**TABLE 3-1.
TERMINAL NOMENCLATURE**

Options (Note 1)	Terminal Positions (See Figure 3-11)											
	1	2	3	4	5	6	7	8	9	10	11	12
SD	+S1	+S2	-S	DCC	DC	GND	+S3	+S4	-	-S	+OUT	-OUT
AC	+S1	+S2	-S	ACC	AC	GND	+S3	+S4	-	-S	+OUT	-OUT
RR (Note 2)	RO, AT, ET, RF (Note 3)											

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. Terminal nomenclature not affected by this option. CC connections made across +S and -S terminals.
3. Terminal nomenclature not affected by this option.

Legend:	DC	+DC Power Input	ACC	AC Power Return
	DCC	-DC Power Input	+S	Signal Input
	GND	Chassis Ground	\pm OUT	Signal Output
	AC	AC Power Input		

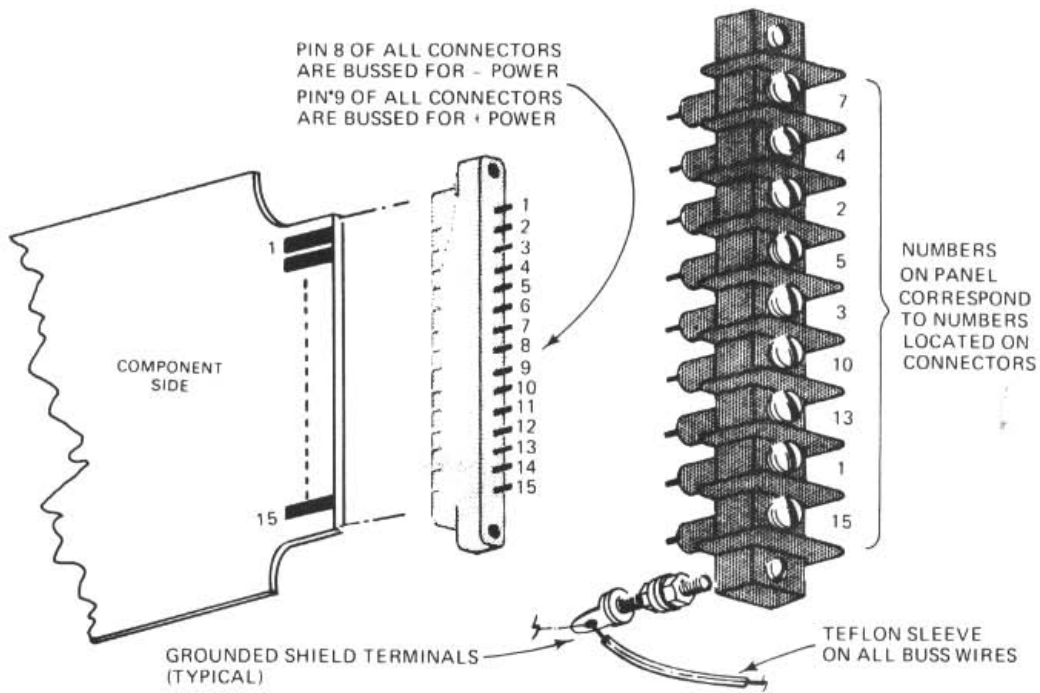


Figure 3-13.
Plug-In Connectors and Terminal Strips Wiring and Identification

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

Options	Terminal Position (See Figure 3-12)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NONE or CC, ET or AT Options	+S1	-S	+S2	+OUT	—	—	-OUT	DCC	DC	+S3	—	—	+S4	—	—
RR (Output)					NO/NC										COM

Keyways

Legend:

DC	+DC Power Input	±S	Signal Input
DCC	-DC Power Input	±OUT	Signal Output
COM	Chassis Ground	NO/NC	Normally Open/Closed

4.1 INTRODUCTION

This section describes the theory of operation of the unit. The description of each circuit is presented in sufficient detail so troubleshooting, if required, can be carried out intelligently and rapidly.

A schematic diagram and a block diagram (Figure 4-1) of the PSM module is included in this manual. Unless otherwise directed, refer to the schematic diagram when reading the following paragraphs.

Components reference designators are listed here for both the standard and the plug-in models. The standard unit reference designator is listed first followed by the reference designator for the plug-in unit in parentheses and italics. If both reference designators are the same, only one is listed.

4.2 GENERAL DESCRIPTION

The PSM electronics consist of the input wave shaping circuits, an astable oscillator, control logic, 4-stage binary counters, a magnitude comparator and the power output stage. In addition to the signal processing circuits, the required voltage conversion and regulation circuits are also provided, with all components mounted on a single printed circuit card.

4.3 AC POWER SUPPLY

The AC power supply will accept standard 117 Vac or an optional 240 Vac, across the primary winding of power transformer T1. In parallel with the primary winding is varistor VS1, which provides transient suppression in the event of input power fluctuation. The secondary winding of T1 is connected to a bridge rectifier consisting of diodes CR7, CR8, CR9 and CR10. (CR9, CR10, CR11, CR12)

4.4 DC POWER SUPPLY

When the standard configuration PSM is to be powered by direct current, the optional power inverter circuit is used and replaces the input transformer. When 24 Vdc, or the optional 45 Vdc, is applied to the power inverter, it is converted to a square wave of approximately 3 KHz using transistors and the primaries of a transformer to form an oscillator circuit. Polarity reversal protection is provided by diode CR6 in series with the positive DC input line, and additional isolation is provided by the inductor L1 and the filter capacitors. The output from the secondaries is used as an AC voltage that is further rectified and filtered to provide DC operating voltages for the unit.

4.5 VOLTAGE REGULATION

The rectified voltage is applied to the SCR switching circuit formed by Q8 and Q9 (Q10, Q11), in addition to the gate signals across R22 and R23 (R28, R29). The SCR output voltage, is applied across R26 (R27) and capacitors C13 and C14 (C16) to provide the approximate 24 Vdc at reference point B which is used by the power driver circuit. The voltage regulator, VR1, and capacitor C12 (C15) provide the +15 Vdc for use as working voltage to the remaining circuits, and as a reference voltage to the emitter of Q7 (Q9). The transistor, acting as a switching regulator, determines if the specified load conditions have been exceeded by sensing a decrease in the base voltage, and providing a gate signal to turn the SCR's on.

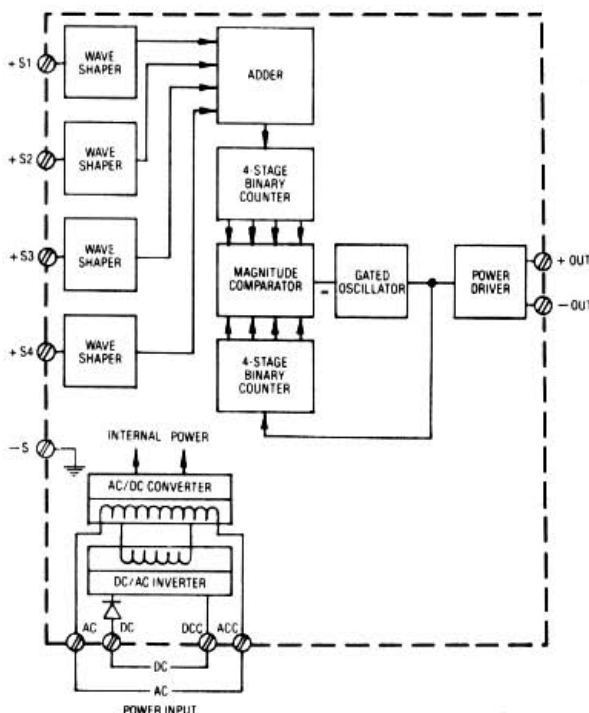


Figure 4-1.
PSM Block Diagram

4.6 INPUT AND WAVESHAPING CIRCUITS

The Pulse Summing Module, produces a proportional output equal to the sum of its inputs, +S1 through +S4. A minimum of two and a maximum of four inputs may be applied, however for this explanation a single input circuit +S1 will be discussed since the remaining input circuits are identical.

When an input pulse is received, it is applied to the base of Q1, turning the transistor on, and pulling the input of IC2 low. The inverter output, Pin 2, is pulled high to provide an input at Pin 3 of the waveshaping flip-flop, IC1. The duration of the input signal is determined by the RC time-constant circuit of R4 and C5 which ensures that Q1 is held on for a minimum of 10 msec. With the minimum pulse duration applied, the output of the flip-flop provides a positive pulse which is sent to the input of the adder.

4.7 CONTROL LOGIC

The logic control circuits are comprised of the input adder IC5, and one half of IC7 which is used as a power on reset flip-flop. When input pulses are applied to the adder, the output signal appears at Pin 11 and is sent back as a reset pulse to the wave shaping flip-flops which then change state and remove the inputs to the adder. The pulse width is typically 540 nsec, with a maximum duration of 1.27 μ sec, and provides positive pulse inputs to the binary counter, IC4, at Pin 1.

The power on reset function is used to initialize the logic states when the system is first turned on. When power is applied, the Q output at IC7 Pin 13 provides a reset signal to the binary counter, in addition to all of the input waveshaping flip-flops. The duration of the reset signal is relatively short due to the oscillator output, IC8 Pin 3, being sent to Pin 11 of IC7 and clearing the reset function.

4.8 BINARY COUNTER

The short duration pulses from the adder provide inputs to one half of the dual 4-stage binary counter, IC4. The pulses are loaded serially and initiate a count sequence to produce a binary output equal to the sum of the inputs. Each half of the dual binary counter produces independent outputs which are sent to a comparator circuit, IC6. While one half of the counter accepts adder inputs, the remaining half accepts oscillator generated signals that are received from Pin 2 of the gate flip-flop, one-half of IC7. The oscillator generated signal will cause one half of the counter to continually produce a binary output which is then applied to the comparator until such time as both counters are equal, producing a comparator output. Table 4-1 shows the binary output and bit location for each of the input counts from 0 to 15. When the sixteenth pulse is received, the counter rolls over producing the equivalent output of a zero count.

4.9 MAGNITUDE COMPARATOR

The 4-bit magnitude comparator, IC6, performs the comparison function of binary data between the A inputs, derived from input pulse counts, and the B inputs which are derived from continuously counting the gated oscillator pulses. When a comparison of binary data is made, a decoded decision signal is present at the comparator output, PIN 6. This output signal is then sent to Pin 4 of IC7, the gate flip-flop, indicating that a comparison of data bits has been made and gating the oscillator output to the power driver stage.

4.10 GATED OSCILLATOR

The oscillator, IC8, is a free running or astable timer with an output frequency determined by the components of an external RC network. The oscillator output is a continuous square wave that is applied through a gated flip-flop to either a 4-stage binary counter or as an output to the power driver stage. When the ET option is selected, the components of the RC network must be changed to alter the output pulse time period from 30 milliseconds, to a pulse period of 500 microseconds. Table 2-2 provides the resistor and capacitor values required to modify the oscillator output.

4.11 POWER DRIVER

The power driver circuit contains the transistors Q5 and Q6, a resistor R20 (R17) and diode CR5. The input pulses are derived from IC7 Pin 1, and provide the drive signal necessary to operate the power circuit. A separate voltage source is provided by the regulation circuits, (Ref. Para 4.5) to provide the +24 Vdc at reference point B. When the gated flip-flop, produces pulse outputs at Pin 1, they are applied to the base of Q5 (Q6), turning the transistor on. With Q5 (Q6) conducting, the power transistor Q6 (Q5) is turned on, providing a ground to the - out terminal.

TABLE 4-1
4 BIT BINARY COUNTER

INPUT COUNT	OUTPUT			
	Q4	Q3	Q2	Q1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

5.1 INTRODUCTION AND GENERAL INFORMATION

This section contains information to aid in the maintenance of the unit. This includes disassembly instructions for all mechanical options, as well as general troubleshooting. Precautions and special techniques required to replace components are also described.

5.2 DISASSEMBLY

When unit troubleshooting is required, it is first necessary to disassemble the unit. The physical configuration of the unit determines the steps to be followed in disassembly. These are described in the following paragraphs.

NOTE

Always identify wires — usually by tagging — before disconnecting existing connections.

CAUTION

DISCONNECT INPUT SIGNAL AND REMOVE POWER INPUT BEFORE DISASSEMBLING UNIT.

5.2.1 Disassembly of Standard Unit and Units With AB or CP Options

To disassemble a standard, AB, or CP unit, remove the unit from its installed position. If the mounting bracket is used, separate it from the unit by removing the two countersunk screws at the rear of the unit. After the unit has been removed from its installed position, disassemble the unit as follows to gain access to the circuit board.

- a. Remove the two front Phillips-head screws at the top of the unit.
- b. Remove the four Phillips-head screws at the bottom of the unit.
- c. Slide the front panel (with the circuit board still attached) down and free of the sides of the case. Points on the circuit board may now be reached for troubleshooting. It is suggested that the case be used as a container for storing the removed hardware.

5.2.2 Disassembly of Unit in NEMA Boxes

Normally electrical connections are made to NEMA boxes through conduits. Units are secured on a mounting plate in the NEMA boxes. The following disassembly instructions apply to the various configurations.

Disassembly of Units in OT, WT and FG Enclosures. Use the following procedures to disassemble unit:

- a. Loosen clamps that hold hinged cover on OT and WT enclosures only, and open enclosure; otherwise loosen screws securing FG cover. Inspect FG gasket for damage and replace if necessary.
- b. Loosen four screws that secure cover on box.
- c. Remove plastic safety cover from unit.
- d. Tag and disconnect wires from unit. On FG units, tag and disconnect ground wire from conduit to mounting post.
- e. Remove four nuts that secure mounting plate assembly into box.
- f. Remove mounting plate assembly from NEMA box.
- g. Loosen and remove mounting nuts that hold units on mounting plate and remove units.
- h. Disassemble unit as described in paragraph 5.2.1.

Disassembly of Units in FG Enclosure. Use the following procedures to disassemble unit:

- a. Open cover on box.
- b. Remove plastic safety cover from unit.
- c. Tag and disconnect wires from unit.
- d. Loosen four mounting screws that hold into box.
- e. Remove four nuts that secure unit mounting bracket assembly to rear of box.
- f. Remove units with attached brackets.
- g. Disassemble units from mounting brackets.
- h. Disassemble unit as described in paragraph 5.2.1.

5.2.3 Disassembly of Units in PA or PST Enclosures

Use the following procedure to disassemble unit:

- a. Remove unit from terminal block by rocking it slightly while pulling upward.
- b. Remove two nuts, screws, washers, holding front panel to bottom PC board (two front bottom).
- c. Remove two side screws from front panel.
- d. Remove one countersunk screw from back-bottom of unit in bottom of PC board.

Terminal block and card connector are keyed to eliminate error when the unit is reinstalled.

5.2.4 Disassembly of Units in EX Enclosures

Use the following procedure to disassemble unit:

- a. Using a bar wrench, attach to wrench lugs and loosen the housing cover from the base.
- b. Unscrew protective cover to expose unit.
- c. Use procedure of paragraph 5.2.3.

5.2.5 Disassembly of PM Units

Use the following procedure to disassemble unit. Refer to Figure 5-1 for parts nomenclature.

- a. Pull out safety cover to expose wiring.
- b. Tag and disconnect wires from terminal strip. If troubleshooting requires access to reverse side of PC board, perform the procedure described in next step.
- c. Remove screws holding cover to frame and lift cover off the case assembly.

CAUTION

WIRE SERVICE LOOP IS SUFFICIENT TO ALLOW PC BOARD AND END PLATE ASSEMBLIES TO BE TURNED OVER. ANY EXCESSIVE MOVEMENT OF THIS ASSEMBLY MAY CAUSE WIRING DAMAGE.

- d. Remove two nuts and washers that secure PC board and end plate into frame and carefully lift and slide board and plate towards terminal panel, out of end holder.

5.2.6 Disassembly of a Plug-In Unit

To remove the cover of a plug-in unit, proceed as follows:

CAUTION

DO NOT LIFT FRONT OF COVER MORE THAN ¼ INCH. EXCESSIVE FORCE APPLIED TO COVER MAY BREAK REAR RETAINING CLIPS.

- a. Gently spread forward locking feet and lift front of cover.
- b. With the front of the cover raised, slide the cover to the rear to disengage it from the plug-in card.

To test a plug-in unit in the operating position, a circuit board extender card (M.I.I. Part No. 350-513-00 or equivalent) is required. The extender card brings the unit forward so components on circuit board are accessible for troubleshooting.

5.2.7 Disassembly of Plug-In Units in Card Racks

Except for SMR, access to units in racks is effected by removing dust cover over plug-in units. Surface Mounted Racks (SMR) do not have a cover over plug-in units since the whole rack may be enclosed into a NEMA box.

5.3 TROUBLESHOOTING

The schematic diagrams include flagged numbers (or letters) at various points in the circuit. Table 5-1 gives the voltages and waveforms at these points for specified input-signal conditions. The assembly drawing shows the physical locations of the parts on the circuit board. Bear in mind that the circuit board is protected with a moisture-resistant coating. Therefore, it may be necessary to use a needle-point probe and exert a fair amount of pressure to break through the coating when it is desired to observe the signal or voltage at a specific point. When connecting a probe to a component on the circuit board, exercise care to make sure the probe does not short-circuit to an adjacent component.

In general, troubleshooting is carried out by tracing the signal with an oscilloscope and referring to the schematic diagrams to determine what component might be causing an observed abnormal indication. If the original symptom was a complete failure of the unit to operate, the most logical components to suspect are those associated with the power supply in the unit (including any voltage regulators). If the unit was producing an incorrect (but not zero) output, check the outputs from the voltage regulator and, if these are normal, apply a standard input signal and trace the resulting signal through the unit.

5.3.1 Plug-In Board Connector Cleaning

Occasionally, modules which have been in service for a long period of time may develop resistive coatings on the gold-plated contacts of the plug-in boards. This coating, if allowed to build up, can cause malfunctions by decreasing the noise margin of a circuit.

There are two types of foreign material coatings which can develop on the gold-plated contacts of a plug-in module. The first type is **INORGANIC**. This type of contamination results when copper "bleeds" through the gold plating and oxidizes. The second form of contamination involves **ORGANIC** substances, which usually are a result of careless handling, and are mainly made up of fingerprints, salts, and oils deposited when the plug-in boards are handled by the gold-plated contacts. Contamination by organic substances can be greatly reduced by careful handling of the modules.

Although rack connectors are usually of the self-cleaning type, it may become necessary to clean the module fingers to ensure reliable connection. When module contacts are in need of cleaning, the following procedures are recommended:

Removal of Inorganic Contaminants

- a. Immerse contacts of plug-in board in an ultrasonic bath of deionized water and a detergent, such as Liquinix, for at least 30 seconds.
- b. Repeat step (a) with pure deionized water only.

CAUTION

REMOVE WATER IMMEDIATELY FROM CONTACTS. IF THIS IS NOT DONE QUICKLY, DAMAGE TO CONTACTS MAY RESULT.

- c. Remove water by immersing contacts in an ethane or methanol bath to same depth used during the ultrasonic cleaning of step (a). Never wipe or use an abrasive cleaner on the contacts. If wiping is necessary, use K-Dry towels or equivalent.

Removal of Organic Contaminants

- a. After inorganic contaminants and water

have been removed, organic materials may be removed by immersion of contacts in trichloroethane for at least 30 seconds.

CAUTION

NEVER USE AN ERASER ON THE CONTACTS. THE USE OF ABRASIVE CLEANERS OR ERASERS ON PLUG-IN BOARD CONTACTS IS CONSIDERED A PHYSICAL ABUSE TO THE PLUG-IN UNIT AND MAY VOID THE UNIT WARRANTY.

- b. Let contacts air dry or wipe with a very fine, nonabrasive material such as K-Dry towels or equivalent.

5.3.2 Component Replacement General Information

Replace all defective components with identical parts. Refer to Section 6 for a list of recommended replacement parts. The last row of numbers in the parts list is the number of spares recommended to be kept on hand for that part, per unit, for up to ten units of the same type. For more than ten units, a spares complement of 10% on the indicated parts should be used.

5.3.3 Component Replacement Techniques

Most parts used in the unit are quite small and are located in a confined area. Therefore, small hand tools are a necessity when servicing the unit. The following is a summary of the general techniques and precautions that should be observed to prevent damage to components in the unit:

CAUTION

CMOS INTEGRATED CIRCUITS ARE VERY SUSCEPTIBLE TO STATIC ELECTRICITY. WHEN REPLACING THESE COMPONENTS, DO NOT HANDLE LEADS BEFORE SOLDERING INTO BOARD. ENSURE THAT SOLDERING IRON IS GROUNDED. SOLDER INTEGRATED CIRCUITS LEAD V (POWER INPUT) BEFORE SOLDERING G (GROUND CONNECTION). FAILURE TO TAKE THESE PRECAUTIONS WILL DAMAGE COMPONENTS.

- a. Use a transformer-operated low-voltage soldering iron with a grounded tip and rated at not more than 50 watts. A temperature-controlled tip is desirable.
- b. Use extreme care when unsoldering the leads to any component. Do not keep the soldering iron on a point for more than a few seconds at a time. Use a suction-type solder-removing tool (solder sucker) as an aid in unsoldering transistors and integrated circuits. The protective coating on the unit may be removed with trichloroethane or equivalent. Be sure adequate ventilation is provided when using this or any other chemical.
- c. Do not excessively bend or twist the leads of small components; they break easily.
- d. Before removing a component, observe the lead dress. Be sure that the lead dress of the replacement is the same as that of the original.
- e. Handle MOSFETs only by the case; if the fingers are allowed to contact the leads, the MOSFET may be ruined. Be sure to leave the metal sleeve around the leads until just before the device is installed on the printed circuit board.

- f. Remove all flux from soldered joints with trichloroethane or equivalent.

NOTE

Units that were calibrated at the factory to customer's specifications have protective caps over the SPAN and ZERO potentiometers. These caps must be removed so the unit can be recalibrated. LIFT, DO NOT TWIST, the caps off, using a screwdriver tip as a prying tool. Snap the caps back in place, WITHOUT TWISTING, when recalibration has been completed.

- g. Test the unit for proper operation and, if necessary, recalibrate by the procedure given in Section 2.
- h. Check that all leads are clear of the board edge before reinstalling the board into its case.
- i. When reinstalling the unit onto the mounting bracket, be sure to use the same screws (or screws of the same size) as the ones removed. Longer screws will damage the unit.

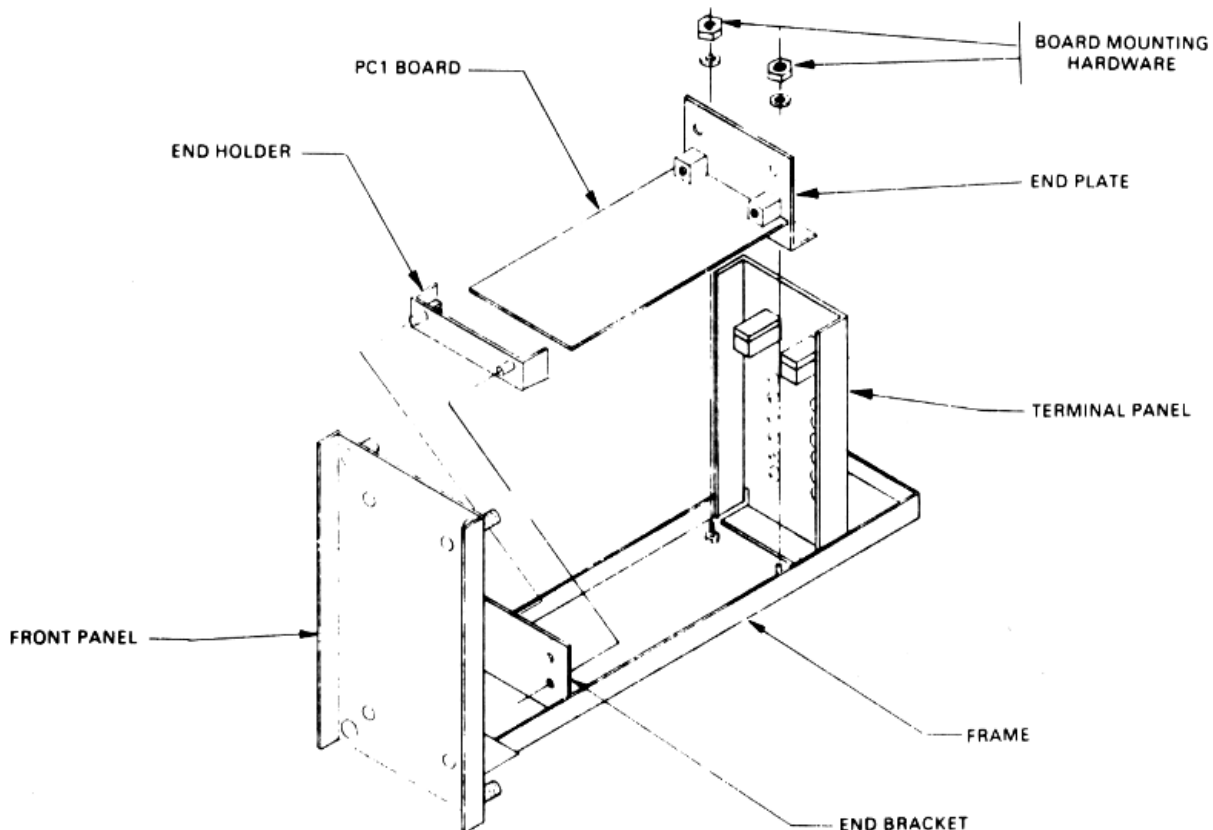
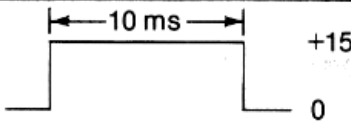
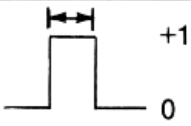
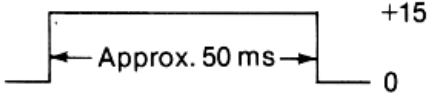
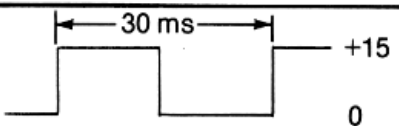
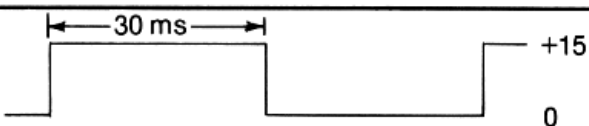


Figure 5-1. Disassembly of PM Units

SECTION 5

MAINTENANCE & TROUBLESHOOTING

**Table 5-1
Wave Forms**

Test Point	Wave Form
1	
2	 <p style="margin-left: 150px;">Typically 540 nsec, 1.27 μsec max</p>
3	Same as TP2
4	
5	
6	

6.1 GENERAL

This section consists of a computer print-out table that provides parts identification information for the unit. Wiring lists have been provided in this section as an aid to the maintenance personnel.

Parts information is grouped according to the number of assemblies. If the unit contains two PC boards, the table will be divided into two major sections: one section will contain information related to PC1 and the other section will list PC2 components information. Each major section in the table contains a complete parts list headed LIST OF MATERIALS specifying which PC board it is describing. This list is usually found at the end of the section. The list of materials consists of the following headings:

6.2 LEGEND

ITEM: A reference for data processing and not used by maintenance personnel.

NAME: Gives the nomenclature of the part.

DESCRIPTION: Identifies the component by manufacturer's part number, usually followed by the component's parameters or value.

REF: Lists the reference designation for the components described in Section 4 and illustrated on the schematic and assembly drawings in Section 6.

PART NUMBER: Specifies the Moore Industries part number. THIS IDENTIFICATION MUST BE PROVIDED WHEN ORDERING PARTS FROM MOORE INDUSTRIES.

SPARE: Specifies the recommended number of component spares per unit type.

6.2 GLOSSARY OF ABBREVIATIONS

C	Capacitor
CR	Diode — Zener included
HW	Special hardware
J	Connecting buss wire
L	Inductor
LB	Label
PC	Printed circuit board
R	Resistor
T	Transformer
IC	Integrated circuit
Q	Transistor
LED	Light emitting diode
TB	Terminal block
VS	Voltage regulating varistor

DO NOT SCALE DRAWING

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

DESIGNER: *ATRESSERS* 12/18/73
CHECKED: _____
ENGINEER: _____
SCALE: *1/8"*

PSM
STD-PC1

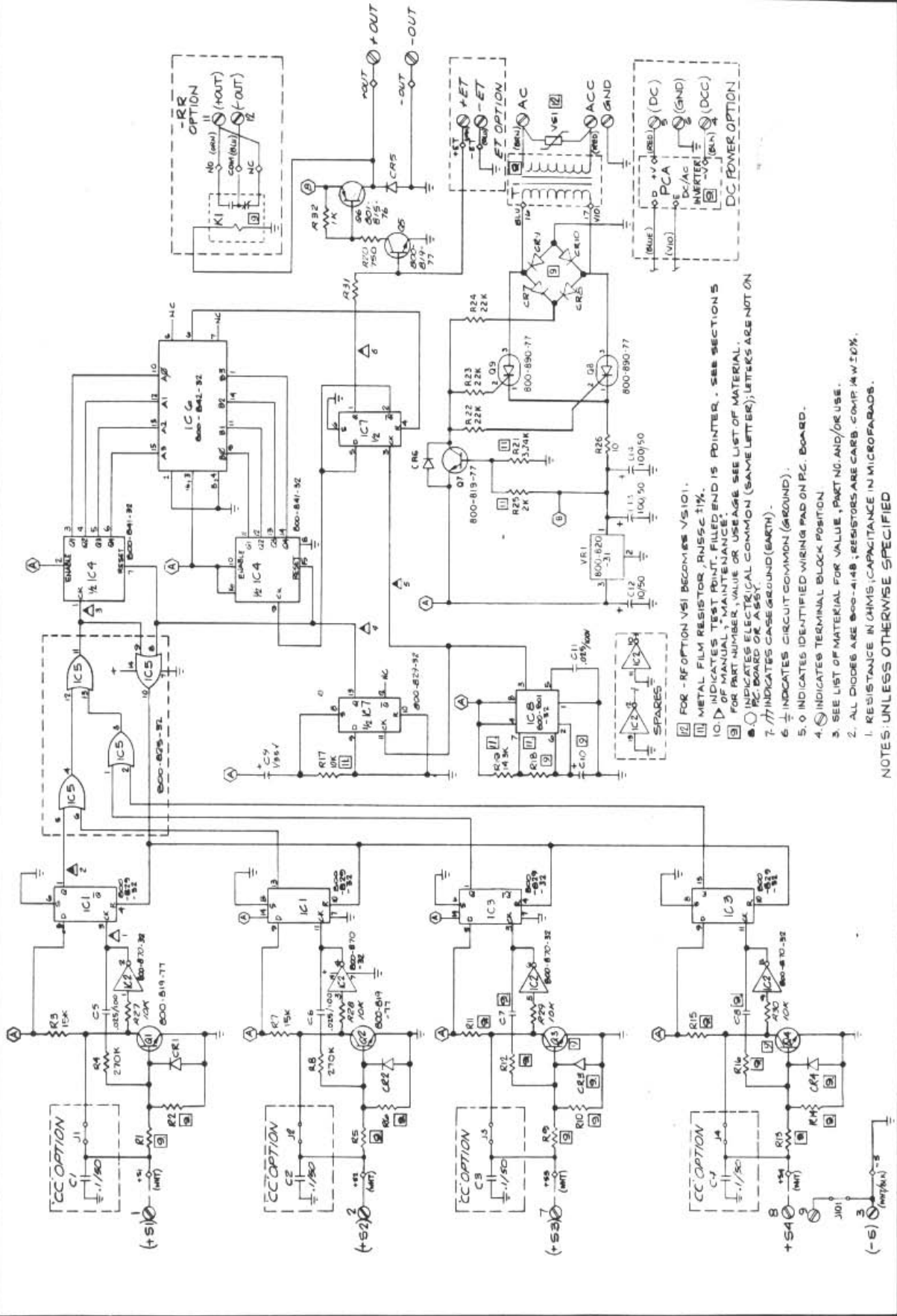
DRAWING NUMBER
44-401-CO

REVISION
E

CATEGORY
SCHEMATIC

REVISED BY
ECC 3646

DATE: 1/1/74
BY: D
APPROVAL: 1



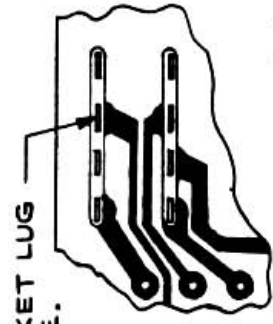
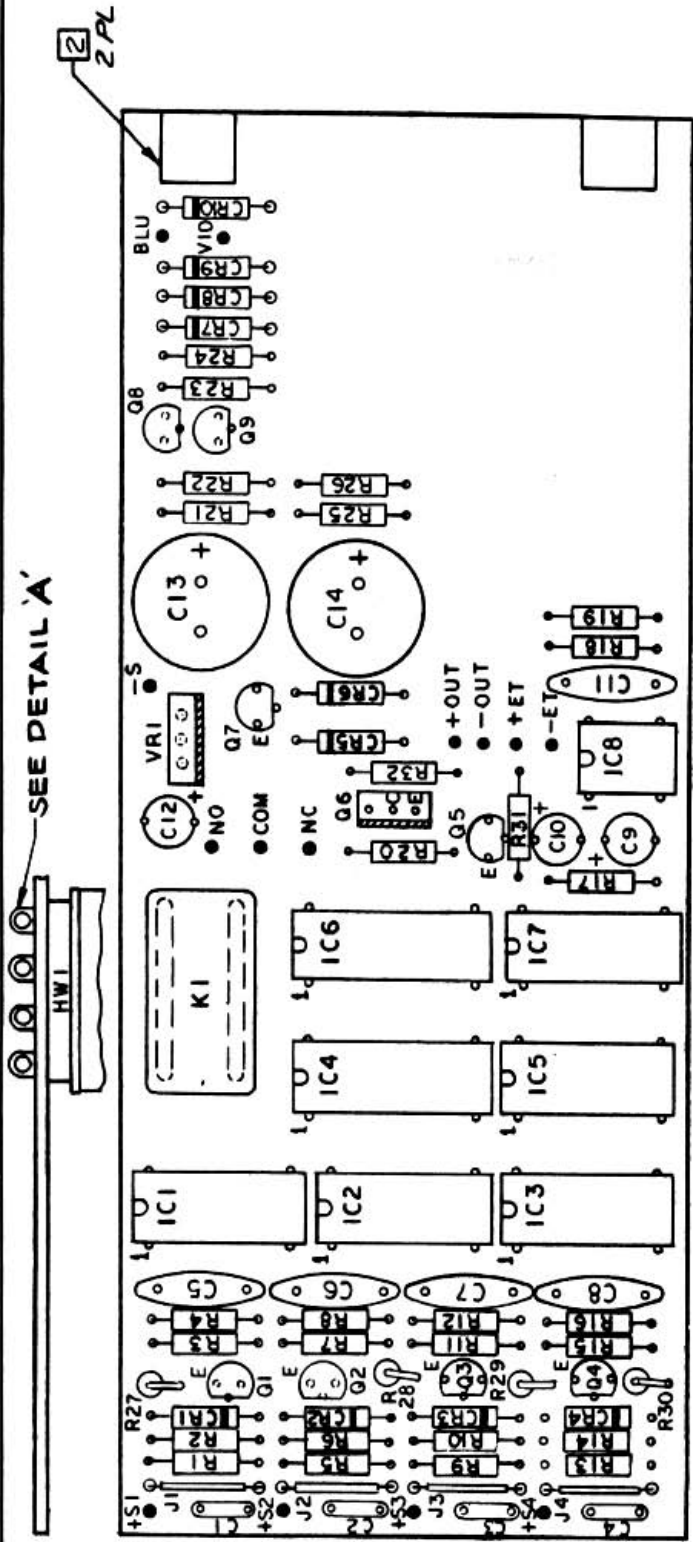
- 1. FOR -RR OPTION VSI BECOMES V/S101.
 - 2. METAL FILM RESISTOR, PWS5C 11X.
 - 3. INDICATES TEST POINT, FILLER END IS POINTER. SEE SECTION 5 OF MANUAL "MAINTENANCE".
 - 4. FOR PART NUMBER, VALUE OR USAGE SEE LIST OF MATERIAL.
 - 5. ○ INDICATES ELECTRICAL COMMON (SAME LETTER); LETTERS ARE NOT ON PC BOARD OR ASSY.
 - 6. // INDICATES CASE GROUND (EARTH).
 - 7. ⊕ INDICATES CIRCUIT COMMON (GROUND).
 - 8. 5.0 INDICATES IDENTIFIED WIRING PAD ON P.C. BOARD.
 - 9. ⊕ INDICATES TERMINAL BLOCK POSITION.
 - 10. SEE LIST OF MATERIAL FOR VALUE, PART NO. AND/OR USE.
 - 11. ALL DIODES ARE 800-4148; RESISTORS ARE CARB. COMP. 1/4 W. 10%.
 - 12. RESISTANCE IN OHMS; CAPACITANCE IN MICROFARADS.
- NOTES: UNLESS OTHERWISE SPECIFIED

MOORE INDUSTRIES
 16650 Schoenborn Street
 Sepulveda, California 91343

DO NOT SCALE DRAWING	
TOLERANCES UNLESS NOTED	SCALE 2/1
X ±.1	CHECKED
XX ±.03	DESIGNED BY <i>J. L. G. 10/6/5</i>
XXX ±.010	APPROVED BY
ANGLES ±30°	

PSM
 STD-PCI

DRAWING NUMBER 144-501-00	REVISED E
CATEGORY ASSEMBLY	
REVISED BY E.C.O.3646	DATE
BY	APPROVAL



SOLDER RELAY SOCKET LUG
 TO ADJACENT TRACE.
 5 PLACES

4. ALL JUMPERS TO BE 22 AWG, TEFLON SLEEVING AS REQ'D.
 3. INDICATES METAL SIDE OF DEVICE.
 - 2 SWAGE IN PLACE BEFORE ADDING COMPONENTS; SEE CASE ASSY FOR POSITION.
 1. ALL LEADS TO BE SOLDERED TO PADS.
- NOTES: UNLESS OTHERWISE SPECIFIED:

MOORE INDUSTRIES
 16650 Schoenborn Street
 Sepulveda, California 91343

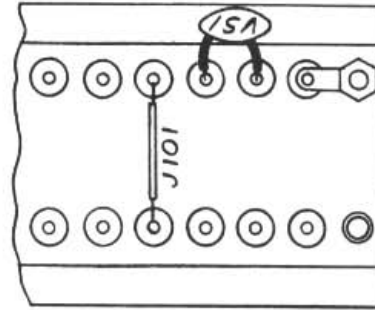
DO NOT SCALE DRAWING

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

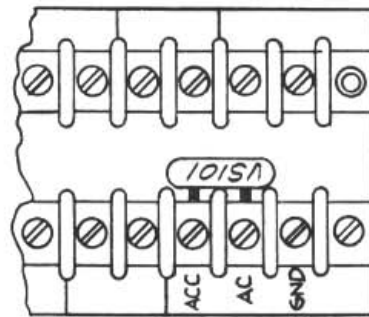
DATE: 89 DEC 78
 CHECKED: [Signature]
 ENGINEER: [Signature]
 SCALE: 2/1

PSM
 STD-PCI

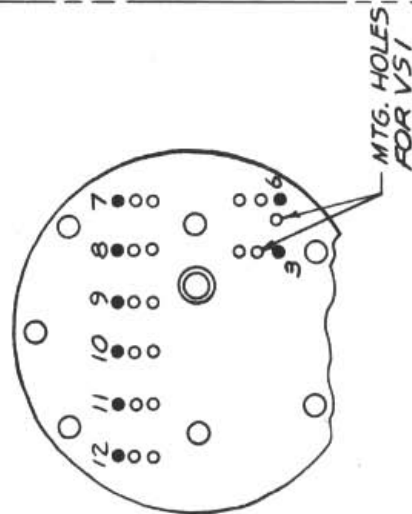
DRAWING NUMBER: 144-501-00 E
 CATEGORY: ASSEMBLY
 REVISED BY: SEE SH 1



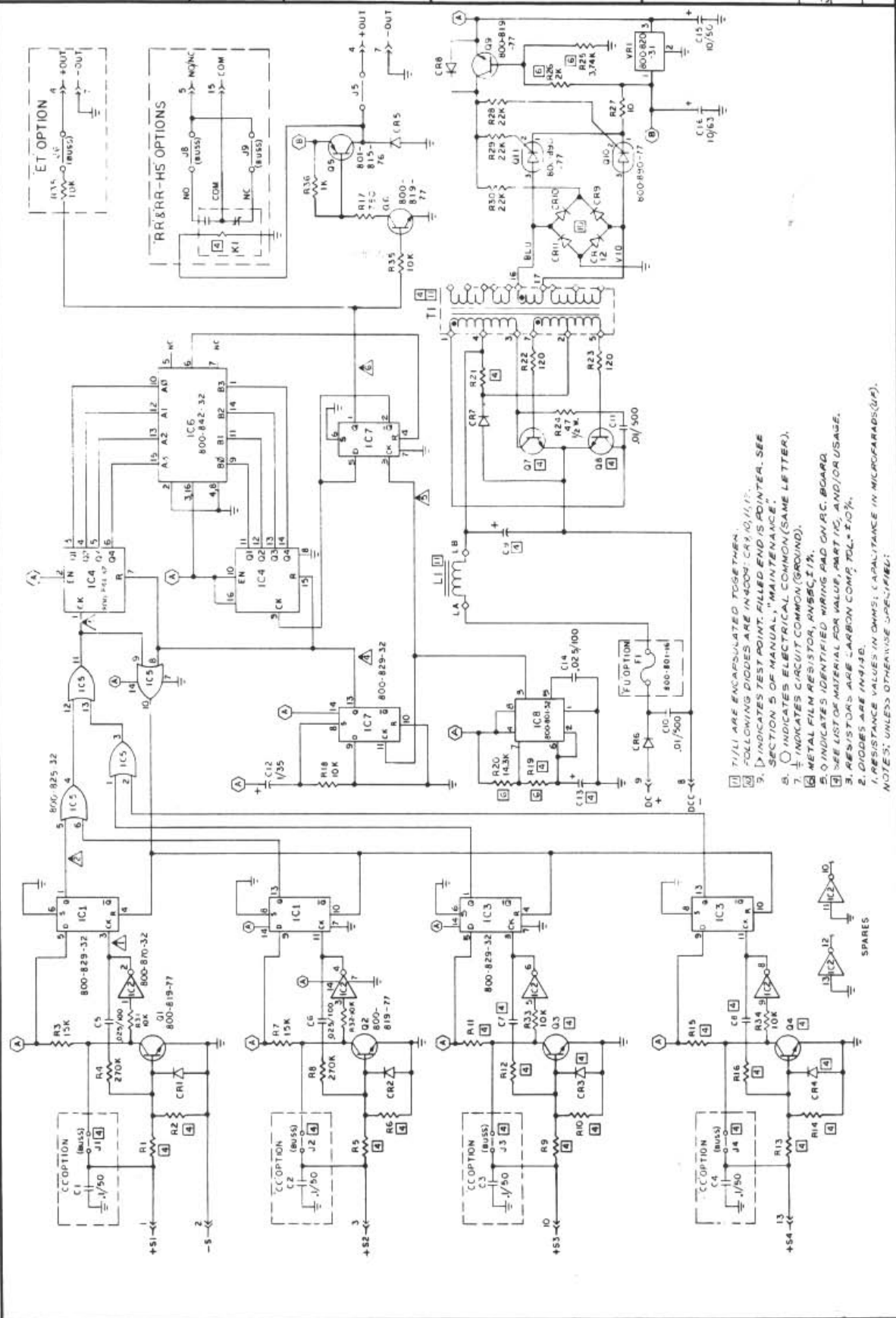
VSI, J101
 REAR OF PANEL



VSI01
 SR & CH CASE



SP CASE

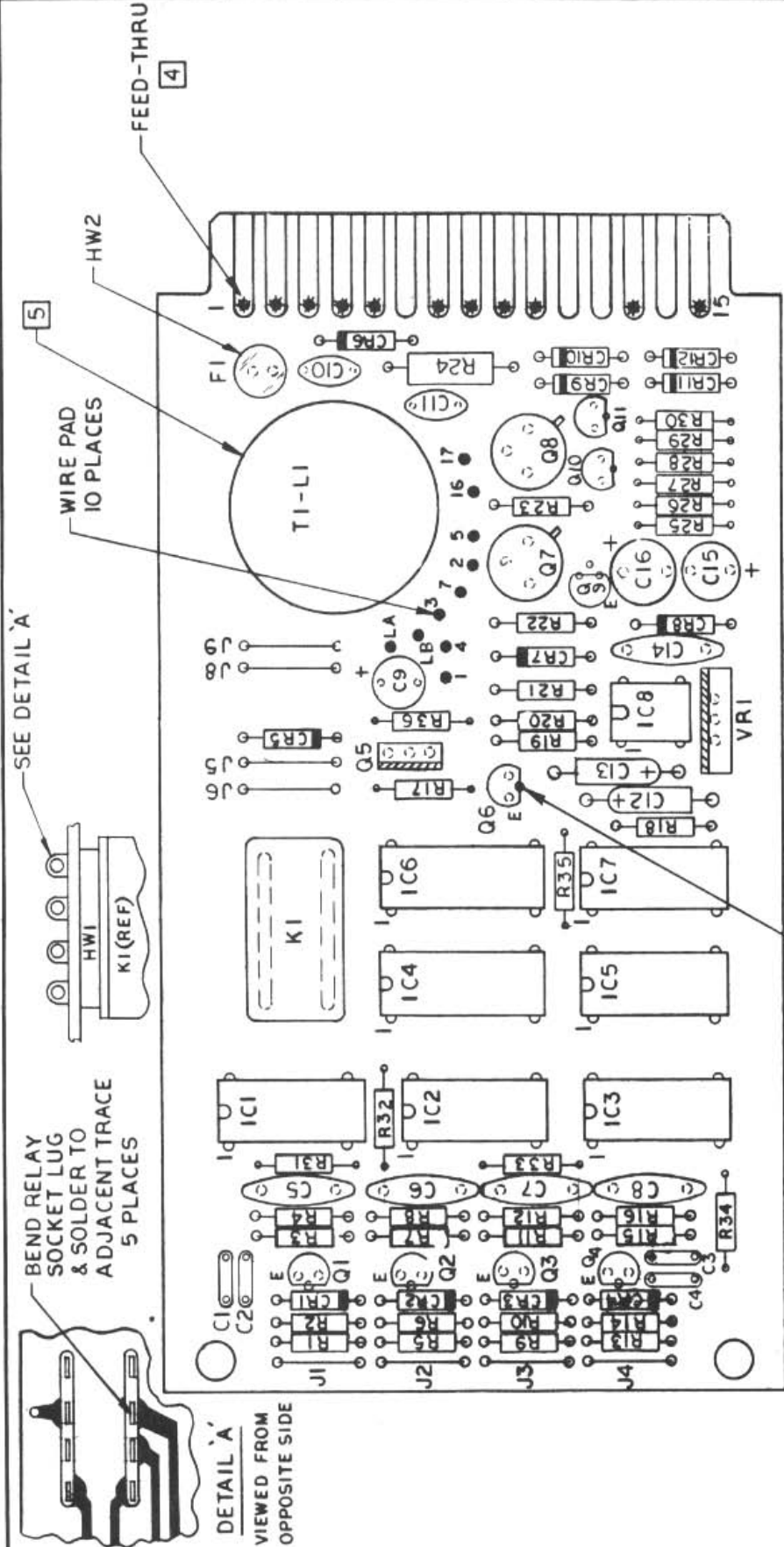


- 1. T1/L1 ARE ENCAPSULATED TOGETHER.
- 2. FOLLOWING DIODES ARE IN4001: CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR8, CR9, CR10, CR11, CR12.
- 3. D INDICATES TEST POINT. FILLED END IS POINT-TO-SEE.
- 4. SECTION 5 OF MANUAL, "MAINTENANCE".
- 5. O INDICATES ELECTRICAL COMMON (SAME LETTER).
- 6. INDICATES ELECTRICAL COMMON (GROUND).
- 7. METAL FILM RESISTOR, RW55C12.
- 8. Q INDICATES IDENTIFIED WIRING PAD ON P.C. BOARD.
- 9. SEE LIST OF MATERIAL FOR VALUE, PART NO., AND/OR USAGE.
- 10. RESISTORS ARE CARBON COMP. TOL. ±10%.
- 11. DIODES ARE IN4148.
- 12. RESISTANCE VALUES IN OHMS; CAPACITANCE IN MICROFARADS (µF).
- 13. NOTE 5; UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DRAWING	
TOLERANCES UNLESS NOTED	DRAWN: [Signature] FEB 79
X ±.1	CHECKED: [Signature]
.XX ±.03	ENGINEER: [Signature] 11/79
.XXX ±.010	SCALE: 2/1
ANGLES ±30'	

PSM
 PLUG-IN
 PCI

DRAWING NUMBER	144-553-00	REVISION	A
CATEGORY	ASSEMBLY		
REVISED BY	INITIAL RELEASE	DATE	BY
			D



FEED-THRU REQ'D WHEN Q6 NOT USED.

- 5 ASSEMBLE PER 200-237-00.
 - 4 INSTALL BEFORE ASSEMBLY. (11 PLACES)
 - 3. ~~INDICATES~~ INDICATES METAL SIDE OF VRI & Q5.
 - 2. JUMPERS TO BE 22 AWG BUSS, TEFLON SLEEVED AS REQ'D.
 - 1. ALL LEADS TO BE SOLDERED TO PADS.
- NOTES: UNLESS OTHERWISE SPECIFIED:

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.



WORLDWIDE • www.miinet.com

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