

1.1 SCOPE OF MANUAL

This manual contains operating and maintenance information on the Signal Limiting Module (SLM) 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 Signal Limiting Module (SLM) accepts standard process input signals, and produces an output signal that is limited to adjustable upper and lower set points. When an input signal exceeds the selected high output limit, the output is held at the maximum selected value. For an input that is less than the selected low limit, the output will be held to the minimum selected value.

1.3 PHYSICAL DESCRIPTION

The electronics for the Signal Limiting Module are mounted on a single printed circuit card to provide input comparison and signal processing circuits. When the standard module is configured to accept DC input power, a second printed circuit card is used to contain the required components for voltage conversion and regulation.



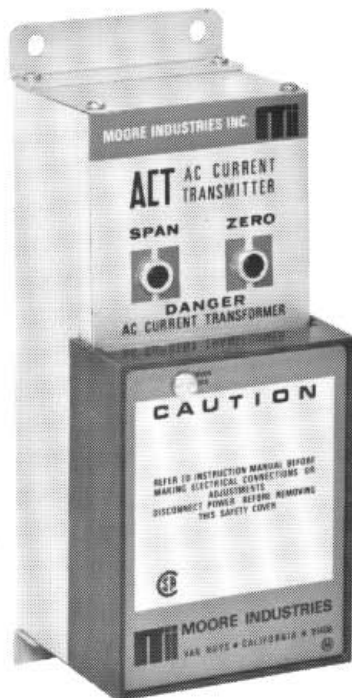
Standard (STD) Unit

SLM SIGNAL LIMITING MODULE
122-701-00A

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 1/2-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

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.



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.



Replacement Mounting (RAA) Option



General Purpose (GP) Enclosure

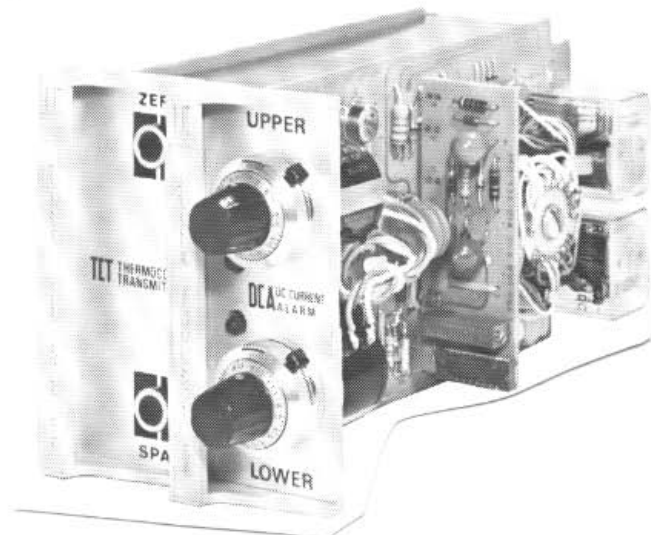


Replacement Mounting (RAT) Option

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.

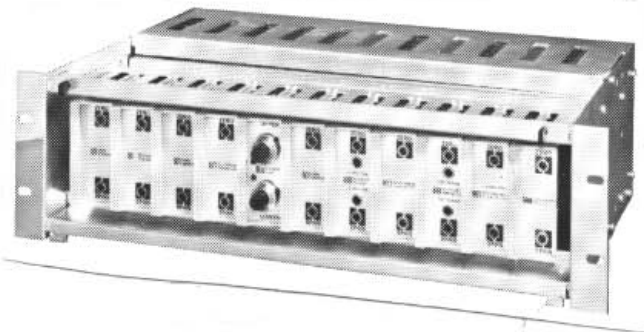
The printed circuit board is keyed to identify the unit and ensure proper connection mating. A removable plastic safety cover protects the printed circuit board and components from normal environmental hazards. When the PC unit is purchased alone, the user must provide a 15 pin connector, such as Viking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



Plug-In (PC) Unit

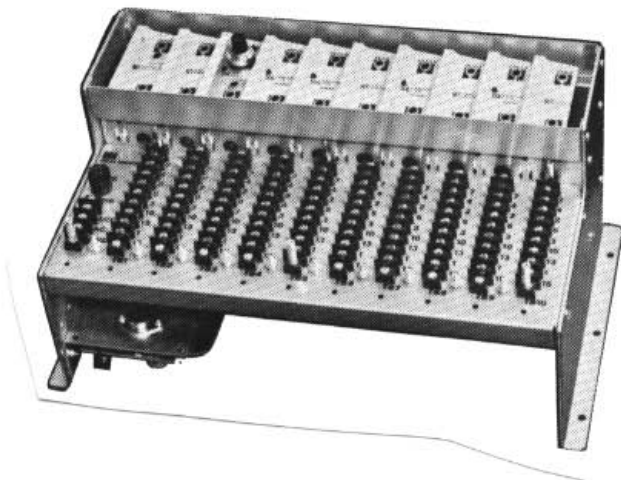
Rack Mounted (RMR) Card Racks. These enclosures are designed to flush-mount in standard 19 and 24-inch relay racks, respectively. The enclosures are provided with standard EIA hole patterns. Eleven and fifteen position RMR racks are available. These are pre-wired from the module PC connector to the screw-type 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)

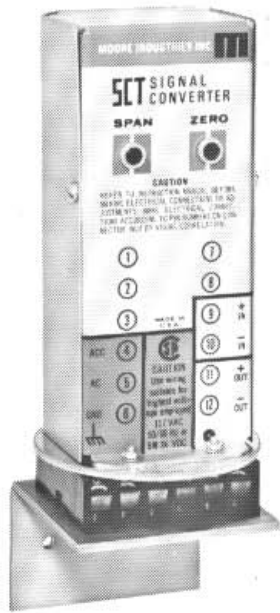
are located in the rear of the side panel which allows for surface mounting or for NEMA box mounting. These enclosures are electrically identical in construction to the RMR racks. Terminal strips for external connections, however, are front-accessed for wiring convenience whenever the rack is mounted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



Surface Mounted Card Racks (SMR)

1.3.6 STANDARD PLUG-IN OPTION

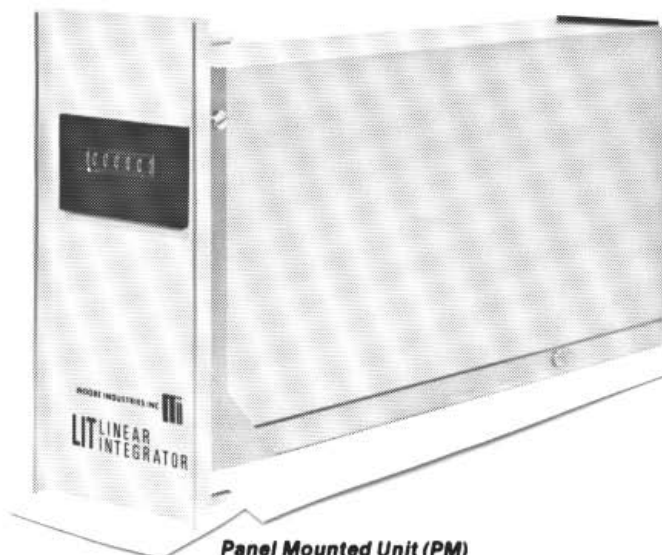
The standard plug-in module consists of a standard enclosure as described in paragraph 1.3 except that connections are not provided on the face of the unit. Instead, the unit is attached physically and electrically to a circular interconnect card with plug-in pins, keyed to eliminate errors in connections. 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 box and remove 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:

Current:

- 1-5 mA into 1000 ohms
- 4-20 mA into 250 ohms
- 10-50 mA into 100 ohms

Voltage:

1-5 Vdc, 1 megohm minimum input impedance

FRONT PANEL ADJUSTMENTS: Adjustable with multiturn potentiometers

Span: With full scale input, adjusts output to 100% ±10% of selected output span

Zero: With minimum input, adjusts output to 0% ±10% of selected output span

Low Limit: -25% to +75% of span

High Limit: +25% to +125% of span

OUTPUT: Operational amplifier feedback current source

Current:

- 1-5 mA into 0-4800 ohm load
- 4-20 mA into 0-1200 ohm load
- 10-50 mA into 0-480 ohm load

Voltage:

1-5 Vdc into 20K ohms minimum

Ripple: 10mVP/P at maximum span and maximum load

Load Effect: ±0.01% of span from 0 to maximum load resistance (current output)

PERFORMANCE:

Calibration Capability: ±0.1% of span (Linearity and Repeatability)

Ambient Temperature Range: -29°C to +82°C (-20°F to +180°F)

Ambient Temperature Effect:

Tracking: 0.01% of span/°F

Limiting: 0.01% of absolute limit value/°F

Frequency Response: 50 Hz(3 dB point)

Isolation: Current and voltage output units have input negative side common to output negative side. Power input isolation is maintained on both ac and dc units

POWER INPUT:

24 Vdc, 45 Vdc

117 Vac, 220 Vac, 240 Vac ±10% 50/60 Hz

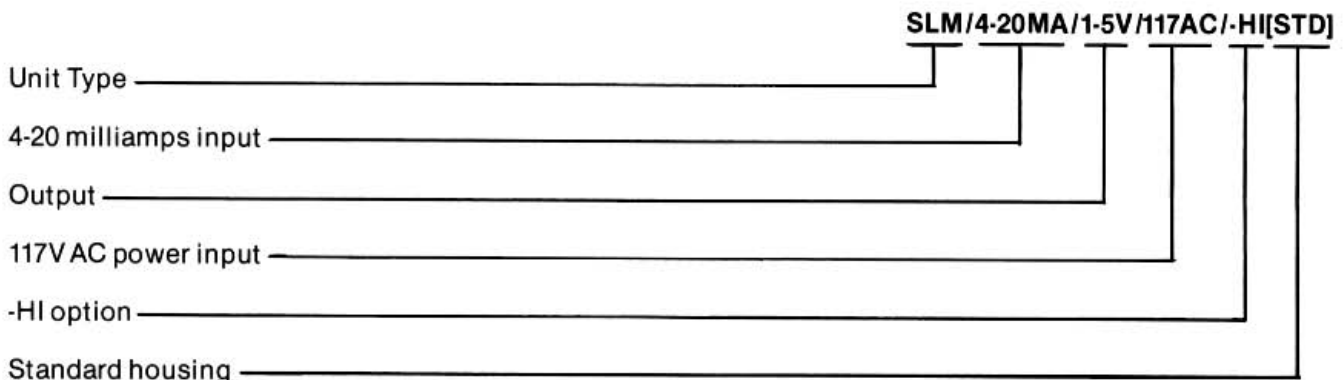
CERTIFICATION: Canadian Standard Association

WEIGHT: Approximately 908 grams (2 lbs)

SAMPLE PART NUMBER:

SLM/1-5 V/4-20 mA/117 AC/-HI(STD)

**TABLE 1-2.
MODEL NUMBER EXAMPLE**



SECTION 1

GENERAL INFORMATION

TABLE 1-3.
ELECTRICAL OPTIONS

OPTION DESCRIPTION	CODE
1-5 Vdc @ 20 mA rated output	HI
RFI filter terminal assembly — adds Moore Industries patented integral filter terminal assembly which prevents radio frequency energy from entering standard aluminum case	RF
External ten turn potentiometers with lockable dials	TT

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.

This type of potentiometer usually requires 20 turns of the shaft to move the wiper from one end of its range to the other. It is equipped with a slip clutch at either end of its travel to prevent damage if it is turned beyond the wiper stop. Usually a slight change in feel will be noticed when the clutch is slipping. However, if this change is not observed, either end can be reached by turning the shaft 20 turns in the desired direction. Controls are connected, so turning the shaft clockwise increases the quantity or makes it more positive, and turning the shaft counter-clockwise has the opposite effect.

2.2 CONTROLS DESCRIPTION AND LOCATION

The controls consist of LIMIT, high and low, ZERO and SPAN adjustments, located on the unit front panel. External controls are multiturn potentiometers that are adjusted with a blade screwdriver.

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.

CAUTION

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

2.4 TEST EQUIPMENT SETUPS

Off-line calibration 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.

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

Equipment or Tool	Characteristic	Purpose
Screwdriver (blade)	Blade not wider than 0.1 inch (2.54 mm)	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)

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 shows 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 Figure 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).

2.4.3 EXPLOSION-PROOF (EX) AND PST 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 PT configuration must be unplugged from the connection block in order to access the connections more effectively.

2.5 CALIBRATION

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 unit performance should be checked by the user before the unit 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 on units that are calibrated to values specified in the purchase order. Units that are calibrated at the factory to customer's specifications have protective caps over the SPAN and ZERO potentiometers; do NOT remove these caps.

An adjustable input signal source and input monitoring device are required for calibration. Also required is a means of determining the output.

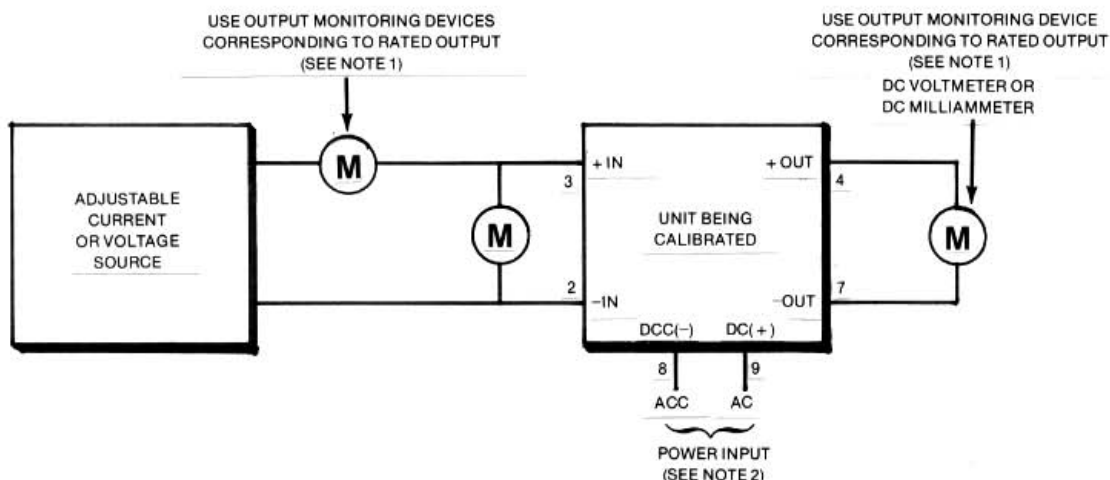
NOTE

Refer to paragraph 1.5 for information on how to use the model number to determine the input signal range and full scale output count range.

To calibrate a unit, use the following procedures.

2.5.1 CALIBRATION OF UNIT

- Connect unit and test equipment as shown in Figure 2-1.
- Apply power to the unit.
- Adjust the input signal source to provide 0% input to the unit (1 mA, 4 mA, 10 mA, 1VDC, or whatever the *minimum* input signal will be).



NOTES:

- Input and output monitoring devices must be accurate to within $\pm 0.01\%$ or better.
- Either AC power or DC power is supplied, but not both.

Figure 2-1
Test Equipment Setup for Calibration

SECTION 2

CALIBRATION PROCEDURES

- d. Adjust the low limit potentiometer to the full counter clockwise or minimum value.
- e. Adjust the high limit potentiometer to the full clockwise or maximum value.
- f. Adjust the zero potentiometer for an output value equal to the 0% input.
- g. Set the input signal source to the maximum value that will be supplied to the unit (5 mA, 20 mA, 50 mA, or 5 Vdc).
- h. Adjust the span potentiometer to obtain 100% output with the input signal applied as in step (g).
- i. Repeat steps (f) through (h) until no further adjustment of either the ZERO or SPAN potentiometers is required.
- j. Decrease the high limit potentiometer and ensure that limiting occurs by observing a decrease in output value.
- k. Set the input signal source to provide a 0% input to the unit (1 mA, 4 mA, 10 mA, or 1 Vdc).
- l. Increase the low limit potentiometer and ensure that limiting occurs by observing an output change.
- m. After step (l) has been completed, remove the signal input to the unit and remove input power.

2.5.2 CALIBRATION OF LIMITING SET POINTS

- a. Connect the unit to the test equipment as shown in Figure 2-1.
- b. Apply power to the unit.
- c. Adjust the input signal source to provide a value slightly less than the desired lower limit.
- d. Slowly adjust the low limit potentiometer until the output is equal to the desired lower limit.
- e. Adjust the input signal source to provide an input value that is slightly more than the desired high limit.
- f. Slowly adjust the high limit potentiometer until the output is equal to the desired high limit.
- g. After step (f) has been completed, remove the input signal to the unit and remove input power.

2.6 CHANGE OF INPUT SIGNAL RANGE

Field modifications may be made to change the range of input values that can be applied to the unit. Use Section 5 for the procedures required to gain access to the printed circuit board, and use Section 6 to obtain component location. Table 2-2 lists the circuit modifications required to change the input range.

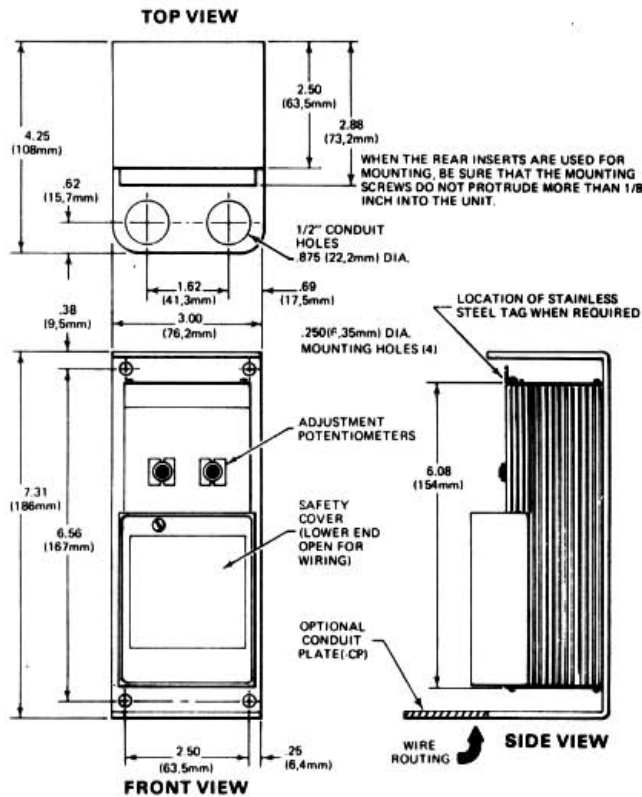
**TABLE 2-2
CIRCUIT MODIFICATIONS**

Input Range	Component	Value
1-5 mA	R3 (R20)	1 K ohms
4-20 mA	R3 (R20)	250 ohms
10-50 mA	R3 (R20)	100 ohms
1-5 Vdc	R3 (R20)	Not Used

INSTALLATION AND OPERATION

3.1 MECHANICAL INSTALLATION

Units may be obtained in various physical configurations. Figures 3-1 through 3-10 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 Dimension

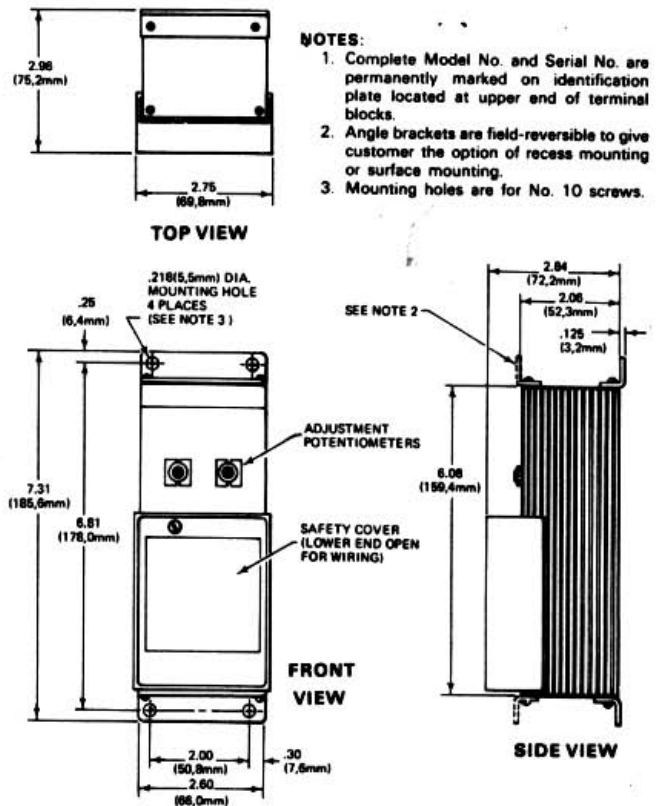


Figure 3-2. Standard Unit with Angle Brackets (AB) Option, Outline and Dimensions

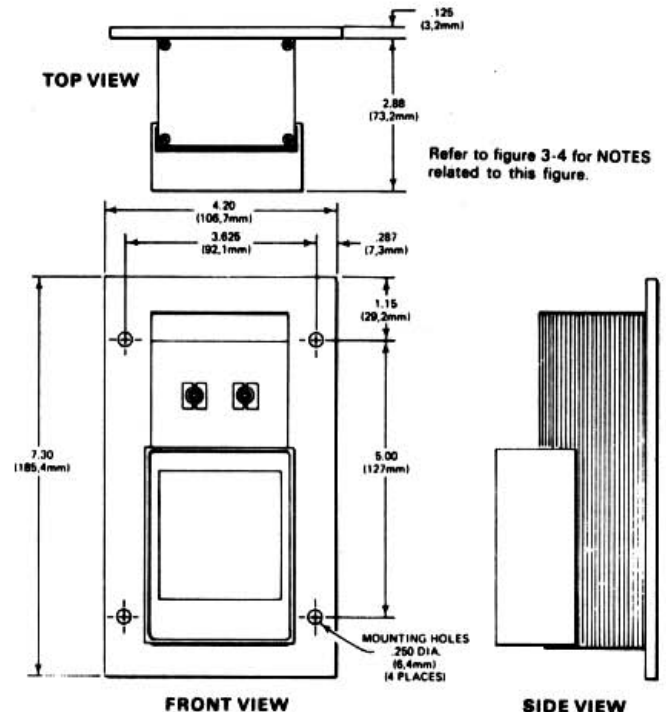
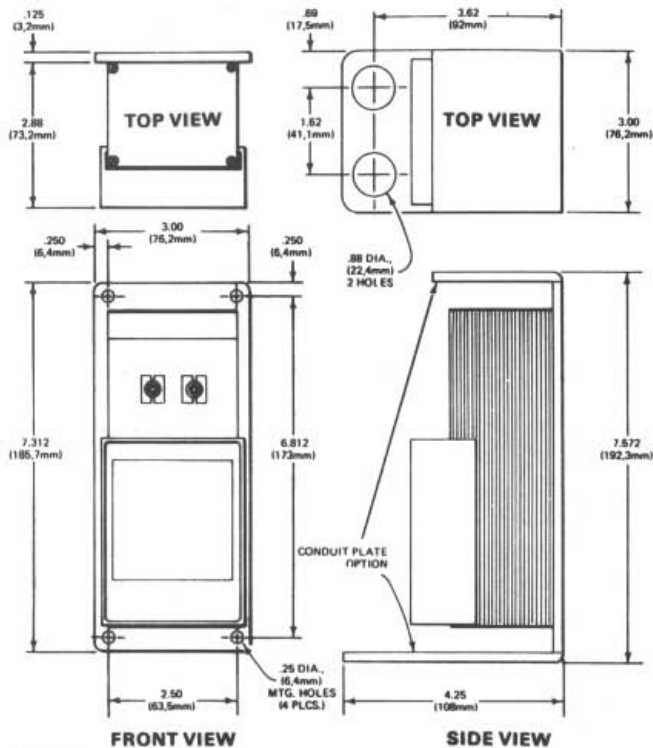


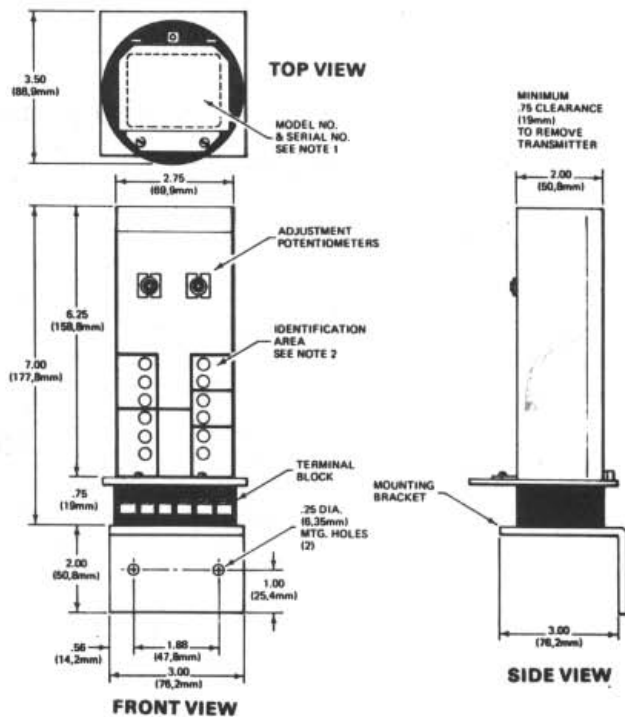
Figure 3-3. Standard Unit, With Adaptor Plate (AA) Option, Outline and Dimensions



NOTES:

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

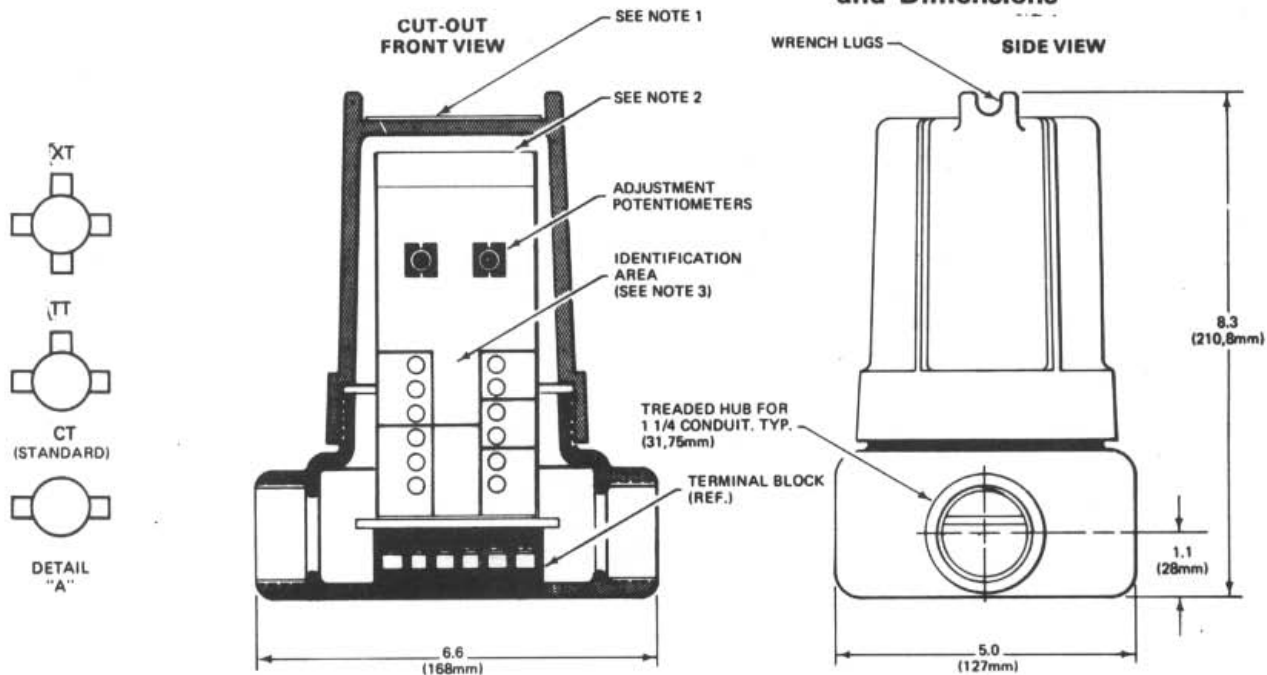
Figure 3-4. Standard Unit, With Adaptor Plate (TA) Option, Outline and Dimensions



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 SD Transmitter (PB) 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. Standard "CT" 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

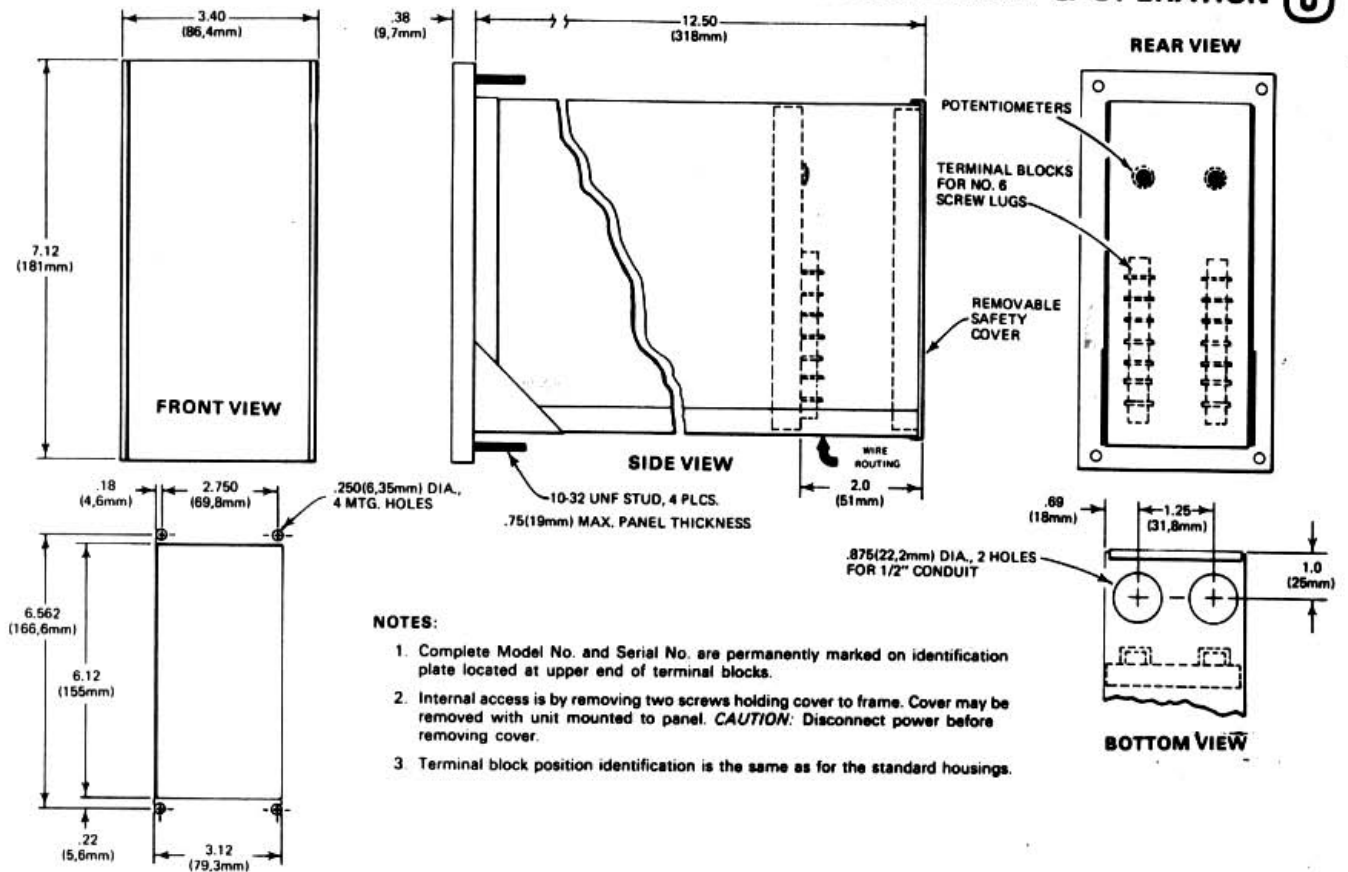


Figure 3-7. Standard Unit with Panel Mount Enclosure (PM) Option, Outline and Dimensions

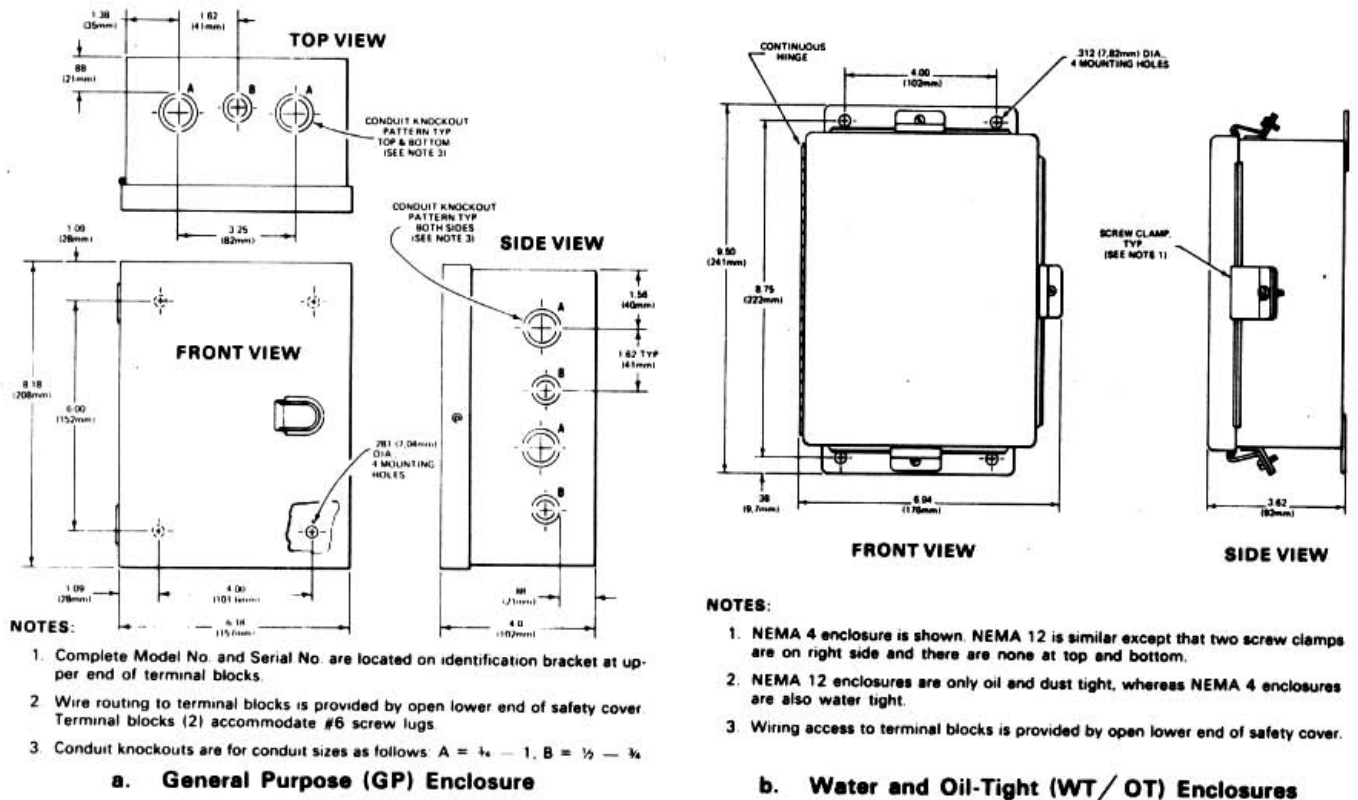
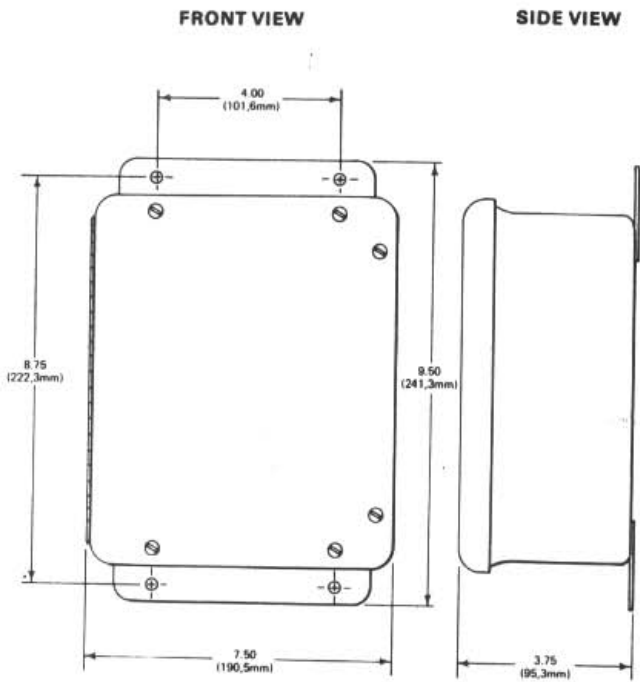


Figure 3-8. Standard Unit in NEMA Boxes, Outline and Dimensions

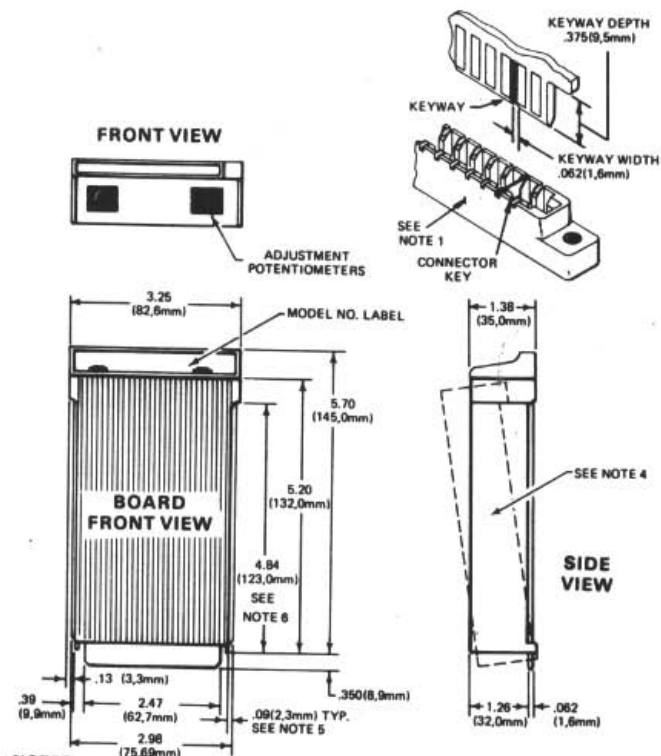


NOTES:

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

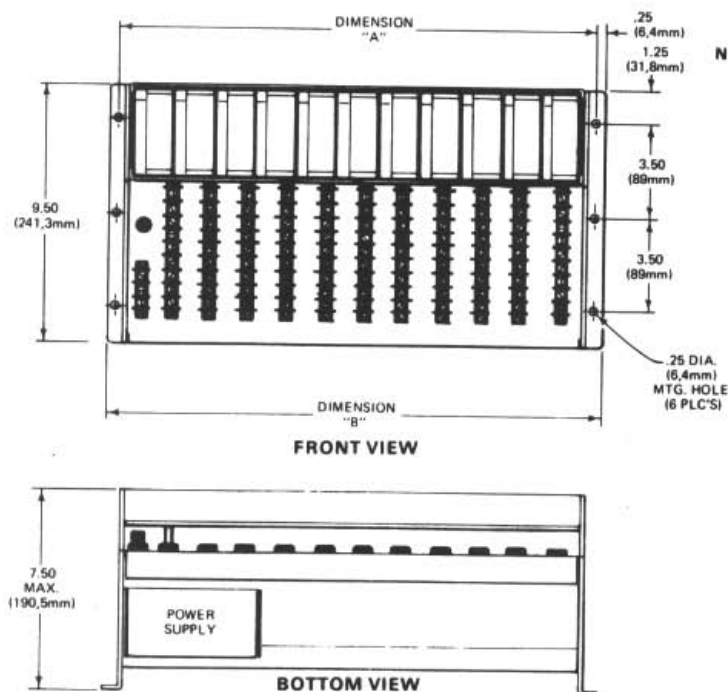
Figure 3-8. Standard Unit in NEMA Boxes, Outline and Dimensions (Cont.)



NOTES:

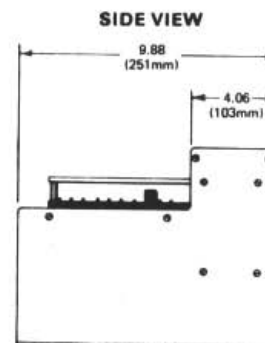
1. Connectors used must have contacts on .156 (3.96mm) centers, with contacts for both surfaces of board (recommended type: Viking part no. 2VK155/1-2).
2. Maximum card insertion depth in connector is .350 (8.89mm).
3. Minimum width of connector insertion slot is 2.470 (62.70mm).
4. Removable plastic 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. M.I.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.

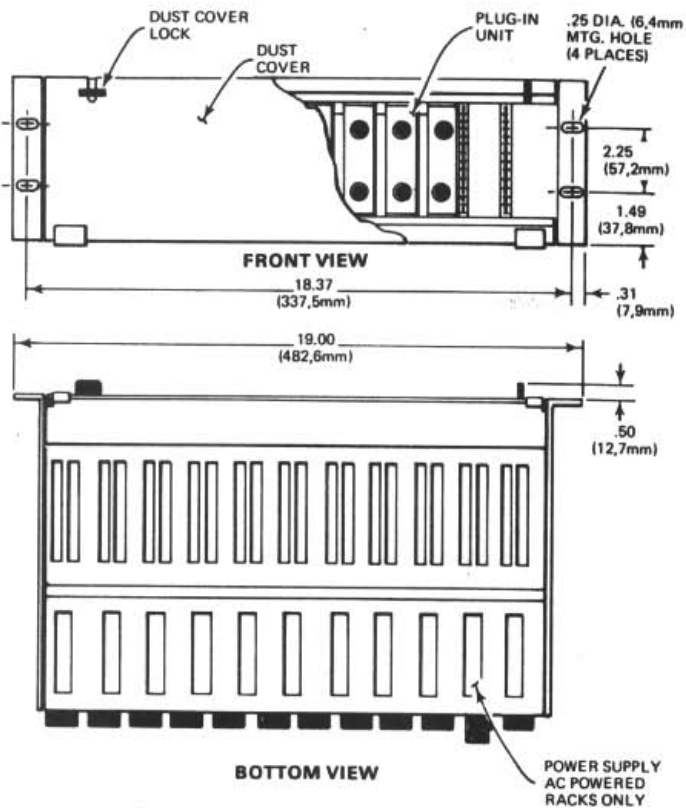


NUMBER OF POSITIONS	DIMENSION			
	A	mm	B	mm
5	9.19	233.4	9.69	246.1
6	10.62	269.7	11.12	282.4
7	12.06	306.3	12.56	319
8	13.50	342.9	14.00	355.6
9	14.94	379.5	15.44	392.2
10	16.38	416	16.88	428.8
11	17.81	452.4	18.31	465
12	19.25	489	19.75	501.7
13	20.69	525.5	21.19	538.2
14	22.12	561.8	22.62	574.5
15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

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

SECTION 3

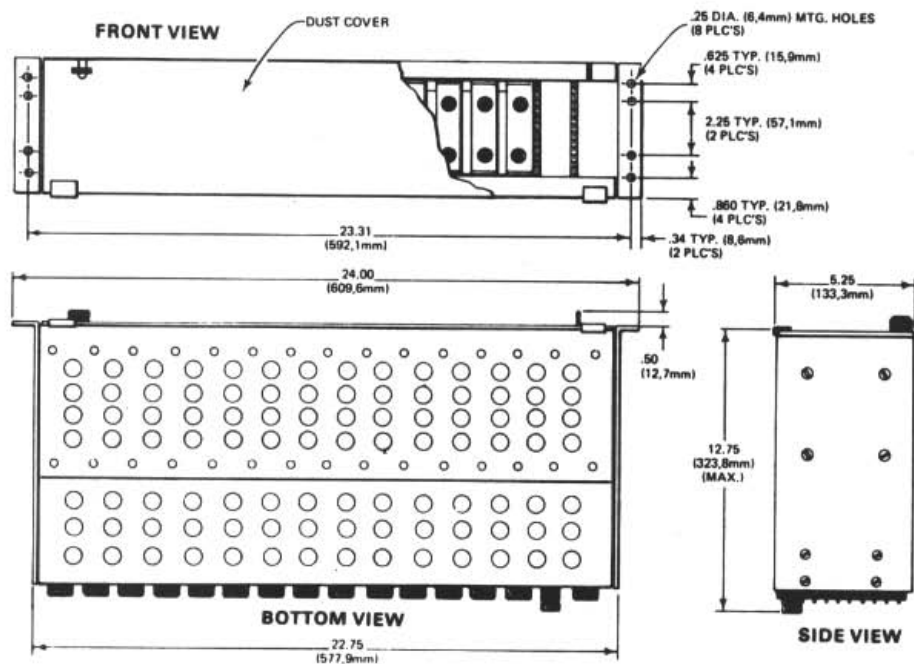
INSTALLATION & OPERATION



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 E.I.A. 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

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 3-11 illustrates the

terminal strip locations and identification for the standard units and the terminal block identifications for the explosion proof and PT 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 PT 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

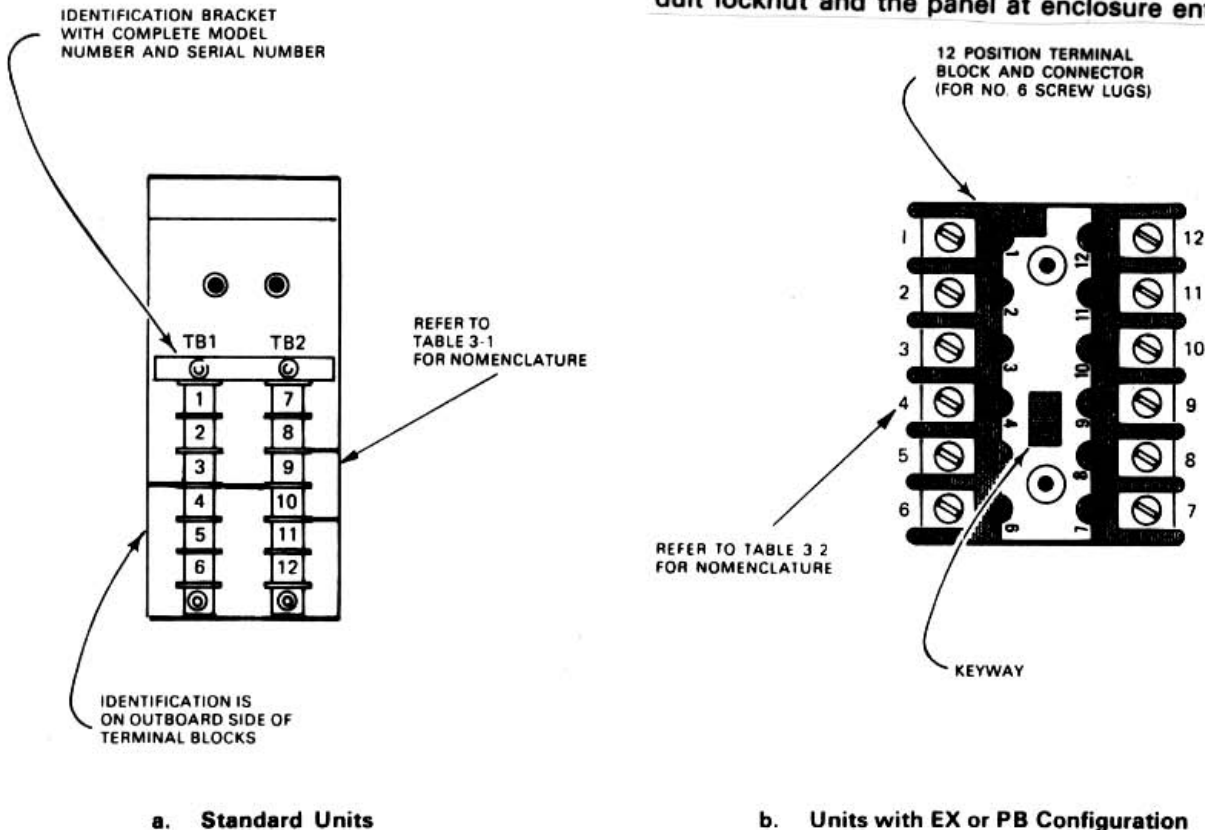


Figure 3-11. Terminal Strips and Terminal Blocks Identification

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. The controls on the outside of the unit are potentiometers, which, after initial adjustments, need no further attention. There are no indicators on the unit. 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	Terminal Positions											
	1	2	3	4	5	6	7	8	9	10	11	12
NONE	—	—	—	DCC	DC	GND	—	—	+IN	-IN	+OUT	-OUT
ALL	—	—	—	DCC	DC	GND	—	—	+IN	-IN	+OUT	-OUT
AC	—	—	—	ACC	AC	GND	—	—	+IN	-IN	+OUT	-OUT

Legend:

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

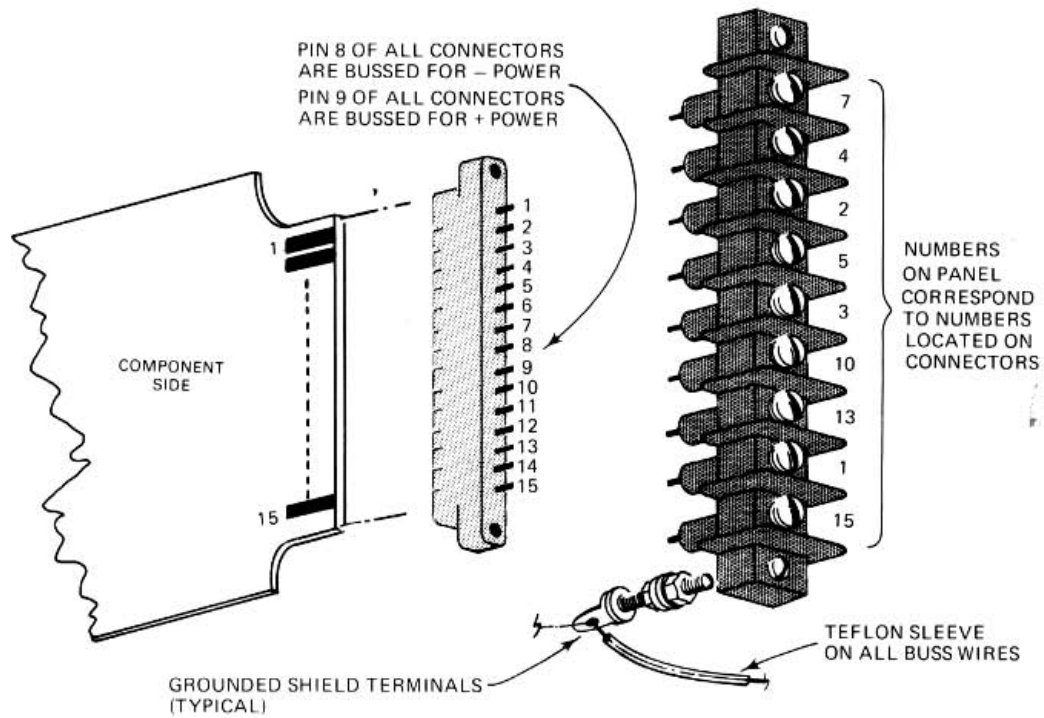


Figure 3-13.
Plug-In Connectors and Terminal Strips Wiring and Identification

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

Options	Terminal Position (See Figure 3-13)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NONE	—	-IN	+IN	+OUT	—	—	-OUT	DCC	DC	-IN	—	—	—	—	—
ALL	—	-IN	+IN	+OUT	—	—	-OUT	DCC	DC	-IN	—	—	—	—	—

Keyways

Legend: DC +DC Power Input ±IN Signal Input
DCC -DC Power Input ±OUT Signal Output

4.1 INTRODUCTION

This section describes the unit operation. An overall view of the unit function based on the block diagram of Figure 4-1 introduces the user to the unit functional elements. This functional analysis is further detailed in the circuit description paragraphs that follow. These descriptions are based on the schematic diagram included in Section 6, Unit Documentation.

A rapid familiarization of the unit can be obtained by reading the general functional description (paragraph 4.2). The paragraphs provide sufficient data so that troubleshooting, if required, can be performed intelligently and rapidly.

Circuit description is provided for both the plug-in and the standard units. If differences in reference designations exist between the two models the plug-in unit reference designator is shown in italics and parentheses immediately following the standard unit reference designator.

4.2 EQUIPMENT FUNCTIONAL DESCRIPTION

The input signal is applied to the non-inverting input of an operational amplifier, which is compared with a feedback signal from an integration circuit. The comparison output signal is sent to the select logic, which produces an output selection of the input signal and the signals which represent either a high or a low

limit setting. When a selection has been made, the resulting signal appears as an input to the integration network whose output is proportional to the input signal but held within the preselected values determined by the limiting function. The limited signal is applied to an output stage where amplification is performed as well as providing adjustment capability for both zero and span.

4.3 POWER SUPPLY CIRCUITS

The power supply is comprised of power transformer T1, the varistor, VS1, and the bridge rectifier circuit CR1 through CR4 (CR7, 8, 9, 10). The varistor is connected across the primary winding of the transformer, and provides transient suppression in the event of a line voltage surge. The output from the center tapped secondary is rectified and filtered before appearing at the input of VR1, which produces an output of +15 Vdc and the -15 Vdc that is used to power the remaining components. An additional secondary winding from the transformer provides the voltage required for the power output stage and is rectified by CR14 through CR17, (CR17, 18, 19, 20) and filtered by capacitor C16 (C9).

When the DC option is specified, a power inverter circuit is used to change the incoming direct current into an alternating voltage which is then applied to the rectifier circuit.

The DC applied to the power inverter input is converted to a square wave of approximately 3 KHz by the components Q1, Q2 and the primary winding of T1 acting as an oscillator. Inductor L1 and capacitor C4 (C2) provide source isolation, while diode CR4 (CR1) provides reverse polarity protection.

4.4 COMPARISON AND LIMITING CIRCUITS

Integrated circuits IC2, 3 and 4 (IC1, 2, 3) perform the input comparison and limiting functions of the circuit. The input signal is compared by IC3 (IC2) with the feedback signal that is derived from the integrator, while IC2 (IC1) performs the comparison between the feedback signal and the high limit potentiometer voltage and IC4 (IC3) performs the comparison with the low limiting voltage. When a comparison is made, by any of the three operational amplifiers, an output is produced which changes state between its zero level and the +15 Vdc positive level to establish the output logic for application to the logic select circuit.

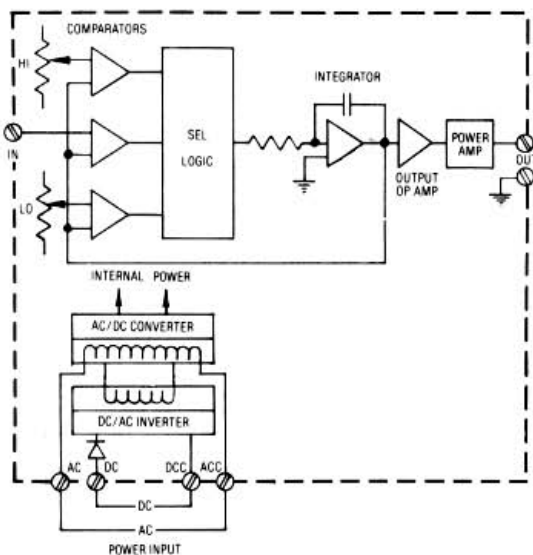


Figure 4-1
Block Diagram

For example, if an applied input signal is within the envelope and is not being limited by either the high or the low limit potentiometer settings, operational amplifier IC3 (IC2) will produce an output that changes state or toggles, indicating a track function. Since limiting is not in effect, the high limit amplifier IC2 (IC1) will produce a constant high level logic output, while the low level amplifier, IC4 (IC3) produces a zero level signal at its output.

4.5 SELECT LOGIC CIRCUIT

The select logic consists of integrated circuit, IC6, (IC4) which is an and/or selection gate that decodes the comparison signals and produces an output of either a logic 1 or a logic 0 which is applied to the integration network. The inhibit function of the select logic is disabled while the enable function is held on to allow gated output dependent only on the selection of two inputs. The signals to the selection circuit will be a combination of the high and the low limiting signals, or either of the limiting signals in combination with the input signal.

4.6 INTEGRATOR

The integrator produces a voltage output that is proportional to the amplitude of the input signal. Integrator feedback is arranged so that it provides a signal to the inverting inputs of

the three operational amplifiers, IC2, 3 and 4 (IC 1, 2, 3) which make up the input limiting and comparison stage.

The integrator produces an output that linearly rises and falls between two limits at a rate that is proportional to the input signal. Because of the very fast transition between the two levels, the integrator output appears as either a fixed positive level, or a fixed zero level. Table 5-1, located in Section 5, illustrates the integrator output at TP3.

4.7 POWER AMPLIFIER CIRCUITS

The DC output signal from the integration network is applied to the non-inverting input of IC7, (IC6) and is summed with the voltage from the ZERO adjust circuit which appears at the inverting input, Pin 2. The resulting output voltage is applied to the power amplifier transistors Q3, Q4 and Q5 and associated components to derive current output. Since the heat dissipation properties are different between the standard unit and the plug in configuration, the output stage used for the plug in module uses only transistors Q3 and Q4 to develop the required drive for current output. When the HI option has been selected, the DC voltage output is derived from the emitter follower circuit of Q4 and its associated components which develop the 1 to 5 Vdc rated at 20 milliamps.

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 $\frac{1}{4}$ 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.

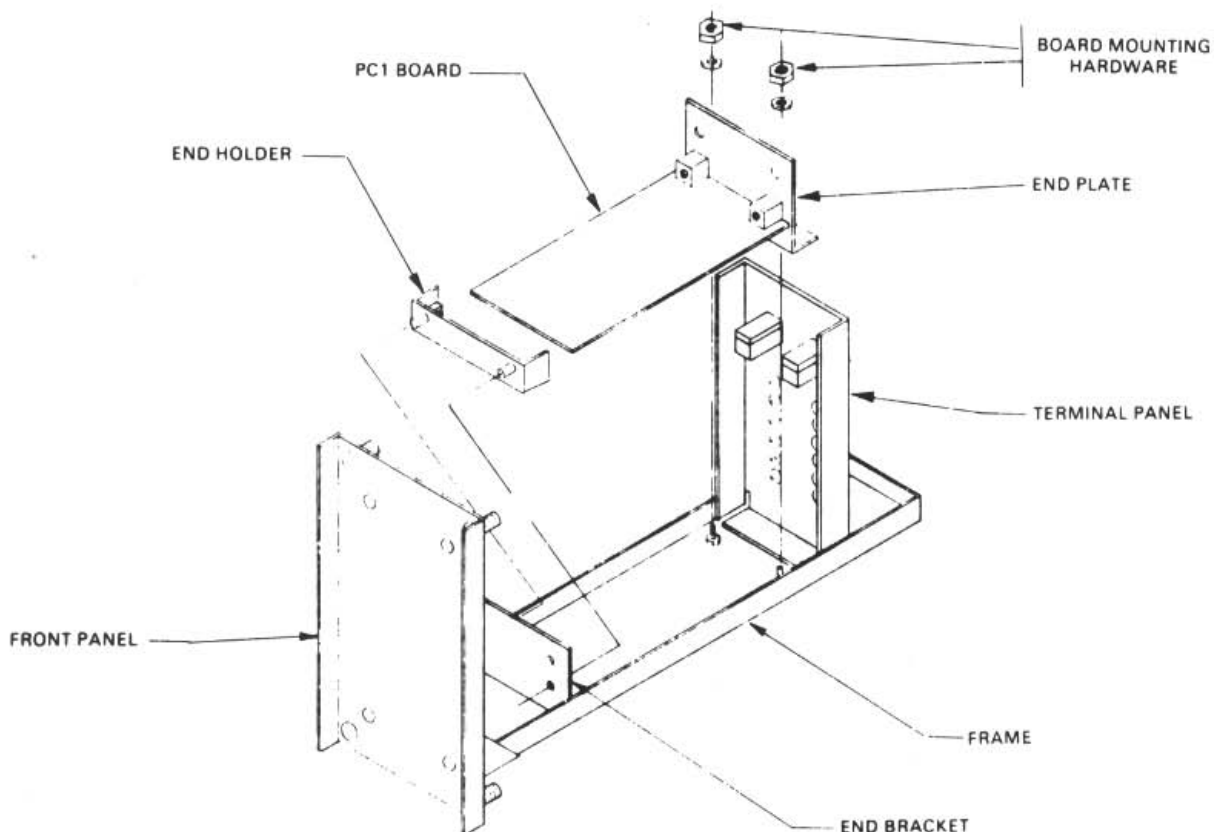
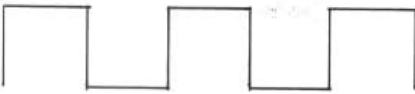
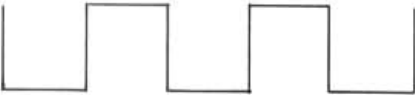
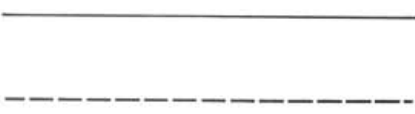
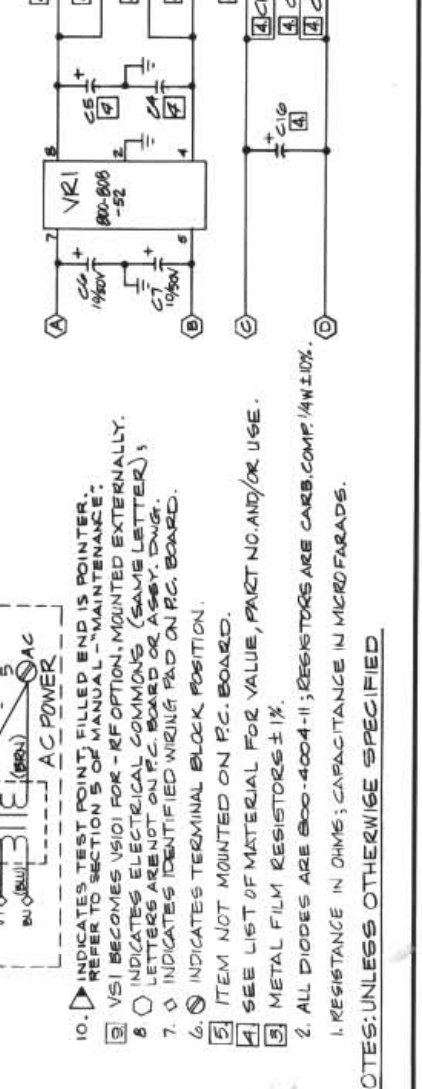
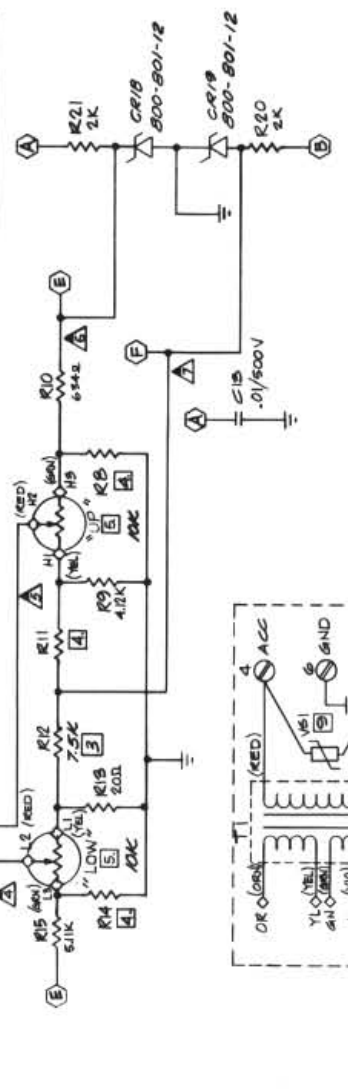
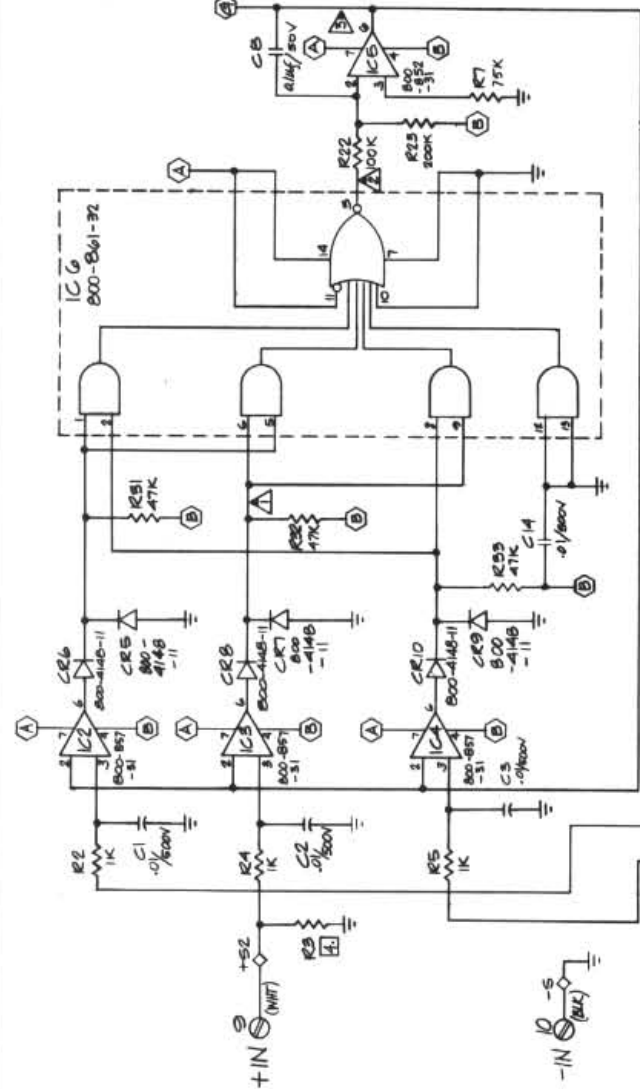
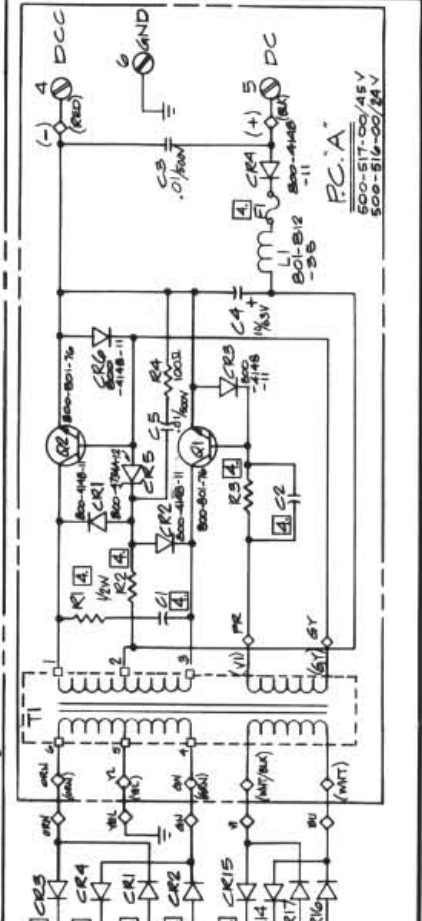
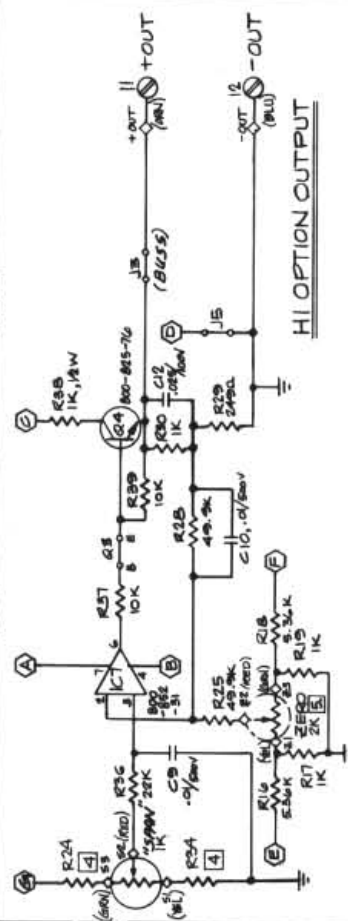
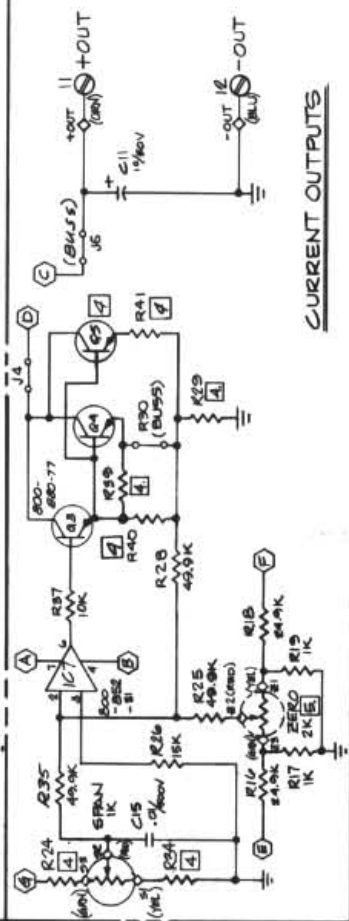
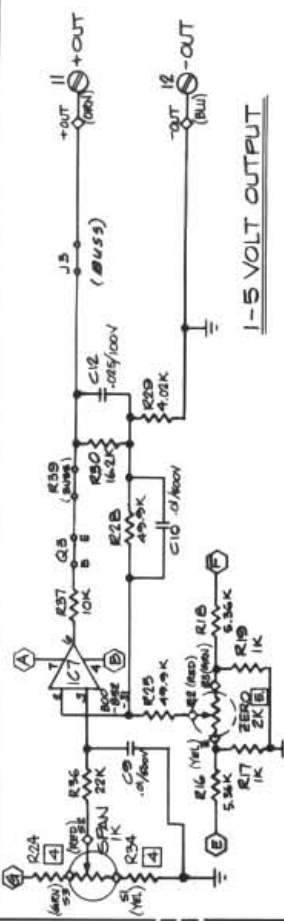


Figure 5-1. Disassembly of PM Units

**TABLE 5-1.
WAVEFORMS AND VOLTAGES**

TEST POINT	WAVEFORM AND VOLTAGE LEVEL
1	 <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> <p>+ 15 Vdc</p> <p>0 Vdc</p> </div> <div style="display: inline-block; vertical-align: middle; margin-left: 20px;"> <p>Zero level indicates low limiting</p> <p>+ 15 Vdc level indicates high limiting</p> <p>Toggle indicates track mode</p> </div>
2	 <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> <p>+ 15 Vdc</p> <p>0 Vdc</p> </div>
3	 <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> <p>+ 5.0 Vdc</p> <p>0 Vdc</p> </div>
4	0 Vdc to +4.0Vdc
5	+ 2.0 Vdc to + 6.0 vdc
6	+ 6.4 Vdc ±10%
7	-6.4 Vdc ±10%



10. \blacktriangle INDICATES TEST POINT FILLED END IS POINTER. REFER TO SECTION 5 OF MANUAL "MAINTENANCE".
11. \square VSI BECOMES VSOI FOR -R OPTION, MOUNTED EXTERNALLY.
12. \circ INDICATES ELECTRICAL COMMONS (SAME LETTER).
13. \circ LETTERS ARE NOT ON PC BOARD OR ASSY. ENG.
14. \circ INDICATES IDENTIFIED WIRING PAD ON PC BOARD.
15. \square INDICATES TERMINAL BLOCK POSITION.
16. \square ITEM NOT MOUNTED ON PC BOARD.
17. \square SEE LIST OF MATERIAL FOR VALUE, PART NO. AND/OR USE.
18. \square METAL FILM RESISTORS $\pm 1\%$.
19. ALL DIODES ARE 800-4004-11; RESISTORS ARE CARB. COMP. 1/4W 10%.
1. RESISTANCE IN OHMS; CAPACITANCE IN MICROFARADS.

NOTES: UNLESS OTHERWISE SPECIFIED



UNITED STATES

DO NOT SCALE DRAWING

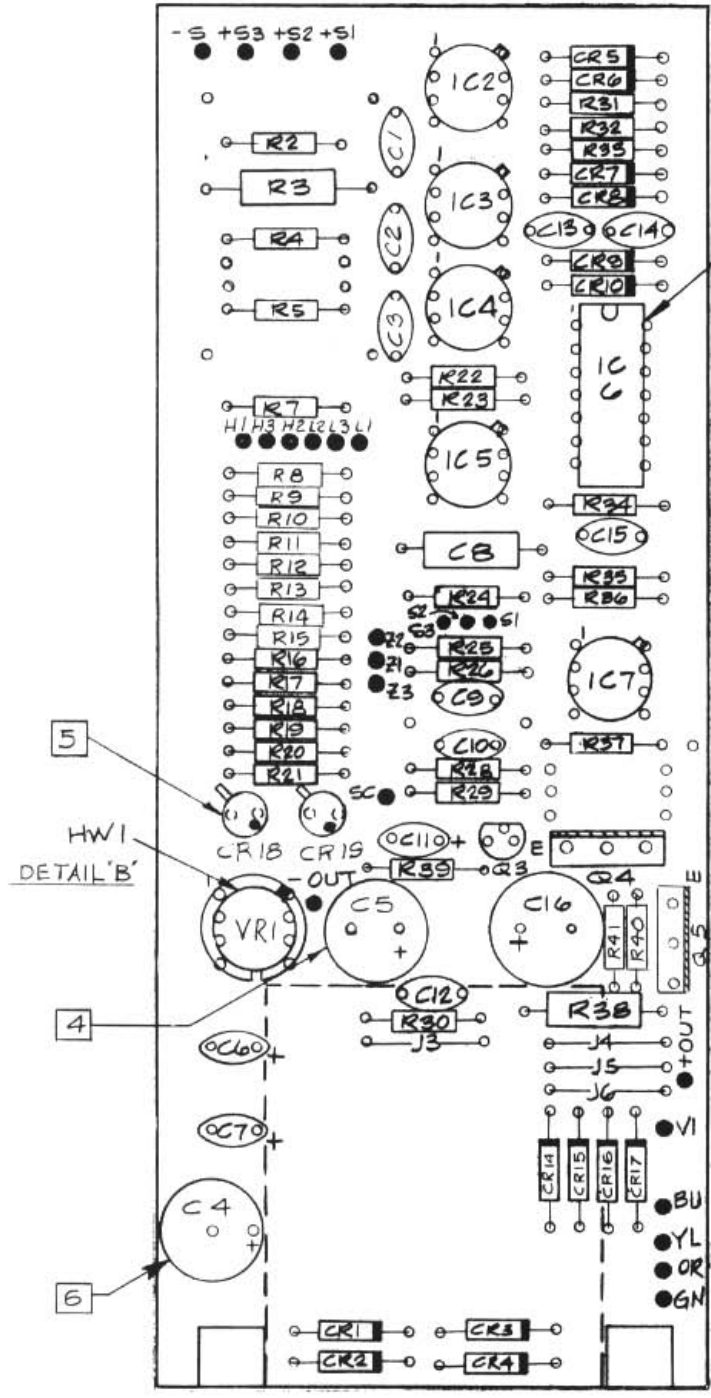
TOLERANCES UNLESS NOTED
X = ±.1
XX = ±.03
XXX = ±.010
ANGLES: 30°
HOLES PER SAE STANDARD
DIMENSIONS IN INCHES

DESIGNED BY G. TESSERS 1/10/78
CHECKED
ENGINEER P 1/14/78
SCALE 2-1

CATEGORY ASSEMBLY
TITLE S.L.M. STANDARD

SHT. 1 OF 2		REVISION
DRAWING NUMBER	122-501-00	E
REVISED BY	ECO 6611	APPROVAL
DATE	12/21/71	BY
		FM

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HW1
DETAIL 'B'

4

6

3 CAUTION

- 6 MOUNT C4 APPROX. 1/4" ABOVE BRD. & OFFSET TO EDGE OF PCB TO CLEAR XFMR. FRAME, (SHOWN, DOTTED)
- 5 NOTE POLARITY DOT, OR SEE DETAIL A
- 4 MOUNT C5 & C16 APPROX. 1/16" ABOVE BRD. & TILT SLIGHTLY TO CLEAR XFMR. FRAME, (SHOWN, DOTTED)
- 3 DO NOT HANDLE LEADS OF IC6 WITH FINGERS, SEE PRODUCTION HANDLING PROCEDURE OR INSTRUCTION MANUAL.

- 2. ALL JUMPER ARE 22AWG BUSS, TEFLON SLEEVED AS REQUIRED.
- 1. ALL LEADS AND TERMINALS MUST BE SOLDERED TO PADS.

NOTES: UNLESS OTHERWISE SPECIFIED

ALTERNATE CR18 & CR19



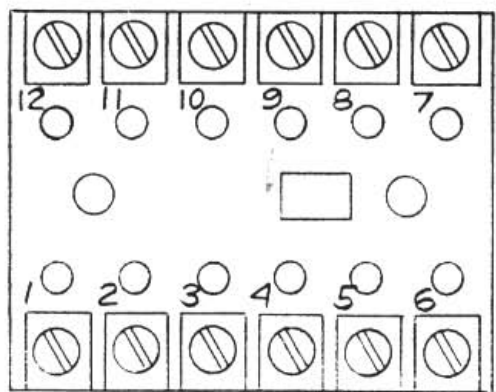
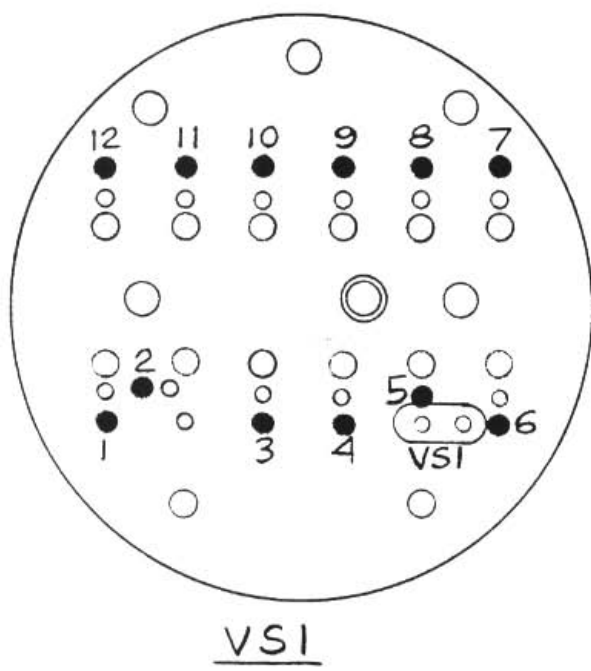
DETAIL 'A'



DETAIL 'B'

SHT. 2 OF 2	
DRAWING NUMBER	REVISION
122-501-00	E
CATEGORY	DATE BY APPROVAL
ASSEMBLY	

ADDITIONAL PARTS
LOCATION,
STD. SLM



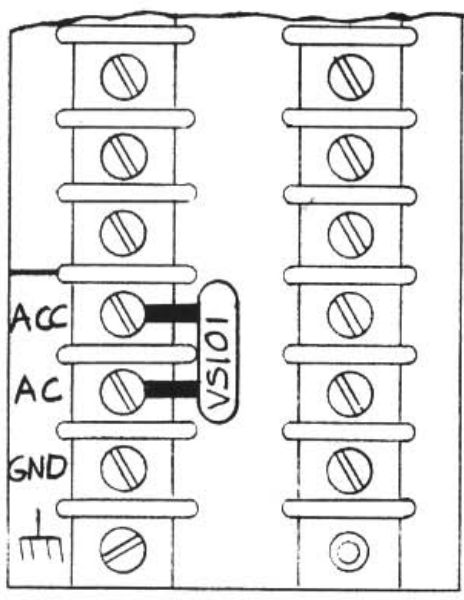
VSI

-"SP" ONLY

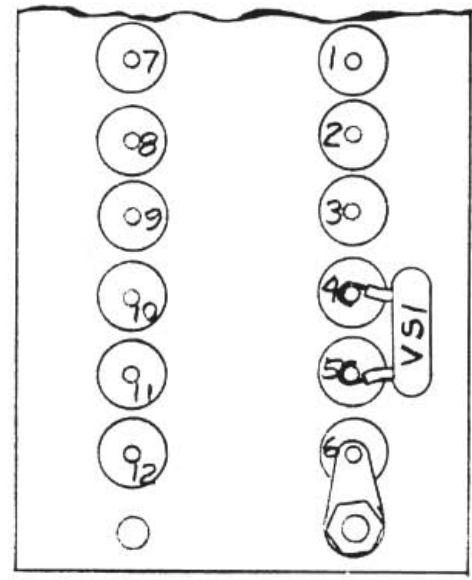
DO NOT SCALE DRAWING

DRAWN	CHECKED	ENGINEER	SCALE
<i>C. FIEDERER</i>	<i>11/30/81</i>		1/1

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



VSI01



VSI

-"SR" ≠ "CH" ONLY

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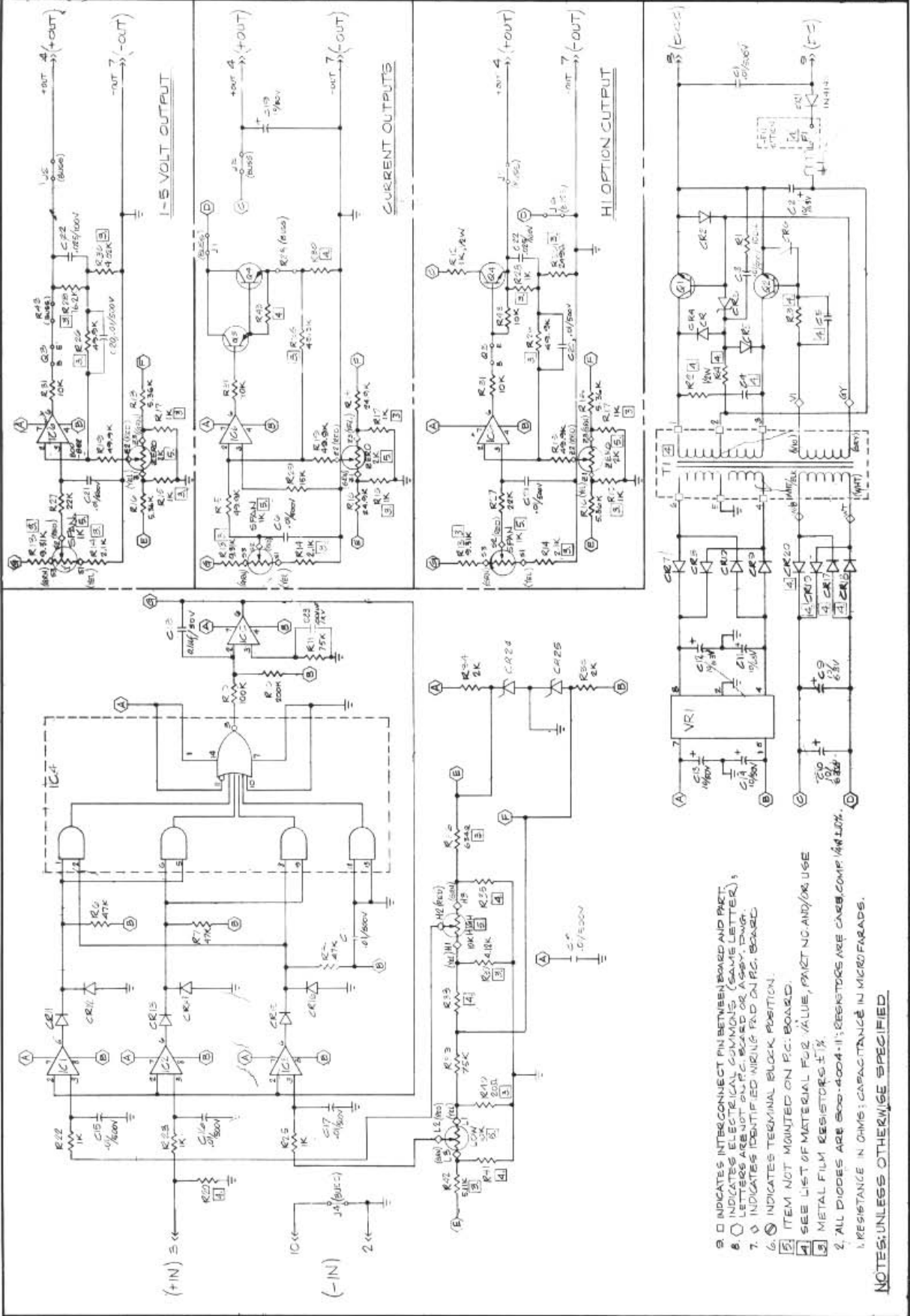
MOORE INDUSTRIES
 16650 Schoenborn Street
 Sepulveda, California 91343

DO NOT SCALE DRAWING

TOLERANCES UNLESS NOTED	DRAWN BY: T. JESSERS	DATE: 7/24/68
.X ±.1	CHECKED:	
.XX ±.03	ENGINEER:	
.XXX ±.010	SCALE: 1/2"	
ANGLES ±30°		

SCHEMATIC
 PLUG-IN
 S L M

DRAWING NUMBER: 122-451-00
 CATEGORY: SCHEMATIC DIAGRAM
 REVISED BY: E.C.O.S. 4/27/5077
 DATE: 7/24/68
 APPROVAL: [Signature]



- 1. RESISTANCE IN OHMS; CAPACITANCE IN MICROFARADS.
- 2. ALL DIODES ARE 800-4004-11; RESISTORS ARE CARB.COMP. 1/4W. 5%.
- 3. METAL FILM RESISTORS 1/4W.
- 4. SEE LIST OF MATERIAL FOR VALUE, PART NO. AND/OR USE.
- 5. ITEM NOT MOUNTED ON PC BOARD.
- 6. INDICATES TERMINAL BLOCK POSITION.
- 7. INDICATES IDENTIFIED WIRE PAD ON PC BOARD.
- 8. UNLESS OTHERWISE SPECIFIED.
- 9. INDICATES ELECTRICAL COMMONS (GIVE LETTER).
- 10. INDICATES INTERCONNECT PIN BETWEEN BOARD AND PRT.

NOTES: UNLESS OTHERWISE SPECIFIED



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

DRAWN BY *G. TESSER* 7/11/78
CHECKED
ENGINEER 7-12-79
SCALE 2/1

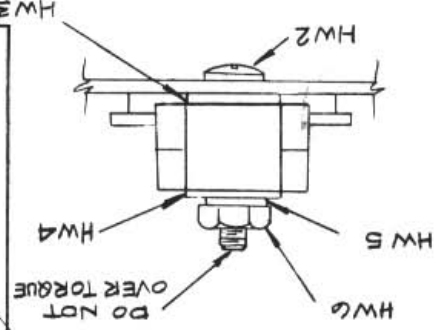
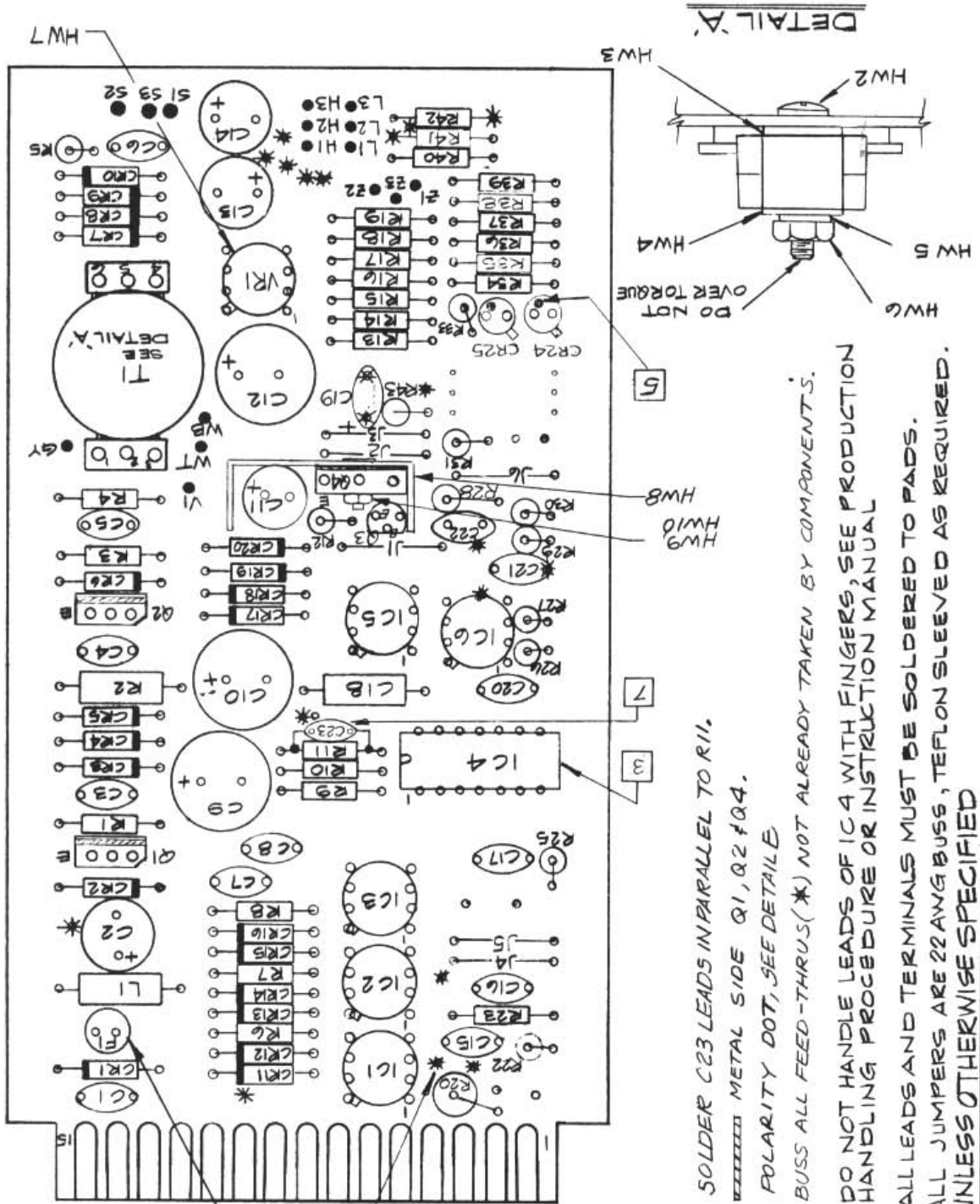
S.L.M.
PLUG-IN

DRAWING NUMBER
122-551-00 C

CATEGORY
ASSEMBLY

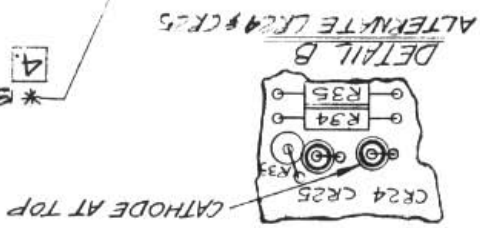
REVISED BY
ECO #6201

DATE 2/1/80
BY JLD
APPROVAL



- 7 SOLDER C23 LEADS IN PARALLEL TO R11.
6. METAL SIDE Q1, Q2 & Q4.
- 5 POLARITY DOT, SEE DETAIL E.
4. BUSS ALL FEED-THRUS (*) NOT ALREADY TAKEN BY COMPONENTS.
3. DO NOT HANDLE LEADS OF IC4 WITH FINGERS, SEE PRODUCTION HANDLING PROCEDURE OR INSTRUCTION MANUAL.
2. ALL LEADS AND TERMINALS MUST BE SOLDERED TO PADS.
1. ALL JUMPERS ARE 22AWG BUSS, TEFLON SLEEVED AS REQUIRED.

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.



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