MOORE INDUSTRIES

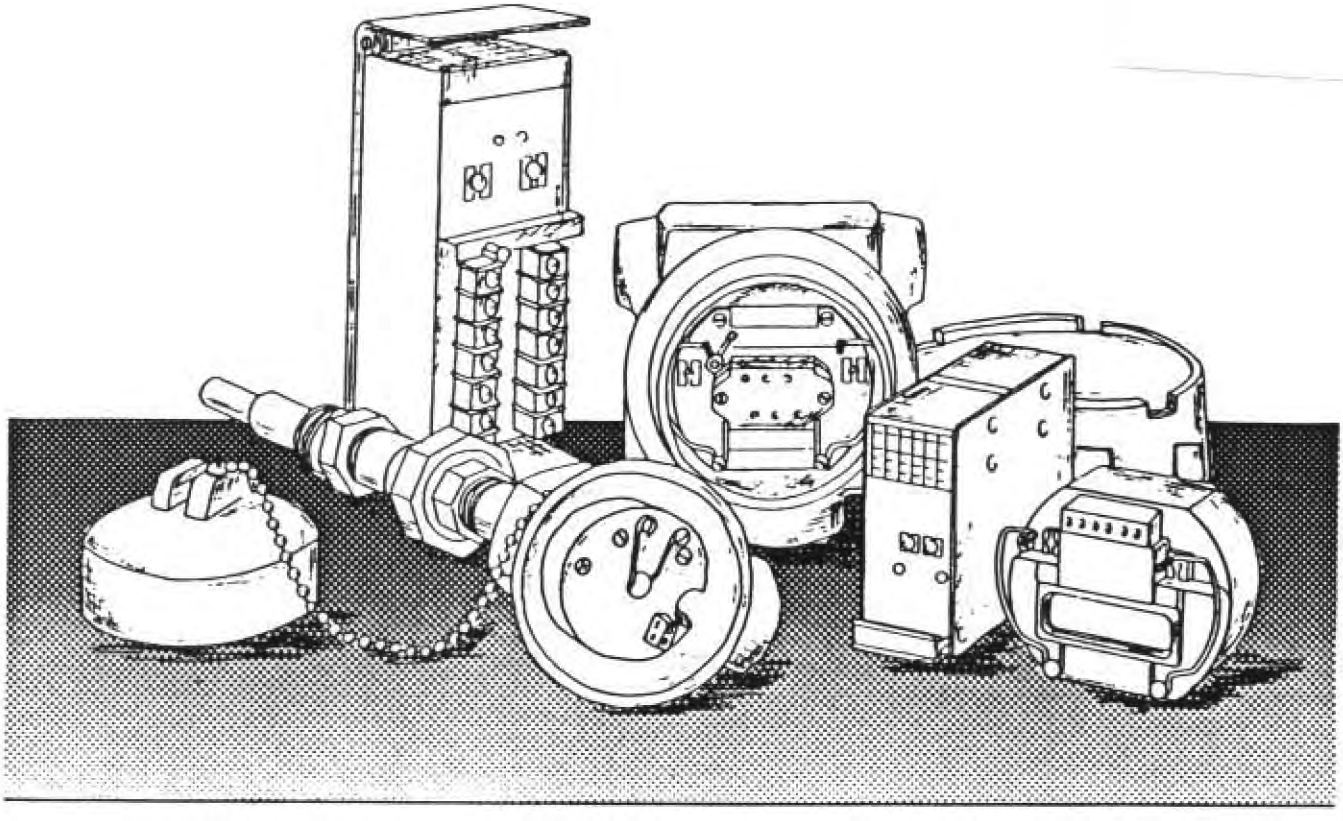
INSTRUCTION MANUAL

ASM

Adder Subtractor Module

Form 194-701-001 B

April 2016



1.0 SCOPE OF MANUAL

This manual contains operating and maintenance information for the Adder-Subtractor Module (ASM) manufactured by MOORE INDUSTRIES INCORPORATED, Sepulveda, California. The manual consists of the following six sections:

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

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

Section 3. Installation and Operation, this section contains mechanical and electrical installation, which includes recommended wiring practices and electrical connections for the unit. An outline of inspection routines is also included.

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

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

Section 6. Unit Documentation, contains schematic diagrams, assembly drawings, and installation and outline drawings.

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

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

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

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

1.1 DESCRIPTION

The Moore Industries Adder-Subtractor Module (ASM) accepts two, three or four standard process input signals and provides an output signal proportional to the input signals (four different configurations include the sum or difference of the inputs). The input may consist of a combination of current and voltage signals; this minimizes the need for preconditioning.

Voltage and/or current input signals are applied to an adder-subtractor circuit that combines the first signal (S1) with the second, third and forth signals (S2, S3 and S4).

1.2 SPEICIFICATIONS

Table 1-1 contains equipment specifications for the ASM. These specifications include options for inputs, outputs, housings and enclosures, and power requirements. Also listed are environmental specifications and equipment ordering information.

1.3 MODEL NUMBER DESCRIPTION AND USE

MOORE INDUSTRIES' model numbers identify the instrument type, functional characteristics, operational parameters, and any options the unit may have. If the unit documentation is missing, the model number can be used to obtain technical information on the unit.

The model number, which is located on the top of the unit, is a permanent reference indicating the type input (e.g., 2X4-20mA = two input signals at 4-20mA) and output (e.g., Z4-20mA (output) = input S1 - S2 divided by two, based on two-input unit) the unit is configured for. Refer to table 1-1 for explanation of input and output nomenclatures.

The following graphic breaks down the ASM model number for configuration and options.

Table 1-1. ASM Specifications

Characteristics

Performance

Frequency Response: 50Hz (3dB point)
Calibration Capability: ±0.5% of span (linearity and repeatability)
Isolation: Voltage output units have input negative side common to output negative side. Current output models have output negative side elevated above input negative side. Power input isolation is maintained on both ac and dc powered units
Temperature Effect: ±0.01%/°F over operating range

Operating Temperature

Ambient: -20°F to +160°F (-29°C to +82°C)

Inputs

Input signals may be any combination of standard inputs
Current:
1-5mA into 1000 ohms
4-20mA into 250 ohms
10-50mS into 100 ohms
Voltage: 0-5V, 1-5V (use 1-5V signal range for interconnection of two or more modules); 250K ohms minimum input impedance; other voltages optional
Input Options: 2, 3, or 4

Outputs

Operational amplifier feedback current source; output limited to 150% of maximum output range value
Current:
1-5mA into 0-4800Ω load
4-20mA into 0-1200Ω load
10-50mA into 0-480Ω load

Outputs (Continued)

Voltage: 1-5Vdc standard into 20K ohms minimum
Functions:
Output W = A+B+C+D
Output X = A+B+C-D
Output Y = A+B-C-D
Output Z = A-B-C-D
Output Formula:

$$\text{Output} = \frac{A \pm B \pm C \pm D}{\text{No. of ADD Inputs}}$$

***Note:** In subtractive configurations, net must always be positive*
Ripple: 10mV P/P at maximum span and load resistance
Load Effect: ±0.01% of span from 0 to maximum load resistance (current output)

Adjustments

Multi-turn potentiometers
Span: With full scale input, adjusts output to 100% (±20%) of selected output span
Zero: With minimum input, adjusts to 0% ± 10% of selected output span

Power

117Vac, 240Vac, 50/60Hz (±10%)
24Vdc, 45Vdc (±10%)
5 watts nominal
Line Effect: ac or dc; ±0.005%/1% line change

Weight

Approximately 2 lbs (908 grams)

Ordering Specifications

Unit **ASM**

Inputs

2X = two signals
3X = three signals
4X = four signals

Inputs (Continued)

1-5V
1-5mA
4-20mA
10-50mA
0-5V (cannot be mixed with any other inputs)

Outputs

Function Code: W, X, Y, or Z
1-5V
1-5mA
4-20mA
10-50mA
0-5V

Power

24Vdc
45Vdc
117Vac
220Vac
240Vac
(ac power option not available with Plug-in Card)

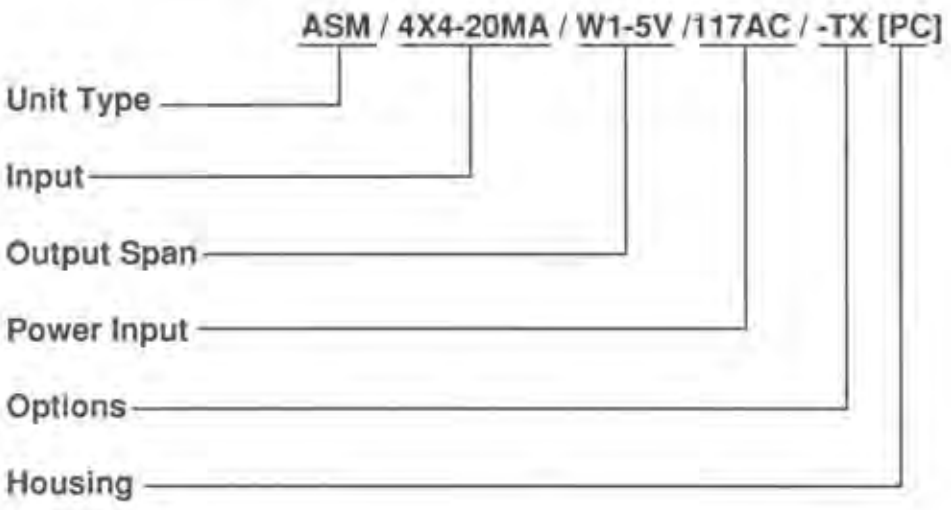
Options

-TX: Two-wire transmitter excitation 35Vdc @ 25mA output to two-wire field transmitter, 4-20mA only
-RF: RFI/EMI
-KO: Internal "K" factor (factory set)

Housings

STD: Standard enclosure (see figure 5-1)
AB: Angle bracket mounting
CP: Conduit plate for use with standard units
EX: Explosion-proof enclosure; Single unit - Div. 1
GP: General purpose enclosure; Single unit - NEMA 1
OT: Oil-tight enclosure; Single unit - NEMA 12
PC: Plug-in Card
PM: Panel mount enclosure
WT: Water-tight enclosure; Single unit - NEMA 4

When ordering, specify: Unit/ Input/Output/Power/Options [Housing]
Example: ASM/4X4-20MA/W1-5V/117AC/ -TX [STD]



1.4 SERIAL NUMBER USE AND LOCATION

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

2.0 CALIBRATION

This section contains adjustment and calibration information for the ASM module. Each unit is adjusted and checked at the factory for proper performance prior to shipment. However, input and output values for each unit should be checked, on site, before the equipment is placed into service. Refer to paragraph 1.3 and table 1-1, section 1.0, for minimum and maximum input and output values.

2.1 TEST EQUIPMENT SET-UP

After an Adder-Subtractor Module is unpacked, general operating level checks are recommended. The test equipment must be provided by the user. Two or more adjustable input signal sources and input monitoring devices, and an output monitoring device are required for calibration. The number of input signal sources (and input monitoring devices) required is the same as the actual number of inputs (up to four) that will be applied to the unit when it is installed. The monitoring devices (current or voltage) must have an accuracy to within ±0.05% or better. See Table 2-1.

To calibrate the Model ASM, proceed as follows:

1. Connect the unit and test equipment as shown in Figure 2-1, using the specified number of input signal sources.
2. Make sure all input signal sources are adjusted to zero output.
3. Refer to Table 2-2 and locate the output equation for your unit. Adjust the input signal sources applied to S1-S4 (if applicable) as indicated in the table to obtain 0% output. Use the minimum and maximum input signals that will actually be applied to the unit when it is installed.
4. With the input signals applied to the unit (step 3), adjust the ZERO potentiometer to obtain 0% output (e.g., 1mA, 4mA, 1Vdc, etc.) output from the unit.
5. Using the same line as used in step 3, adjust the signal sources applied to S1-S4 (if applicable) as indicated to obtain 100% output (e.g., 5mA, 20mA, 5V, etc.). Use the minimum and maximum input signals that will actually be applied to the unit when it is installed.
6. With the input signals applied to the unit, (step 5), adjust the SPAN potentiometer to obtain 100% output from the unit.
7. Repeat steps 3 through 6 until no further adjustment of either the ZERO or SPAN potentiometer is required.
8. Use Table 2-3 to check the linearity of the unit. Adjust the inputs to the indicated percentage of SPAN above minimum for the appropriate output function. Check that the outputs agree (to within ±0.25%) with the indicated percentages of maximum.
9. Remove the input signals and turn the power to the unit off.

Table 2-1. *Test Equipment and Tools Required*

Equipment or Tool	Characteristic	Purpose
Screwdriver (flat-head)	Blade width no greater than 0.1 inch (2.54mm)	Zero and Span front panel control adjustment
Adjustable dc signal source	Must be capable of producing signal ranges defined by input level requirements of purchased unit	Simulate input signal
DC Voltmeter	Must be accurate to within ±0.05% or better	Input/output signal monitoring (voltage only)
DC Milliammeter	Must be accurate to within ±0.05% or better	Input/output signal monitoring (current only)

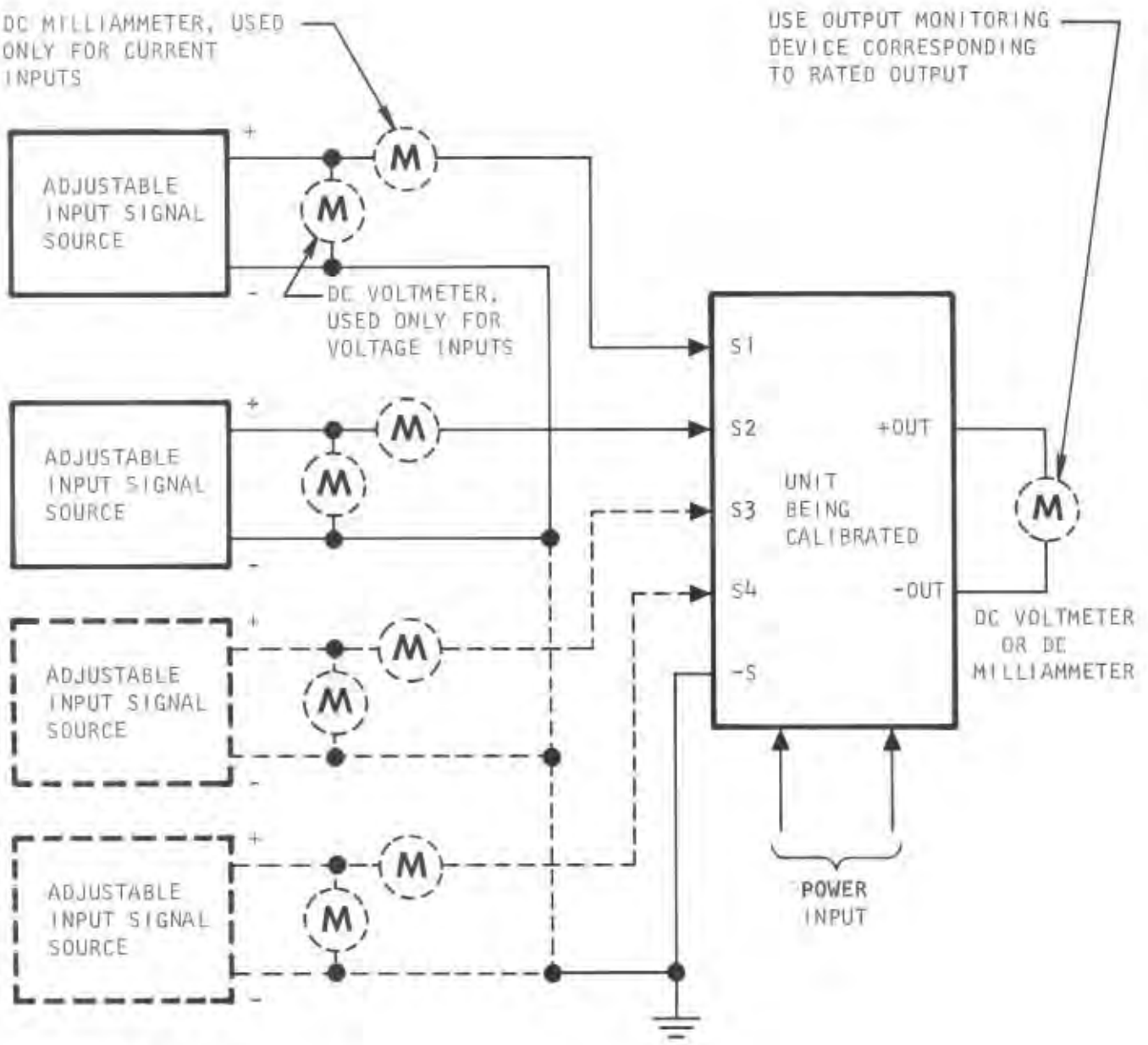


Figure 2-1. Test Equipment Setup for Calibration

Table 2-2. Input Signals for Zero and Span Adjustments

OUTPUT FUNCTION	0% OUTPUT				100% OUTPUT			
	S1	S2	S3	S4	S1	S2	S3	S4
OUTPUT = K(S1+S2+S3+S4)	MIN	MIN	MIN	MIN	MAX	MAX	MAX	MAX
OUTPUT = K(S1+S2+S3−S4)	MIN	MIN	MIN	MIN	MAX	MAX	MAX	MIN
OUTPUT = K(S1+S2−S3−S4)	MIN	MIN	MIN	MIN	MAX	MAX	MIN	MIN
OUTPUT = K(S1−S2−S3−S4)	MIN	MIN	MIN	MIN	MAX	MIN	MIN	MIN
OUTPUT = K(S1+S2+S3)	MIN	MIN	MIN	—	MAX	MAX	MAX	—
OUTPUT = K(S1+S2−S3)	MIN	MIN	MIN	—	MAX	MAX	MIN	—
OUTPUT = K(S1−S2−S3)	MIN	MIN	MIN	—	MAX	MIN	MIN	—
OUTPUT = K(S1+S2)	MIN	MIN	—	—	MAX	MAX	—	—
OUTPUT = K(S1−S2)	MIN	MIN	—	—	MAX	MIN	—	—

Table 2-2. Input Signals for Linearity Check

OUTPUT FUNCTION	S1	S2	S3	S4	OUTPUT
OUTPUT = K(S1+S2+S3+S4) W	100% 75% 50% 25% 0%	100% 75% 50% 25% 0%	100% 75% 50% 25% 0%	100% 75% 50% 25% 0%	100% 75% 50% 25% 0%
OUTPUT = K(S1+S2+S3−S4) X	100% 25% 25% 25% 25%	100% 100% 25% 25% 25%	100% 100% 100% 25% 25%	0% 0% 0% 0% 75%	100% 75% 50% 25% 0%
OUTPUT = K(S1+S2−S3−S4) Y	100% 50% 50% 25% 25%	100% 100% 50% 25% 25%	0% 0% 0% 0% 25%	0% 0% 0% 0% 25%	100% 75% 50% 25% 0%
OUTPUT = K(S1−S2−S3−S4) Z	100% 75% 50% 50% 75%	0% 0% 0% 25% 25%	0% 0% 0% 0% 25%	0% 0% 0% 0% 25%	100% 75% 50% 25% 0%
OUTPUT = K(S1+S2−S3) X	100% 75% 75% 50% 25%	100% 75% 75% 25% 25%	0% 0% 25% 50% 50%	— — — — —	100% 75% 62.5% 25% 0%
OUTPUT = K(S1−S2−S3) Z	100% 100% 100% 75% 50%	0% 25% 25% 25% 25%	0% 0% 25% 25% 25%	— — — — —	100% 75% 50% 25% 0%
OUTPUT = K(S1−S2) Z	100% 100% 75% 75% 50%	0% 25% 25% 50% 50%	— — — — —	— — — — —	100% 75% 50% 25% 0%

3.0 INSTALLATION AND OPERATION

The model ASM is available in several physical configurations and or enclosures. Installation details can be found on the Outline and Installation drawing contained in Section 6.0. Observe any special procedures and precautions given with the installation.

3.1 MECHANICAL INSTALLATION

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

3.2 ELECTRICAL CONNECTIONS

On standard and explosion-proof units, all electrical connections are made to terminal blocks on the module. On plug-in units, the electrical connections are made to terminals on the mating connector for the module.

Special wiring or cabling is not required for signal connections to the unit. To avoid transients and stray pick-ups, it is recommended that twisted conductors be used when they run close to other services (such as power wiring). For units housed in a NEMA enclosure, run all wiring up through the opening in the bottom of the snap off cover. Spade lug connectors are recommended for all wire terminations.

The Model ASM can operate from either an ac or dc power source. Refer to the model number on your unit to determine the type of power required (see paragraph 1.3 for further information).

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

AC Units: the AC terminal is connected to the ungrounded or "hot" side of the power source; the ACC terminal is connected to the neutral or common side. The GND terminal is the mechanical case connection. The 117 volt ac source should be regulated to within ± 10% of the nominal voltage, 50/60Hz, 5VA nominal power is required.

3.3 OPERATION AND PERIODIC INSPECTION

Once adjusted and installed, the unit operates unattended. The SPAN and ZERO potentiometers need no further adjustment after initial installation adjustments. Because the unit uses highly reliable solid-state components, the ASM operates maintenance free for extended periods of time. If at a future time, a malfunction is isolated to the ASM, refer to the troubleshooting procedures in Section 5.0.

The ASM may become warm during operation, especially where the ambient temperature is above normal. This is acceptable and should not cause alarm unless a malfunction is also observed.

4.0 THEORY OF OPERATION

This section describes the operation of Model ASM, based on the simplified schematic diagram in Figure 4-1. A detailed schematic can be found in Section 6.0, Unit Documentation. The purpose of this description is to show how signals are processed through the unit; this can be used to troubleshoot the data loop if a malfunction should occur.

4.1 OPERATION

Power Supply Circuit (AC only): In the ac operated unit, the power supply consists of a power transformer rectifier and a filter to develop the dc output. The applied ac power is filtered by VS1, thus preventing line noises and spikes from getting into the unit. The output from center top secondary 8-10-13 is rectified by diodes CR5 through CR8 and the resultant ripple dc voltage is filtered by C1 and C2. Zener diode CR3 regulates the +15 volt supply and zener diode CR4 regulates the −15 volt supply. Voltage across secondary winding 16-17 is rectified by diode CR9, filtered by C3 and provided at point C as the +38 volt supply.

Power Inverter Circuit: The dc applied to the power inverter is converted to a 3KHz square wave by Q1, Q2 and the primaries of T1. Inductor L1 and capacitor C5 prevent any ac from feeding back to the dc source. Diode CR10 provides reverse input voltage protection. The output from center tapped secondary 8-10-13 is rectified by diodes CR5 through CR8 and the resultant ripple voltage is filtered by C1 and C2. Zener diode CR3 regulates the +15 volt supply and zener diode CR4 regulates the −15 volt supply. The voltage from secondary winding 16-17 is rectified by diode CR9, filtered by C3 and provided at point C as the +38 volt supply.

Adder/Subtractor Circuit: The addition/subtraction function is accomplished by operational amplifier IC1, IC2 and their associated components. Voltage or currents to be added or subtracted are applied to inputs S1 through S4. The inputs to be subtracted are applied to the inverting inputs of IC2. The inverted output is summed at the inverting input of IC1 with the voltages to be added. Consequently, the output of IC1 is proportional to the combination of added and subtracted input voltages. Resistor R31 provides feedback for IC1 and thereby determines the gain of the amplifier. Integrated circuits IC1 and IC2 are operated from +15 and −15 volt supplies.

Operational Amplifier IC3 Circuit: The input to IC3 is the output from IC1. Feedback for IC3 is taken through R19, the SPAN potentiometer and R20. The gain of IC3 and the 100% output of the unit is set by the SPAN potentiometer. Zero percent adjustment or minimum output is set by the ZERO potentiometer. The ZERO potentiometer is connected as part of a voltage divider network consisting of CR2, R10, R9 and CR1. The output of IC3 is applied to the input of the power amplifier through resistor R14, which also protects IC3 from damage if the output terminals are short circuited. Integrated circuit IC3 is operated from +15 and −15 volt supplies.

Power Amplifier Circuit: The power amplifier consists of Q4 and Q5 connected as a Darlington array for the current output configuration. Current output is taken across +OUT and −OUT. For the voltage output configuration, the output of IC3 is fed directly to +OUT with reference to −OUT. The output amplifier in both the current and voltage configurations operates from the +38 volt supply. In units with the –SC option, the selectable current output resistor replaces R20.

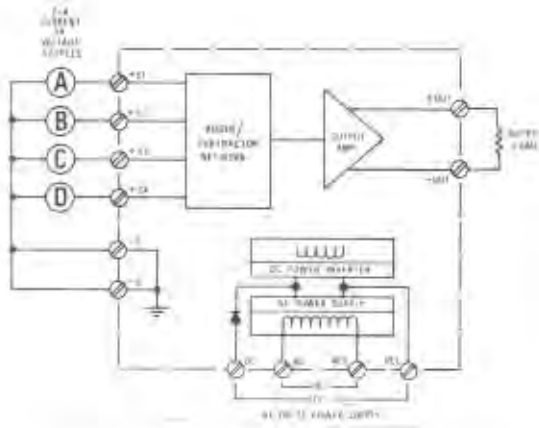


Figure 4-1. ASM Block Diagram

5.0 MAINTENANCE AND TROUBLESHOOTING

This section contains information on maintenance and troubleshooting of the unit. After following these procedures, if any unit is found to be performing below specifications, the unit should be returned to the factory for service in accordance with the instructions found on the inside back cover of this manual. In an emergency, the user may contact the Customer Service department for verbal assistance in diagnosing and repairing an Adder-Subtractor Module problem.

5.1 MAINTENANCE

The design of the ASM limits maintenance primarily to keeping the input and output terminals and conductors clean and tight while maintaining a heat conduction path to a suitable heat sink.

A thorough cleaning of the terminal block requires complete module disassembly and should only be done at the factory. It is recommended that the user check the terminations every six months of service to verify that they are secure and free of oxidation.

5.2 TROUBLESHOOTING

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

1) Verify that all electrical connections are clean and tight.

2) Verify that the measuring instrument used for input/output current is of the proper range and accuracy.

3) Verify that the output circuit is electrically isolated from the input circuit.

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

6.0 UNIT DOCUMENTATION

This section contains the drawings necessary to install, configure, and maintain the ASM module. Outline drawings for the standard unit and plug-in card are provided here for installation purposes. Also illustrated in this section are the schematic diagrams and relevant assembly drawings. Refer to table 1-1, section 1.0, for unit specifications.

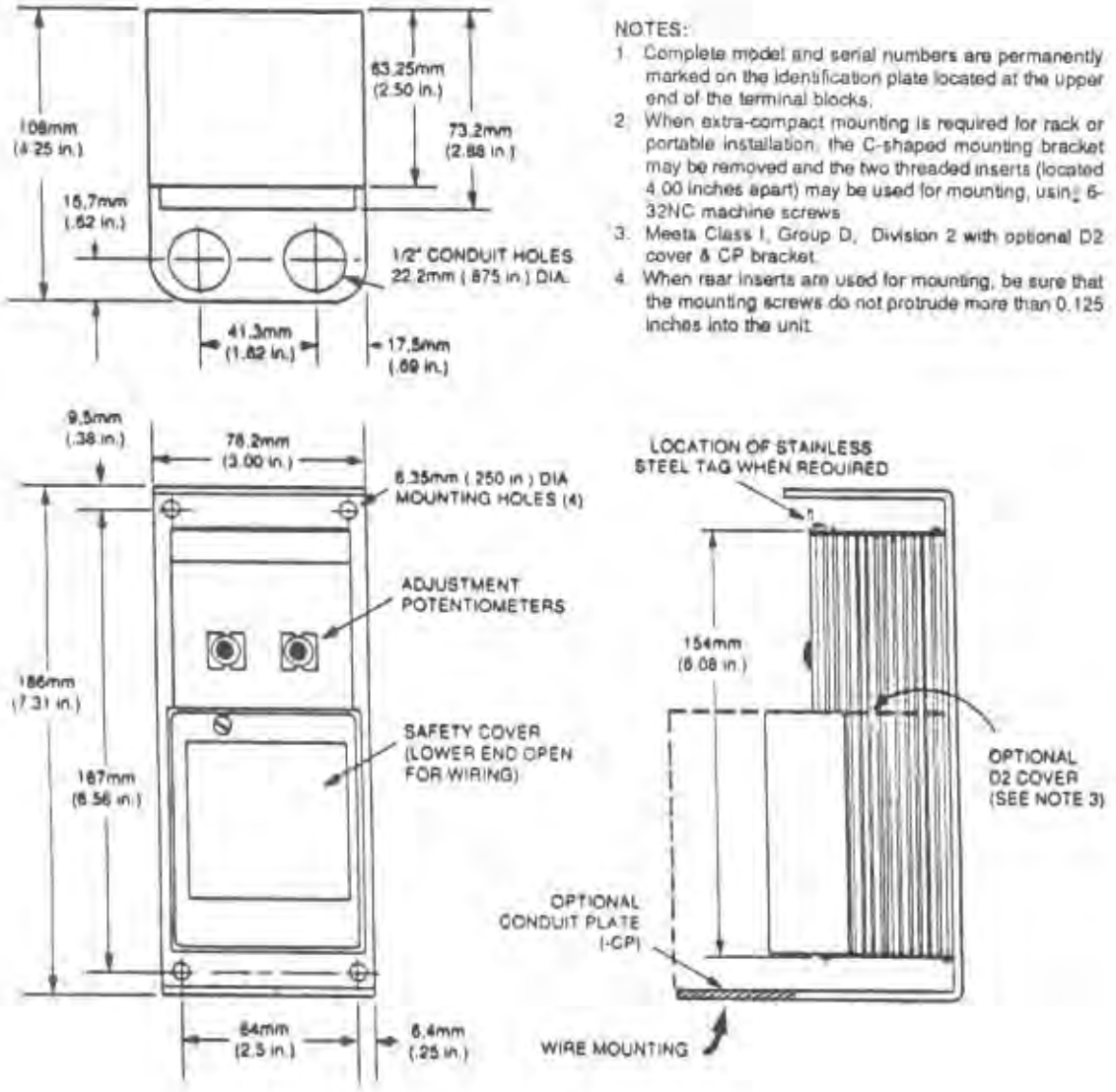
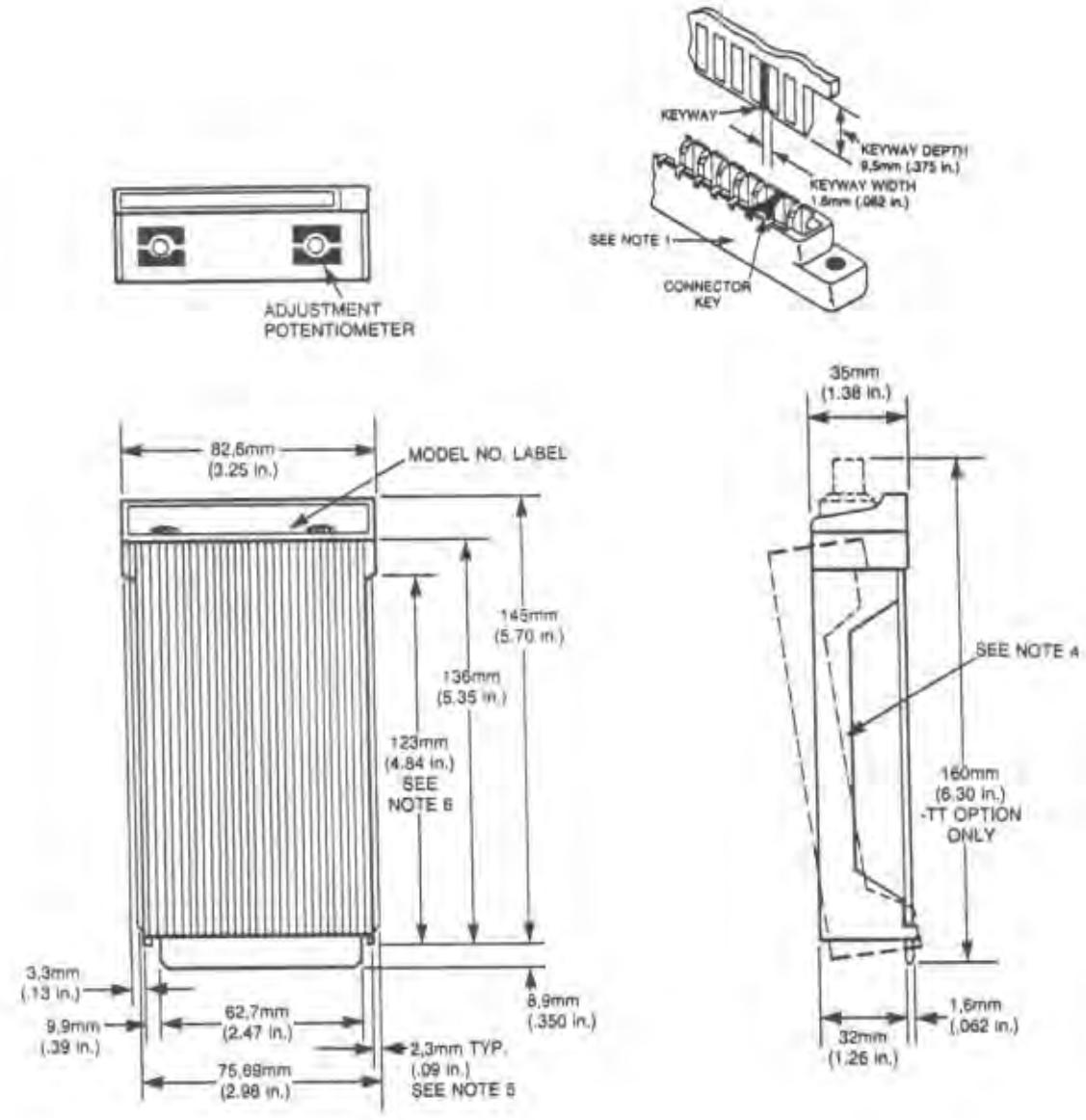


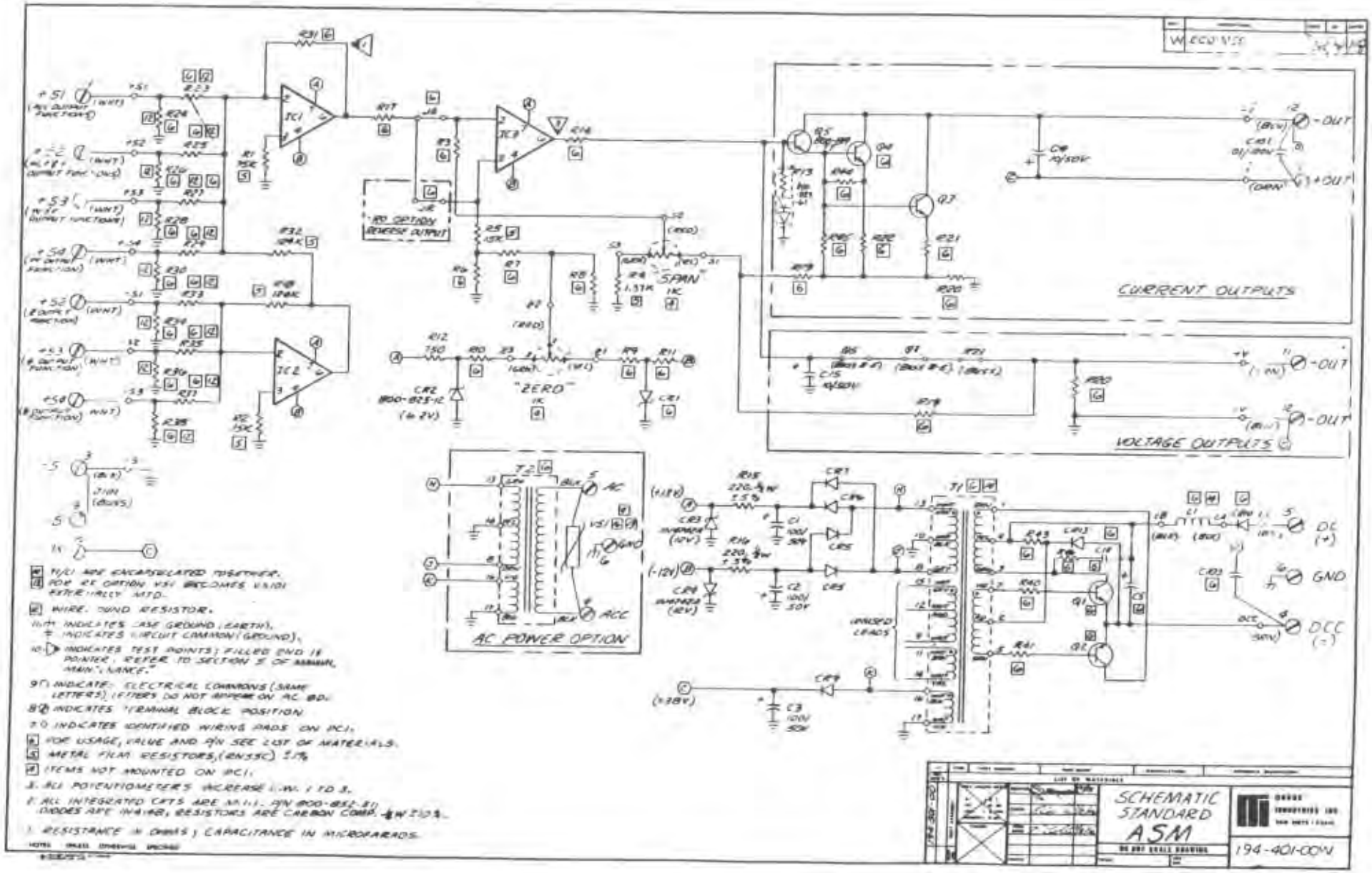
Figure 6-1. Standard Unit Dimensions



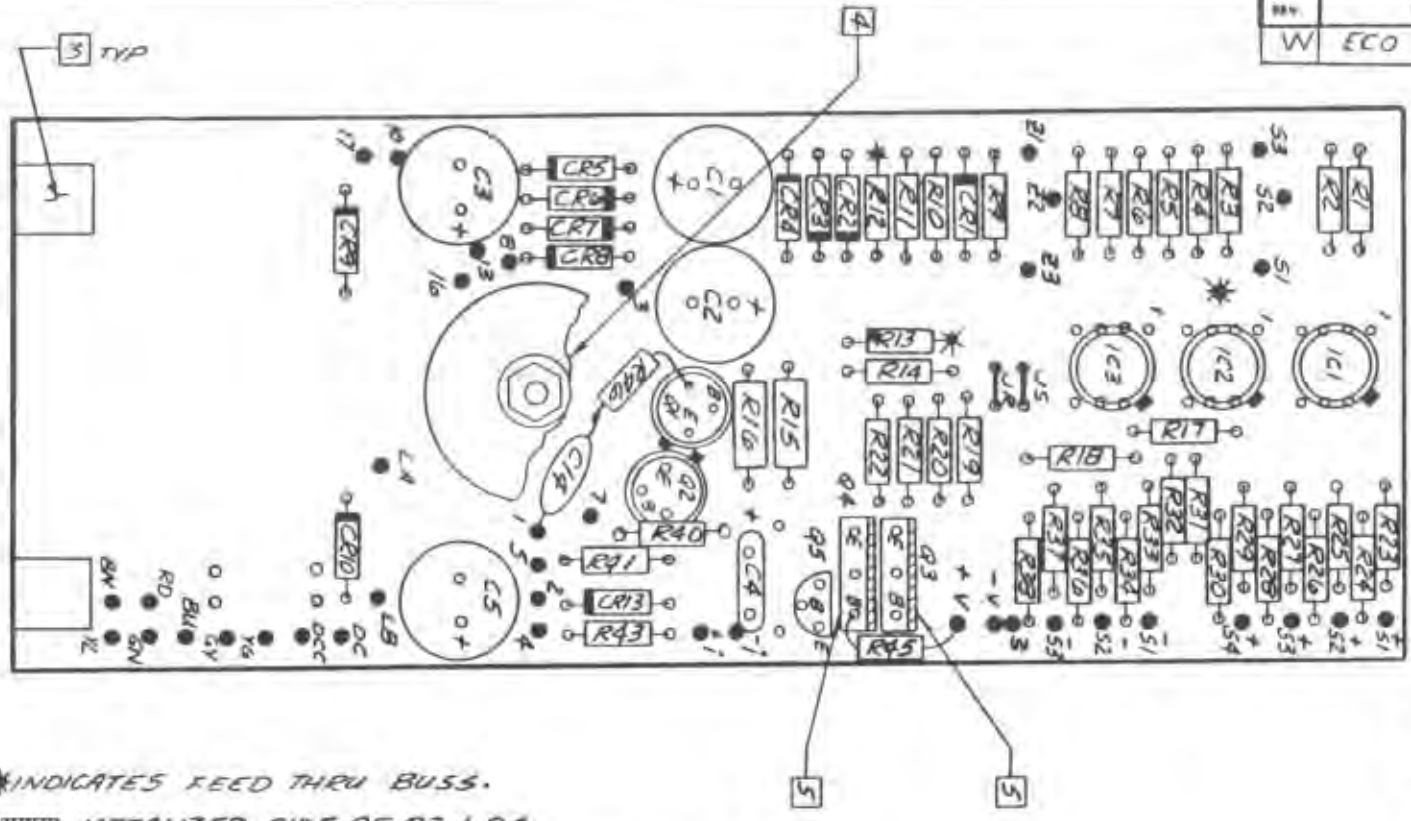
NOTES:

1. Connectors must have contacts on 3,96mm (.156 in.) centers, with contacts for both surfaces of board (recommended type: Viking part no. 2VK155/1-2).
2. Maximum card insertion depth in connector is 8,89mm (.350 in.).
3. Minimum width of connector insertion slot is 62,70mm (2.470 in.).
4. Removable plastic safety cover, 71,12mm (2.80 in.) wide. To remove safety cover, spread forward locking feet and lift front end approximately ¼" inch; then slide cover to rear to disengage from card. ***CAUTION:*** *DO NOT LIFT FRONT END HIGHER THAN ¼" OR TABS AT CONTACT END WILL BREAK.*
5. Maximum card edge-guide insertion depth is 2,29mm (.09 in.). Guides must be non-conductive.
6. Card edge-guides cannot extend beyond point indicated.
7. Card extender part No. 350-513-00 is available for testing transmitter while in operating position.
8. Certified: CSA
9. All PC units are dc powered.

Figure 6-2. *Plug-in Unit Dimensions*

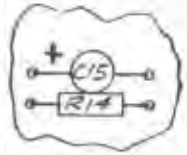

SPAN
"ZERO"
CURRENT OUTPUTS
VOLTAGE OUTPUTS
AC POWER OPTION
SCHEMATIC STANDARD ASM
194-401-00N

REV.	DESCRIPTION	DATE	BY	APPRV
W	ECO 5855			



MTG DETAIL OF R44

MTG DETAIL OF C15



6. * INDICATES FEED THRU BUSS.

5 METALIZED SIDE OF Q3 & Q4.

4 SEE DWG. 200-237-00 FOR MTG DETAIL OF T1/L1.

3 MOUNT SPACE BLOCKS BEFORE COMPONENTS. SEE CASE ASSY FOR POSITION.

2. ALL LEADS AND TERMINAL MUST BE SOLDERED TO PADS.

1. ALL JUMPERS ARE 22 AWG BUSS, TEFLON SLEEVED AS REQ'D.

NOTES: UNLESS OTHERWISE SPECIFIED

-1	ITEM	PART NUMBER	PART NAME	MANUFACTURER	REFERENCE DESIGNATION
NO. REQ'D		LIST OF MATERIALS			

TOLS. UNLESS NOTED	DRAWN
NEXT ASSEMBLY	CHECK
FINISH	PROJ. ENGR.
DETAIL NO.	CUST'R

P.C. BOARD ASS'Y
STANDARD
ASM

DO NOT SCALE DRAWING

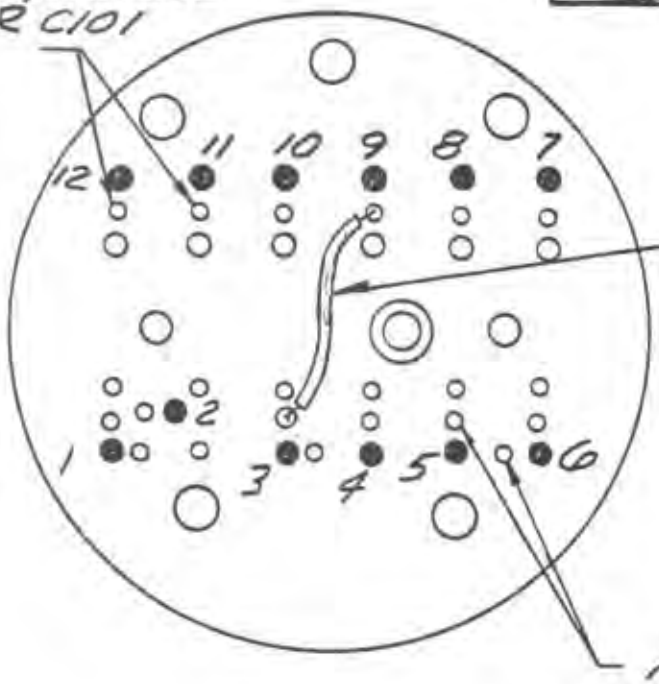
SCALE

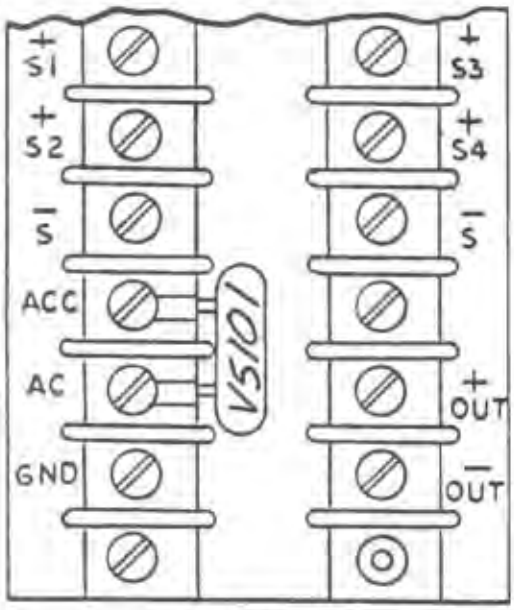
JOB NO. 194

MOORE INDUSTRIES INC.
VAN NUYS • CALIF.

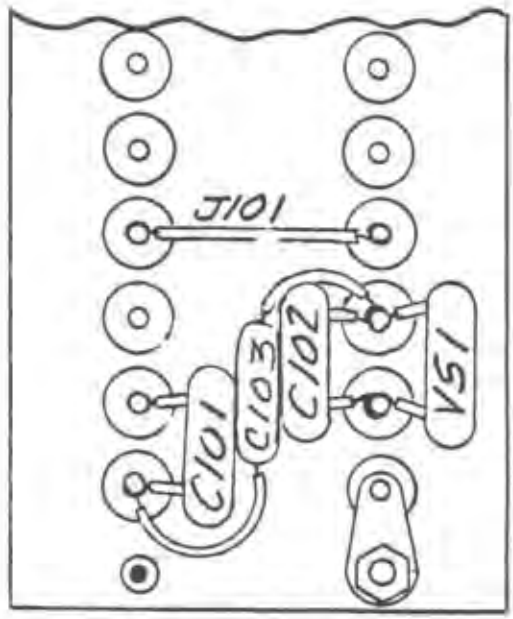
194-501-00W

REV	DESCRIPTION	DATE	BY	APPR





VS101



V51, C101, C102 & J101 (SLEEVE LEADS)

" SR OR CH CASE"

NOTES: UNLESS OTHERWISE SPECIFIED

PAGE 2 OF 2

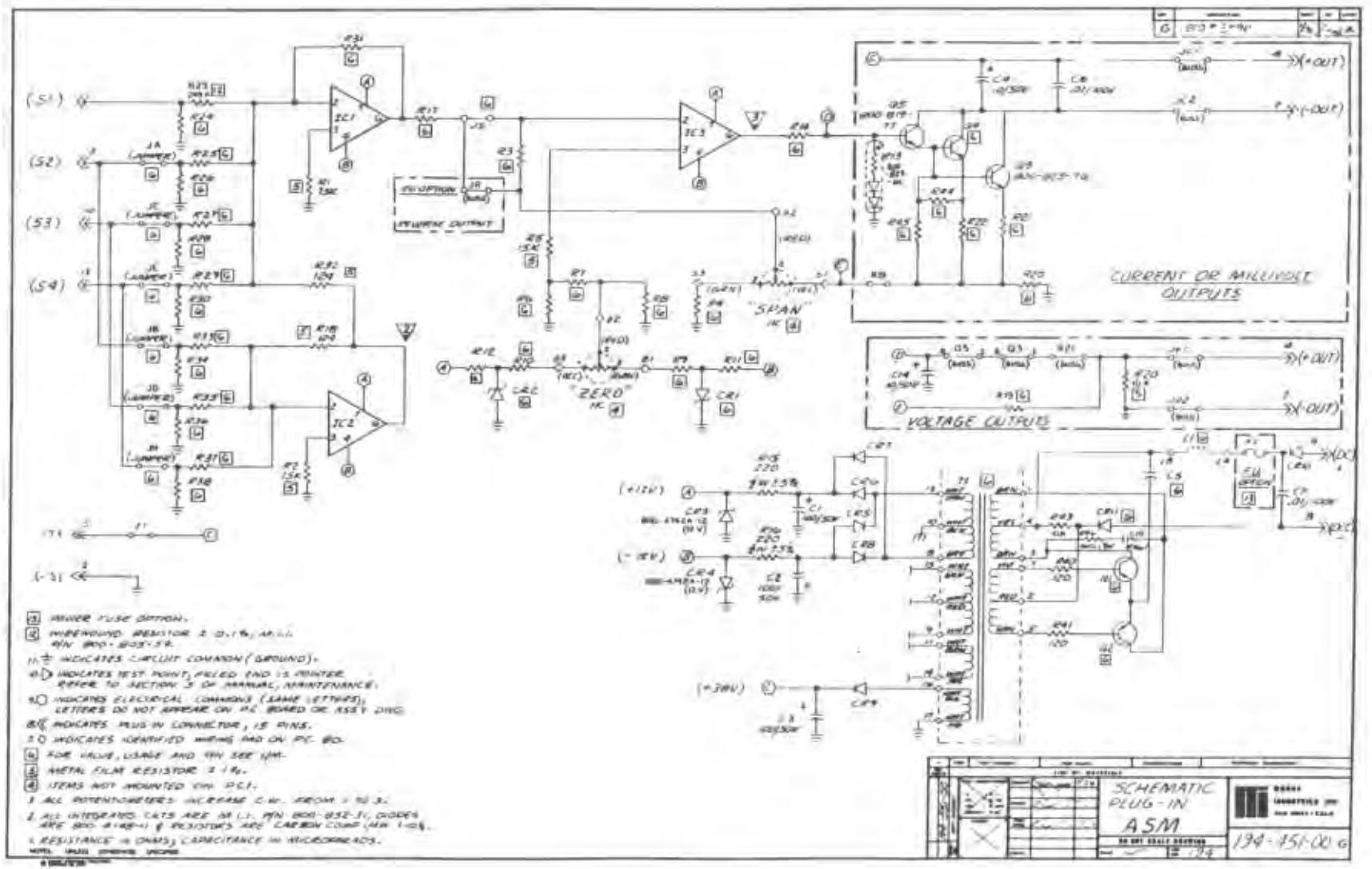
TOLS UNLESS NOTED:			
.X	: ±.10	DRAWN	3/4/76
.XX	: ±.030	CHECKED	3/6/76
.XXX	: ±.010		
ANGLES	: ± 30°		
HOLES	: +.002 −.001	PROJ. ENGR.	3/6/76
DO NOT SCALE DRAWING			
SCALE:		CUSTMR.	

MOORE INDUSTRIES INC.
SEPULVEDA ■ CALIF.

P.C. BOARD ASS'Y
STANDARD ASM

DWG. NO. 194-501-00

REV. W


CURRENT OR MILLIVOLT OUTPUTS
VOLTAGE OUTPUTS
"SPAN" PC
"ZERO" PC
SCHEMATIC
PLUG-IN
ASM
194-451-00 G

REV	DESCRIPTION	DATE	BY	APPR
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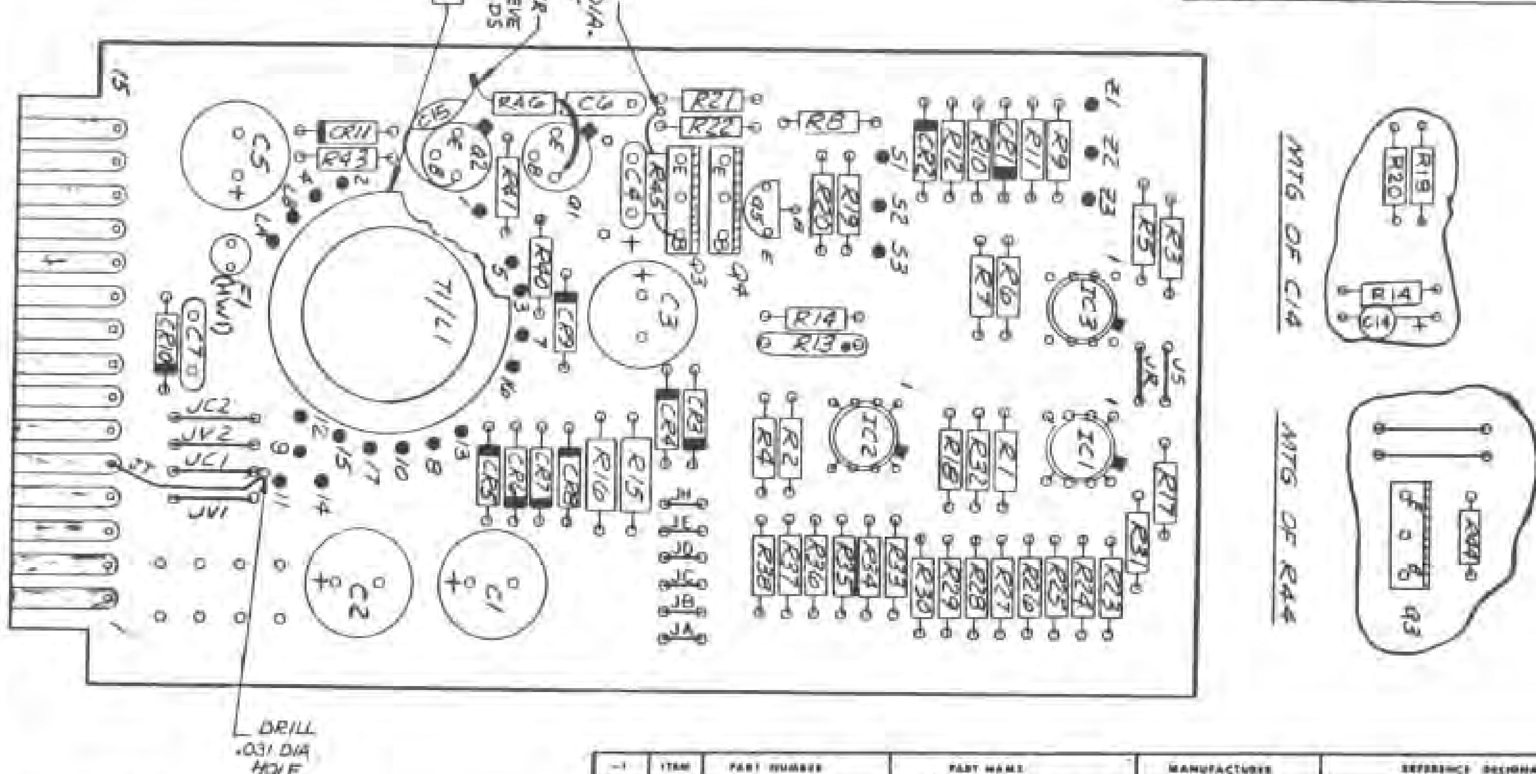

4. DELETED.

3. ▨▨▨ INDICATES METALIZED SIDE OF Q3 & Q4.

[2] FOR T1/L1 MTG SEE DWG 200-237-00.

1. ALL WIRING 22 AWG STRANDED, ALL JUMPERS 22 AWG, TEFLON SLEEVED AS REQD.

NOTES: UNLESS OTHERWISE SPECIFIED

NO REQ'D	ITEM	PART NUMBER	PART NAME	MANUFACTURER	REFERENCE DESIGNATION

LIST OF MATERIALS

DRAWN	[illegible]	4/1/74
CHECK	T. HART	1-6-76
PROD. ENGR.	[illegible]	[illegible]
CUSTS		

P.C. BD ASS'Y PLUG-IN ASM

DO NOT SCALE DRAWING

SCALE 2/1 JOB NO 194

MOORE INDUSTRIES INC. VAN NUYS • CALIF.

194-551-00 G

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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