

## 1.1 SCOPE OF MANUAL

This manual contains the Sample Timing Module (STM) instructions for calibration, adjustment and installation, theory of operation description, maintenance instructions, schematic diagrams, assembly drawings, and parts lists information.

## 1.2 PURPOSE OF EQUIPMENT

The STM is used in the delta alarm monitor system in conjunction with MII DCA and SHM modules to produce timing pulses for the MII SHM module.

## 1.3 GENERAL DESCRIPTION

The STM produces pulses from one every half second to one every 3200 seconds. Output repetition rate is selected by choosing the output of counters with panel-mounted selector switches. Basic counterclock rate is generated by a voltage control oscillator. The STM is designed to use the power from an MII SHM unit with a TX option. Power from the SHM is internally regulated in the STM to drive the timing circuits of the unit. Output is fed directly into the contact closure (CC) input to the SHM thereby providing the pull-up resistance necessary for the STM output stage. No internal power isolation is provided by the STM as DCC (-) and -OUT are common. However, isolation from power external to the system is achieved through the SHM.

## 1.4 PHYSICAL DESCRIPTION

The STM is available in several different physical configurations. In general, the unit consists of a printed-circuit board, which contains the electronics, enclosed in a protective housing. The bracket (supplied when specified in order) may be used to mount the assembly. For hazardous environments, an explosion-proof housing with a base containing up to four threaded hubs for wiring can be supplied. Also available are enclosures that are oil-tight and dust-tight and another that is water-tight. Although the printed-circuit board is electrically identical regardless of the physical configuration and mounting method, the external connections may be made to different terminals on the terminal blocks in the various versions of the unit. Specific details for making electrical connections are given in Section 2, Installation.

## 1.5 SPECIFICATIONS

The specifications of the STM are listed in Table 1-1.

**SECTION 1**  
**INTRODUCTION**

Table 1-1. STM Specifications

<u>RATE:</u>	Adjustable with multiturn potentiometer. Pulse rate of 0.5 to 2 second multiplied by fixed factors: 1, 2, 4, 8 or 16 and fixed factors: 1, 10 or 100.
<u>ISOLATION:</u>	Refer to SHM specifications for isolation information.
<u>OUTPUT PULSES:</u>	One pulse every 0.5 second to one pulse every 3200 seconds +12V amplitude with 50% duty cycle.
<u>REPEATABILITY:</u>	+0.1% of selected range
<u>CALIBRATED ACCURACY:</u>	+0.5% of selected range
<u>AMBIENT TEMPERATURE RANGE:</u>	-20 <sup>0</sup> F to +180 <sup>0</sup> F (-29 <sup>0</sup> C to +82 <sup>0</sup> C)
<u>AMBIENT TEMPERATURE EFFECT:</u>	+0.01%/ <sup>0</sup> F over above range
<u>POWER INPUT:</u>	38 VDC standard, from the TX option of an MII SHM. Refer to SHM specifications for power information

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INSTALLATION INFORMATION

## 2.1 GENERAL INSTALLATION INFORMATION

Installation, in general, consists of calibration (when required), mechanical mounting, and making the electrical connections to the unit. The following paragraphs describe the necessary procedures.

## 2.2 CALIBRATION

Units are calibrated and checked for proper performance at the factory before they are shipped. However, if a malfunction caused a change in components of the oscillator circuit, the unit should be calibrated by the user before the unit is placed in service.

An output monitoring device is required for calibration. The monitoring device must have an accuracy within 0.05% or better. To calibrate a unit, proceed as follows:

- a. Connect unit and test equipment as shown in Figure 2-1.
- b. Set both X1 switches to on.
- c. Vary the RATE potentiometer from 0 to 10. Observe that the output varies by 1.5 seconds between the 0 and the 10 position of the potentiometer.
- d. Adjust the RANGE potentiometer located on PC1 to produce the change specified in (c).
- e. Adjust the CENTER FREQ potentiometer located on PC1 so that the 1.5 second variation of (c) above occurs within 0.5 seconds and 2 seconds.
- f. Repeat steps (c) through (e) until no further adjustment of either the RANGE or CENTER FREQ potentiometer is required.

## INSTALLATION INFORMATION

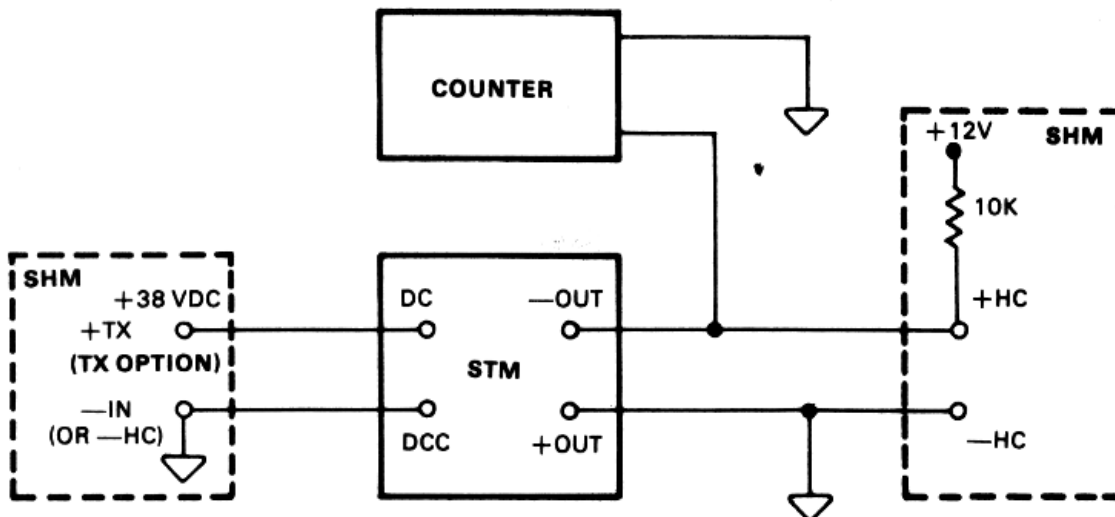


Figure 2-1. Test Equipment Set-Up For Calibration.

### 2.3 MECHANICAL INSTALLATION

As mentioned in Section 1, the unit may be obtained in various physical configurations and/or case sizes. Figure 2-2 shows the outline dimensions and other installation requirements for the particular configuration supplied. Be sure to observe the applicable special procedures and precautions given with the illustration.

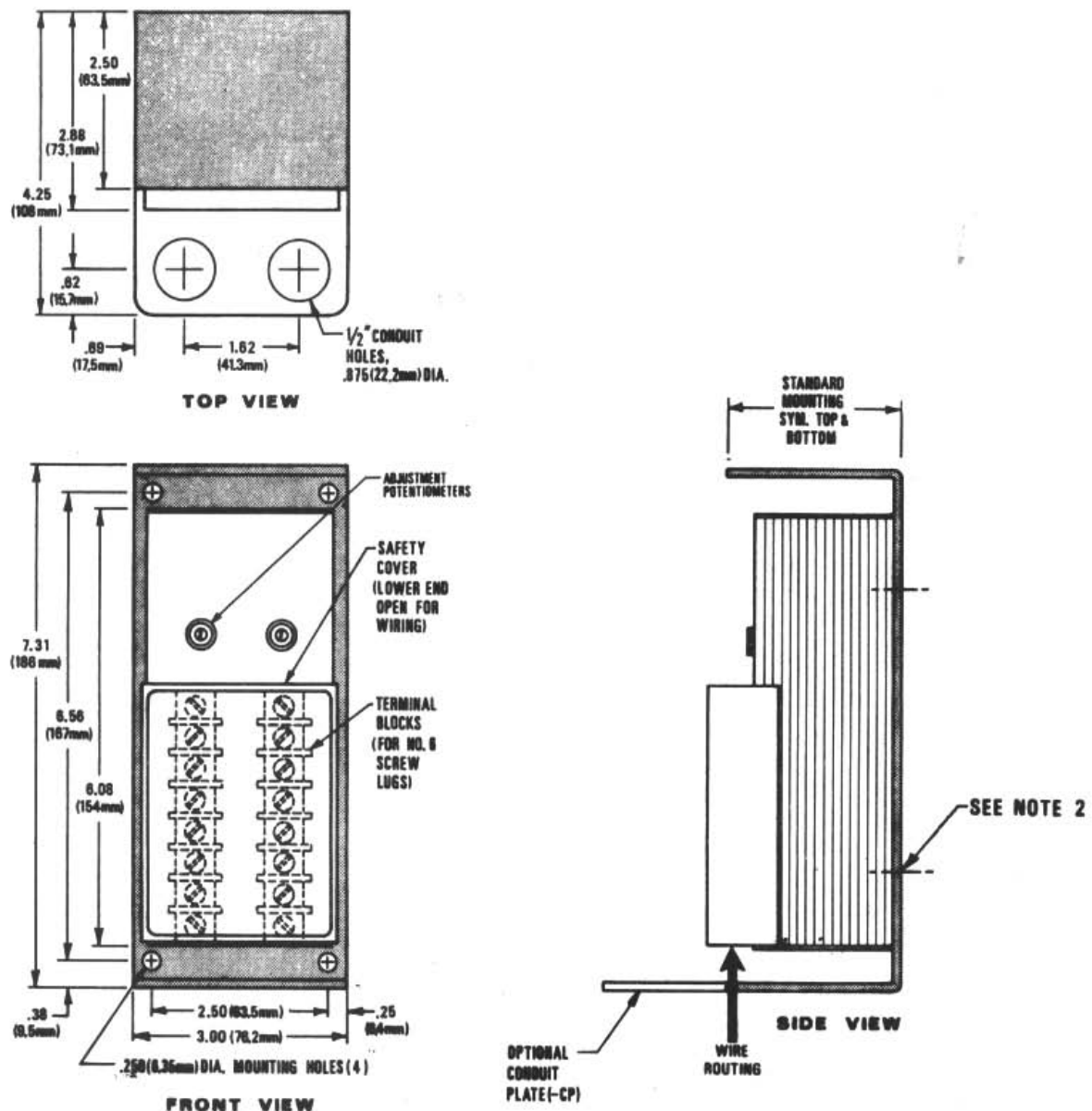
### 2.4 ELECTRICAL CONNECTIONS

The electrical connections are made to the PC connector where the unit plugs in. Terminals to be used for the electrical connections are indicated in Figure 2-3. The following paragraphs provide additional information on wiring the unit.

#### 2.4.1 General Wiring Techniques

No special wire or cable is required for signal connections to the unit. To avoid transients and stray pickup, it is recommended that twisted conductors be used where they are run close to other services (such as power wiring). Spade-lug connectors are recommended for all wire terminations. All terminals are supplied with 6-32 screws long enough to easily accept three spade-lug connectors.

## INSTALLATION INFORMATION



## NOTES:

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

**CAUTION**

WHEN THE REAR INSERTS ARE USED FOR MOUNTING, BE SURE THAT THE MOUNTING SCREWS DO NOT PROTRUDE MORE THAN 1/8 INCH INTO THE UNIT.

Figure 2-2. Outline and Dimensions.

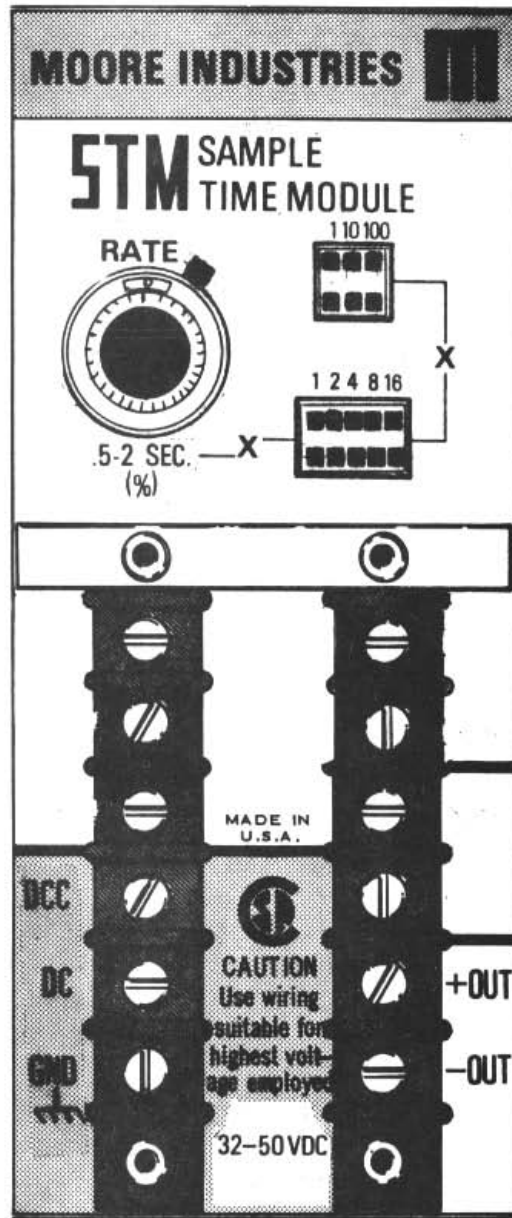


Figure 2-3. Electrical Connections.

## OPERATING INFORMATION

## 3.1 OPERATING PROCEDURE

Once calibrated and installed, the unit may be operated unattended. The only controls on the outside of the unit are the RATE potentiometer and the mini switches which, after initial adjustment, 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.

The 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.

To produce the required output pulse rate, select the proper switch and dial setting combination to generate the required output rate. Table 3-1 shows the switch settings required to obtain a given range of output pulse rate.

For improved accuracy and ease of adjustment, select a switch combination that will produce the required output pulse rate when RATE potentiometer is set near the center of the dial. Assuming that one pulse every three seconds is required, use the X2 and X1 switch setting for SW201 and SW202, respectively. Dial selection will now allow finer adjustment as the control approaches specified pulse rate.

The RATE potentiometer setting formula shown below defines the calculations necessary to set the RATE potentiometer for the desired rate output.

$$\frac{\text{RATE OUTPUT REQUIRED} - (\text{SW201} \times \text{SW202} \times .5)}{\text{SW201} \times \text{SW202} \times 1.5} = \text{Rate Potentiometer Setting}$$

Table 3-1. STM Output Selection

SW201 Setting	SW202 Setting		
	X1	X10	X100
X1	0.5 to 2 seconds	5 to 20 seconds	50 to 200 seconds
X2	1.0 to 4 seconds	10 to 40 seconds	100 to 400 seconds
X4	2 to 8 seconds	20 to 80 seconds	200 to 800 seconds
X8	4 to 16 seconds	40 to 160 seconds	400 to 1600 seconds
X16	8 to 32 seconds	80 to 320 seconds	800 to 3200 seconds



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THEORY OF OPERATION

## 4.1 INTRODUCTION

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

## 4.2 GENERAL CIRCUIT DESCRIPTION

The circuits in the STM generate output pulses, whose repetition frequency can be selected to provide a pulse separation from 0.5 seconds up to 3200 seconds.

A power supply generates a regulated voltage that powers a voltage controlled oscillator and the STM components. The oscillator output is counted-down by a binary counter. The output of this counter is either selected by panel-mounted mini switches or in turn is counted-down by two cascading decade counters. Output pulse periods are thus selected by the mini switches at various stages of the count-down and buffered out by an output buffer circuit. Figure 4-1 functionally illustrates the STM, while schematic 219-401-00 gives complete component connections and identification.

## 4.3 POWER SUPPLY

The STM is powered by the TX option output of a MII Sample and Hold Module. The STM power supply consists of IC3 with pass transistor Q2, and associated components. When +38 VDC is applied to the STM, regulator IC3 and transistor Q2 maintain a constant output regardless of the load variations. This output is filtered by C6 to provide a constant +12 VDC at point A of schematic 219-401-00. Zener diode CR2 limits possible input voltage fluctuations that may damage IC3. Diode CR1 prevents accidental damage to the STM if the DC connections are reversed.

## 4.4 BASIC OSCILLATOR

The basic oscillator consists of a voltage control oscillator IC4 and associated components. Oscillator repetition rate is controlled by R7, R9 and RATE potentiometers. The output of IC4 is capacitively coupled to Q4 through C4 and held above ground by CR2. Transistor Q4 buffers the output signal and provides the drive necessary to clock the binary counter. The RATE control is a panel-mounted ten-turn dial potentiometer that varies the oscillator pulse period. The RANGE control compensates for resistance tolerances in the RATE potentiometer. The CENTER FREQUENCY control provides the necessary adjustment to set the RATE potentiometer effects on the oscillator repetition rate within the specified limits of 0.5 to 2 seconds.

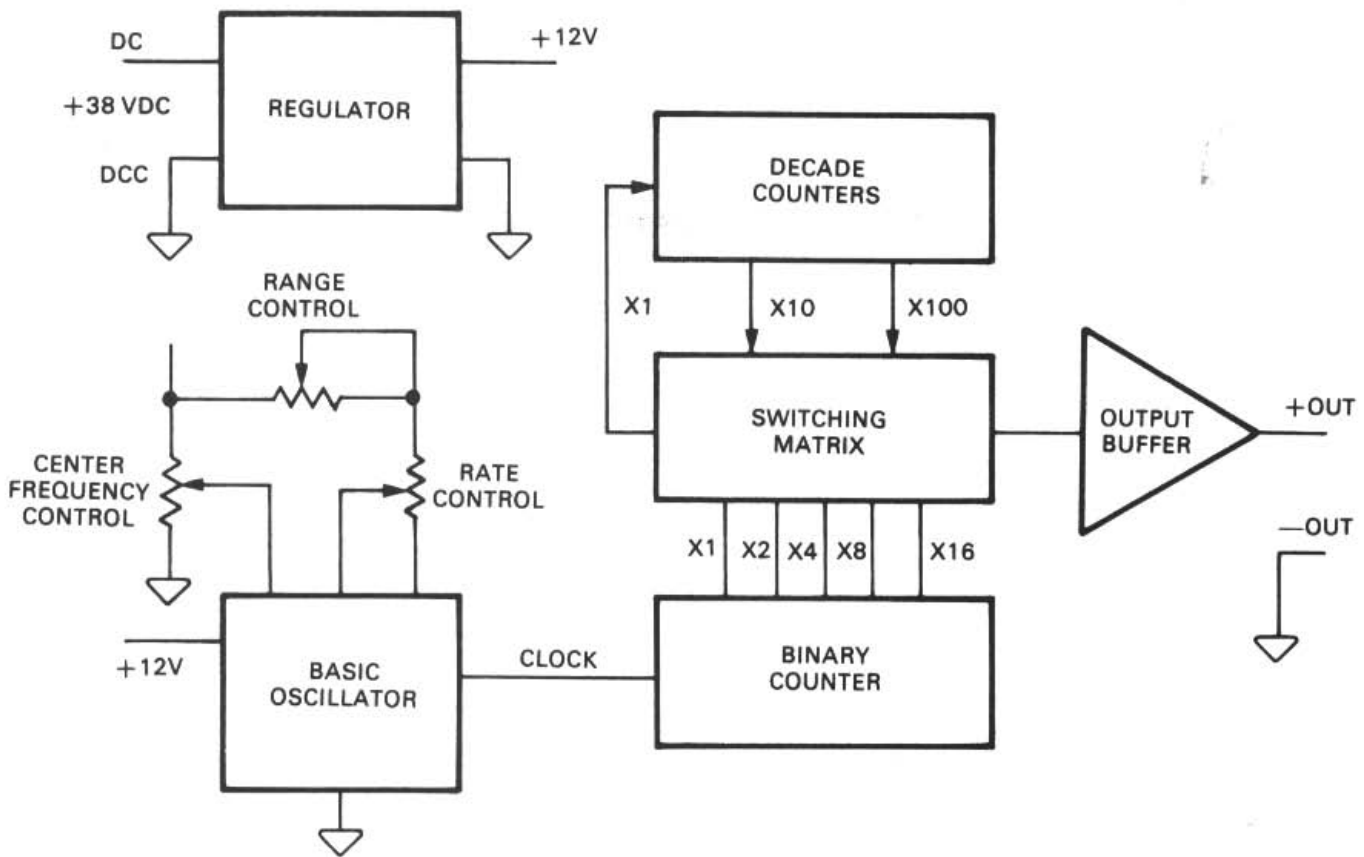


Figure 4-1. STM Current Transmitter Block Diagram

#### 4.5 INITIALIZATION CIRCUITS

The initialization circuits consist of Q1 and associated components. Initially when power is applied, C1 charges to some positive value through R2. During this time Q1 is off, the reset inputs to counters IC1 and IC2 are high, and the counters reset to zero. When the charge on C1 is high enough, Q1 is on, and the output of Q1 is low, disabling the counters reset inputs. Counters IC1 and IC2 are now ready to count-up from zero.

#### 4.6 TIMING SELECTION CIRCUITS

The timing selection circuits consist of three counters in two chips IC1, IC2 and eight panel-mounted minidip switches. IC1 consists of two cascaded decade counters while IC2 is a seven-stage binary counter. IC2 clock input is at pin 1. The lowest frequency output of IC2 is pin 9 (basic frequency). The next four outputs (pins 6, 5, 4, 3, respectively) are a divide-down of the basic frequency.

If both X1 switches are on, the selected output of the binary counter only is provided to the output driver Q3.

If X1 of switch SW202 has not been selected, the selected output of IC2 by switch SW201 is used to clock the first decade counter IC1 at pin 2. The output of the first decade counter IC1 pin 6 provides a clock to the second decade counter IC1 at pin 10. The output of the second decade counter IC1 at pin 14 provides a frequency output ten times that of its clock input.

#### 4.7 OUTPUT BUFFER

Switch selection of the counter outputs is buffered by an output buffer circuit consisting of resistor R5 and transistor Q3. Resistor R5 attenuates the signal input, and Q3 provides output power. The collector of Q3 is normally returned to +12 volts at the +HC input of the MII Sample and Hold Module (SHM). Although the -OUT output is common to the -DC (DCC), power isolation with the external system is not affected since the SHM unit provides this feature.

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MAINTENANCE INFORMATION

## 5.1 INTRODUCTION

This section contains information on maintenance of the unit. General troubleshooting procedures are given, using conventional signal-tracing techniques. Precautions and special techniques used to replace components are also described.

## 5.2 PERIODIC MAINTENANCE

It is suggested that the calibration of the unit be checked approximately every six months as described in Section 2. No other periodic maintenance is required.

## 5.3 CORRECTIVE MAINTENANCE

The following paragraphs provide information on corrective maintenance of the unit. Corrective maintenance should be carried out only by qualified personnel who have read and thoroughly understand the description of circuit operation given in Section 4.

5.3.1 Disassembly

To troubleshoot the unit, it is first necessary to disassemble it so the circuit board is exposed. The physical configuration of the unit determines the steps to be following in disassembly and are described in the following paragraphs. In all cases, turn off power input before disassembling unit.

## 5.3.1.1 Disassembly of Standard and -CP Units

To disassemble a standard 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.

## SECTION 5

### MAINTENANCE INFORMATION

#### 5.3.1.2 Disassembly of an Explosion-Proof Unit

To disassemble an explosion-proof unit, proceed as follows:

- a. Use a bar wrench to loosen the housing cover from the base, then unscrew and remove the housing cover to expose the unit.
- b. If required, remove the unit from the socket by rocking the unit slightly while pulling upward until it is free of the socket. The socket and terminal card are keyed to eliminate error when the unit is reinstalled.

#### 5.3.2 Troubleshooting



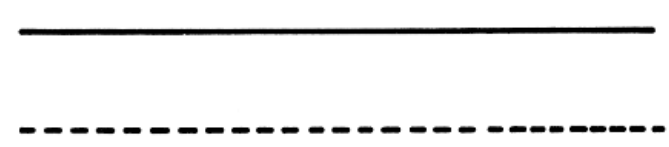

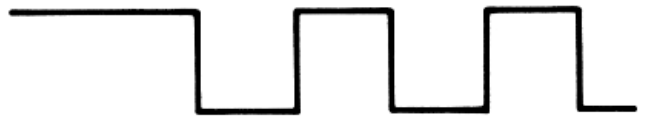
The schematic diagram(s) includes flagged numbers at various points in the circuit. Table 5-1 gives the voltages and waveforms at these points for specified conditions. The assembly drawing(s) shows the physical location of the parts on the circuit board. Bear in mind that the circuit board is protected 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 diagram 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 place to look for trouble is in the power supply.

#### 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.

Table 5-1. Test Points and Waveforms

TEST POINTS	WAVEFORMS
1	 <p style="text-align: right;">+12V +6V 0V</p>
2	 <p style="text-align: right;">+12V 0V</p>
3	 <p style="text-align: right;">+12V 0V</p>
4	 <p style="text-align: right;">+12V 0V</p>
5	 <p style="text-align: right;">+12V 0V</p>

## SECTION 5

### MAINTENANCE INFORMATION

- 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 trichlorethane or equivalent. Be sure adequate ventilation is provided when using this or any other chemical.

#### NOTE

Unused connections on integrated circuits are left unsoldered to aid in removal. Refer to the assembly drawing for more complete information.

- 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. Remove all flux from soldered joints with trichloroethane or equivalent.
- f. Test the unit for proper operation, and if necessary, recalibrate by the procedure given in Section 2. When the performance of the unit is known to be satisfactory, apply clear acrylic to reseal the unit where required.
- g. Check that all leads are clear of the board edge before reinstalling the board into its case.
- h. 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.

## 6.1 GENERAL

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

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

- ITEM: A reference numeral used for data processing and not used by maintenance personnel.
- NAME: Gives the nomenclature of the part.
- DESCRIPTION: Identifies the component by manufacturer's part number, usually followed by component's parameters or value.
- REF: Lists the reference designation for the component.
- PART NUMBER: This column specifies the Moore Industries assigned part number. This is the part identification required when ordering parts from Moore Industries.
- SPARE: The numeral in this column specifies the recommended number of component spares per unit type that should be kept on hand by maintenance personnel.

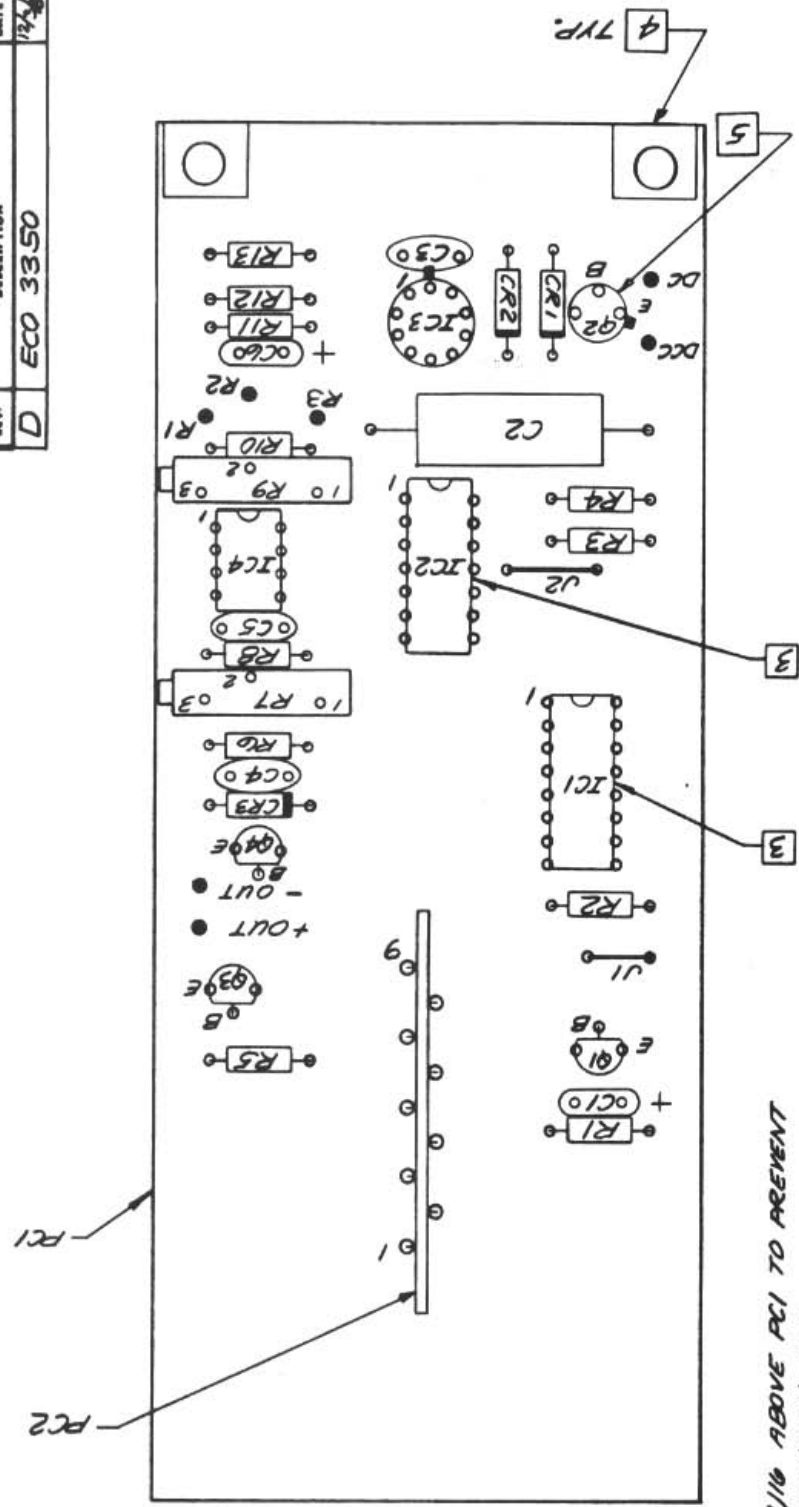
## 6.2 GLOSSARY OF ABBREVIATIONS

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





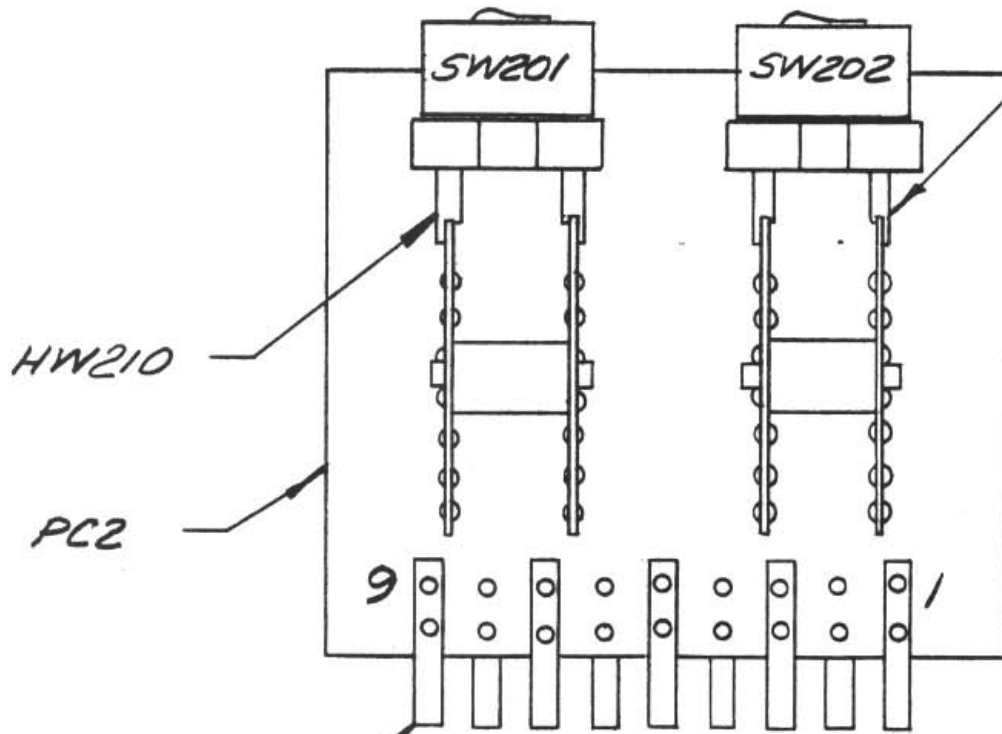
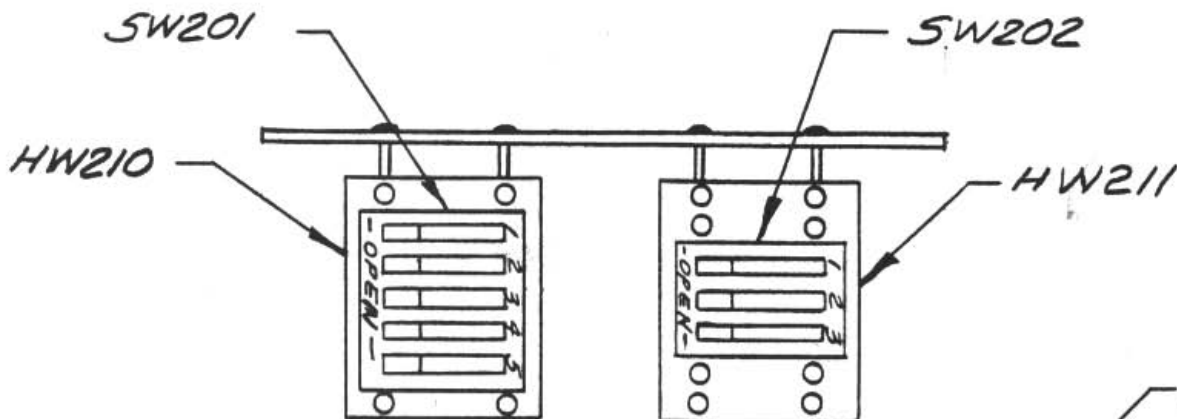
REV.	DESCRIPTION	DATE	BY	APPROV.
D	ECO 3350	1/11/61	J.P.	J.P.



5. MOUNT Q2 3/16 ABOVE PC1 TO PREVENT INTERFERENCE WITH CR1.
4. INSTALL MT6 BLOCKS BEFORE ADDING PARTS. SEE CASE ASSY FOR POSITION.
3. DO NOT HANDLE LEADS OF IC1 & IC2 WITH FINGERS. SEE PRODUCTION HANDLING PROCEDURE OR INSTRUCTION MANUAL.  
2. SOLDER ALL LEADS AND TERMINALS TO BOARD.
1. ALL JUMPERS 22 AWG.  
NOTES: UNLESS OTHERWISE SPECIFIED

ITEM NO.	PART NUMBER	PART NAME	MANUFACTURER	REFERENCE DESIGNATION
-1	MT6	MT6		
LIST OF MATERIALS				
MAN.	CHKD.	APPROV.	DATE	
P.C. BOARD ASSEMBLY STANDARD				
<b>STM</b> (PC1)				
DO NOT SCALE DRAWING				
				FOR NO.
				NO.
				SCALE
MOORE INDUSTRIES INC. VAN NUYS • CALIF.				
219-501-000				

REV	DESCRIPTION	DATE	BY	APPR
C	ECO 3961	4/4/80	JAD	7M



HW201-209

MOUNT  
F-PINS FLAT  
ON P.C.  
BOARD & TRIM  
EXCESS.  
TYP.

1. ALL LEADS & TERMINALS  
TO BE SOLDERED TO P.C. BD.  
NOTES: UNLESS OTHERWISE SPECIFIED

TOLS UNLESS NOTED:  
.X = ±.10  
.XX = ±.030  
.XXX = ±.010  
ANGLS = ± 30°  
HOLES = +.002 -.001

DRAWN *[Signature]* 5/23/75  
CHECKED *[Signature]* 5/27/75  
PROJ. ENGR. *Abdy Desai*

**MOORE INDUSTRIES INC.**  
SEPULVEDA CALIF.

P.C. BOARD ASSEMBLY  
STANDARD STM (PC2)

DO NOT SCALE  
DRAWING

DWG. NO. 219-502-00 REV. C

SCALE:

CUSTMR.

## 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.

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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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