# MODEL 2600

## Multichannel Hydrogen Sulfide Monitor

*GENERAL MONITORS*

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## MODEL 2600 MULTICHANNEL HYDROGEN SULFIDE MONITOR

## I. INTRODUCTION

### A. NOTICE

The Model 2600 system is easy to install, calibrate, and operate when the procedures described in this manual are followed. GENERAL MONITORS urges that the entire manual be carefully read before attempting to place the system in service, and that all "CAUTIONS" and "WARNINGS" stated in this manual be observed.

Purchase and use of the Model 2600 system does not license the buyer to utilize any information provided in this manual except to operate the system in the intended safety application, nor to reproduce any portion of this manual, or technical information/drawings provided separately, without prior written permission from GENERAL MONITORS, INC.

### B. GENERAL

The GENERAL MONITORS (GMI) Model 2600 multichannel system has evolved from earlier GMI systems which have been used worldwide for many years. GMI systems have an unsurpassed reputation for reliability. By carefully following the instructions in this manual you will be assured of continuous and dependable protection against hazardous accumulations of hydrogen sulfide gas.

Model 2600 is a multichannel system for continuous, independent monitoring of up to 16 individual active channels.

The controller is a general purpose solid state electronic instrument featuring recent advances in electronic circuitry and packaging techniques. It mounts in a standard 19 inch rack or panel, and it must be installed in a non-hazardous, weather protected area.

External controller connections are made to positive pressure terminals on rear-mounted terminal blocks. Primary power requirements are 117 VAC @ 50-60 Hz, or 24 VDC. If desired, the DC input terminals may be used for "battery backup" connections, to provide continuous operation during commercial power outages. (See BATTERY BACKUP SECTION, Page 6 for details.) Power consumption is 5 watts per channel (nominal).

Each active channel on the controller provides independent information from the sensor connected to it. Each channel has a separate meter; a 4-20 ma analog output signal; three potential free relay contacts (two for the two gas alarm circuits (HIGH and LOW) and one for the MALFunction alarm circuit); and visual status indicators for normal operation, gas alarms, and malfunction. The meter is linear and is scaled from either 0-20 ppm, 0-50 ppm or 0-100 ppm $H_2S$, depending upon which range was specified on the purchase order.

C. SENSOR OPERATING PRINCIPLE

GMI's sensor is a solid state, continuous diffusion type element. $H_2S$ will adsorb onto different metal oxide semiconductors, and change their electrical resistance. GMI has developed a proprietary metal oxide semiconductor which is extremely selective in "permitting" only $H_2S$ to adsorb onto it. That is, very few other compounds found in practical applications will affect this metal oxide.

The semiconductor is located in the system circuit, acting as a resistor. When air which contains $H_2S$ diffuses into the sensor through the flame arrestor, the adsorption of the $H_2S$ onto the semiconductor causes its electrical resistance to decrease. The sensor is temperature controlled to prevent adsorption rate variations from ambient temperature changes. The decrease in resistance is extremely repeatable over a range of 0-100 ppm $H_2S$. The resistance change produces an analog signal proportional to the $H_2S$ concentration. This signal is processed and displayed on the controller meter in ppm $H_2S$. The controller analog output signal accurately tracks the $H_2S$ reading as well.

The adsorption process is reversible, so that when air which is free of $H_2S$ subsequently diffuses into the sensor, the $H_2S$ gas desorbs. The semiconductor then resumes its original "clean air" resistance value.

## II. CONTROLLER FEATURES

The Model 2600 controller chassis accommodates from 1 to 16 independent channels. It is designed for installation in a 19 inch rack or panel, and it is of a general purpose electrical configuration.

Each active channel has a separate channel control card (P/N 50857), which may be removed or inserted into the front of the controller chassis after lowering a hinged door. There are two such doors situated on either side of a center front panel divider. The doors are locked in the closed position by means of four locking clamps. The center divider panel contains a MANUAL RESET SWITCH, which resets latching alarm circuits.

Each control card operates in conjunction with a relay module. Several relay options are available, as described in Section II. D. Relay modules are inserted from the rear of the controller chassis. They are rigidly mounted so as to mate with the control cards. If not installed or if improperly mated to the control card, the green NORM LED on the front panel will not illuminate.

Individual sensor terminals and analog output terminals per channel are permanently mounted on the lower half of the rear panel of the chassis. They are wired to fixed connectors. Common POWER and SIGNAL BUS BARS are connected to the rear of the fixed connectors. The power input transformers are mounted underneath the relay modules.

Ventilation holes are provided in the chassis to facilitate convection air cooling. They should not be obstructed.

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## A. CHANNEL CONTROL CARDS

The control card is an electronic circuit card partially enclosed in a metal frame, which attaches to the front panel. All control modules are fully independent (except for A.C. source transformers) and operate in conjunction with their respective relay modules.

The standard front panel indicators are high visibility wide angle LED's. The red HIGH and amber LOW indicators flash when a channel is in alarm, so as to focus maximum attention. The green NORMAL indicator glows steady to indicate the system is operational after power is applied and an initial time-out period of approximately 5 seconds is completed.

An amber malfunction (MALF) indicator flashes whenever a malfunction is detected in the circuitry of that channel, and its associated malfunction relay is then de-energized (this relay operates normally energized). The HIGH and LOW alarm circuits are rendered inoperative during a system malfunction.

The calibration adjustment potentiometers for each channel are accessible through ports in the front of the control card frame when the calibration door is lowered. These potentiometers are labeled "High", "Low", "Cal", "U", and "L". Their functions are explained in Sections IV. and V.

## B. "CALIBRATION" TOGGLE SWITCH

This three position switch is also located on the front of the control card and is accessible when the calibration door is lowered. The three positions are:

1. "N" (Normal Operation). This is the position for everyday operation.
2. "C" (System Calibration). This position is for use whenever a system calibration is performed (see the CALIBRATION SECTION of this manual). With the switch in this position the low and high gas alarm relays are disabled to prevent false alarms.
3. "A" (Alarm Set). The controller must be switched to this position whenever the alarm set points or the analog output signal are being adjusted (see the INSTALLATION INSTRUCTIONS SECTION). In this position all gas alarm relays are disabled to prevent false alarms.

NOTE: In the "C" and "A" positions, the channel Malfunction LED will flash on/off indicating "not normal operation" and the green NORM LED will go out. This safety feature will remind the operator to return the Calibration Toggle Switch to the Normal Operation ("N") position.

## C. CHANNEL STATUS INDICATORS

Each active channel has four status indicators (LED's). They are:

1. Malfunction (MALF). An internal electronic circuit monitors each active channel for certain problem conditions (power outage or low line power, loose sensor power leads, severed white or black sensor leads, and improper sensor heater functioning). Any channel in malfunction at any given time will have its yellow MALF LED flashing.

C. CHANNEL STATUS INDICATORS (cont.)

2. Low Gas Alarm ("LOW"). An internal circuit monitors each channel for a pre-set low alarm ppm level. The set point level is fully adjustable over the meter range. If one or more sensors are exposed to an $H_2S$ concentration which reaches or exceeds the set point level, the yellow "LOW" LED for each channel in low alarm will flash.

3. High Gas Alarm ("HIGH"). The high alarm circuit operates the same as the low alarm circuit, but is independent from it.

4. Normal ("NORM"). A visual green status indicator for normal operation.

D. RELAY MODULES

Each relay module consists of an electronic printed circuit board assembly mounted in a metal frame. A connector on one end mates with the control card. Terminals for the connection of external equipment (alarm horns, fans, etc.) are available at the opposite end. The module is held rigidly in place by means of two threaded fasteners.

All relay modules, irrespective of optional configuration, are compatible with all channel control cards. All channels in a controller will be equipped with the identical relay configuration.

Use the following to properly order or identify a Model 2600 relay module.

1. Determine relay type:

| | SPDT | DPDT | SPDT-Heavy Duty |
|---|---|---|---|
| Unsealed | P/N 20574-1 | P/N 20575-1 | P/N 20576-1 |
| Sealed | P/N 20574-2 | P/N 20575-2 | N/A |

2. Identify latching or non-latching operation:

| | |
|---|---|
| P/N 20577-1 | Latching high and low gas alarms |
| 20577-2 | Non-Latching high and low gas alarms |
| 20577-3 | Latching high, non-latching low gas alarms. |

3. Identify energized or de-energized operation:

| | |
|---|---|
| P/N 20578-1 | Normally energized gas alarms |
| 20578-2 | Normally de-energized gas alarms |

Note the following important information.

a. To completely describe a relay module three numbers are required. For example, an unsealed DPDT relay set, with latching high alarm and non-latching low alarm, normally de-energized, is: Model 2600 DPDT relay module (20575-1, 20577-3, 20578-2).

b. The malfunction relay is always normally energized, non-latching.

D. RELAY MODULES (cont.)

c. As used herein normally energized or normally de-energized refers to relay operation with power applied to the controller when no alarm condition exists.

d. The configuration considered standard is unsealed SPDT, latching high, non-latching low, normally de-energized (20574-1, 20577-3, 20578-2). Other configurations are optional.

e. Contact ratings are:

SPDT - 3 amps at 117 VAC, resistive
DPDT - 3 amps at 117 VAC, resistive
Heavy duty SPDT - 5 amps at 250 VAC, resistive

E. MISCELLANEOUS

Blank control card panels (P/N 20534-2) and relay module panels (P/N 20536) are provided for inactive channel spaces. These panels preserve the attractive appearance of a system in which less than sixteen channels are employed, and guard against tampering and dust.

Extender cards to facilitate the repair of faulty channel control cards and relay modules are provided.

## III. INSTALLATION INSTRUCTIONS

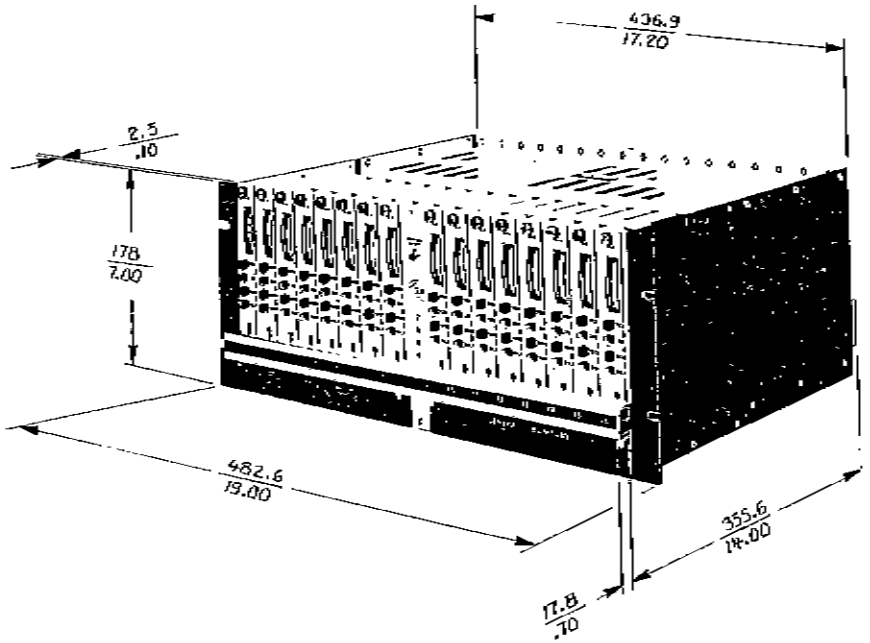
A. LOCATION OF THE CONTROLLER

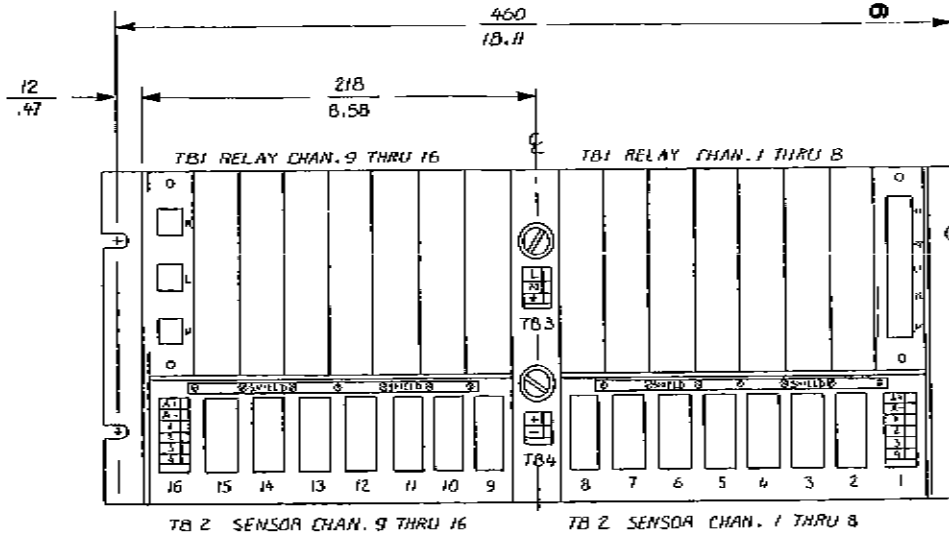
The Model 2600 Controller must be installed in a weather-protected, non-hazardous area. It may be mounted in a standard 19" rack or panel. Mounting and cutout dimensions are shown on Figure 1.

The mounting should be as free from shock and vibration as possible. Caution must also be taken not to obstruct the ventilation holes which allow convection air cooling. Although the controller is resistant to electromagnetic interference, it should not be mounted in close proximity to radio transmitters or similar equipment.

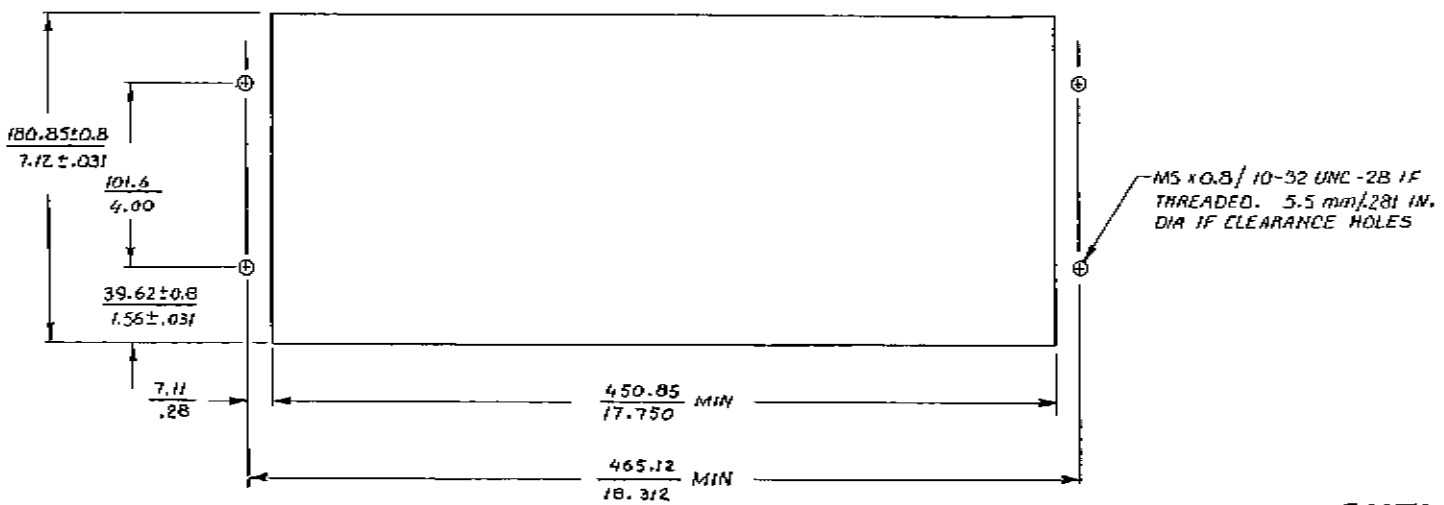
B. POWER CONNECTIONS

The system will operate on nominal line power of 117 VAC, 50/60 Hz or 24 VDC. 220 VAC, 50/60 Hz operation is available on special request. (NOTE: do not connect a system provided for 117 VAC operation to 220 VAC, or vice versa.) The system is designed for continuous use to maximize protection from hydrogen sulfide gas. The controller is not provided with a power on-off switch to prevent accidental system shutdown. Since the system does not have a power on-off switch, power must remain disconnected until all other wiring connections are made.




REAR VIEW




DIMENSIONS
mm
INCH

CUSTOMER PANEL CUTOUT DIMENSIONS

(REF 50851 A)

**FIG. 1**

**OUTLINE DRAWING & REAR TERMINAL CONNECTIONS**

If AC is to power the system, connect the line power supply to terminals LINE, NEUTRAL, and GROUND (L, N, and ⏚ ) on terminal block TB3 located on the center panel on the rear of the controller. Refer to Figure 2.

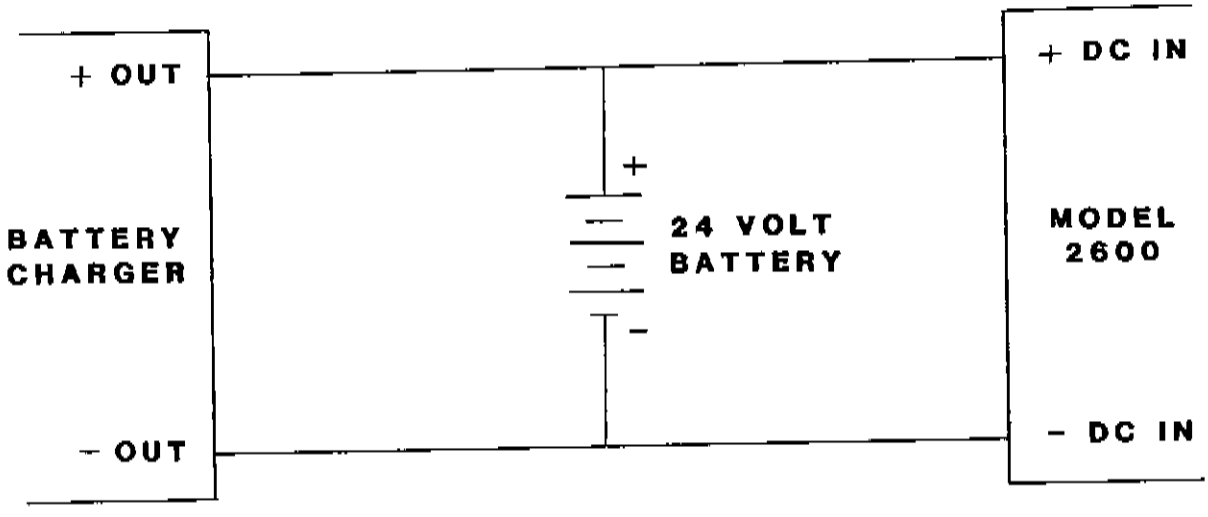
Primary DC power may be provided by any 24 V nominal direct current supply. Heavy duty cables should be used to prevent excessive voltage drop, and the cable run should be as short as possible. Connect the positive supply to (+) and the negative supply to (-) on terminal block TB4. Internal diodes protect the system in the event of inadvertent supply reversal.

## C. BATTERY BACK-UP

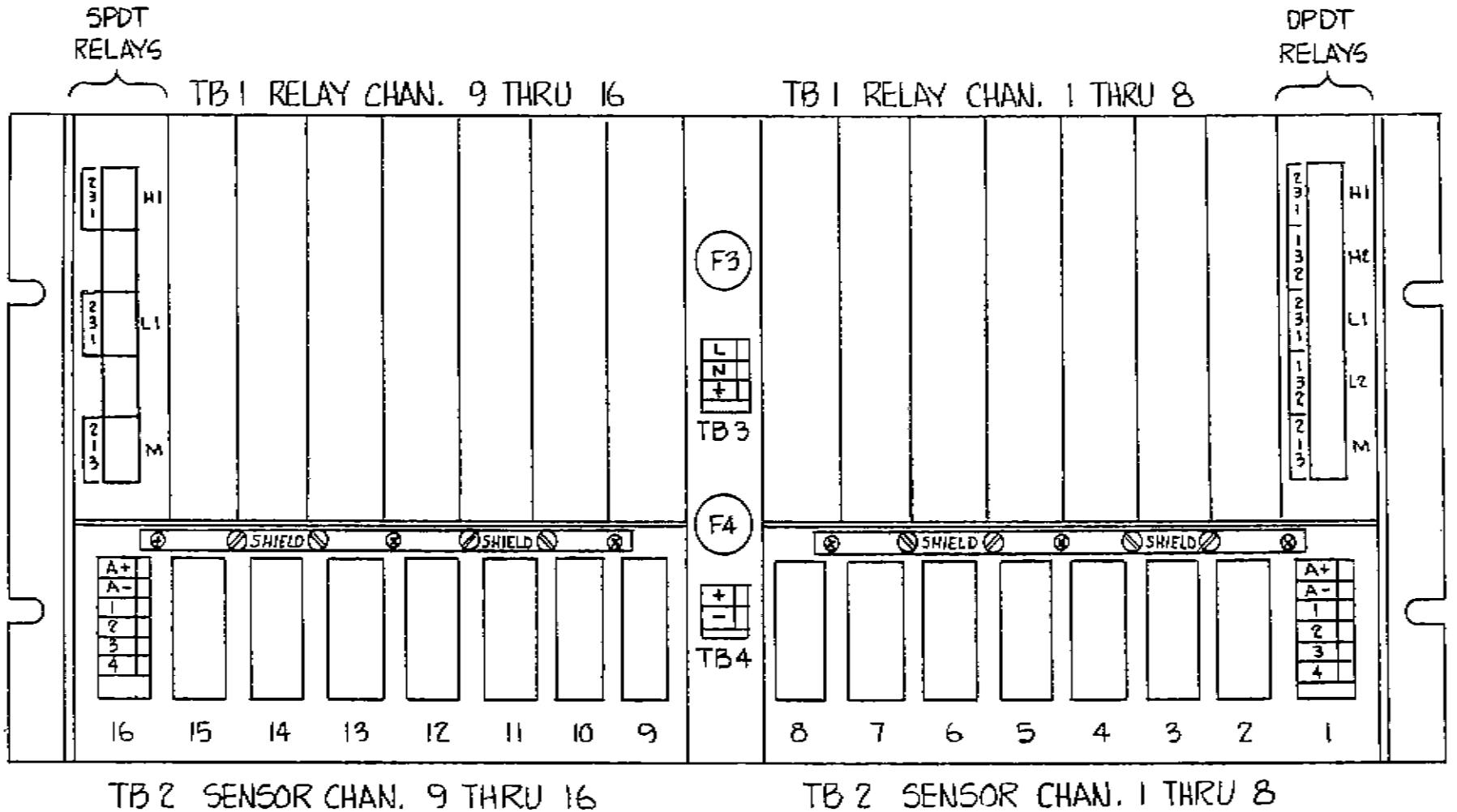
An emergency DC back-up supply may be utilized on a system normally powered by A.C. Connect the battery positive supply to terminal (+) and the negative supply to (-) on terminal block TB4, using No. 14 AWG wire (See schematic below).

NOTE THAT THERE IS NO PROVISION FOR BATTERY CHARGING. A SEPARATE CHARGER MUST BE CUSTOMER-SUPPLIED. CARE MUST BE TAKEN THAT THE CHARGER DOES NOT INJECT VOLTAGE TRANSIENTS ABOVE 30V, WHICH CAN POTENTIALLY OCCUR FROM SOME CHARGERS WHEN NOT EQUIPPED WITH A GOOD QUALITY BATTERY.

Nominal power consumption of the system is approximately 5 watts per channel in the absence of an alarm condition. It reaches a maximum of approximately 12.5 watts when the channel is in high alarm. This will increase with increasing sensor cable run distance and with certain alarm relay options. Be sure to check that a sufficient power reserve exists to maintain operation for the amount of time the battery would operate during an AC power failure.




Schematic: Battery Back-up System




(REF 20501 D)

**FIG.2**

**REAR TERMINAL CONNECTIONS**

## D. CHOOSING SENSOR LOCATIONS

There are no hard and fast rules governing the selection of optimum sensor locations. The customer must evaluate conditions at his own facility to make this determination. The following are the major factors to be considered.

### 1. LIKELY SOURCES OF ESCAPING $H_2S$

In general at least one sensor should be located in close proximity to each point where $H_2S$ is most likely to escape into the air. Consideration should also be given to placing sensors at locations where the $H_2S$ may be carried by local air currents, ventilation equipment, etc.

### 2. ENVIRONMENTAL FACTORS

Avoid installing sensors where they will be unnessarily exposed to wind dust, water, shock, or vibration. Observe the temperature range limitations of sensors, covered in the specification section of this manual.

### 3. "POISONS" AND "CONTAMINANTS"

Sensors may be adversely affected by prolonged exposure to certain materials Loss of sensitivity, or corrosion, may be gradual if such materials are present in low concentrations, or it may be rapid at higher concentrations. The more important materials adversely affecting sensors are:

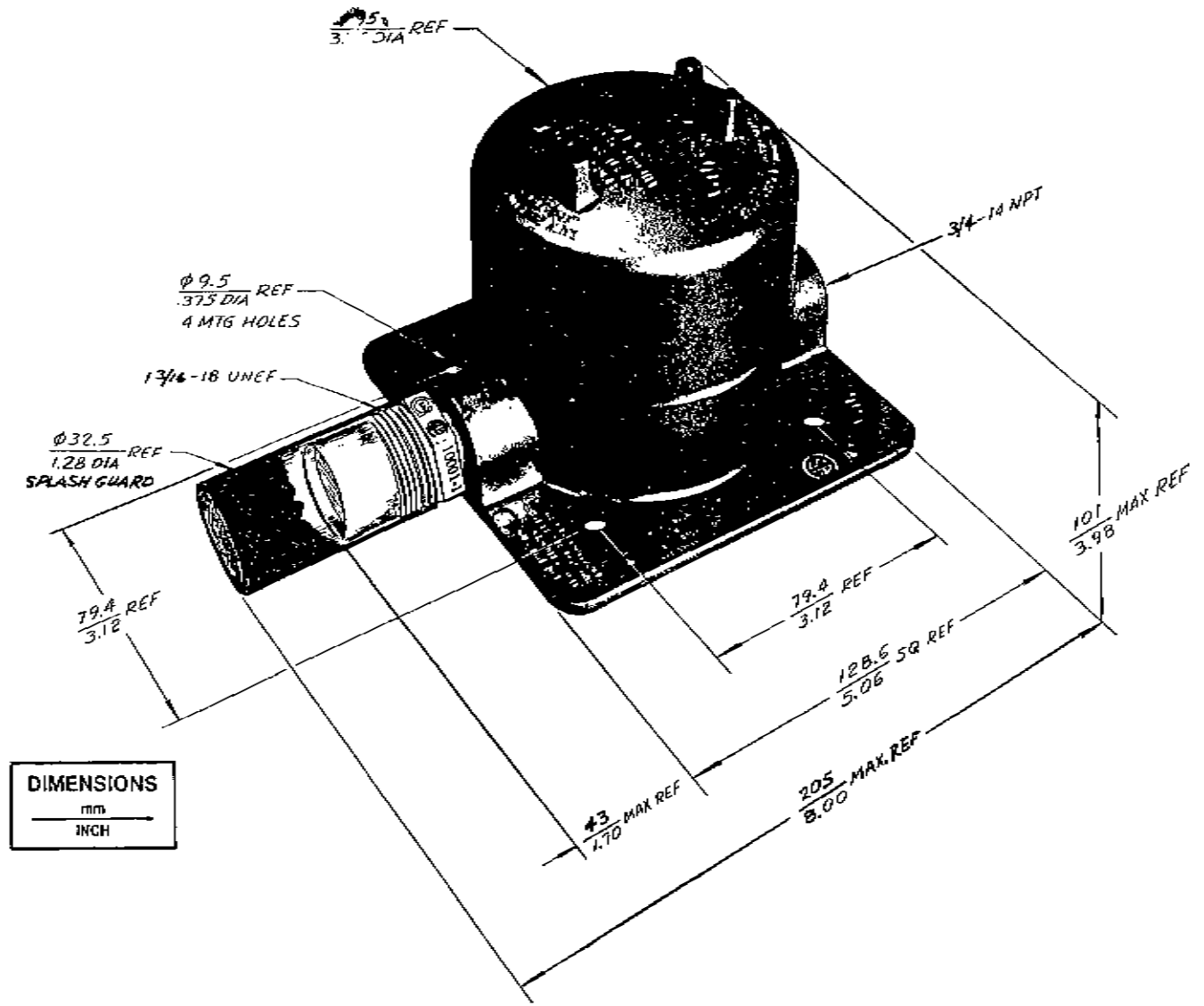
- Halides (compounds containing chlorine, fluorine, bromine, or iodine).
- Silicones (often contained in greases and aerosols). Silicones do not chemically attack the sensor. They instead coat it and therefore reduce or stop its response to $H_2S$.
- Acid vapors
- Caustic liquids or vapors.

The presence of such materials in an area does not necessarily preclude the use of a sensor. The feasibility of using a sensor in such areas must be determined by an analysis of the specific factors in each application. However, sensors used in such areas usually require calibration checks on a more frequent basis than normal, and typically have a shorter life than normal. In many such applications the normal two year warranty would not apply.

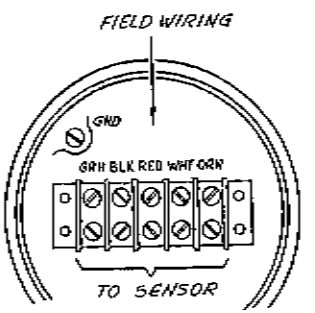
## E. SENSOR ASSEMBLY INSTALLATION

******* CAUTION - VERY IMPORTANT ******

You will note that each sensor is shipped from the factory with a protective red plastic cap fitted over the sensing head. Inside the cap is a desiccant. DO NOT remove this cap until you are ready to power the system. SAVE the cap and




| SENSOR GUARDS | |
|---|---|
| P/NUMBER | DESCRIPTION |
| 18 00822 | DUST GUARD, SINTER |
| 10 117 | SPLASH GUARD |
| 10 110 | DUST GUARD W/DISPOSABLE SCREEN |




WIRING DETAIL
(COVER REMOVED)

3. JUNCTION BOX ASSY (WITHOUT SENSOR) PN 10252.
2. SENSOR INSTALLATION - LUBRICATE THREADS AND DO NOT USE WRENCH; HAND TIGHTEN ONLY.
1. BEFORE INSTALLING LID, LUBRICATE THREAD STACK.

(REF 10266D)

**FIG. 3**

**JUNCTION BOX ASSY-SENSOR**

RE-CAP the sensor at any time in the future when the system's power will be turned off for an extended period of time. The desiccant pack may be discarded. When installing sensors be sure to leave enough clearance from the ground, walls, etc. to be able to fit the calibration bottles supplied with the system onto the sensor head. A 1" clearance from the wall to the sensor head will normally be adequate. Each sensor is matched with a specific channel at the factory, and is tagged accordingly. Check and match each sensor to the proper channel before installing it.

The standard sensor assembly (see Figure 3) consists of a sensor housing (GMI P/N 10252) and sensor (P/N 50445-1, -5, or -9). The dash (-) numbers correspond to full scale ranges of 0-100, 0-50, or 0-20ppm respectively. The sensor assembly is recognized as safe for U.S. National Electric Code (NEC) Class I, Division 2, Groups B, C and D hazardous areas, and is approved by the Canadian Standards Association (CSA).

IMPORTANT: Sensors should always be mounted pointing downward so that water will not be able to accumulate on the sensor head. Mounting should be as free from shock and vibration as possible, and should be convenient for calibration checks in place. The sensor housing must never be opened when power is on, otherwise the explosion-proof integrity of the sensor assembly is violated. The threads on the housing lid must be fully engaged. Use extreme caution if sensor assemblies are painted. Gas will not diffuse through a "painted over" flame arrester. Several sensor covers are available, which will have been supplied with the system if ordered. These include P/N 10071 porex dust cover, P/N 1800822 sintered stainless steel dust cap, P/N 10117 splash guard, and P/N 10110 dust guard. All of these accessories are designed to provide extra protection in problem environments.

The sensor is connected to a terminal strip within the sensor housing. To connect the sensor, remove the P/N 10252 housing lid to reveal the terminal strip. The sensor is connected in the housing according to the color designations shown in Figure 3.

The Sensor Assembly should be installed with conduit in hazardous areas. The sensor cable should be shielded, especially when run near high power electrical circuits or R-F equipment. Shielded cable should be grounded only at the controller, using the ground terminals provided (see Figure 2). Care should be taken to insure that the outer braid does not contact the conduit or junction boxes. Four ground terminals are provided for each group of sensors (1 through 8 and 9 through 16) and are located on the mounting plate above the set of TB2 terminal blocks at the controller.

Sensor cables are connected at the controller at the set of TB2 terminal blocks located along the bottom of the rear of the controller. The channel number (from 1 to 16) is identified for each TB2. Connections are identified as 1, 2, 3 and 4. Connect the cable at TB2 as follows:

| CABLE WIRE COLOR | CONTROLLER-TB2 TERMINAL NUMBER |
|---|---|
| White | 1 |
| Red | 2 |
| Green | 3 |
| Black | 4 |

## F. ALARM WIRING CONNECTIONS

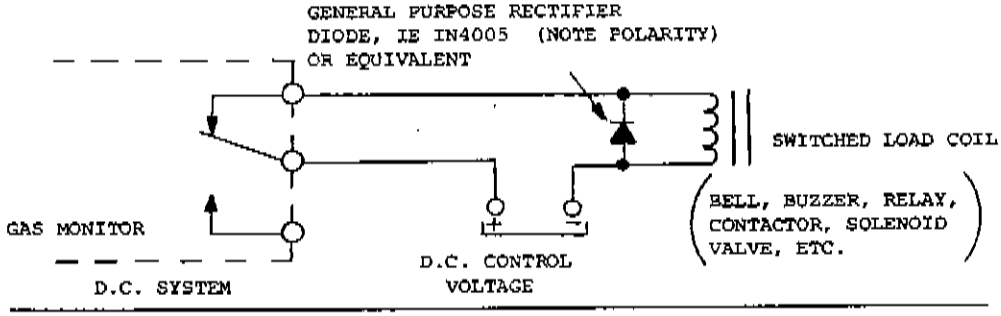
Refer to Figure 2. Connections per channel are made at the set of sixteen terminals TB1 along the top rear of the controller. Note that each connection for high or low alarm has a number designation (1, 2, and 3) along the left hand side of the terminal strip. This number designation is in accordance with the following code.

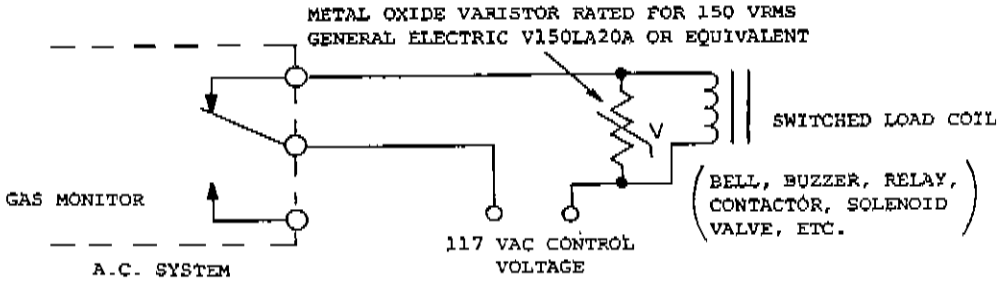
| GAS ALARM CONFIGURATION | CODE |
|---|---|
| (A) Normally de-energized (with power applied) | 2 = Common<br>1 = Normally open<br>3 = Normally closed |
| (B) Normally energized (with power applied) | 2 = Common<br>1 = Normally closed<br>3 = Normally open |

Note that the malfunction relay operates normally energized when power is applied to the controller, and corresponds to Code "B" above. The standard SPDT contacts are rated 3A at 117 VAC resistive.

**CAUTION**

**Inductive loads (bells, buzzers, relays, contactors, solenoid valves, etc.)connected to the high alarm, low alarm, and malfunction alarm relays must be clamped as shown in the following diagrams. Unclamped inductive loads can generate voltage spikes in excess of 1000 Volts. Spikes of this magnitude will cause false alarms and possible damage.**



The relay contacts may be used to operate customer auxiliary alarms, shut down or start up equipment, etc. The malfunction relay is normally energized with power applied. The gas alarm relays (HIGH and LOW) are normally de-energized (normally energized operation of these relays is available on special order).

### G. ANALOG OUTPUT CONNECTION

The 4-20ma analog output must either be used or jumpered, or the system will not operate. The two analog output terminals, (A+) and (A-), are located on the set of sixteen terminal blocks TB2 above the terminals for sensor connections (see Figure 2).

## IV. OPERATIONAL ADJUSTMENTS AND PROCEDURES

### A. GENERAL

Before applying power to the system for the first time, all wiring connections should be double checked for correctness. Also check to assure that all channel control cards and relay modules are firmly in place.

### B. APPLICATION OF POWER

Apply power to the controller. The Normal Indicator, a light emitting diode (LED), glows a steady green whenever the channel is operating normally (i.e. when power is on, there is no malfunction alarm condition and the initial time-out period of approximately 5 seconds is completed). Should a malfunction condition be displayed, check the sensor cable for that channel for proper connections at the controller and sensor housing, and for cable splices. If this check does not locate the problem, check for proper Primary Voltages (AC or DC).

### C. INITIAL START-UP

Each Model 2600 system is completely checked at the factory, to include calibration with associated sensors at the time of purchase. However, a complete checkout is a necessity upon placing the system in operation to assure system integrity. This includes checking and adjusting alarm set points, and performing a complete calibration procedure for each channel.

### D. ACCESS TO ALARM OR CALIBRATION ADJUSTMENTS

To perform alarm or calibration adjustments, rotate the CALIBRATION DOOR locking devices counterclockwise, then lower both doors.

NOTE: If the latches are not tight when the doors are being closed after calibration, adjust them clockwise to tighten.

## E. ALARM SET POINT ADJUSTMENTS

### Low Alarm

1. Set the Toggle Switch S1 to position "A". This position permits adjustment of analog circuitry and disables the external alarm circuitry. With the switch in this position, the malfunction LED will flash and the green Normal LED will go out indicating the controller is "out of normal operating mode".

2. Turn "Cal" Pot (R82) clockwise and observe the meter needle deflection. Adjust the pot to move the needle to the desired low alarm set point.

3. With the meter at the desired level, adjust the LOW Pot (R84) counter-clockwise (CCW) until the Low Alarm LED just starts flashing. If this Low Alarm LED is flashing initially, turn the pot clockwise (CW) until the LED goes off, then adjust CCW until the LED flashes.

4. To check the alarm setpoint, adjust the meter down scale using the CAL pot then slowly adjust the meter upscale, noting the concentration on the meter at which the Low Alarm LED flashes. Repeat steps 2 and 3 if the Low Alarm LED does not start to flash at the desired concentration.

5. Return the toggle switch to position "N". The malfunction light will turn "OFF" and the green Normal LED will light after the time-out period.

THE PROCEDURE FOR ADJUSTING THE HIGH ALARM is similar to the Low Alarm adjustment procedure.

1. Set the Toggle Switch S1 to Position "A". Malfunction light will start flashing and the green Normal LED will go out.

2. Using CAL pot (R82), adjust the meter to the desired high alarm set point.

3. If the High Alarm LED is off, adjust HI pot (R83) CCW until the High Alarm LED just starts flashing. If the High Alarm light is flashing adjust HI pot (R83) CW until it goes out, then CCW until it starts flashing.

4. To check the High Alarm set point adjust the meter downscale, then slowly adjust it upscale, noting the point at which the High Alarm LED starts flashing. If the set point is not adjusted properly, repeat Steps 2 and 3. The high alarm is now set.

5. Return the toggle switch to position "N" for normal operation. Malfunction light will turn "OFF" and the green Normal LED will light after the time-out period.

# V. CALIBRATION

## A. GENERAL

Calibration of each channel/sensor of the Model 2600 System will be required in the following situations:

1. Calibration Check

   This procedure is used to periodically and routinely check the response of an installed system to a known concentration of $H_2S$ (see Part C below).

2. System Calibration

   This procedure is used for the initial installation/startup of the system. This procedure is also used to re-calibrate the system if a controller or sensor is replaced/exchanged (see Part D below).

General Monitors recommends that a calibration check be conducted at least every ninety days. This statement is not intended to discourage the customer from checking calibration more frequently. Local environmental problems (such as mud collecting on the sensor head, or sensors accidently being painted over) are distinct possibilities in many applications. By recommending "frequent" calibration checks GMI is not implying that the customer should expect problems with sensor life or stability. The opposite is true. In fact, our typical sensor life and stability are probably unmatched by competitive $H_2S$ sensors. "Frequent" calibration checks merely assure the integrity of this life-protecting equipment.

## B. PRE-CALIBRATION INSTRUCTIONS

Before a full calibration or a calibration check is begun, assure that the sensing assembly is in "clean air". If the atmosphere at the sensor contains a low background of $H_2S$ observe the following procedure:

1. Obtain a GMI field calibrator plastic bottle (P/N 50000). Assure that it contains no $H_2S$ by flushing it with clean air. Place your hand or a cover over the bottle's open end and take it to the sensor.

2. Place the bottle over the sensor.

3. Wait a few minutes for the sensor to become permeated with clean air. The meter will be in the wide black zone on the meter face.

4. Remove the sensor from the bottle.

After each use of the field calibrator plastic bottle, it is necessary to clear the bottle of residual $H_2S$ gas. This may be done by flushing the plastic bottle with clean air or by human breath.

C. CALIBRATION CHECK

Using field calibrator plastic bottle (P/N 50000), obtain a GMI glass ampoule which has the same ppm $H_2S$ concentration as the 50% of full scale marking on controller. For example, for a 100 ppm full scale range, use a 50 ppm ampoule. Check the date code on the ampoule. Ampoules may start to lose concentration after a specified period. The ampoule label will state: "EXP (date)". Please adhere to this cut-off date. Place the ampoule in the holder inside the calibration bottle and place the bottle over the sensor to be calibrated. Crush the ampoule by turning the screw assembly which serves as a vise to crush the ampoule. Wait for the meter to stabilize.

After stabilizing, the meter should read 50± 5ppm. If so, CALIBRATION CHECK is completed. If the meter does not read within noted tolerances, it will be necessary to calibrate per Section D which follows.

D. SYSTEM CALIBRATION

1. Controller and sensors are factory calibrated and should be installed as a matched set in order to preserve factory-set calibration points. The correct sensor serial number to be used with each channel, along with alarm set points, are found on the white tag attached to the mounting screw on each control card. Be sure each controller/sensor has been in operation for 24 hours prior to calibration to assure its stability.

2. Assure that the sensor is in "clean air" per Section B above. Select an $H_2S$ calibration ampoule that represents the full scale reading on the meter. Place the ampoule in the calibration bottle (P/N 50000). Place the bottle over the sensor and crush the ampoule as described in Section C above. Make sure that there is a tight seal. Approximately 5 minutes should be allowed to assure a stabilized reading. After it stabilizes, adjust the front panel "U" Span Pot for that channel, to obtain a full scale reading. Remove the calibration bottle from the sensor and empty the broken glass. Clear the bottle of residual $H_2S$ gas before exposure to the "low calibration ampoule".

3. Select an $H_2S$ calibration ampoule that represents 20% of the full scale meter range. Place the ampoule in the field calibration bottle and repeat the procedure per Step 2 above to expose the sensor to $H_2S$ gas for 5 minutes. Then adjust the "L" Span Pot to move the meter needle to 20% of full scale. Remove the calibration bottle from the sensor and empty broken glass.

4. Next, perform the procedure given in Part C above at 50% of full scale. This will verify the accuracy of calibration.

5. When a new sensor is installed in an existing system, re-calibrate using each step of Section D.

## VI. TROUBLESHOOTING PROCEDURES

| PROBLEM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| 1. No Front Panel LED on or flashing and all the meters of the control cards are resting underrange. | 1. No Primary Power.<br>2. Primary Power (AC or DC) fuse is blown. | 1. Check Primary Power.<br>2. Replace blown fuses (on rear center panel of the instrument chassis). |
| 2. No Front Panel LED on or flashing on one or more control cards (but not all) and their meters resting underrange. | 1. Fuses in the control card are blown. | 1. Replace blown fuses in the control cards that are bad. |
| 3. Front Panel Alarm LED flashing all the time and meter staying upscale. | 1. Gas at Sensor.<br>2. Sensor leads (Red & Green) are shorted. | 1. Check for gas at the sensor.<br>2. Check sensor cable & connections for shorts. |
| 4. Alarm circuits (Low and/or High) do not turn on when gas is at the sensor. | 1. Sensor leads (Red and/or Green) are not connected properly at sensor or controller.<br>2. Problem in the controller alarm circuits. | 1. Check sensor cable and connections for open circuit.<br>2. Short Red to Green lead. This will cause false Low and High alarms if controller is working OK. Problem is in sensor or sensor cable. |
| 5. Front Panel Malfunction LED is flashing and meter is not in underrange. | 1. Toggle switch SW1 in "C" or "A" position. | 2. Be sure Toggle Switch is in the N (Normal Operation) position. |
| 6. Front Panel Malfunction LED is flashing and meter is in underrange. | 1. Sensor cable (White and/or Black leads) is not connected properly at sensor or controller.<br>2. Low Primary Power (AC or DC) to Controller.<br>3. Sensor bad | 1. Verify sensor cable connection correct at sensor and controller.<br>2. Verify proper Primary Voltage to controller.<br>3. Replace sensor |

If the problem appears to be beyond the scope of the above procedures, please consult the factory. Repair effort beyond replacement of recommended spare parts by other than factory personnel may void the warranty.

## GENERAL MONITORS

### VII. SPECIAL WARNING

Through engineering design, testing, manufacturing techniques, and rigid quality control, General Monitors delivers the finest gas detection systems available. The user must recognize his responsibility for maintaining the gas detection system in operational condition.

(1) GENERAL MONITORS recommends a calibration check on a regular schedule. The calibration check should be conducted at least every ninety (90) days. This is the only method of insuring proper system operation and response to $H_2S$. More frequent calibration checks are encouraged, to spot problems such as mud collecting on the sensor heads, accidental painting over of sensors, etc. A calibration check is defined as the procedure of applying a known concentration of gas to the system sensors while observing the controller. The visual display will indicate the gas concentration and activate alarm indicators/circuits in direct relationship to gas concentration. Calibration adjustments must be made if results are at variance (see CALIBRATION section of this manual).

(2) GENERAL MONITORS cautions, as with all equipment of this type, that high levels or long exposure to certain atmospheres will "poison" the sensor and eventually affect sensitivity. See Section III. D. (3) for specific information. Use in such atmospheres requires calibration checks on a more frequent schedule than normal. General Monitors should be consulted for application feasibility determination before installing a system in such atmospheres.

(3) GENERAL MONITORS' sensors and sensor housings are designed and tested for use in certain classes of hazardous atmospheres. Explosion-proof integrity cannot be maintained if sensors and sensor housings are operated in other than the "as designed" condition. Terminal access covers of sensor housings must be on. Sensor housing must be installed in accordance with National Electrical Code acceptable practices for the class of hazardous atmosphere.

(4) Sensors are designed with sintered metal or screen covers which act as flame arrestors. Do not operate sensors without screen or sintered metal parts in place.

(5) GENERAL MONITORS' gas detection systems are primarily SAFETY devices for the protection of personnel and facilities, and must be "always ready". With proper installation, calibration, and maintenance, the system will provide continuous monitoring of hazardous areas. The user must assume all liability for misuse of GENERAL MONITORS' gas detection systems.

(6) The system's full two year warranty will be voided if customer personnel or third parties damage the system during repair attempts.

## VIII. WARRANTY

GMI warrants all of its products to be free from defects in workmanship or material under normal use and service within two (2) years (Gas Detection) and (1) year (Flame Detection) from date of shipment. GMI will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by GMI personnel. Gas detection elements which have been poisoned by contaminants are not included in this warranty. In all cases this warranty is limited to the cost of the equipment. All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without GMI approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered. GMI's responsibility under the above warranty shall be limited to the repair or replacement at GMI's option at no cost to the purchaser for parts or labor, of any component which fails during the warranty period provided that the purchaser has promptly reported such failure to GMI in writing and GMI, upon inspection, found such component to be defective. The purchaser must obtain shipping instructions for the return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

EXCEPT FOR THE EXPRESS WARRANTY STATED ABOVE, GMI DISCLAIMS ALL WARRANTIES WITH REGARD TO THE PRODUCTS SOLD HEREUNDER, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, AND THE EXPRESS WARRANTIES STATED HEREIN ARE IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF GMI FOR DAMAGES INCLUDING, BUT NOT LIMITED TO, CONSEQUENTIAL DAMAGES ARISING OUT OF/OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE PRODUCT.

GENERAL MONITORS

## IX. MODEL 2600 SPECIFICATIONS

### CONTROLLER

| | |
|---|---|
| Mounting Configurations: | Rack, panel. |
| Dimensions: | 483mm x 178mm x 378mm (19"W x 7"H x 14.9"D). |
| Weight: | 18 kg (45 lbs). |
| Temperature Range: | -18°C to + 66°C (0°F to + 150°F). |
| Power: | 22-30 VDC; 105-130 VAC, or 205-255 VAC, 50-60Hz; 5 watts per channel nominal. |
| Meter Range: | 0-100ppm $H_2S$ (standard). Others available are 0-20, 0-50ppm. |
| Repeatability: | 5% of reading. |
| Alarm Circuits: | Three: High, Low and Malfunction per channel, Non-latching malfunction and low alarm, and latching high alarm standard. DPDT contacts rated at 3A @ 117 VAC, resistive. |
| Status Indicators: | Analog meter. LED's to indicate high alarm, low alarm, malfunction, and normal conditions. |
| Output Signal: | 4-20ma into a maximum 600 ohm load. |
| Electrical Classification: | General purpose. |
| Options: | Normally energized low and high alarms.<br>Latching or non-latching low and high alarms (any combination).<br>Sealed relays. |
| Warranty: | Two years. |

## SENSOR

| | |
|---|---|
| Type: | Continuous diffusion, adsorption type. |
| Temperature Range: | -40°C to + 90°C (-40°F + 195°F). |
| Response Time: | Meter display reads 25% full scale within 20 seconds, 50% within 60 seconds, when exposed to $H_2S$ in a concentration equal to full scale. |
| Drift: | 5% per year. |
| Electrical Classification: | NEC AND CEC Class I, Division 1, Group B, C, and D. Approved by the Canadian Standards Association (CSA). |
| Specificity: | $H_2S$ specific. |
| Warranty: | Two years. |
| Cable: | Four conductor cable. Maximum length of cable between controller and sensor assembly with loop resistance of 20 ohms: |

| Wire Size | Length | |
|---|---|---|
| AWG | Meters | Feet |
| 14 | 1,029 | 3,375 |
| 16 | 686 | 2,250 |
| 18 | 411 | 1,350 |
| 20 | 274 | 900 |

NOTE: Shielded cable is recommended.

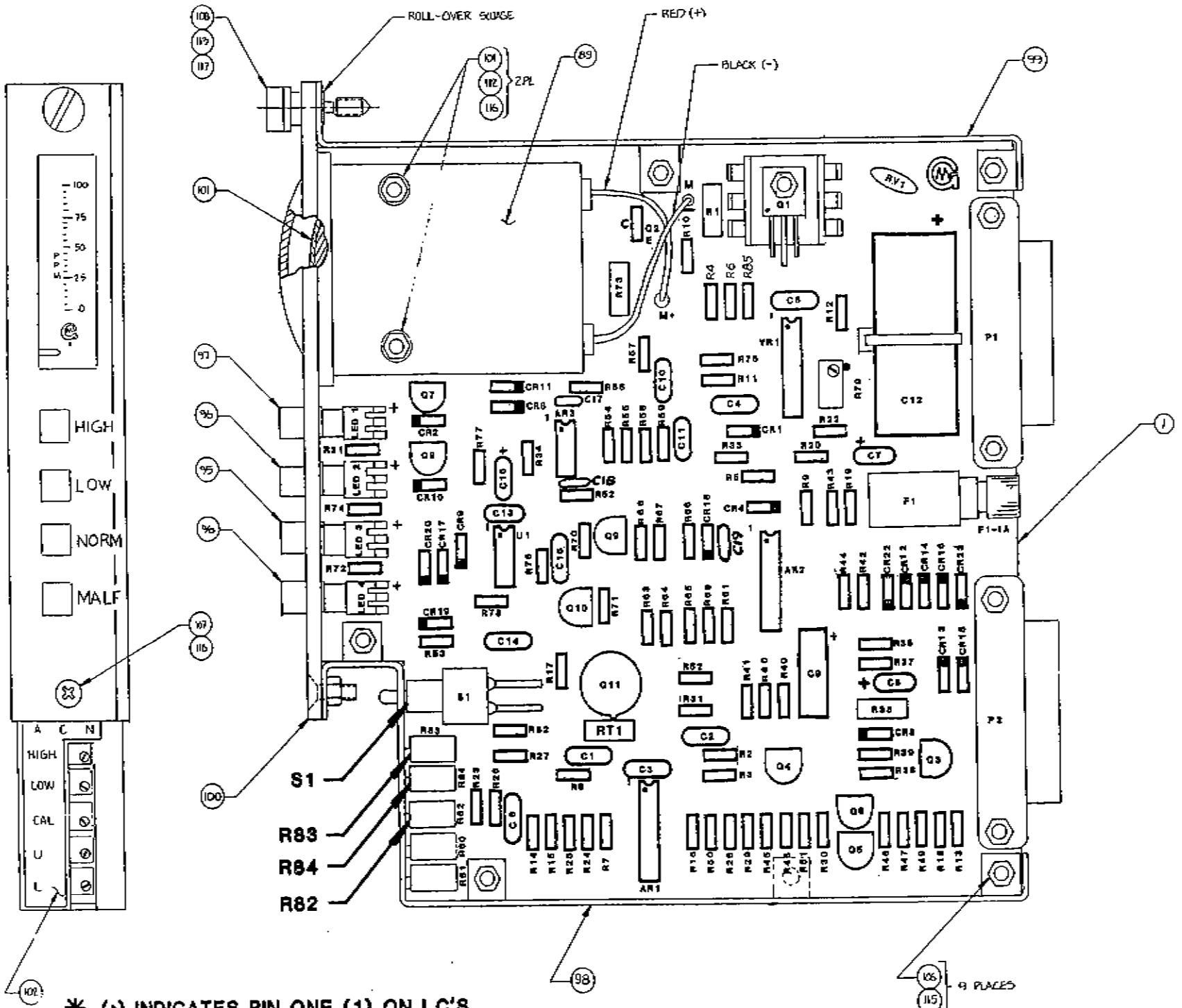
GENERAL MONITORS

## XI. RECOMMENDED SPARE PARTS

### ONE MODEL 2600

### FOR UP TO TWO YEARS OPERATION

| P/N | DESCRIPTION | QUANTITY |
|---|---|---|
| 948-323 | LED-Amber (Low alarm or malfunction) | 4 |
| 948-322 | LED-Green (Normal) | 4 |
| 948-321 | LED-Red (High alarm) | 4 |
| 939-048 | Lens - Amber | 4 |
| 939-047 | Lens - Green | 4 |
| 939-049 | Lens - Red | 4 |
| 945-030 | Relay (this P/N for standard configuration only). Consult the factory or your local representative for systems ordered with optional relay configurations. | 3 |
| 951-013 | Fuse (circuit symbol F1). Located on each channel control card. 1 amp, 250V. | 16 |
| 951-007 | AC Fuse (rear panel) 3 amps, 250V, 3AG | 4 |
| 951-112 | DC Fuse (rear panel) 10 amps, 125V, 3AG | 4 |
| 50445-X | Sensor (specify range) | 2 |
| 10252 | Sensor Housing | 1 |
| 50857 | Channel Control Card | 1 |
| Various (see page 4) | Relay Card | 1 |
| 20314 | Meter (specify range) | 2 |
| 50009-X | Calibration Kit (specify meter range) | A/R |
| 50008-X | Calibration Ampoules (box of 12) (specify meter range) | A/R |

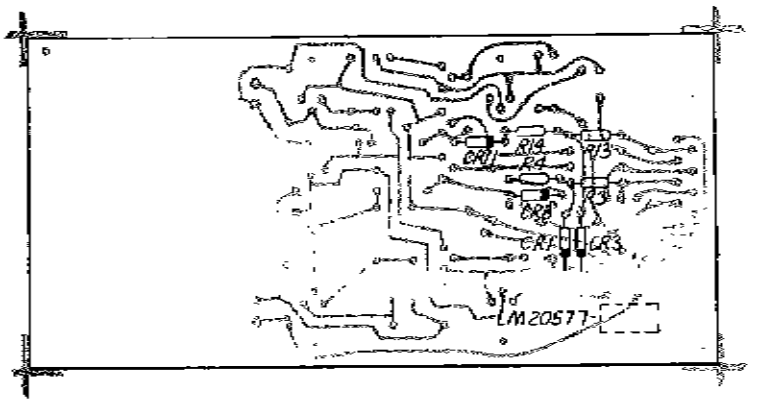



✱ (•) INDICATES PIN ONE (1) ON I C'S.

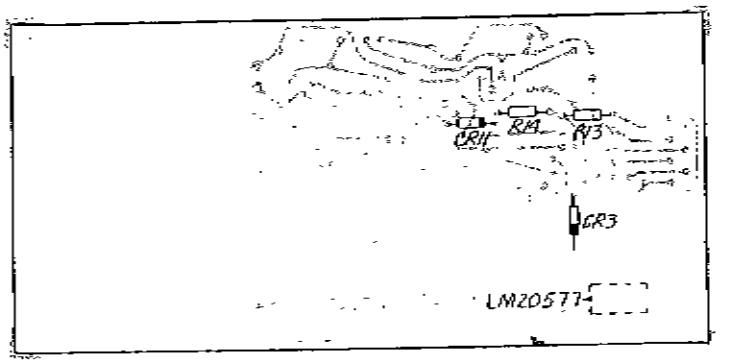
(REF 50857 G)

**FIG.6** SHT 1

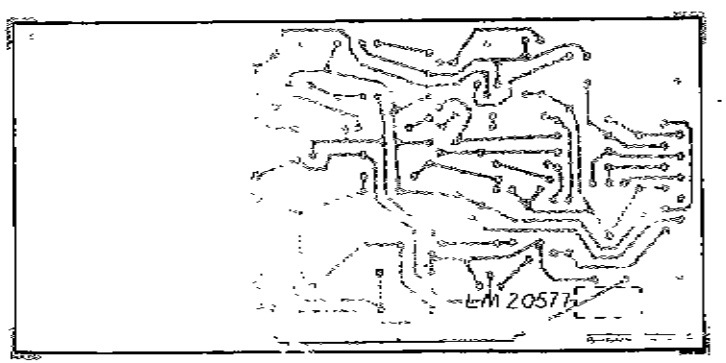
**CCA, CONTROL ELECTRONICS**




-1 ASSY
(LATCHING)




-3 ASSY
(LATCHING HI/NON-LATCHING LOW)



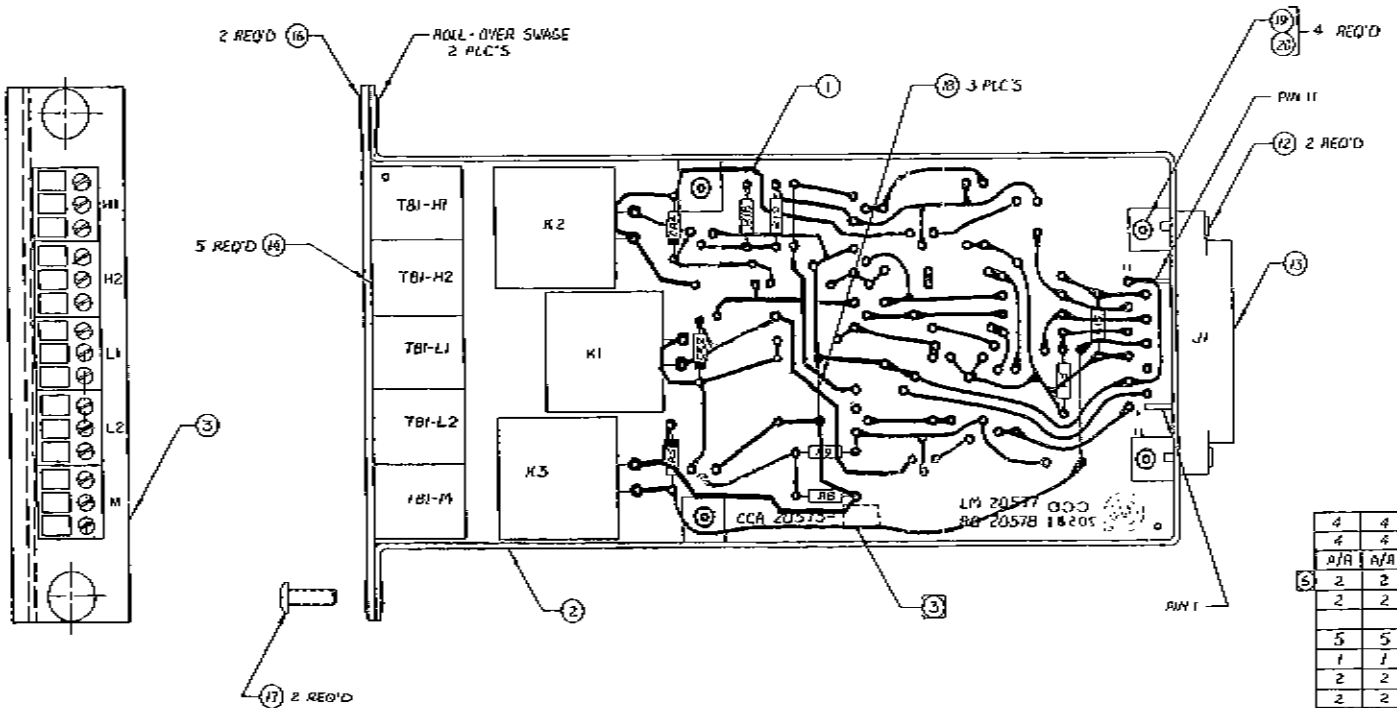

-2 ASSY
(NON LATCHING)
(NO ADDITIONAL COMPONENTS)

| QTY-3 | QTY-2 | QTY-1 | PART NO. | DESCRIPTION | | ITEM |
|---|---|---|---|---|---|---|
| 2 | — | 4 | 948-104 | DIODE, IN4148 | CR1,3,8,11 | 4 |
| 1 | — | 2 | 947-036 | RESISTOR, 10K, ¼W, ±5% | R3,13 | 3 |
| 1 | — | 2 | 947-033 | RESISTOR 5.6K ¼W ±5% | R4,14 | 2 |
| | | | | | | 1 |

(REF 20577 A)

**FIG.7**

**CCA, LATCHING MODES**
**COMMON COMPONENTS**

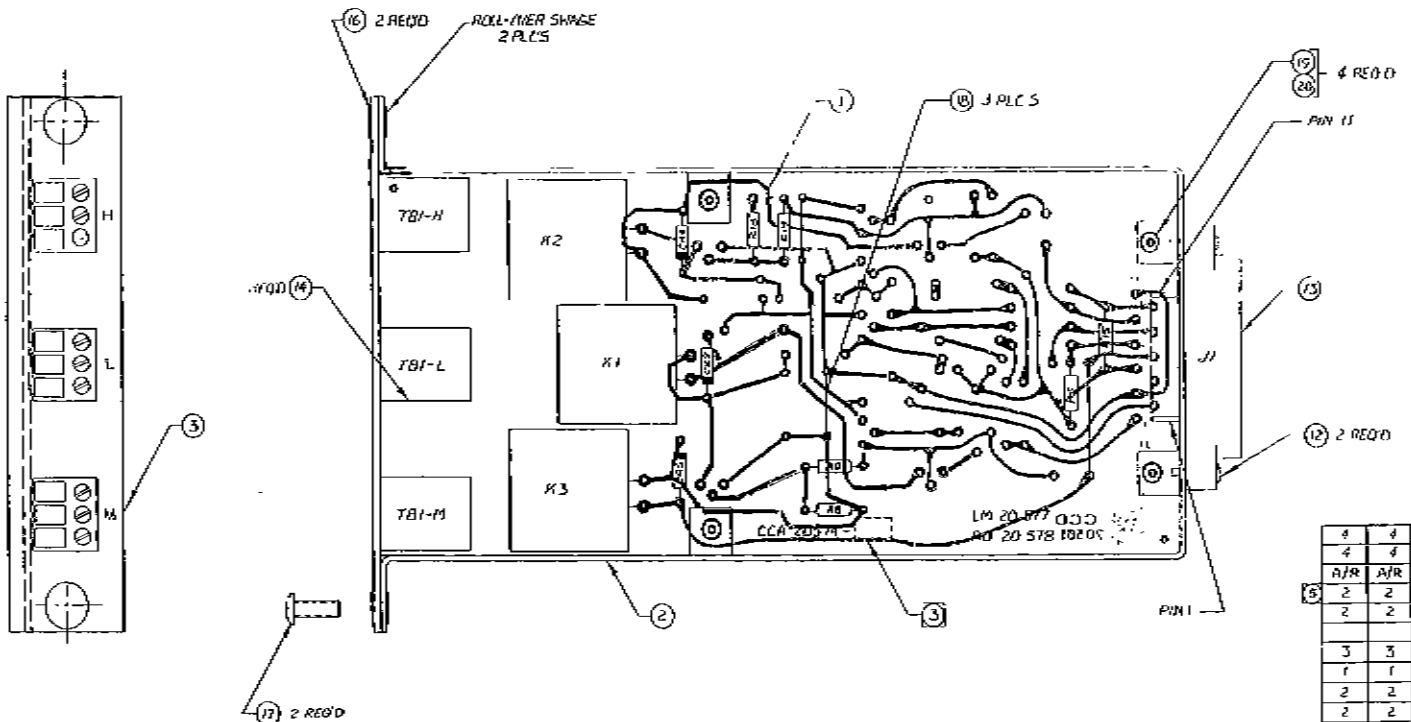



| | | | | | |
|---|---|---|---|---|---|
| 4 | 4 | | NUT, HEX, M3×0.5, NYLON | | 20 |
| 4 | 4 | | SCREW, MACH M3×0.5×8 P-SLT- NYLON | | 19 |
| A/R | A/R | | WIRE, BUS - 22 AWG | | 18 |
| (5) 2 | 2 | DIN 7985 | S.R. MACH M3.5 X 0.6 X 10 P-PAN-SST | | 17 |
| 2 | 2 | 928-758 | EYELET, 5.800 X 5.7mm LG (.29X.22IN) | | 16 |
| | | | | | 15 |
| 5 | 5 | 921-326 | TERMINAL BLOCK - 3 POS | T81-H1,H2,L1 L2,M | 14 |
| 1 | 1 | 921-161 | SOCKET, CONN-11 POS | J1 | 13 |
| 2 | 2 | 928-747 | RIVET, POP - ALUM | | 12 |
| 2 | 2 | 947-028 | RESISTOR 2.2K, 4W ±5% | R8 18 | 11 |
| 2 | 2 | 947-041 | RESISTOR, 6.8K 4W ±5% | R9 19 | 10 |
| 2 | 2 | 947-036 | RESISTOR 10K 4W ±5% | R5 15 | 9 |
| 3 | 3 | 948-104 | DIODE, IN4148 | CR 2 4 5 | 8 |
| | | | | | 7 |
| | | | | | 6 |
| — 3 | 3 | 945-027 | RELAY, UNSEALED | K1, 2, 3 | 5 |
| 3 | — | 945-030 | RELAY, SEALED | K1, 2, 3 | 4 |
| 1 | 1 | 20 540 | REAR PANEL RELAY CARD | | 3 |
| 1 | 1 | 20 530 | FRAME, RELAY CARD | | 2 |
| 1 | 1 | 20 584 | CCD, RELAY BOARD | | 1 |
| QTY-2 | QTY-1 | PART NO. | DESCRIPTION | | ITEM |

(REF 20576 D)

**FIG.8**

**CCA, DPDT RELAY - COMMON COMPONENTS**

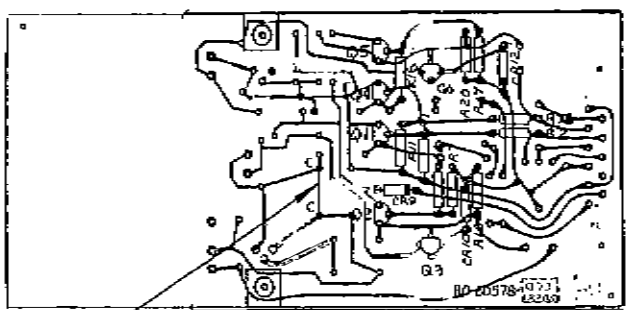



| | | | | | |
|---|---|---|---|---|---|
| 4 | 4 | | NUT, HEX M3 x 0.5, NYLON | | 20 |
| 4 | 4 | | SCREW MACH-M3 x 0.5 x 8, P-SLT-NYLON | | 19 |
| A/R | A/R | | WIRE, BUS - 22 AWG | | 18 |
| 2 | 2 | ANU 7285 | SCREW, MACH Ø3.5 x 0.6 x 10 PAN-SST-PHIL | | 17 |
| 2 | 2 | 928-758 | EYELET, 5.a Ø0 x 5.7 mm (6 (.23 x .22 IN) | | 16 |
| | | | | | 15 |
| 3 | 3 | 921-326 | TERMINAL BLOCK - 3 POS | TBI-H, L, M | 14 |
| 1 | 1 | 921-161 | SOCKET, CONN - 11 PNS | J1 | 13 |
| 2 | 2 | 928-747 | RIVET, PYP - ALUM | | 12 |
| 2 | 2 | 947-028 | RESISTOR, 2.2K, ¼W, 5% | R8, 18 | 11 |
| 2 | 2 | 947-041 | RESISTOR, 6.8K ¼W 5% | R9 19 | 10 |
| 2 | 2 | 947-036 | RESISTOR, 10K, ¼W, 5% | R 5 15 | 9 |
| | | | | | 8 |
| 3 | 3 | 948-104 | DIODE, IN4148 | CR 2 4 5 | 7 |
| | | | | | 6 |
| — | 3 | 945-027 | RELAY SPDT - UNSEALED | K1 2 3 | 5 |
| 3 | — | 945-030 | RELAY, SPDT - SEALED | K1, 2 3 | 4 |
| 1 | 1 | 20 530 | REAR PANEL, RELAY CARD | | 3 |
| 1 | 1 | 20 550 | FRAME, RELAY CARD | | 2 |
| 1 | 1 | 20 580 | CCD, RELAY BOARD | | 1 |
| QTY-2 | QTY-1 | PART NO. | DESCRIPTION | | |

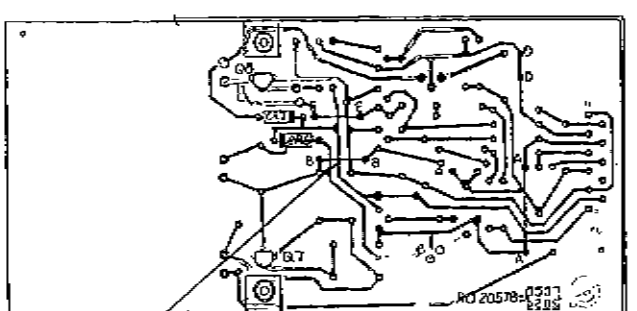
(REF 20574 C)

**FIG.9**

**CCA, SPDT RELAY & COMMON COMPONENTS**



2 REQ'D (15) -1 ASSY (ENERGIZED)



5 REQ'D (15) -2 ASSY (DE-ENERGIZED)

| A/R | A/R | 932-002 | COATING, CONFORMAL | | 18 |
|---|---|---|---|---|---|
| | | | | | 17 |
| | | | | | 16 |
| A/R | A/R | | WIRE, BUS - 22 AWG | | 15 |
| | | | | | 14 |
| 2 | 2 | 948-240 | TRANSISTOR, MPSA56 | Q1,4,7,8 | 13 |
| — | 4 | 948-243 | TRANSISTOR, MPSA06 | Q 2,3,5,6 | 12 |
| | | | | | 11 |
| | | | | | 10 |
| — | 2 | 947-028 | RESISTOR, 2.2K, ¼W, ±5% | R10, 20 | 9 |
| — | 2 | 947-039 | RESISTOR, 22K, ¼W, ±5% | R 7, 17 | 8 |
| — | 2 | 947-046 | RESISTOR, 68K, ¼W, ±5% | R 6, 16 | 7 |
| — | 2 | 947-042 | RESISTOR, 33K, ¼W, ±5% | R 2, 12 | 6 |
| — | 2 | 947-036 | RESISTOR, 10K, ¼W, ±5% | R 1, 11 | 5 |
| | | | | | 4 |
| 2 | 3 | 948-104 | DIODE, IN4148 | CR6, 7, 9, 10, 12 | 3 |
| | | | | | 2 |
| | | | | | 1 |
| QTY-2 | QTY-1 | PART NO. | DESCRIPTION | | ITEM |

(REF 20578 C)

**FIG. 10**

**CCA, RELAY OPERATION - COMMON COMPONENTS**