GENERAL MONITORS

Protection for life.

MODEL 2180

Single Channel
Hydrogen Sulfide Gas Monitor

INSTRUCTION MANUAL 11/88

Part No. MAN2180
Revision 11-88

GENERAL MONITORS

TABLE OF CONTENTS

I. INTRODUCTION

A. PATENT NOTICE

B. GENERAL

The Model 2180 Hydrogen Sulfide Monitor has evolved from earlier GMI systems which have an established reputation for reliable performance. By carefully following the instructions in this manual, you will be assured of the most dependable, continuous protection against hazardous accumulations of hydrogen sulfide gas. Except for periodic calibration checks there is no routine maintenance requirement. The Model 2180 controller is a solid-state instrument which features recent advancements in electronic circuitry and packaging techniques. The system's sensor is a second generation product, incorporating advancements in sensor technology and performance. Its expected life is three years in normal service.

The Model 2180 is a single channel unit. The controller is designed for panel, wall or rack mounting, utilizing mounting hardware that can be supplied by GMI or the customer. Weatherproof and explosion proof controller housings are also available from GMI. The front panel is 175 mm (7") high and 53 mm (2") wide. External wiring connections are made to positive pressure terminals in the rear mounted terminal boards. GMI normally recommends that a service loop be used with the connecting wiring, to facilitate frontal access to the alarm pots and rear panel connections.

The sensor is for remote mounting, directly in the potentially hazardous area.

Primary power requirement for the Model 2180 is 105-130 VAC or 205-255 VAC @ 50-60 Hz, or 22-30 VDC. If desired, the DC input terminals may be used for "battery backup" connections to assure uninterrupted operation during commercial power outages (see page 11 for details). Power consumption is nominally 7 watts.

All alarm, readout and display capability is located at the controller. Front panel indicators include:

a) A linearly scaled meter with an active zero which reads ppm H_2S in one of three ranges: 0-20, 0-50 or 0-100 ppm.

b) Low, high and maalfunction alarm LEDs.

c) Normal LED.

Additionally, independent relays are provided for customer use in the high, low and malfunction alarm circuits.

The controller also provides an analog output signal proportional to H_2S concentration for customer use.

C. SENSOR OPERATING PRINCIPLE

GMI's sensor is a solid state, continuous, diffusion type element. The sensor utilises hydrogen sulfide's ability to strongly and significantly adsorb onto certain materials as the basis for the measurement. Specifically, H_2S will adsorb onto many different metals (as will many other materials, including numerous hydrocarbons, sulphur dioxide and other sulphur compounds). GMI has developed a proprietary metal oxide semiconductor which is extremely selective in "permitting" H_2S to adsorb onto it. That is, very few other compounds found in practical applications will affect this metal oxide. The semiconductor material is therefore, for all practical purposes, specific to H_2S.

The semiconductor is located in the system circuit, acting as a resistor. When air which contains H_2S diffuses into the sensor through the outer 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 to 100 ppm H_2S, thus the change produces an analog signal approximately proportional to the logarithm of the H_2S concentration. This signal is processed, linearized, and displayed on the controller meter in ppm H_2S. The controller's analog output signal accurately tracks the H_2S reading as well. The adsorption process is reversible, so that when air containing no H_2S subsequently diffuses into the sensor, the H_2S gas desorbs. The semiconductor then resumes its original "clean air" resistance value.

D. CONTROLLER FEATURES AND ADJUSTMENTS

The controller contains the alarm, display and readout capability described in Part B above.

An analog output signal is available for customer use. This signal tracks the meter readout and is nominally 4-20 ma linear standard.

Independent DPDT relay contacts are provided for HIGH alarm and LOW alarm. These relays can be configured to provide either latching (manual reset required) or non-latching (automatic reset) and normally energized or normally de-energized operation. These variations are accomplished by setting sections of switch S3 to the proper position (see figure 5, sheet 1, for the location of S3).

The malfunction relay contacts are SPDT and are always supplied non-latching and normally energized. When the gas alarm circuits are in the latching configuration, they are manually reset by depressing the momentary action RESET switch. The low and high alarm will only reset, whether latching or non-latching, when the H_2S concentration at the sensor is below the concentration where the alarms have been set. As stated above, an alarm condition is also indicated by a LOW alarm LED (amber), HIGH alarm LED (red), or Malfunction, MALF, LED (amber) on the front panel. Both gas alarms are fully adjustable to any H_2S concentration within the full scale.

On the front panel are adjustments for calibrating the system. They are located behind small, restricted access holes. See Section IV of the manual for the procedures involved.

Also behind the front panel is a three position toggle switch. 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 are being adjusted (see the PRE-OPERATION ADJUSTMENTS SECTION). In this position all gas alarm relays are disabled to prevent false alarms.

NOTE

In the "C" and "A" position, 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 Operating ("N") position. However, the malfunction relay will remain energized and will function normally should a malfunction condition occur.

When power is first applied to the controller, there is approximately a six (6) second time-out period during which a malfunction indication will be present. After time-out, the malfunction LED will extinguish and the NORMAL (NORM) LED will light. If there is a gas concentration at the sensor exceeding either alarm set point, the appropriate alarm circuit will actuate at the conclusion of the time-out period.

II. INSTALLATION INSTRUCTIONS

A. CONTROLLER LOCATION

The Model 2180 Controller should be installed in a weather protected, non-hazardous area. The following mounting hardware is available to facilitate installation:

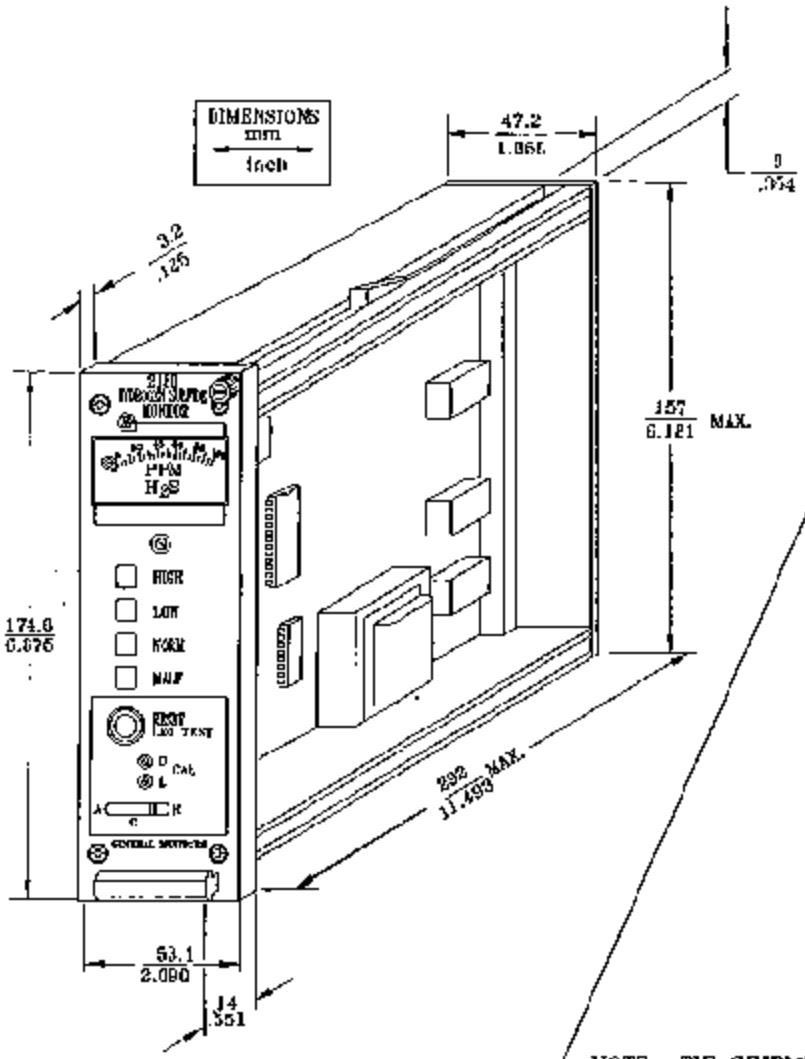
49mm (2") panel mount frame	P/N 10201-1
98mm (4") panel mount frame (2 controllers)	P/N 10199-1
483mm (19") rack frame (8 controllers)	P/N 10200-1
Blank panel (one for each unused position in 19" frame)	P/N 10187
49mm (2") wall mount bracket	P/N 10195-1
98mm (4") wall mount bracket (2 controllers)	P/N 10202-1
Weatherproof Enclosure	P/N 10259-1
NEMA 7 Explosion Proof Enclosure	P/N 10099
Desk Top Cabinet (up to 8 controllers)	P/N 914-006

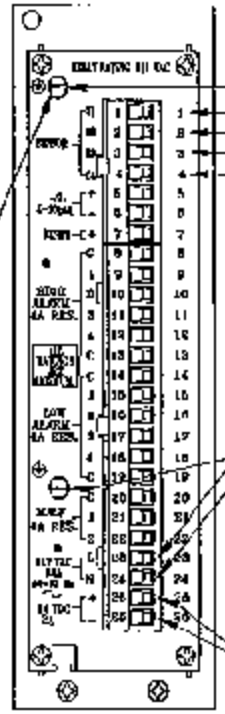
Mounting should be as free from shock and vibration as possible. Caution should be taken not to mount the controller in close proximity to radio transmitters or similar equipment, even though the controller is RFI resistant. It is recommended that a wiring service loop be utilized to facilitate gaining access to the alarm set points. Care should be taken to assure adequate ventilation. Do not mount the controller in a manner which will restrict the natural convection air flow from normal ambient air. The controller operating temperature range is 0° C to 60° C (32° F to 140° F).

D. REAR TERMINAL INTERCONNECTIONS

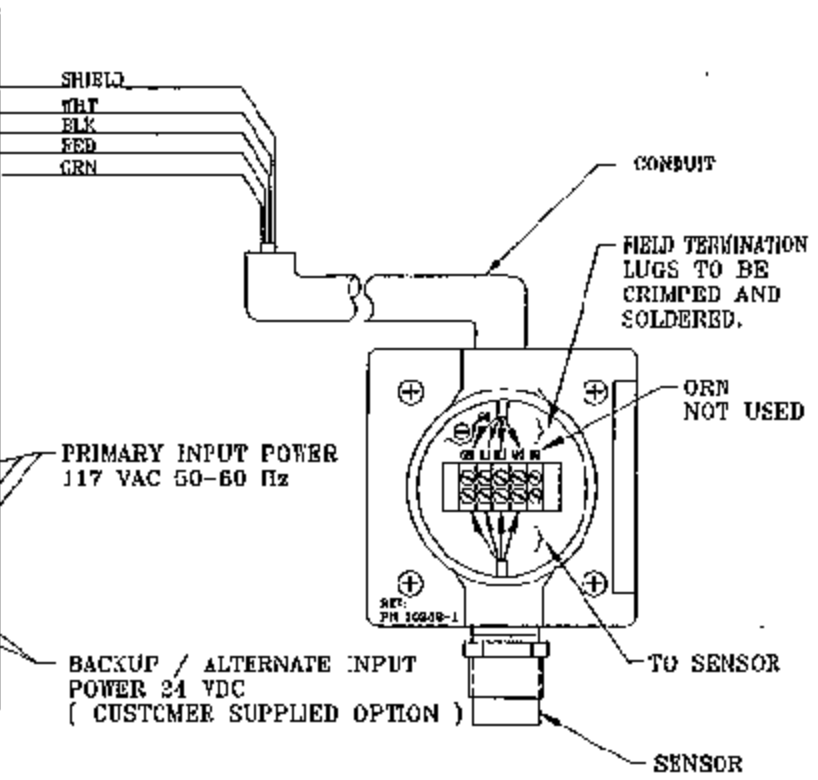
As an aid in wiring and in servicing, the Model 2180 controller is supplied with removable plugs for the rear terminations. The plugs are held securely in the header assemblies by a locking ramp (See Figure 1). To complete the interconnection wiring, the external connections should be made to the screw terminations of the plugs. If it is more convenient, the plugs may be removed from the controller by depressing the locking ramp, pulling them straight out and making the external connections to them. The plugs should then be replaced making sure they are seated fully and the locking ramp is locked into its proper position.

> NOTE
>
> It is important that a wiring service loop be utilized to ensure access to the alarm set point adjustments and to unplug the controllers from the interconnecting wiring when necessary.





REAR VIEW



JUNCTION BOX WIRING DETAIL
(COVER REMOVED)

NOTE: TIE SHIELD AT REAR OF CONTROLLER ONLY. IT MUST NOT TOUCH SENSOR HOUSING, CONDUIT OR ANY OTHER GROUND POINT.

CABLE: 4 CONDUCTOR SHIELDED CABLE. DO NOT SPLICE CABLE UNLESS NECESSARY. SPLICES INCLUDING SHIELD MUST BE TIGHT AND SOLDERED (ALL ACTIVE CHANNELS).

TYPICAL WIRING INSTALLATION – FOR REFERENCE ONLY

(REF 50671)

FIG. 1

OUTLINE DRAWING & REAR TERMINAL CONNECTIONS MODEL 2180

C. POWER CONNECTIONS

The system will operate on nominal line power of 117 VAC, 50/60 Hz. 220 VAC, 50/60 Hz operation is available on special request.

> NOTE
>
> To eliminate accidental system shutdown, GMI does not provide a power on-off switch so power must remain disconnected until all other wiring connections are made.

If AC is to power the system, connect the line power supply to the rear panel TB-1 terminals Line (L) and Neutral (N). Connect the Ground to the (⏚) connection on the left side of the rear panel. Refer to Figure 1. Use accepted commercial wiring practices.

Primary DC power may be utilized instead. Use any 24V nominal, 1A direct current supply. No. 14 wire should be used to prevent excessive voltage drop, and the run should be as short as possible. Connect the positive supply to 24 VDC (+) and the negative supply to 24 VDC (-) on the terminal block. An internal diode protects the system in the event of inadvertent supply reversal.

D. ALARM WIRING CONNECTIONS

The low and high alarm contacts for customer use are DPDT, and are rated 4 amps at 117 VAC, resistive. The malfunction alarm contact is SPDT, 4 amps at 117 VAC, resistive. These contacts are brought out to terminals on the rear of the controller as follows (see figure 1):

	CONTACT CONDITION		
ALARM RELAY	OPEN	COM	CLOSED
Malfunction, TB-1	1	C	2
Low Alarm, TB-1	2,3	C	1,4
High Alarm, TB-1	2,3	C	1,4

The above chart shows the high and low alarm contacts in the normally de-energized state (with power applied).

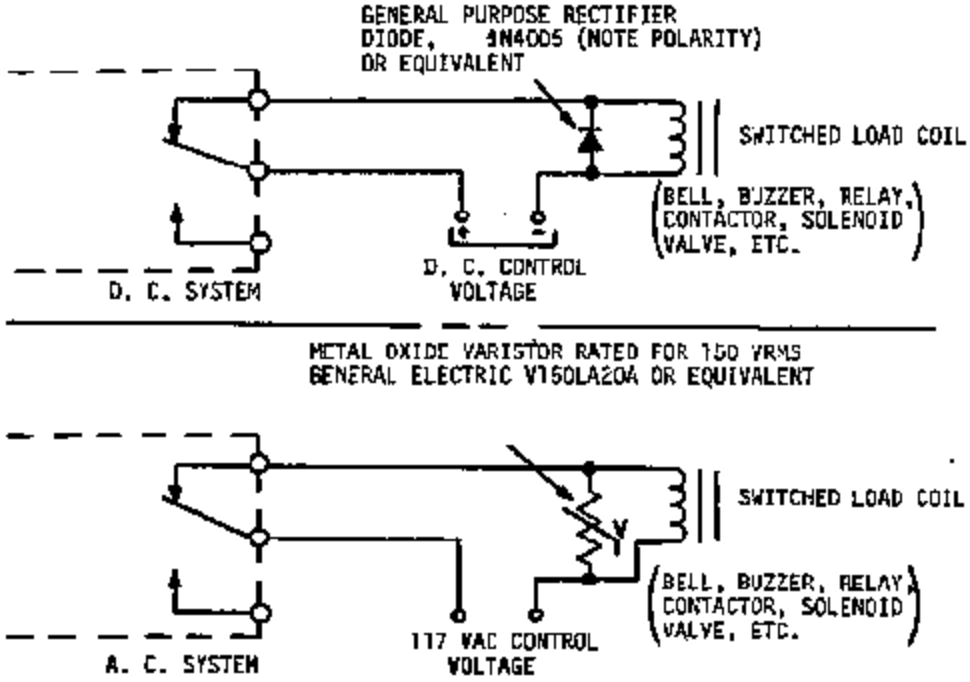
D. ALARM WIRING CONNECTIONS (cont'd)

> NOTE
>
> The malfunction relay is always supplied normally energized.

In the normally energized state (with power applied), the terminations are:

	CONTACT CONDITION		
ALARM RELAY	OPEN	COM	CLOSED
Malfunction TB-1	1	C	2
Low Alarm TB-1	1,4	C	2,3
High Alarm TB-1	1,4	C	2,3

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



E. ANALOG OUTPUT CONNECTION

The analog output must either be used or jumpered, or the system will not operate. The two analog output terminals, (AO+ and AO-), are located on the rear panel. The analog output is 4-20ma into a maximum 600 ohm load.

F. REMOTE RESET CONNECTION

Remote reset (of alarm circuits) connections are made to rear panel Terminal Board connections RESET and sensor terminal G4. If a remote reset switch is used, it must be a "normally open, momentary action" type.

G. 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 high 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 two year warranty would not apply.

H. SENSOR ASSEMBLY INSTALLATION

CAUTION - VERY IMPORTANT

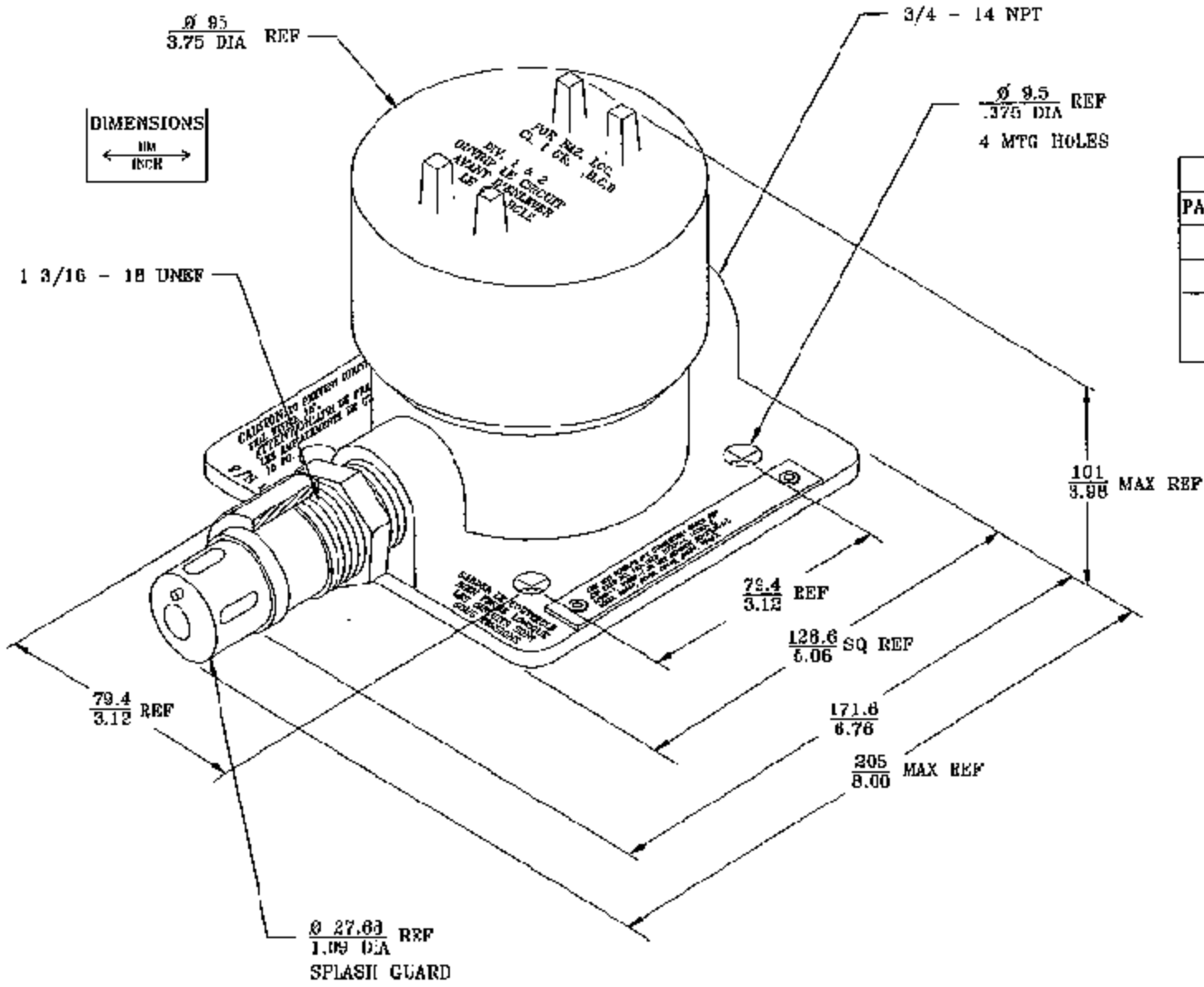
You will note that each sensor is shipped from the factory with a red plastic cap fitted over the sensing head. Inside the cap is a desiccant. DO NOT remove this cap until you are ready to power the system. SAVE the cap and RE-CAP the sensor at any time in the future when the system's power is off for 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. 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 consists of a sensor housing (GMI P/N 10252) and sensor (P/N 50445-1, -5, or -9) (see Figure 2). The dash (-) numbers correspond to full scale ranges of 0-100, 0-50, or 0-20 ppm respectively. The sensor assembly is recognized safe for U.S. National Electric Code Class I, Division 1, Groups B, C and D hazardous areas, and is approved by the Canadian Standards Association (CSA).

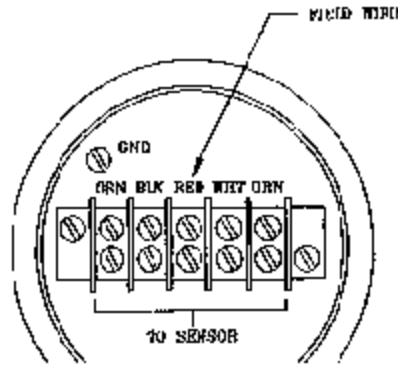
Sensors should ALWAYS be mounted pointing DOWNWARD to prevent the collection of moisture or contaminants. Several sensor covers are available, which will have been supplied with the system if ordered. These include P/N 10071 Porex Dust Cover, P/N 1800822 Sintered Stainless Steel Dust Cap, P/N 10117 Splash 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 numbered terminal strip within the sensor housing, as follows (Terminal #5 is not used):

SENSOR HOUSING TERMINAL NUMBER	SENSOR WIRE COLOR
1	White
2	Black
3	Red
4	Green



SENSOR GUARDS	
PART NUMBER	DESCRIPTION
1000822	DUST GUARD
10395	SPLASH GUARD
10110	DUST GUARD WITH DISPOSABLE SCREEN



WIRING DETAIL

(COVER REMOVED)

JUNCTION BOX ASSY-
SENSOR

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.2

JUNCTION BOX ASSY-SENSOR

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. Care should be taken to insure that the outer braid does not contact the conduit or junction boxes.

GENERAL MONITORS' sensor leads are color coded, and should be connected to Rear Terminal Board as shown in the following table:

TERMINAL BOARD	SENSOR CABLE COLOR
W1	White
B2	Black
R3	Red
G4	Green

Splices in the sensor cable should be avoided where possible. If required, they must be of high quality and must be soldered. Soldered connections in the sensor cable run will insure trouble-free operation of the low level sensor signals.

I. BATTERY BACKUP

Customer furnished BATTERY BACKUP may be used to provide emergency power to the Model 2180 Controller. The customer furnished battery may be connected as shown on Page 12. No manual or relay switching is required. A customer furnished battery charger should be used to keep the battery charged to the manufacturer's recommended level. The cable length (battery to controller) should be as short as possible. Should a power failure (AC) occur, the 24 volt battery supplies power to the 2180 circuitry.

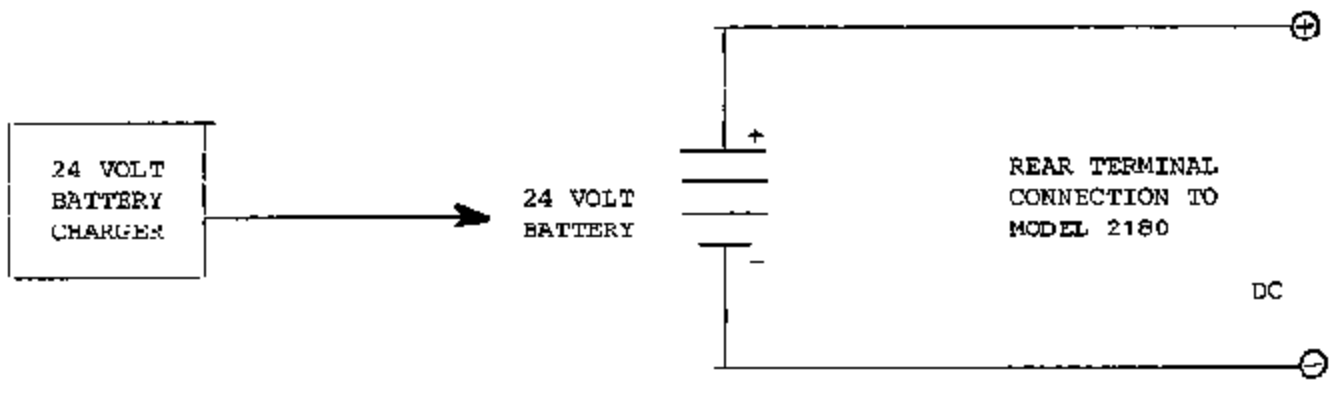
DO NOT USE MORE THAN A 24 VOLT BATTERY. The battery rating (ampere-hour) capacity) is dictated by the length of time you expect the power outage to last. A Model 2180 requires approximately 0.3 ampere at 24 volts DC.

NOTE

The schematic shown below is complete for a total of one Model 2180 Controller.

CAUTION

BATTERY BACKUP CIRCUIT, AS SHOWN BELOW, DOES NOT POWER EXTERNAL ALARM CIRCUITS.



III. PRE-OPERATION ADJUSTMENTS

A. GENERAL

Review the previous installation section and double check that all cable and power connections are installed properly before applying power. Also assure that the sensor is correctly installed.

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 6 seconds is completed). Should a malfunction condition be displayed, check the sensor cable 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). Wait 30 minutes for system warm-up.

REAR PANEL SENSOR TERMINAL	OPERATING VOLTAGE
*W (White)	*18 to 19VDC
*R (Red)	*14 to 15VDC

*Use the (-) DC terminal on the Rear Panel as "common" for these measurements.

C. SETTING RELAY OPERATION

As described above, the HIGH and LOW alarm relays can be set by the user to provide either latching or non-latching operation and energized or de-energized operation. Mini-Dip switch S3, located on the circuit board, is used to accomplish these settings. Refer to Figure 5, sheet 1, for location of S3.

To gain access, slide the controller forward a few inches from its mounted position.

Switch S3 incorporates a locking rod design which allows the insertion of a nylon rod through the rockers to prevent accidental actuation. Remove the rod to permit setting of the switches. There are four sections of switch S3. Sections S3-1 and S3-2 are used to set the energized or de-energized conditions of the HIGH and LOW alarm relays respectively and sections S3-3 and S3-4 are used to set the latching and non-latching modes of these same relays.

When viewing S3 from the side of the controller, depress the numbered end (1, 2, 3 or 4) to achieve the "ON" condition. Conversely, depressing the opposite (unnumbered) end turns the switch "OFF".

To set the desired relay operation, refer to the following table and set the switch sections accordingly.

> CAUTION
>
> After the switches are set, be sure to replace the locking rod to prevent accidently moving them during subsequent operations.

RELAY OPERATION
OPTION TABULATION

ALARM	NORMALLY	Switch (S3) Section 1	2	3	4
HIGH	ENERGIZED	OFF			
HIGH	DE-ENERGIZED	ON			
LOW	ENERGIZED		OFF		
LOW	DE-ENERGIZED		ON		
HIGH	LATCHING			OFF	
HIGH	NON-LATCHING			ON	
LOW	LATCHING				OFF
LOW	NON-LATCHING				ON

D. ALARM ADJUSTMENTS

Alarm adjustment pots are also accessible from the right hand side of the controller (when facing it), and when it is extended forward a few inches from its mounted position.

TO ADJUST THE LOW ALARM: (see Figure 5).

1. Set the toggle switch (located behind the front panel) to position "A". This position permits adjustment and disables external alarm circuitry. With the toggle switch in this position, the malfunction LED will flash, indicating the controller is "out of normal operating mode".

2. Turn ALARM SET Pot, R43, (on the right side of unit) (see Figure 5) 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, R45, (on the right side of unit) counterclockwise (CCW) until the Low Alarm LED turns on. If this Low Alarm LED is lit initially, turn the pot clockwise (CW) until the LED goes off, then adjust CCW until the LED turns on.

4. To check the alarm set point, adjust the meter down scale using the ALARM SET pot then slowly adjust the meter upscale, noting the concentration on the meter at which the Low Alarm LED lights. Repeat steps 2 and 3 if the Low Alarm LED does not light at the desired concentration.

5. Return the toggle switch to position "N". The Malfunction LED will stop flashing and turn "OFF".

TO ADJUST THE HIGH ALARM:

The procedure for adjusting the High Alarm is similar to the Low Alarm adjustment procedure.

1. Set the toggle switch to position "A". Malfunction LED will start flashing.

2. Using ALARM SET Pot R43, adjust the meter to the desired High Alarm set point.

3. If the High Alarm LED is off, adjust High pot R47, CCW until the High Alarm LED just turns on. If the High Alarm LED is lit, adjust High Pot R47, CW until it goes out, then CCW until it turns on.

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 lights. 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 LED will turn "OFF" and the green Normal LED will light after the time-out period.

E. FRONT PANEL LED TEST

Depress the front panel RESET switch and hold the switch in for 1 second. This permits you to observe that all front panel LEDS are working. Any LED which does not light is defective and should be replaced. The meter should also read zero (0) ppm during this test. This test should be conducted prior to system calibration and, if necessary, the meter should be adjusted to read zero (0) ppm.

IV. CALIBRATION

A. GENERAL

Considering the toxicity of hydrogen sulfide, General Monitors strongly recommends the period between calibrations should never exceed 90 days.

It is very important that the owner/operator of this equipment determine the correct calibration schedule for their particular environment. Frequently because of environmental contaminants and conditions the frequency of calibration may be substantially shorter than 90 days. This calibration frequency must be determined empirically by following a regular calibration routine and procedure.

A sample calibration schedule and checklist have been provided in the appendix of the manual. Please refer to it in establishing the required calibration program.

There are two calibration routines for the Model 2180 H_2S monitoring system which will required periodically. They are described in detail below.

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/start-up 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).

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 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 zero zone on the meter face.
4. Remove the bottle from the sensor.

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 the field calibrator plastic bottle (P/N 50000, obtain a GMI glass ampoule which has the same ppm H_2S concentration as the 50% full scale marking on the 2180 Controller. For example, for a 100 ppm full scale range, use a 50 ppm ampoule. Check 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 bottle and place the bottle over the sensor to be calibrated. Crush the ampoule by turning the screw assembly, which serves as a vise. Wait for the meter to stabilize.

After stabilizing, the meter should read[50 +/- 10 ppm (e.g.+/- 20%)]. If so, the CALIBRATION CHECK is completed. It the meter does not read within above noted tolerances, it will be necessary to calibrate per Section D which follows:

D. FULL SYSTEM CALIBRATION

1. Controller and sensors are factory matched and should be installed as a set in order to preserve factory-set adjustment points. The correct sensor serial number to be used with each channel, along with alarm set points, are found on the white label on the top plate of the controller. Be sure each controller/sensor has been in operation for 24 hours prior to calibration to assure stability.

2. Assure that the sensor is in "clean air" per Section B above. Select a H_2S calibration ampoule that represents the full scale reading on the meter. Place the 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 break as described in Section C above. Make sure that there is a tight seal between the sensor and the bottle. Approximately 5 minutes should be allowed to assure a stabilized reading. After it stabilizes, adjust the front panel "U" Span Pot (R1) for that channel, to obtain a full scale reading. Remove the calibration bottle and empty of broken glass. Clear the bottle of residual H_2S gas before exposure to the "low calibration ampoule".

3. Select a H_2S calibration ampoule that represents 20% of the full scale range. Place the ampoule in the field calibration bottle and repeat procedure per Step 2 above to expose the sensor to H_2S gas for 5 minutes. Then adjust the "J" Span Pot (R11) to move the meter needle to 20% of full scale. Remove the calibration bottle and empty the 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.

V. TROUBLE-SHOOTING

	PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
1.	No LED or meter indication on application of primary power to controller.	1. No. primary power. 2. Fuse (A.C. or D.C.) blown	1. Check primary power. 2. Replace blown fuse.
2.	Controller in alarm (even after reset).	1. Gas at sensor. 2. Sensor leads (Red and Green) are shorted.	1. Check for gas at sensor. 2. Check sensor cable and connections for shorts.
3.	Front panel Malfunction LED is flashing.	1. Sensor heat has not stabilized. 2. Sensor heater leads (black and/or white) are open. 3. Primary power voltage is too low or too high. 4. Mode switch is in ALARM or CALIBRATE position. 5. Analog out open.	1. Check sensor. 2. Check sensor cable and connections for opens. 3. Check primary power. 4. Move mode switch to NORMAL position. 5. Connect or short out the analog out, A.O. + and A.O. −.
4.	Incorrect relay operation.	1. DIP switches incorrectly set.	1. Set DIP switches for correct relay operation (see page 14).

IMPORTANT NOTE: The above information is not all-inclusive regarding potential problems. If the corrective actions listed above do not eliminate a particular problem, the best course of action is to return the system to the factory for repair. If the system is still under warranty, damage caused by customer repair may void the warranty.

VI. 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 II. F (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 steel 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.

GENERAL MONITORS

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.

APPENDIX

A.RECOMMENDED SPARE PARTS

QTY.	DESCRIPTION	PART NUMBER
1	Lens - amber	939-046
1	Lens - red	939-049
1	Lens - green	939-047
2	Fuse - 0.3A	951-011
2	Fuse - 0.8A	951-012
1	Sensor	Per original order

GENERAL MONITORS

B. SAMPLE CALIBRATION SCHEDULE AND CHECKLIST

Sensor Serial Number _____ Location _____

1) Installation and Preliminary Calibration (Record date after preliminary calibration is done)

Date: _____

2) 24 hour calibraton (Record date after 24 hour calibration is done)

Date: _____

3) 7 day calibration check (Record date and reading of calibration check. Repeat after 7 days if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 4)

Date/Reading		Date/Reading		Date/Reading	

4) 14 day calibration check (Record date and reading of calibration check. Repeat after 14 days if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 5)

5) 1 month calibration check (Record date and reading of calibration check. Repeat after 1 month if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 6)

6) 2 months calibration check (Record date and reading of calibration check. Repeat after 2 months if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 7)

7) 90 day calibration check

C. SPECIFICATIONS

CONTROLLER

Mounting Options:	rack, panel, wall, weatherproof enclosure
	53mm x 175mm x 294mm 2.1" W x 6.9" H x 11.5" D
Weight:	1.8 kg. (Approx. 3.8 lbs.)
Temperature Range:	0° C to 60° C (32° F to 140° F)
Power:	105-130VAC/50-60 Hz 205-255VAC/50-60 Hz 22-30VDC, 7 watts
Humidity:	0 to 90% non-condensing
Meter Range:	0-20, 0-50, or 0-100 (one only)
Repeatability:	+/- 1% of input
No. of Channels:	One
Alarm Circuits:	Three: High and Low may be Latching or Non-Latching; Normally Energized or Normally De-energized. High and Low have DPDT contacts. Malfunction has SPDT contacts and is always non-latching and energized. All contacts rated at 4A, 117VAC resistive or 3A, 30VDC.
Output:	4-20ma standard, into a maximum 600 ohm load.
Status Indicators:	High alarm (Red), Low alarm (Amber), Malfunction (Amber) and Normal (Green).
Electrical Classifications:	General purpose (explosion-proof housing available).
Warranty:	Two years.

SENSOR

Type:	Continuous, diffusion, adsorption type.
Temperature:	-40° C to +90° C (-40° F to +195° F)

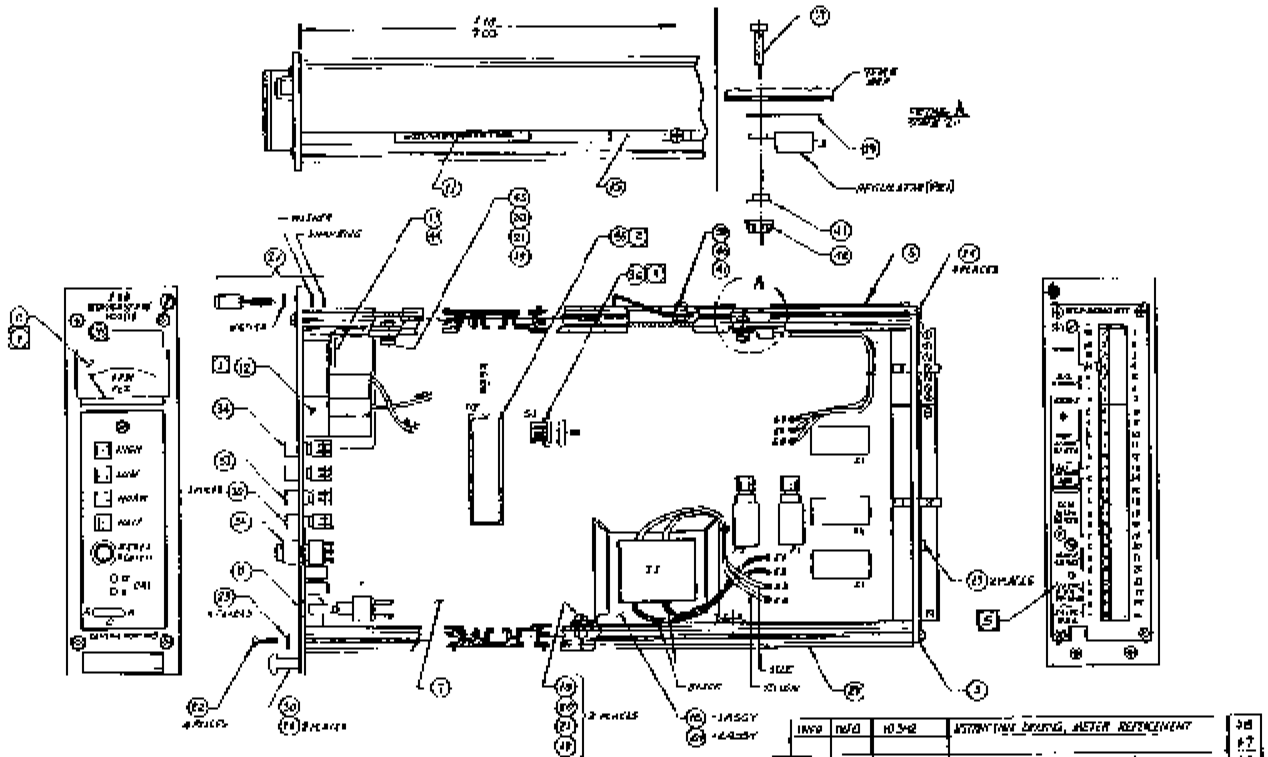
GENERAL MONITORS

C. SPECIFICATIONS (continued)

Response Time:	Meter reads 50% of full scale within 60 seconds, when exposed to H_2S concentration equal to full scale.
Drift:	Less than 5% per year.
Repeatability:	+/- 10% or 2ppm of reading, whichever is greater
Electrical Classification:	Class I, Division 1, Groups B, C and D.
Specificity:	H_2S specific.
Warranty:	Two years.
Cable Length:	Four conductor cable. Maximum length of cable between controller and sensor assembly with total loop resistance of 20 ohms at 25° C.

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

NOTE: GENERAL MONITORS reserves the right to modify equipment design and to change specifications, without notice, due to subsequent changes in the equipment.



INFO	INFO	10342	INSTRUCTIONS, DRIVING, METER REPLACEMENT	48
				47
1	1	10284-6	MICRO COMPUTER, PROGRAMMED	46
4	4	[illegible]	SPACER, HEX [illegible] P-PAN-SST	45
AR	AR	937-013	TAPE, FOAM, 1/8 THICK	44
4	1		NUT, HEX NO.6 STL-CAD	43
4	4		LOCKNUT, HEX NO.6 STL-CAD	42
1	1	931-015	WASHER, SHOULDER [illegible]	41
1	1		WASHER, LOCK, INT TOOTH NO. 6 STL-CAD	40
1	1	931-048	INSULATOR, SIL PAD	39
1	1		SCREW, MACH 6-32 x .25 P-PHIL SST	38
1	1		SCREW, MACH 2-56 x .25 [illegible]	37
AR	AR		PLUG LOCKING	36
				35
1	1	931-045	LENS LED RED	34
1	1	931-047	LENS - LED GREEN	33
2	2	931-046	LENS - LED AMBER	32
1	1	921-719	[illegible]	31
QTY-2	QTY-1	[illegible]	[illegible]	ITEM

1	1	[illegible]	HANDLE, [illegible]	30
1	1	[illegible]	PLATE, [illegible]	29
1	—	50681-4	TRANSFORMER, POWER [illegible] T1	28
1	1	[illegible]	[illegible]	27
2	2	[illegible]	SCREW, MACH [illegible]	26
2	2	944-313	SCREW, [illegible]	25
4	4		SCREW, [illegible]	24
4	4		WASHER, FLAT [illegible]	23
4	4		SCREW, [illegible]	22
3	3	[illegible]	LOCKWASHER, [illegible]	21
3	3	[illegible]	WASHER, FLAT [illegible]	20
5	3	[illegible]	NUT, HEX [illegible]	19
2	2	[illegible]	SCREW, MACH [illegible]	18
1	1	10866-1	CABLE, [illegible]	17
—	1	[illegible]	TRANSFORMER, [illegible] T1	16
1	1	[illegible]	[illegible]	15
1	1	[illegible]	SCREW, [illegible]	14

50670

6

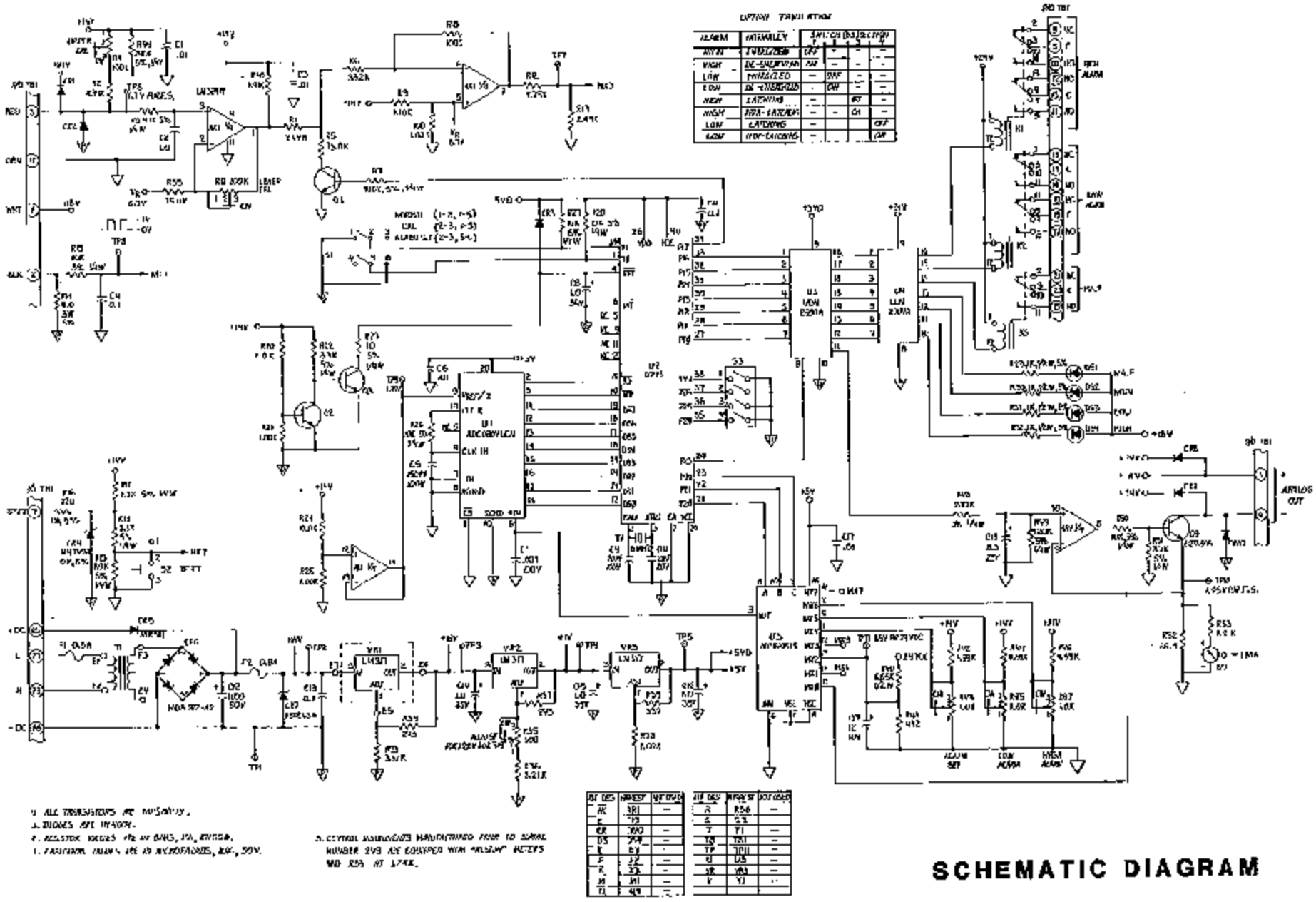
1	1	[illegible]	BRACKET METER	13
1	1	[illegible]	METER, [illegible]	12
1	1	10218-1	METER, [illegible], 0-100 PPM [illegible]	11
1	—	931-019	[illegible] F1	10
1	1	[illegible]	PANEL, [illegible]	9
1	1	[illegible]	PANEL, FRONT [illegible]	8
1	1	50676-1	[illegible], CONTROL ELECTRONICS	7
1	1	50674-1	PLATE, MOUNTING [illegible]	6
[illegible]	[illegible]	[illegible]	[illegible]	5
[illegible]	[illegible]	[illegible]	SCHEMATIC DIAGRAM	4
				3
—		-2	FINAL ASSY, H_2S MONITOR [illegible]	2
	—	1	FINAL ASSY, H_2S MONITOR [illegible]	1
QTY-2	QTY-1	[illegible]	[illegible]	ITEM

(REF 50670)

FIG. 3

FINAL ASSEMBLY H_2S MONITOR

MODEL 2180

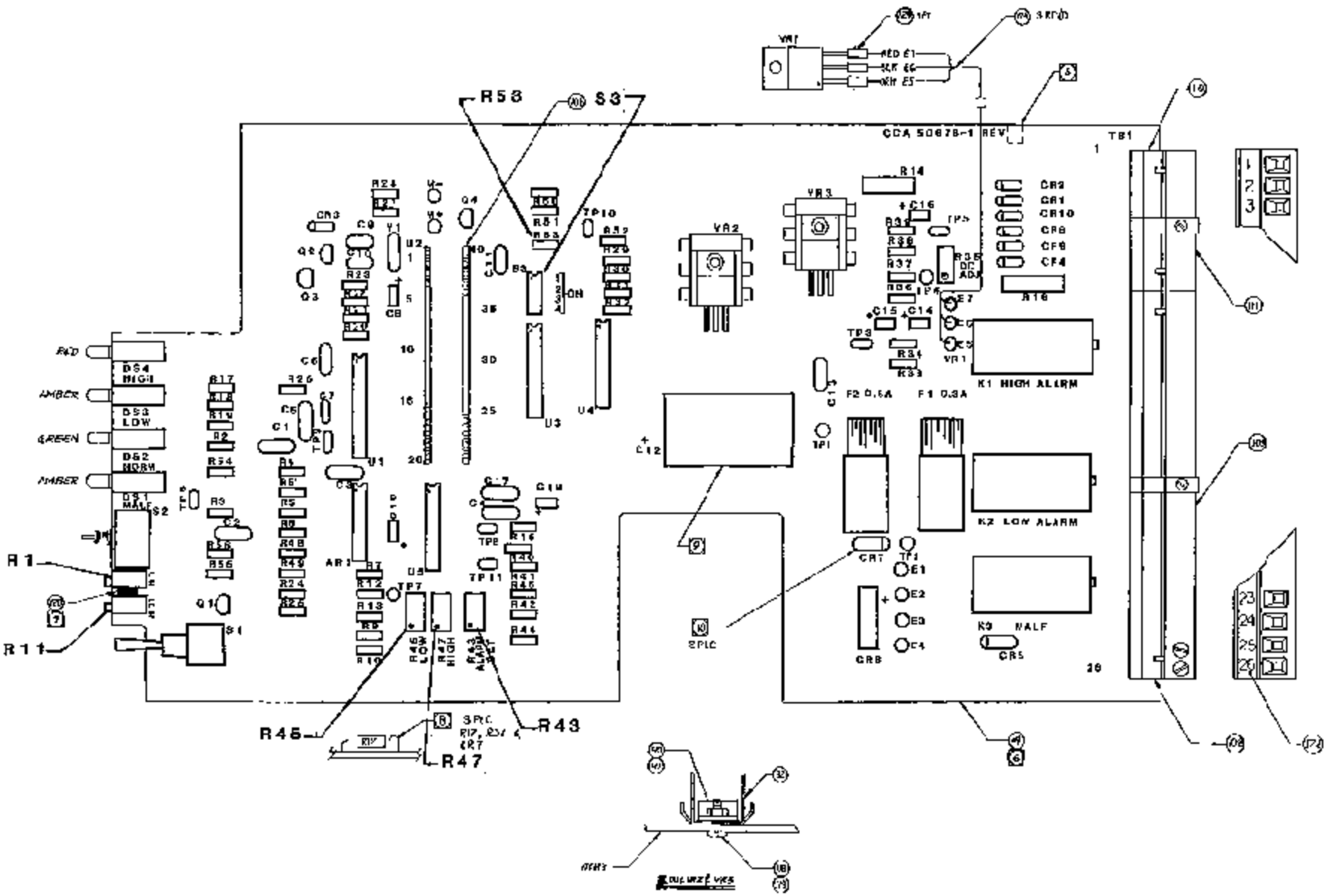


SCHEMATIC DIAGRAM

MODEL 2180

(REF 60672)

FIG. 4

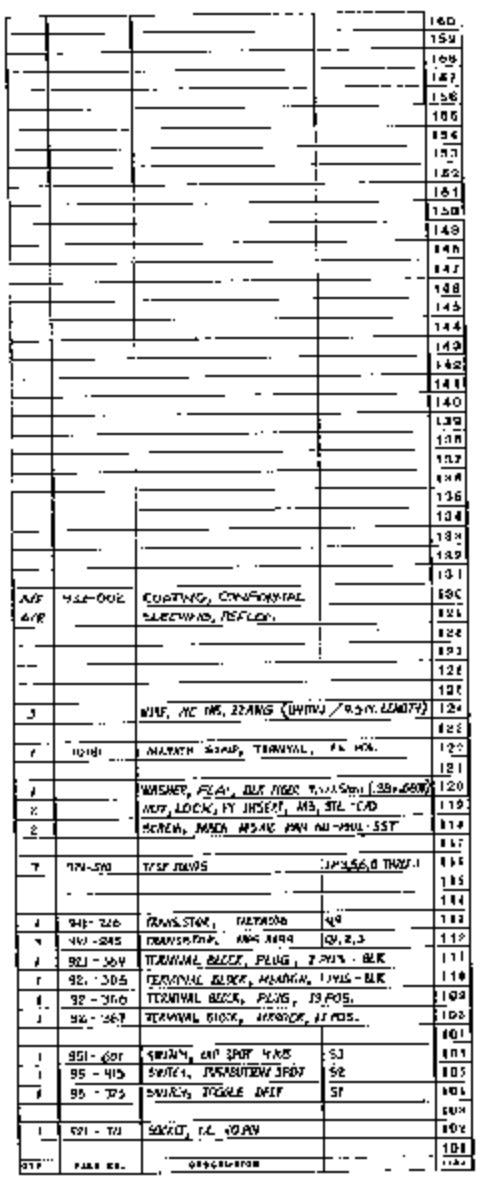


(REF 50678)

FIG. 5

SHT 1

CONTROL ELECTRONICS CIRCUIT CARD ASSEMBLY



(REF 50678)

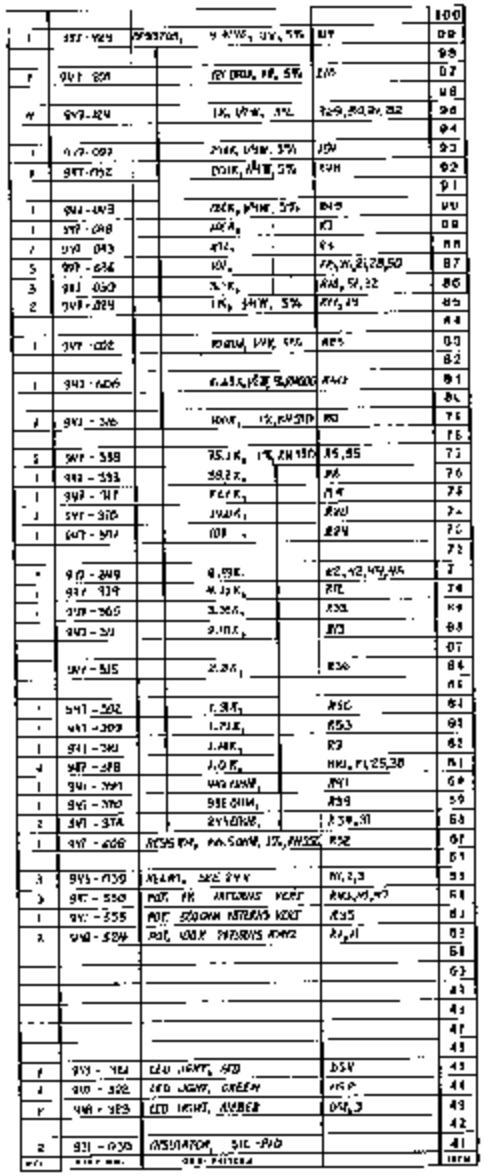
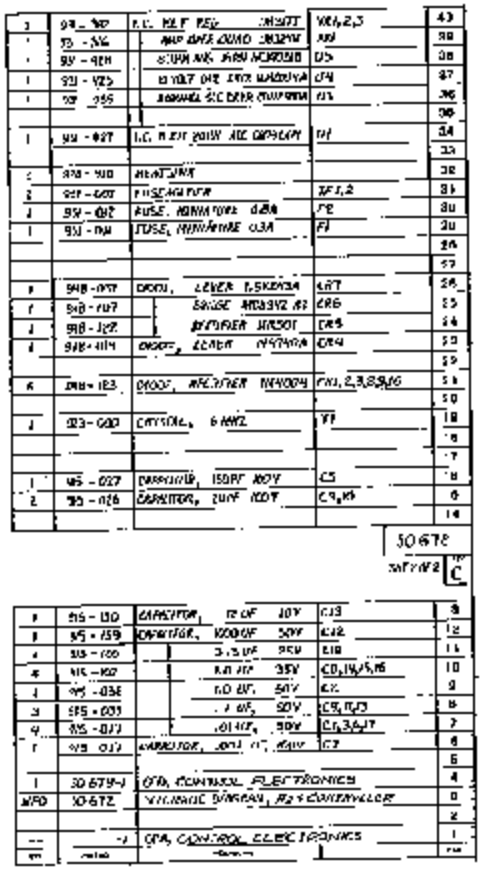
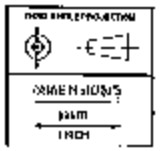
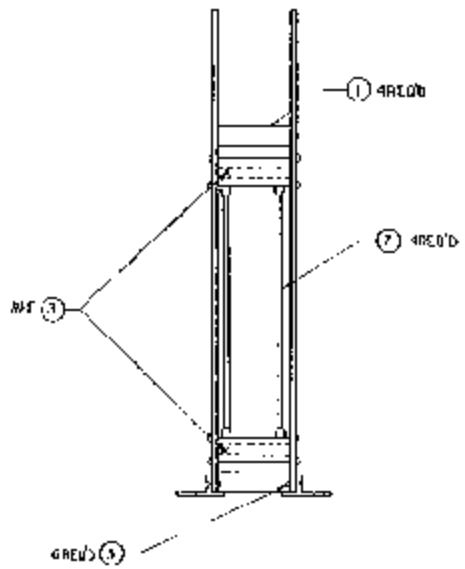


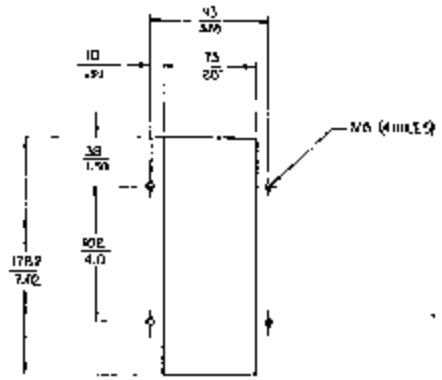
FIG. 5
SHT 2



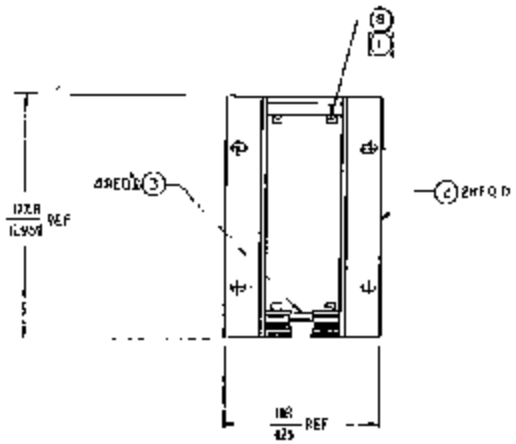
CONTROL ELECTRONICS CIRCUIT CARD ASSEMBLY

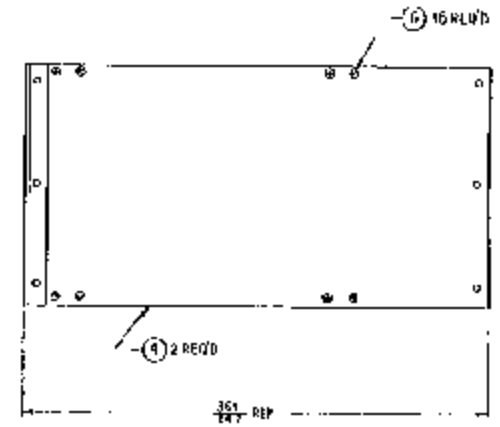






CUSTOMER PANEL
CUTOUT DIMENSIONS





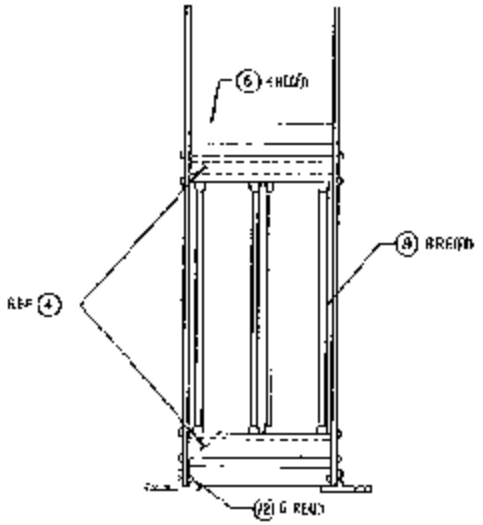
	1	[1]	NUT, SQUARE M4 0.7 STL-CAD-PLT	8
	4	921-209	GUIDE, SNAP-IN	7
	#6		SCR, RHD, FORMING, N3 x 0.5 x 12, P-P4-SS-21	6
	6	DIN 7985	SCR, MACH - M4 x 0.7 x 6, P, PAN - SST	5
	2	10 197	SIDE PANEL	4
	4	10 185-1	STRIP, LOCATING	3
	2	10 196	MOUNTING BRACKET, FRONT VERTICAL	2
	4	10 198-1	HORIZONTAL MEMBER	1
QTY-2				

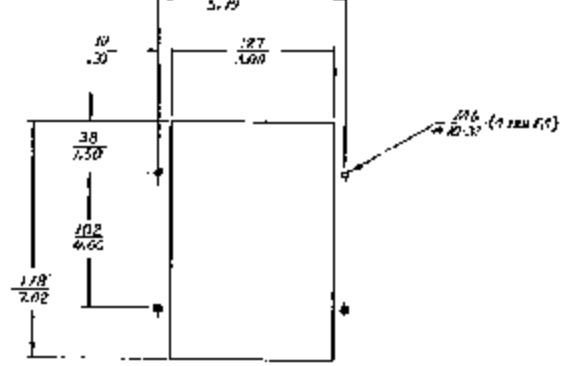
[1] INSERT 10 NUT INTO TOP GUIDE AS INDICATED. (SUPPLIED WITH KIT PPL 988-313)

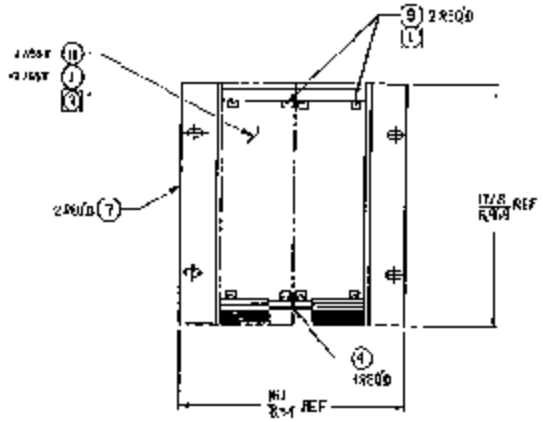
(REF 10201B)

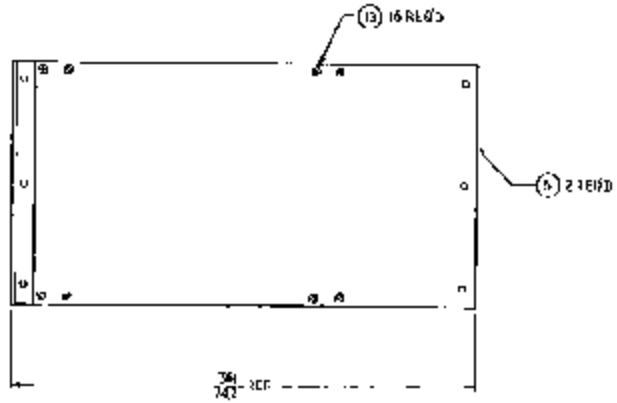
FIG. 6

RACK ASSEMBLY, PANEL MOUNT - 49









15	10		SCREW, TRP PHMND, M3 X 8 P-PH-ST-Z1	15
14	6	DIN 7985	SCREW, MACH M3 X 6 P-PNL-BLT	14
13 [2]	REF	10187-3	PANEL ASSY, BLANK - 9U, YELLOW	13
12	REF	10187-1	PANEL ASSY, BLANK - 4U, BLACK	12
11	2	[1]	NUT, SQUARE MACHT SPL-ENB-SLT	11
10	8	928-209	CLIP, SNAP - IN	10
9	2	10196	MOUNTING BRACKET, FRONT VERTICAL	9
8	4	10198-3	HORIZONTAL MEMBER	8
7	2	10197	SIDE PANEL	7
6	4	0185-2	SCREW LOCATING	6
5				5
4		2	RACK ASSEMBLY, PANEL MOUNT-9U (YELLOW)	4
3		1	RACK ASSEMBLY, PANEL MOUNT-4U (BLACK)	3
QTY-Z				

[2] BLANK PANEL ASSY (ITEM 10 OR 12) SUPPLIED PER CUSTOMER REQUIREMENT.

[1] INSERT SQ NUT INTO TAP GUIDES AS INDICATED. (SUPPLIED WITH KIT PPL 928-015).

(REF 10199C)

FIG. 7

RACK ASSEMBLY, PANEL MOUNT - 9S