GENERAL MONITORS

MODEL 4800

Multichannel

Combustible Gas Monitor

1087

GENERAL MONITORS, INC.
3037 Enterprise Street
Costa Mesa, CA 92626
(714) 540-4895 Telex 678-372

GENERAL MONITORS

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GENERAL MONITORS

MODEL 4800

MULTICHANNEL COMBUSTIBLE GAS MONITOR

I. INTRODUCTION

A. NOTICE

All information contained in this instruction manual may be used only to install and operate the Model 4800 System provided by GENERAL MONITORS. The sale of the instrument does not license the user to reproduce GENERAL MONITORS' drawings or to utilize proprietary circuitry without prior written permission.

The Model 4800 System is as easy to install and operate as any combustible gas monitor available. However, this manual should be read in full, and the information contained herein understood, before attempting to install or operate the system.

B. GENERAL

The Model 4800 Multichannel System is designed to provide continuous dependable service in monitoring for potentially explosive concentrations of most combustible gases or vapors. Normally only a periodic calibration check is needed to assure dependable performance.

The solid state controller accommodates up to 16 individual active channels. It mounts in a standard 19 inch rack or panel, and it must be installed in a non-hazardous, weather protected area.

Any of GENERAL MONITORS' low temperature catalytic bead sensors may be used with the system. Sensor assemblies may be mounted outdoors in hazardous areas. They must be connected to the controller in accordance with the instructions in this manual.

The Model 4800 is designed to monitor concentrations of combustible gases and vapors in the range 0 - 100% Lower Explosive Limit (LEL). There are relatively few combustible gases which should not be monitored by the system; however, as a precaution GMI should always be consulted to verify the feasibility of monitoring any gas or vapor other than those specified at the time of purchase.

Each active channel on the controller provides independent information from the sensor connected to it. Each channel has a separate meter (0-100% LEL); 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.

C. SENSOR OPERATING PRINCIPLE

A high efficiency source supplies constant direct current to a Wheatstone Bridge circuit. One leg of the bridge is formed by two bead elements in series contained within the sensor. These beads are heated by the direct current. The other leg, located on the channel control card at the controller, is a resistive divider. With the sensor exposed to clean air, any initial bridge imbalance is trimmed out with a zero pot. When a combustible gas/air mixture diffuses into the sensor, it oxidizes on one of the beads (the "active" bead, which has been catalytically treated). The second (reference) bead inert to combustible gases, compensates for ambient temperature, humidity, and pressure variations. The oxidation at the active bead causes a temperature increase which produces an electrical resistance change and imbalances the Wheatstone Bridge. The difference in resistance between the two beads is proportional to the concentration of the combustible gas. The signal from the bridge imbalance is amplified at the channel control card, and is displayed as % LEL on the channel meter.

II. SYSTEM COMPONENTS

A. SENSORS

Several types (P/N's) of sensors are available (see Section X). The proper sensor P/N will have been provided with the Model 4800 system if GMI was informed of the gas or gases which will be monitored. Most gases which are combustible can be monitored including most hydrocarbons, hydrogen, and carbon monoxide.

CAUTION: A sensor has a different sensitivity to each gas. GMI should be consulted if a sensor is expected to detect more than one gas, to determine the best calibration gas.

The SENSOR ASSEMBLY (P/N 10266) is comprised of the sensor plus sensor housing. The sensor assembly is approved for NEC Class I, Division 1, Groups B, C, and D hazardous areas. When used with sensor P/N 10001-1, the assembly is performance certified to CSA C22.2-NO. 152-1976.

A variety of sensor covers may be purchased. They provide extra protection from wind, weather, and dust. See Section XI for information on selecting the best sensor cover for various conditions.

B. CONTROLLER CHASSIS (P/N 20507)

The Model 4800 controller chassis accommodates from 1 to 16 independent channels. It is designed for installation in a 19 inch rack or panel, and it is general purpose electrical configuration.

Each active channel has a separate channel control card (P/N 20555), 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. Two doors are provided so that one block of eight channels may be calibrated without disrupting the operation of the other eight channels. When a door is open, all gas alarm relays in that bank of eight channels are held in the standby mode. In this mode the meter will continue to display the gas concentration but the relays will not be activated.

Mounted on the center divider are two CALIBRATION WARNING INDICATORS which glow a steady red when the doors are open. The divider also 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.

B. CONTROLLER CHASSIS (P/N 20507) (Cont'd)

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.

C. CHANNEL CONTROL CARDS (P/N 20555)

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 following a timeout period of 45 seconds after power is first applied. The timeout period allows the system to stabilize without spurious alarms, since the HIGH and LOW alarm circuits are disabled during this period. Note also that the NORMAL indicator will be inactive in the presence of a system malfunction or if that channel's relay module is not installed.

An amber malfunction (MALF) indicator is lit 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", "Span", and "Zero". Their functions are explained in Section V.

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. Normally all channels in a controller will be equipped with the identical relay configuration.

D. RELAY MODULES (Cont'd)

Use the following to properly order or identify a Model 4800 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 4800 DPDT relay module (20575-1, 20577-3, 20578-2).
b. The malfunction relay is always normally energized, non-latching.
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

E. MISCELLANEOUS

Blank control card panels (P/N 20534-1) 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 4800 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 fairly immune 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 does not have a power on-off switch, so power must remain disconnected until all other wiring connections are made. A power on-off switch is not included to eliminate accidental system shutdown, since the system is designed for continuous use to maximize protection from combustible gases.

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 1, which follows.

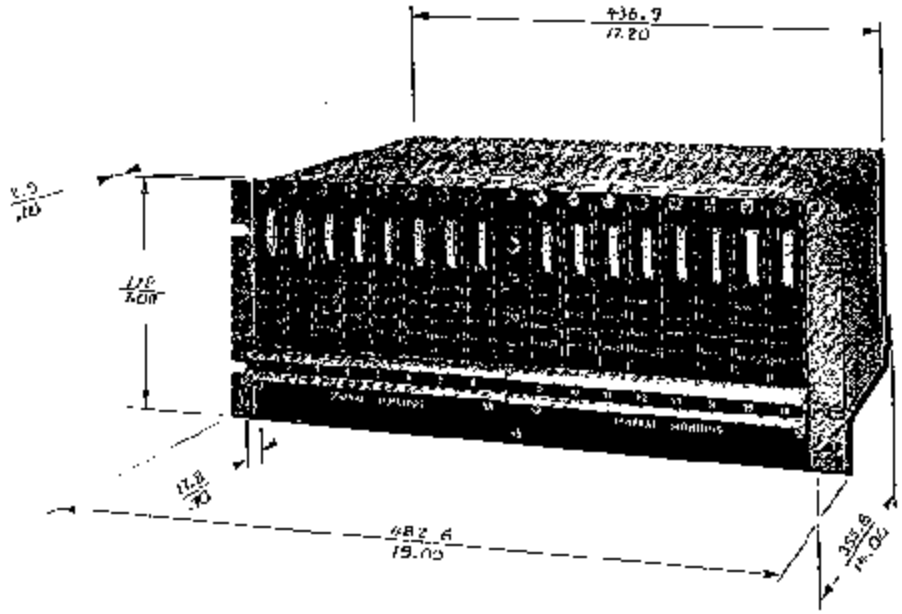
Primary DC power may be provided by any 24 V nominal direct current supply. Heavy duty cables should be used to prevent excessive voltage drop, and the cable run should be as short as possible. Connect the positive supply to (+) and the negative supply to (-) on terminal block TB4. Internal diodes protect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

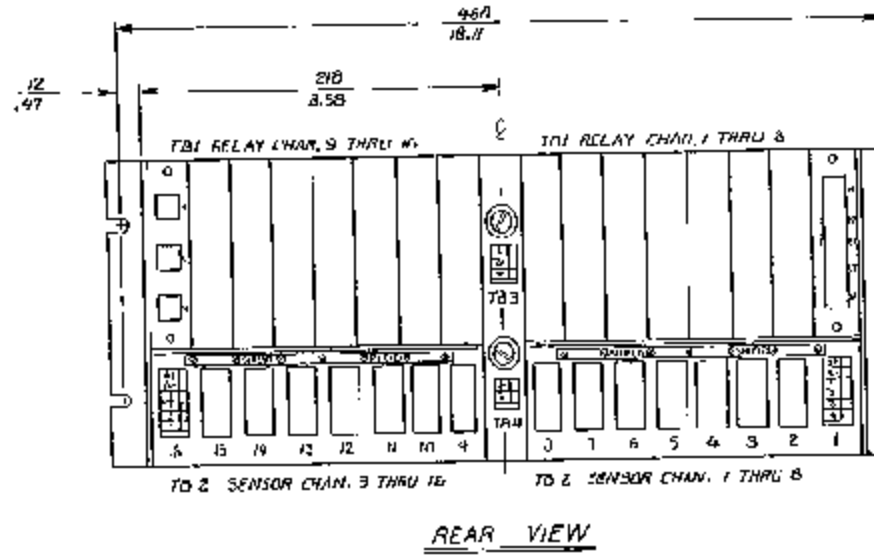
C. BATTERY BACKUP

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.

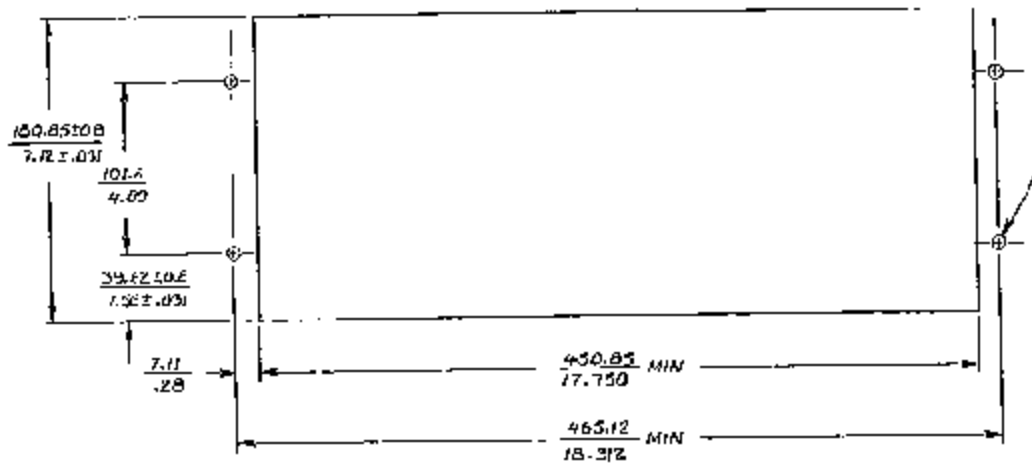
NOTE THAT THERE IS NO PROVISION FOR BATTERY CHARGING. A SEPARATE CHARGER MUST BE CUSTOMER - SUPPLIED. CARE MUST BE TAKEN THAT THE CHARGER DOES NOT INJECT VOLTAGE TRANSIENTS ABOVE 30 V, WHICH CAN POTENTIALLY OCCUR FROM SOME CHARGERS WHEN NOT EQUIPPED WITH A GOOD QUALITY BATTERY.

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.





REAR VIEW



CUSTOMER PANEL CUTOUT DIMENSIONS

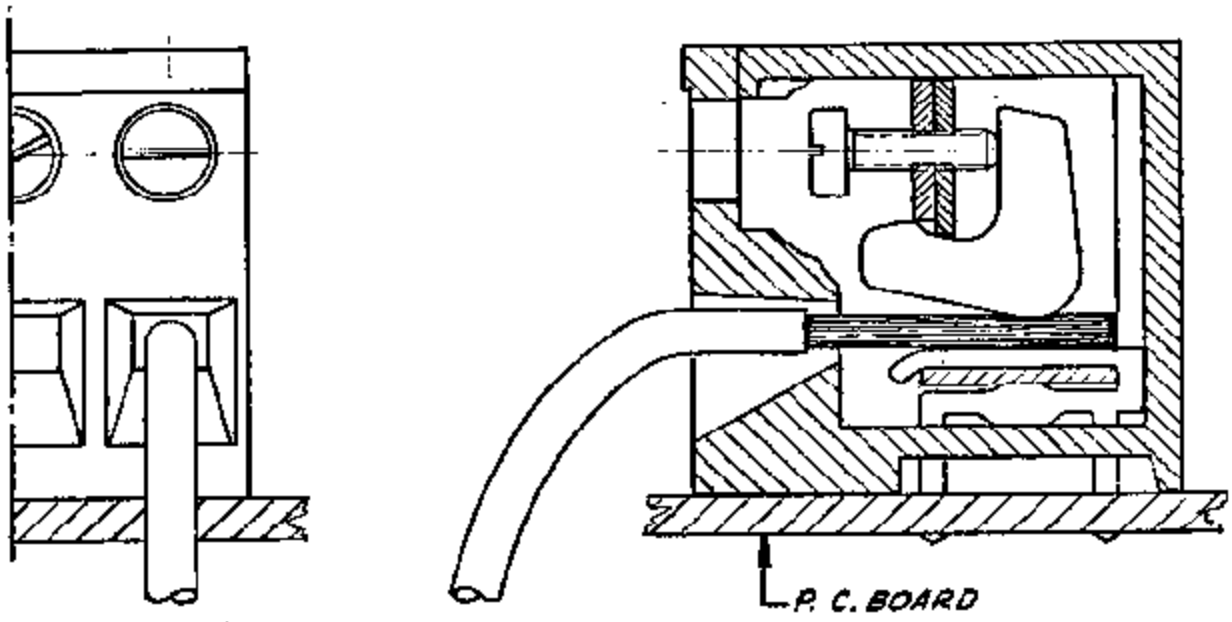
DIMENSIONS
mm
INCH

FIG. 1

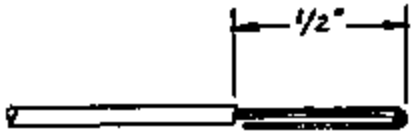
OUTLINE DRAWING & REAR TERMINAL CONNECTIONS MODEL 4800

(REF 20501 D)

WIRE INSERTION INSTRUCTIONS
FOR WEIDMÜLLER TYPE "TOP" TERMINAL BLOCKS



WIRES 14 TO 18 AWG



WIRES 20 OR 22 AWG

NOTES:

1. STRANDED WIRE IS PERMISSIBLE, BUT SOLID WIRE IS PREFERRED.
2. WIRE MUST BE STRIPPED, AS SHOWN, AND FULLY INSERTED.
3. LEADS MUST NOT BE TINNED.
4. THE USE OF ANY SCREWDRIVER OTHER THAN THE PROVIDED "GENERAL MONITORS" MODEL OR ANY STRAIGHT SHANK (CABINET) 1/8" MIN. BLADE MAY CAUSE INCORRECT TIGHTENING, BREAK THE SCREW HEAD OR OTHERWISE DAMAGE THE TERMINAL BLOCK AND ITS CONNECTION.

OCTOBER 1984

D. LOCATION OF SENSORS

Several variables are involved in selecting locations to install sensors to assure the detection of combustible gases. There are no hard and fast rules defining the optimum location. However, the following general suggestations should be considered in regard to particular conditions at the site a Model 4800 ic being installed.

(1) Vapor Density

Whether the gas/vapor to be monitored is lighter or heavier than air will affect sensor placement. For lighter-than-air gases, sensors should generally be placed close to the roof or ceiling in indoor installations. For gases much heavier than air, sensors should generally be located near the floor or ground when there are no air currents in the area. Cases with a density equal to air, or slightly greater than air, will tend to rise, particularly in moving air.

(2) Air Currents

If there are winds, fans or other sources of air movement, combustible gases might tend to rise or to accumulate in certain sections of a facility. Local air currents should be studied to aid in selection of sensor locations.

(3) Likely Sources of Gas Emission

In general at least one sensor should be located in close proximity to each point where a leak of a combustible gas is likely to occur. This is particularly important when a liquid having a low volatility is to be monitored.

(4) Environmental Factors

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

(5) Catalytic "Poisons"

Sensors will be adversely affected by prolonged exposure to certain materials. Loss of sensitivity (i.e., reduced response to combustible gases), or corrosion, may be gradual if such material 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).

-Sulfur compounds such as SO_2, H_2S and CS_2.

-Heavy metals such as tetra-ethyl lead.

D. LOCATION OF SENSORS (Cont'd)

-Silicones (often contained in greases and aerosols). Silicones do not chemically attack the sensor. They instead coat the catalytic beads and therefore reduce or stop the oxidation of the combustible gas at the catalytically active bead.

-Acid vapors.

-Caustic liquids or vapors.

The presence of such materials in an area does not necessarily preclude the use of a catalytic bead sensor. The feasiblity 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.

******CAUTION*****

GMI discourages the painting of sensor assemblies for two reasons. First; if the sensor head is painted over, gas will not be able to diffuse into the sensor. Secondly, many paints contain lead compounds which can poison a sensor.

E. SENSOR INSTALLATION

Various types (P/N's) of sensors can be provided with the Model 4800. However, the installation method is identical in all cases. See Section X for information on sensors available.

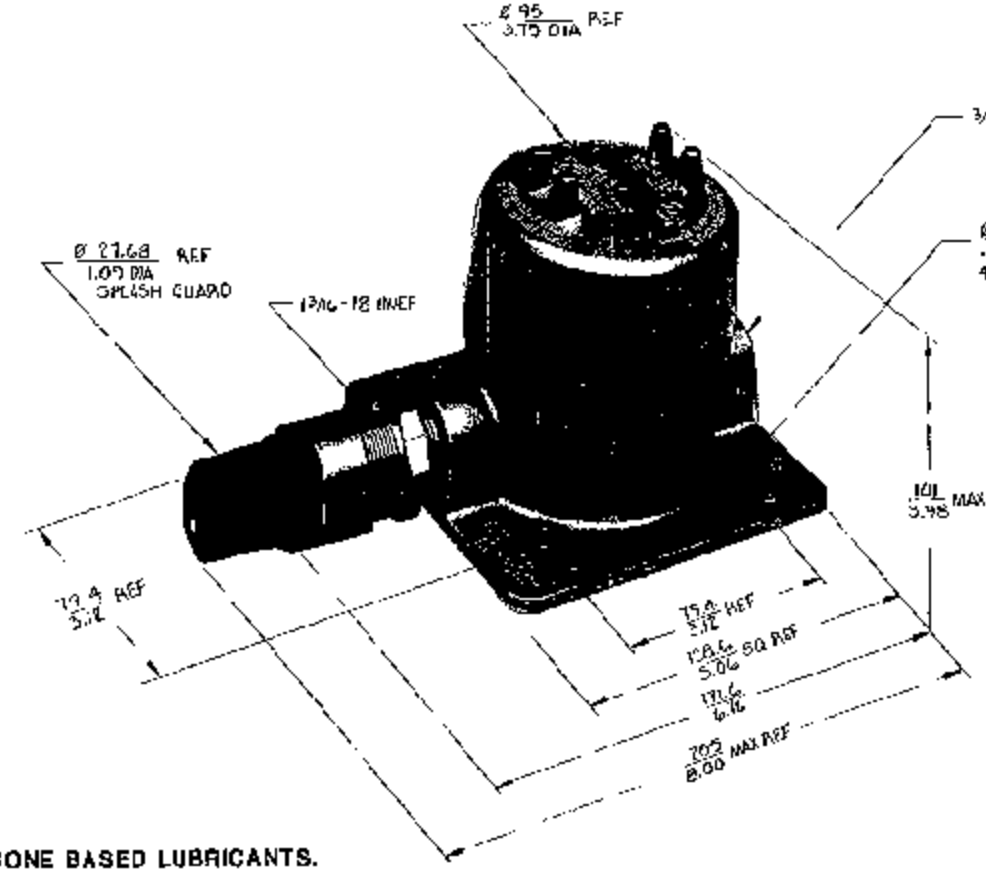
Although sensors and control cards are interchangeable, it is recommended that each sensor be used with the channel control card it was matched with at the factory.

GMI hydrocarbon sensors are approved for NEC Class I, Division 1, Groups B, C, and D hazardous areas. To assure safe installation, conformance with appropriate electrical codes is necessary.

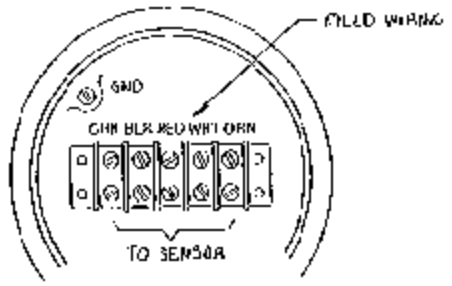
The SENSOR ASSEMBLY (P/N 10266) consists of any GMI hydrocarbon sensor plus a sensor housing (normally GMI P/N 10252 housing). The sensor is connected to the controller using 3-conductor stranded cable, and must be installed with conduit in hazardous areas. Total loop resistance excluding the sensor must not exceed 40 ohms.

Due to the low levels of sensor signal voltages, shielded cable will be required to guard against extraneous electrical noise found at some industrial facilities. The shield must be enclosed in a suitable insulating outer jacket, and must be grounded only at the controller.* Care must be taken to assure that the shield does not come into contact with the sensor housing or metal conduit. One ground terminal is provided for every two sensors and is located on the mounting plate above the set of TB2 terminal blocks.**

DIMENSIONS
mm
INCH



SENSOR GUARDS	
PART NUMBER	DESCRIPTION
1800822	DUST GUARD
10395	SPLASH GUARD
10710	DUST GUARD WITH DISPOSABLE SCREEN



WIRING DETAIL
(COVER REMOVED)

4. DO NOT USE SILICONE BASED LUBRICANTS.
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.

JUNCTION BOX ASSY-SENSOR

(REF 10266D)

FIG. 2

E. SENSOR INSTALLATION (Cont'd)

Avoid running sensor cables close to high power cables, radio transmission lines, or cables subject to pulses of high current.

Sensor cable connections must be crimped and soldered for stable operation. Use only continuous, unjointed cable runs if possible. Improperly spliced cable can result in corrosion, resistance changes, and drift.

To connect the cable at 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 2. [The green and orange positions are not used).

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 (terminal 4 is not used). Connect the cable at TB2 as follows:

Terminal Number	Cable Color
1	Black
2	Red
3	White
4	NC

* Using the ground terminals provided (see Figure 3).

** On earlier models the grounding terminal was part of TB2 for each channel. No grounding terminal was provided on controller Serial Numbers 1-25.

*** On S/N's 1-25 each TB2 is labeled B, R, and W.

Cable runs should not exceed the following distances (maximum loop resistance of 40 ohms):

AWG	METERS	FEET
14	2320	7600
16	1460	4800
18	910	3000
20	580	1900

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.

F. ALARM WIRING CONNECTIONS

Refer to Figure 3 on the following page. 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 1 = Normally open 3 = Normally closed
(B) Normally energized (with power applied)	2 = Common 1 = Normally closed 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. Do not utilize an inductive load without first consulting the factory.

***** CAUTION *****

Externally applied high voltages may be present on the terminals of the relay modules. These will generally be independent of the supply to the controller. Caution should be exercised when working in this area. Electric shocks felt when wiring the alarm relay contact on low voltage DC systems indicate the presence of unsuppressed inductive loads, and should be investigated.

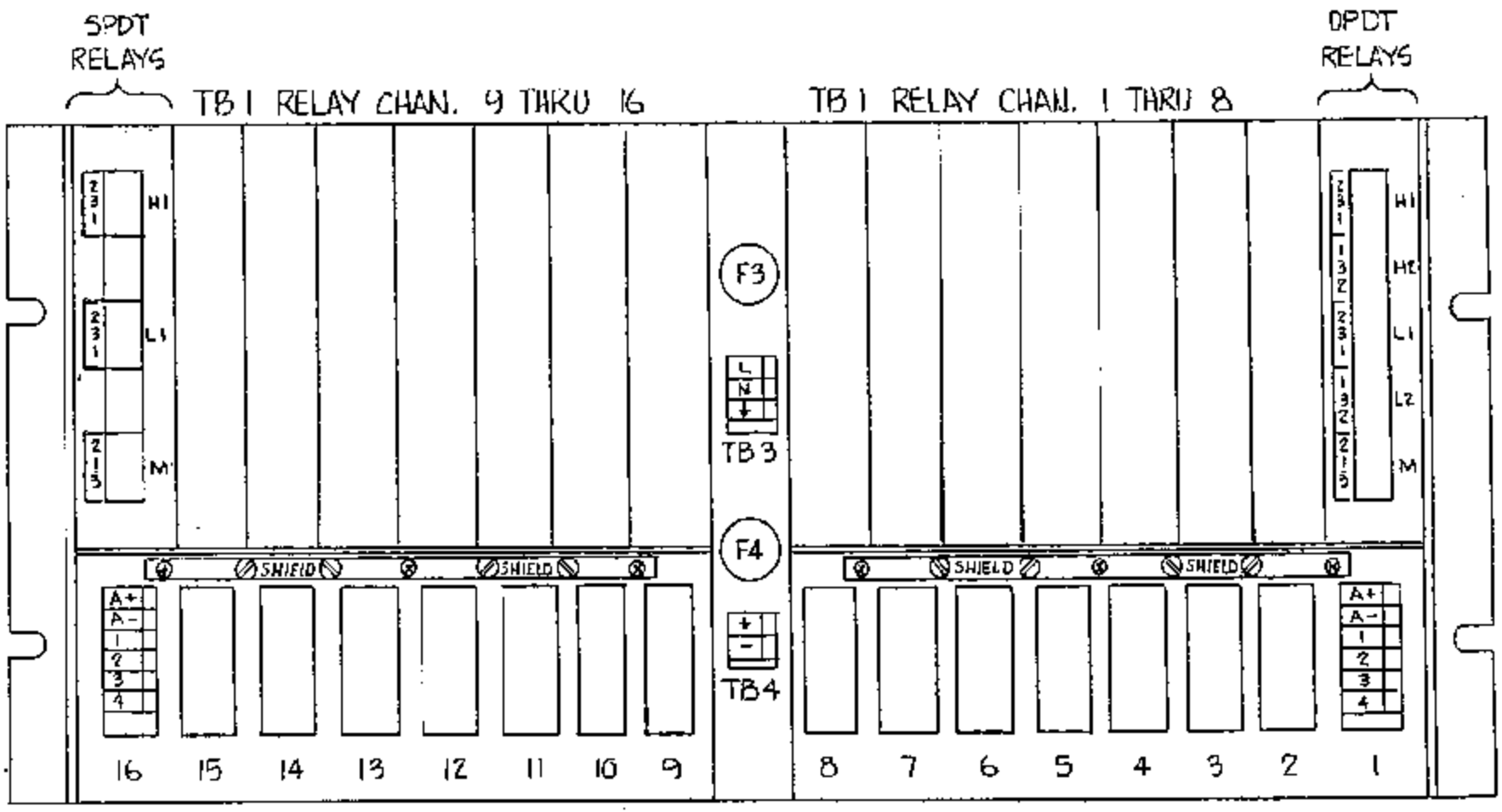
G. ANALOG OUTPUT CONNECTION

The 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.

H. APPLYING POWER

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

The system has a time delay feature. For approximately 45 seconds after power is applied the alarm relays remain deactivated and front panel indicators except MALF cannot light. The purpose of this feature is to eliminate spurious alarms which might otherwise result while the system was stabilizing.



(REF 20601 D)

FIG.3

REAR TERMINAL CONNECTIONS
4800

H. APPLYING POWER (Cont'd)

If the MALFunction light on any channel is illuminated during or after the time delay period, the channel is in an authentic malfunction condition. Refer to Section VI. for causes and solutions.

Following the application of power when initially placing the system into operation, the procedures described in Section V. must be performed before the system is completely functional. The system should be placed in CALIBRATION MODE (See Section V. B.) prior to initially applying power if the possibility of gas alarm contacts activating after timeout would cause problems.

IV. INDICATORS, SWITCHES, AND FUNCTIONS

A. % LEL Meter. The analog meter is scaled from 0 to 100% LEL for the gas/vapor for which the channel will be calibrated. Should a malfunction occur, the meter will read below zero. **CAUTION** readings of 100% LEL, or high offscale reading, indicate an explosive gas concentration is present.

B. Normal Indicator. This light emitting diode (LED) glows a steady green whenever the channel is operating normally (i.e., when power is on and there is no malfunction alarm condition.)

C. Gas Alarm Indicators. Red high alarm LED (HIGH) and an amber Low alarm LED (LOW) indicators per channel flash whenever the gas concentration at a sensor exceeds the concentration at which the respective alarm circuits were preset. The flashing of the LED's will be accompanied by the activation of the gas alarm relay contacts. If a channel moves from low to high alarm condition the amber LED will stop flashing but the low alarm relay will remain activated.

D. Malfunction Indicator. Normally off, this amber LED illuminates any time there is a fault in the channel. Gas alarm relays and indicators are bypassed during a malfunction, and the MALFUNCTION RELAY de-energizes.

E. Calibration Indicators. There are two CALIBRATION WARNING LED INDICATORS, one for each bank of eight channels, which glow a steady red whenever the calibration doors are open. They are located on the center divider of the front panel. These LED's play no part in normal system operation, and are included to help prevent accidental deactivation of either bank of channels.

F. Master Reset Switch. Any alarm relay which is wired for LATCHING operation operation, and its associated alarm indicator, will stay in alarm condition even if the gas concentration at the associated sensor drops below the alarm set point. The alarm condition of the relay and indicator can only be cancelled by depressing the momentary action MASTER RESET SWITCH, common to all channels, which is located on the center divider of the front panel. Depressing the switch has no effect if the gas concentration is still above the set point levels.

G. Analog Output Signal. A 4-20 ma analog output is provided for each channel. Wiring connections are made to the set of TB2 terminal blocks on the rear of the controller. The 4-20 ma signal tracks the %LEL meter. The analog output must either be used or jumpered for the system to operate.

V. OPERATIONAL ADJUSTMENTS AND PROCEDURES

A. INITIAL START-UP

Each Model 4800 system is completely checked at the factory, to include calibration with the gas specified 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.

B. ACCESS TO ALARM OR CALIBRATION ADJUSTMENTS

To perform alarm or calibration adjustments, rotate the CALIBRATION DOOR locking devices counterclockwise, then lower both doors. All channels are now in CALIBRATION MODE. Both CALIBRATION WARNING INDICATORS should be illuminated.

In calibration mode all high alarm and low alarm relays are deactivated, although the front panel indicators are active. The system was designed with alarm deactivation in the calibration mode to eliminate having to disconnect external wiring during calibration.

NOTE: If the latches are not tight when the doors are being closed after calibration, adjust the latches one turn beyond the point where the warning indicator goes out.

C. ALARM SET POINT ADJUSTMENTS

(1) Low Alarm

Rotate the ZERO potentiometer to give a meter reading corresponding to the desired low alarm set point. Rotate the LOW ALARM potentiometer (L) in a clockwise direction if the low alarm LED is already flashing; otherwise rotate it counterclockwise, just to the point where the LED begins to flash.

(2) High Alarm

Rotate the ZERO potentiometer to give a meter reading corresponding to the desired %LEL for high alarm. Rotate the HIGH ALARM potentiometer (H) in a clockwise direction if the high alarm LED indicator is already flashing; otherwise rotate (H) counterclockwise just to the point where the LED begins to flash. The LOW alarm LED will now stop flashing.

C. ALARM SET POINT ADJUSTMENTS (Cont'd)

(1) Low Alarm

Rotate the ZERO potentiometer counterclockwise back to near zero, then check both set points by moving the meter upscale once again. When the set points have been checked, re-set the meter back to zero with the ZERO potentiometer.

Note: Some hysteresis is normal around alarm set points. This is required to prevent relay chatter. If the relays are latching, the RESET will have to be depressed to deactivate alarm circuits.

D. CALIBRATION

(1) Procedure

(a) Assure that the sensor is exposed to clean air. Do not remove any sensor covers in use.

(b) Rotate the Zero potentiometer so that the meter reads 0% LEL.

NOTE: Adjustments to the ZERO potentiometer do not affect SPAN settings.

(c) Expose the sensor to calibration gas having a known concentration. The %LEL meter will move upscale. Allow sufficient time for the reading to stabilize.

(d) Use the SPAN potentiometer to set the meter to agree with the known concentration of the calibration gas (Generally the calibration gas will be approximately 50% LEL.)

(e) Remove the calibration gas and expose the sensor to clean air. Allow sufficient time for the meter reading to stabilize. It should stabilize at or near 0% LEL.

(f) If a minor adjustment is required to reach zero, the calibration is acceptable. Adjust the meter to zero with the ZERO potentiometer. If a significant adjustment is necessary to return to zero, repeat the entire calibration procedure.

(2) Frequency of Calibration

As a rule of thumb GMI recommends that the calibration be checked on each sensor at least every 90 days. If a sensor is installed where it may be subjected to splashing water, mud or dirt accumulation, or adverse gases as described in Section III D. (5), more frequent calibration is recommended. The exact frequency can vary with the severity of conditions and must be established in the field.

D. CALIBRATION (Cont'd)

(3) Calibration Check-Points

(a) A negative movement of the %LEL meter when the sensor is exposed to calibration gas indicates that the white and black leads of the sensor cable are reversed.

(b) The number of clockwise turns of the SPAN potentiometer required to obtain the correct meter reading varies from one gas to another. For one particular gas at a specific concentration a steady increase over a short period of time in the number of turns required to obtain the correct meter reading indicates that the sensor is losing sensitivity, and is probably reaching the end of its useful life. GMI highly recommends replacing the sensor while a few turns still remain, otherwise the sensor may expire and no protection against combustible gases will be afforded until the failure is detected at the next scheduled calibration check. The total number of turns of the potentiometer is 20.

(4) Background of Combustible Gases

In some applications there will be an occasional or continuous presence of "background" combustible gases. Generally this will be a very small % LEL. Usually it is advisable to zero out the background gas concentration during calibration. To do so, isolate the sensor from the surrounding air using a plastic bag or by placing your hand tightly over the sensor. Observe the reading on the %LEL meter. A gradual drop in reading indicates the presence of a background of combustible gases. With the bag in place, set the meter to read 0% LEL using the zero potentiometer. Remove the bag and proceed with normal calibration.

(5) ***** CAUTION ***** EXTENDED EXPOSURE TO COMBUSTIBLE GASES

Extended exposure of a sensor to a high concentration of combustible gases can introduce stress in the sensing element which may seriously affect performance. Recalibration should therefore be performed after an alarm due to a high concentration of gas, and the sensor should be replaced, if necessary.

NOTE: The foregoing warning is applicable to all catalytic bead sensors regardless of manufacturer.

E. FACTORY-SET ADJUSTMENTS ON CONTROL CARDS

The following adjustments are factory set, and normally do not require readjustment in the field. We do not recommend they be checked or adjusted unless the system is not operating properly. If they are adjusted, the 15 V supply must be adjusted first. Any of these adjustments must always be followed by recalibration. A 20,000 ohm/volt meter will be adequate for the measurements described.

E. FACTORY-SET ADJUSTMENTS ON CONTROL CARDS (Cont'd)

(1) Electronics Supply Bus

Using the volt meter, set the electronics supply bus, measured between the bottom of C17 and the bottom of R15, to 15 + .025 volts, using the "SET 15V" potentiometer (R16).

(2) Bridge Amplifier Bias Adjustment

Rotate the SPAN potentiometer (R36) fully counterclockwise so as to have zero differential voltage to the bridge amplifier. Using a high impedance volt meter, connected between TP3 (the junction of resistors R14, R19, R20) and the emitter of transistor Q5, measure the offset voltage of the bridge amplifier. Set this reading to 0 + 5mv using the BIAS potentiometer (R39).

(3) Sensor Current Adjustment

With a sensor or dummy load (P/N 10102) properly connected to the channel, and an accurate DC milliammeter in series with either the white or the black sensor lead, set the current to read 300 ma + 1 ma using the "SENS" potentiometer (R34). The reading may be checked at any time by measuring the voltage across the "current sense" resistor R50. The reading on a high impedance volt meter should be 450 + 1.5mv.

VI. SYSTEM PROBLEMS AND TROUBLESHOOTING

A. GENERAL

It is highly recommended that spare sensors be on hand at all times. While GMI sensors are the most reliable, longest life catalytic bead sensors available, sensor failure tends to be the largest potential cause of real downtime. A full complement of other GMI recommended spare parts should also be on hand.

GMI's warranty will be voided if damage results from repair efforts involving replacement of PC board components or other system components, other than routine replacement of recommended spare parts. It is recommended that defective control cards, relay modules, or controllers be returned to the factory for repair even if the warranty has expired.

B. MAINTENANCE

Once installed, the Model 4000 system requires little or no routine maintenance other than periodic calibration checks. GMI recommends that a calibration schedule be established and adhered to. GMI also recommends that a log book be kept showing calibration dates, date of sensor or other component replacement, etc.

The removal of particulate matter from accessory sensor covers may be facilitated by the use of an appropriate halogen-free solvent. Water or ethanol are examples of suitable solvents. The accessories should be thoroughly dried, with compressed air if necessary, before refitting to the sensor body. A calibration check should be made after the cleaned cover has been re-installed because the cleaning process may have increased sensor response.

C. TROUBLESHOOTING TABLE

The information presented in the following table is designed to correct the more common problems which appear during system starting and operation, and which are repairable by a competent operator.

Should the various actions suggested in the table fail to restore normal operation, the defective component should be replaced and returned for repair. Replacing a control card necessitates re-calibration.

TROUBLE SHOOTING TABLE

SYMPTOM	POSSIBLE CAUSES	ACTION
No front panel LED's lit. All % LEL meters underrange.	AC or DC fuse blown or loss of primary power.	Check AC or DC fuse on the rear panel. Check wiring for loss of power or break
One channel only reads underrange and its Malf. LED is not lit.	DC fuse blown in this control module.	Replace DC fuse.
Malfunction indication on all channels.	Primary power voltage too low.	Increase primary power voltage to recommended value.
Malfunction indication one channel only	Analog output load open circuit.	Check recorder wiring or replace wire link on terminals.
	ZERO potentiometer incorrectly set.	Rotate ZERO potentiometer clockwise to give a meter reading of 0% LEL.
	Break in sensor cable or short circuit between white and red leads.	Check cable connections and perform resistance checks to locate source of problem.
	SPAN potentiometer set to minimum.	Rotate SPAN potentiometer approximately 5 turns clockwise and adjust ZERO potentiometer to give a meter reading of 0% LEL.
	Sensor current too low or absent.	Check sensor current in white or black sensor line or through (R50). Sensor current should be 300 MA, and is factory set using R34 (I SENS).
	Open circuit sensor.	Check resistance of sensor elements, red to white and red to black leads (10 ohms).

TROUBLESHOOTING TABLE Cont'd

SYMPTOM	POSSIBLE CAUSES	ACTION
Malfunction upon sensor being exposed to combustible gas.	Sensor leads reversed at controller or sensor.	Check and correct sensor lead connections.
Meter reads 0% LEL. No front panel LED lit on this channel.	Channel in timeout period.	Wait one minute for completion of timeout period, when the green NORM LED should light.
Meter reads 0% LEL. No front panel LED lit after timeout period.	Relay module not inserted.	Insert relay module.
Meter reads 0% LEL, ALARM LED's flash.	Alarm set points incorrectly set.	Re-set alarm set point.
CAL MODE LED does not switch off when calibration door is closed.	Calibration door not properly secured.	Tighten door locks.

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 combustible gases. 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 catalyst and eventually affect sensitivity. See Section III.D. (5) 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.

IX. GENERAL SPECIFICATIONS

CONTROLLER

Dimensions:	483mm X 178mm X 378mm (19"W X 7"H 14.9"D).
Weight:	18kg (45 lbs.).
Mounting Configurations:	Rack, panel.
Temperature Range:	-18°C to +66°C (0°F to 150°F).
Power:	105-130VAC/50-60Hz 205-255VAC/50-60Hz 22-30VDC 5 watts per channel nominal @ 117VAC.
Meter Readout:	Range 0-100% Lower Explosive Limit (% LEL).
Repeatability:	± 2% full scale
Linearity:	±5% full scale
Alarm Circuits:	High, Low and Malfunction. S2DT 3 amps @ 117 VAC relays per alarm circuit, per channel, standard. High and low alarm relays normally de-energized. Malfunction relay normally energized. Other options available.
Status Indicators:	Flashing amber for low alarm; flashing red for high alarm; green for Normal (power on); steady amber for malfunction.
Output Signal:	4-20 ma into a maximum 600 ohm load.
Electrical Classification:	General purpose (non-hazardous, indoors).
Warranty:	Two years.

SENSOR

Type:	Diffusion, low temperature catalytic bead. Standard Industrial and High Temperature Combustible Gas.
Temperature Range:	-55°C to +93°C (-65°F to +200°F) standard; high temperature special to 200°C (400°F).
Response Time:	Typically 6 second time constant when exposed to 50% LEL of methane gas.
Zero Drift:	Less than 5% per year.
Typical Life:	3 years in normal service.
Electrical Classification:	NEC Class I, Division 1, Groups B, C, and D.
Warranty:	Two years.
Cable:	3 wire maximum cable length allowable between controller and sensor assembly with one way resistance of 20 ohms (total 40 ohms loop):

AWG	METERS	FEET
14	2320	7600
16	1460	4800
18	910	3000
20	580	1900

X. SENSORS

The following is a list of GMI sensors generally used with the Model 4800 System:

P/N	
10001-1	Standard Industrial Combustible Gas Sensor. Used for certain light hydrocarbons such as methane, ethane, propane, butane, and pentane, and for hydrogen. Temperatures range from -55°C to 93°C (-65°F to +200°F). Performance certified to CSA standard C22.2 No. 152-1976.
10001-1R	Same as P/N 10001-1 except greatly improved resistance to poisons such as HMDS (Hexamethyldisiloxane) and H_2S
10014-1	High Temperature Standard Industrial Combustible Gas Sensor. Same as P/N 10001-1 except it may be used at temperatures up to 200°C (400°F).
10058-1	Same as P/N 10001-1 except sensor body is stainless steel. Performance certified to CSA standard C22.2 No. 152-1976.
10058-1R	Same as P/N 10058-1 except greatly improved resistance to poisons such as HMDS (Hexamethyldisiloxane) and H_2S

P/N 10252 sensor housing is normally used with all sensors except PTB approved sensors. Special PTB approved sensors and sensor housings are generally used in Europe.

XI. ACCESSORIES

A. CALIBRATION EQUIPMENT

Calibration accessories may be purchased from GMI. Contact the factory or your local representative for technical or ordering information.

The P/N 1400200 Portable Calibration Chamber is used to calibrate sensors for any specific combustible vapor which has a boiling point below ambient temperature. The customer must provide his own sample of the liquid to use with the chamber. GMI provides a microliter syringe with the chamber, for exact measurement of volumes to be used. Instructions for use are provided with the chamber.

GMI P/N 1400150 portable purge calibrators are available for several common gases, including hydrogen, methane, ethane, propane and butane.

The portable purge calibrator is a ready-for-use assembly including a lecture bottle containing approximately 50% LEL of the gas ordered, plus regulator and adapter which fits over the sensor. Replacement cylinders are also available.

B. SENSOR COVERS

The information below is of a general nature. GMI or your local representative should be contacted for specific recommendations.

NOTE: If sensor covers are used they should remain in place during calibration. If they are going to be cleaned, the sensor should be recalibrated after the sensor cover is re-installed. Although several of the available covers do not affect sensitivity or response time themselves, accumulations of dust, dirt, water, etc., may do so.

(1) Dust Guard Assembly (P/N 10110):

The dust guard assembly is a simple, threaded stainless steel (type 303) cylinder with a disposable wire screen at one end. It is easily unscrewed for cleaning and/or replacement of the screen. The screen material is stainless steel (type 316) with a nominal 40 micron mesh. This accessory is specially designed to prevent dust and particulate matter from reaching the sensor flame arrestor. Such debris can plug the screen and limit the amount of gas reaching the active surface of the sensor. When the dust guard is installed, this problem is minimized and sensor response is virtually unchanged. The dust guard is also available in a kit (P/N 10044) with twelve replacable screens. It can be used as an effective windscreen, and is recommended for corrosive, windy or high temperature environments. A typical application would be in the area surrounding a drying oven.

B. SENSOR COVERS (Cont'd.)

(2) Sintered Stainless Steel Dust Guard (P/N 1800822):

The construction of this accessory is similar to P/N 10110 above, but it has a 3mm (1/8") thick sintered stainless steel disc at one end. The body material is stainless steel. It has an internal thread for installation on the sensor body. This dust guard provides protection from fine particulates and windy environments. It should be used only in dry locations because of the tendency of the sintered disc to absorb water, which would then act as a gas diffusion barrier until the disc dried out again. This dust guard reduces sensor response, so it must never be removed for calibration.

(3) Splash Guard (P/N 10395-1):

The Splash Guard is a rugged VALOX plastic cylinder which screws into place over the sensor body. It contains a series of internal baffles and a stainless steel mesh which are designed to deflect water spray away from the sensor flame arrestor. The Splash Guard is recommended for areas where heavy rain or frequent equipment hosedowns occur.

(4) Sensor Flow Chamber (P/N 10066):

The General Monitors Sensor Flow Chamber is constructed of aluminium (optional stainless steel construction available). The chamber has an internal thread into which a sensor may be screwed, and two threaded ports which accept 1/4 inch tube fittings. The chamber is designed for insertion into a sampling system.

(5) Duct Mounting Plate (P/N 10041):

The Duct Mounting Plate is a rectangular plate measuring 73 X 116 mm (2.88" X 4.56") containing four captive mounting screws and fitted with a Neoprene O-ring seal. The sensor is mounted in a threaded hole in the center of the plate. The assembly is ideally suited to the monitoring of ducted air. Note that the sensor should be mounted pointing down, protected from excessive air velocity and in a position to facilitate recalibration. If air velocities will be high, any of the sensor covers described above as being suitable for windy areas may be used.

GENERAL MONITORS

XII. RECOMMENDED SPARE PARTS

FOR ONE MODEL 4800

FOR UP TO TWO YEARS OPERATION

P/N	DESCRIPTION	QUANTITY
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
951-205	Fuse (interface board). 1/4amp, 250V.	4
VARIOUS See Section X.	Sensor.	2
20555	Channel Control Card	1
Various see Page 4	Relay Card	1