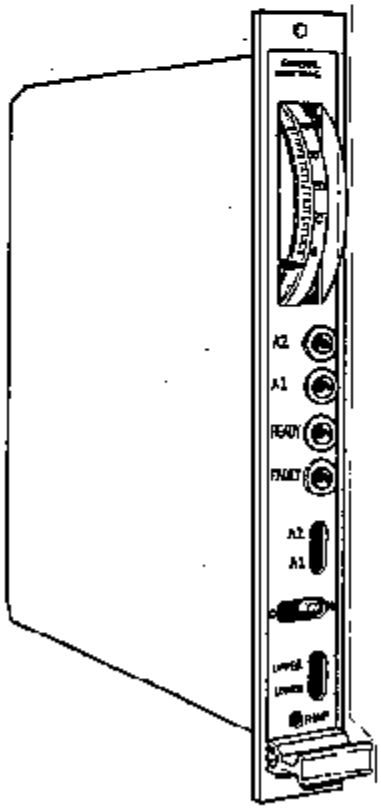
Model 2601
Hydrogen Sulfide Gas Monitor



Instruction Manual

General Monitors reserves the right to change published specifications and designs without prior notice.

Part No. 2601/0088
Rev. I/5/90

Warranty

General Monitors warrants all of its electrical units, combustible gas and H2S gas sensors to be free from defects in workmanship or material under normal use and service for two years. Flame detection and Chlorine gas sensors for 1 year and CO sensors for 6 months.

General Monitors will repair or replace, without charge, any equipment found to be defective during the warranty period. Final deter-mination of the nature and responsibility for defective or damaged equipment will be made by General Monitors 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 General Monitors 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. General Monitors responsibility under the above warranty shall be limited to the repair or replacement at General Monitors option at no charge 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 General Monitors in writing and General Monitors 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 instructions shall be a condition of this warranty.

Except for the express warranty stated above, General Monitors 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 General Monitors for damages including, but not limited to consequential damages arising out of/or in connection with the use or performance of the product.

Warning

1. Correct functioning of this instrument must be verified by carrying out a calibration check at least every ninety (90) days. See sub-section 4-13
2. Take note of sub-section 3-5 Sensor Poisons
3. Install and maintain all hazardous area equipment in accordance with the relevant regulations and practices of the country concerned. See Section 3- Installation.
4. The RAMP switch which is incorporated in each Model 2601 control module verifies correct operation of the control electronics ONLY and gives no indication of sensor condition.

CONTENTS

Section 1
Introduction

Introduction

1-1 General Description

The Model 2601 is a single channel Control Module which operates with a range of General Monitors Hydrogen Sulfide sensors.

Each control module provides a 4-20mA analog output signal, open collector alarm outputs and optional potential free relay contact outputs. Other options include an alarm reflash capability and transient over-voltage protection of the sensor input circuitry.

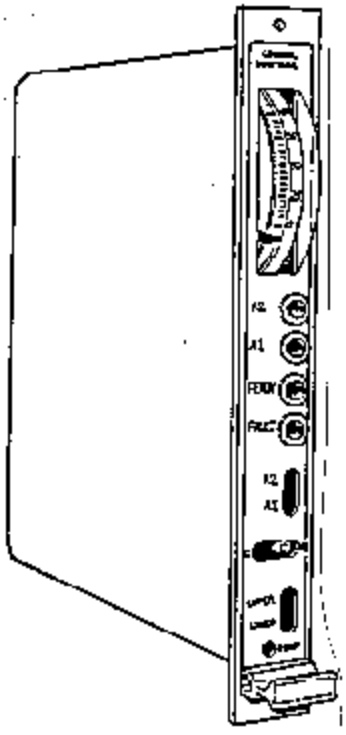
The control modules are housed in four, eight or sixteen channel chassis assemblies. An optional Facilities Module may be inserted next to the last channel position in each case. Interconnection is by means of a standard DIN 41612 two-part connector which facilitates field servicing and system expansion or reconfiguration. Note that a range of compatible control modules (Hydrocarbon, Flame detection, etc.) is available and these may be combined in any of the chassis types above. Each channel is coded, by means of a coding strip, to dedicate it to a particular module.

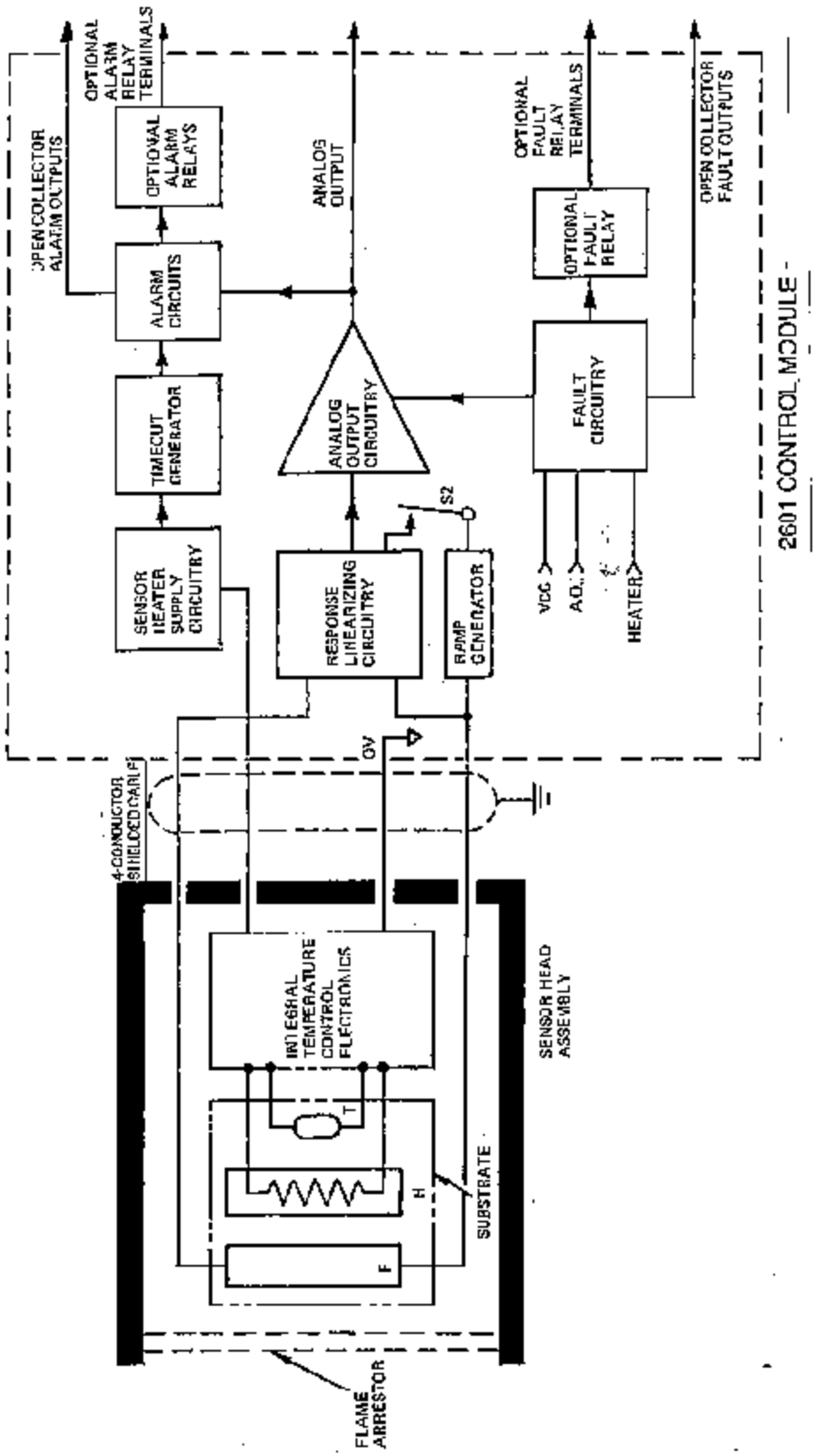
The chassis should be mounted in a non-hazardous and protected environment. Gas sensor assemblies in the hazardous areas to be monitored should be connected to the controller in accordance with the installation instructions contained in this manual.

The Model 2601 Control Module is designed to measure concentrations of Hydrogen Sulfide gas in the range 0-100 parts per million (ppm) (50 and 20 ppm ranges are also available). The proper operation of the instrument depends upon routine recalibration procedures and these simple adjustments should be carried out at least **every 90 days.**

A comprehensive range of accessories is available to facilitate the installation and reliable operation of the instrument.

General Monitors is recognized as a leader in the field of gas detection and a dedicated team of experts is always available to provide advice or service as required.




OPEN COLLECTOR ALARM OUTPUTS
OPTIONAL ALARM RELAY TERMINALS
OPTIONAL ALARM RELAYS
ALARM CIRCUITS
TIMECUT GENERATOR
SENSOR HEATER SUPPLY CIRCUITRY
ANALOG OUTPUT
ANALOG OUTPUT CIRCUITRY
RESPONSE LINEARIZING CIRCUITRY
RAMP GENERATOR
S2
OPTIONAL FAULT RELAY TERMINALS
OPTIONAL FAULT RELAY
FAULT CIRCUITRY
OPEN COLLECTOR FAULT OUTPUTS
VCC
AO
HEATER
2601 CONTROL MODULE
0V
4-CONDUCTOR SHIELDED CABLE
INTEGRAL TEMPERATURE CONTROL ELECTRONICS
T
H
F
SUBSTRATE
SENSOR HEAD ASSEMBLY
FLAME ARRESTOR

1-2 Principle of Operation

The sensor is a solid state, adsorption, diffusion type element. It utilizes Hydrogen Sulfide's ability to strongly adsorb onto a very selective proprietary metal oxide semiconductor 'R' as the basis for measurement.

The semiconductor is located on a substrate which is temperature controlled by the integral sensor electronic circuitry using heater 'H' and thermistor 'T'.

The change in resistance is repeatable and reversible, so that when pure air enters the sensor the semiconductor resistance returns to its clean air value. Because the relationship between hydrogen sulfide gas concentration and semiconductor resistance is non-linear, the control module incorporates linearizing circuitry.

A 4-20 mA linear Analog output signal is available on all modules.

When the Calibration door on the control module front panel is opened the instrument is automatically placed in Calibration Mode and the gas alarm output circuitry is held in a standby condition. The Ramp Switch S2 is now accessible and when depressed it causes the analog output and alarm circuitry to be subjected to a simulated rising and falling gas condition.

This facility allows the electronic circuits to be checked at any time without the necessity of gassing the sensor.

The A1 and A2 gas level alarm circuits drive open collector outputs. Relay outputs are available as an option.

Fault detection circuitry continually monitors each channel for sensor heater cable faults, low supply voltage or analog outputs faults. In the event of a fault being detected the gas alarm circuitry is held in standby, the normally energized fault circuitry is de-energized, and the front panel fault indicator is lit.

1-3 Description of components

Item		Notes	Qty
1	Control module (P/N F25-005)	1	1 per channel
2	Chassis (P/N E47-060 or E47-160)	2	1
3	Facilities module (P/N F47-017)	3	Optional
4	Termination (See sub-section 1-7)		1 per channel
5	Sensor assemblies (See page 1-9)		1 per channel
6	Sensor accessories (See Section 8)		Optional
7	Blank panel (P/N E25-040)		As required
8	Extender card (P/N F47-066)		Optional
9	Calibration equipment (See Section 8)		As required
10	Instruction manual (P/N 2601-0088)		As required
11	Calibration tool (P/N 926-725)		1

Notes:
1. P/N F25-005 refers to the Model 2601 Hydrogen Sulfide control module
2. Select E47-060-16, -8 or -4 for 16, 8 or 4 channel versions respectively, rack mounting
   Select E47-160-16, -8 or -4 for 16, 8 or 4 channel versions respectively, panel mounting
3. Refer to Sub-section 1-8

Please consult your General Monitors representative for information and advice on special requirements.

1-4 Control Module (P/N F25-005)

The control module contains all of the electronic circuitry required for one gas monitoring channel.

This module interfaces with the customers cabinet wiring by means of a two-part connector which conforms to the DIN 41612 standard. The male part of the thirty-two pin connector is mounted on the rear of the Control Module card and mates with the corresponding female part which is mounted in the chassis.

This termination is common to all modules in the range, facilitating the production of systems for mixed applications. In order to avoid the possibility of inadvertent module reversal in such mixed systems, each channel is coded by means of a coding strip so that only the correct module type may be inserted in any channel position.

The Model 2601 control module front panel incorporates the following indicators and controls:

- Edgewise meter, scaled in ppm H_2S
- Red 'A1' and 'A2' LED gas alarm indicators
- Green 'READY' indicator
- Yellow 'FAULT' indicator
- Calibration Door mechanism

For details concerning these controls and indicators refer to Section 4.

1-5 Control Module Options

The following options are available on the Model 2601 control module.

P/N F25-005-TO
This is the basic version having open collector alarm outputs but without relays or the ACCEPT/OSCILLATOR circuitry. The following outputs are provided.

- TA1 – NPN open collector 'A1' alarm (Pin 12z)
- LA1 – As TA1 but with internal pull-up (Pin 14d)
- TA2 – As TA1, but referenced to 'A2' alarm (Pin 14z)
- LA2 – As LA1, but referenced to 'A2' alarm (Pin 16z)
- CAL – Pull down to 0.7V approximately in Calibration mode (Pin 18z)
- AO+ – 4-20mA Analog output (500 ohms) (Pin 24z)
- AO– – Negative line of AO+ (Pin 24d) Flashing fault indication

P/N F25-005-TA
This incorporates all of the facilities of P/N F25-005-TO but also includes the ACCEPT/OSCILLATOR circuitry, giving the following additional features:

- Reflash of A1 and A2 indicators for new alarms
- Pulsing of LA1 and LA2 outputs by the Oscillator
- Alarm Accept input, giving steady alarm indication and steady LA1 and LA2 outputs (Pin 18d)
- Unaccepted Alarm Outputs, an open collector output normally high, which goes low in the event of an unaccepted alarm (Pin 10d)
- Flashing Fault indication

P/N F25-005-RO
This is similar to F25-005-TO except that the following features are added:

- SPDT FAULT relay (Pins 2z, 2d and 4z)
- SPDT 'A1' relay (Pins 6z, 8z and 10z)
- SPDT 'A2' relay (Pins 4d, 6d and 8d)
- Relays are rated 117 VAC 1Amp res. max.

Note that the FAULT relay is always energized in NORMAL operation. The 'A1' and 'A2' relays may be normally energized or normally de-energized.

P/N F25-005-RA
This combines the facilities of both P/N F25-005-TA and P/N F25-005-RO.

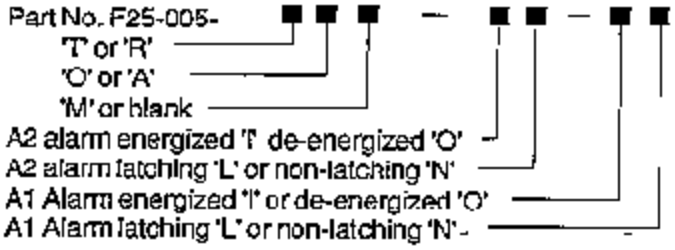
Varistor Option
Any of the four previous options may be additionally supplied with three Metal Oxide Varistors (Mov. 1, 2 & 3) for the suppression of transient over-voltages on the sensor input lines (Pins 26z & d, 30z & d and 32z and d) such as might occur due to indirect lightning strikes. To specify this option, add suffix 'M' to the part number, e.g. F25-005-TAM.

Alarm Configurations
As previously noted, the 'FAULT' alarm is always energized in normal operation and de-energizes in a Fault condition. No latching capability exists for the 'Fault' alarm.

The 'A1' and 'A2' gas alarms may be configured as follows:

A1	Normally de-energized	Insert jumper P1-0
A1	Normally energized	Insert jumper P1-1
A2	Normally de-energized	Insert jumper P2-0
A2	Normally energized	Insert jumper P2-1
A1	Non-latching	Remove diode D25
A1	Latching	Insert diode D25
A2	Non-latching	Remove diode D8
A2	Latching	Insert diode D8

The above configurations may be modified by the user, if required. When ordering, the configurations may be defined verbally or, may be defined as follows:



If the configuration is not specified, the -OL-OL format will be shipped.

1-5 Chassis Assembly (P/N E47-060

The chassis assembly consists of two black anodized end-plates, with integral mounting slots, and five extruded aluminum sections mounted between them. Four of these sections are fitted with steel spacer strips which serve to align the card guides on which the Control Modules slide. Connector mounting strips are attached to the extruded sections at the rear of the Chassis and are used to mount the DIN 41612 connectors for termination purposes.

On the rear part of each channel card a code strip is mounted adjacent to its connector on the Connector Mounting Strip. A channel is coded by inserting red plastic coding pins in the slots provided. In the case of the Model 2601 control module, the slot numbers are '2' and '11'.

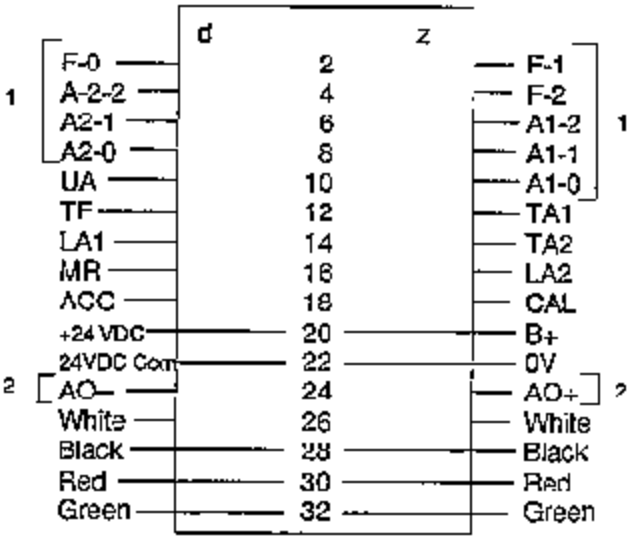
Chassis Assembly P/N E47-160

This Chassis Assembly is similar in construction to Chassis P/N E47-060 except that the end plates are adapted to panel mounting using self locking M6 fasteners, in conjunction with a Bezel (see User Information Drawing page 1-8).

1-7 Termination Options

A Screw termination (P/N 921-377) is provided for the female DIN 41612 connector mounted at the rear of the chassis. This is fully compatible with the male connector mounted on the Control Modules.

The connector pin designations for the Model 2601 control module are shown in the following diagram as they appear looking from the rear of the chassis.



Notes:

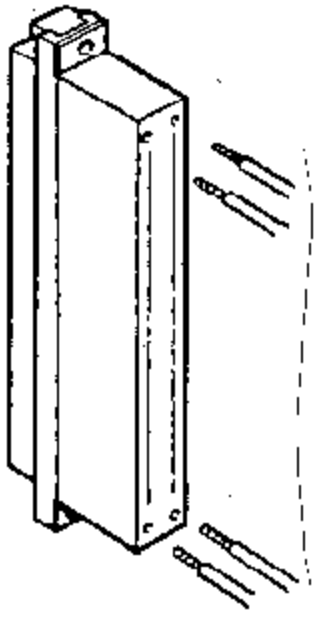
1 These relay contact outputs are relevant only if the relays option is used.

2 These pins must be shorted if an analog output is not required.

Screw Termination P/N 921-377
This 32-pin connector conforms to the DIN 41612 specification.

The insulation stripping length is 0.4 inch in each case. A slotted conical drive screw is turned in a clockwise direction after the conductors are fully inserted in the openings provided, thus providing a secure and vibration-proof termination.

Manufacturer:	Phoenix
Connector:	P/N 22 85 195 (Type SFL/F32/ZD
Insulation housing:	Green fiber glass reinforced 6.6 polyamide
Spring contacts:	CuSn6 with 0.8 micron hard gold plating
Screw contacts:	CuSn39 with nickel plating
Wire size:	14 AWG - 18 AWG
Stripping length:	0.4 inch
Max current:	1A
Rated voltage:	125 VAC



1-8 Facilities Module

The Facilities Module is an optional assembly which plugs into the right-hand side next to the last control module position in a 4, 8 or 16 Channel Chassis. This module can be ordered with several options to meet customer requirements, for example:

Integral Master Reset Switch
Integral Accept Switch
Integral Common Alarms

F47-017-1
01 and Trip Amplifier module with Master Reset Option.
F47-017-2
01 & Trip Amplifier module with Accept Option
F47-017-3
01 & Trip Amplifier module with Master Reset and Accept Option.

F47-117
The F47-117 Facilities Module is designed to provide common alarm outputs for A1, A2 Fault and unaccepted alarm. A1, A2 and Fault may or may not be supplied with relays.

The UA buss is switched low when an alarm is activated on any channel, this turns transistor Q8 on thus energizing relay K4. The voltage developed across the coil of K4 turns on transistor Q9 which in turn switches off transistor Q10 which allows IC1-5 or IC1-6 to switch on depending upon whether it is an A1 or A2 alarm. This gives an open collector output on 24d for A1 or 24z for A2.

The fault relay K3 is normally energized, IC1-7 is normally switched on. When a control module goes into fault a logic high signal appears on the Tf buss. This turns transistor Q7 on, thus pulling the collector of Q7 and input to IC1-7 low causing IC1-7 to switch off, thus de-energizing IC3 fault relay and the Tf open collector on 12d.

A1 and A2 circuits are similar, so only A1 will be dealt with. When an A1 alarm occurs the A1 buss is pulled low. This switches on transistor Q2 which allows capacitor C4 to charge up. Capacitor C4 is necessary as when the accept/reflash option is installed on the control module the LA1 buss will pulse at the same frequency as the LED's. Capacitor C4 prevents the common alarm output from following suit. When C4 is sufficiently charged it switches transistor Q4 on which in turn switches on IC1-3 and IC1-4 giving both a relay output where fitted and two open collector outputs. Resistors R12, R14, R16 and transistor Q6 are necessary when normally energized relays or open collector A1 output is required.

During calibration, the cal buss is held low and hence the base of transistors Q3 and Q4 via diodes D1 and D4 respectively.

The card is powered through D11 and protected by fuse FS1 smoothed by capacitors C5 and C6.

F47-117-TO-O
01 & Trip Amplifier module with Master Reset and Accept Option, Open Collector Outputs and Unaccepted alarm relay output. Normally de-energized alarms.
F47-117-RO-O
01 and Trip Amplifier module with Master Reset and Accept Option, Open Collector outputs, Relay outputs and Unaccepted Alarm relay outputs. Normally de-energized alarms.
F47-117-TO-1
As TO-0 with normally energized alarms
F47-117-RO-1
As RO-O with normally energized alarms

Pin Assignments for the Facilities Module are as follows:

	d	z	
CF-0	2	2	CF-1
CA2-2	4	4	CF-2
CA2-1	6	6	CA1-2
CA2-0	8	8	CA1-1
UA BUSS	10	10	CA1-0
CTF	12	12	CTA1
LA1 BUSS	14	14	CTA2
MR BUSS	16	16	LA2 BUSS
ACC BUSS	18	18	CAL BUSS
B+ BUSS	20	20	B– BUSS
OV BUSS	22	22	OV BUSS
CUA 1	24	24	CUA 2
CLA 1	26	26	CLA 2
TF BUSS	28	28	OV
OV	30	30	UAR-0
UAR-1	32	32	UAR-2

Please consult your General Monitors representative for details.

1-9 Hydrogen Sulfide Sensors with Integral Temperature Control

P/N50445
Standard aluminum bodied H2S Sensor with flame arrester conforming to National Electrical Codes of the USA & Canada. Temperature range –40°F to +195°F (–40°C to +90°C).

P/N 50448
As above, but with a stainless steel body.

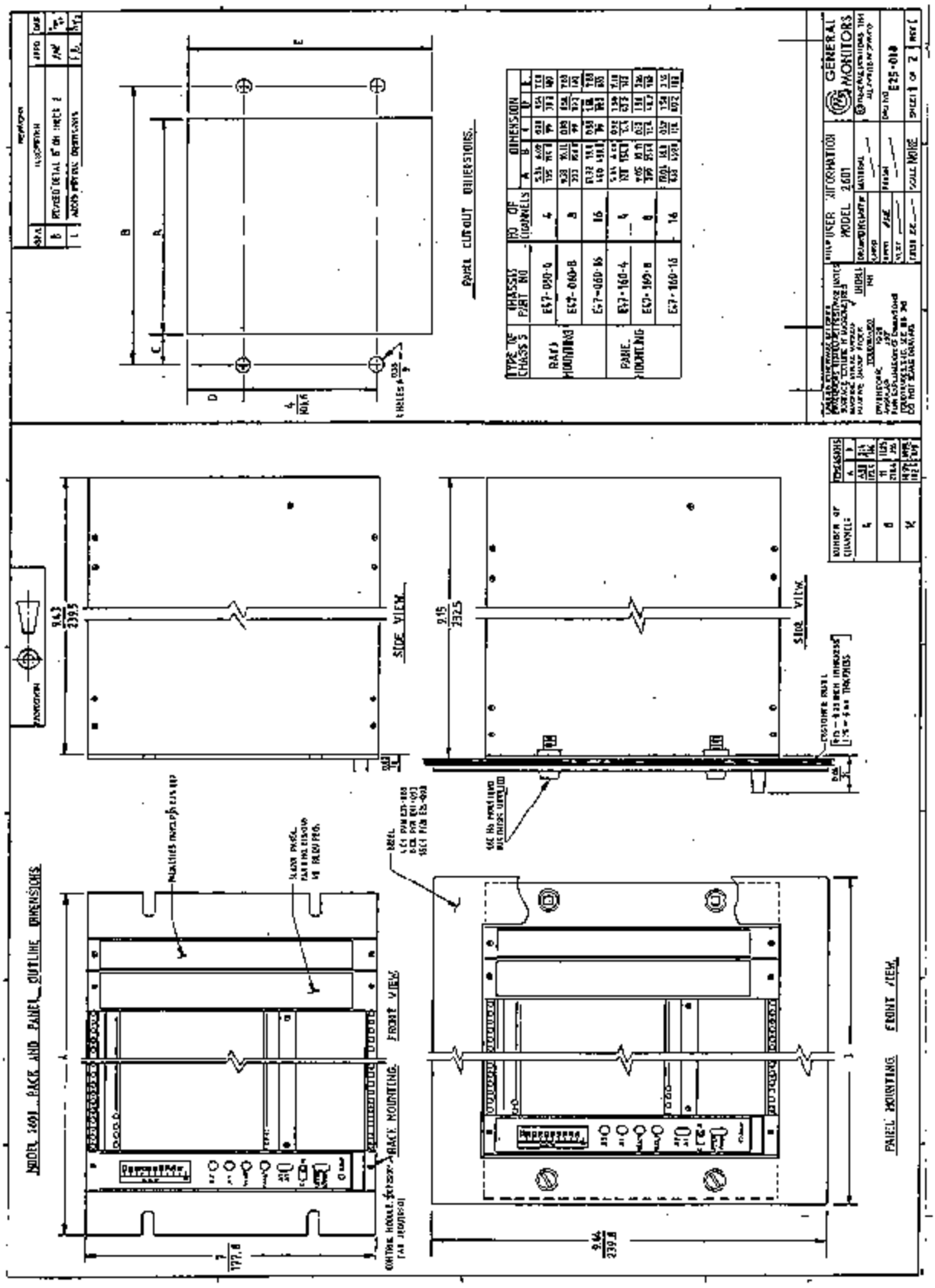
P/N 50454
Equivalent to P/N 50445 but supplied with a sintered flame arrester conforming to European requirements.

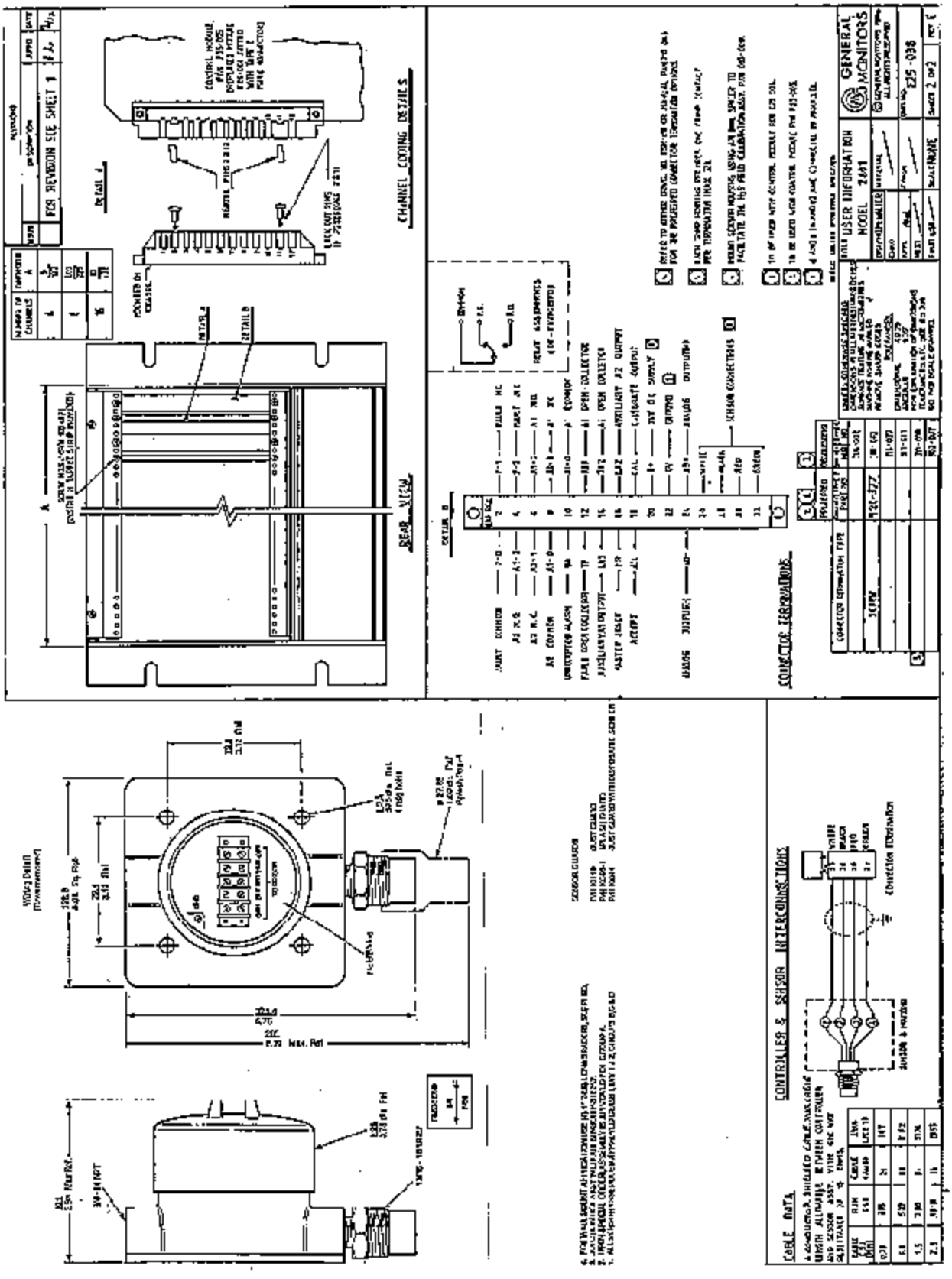
P/N 50457
As P/N 50454, but with a stainless steel body.

Sensor Ranges:

The above sensors are marked with a dash number to indicate their ranges:

Dash No.	Range (ppm H2S)
–1	0-100
–5	0-50
–9	0-20

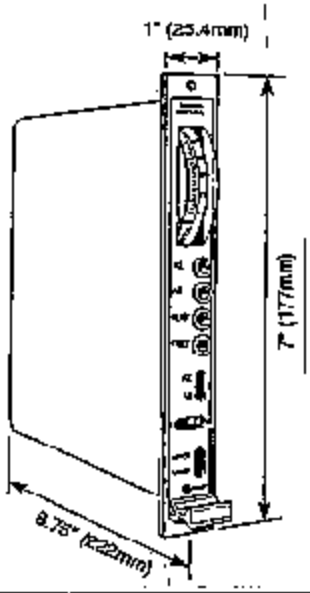

MODEL 2601 BACK AND PANEL OUTLINE DIMENSIONS
SIDE VIEW
REAR VIEW
FRONT VIEW
RACK MOUNTING
PANEL MOUNTING
FRONT VIEW
PANEL CUTOUT DIMENSIONS
GENERAL MONITORS
MODEL 2601



Section 2
Specification

System specification

Model 2601



Specification

System Specification

Application:	Hydrogen sulfide gas monitor
Built to conform to the requirements of:	Canadian Standards CSA C22.2 No. 0-M1982 and 142-M1983 and ISA SP12.15 Pt 1, ISA performance standards for H_2S Detection Instruments
Measuring Range:	0-20, 0-50 or 0-100ppm
Accuracy:	± 2ppm or 10% of applied gas, whichever is greater
Temperature variation:	± 4ppm or 10% of applied gas, whichever is greater over −10°C to +50°C temperature range
Long term stability:	± 4 ppm or 10% of applied gas, whichever is greater over a 21 day time period
Response time:	Wire screen flame arrestor version, T50 ≤ 60 seconds of full scale with full scale concentration applied. Sintered stainless steel arrestor version, T50 ≤ 2 minutes of full scale with full scale concentration applied.
Humidity variation:	± 4 ppm or 10% of applied gas, whichever is greater over 15 to 90% RH at ambient temperature

Environmental Specifications

Operating temperature:	Sensor −40°C to +60°C Controller −18° C to +66°C
Humidity range:	0 - 99% RH (non-condensing)
Storage temperature:	Sensor −55°C to 85°C Controller −55°C to 85°C

Electrical Specifications

Supply voltage:	20 - 32 VDC
Power consumption:	150mA at 24V (typ)
Analog output:	0 - 22mA (4-20 mA FSD)
Analog output load:	600 Ω max.
Lead length:	Four conductor cable, maximum length of cable between controller and sensor assembly with loop resistance of 20 ohms

Cable (AWG)	Run (Feet)	Run (m)
14	1029	3375-
16	686	2250
18	411	1350
20	274	900

Chassis

Part No.	Height	Width	Depth	Weight
Rack mounting				
E47-060-16 (16 channel)	7"	19"	9.5"	3.85lb
E47-060-8 (8 channel)	7"	11"	9.5"	2.75lb
E47-060-4 (4 channel)	7"	7"	9.5"	1.94lb
Panel Mounting				
E47-160-16 (16 channel)	9.5"	19.3"	9.2"	3.88lb
E47-160-8 (8 channel)	9.5"	11.25"	9.2"	2.75lb
E47-160-4 (4 channel)	9.5"	7.25"	9.2"	1.94lb

Mounting

16 channel – 19 " rack or panel
8 channel – rack or panel
4 channel – rack or panel

Channel Assignment: Coding strip (P/N 921-798)
Termination: DIN 41612

All panel mounting chassis are supplied with a Mounting Bezel as follows:

4 channel	P/N E26-628
8 channel	P/N E47-093
16 channel	P/N E26-093

N.B. Cable runs calculated for a 22 volt supply voltage. Typical cable runs may be appreciably longer.

Analog output:	4-20mA
AO limit:	27 mA
AO load	0-500 ohms
Alarm output ratings:	TF, TA1, TA2 (–'T'– option) 100 mA TF, TA1, TA2 (–'R'– option) 50 mA LA1, LA2, 50 mA
Relay contact ratings:	117VAC 1A res Max.
Master reset load:	3 mA at 15 V
Accept load:	220 µA at 15V

Section 3
Installation

Installation

3-1 On Receipt of your Equipment

All items of equipment shipped by General Monitors are pre-packed in sturdy containers and enclosed in anti-static foam filling which affords a considerable degree of protection against physical damage. The contents should be carefully removed and checked against the enclosed packing slip.

Any discrepancies between the contents and the packing slip must be reported to General Monitors within ten days of receipt of the shipment. General Monitors cannot be held responsible for shortages not reported within this period.

Damage to the contents of a shipment should be brought to the attention of the carrier immediately and a claim filed.

3-2 Chassis Installation

The chassis should be mounted in a non-hazardous protected environment. The sixteen channel version is suitable for 19" rack mounting (P/N E47-060-16).

The chassis should be subjected to a minimum of shock and vibration. Although the instrument is to a great extent immune to electromagnetic interference, it should not be mounted in close proximity to radio transmitters or similar equipment.

The control modules require free air circulation to avoid excessive heat build-up inside the enclosure. If controllers are to be stacked vertically within an enclosure, forced air circulation will be required.

In installations where two or more control module types are to be mixed in one chassis, check that the individual channel coding strips match the channel application.

The coding strips are pre-configured at the factory and the male portion is provided ready mounted on each Control Module. The female portion, when provided unmounted with the Control Module for system expansion, must be fastened in position on the Connector Mounting Strip so as to mate with its counterpart on the Control Module.

Connectors for system expansion should be fastened in a similar fashion, using the screws and nylon insert nuts provided.

Do not over-tighten the connector or coding strip fasteners, as this may damage the plastic moldings.

3-3 Installation of Sensor Head Assemblies.

The sensor head assemblies should be installed in the hazardous areas in accordance with the relevant regulations and practices of the country concerned. The mounting should be as free from shock and vibration as possible, and must be accessible for calibration purposes. Sensors should always be mounted pointed down, so as to avoid accumulation of moisture and particulate deposits. Under no circumstances must a sensor be connected to or disconnected from an instrument which is powered up. This will seriously damage or destroy the sensor. Sensors damaged in this manner are not covered under warranty.

Various sensor accessories are available to minimize the effects of rain, wind and particulate matter. Refer to Section 8 'Accessory Equipment'.

The Model 2601 control modules and sensors are factory calibrated and should be installed as a matched system in order to preserve the factory set calibration points.

IMPORTANT
The housing (P/N 10250) should be spaced at least 1 inch off the mounting surface using the 1 inch spacers provided, to facilitate application of calibration gas using the field calibrator (P/N 50090).

3-4 Sensor Locations

Due to the many variables involved, there are no hard and fast rules defining the optimum location for a sensor. The following should, however, be kept in mind.

1 Ensure that the location is accessible for calibration purposes and that sufficient clearance exists to allow the use of the Field Calibrator (P/N 50000).

2 Locate sensors where prevailing air currents contain maximum concentration of gas.

3 Consider how the gas will disperse. Generally, sensors should not be located too far away from a potential leak point. Remember that Hydrogen Sulfide is heavier than air but do not rely on this property when selecting a sensor position.

4 Observe the temperature limitations quoted in the individual sensor data sheets. If a sampling or pre-conditioning system is to be employed, always ensure that vapors will not condense in the piping of the system.

3-5 H2S Poisons & Contaminants

Sensors may be adversely affected by prolonged exposure to certain atmospheres. Loss of sensitivity or corrosion may be gradual, if the poisons are present in very low concentrations, or rapid in the event of large concentrations of poison being present.

The more important poisons are:

Halides	Compounds containing fluorine, chlorine, bromine and iodine
Sulfur	Heavy metals, e.g. Tetraethyl lead

Silicones, contained in greases or aerosols, are the most common 'coating' agents, which are not true sensor poisons but reduce sensor response.

Other materials which have a deleterious effect include mineral acid vapors and caustic vapors which attack the sensor physically.

The presence of such poisons and damaging vapors does not imply that the sensor may not be used in these locations. A careful analysis of ambient air conditions should be undertaken and the customer should be aware that sensor calibration may need to be repeated at shorter intervals. Sensors used in these atmospheres may have a shorter life than normal and in many such applications the normal two year warranty would not apply.

3-6 Recommendations for Sensor Field Cables

The sensor cable should be a four conductor stranded cable of sufficient cross sectional area (see Sub-section 2-2). The total loop resistance excluding the sensor must never exceed 20 ohms (i.e. 10 ohms per conductor). Due to the high impedances present in the sensing element, the use of a shielded cable is required.

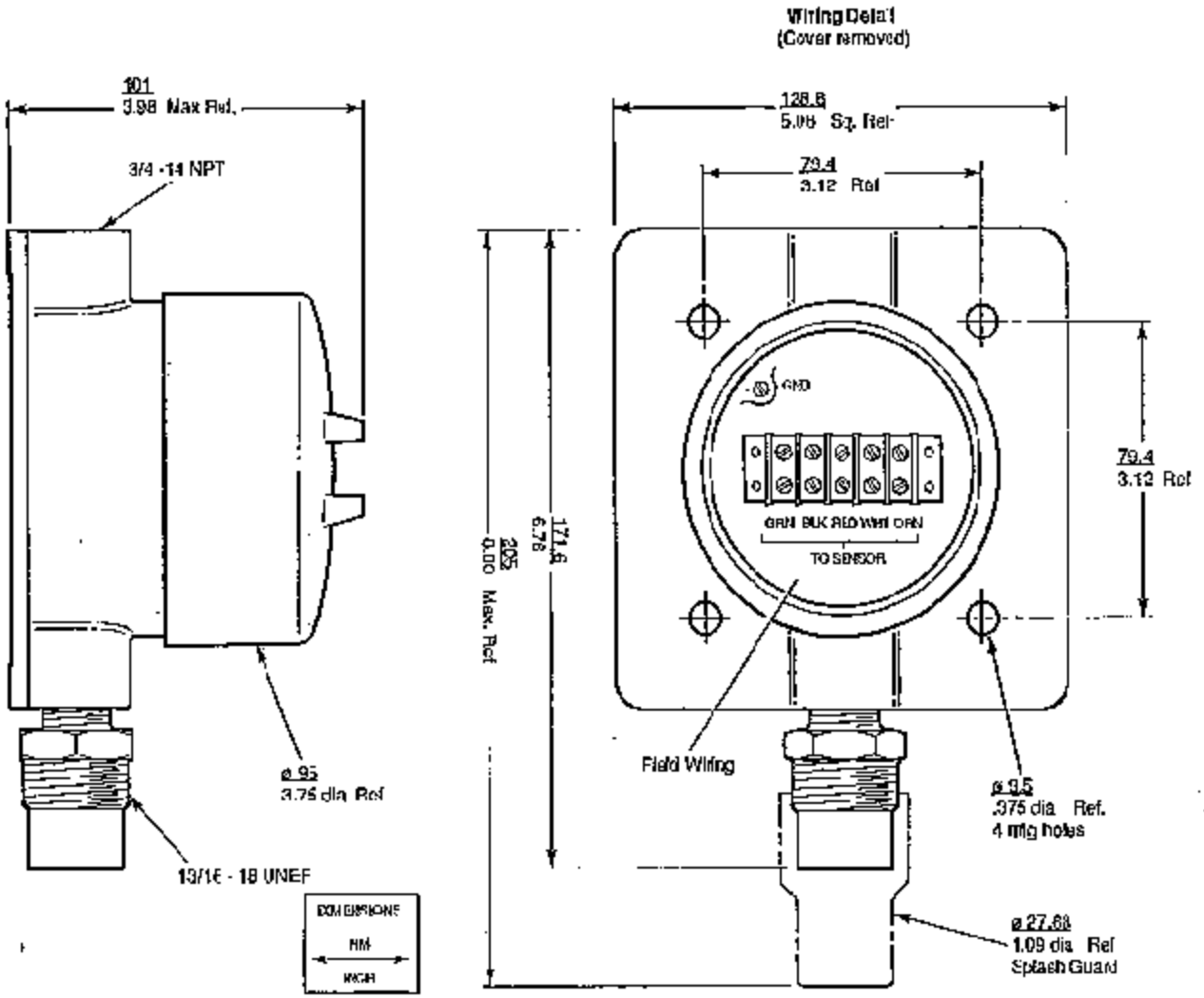
This shield should be enclosed in a suitable insulating outer jacket, and should be grounded at the controller end only.

Care should be taken, particularly at the sensor end, that the shield does not come into contact with any metal conduit or junction box. Ideally the cable should be continuous between the control module location and the sensor head junction box. However, if a splice is unavoidable, this must be of good quality soldered and not subject to variations in contact resistance.

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

Warning
The integral temperature control circuitry of the Hydrogen Sulfide sensor causes pulses of current to flow in the black and white sensor conductors.

These pulses would cause interaction between channels in a multi-channel multi-conductor cabling system. The use of individual channel shielded cables is therefore necessary.



4. FOR WALL MOUNT APPLICATION USE (4) 1" (216) LONG SPACERS, SUPPLIED.
3. JUNCTION BOX ASSY WITHOUT SENSOR P/N10252.
2. UPON SPECIAL ORDER, ASSEMBLY IS APPROVED FOR GROUP A.
1. ALL SENSOR ASSEMBLIES APPROVED CLASS I, DIV 1 & 2, GROUPS B,C & D.

SENSOR GUARDS

P/N 10110	DUST GUARD
P/N 10995-1	SPLASH GUARD
P/N 10044	DUST GUARD WITH DISPOSABLE SCREEN

3-7 Sensor Cable Termination

Remove the sensor junction box lid to reveal the numbered terminal strip. The recommended terminal assignments are given below.

Terminal No.	Sensor lead
1	White
2	Black
3	Red
4	Green

Connect the sensor cable as required.

Ensure that all connections are tight. Terminate the sensor cable conductors on the intermediate terminals at the rear of the cabinet. The final termination to the chassis will conform to the following table.

Sensor lead	Termination designation
White	26d/26z
Red	30d/30z
Green	32d/32z
Black	28d/28z

The shield should be terminated on the system ground as appropriate.

3-8 Analog Output Termination

The Analog output is a 4-20mA current signal which will operate into any resistive load between 0 and 500 ohms. Loads in excess of this maximum value will result in a Fault indication. Where the Analog Output is not being used to drive external equipment, it is a common oversight to omit the Analog Output termination during system installation, which will result in a FAULT display. This may be avoided by shorting the AO+ (Pin 24z) and AO– (Pin 24d) terminals during installation.

3-9 Relay Terminations

These terminations are applicable only when relays have been specified and are otherwise open circuits on the Control Module. Relay outputs are labelled as shown in the following table, where it is assumed that the relays are de-energized.

Relay	Common	Normally Open	Normally Closed
A2	A2-0 = Pin 8d	A2-1 = Pin 8d	A2-2 = Pin 4d
A1	A1-0 = Pin 10z	A1-1 = Pin 8z	A1-2 = Pin 6z
Fault	F-0 = Pin 2d	F-1 = Pin 2z	F-2 = Pin 4z

Note that the 'FAULT' relay is always configured in a normally energized format and de-energizes in a FAULT condition. The 'A1 and A2' relays may be normally energized, installing jumpers 'P1-1 and P2-1'.

The relay contacts are rated at 117 VAC, 1 A, res max. but ensure that the panel wiring and intermediate terminations are compatible with the voltage, current and power requirements of the load. Inductive loads will generally require suppression devices such as clamping diodes or varistors. Capacitive loads may require current limiting so as to limit inrush currents to a safe value below the maximum rating of the contacts.

3-10 Open-Collector Outputs

The operation of these outputs is fully described in Section 6 of this manual and output specifications are given in Section 2.

The output terminations are repeated in the following table for convenience.

Alarm Output	Main Output	Auxiliary Output
A2	TA2 = Pin 14z	LA2 = Pin 16z
A1	TA1 = Pin 12z	LA1 = Pin 14d
Fault	TF = Pin 12d	

The A1 and A2 open-collector outputs are fitted with isolating diodes so these outputs may be commoned together. The fault output of modules can be commoned by using the fault relay contacts. To common the fault output in conjunction with a common Facilities Module, the TF open collector output of each card must be connected via a 10K resistor to the DC supply and also via a diode IN 4148 (anode to TF output) to the TF input of the Facilities Module.

3-11 Power Supply Connections

The positive lead of the 24 volt DC supply should be connected to Pins 20z and / or 20d. Similarly the (24 VDC common) supply should be connected to Pins 22z and / or 22d. Care should be taken, particularly if the supplies are looped from one channel to the next, that cable of adequate cross-section is used.

In general, use cables as short as possible to avoid substantial voltage drops between the supply and the chassis.

3-12 Master Reset and Accept Signals

Both of these inputs, if required by the options chosen for the Control Modules, require single-pole Normally Open switches, connected between the respective terminals and DC return. These switches are customer supplied.

3-13 Power from AC Supply

110/220/240 VAC 50/60 Hz power supplies are available. These may be mounted within a cabinet adjacent to the chassis.

Chassis type	Power unit
E47-060-4	A00-011
E47-060-8	
E47-060-16	A00-020

3-14 Caution Note

Externally applied high voltages may be present on the relay contact terminals. These will generally be independent of the supply to the control module and caution should be exercised when working in this area. Electric shocks felt when wiring the alarm relay contacts on a low voltage DC system indicate the presence of unsuppressed inductive loads and should be investigated.

3-15 Initial Application of Power

1 Using the calibration door tool. (P/N 928-725) place all channels in Calibration mode by sliding the CAL door actuators to the left.

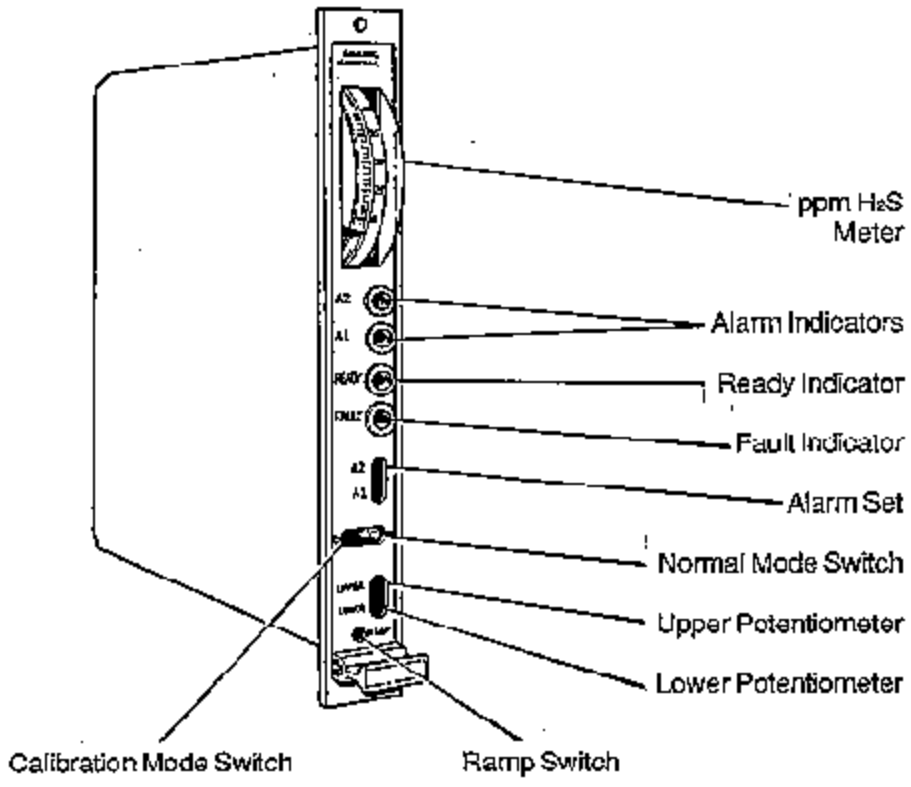
Note that the A1 and A2 gas alarm circuitry and relays, if provided, will be held in standby condition in this mode, but the TF, LA1 & LA2 outputs are also active in CAL mode.

2 Apply power to the system, and observe the indicators on the front panel of each control module.

Under normal conditions, the meter reading will settle near zero and all green Ready indicators will be on. Should any Ready indicator fail to illuminate, refer to Basic Fault Finding, Section 6.

Allow the system 24 hours to stabilize.

Section 4
Operating Instructions



Operating Instructions

The General Monitors Model 2601 Control modules will normally be mounted in a control room in direct view of the operating personnel. The alarm indicators chosen for this instrument provide a visible display even in high ambient lighting conditions.

Function of Indicators and Controls

4-1 ppm H2S Meter

The analog meter is scaled from 0-100 parts per million (ppm) Hydrogen Sulfide (H2S) gas. Due to the logarithmic response of the sensor to H2S concentration under 5ppm cannot be accurately read on an instrument of this range.

0-50 and 0-20 ppm ranges are also available.

Should a system malfunction occur, the Fault indicator will be lit and the meter will read under-range.

4-2 Ready Indicator

This green light-emitting-diode (LED) normally glows steadily indicating that the channel is operational.

4-3 Alarm Indicators

The red 'A1' and 'A2' LED indicators are illuminated whenever the gas concentration at the sensor exceeds the set-point level to which the alarms have been pre-set. In normal operation this action will be accompanied by a gas alarm output signal and the actuation of the alarm relay contacts, if relays are supplied.

4-4 Fault Indicator

This indicator is normally off. When lit, it indicates a fault in the system and the Fault circuitry overrides the gas alarm circuitry. If Latching gas alarm circuitry has been provided, this will remain in the condition that existed before the fault occurred.

The Operator should refer to Section 6 for guidance when dealing with a system malfunction.

Note that both the FAULT and READY indicators will be illuminated if the controller is in Calibration mode.

4-5 Calibration Mode

Using the special tool provided (P/N 928-725) the Calibration Door may be moved to the left. The module is then in Calibration Mode and the user has access to the Upper/Lower, A1 and A2 adjustment potentiometers.

In Calibration mode the gas alarm outputs are disabled, although the A1 and A2 indicators remain active as does the Fault circuitry. The yellow FAULT indicator is illuminated steadily.

Note also that the CAL output on Pin 18z of the connector is held at approximately OV in Calibration Mode.

See Sub-section 4-10 for Calibration Instructions.

4-6 Ramp Switch

Depressing the Ramp Switch, which is accessible only in Calibration Mode, causes the meter to climb very slowly over its full range. In calibration mode the TA1, TA2 and optional gas alarm relay outputs are inhibited but the LA1, LA2 outputs are active and the Analog output current tracks the indicated meter readings. Should remote alarms be monitoring the Analog Output current or the auxiliary outputs, provision must be made to bypass these when in calibration mode. The meter reading returns to zero when the ramp switch is released.

4-7 Master Reset Switch

Gas alarm circuits which are wired for Latching Operation will remain in the active condition even when the gas concentration at the affected sensors drops below the set-point levels. Depressing the momentary-action Master Reset Switch will cancel these alarms. This switch is externally mounted and connected to Pin 16d of the rear termination. It may be user-supplied or optionally is available on the front panel of the Facilities Module.

Operation of the switch will have no visible effect if the gas concentration is above the set-point levels.

4-8 Accept Switch

(This section applies only to modules supplied with the Accept/Oscillator option).

Any gas alarm causes the appropriate A1 & A2 alarm indicators flash and these may be accepted using the Accept switch. When an Accept signal is received, the indicators are illuminated steadily and the LA1 and LA2 output signals remain in a steady alarm condition instead of oscillating with the alarm indicators. The Accept switch may be user-supplied or optionally is available on the front panel of the Facilities module.

4-9 Caution Note

The H2S sensor is shipped with a red plastic cap covering the flame arrester. Inside the cap is a small desiccant which prevents moisture affecting the sensor substrate. **Do not remove** this plastic cap until the system has been under power for approximately 10 minutes.

The desiccant may now be discarded, but the plastic cap should be retained.

Place the red plastic cap over the sensor flame arrester whenever power to the sensor is removed.

This procedure should be followed even if power is to be cut off for only a few minutes.

After every power outage, perform a calibration check to ensure normal operation of the system. A full System Calibration must be performed on each channel when its sensor is replaced.

4-10 Calibration Instructions

Warning

A calibration check should be performed at least every 90 days. Local conditions may require a calibration check at more frequent intervals in order that appreciable inaccuracies do not affect system dependability.

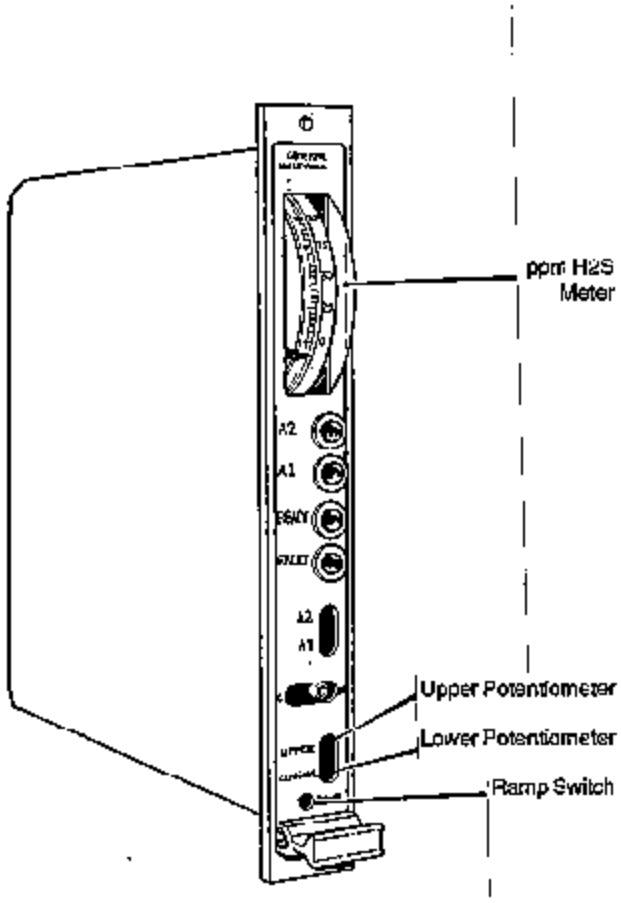
Note that any foreign matter, such as oil, dust paint etc. clogging the dust filter or flame arrester, will seriously impair the effectiveness of the system. It is therefore recommended that dust covers and accessories be cleaned and or replaced as necessary on a regular basis.

4-11 Initial set up for non-calibrated systems

a Use the calibration tool to slide the Calibration Door to the left, placing the control module into Calibration Mode. Both the Ready and Fault indicators should be steadily illuminated.

b Set both Upper and Lower twenty turn potentiometers to mid-position.

c If there is any doubt with regard to a background concentration of gas while calibrating a channel, purge a field calibrator with clean air and place it over the sensor for a few minutes.



4-12 System Calibration.

a Place an ampoule corresponding to full scale H2S concentration in the Field Calibrator which has been purged with clean air, and following the instructions on the calibrator, gas the sensor.

b Allow approximately 5 minutes for the reading to stabilize. Set the meter to read full scale, adjusting the Upper potentiometer. Remove the field calibrator and allow the sensor to be permeated with clean air until the reading stabilizes at a low value.

c Remove all glass fragments from the field calibrator and insert an ampoule corresponding to 20% of full scale concentration. Again gas the sensor and allow approximately 5 minutes for the reading to stabilize. Set the meter to read 20% of full scale adjusting the Lower potentiometer and remove the field calibrator. Allow the reading to stabilize.

d Repeat a to c as required.

e Perform a Calibration Check as outlined in Section 4-13, to verify calibration accuracy.

f Using the Calibration Tool, slide the Calibration Door to the right. The Ready indicator should now be illuminated constantly and the Fault indicator should be extinguished.

4-13 Calibration Check

To insure proper calibration, visually inspect the sensor and all accompanying accessories. Clean or replace the sensor if necessary.

Place an ampoule of approx. 50% full scale H2S concentration in the Field Calibrator (P/N 50000) and gas the sensor (See 8-7). Allow a few minutes for the meter reading to stabilize and check that the display reads 50% of full scale ± 5%. This completes the Calibration Check.

If the meter does not respond as indicated above, check that the ampoule used was not out of date by reading the expiration date stamped on the label. (Ampoules may begin to lose concentration after 12 months).

If the ampoules are current and the meter reading is outside tolerance, a full System Calibration is required.

4-11 Alarm Settings

A1 Alarm

Place the instrument in Calibration Mode. Depress the Ramp switch and observe the meter reading at which the A1 alarm indicator switches ON. Rotate the A1 alarm potentiometer in a clockwise direction if the A1 alarm setting is too low. Otherwise rotate this potentiometer in a counter-clockwise direction until the A1 Alarm Indicator just switches on at the required setting.

Note that even if latching gas alarm circuits have been incorporated, these will operate as non-latching circuits in Calibration Mode. This facility minimizes the risk of inadvertent alarms.

A2 Alarm

With the Ramp Switch depressed as before, observe the meter reading at which the A2 alarm indicator switches on. Rotate the A2 alarm potentiometer in a clockwise direction if the A2 alarm setting is too low. Otherwise rotate this potentiometer in a counter-clockwise direction until the A2 alarm indicator just switches on.

Note that some hysteresis is present in the alarm trip levels. This is required to prevent relay 'chatter'.

The Alarm set-points are now adjusted for this channel. Repeat for all remaining channels.

Section 5
Maintenance

Maintenance

5-1 Maintenance

Once correctly installed, systems require very little maintenance other than Routine Re-calibration. (See Section 4) and periodic inspection.

Sensor heads exposed to the elements may require a little grease on the accessory mounting threads occasionally. The greases used must be free from silicones (refer to Sub-section 3-5 Sensor Poisons) and have a high melting point. Alternatively, PTFE tape may be used.

The removal of particulate matter from sensor accessories 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 replacing on the sensor body.

General Monitors strongly recommends that the complete system, including all alarm circuitry, be tested at least annually and that the following checks be incorporated.

1 All sensor assemblies for effectiveness of mounting positions so that modifications to plant layout have not affected this.

2 Security of mounting of sensor assemblies.

3 Sensor flame arresters for clogging due to water, oil, dust or paint.

4 Sensor accessories, if used.

5 Condition and fastening of cables.

6 Connections for tightness and damage.

7 Cooling air filters, where used. Ensure that replacement filters are clean and dry.

8 Operation of complete system on stand-by supplies, where used, for the full prescribed time.

9 Spare parts stocks (See Section 7)

5-2 Storage

Electronic modules should be stored in a clean dry area and within the temperature range quoted in the specification (refer to Section 2).

When prolonged storage is anticipated, modules should be sealed, together with a desiccant, into plastic bags and double wrapped for protection. The RED CAP supplied with the sensor should be in position throughout the storage period.

Some degradation of the dielectric present in aluminum electrolytic capacitors will occur during prolonged storage, and after one year the initial leakage currents of these components may be up to one hundred times the leakage measured when new. It is therefore advisable to restore the dielectrics of these components after prolonged unpowered storage using the following method.

Remove the control modules from the chassis. Obtain a current and voltage limited DC power supply and set the output voltage to zero. Set the current limit to 100mA. Connect the supply in the correct polarity across the electrolytic capacitor. Slowly raise the applied voltage to nominal and observe that the current drain stabilizes. Repeat for each module.

Section 6
Basic Fault Finding

Basic Fault Finding

Included in this Section is a trouble shooting table. The information presented here is designed to cope with the more common faults which appear during system commissioning and operation and which are repairable by a competent operator.

Should the various actions suggested in the table fail to restore normal operation, the affected module should be replaced and returned for repair. A replacement control module will require calibration (Refer Section 4).

If the equipment is under warranty, any repairs performed by persons other than Genral Monitors authorized personnel may void the warranty. Please read the Warranty statement carefully.

6-1 Basic Fault Finding

Symptoms	Possible Causes	Action
No front panel indicators lit and all meters less than zero	Loss of power to instrument	Check power supply to chassis
Intermittent fault indication on all channels	Low instrument supply voltage	Ensure supply conforms to specification
Continuous fault on all channels	Low instrument supply voltage	Ensure supply conforms to specification
	Analog output loads in excess of specification (R max. 500 ohms)	Jumper AO+ and AO– terminals as required if analog output signal not used
Continuous fault and meter reading below zero	Analog output load in excess of specification	As above
	Incorrect or open circuit sensor heater or sensor heater cable	Check sensor cable for shorts and opens*
		Replace sensor and recalibrate (See section 4)
Meter reading less than zero. No fault indication	Module fuse open circuit	Remove module and check fuse.*

* Refer to Operating Instructions

6-2 Typical Values

The following table may be used as a guide to typical parameter values during servicing. Items marked with an asterisk(*) are factory set initially, and should not normally require re-adjustment.

Parameter	Design Value	Approx Range	Units	Circuit Ref.	Set by
Supply voltage	24	22-32	V	B+	External
DC Buss voltage	24	22-32	V	Vcc	External
Low voltage trip	20	±5%	V	IC 3-1	–
Low voltage hysteresis	1.6	–	V	R72	–
15 volt regulator O/P	15.00	13-17	V	IC2	VR3*
Ramp up time	15	±20%	Seconds	R52, C13	–
Ramp down time	20	±20%	Seconds	R53, C13	–
Under range trip	1.88	±5%	mA	IC 3-2	–
Under-range hysteresis	1.34	–	mA	R75	–
AO Span	16	–	mA	IC1-4	–
AO Live Zero	4	±0.25	mA	R13,R15	–
AO current limit	27	±10%	mA	Q2	–
Alarm set-point range	0-100	–10– +105%	ppm	IC3-3 IC3-4	VR4 VR5
LED oscillator frequency	8	±20%	Hz	IC7	–
Max transient energy	7	–	J	Mov 1,2,3 & 4	–
Standby supply interruption (max)	20	–	mS	–	–

6-3 Circuit Description - 2601 Control Module

Power Supply

The 24V (nominal) direct current supply appears on Pins 20z and 20d (B+) and on Pins 22z and 22d (DC return). Diode D32 prevents damage to the equipment should the polarity of the supply be inadvertently reversed.

Fuse FS1 (5 x 20mm) is rated 1A and protects both the electronics and sensor. Excessive voltage transients appearing on the supply are absorbed by the varistor MOV 4. Capacitors C22 and C5 attenuate low and high frequency noise on the Vcc supply.

6-4 Voltage Regulator Circuit

IC2 integrated circuit is a monolithic voltage regulator which operates in the linear mode and is internally protected against both current and power overload. Diodes D4 and D5 provide reverse voltage protection and capacitors C5, C6 and C7 improve stability and transient response. An internal temperature compensated reference voltage is developed across diode D5 and this is used in conjunction with potentiometer VR3 to generate the 15V supply.

6-5 Signal Processor

Resistor R2 and capacitor C1 form a low-pass filter which helps to suppress any electrical noise superimposed on the sensor signal.

Buffer amplifier IC1-1 buffers the sensor signal. The input of this unity gain stage is protected by diodes D1 and D2.

Signal amplifier IC1-2 and associated components pre-conditions the buffered sensor signal and drives the anti-log generator comprising of IC1-3, 1-4 and associated components.

In the calibration process the two calibration potentiometers Upper and Lower are set to correspond to the characteristic of the sensor. When this has been done, full scale H2S concentration will cause the emitter voltage of transistor Q3 to be 1.25V whereas the zero gas level will be 0.25V.

6-6 Analog Output Amplifier

Operational amplifier IC1-4 transistor Q3 and associated circuitry form a current amplifier with a gain of 160.

A bias current of 25µA flows through resistor R14 and generates the 4mA live zero analog current.

Full scale deflection (i.e. 20mA) corresponds to a further 100µA of current into the collector of transistor Q1b.

The analog output current loop connections appear on the AO+ (Pin 24z) and AO– (Pin 24d) terminals.

Transistor Q2 limits the AO current to approximately 27mA in an over-drive condition.

Note that the maximum AO load is 500 ohms.

6-7 Ramp Generator

The Ramp Switch S2 is accessible in calibration mode through a port in the front panel.

In normal operation the base of transistor Q7 is held at OV by means of resistor R53.

When the Ramp Switch is depressed, capacitor C13 charges through resistor R52 . This high impedance circuit is buffered by the emitter following Darlington transistor Q7 and its slowly ramping emitter voltage forward biases diode D3 and simulates a rising gas condition on the controller input.

When the switch is released, the circuit slowly ramps down as capacitor C13 discharges through resistor R53.

The switch may be rapidly toggled at any point to cause the simulated gas reading to hover around any particular indication.

6-8 – 5Volt Supply

Integrated circuit IC5 is configured as a free running multivibrator of frequency 9kHz approximately. Its rectangular wave output (Pin 3) drives the diode pump circuit formed by diodes D20, D21 and capacitors C17 and C18. This results in an unstabilized –12V potential across capacitor C18. This negative supply biases integrated circuit IC4 and resistors R56, R57 and R58 are chosen, so that the output voltage of IC2 (Pin 1) generates – 5V with respect to OV.

Capacitors C16 absorbs the current transients generates by the switching within IC5.

6-9 Sensor Heater Fault Detector

In normal operation, the sensor draws pulses of current from the controller Vcc supply via the White conductor (Pins 26z and 26d) and the return circuit is via the Black conductor (Pins 28z and 28d) to ground. These pulses of heater current generate a rectangular waveform across resistor R41 and these are a-c coupled via capacitor C11 and resistor R43 to the base of transistor Q5.

Transistor Q5 is therefore switched on momentarily on the negative-going transitions of the pulse waveform and it in turn pulses transistor Q6, thus maintaining capacitor C12 in a discharged condition.

Should the heater fail in either the ON or OFF conditions, transistor Q6 will remain OFF and capacitor C12 will charge through resistor R50.

When the voltage across capacitor C12 reaches approximately 12.5 volts the output (Pin 7) of Schmitt Trigger IC4-1 goes low causing the Analog Output current to fall to zero. This in turn is detected by the AO Fault Detector and a Fault is indicated.

The time-out period of the Sensor Heater Fault Detector is approximately 18 seconds.

6-10 Vcc Fault Detector

The output of the Schmitt Trigger IC3-1 (Pin 8) is normally High but falls to a Low value if the Vcc supply drops below 20V.

When this occurs, the analog output current falls to zero as transistor Q3 is switched off. This condition is then sensed by the AO Fault Detector and a Fault is indicated.

The Vcc supply must rise to at least 21.6 volts before normal operation will be restored.

6-11 AO Fault Detector

The output of IC3-2 (Pin 14) is normally Low causing the Ready indicator to be ON and the Fault circuitry to be in the normally energized condition.

If the analog output current falls below 1.88 mA, the output (Pin 14) goes high, thus extinguishing the Ready indicator, illuminating the Fault indicator and generating a Fault signal on the TF output (Pin 12d) and the optional relay K1.

Normal operation will be restored when the analog output current rises to 3.3mA.

6-12 Alarm Circuits

The A1 and A2 gas alarm circuits are identical, so that only the A2 circuit need be described.

Operational amplifier IC3-3 is configured as a comparator with approximately 5% hysteresis due to regenerative feed-back through resistor R29.

In normal operation the voltage present on the emitter of transistor Q3, representing gas concentration, is compared with the user-preset voltage on the wiper of potentiometer VR4(A2) representing the A2 alarm set-point.

When the comparator set-point voltage is exceeded, the comparator output on IC3-3 (Pin 1) switches High and other conditions permitting, drives the Darlington output inverters IC8-1, -2, -3 Low.

Alarm latching is achieved by regenerative feed-back through resistor R35 and diode D8. Thus when IC8-1 Pin 11 switches Low, transistor Q4 is switched On and the logic High condition on the cathode of diode D8 is reinforced. Capacitor C9 introduces a delay so as to prevent spurious triggering.

The application of a Master Reset cancels the A2 alarm (via diode D6) only if the alarm comparator output is Low. Diode D8 is removed if non-latching operation is required.

An open collector alarm output is provided on connector Pin 14z TA2. This may optionally be normally de-energized, via programming link P2-0 or normally energized is P2-1 is used.

Note that both IC8-1 and IC8-2 inverters are inhibited in Cal mode, due to the diversion of drive current through diode D7.

The red LED alarm indicator (LED 1) is driven by inverter IC8-3 and is illuminated whenever comparator IC3-3 switches on. Note that this output is routed to connector Pin 16z LA2 and is present even in CAL mode.

The Alarm circuitry is inhibited during Timeout due to a logic high on the anode of diode D4, which forces the comparator into an off condition for the sixty second timeout interval at start-up or following the clearing of a Fault condition.

6-13 Open-Collector Outputs

The provision of true open-collector low-offset transistor outputs is incompatible, in practical terms, with full voltage, current and power limiting of such outputs. The design of these Control Modules is to provide all user accessible transistor outputs from one integrated circuit (IC8) containing seven Darlington circuits. This device is mounted in a socket to allow for convenient field replacement and may be regarded as a semiconductor fuse. The device is very conservatively rated and should provide the same high level of reliability that exists elsewhere in the Control Module circuitry.

The outputs are shown in the following table:

Alarm	Main Output	Auxiliary Output
A2	TA2 = Pin 14z	LA2 = Pin 16z
A1	TA1 = Pin 12z	LA1 = Pin 14d
Fault	TF = Pin 12d	

The Main outputs TA2, TA1 and TF are true open collector outputs, unless relays are fitted, in which case they are used to drive the relay coils in parallel with any external load. The TA2 and TA1 outputs are inhibited by placing the module in Calibration Mode but the TF output is not.

The Auxiliary outputs LA2 and LA1 drive the A2 and A1 LED indicators together with any external load.

All open-collector outputs are provided with isolation diodes to allow for the commoning of these outputs.

The LA2 and LA1 outputs have two possible modes of operation:

1 Without Accept/Oscillator

In this case the LA2 and LA1 outputs operate the same as the TA2 and TA1 outputs, with the exception that they are not inhibited in Calibration Mode.

2 With Accept/Oscillator

In this case the LA2 and LA1 outputs have three possible conditions. These are:

* Off in the absence of a gas alarm
* Flashing at the frequency of the Oscillator in a gas alarm condition prior to the receipt of an Accept signal or following a new gas alarm.
* On steadily in the presence of a gas alarm condition, following the receipt of an Accept signal.

An open-collector output is also provided to indicate the presence of an unaccepted alarm. This output goes low on detecting a new alarm and will go high when the alarm is accepted. This is only available when the Accept/Oscillator option is ordered.

6-14 Optional Sensor Cable Input Protection

In the case of installations subject to damage due to frequent violent thunderstorms, Metal Oxide Varistors (Mov 1, 2 & 3) may be specified for inclusion on the Control Module. These devices are capable of dissipating transient over-voltages up to a maximum energy of 7 Joules per component.

6-15 Optional Alarm Relays

Where relay outputs are required, relays K1, K2 and K3 may be specified. Note that the open-collector type outputs TA2, TA1 and TF are still available for customer use but at a reduced maximum current capability.

6-16 Accept/Oscillator Circuit

This optional circuit is used to provide an alarm reflash capability.

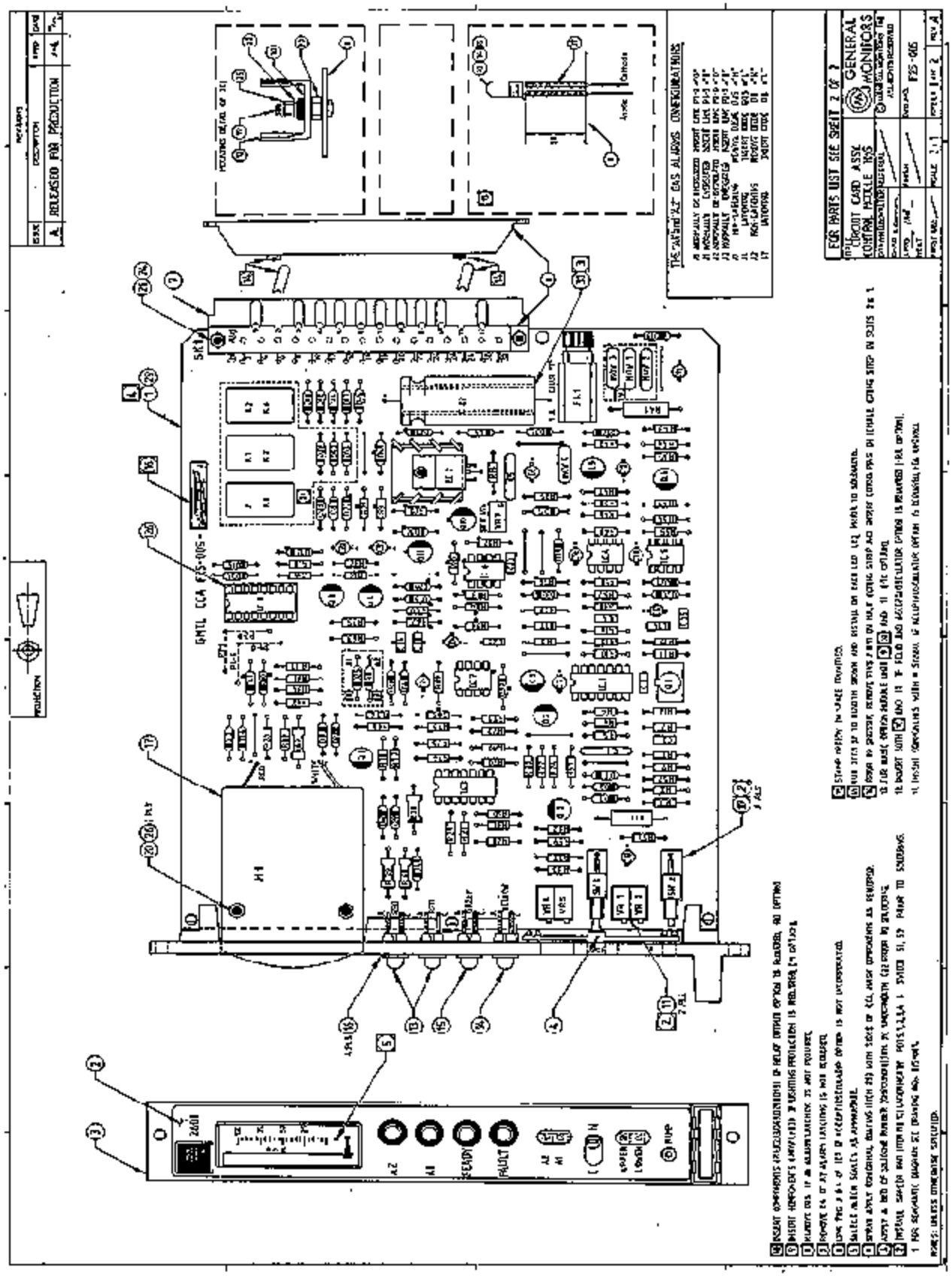
Integrated circuit IC7 and associated components is configured as an astable multi-vibrator whose output (Pin 3) drives the Fault indicator directly and modulates the gas alarm indicators via diodes D10 and D41.

The oscillator is normally in a quiescent condition (Pin 3 high) and is activated by a High on either IC6 (Pin 3) or IC3-2 (Pin 14).

A High on IC3-2 (Pin 14) occurs in a Fault condition, transistor Q9 is switched On and the Fault indicator (LED 4) flashes at the frequency of the IC7 oscillator.

A High on IC6 (Pin 3) is caused by a gas alarm. In this case the VTH line goes Low via diode D12 or diode D27 and a negative-going pulse is received on IC6 (Pin 2). This pulse sets the IC6 bistable latch, causing the output (Pin 3) to go High. It will remain in this condition until reset by a High level on Pin 6, due to either the receipt of an Accept signal on the connector (Pin 18d) or a High level on the VTH line due to the resetting of the gas alarm circuitry. In the latter case, this may be due to either the automatic resetting of non-latching alarm circuits or the application of a Master Reset signal for latching circuits.

When the output of IC5 (Pin 3) goes high, the MSA06 transistor is switched on resulting in an open-collector UA signal.



Section 7
Spare Parts

Start-up Spares Kit
One Year Operational Spares Kit

Spare Parts

Spare Parts Ordering Procedure

When ordering Spare Parts, Kits etc. or requiring current prices, please contact your nearest General Monitors Representative or General Monitors direct giving the following information.

Part number of spare part required
Description of spare part required
Quantity required

Recommended Spare Parts

Start-up Spares Kit Model 2601 - P/N 720-027

Item No.	Part No.	Description	Qty.
1	443-002	Meter	1
2	550-000	LED Red	1
3	550-001	LED Yellow	1
4	550-002	LED Green	1
5	517-002	IC ULN 2004A (Subject to customer option)	5
6	320-012	Switch, toggle SPDT	1
7	321-016	Switch, pushbutton SPDT	1
8	440-018	Relay DPDT (Subject to customer option)	3
9	420-004	Potentiometer 10K	1
10	420-003	Potentiometer 1K	1
11	420 012	Potentiometer 100K	1
12	100-016	Screw	10
13	430-009	Fuse 1A	15
14	500-002	Transistor MPSA06	2

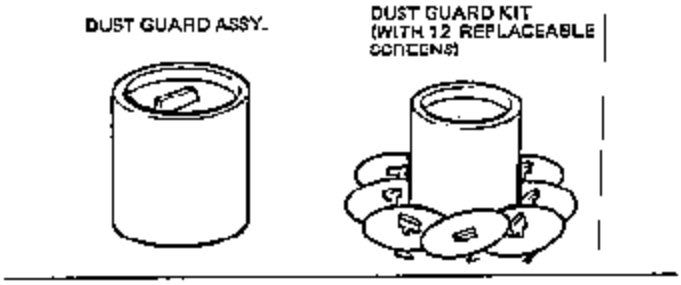
One year operational Spare Parts Kit Model 2601 - P/N 720-026

Item No.	Part No.	Description	Qty
1	443-002	Meter	1
2	550-000	LED Red	1
3	550-001	LED Yellow	1
4	550-002	LED Green	1
5	517-002	IC ULN 2004A (Subject to customer option)	5
6	320-012	Switch, toggle SPDT	1
7	321-016	Switch, pushbutton SPDT	1
8	440-018	Relay DPDT (Subject to customer option)	6
9	420-004	Potentiometer 10K	1
10	420-003	Potentiometer 1K	1
11	420-012	Potentiometer 100K	1
12	100-016	Screw	10
13	430-009	Fuse 1A	10
14	500-002	Transistor MPSA06	2

Section 8
Accessory Equipment

Accessory Equipment

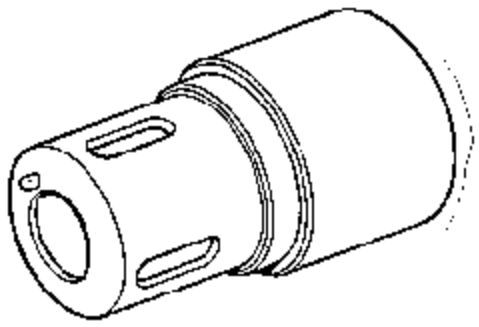
8-1 Dust Guard Assembly (P/N 10110)



The dust guard is a simple, threaded (1 3/16-18 UNEF 2B) stainless steel (type 303) cylinder with a wire screen at one end. It is easily unscrewed for cleaning and/or replacement of the disposable screen. The screen material is stainless steel (type 316) with a nominal 40 micron mesh. This General Monitors accessory is specially designed to prevent dust and particulate matter from reaching the sensor flame arrester. Such debris can plug the screen and limit the amount of gas reaching the active surface of the sensor, thereby creating a potentially hazardous situation. 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 replaceable 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.

8-2 Sintered Stainless Steel Dust Guard (P/N 1800822-1)

The construction of this accessory is similar to P/N 10110, but with 3mm (1/8") thick sintered stainless steel (type 316) disc at one end. The body material is type 303 stainless steel with an internal 3/16 UNEF 2B 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.



8-3 Splash Guard (P/N 10395-1)

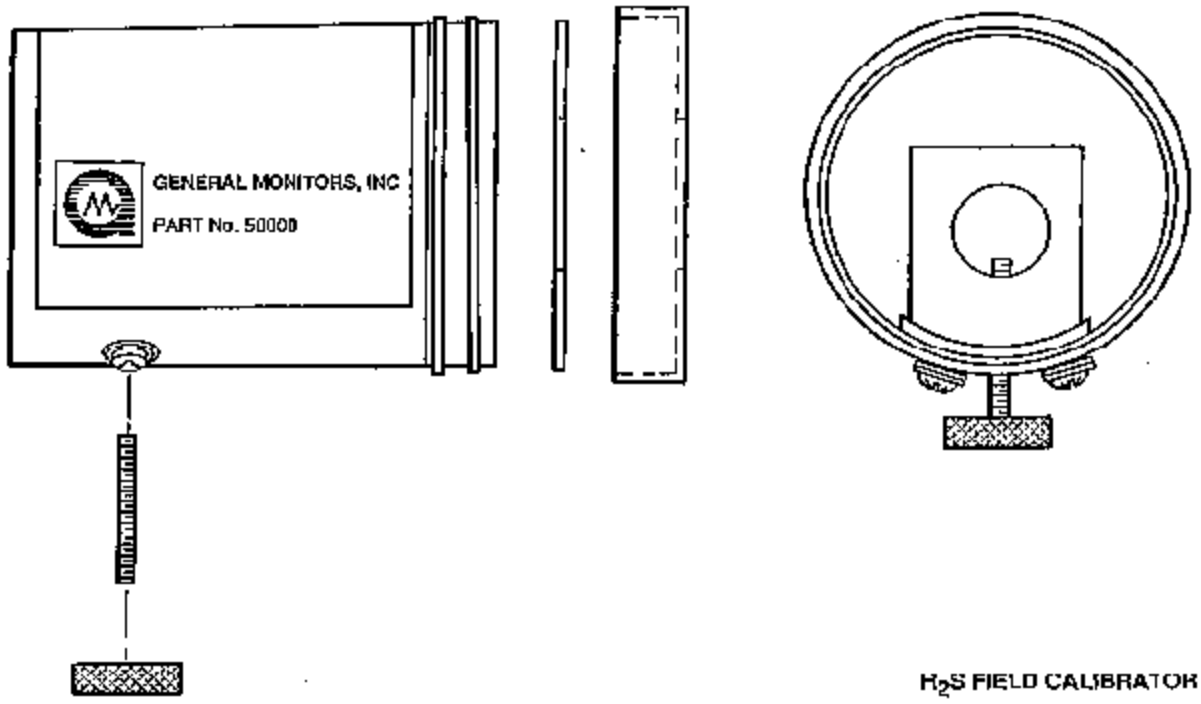
The Splash Guard is a rugged thermoplastic polyester (Valox) plastic cylinder which screws into place over the sensor body. It contains a series of internal baffles which are designed to deflect water spray away from the sensor flame arrester. The splash guard is recommended for areas where heavy rain or frequent equipment hosedowns occur. It also makes an effective barrier against high winds.

8-4 Sensor Flow Chamber (P/N 10066)

The General Monitors Sensor Flow Chamber is constructed of 2024T aluminum (optional stainless steel type 316, P/N 10066-SS). The chamber has an internal thread 1 3/16-18 UNEF 2B, into which a sensor may be screwed, and two threaded ports (1/8-27 NPT L1 NOM) which accept 1/4" tube fittings (P/N 925-029). The chamber is designed for insertion into a sampling system and the recommended flow rate is 0.47 liters per minute (1cu. ft/hr.).

8-5 Duct Mounting Plate (P/N 10041)

The Duct Mounting Plate is a rectangular plate measuring 73 x 116mm (2.88" x 4.56") containing four captive mounting screws (6-32 UNC), and a Neoprene O-ring seal. The sensor is mounted through a hole in the center of the plate and secured with an O-ring gasket and nut. The assembly is ideally suited to the monitoring of ducted air for living quarters in large offshore modules. Note that the sensor should be mounted pointing down, protected for excessive air velocity and in a position to facilitate recalibration.



H_2S FIELD CALIBRATOR

8-7 Field Calibrator (P/N 50000)

The General Monitors Field Calibrator provides a simple and efficient means of calibrating H2S sensors in the field.

It consists of a plastic jar with a removable lid and a seal which fits snugly over the sensor cap. An integral aluminum block with external thumb screw performs the dual functions of retaining and breaking the glass ampoules.

Operating Instructions

a Ensure that the calibrator is clean and dry and that all fragments of broken glass have been removed.

b Inset an ampoule of the desired concentration into the hole in the aluminum block, with its base resting on the bottom of the jar. Replace lid and seal.

c Place calibrator in position on sensor.
If a background gas level is suspected, purge the calibrator with clean air and seal the opening in the lid until just before the calibrator is slipped onto the sensor.

d Screw thumb screw until ampoule shatters.

e Leave the calibrator in position for approximately five minutes or until a stable meter reading is obtained.

f remove the calibrator and dispose of the glass fragments safely.

8-7 Ampoules of Hydrogen Sulfide (P/N 50004)

These glass ampoules are manufactured under strict quality control procedures for use with the Field Calibrator (P/N 50000). They are marked with a gas concentration in ppm H2S which corresponds to the concentration when released within the Field Calibrator.

An expiration date is stamped on each ampoule label because ampoules may start to lose concentration after 12 months.

Out of date ampoules should therefore be regarded with suspicion, particularly if erratic results are obtained in calibration.

Ampoules are manufactured in various concentrations and are distinguished by the addition of a suffix to the part number. See table for details.

Part Number	Suffix	Concentration ppm H2S
50004	-23	3
50004	-11	5
50004	-3	10
50004	-9	20
50004	-21	25
50004	-13	50
50004	-5	100