General Monitors

by MSA

MODEL S4100T

Hydrogen Sulphide
Smart Transmitter

Instruction Manual **01/18**

Part No. **MANS4100T-EU**
Revision **Q/01-18**

DECLARATION OF CONFORMITY

We, at General Monitors Inc, hereby declare that the equipment described below, both in its basic design and construction, and in the version or versions marketed by us, conforms to the relevant safety and health related requirements of the appropriate EU Directives, only as follows:

MODEL S4100T

General Monitors Ireland
Ballybrit Business Park
Galway, Ireland
Telephone: +353-91-751175
www.MSAsafety.com/detection

a) Conform to the protection requirements of EMC Directive 2014/30/EU
Report Numbers EM01006462. ITS Testing and Certification Ltd. ITS House, Cleeve Road, Leatherhead Surrey KT22 7SB, England
Relevant Standards:
EN 50270
EN55011: ENV50204
EN 61000-4-2: EN 61000-4-4: EN 61000-4-6
EN 61000-4-3: EN 61000-4-5: EN 61000-4-8

b) Sira Certification Service, notified body number 0518 in accordance with Directive 2014/34/EU, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive. Certificate No. 99ATEX3180.

Relevant standards:
EN60079-0:2009
EN60079-7:2007
EN60079-18:2009

This declaration shall cease to be valid if modifications are made to the equipment without our approval.

PRODUCT: S4100T Intelligent Sensor H_2S Gas
It is ensured through internal measures and our ISO9001: 2008 certifications, and the requirement for compliance with QAN/QAR as issued by Sira, that series production units conform at all times to the requirements of these current EU Directives and relevant standards.

General Monitors Ireland Ltd. in order to comply with ATEX, will provide this Instruction Manual in a European Language required to operate the product upon request. Should this be necessary, General Monitors Ireland Ltd. should be notified of this request to allow adequate time to process the request.

ATEX Certificate Markings.

II 2 G **SIRA 99ATEX3180**

0518 **Ex emd IIC T5 Gb** **Ta -40°C to +55°C** **Ex emd IIC T4 Gb** **Ta-40° C to +70°C**

Responsible Person: Date: 15-09-16

Cecil Lenihan
Business Leader, Galway, Ireland
The signatory acts on behalf of company management, and with full power of attorney

General Monitors
by MSA

Warranty Statement

General Monitors warrants the Model S4100T to be free from defects in workmanship or material under normal use and service within two (2) years from the date of shipment. General Monitors will repair or replace without charge any equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by General Monitors' personnel. Defective or damaged equipment must be shipped prepaid to General Monitors' plant or the representative from which shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees or other personnel. All warranties 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. Except for the express warranty stated above, General Monitors disclaims all warranties with regard to the products sold, 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.

Warnings

The instrument should be calibrated at least every 90 days. See sub-section 4.1.

Take note of sub-section 3.4 Sensor Poisons.

Install and maintain all hazardous area equipment in accordance with the relevant regulations and practices of the country concerned. See Section 3 Installation.

The S4100T must be protected by in-line 500mA PC≥ 1500A Char "T" fuse is required if voltage at unit is between 18VDC and 35VDC in the 24 VDC supply line. This is necessary to fully comply with approval requirements and good installation practices.

Note: General Monitors series of Trip Amplifiers have the 500mA fuse as standard.

The S4100T must be protected by an in-line 63mA; PC≥ 1500A Char "F" fuse in the analogue output line. This is necessary to fully comply with approval requirements and good installation practices.

WARNING - Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

Table of Contents

1.0 Introduction

1.1 General Description

The General Monitors Model S4100T Smart Transmitter is a highly reliable, self contained, microprocessor controlled, single point calibration Hydrogen Sulphide monitor with integral 3-digit readout. The Transmitter is connected to the user's indicating and shut-down equipment by means of a screened and armoured cable.

The S4100T is designed to measure and display concentrations of Hydrogen Sulphide in one of three ranges: 0 to 20ppm, 0 to 50ppm and 0 to 100ppm, but will continue to display concentrations up to 120% of FSD.

No user adjustments are required. The instrument will record the number of successful calibrations, compute the sensor resistance in kohm during calibration and store in non-volatile memory, along with calibration and setup parameters.

The entire electronics modules is fully encapsulated in compliance with the relevant standards.

The Smart Transmitter's user interface is menu driven. In addition the instrument may be addressed via the dual Modbus RTU serial interface.

The accuracy of the Smart Transmitter depends upon routine re-calibration which should be carried out at least every 90 days. This procedure is extremely simple and may be carried out by one person aided by prompts from the digital display. Calibration may be completed in less than 5 minutes. All calibration parameters are tested by advance software routines before being accepted. Any errors detected will be shown on the digital display by means of an appropriate fault code.

Hydrogen Sulphide is an extremely dangerous gas. To ensure optimum performance the sensors should be tested at frequent intervals, especially in areas where risk of release or leakage is considered to be significant, or in conditions where the sensor may become blocked or damaged by adverse environmental conditions.

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

2.0 Specifications

2.1 Approvals

Hazardous Area Standards	EN 60079-0, EN 60079-7, EN 60079-18
Code of Protection	Ex emd IIC T5 Gb (-40°C + 55°C) Ex emd IIC T4 Gb (-40°C + 70°C) Cable insulation rated to at least 110°C
Application:	Hydrogen Sulphide Gas Monitor

2.2 Functional

Measuring Range:	0-20 ppm, 0-50 ppm and 0-100 ppm, user selectable option setup
Measuring Resolution	1 ppm
Over-range Indication:	Display flashes for readings greater than 99% FSD, but continues to display gas concentration up to 120%
Calibration Level:	50% of selected measuring range
A1 Trip Level:	User selectable in 1 ppm increments 1 – 19 ppm for 0-20 ppm Measuring Range, default 5 ppm 5 – 45 ppm for 0-50 ppm Measuring Range, default 10 ppm 10 – 60 ppm for 0-100 ppm Measuring Range, default 25 ppm
A1 Open Collector Output	User selectable Energised/De-energised and Latching/Non-latching
A2 Trip Level:	User selectable in 1 ppm increments 1 – 19 ppm for 0-20 ppm Measuring Range, default 10 ppm 5 – 45 ppm for 0-50 ppm Measuring Range, default 25 ppm 10 – 95 ppm for 0-100 ppm Measuring Range, default 50 ppm
A2 Open Collector Output	User selectable Energised/De-energised and Latching/Non-latching
Fault Open Collector Output	Normally Energised
Analogue Output during Calibration	User selectable 0.0 mA, 1.5 mA and 2.0 mA
Modbus Baud Rate	User selectable 2400, 4800, 9600 and 19200 Baud
Modbus Format	User selectable 1/2 stopbits, odd/even/no parity, 8 databits
Modbus Node Address	User selectable 1 – 255; Address 0 is recognised as broadcast mode
Stability, Long Term:	± 4 ppm or 10% of applied gas whichever is greater (over 21 days)
Accuracy (Linearity)	± 4 ppm or 10% of applied gas whichever is greater (10°C to 50°C)
Temperature Variation	± 4 ppm or 10% of applied gas whichever is greater (-50°C to +70°C)
Humidity Variation:	± 4 ppm or 10% of applied gas whichever is greater (5%RH – 90% RH)
Response Time	T50< 30 seconds

2.3 Mechanical

Height	150mm (6”)
Height incl. Sensor:	200mm (8”)
Width:	150mm (6”)
Depth:	95mm (3.75”)
Weight including Sensor:	2.5kg (5.5lbs)
Mounting Holes:	4 x 7 mm (0.28”) dia holes
Termination:	Ex e rated Terminal Block

2.4 Environmental

Operating temperature range (continuous) min/max	- 40°C to + 70°C
Storage temperature range min/max	- 50°C to + 85°C
Relative humidity min/max:	5% to 100%, non-condensing
Operating Altitude max:	8000 ft
Non-operating Altitude max:	16000 ft
EMI/RFI Susceptibility:	Meets EN 50270 EN55011: ENV50204 EN 61000-4-2: EN 61000-4-4: EN 61000-4-6 EN 61000-4-3: EN 61000-4-5: EN 61000-4-8
IP Rating:	IP66/67

2.5 Electrical

Supply voltage min/max:	(18.5 VDC / 35 VDC)
Supply voltage abs min/max:	18.5 VDC / 40 VDC
Supply voltage ripple & noise max.	1Vpp
Supply current consumption, including sensor typ/max:	140mA/200mA @ 24VDC
Supply fuse rating: 18VDC – 35VDC operation	500mA Chart “T” PC ≥ 1500A
Supply voltage low detection threshold min/max:	9.20VDC / 10.32 VDC
Sensor Bias Current (Rsensor + Rcable = zero ohms) max:	420uA
Sensor Resistance range @ 50% FSD	3-80 kohms
Analogue Output Current Range:	0 – 22.0mA
Analogue Output Current abs max:	22.1mA
Analogue Output Current Ripple and Noise max.	20uApp
Analogue Output Current Tolerance max:	±50uA
Analogue output termination resistance min/max: (including total cable resistance)	0 – 750 ohms
Analogue output open-circuit detection current range min/max:	1.0mA – 22.0mA
Analogue output fuse rating:	63mA Char “F” PC ≥ 1500A
Remote calibration input Isink max	2.7mA
Remote calibration input Vin max:	24VDC
Open collector output Isink max Note: Inductive loads require an external clamp diode	100mA
Open collector output Vin max:	35VDC
Open collector output Vdrop-out @ 100mA max:	1VDC

2.6 Factory default settings

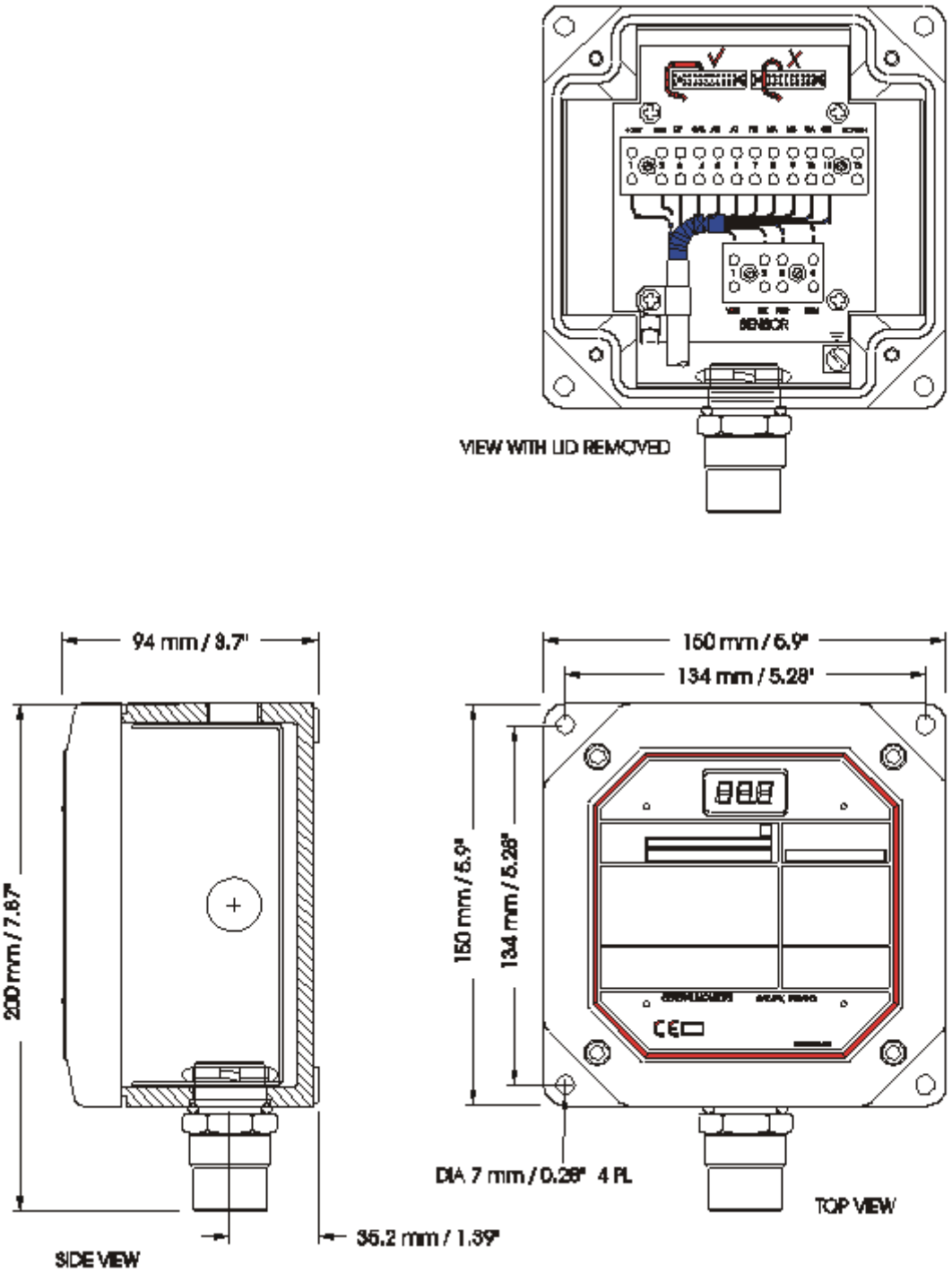
Option	-5 (0-50 ppm)
A1 Trip Level	10 ppm
A1 Open Collector Output:	De-energised and non-latching
A2 Trip Level:	25 ppm
A2 Open Collector Output	De-energised and non-latching
Analogue output during calibration	1.5mA
Modbus Baud rate:	19200 Baud
Modbus Format:	1 stopbit, no parity, 8 databits
Modbus Node address;	1

2.7 Sensor Material and Specifications when connected to S4100T

General Monitors Sensors (51457-X) are constructed from 316 Stainless Steel. The temperature and classification becomes

Ex emd IIC T5 Gb (Tamb -40ºC to +55ºC)
Ex emd IIC T4 Gb (Tamb -40ºC to +70ºC) when the sensors are fitted to the S4100T units only.

2.8 Outline Drawing



3.0 Installation

WARNING - Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

3.1 On Receipt of your Equipment

All instruments shipped by General Monitors are pre-packed in stout containers and enclosed in a shock absorbing filling which affords a considerable degree of protection against physical damage. The contents should be carefully removed and checked against the enclosed packing slip.

All discrepancies between the contents and the packing slip must be reported to General Monitors within 10 days of receipt of equipment. 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.

All subsequent correspondence with General Monitors must specify the equipment part numbers and serial numbers.

3.2 Smart Transmitter location Guidelines

The following guidelines should be observed with regard to the location in which to install a Smart Transmitter.

- Consider how the leaking gas will disperse. Locate the Smart Transmitter where prevailing air currents are likely to contain the maximum amount of leaking gas, but sufficiently distant from minor leak sources so as to avoid spurious alarms.

- Hydrogen Sulphide gas is heavier than air and therefore tends to accumulate in low-lying areas, but do not rely on this property when selecting sensor locations. The lower concentrations of gas which result from natural dilution in the atmosphere will be carried along with the prevailing air currents. In general, the Smart Transmitter should be located close to ground level (but out of the splash zone) and close enough to the likely leak sources to avoid excessive dilution.

- Site the Smart Transmitter so as to facilitate routine re-calibration; refer to the Ancillary Equipment Section for details. In particular, ensure that the mounting allows sufficient clearance for the Field Calibrator (P/N 50000). Ensure that the mounting allows for the replacement of a faulty sensor and that access to any accessories is not restricted. Check that the calibration instructions and display will be visible under all normal weather conditions whenever required. A combination of rain and sun guard is recommended for outdoor locations because it protects the Smart Transmitter against the heat of direct sunlight and the adverse effects of rain-borne grime whilst simultaneously improving display visibility under sunny conditions.

- Observe the ambient temperature limitations quoted in the specification. If a sampling preconditioning system is employed, take steps to ensure that vapours will not condense in the associated pipework.

- The mounting should be as free from shock and vibration as possible. Avoid mounting Smart Transmitters directly on structures or process equipment prone to high levels of vibration or shock.

- Select sensor accessories (see Section 7 – Ancillary Equipment) so as to protect the sensor against high wind velocities, rain, dust, hosing down and any other anticipated environmental hazards.

- Avoid locations where the Smart Transmitter will be subjected to strong electromagnetic interference (greater than 10V/m field strength) such as found in proximity to radio transmitters, welders, switched mode power supplies, inverters, battery chargers, ignition systems, generators, switch-gear, arc lights and other high frequency or high power switching process equipment. Walkie-talkie radios should not be operated at a distance less than 0.75m from the Smart Transmitter.

3.3 Sensor Poisons

H_2S Sensors may be adversely affected by prolonged exposure to certain atmospheres.

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

Other materials that have a deleterious effect on H_2S Sensors include mineral acid vapours and caustic vapours that attack the sensor physically.

The presence of such damaging vapours does not imply that the General Monitors 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 might need to be repeated at shorter intervals.

3.4 Interconnecting cable Guidelines

- The Smart Transmitter requires an interconnecting cable with an overall screen (shield) and armour. Cables to BS5308 Part 2, Type 2 or equivalent are suitable.

- Interconnecting cables should be segregated from power and other “noisy” cables. Avoid proximity to cables associated with radio transmitters, welders, switched mode power supplies, inverters, battery chargers, ignition systems, generators, switch gear, arc lights and other high frequency or high power switching process equipment. In general, maintain a separation of at least 1m between instrument and other cables. Greater separation is required where long parallel cable runs are unavoidable. Avoid running instrument cable trenches close to lightning conductors earthing pits.

- Complete all cable insulation tests **before** connecting the cable at either end.

- General Monitors do not recommend the use of cable shoes or crimps on any junction box or housing wiring terminals. Poor crimping can cause bad connection when unit experiences temperature variations. We therefore recommend good practice is to just terminate cable or sensor wires as is, especially in remote sensor applications.

3.5 Installation of Sensor

General Monitors sensors are machined to a ¾ NPT thread for fixing into the junction box, through a suitably machined entry. Each sensor requires a suitable O'Ring and Lock Nut to ensure correct assembly. To assemble the sensor into the junction box the wires should be placed through the O'Ring, over the ¾ NPT thread until it rests at the end of the machined thread. The sensor is then placed through the entry of the junction box and held in place by fitting the ¾ NPT Lock Nut. The sensor should be tightened sufficiently to ensure a good seal, but not over tightened to damage the O'Ring. The colour coded wires should then be connected into the corresponding locations of the connector which is installed and labelled in the junction box. Care should be taken not to tighten the connection on the insulation of the wires.

3.6 Installation Instructions

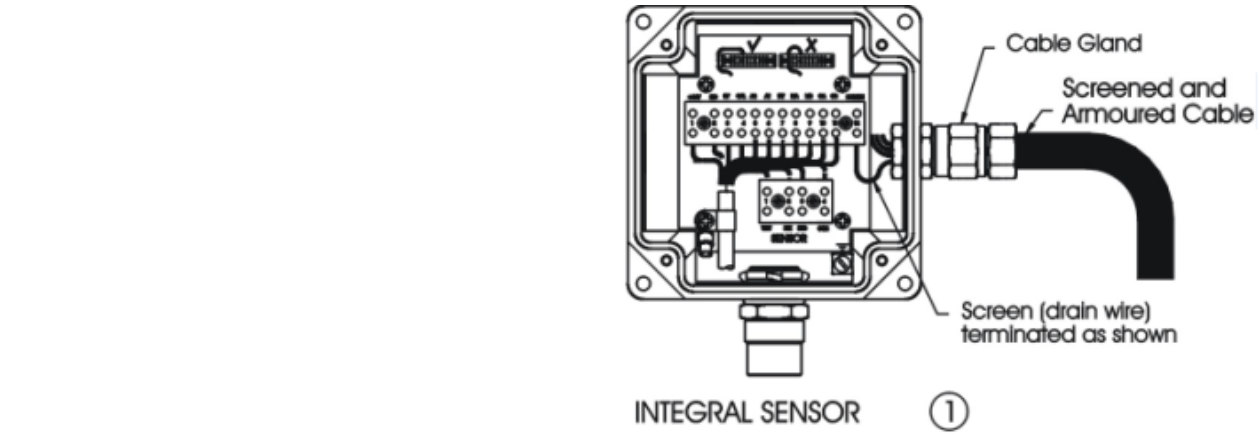
3.6.1 Smart Transmitter Cable Termination

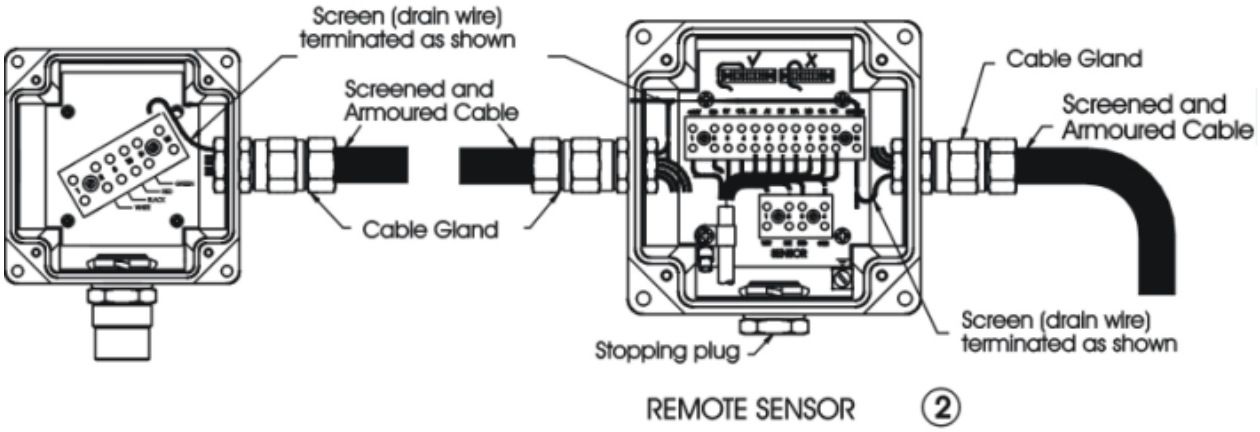
- The Smart Transmitter should be installed in accordance with the certification documents and the relevant regulations of the country concerned.
- Ensure that the gas sensor, if used, points downwards so as to protect it from rain and the accumulation of deposits.
- Ensure that approved Exe cable glands are used and installed according to the manufacturer's instructions.
- The cable glands must be electrically connected to the continuity plate by means of a suitable nut. The cable armour must be terminated in the gland to ensure a positive electrical connection.
- The cable screens (drain wires) must all be terminated on the isolated terminal in the transmitter housing (and sensor junction box if the sensor is mounted remotely). The cable screens must not be connected electrically to the electronic circuitry of the Smart Transmitter or the sensor.
- Connect an external earth stud in accordance with local practice if required.
- Ensure no wires cross over the top of the connector blocks as they may become trapped between the blocks and the electronics module when the lid is fitted.
- When fitting the lid, ensure the fly-lead and earth strap from the electronics module fit freely into the box. Press the lid home and verify it fits snugly against the box, before tightening the screws.
- Ensure there is 1mm spacing between insulation of wire and end connector block. Ensure that insulation is not crimped.

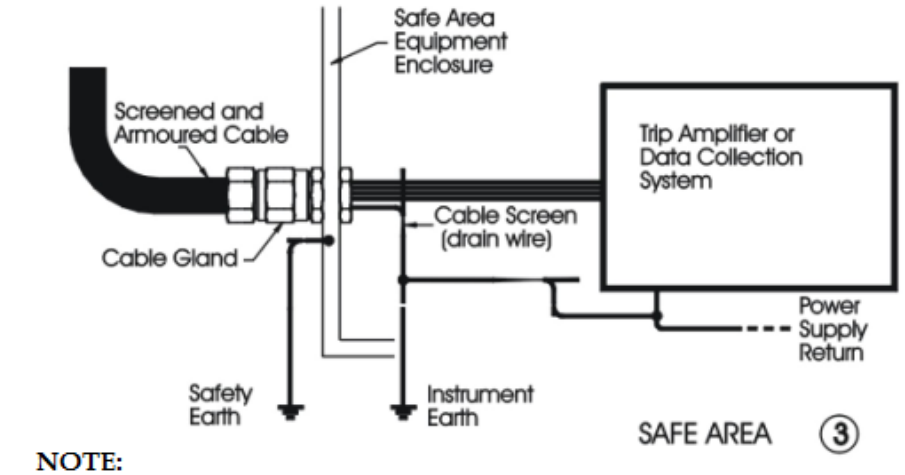
3.6.2 Cable Termination in Safe Area

- The cable armour must be connected to Safety Earth.
- The cable screens (drain wire) and power supply return (OV) must be connected to Instrument Earth.
- The power supply or power distribution system employed should meet the requirements of EN5008 I- 1/2 and EN60101-1.
- **Power supply or GM Trip Amplifier Power and analogue output must be fused in accordance with the Smart Transmitter specification.**

3.6.3 Cable Termination Drawing



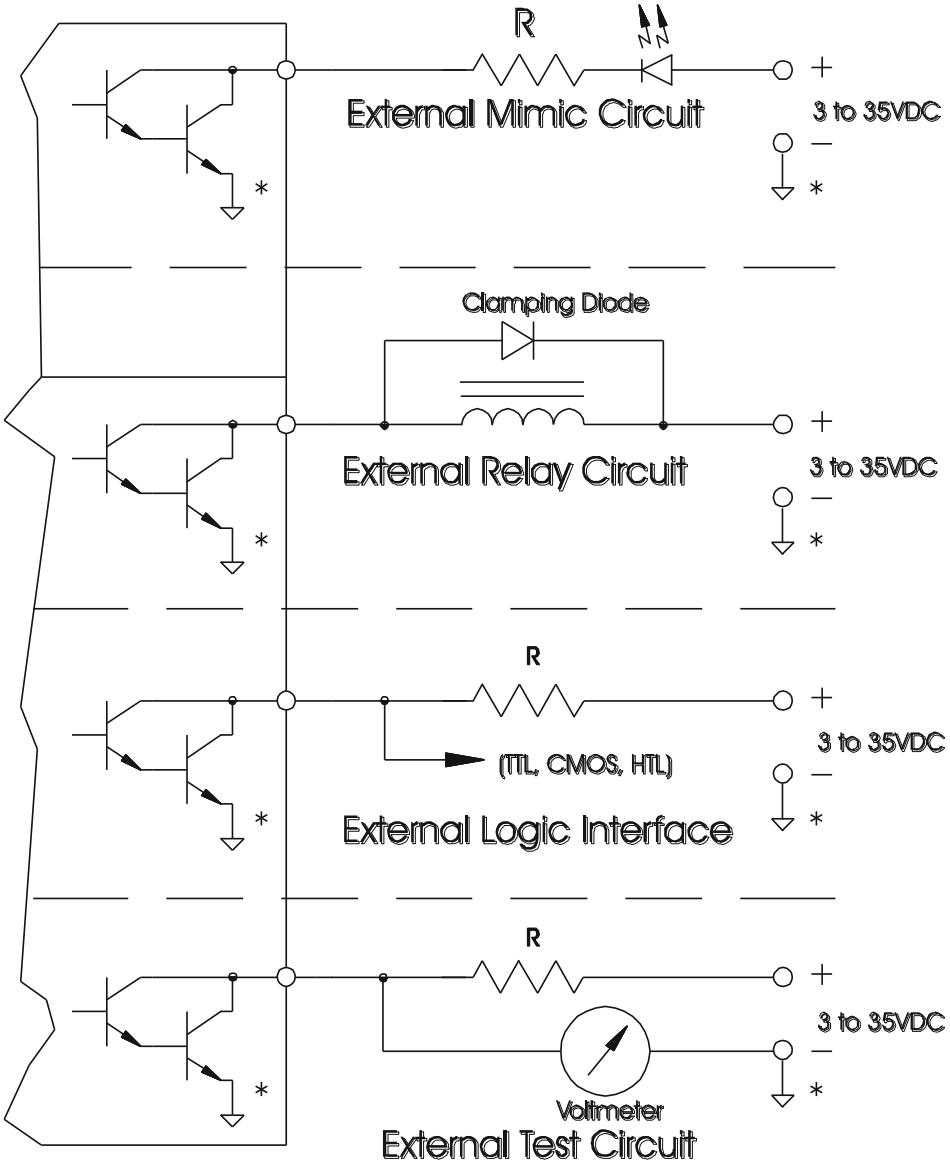




NOTE:
Cable Armour connected to Safety Earth via Gland or otherwise

The electrical rating for all open collector outputs is 100mA @ 35VDC.

The diagram below illustrates some typical open collector external circuits.



* Note: All system commons (⏚) must be tied together.

3.7 Interconnection Details

Signal Name	12-Way Terminal	Function	If not used	Module Fly lead colour
+ 24VDC	1	Power Supply		brown
SIG	2	Analogue output	connect to OV	yellow
OV	3	Power Supply Return		blue
CAL	4	Remote calibration input (Note)	leave unconnected*	grey
A2	5	Alarm 2 open collector output	leave unconnected*	orange
A1	6	Alarm 1 open collector output	leave unconnected*	violet
FLT	7	Fault open collector output	leave unconnected*	green/black
MA	8	Modbus 1 serial interface line A	leave unconnected*	red/black
MB	9	Modbus 1 serial interface line B	leave unconnected*	red/green
GA	10	Modbus 2 serial interface line A	leave unconnected*	red/brown
GB	11	Modbus 2 serial interface line B	leave unconnected*	red/blue
SCREEN	12	Terminate all cable screens (drain wires) at this connection		NA

Signal Name	4-Way Terminal	Function	Module Fly lead colour
WHT	1	Sensor heater supply	white
BLK	2	Sensor heater return	black
RED	3	Sensor Bias supply	red
GRN	4	Sensor Bias Return	green

* Ensure conductor ends have been cut back so that bare conductors do not cause shorts.

NOTE: If remote calibration is required, connect the Remote Calibration Input to Power Supply Return via a momentary action-NO-switch in the Safe Area. The switch should be rated 5V, 5mA or better.

NOTE: For Smart Transmitter Interconnection Cable details consult Appendix A.

3.8 Power up Routine (see also Section 4.5 and 4.6)

When all wiring has been completed and checked, the instrument may be powered up. Remove the red cap after power up. Replace the cap and desiccant if the sensor is to be left off-power for long periods of time.

Immediately following power-up, the instrument will carry out “Display Test”, then blank the display for 1 second, display “Software Revision” and then display “Power up in progress”, followed by normal operation. The analogue output will be at 4.0mA and the Fault open collector output energised.

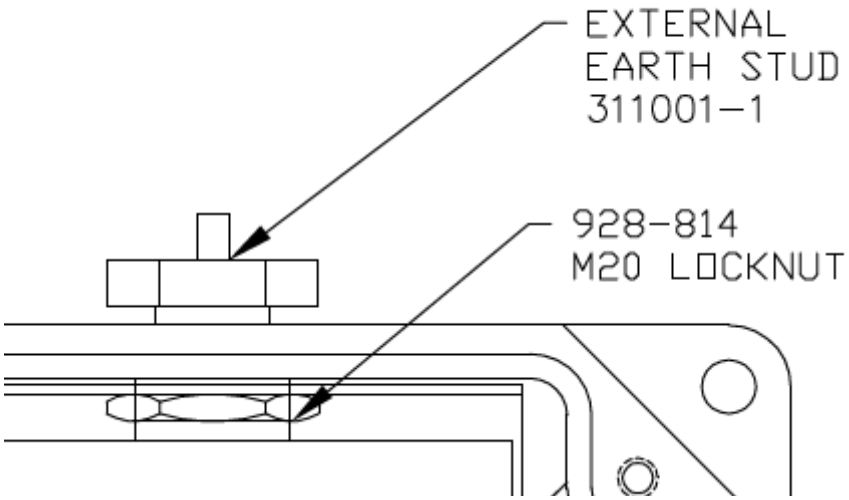
The Smart Transmitter should then be allowed to stabilise for 24 hours. The display should read “0” if no Hydrogen Sulphide gas is present at the sensor.

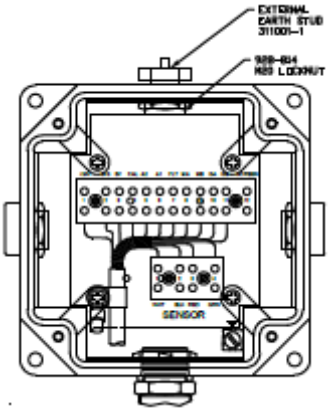
If the instrument indicates differently from the above, refer to Section 6, Trouble Shooting.

3.9 Stopping Plug Installation

NOTE: The stopping plug, 311001-1, is fitted at the factory, the following instruction will only be necessary if the stopping plug has been removed from its current location to another entry of this product.

- Screw Earth/Stopping Plug (P/N 311001-1) into Top Entry of S4100x Housing.
- Fully tighten using a suitable hand wrench.
- Do not over tighten such that the O'Ring is damaged
- Screw Continuity Hex Nut (P/N 928-814) on the inside of the S4100x Housing to the Earth/Stopping Plug (P/N 311001-1).
- Tighten to insure it is secure and making good contact with internal continuity plate.





- If removing the Earth/Stopping Plug (P/N 311001-1), unscrew Continuity Hex Nut (P/N 928-814) on the inside of the S4100x Housing from the Earth/Stopping Plug.
- Unscrew the Earth/Stopping Plug (P/N 311001-1) from the Top Entry of S4100x Housing.

4.0 Operating Instructions

WARNING – Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

4.1 Menu Operation and Display Codes

Note: See Table 1 and Table 2 for Display Codes

Menu operation starts at Level 1. To enter the menu, the magnet is applied to the General Monitors Logo on the Nameplate and held in place. The instrument will display "- - -" indicating magnet present. After 5 seconds delay the instrument will start scrolling through Table 1, Level 1 at the rate of 1 step per 2 seconds, the magnet may now be removed. In the presence of (latched) Alarms, the delay time will increase to 90 seconds. The scrolling will continue until a selection is made by briefly applying the magnet. The display will rapid-flash the selection for one second to acknowledge. The operation will then move to the next level corresponding to that selection, which can be scrolled in a similar fashion, etc.

At all menu levels, the instrument will start "10 second menu timeout", 30 seconds after the last selection was made, allowing the user to re-enter the menu while the analogue output is still at cal level (0.0, 1.5 or 2.0mA). Once "10 second menu timeout" has expired, menu data is written to EEPROM, following which the instrument returns to normal operation.

Calibration and Check Calibration mode will be terminated upon completion of the corresponding calibration or calibration check procedure. The unit expects to "see" calibration gas within 6 minutes following selection and will display the appropriate fault code if no gas has been applied and exit the menu. Similar action occurs if the calibration gas supply is interrupted during "Calibration in progress" or if the calibration gas is not removed within 6 minutes following "Calibration completed."

While in Check Calibration mode, Calibration mode may be activated by entering the menu as normal.

When A1 alarm trip level, A2 alarm trip level or Calibration is selected, the current value is shown on the display. The most significant digit will scroll and the desired value is acknowledged by briefly applying the magnet, following which the next lower significant digit will scroll and is acknowledged in similar fashion. The display will rapid-flash each selection for one second to acknowledge. If the current value is acceptable, two subsequent "acknowledge" commands, (one for each digit) will allow the user to continue.

Setting A1 alarm trip level higher than the current A2 alarm trip level causes the A2 alarm trip level to be set to the same level as A1 alarm trip level and following acknowledge of A1 alarm trip level the menu automatically jumps to "A2 alarm set up" to alert the user and allow re-adjustment of A2 alarm trip level. Similar action occurs if A2 alarm trip level is set lower than the current A1 alarm trip level.

Change of Option causes the instrument to enter Calibration mode immediately and Alarm trip levels to change to default levels corresponding to the new Option, alleviating the necessity of a password option.

Faults and Alarm status and ppm level determine which Level 1 menu selections are available. Any Fault inhibits menu operation.

Menu Selection Availability:

Faults?	Alarms?	Latched Alarms?	ppm<min Trip level?	Level 1 menu selections available	Menu entry delay
No	No	No	Yes	ACA, CCA, ASU, CSU & ncl	5 sec
No	No	No	No	ACA, ASU, CSU & ncl	5 sec
No	No	Yes	Yes	ACA & CCA	90 sec
No	No	Yes	No	ACA & ncl	90 sec
No	Yes	No	NA	ACA & ncl	90 sec
No	Yes	Yes	NA	ACA & ncl	90 sec
Yes	NA	NA	NA	None	NA

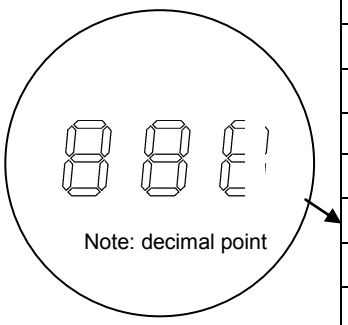
Note: Minimum trip level is 1ppm for –9 option, 5ppm for –5 option and 10ppm for –1 option.

4.2 Tables

TABLE 1 – MENU DISPLAY CODES

Level 1		Level 2		Level 3		Level 4	
ACA	Activate calibration mode	AC	Activate calibration, Apply calibration gas				
		CP	Calibration in progress				
		CC	Calibration completed, Remove calibration gas				
CCA	Check calibration mode	ACA	Activate calibration mode				
ASU	Activate setup mode	-A1	A1 alarm setup	-En	Open collector output normally energized		
				-dE	Open collector output normally de-energized		
				-LA	Open collector output latching		
				-nL	Open collector output non-latching		
				-tP	Trip level setup	-88	Trip level adjustable ppm 10-60/5-45/1-19
				=A2	A2 alarm setup		
				rtn	Return to level 2		
		=A2	A2 alarm setup	=En	Open collector output normally energized		
				=dE	Open collector output normally de-energized		
				=LA	Open collector output latching		
				=nL	Open collector output non-latching		
				=tP	Trip level setup	=88	Trip level adjustable ppm 10-95/5-45/1-19
				c--	Analog output setup		
				rtn	Return to level 2		
		c--	Analogue output setup	c00	Analogue output 0mA during calibration		
				c 1.5	Analogue output 1.5mA during calibration		
				c 2.0	Analogue output 2.0mA during calibration		
				V--	Option setup		
				rtn	Return to level 2		
		V--	Option setup	V-1	Gas sensor type 100 ppm FSD		
				V-5	Gas sensor type 50 ppm FSD		
				V-9	Gas sensor type 20 ppm FSD		
				-A1	A1 alarm setup		
				rtn	Return to level 2		
		rtn	Return to level 1				

TABLE 1 – MENU DISPLAY CODES							
Level 1		**Level 2**		**Level 3**		**Level 4**	
CSU	Check setup mode	V-8	Gas sensor type 100, 50, 20 ppm FSD				
		-88	A1 open collector output norm. (de)-energized				
		-88	A1 open collector output (non)-latching				
		-88	A1 alarm triplevel ppm				
		=88	A2 open collector output norm. (de)-energized				
		=88	A2 open collector output (non)-latching				
		=88	A2 alarm triplevel ppm				
		c t 8	Analogue output current during calibration in mA				
		88t	Nr. of successful calibrations				
		888	Modbus port 1 & 2 node address				
		rtn	Return to level 1				
ncL	New sensor calibration	ncL	New sensor calibration	AC	Activate calibration, Apply calibration gas	Note:	This operation sets nr. of calibrations to 1 when successful
				CP	Calibration in progress		
				CC	Calibration completed, Remove calibration gas		
		rtn	Return to level 1				
tEn	Terminate menu						



tEn	Slow Flash (2/sec)

"10 sec Menu Timeout in progress". This timeout starts 30 sec after the last menu selection was made.
Apply magnet to re-enter at Level 1. The analogue output remains at calibration level in this mode.
If magnet not applied, the instrument will write menu parameters to EEPROM,
exit menu and revert to normal operation following timeout.

TABLE 2 – DISPLAY CODES	
8.8.8.	Display Test (1 sec)
r88	Software Revision (1 sec)
SU	Power up in progress (58 sec)
-88	Gas measurement with A1 alarm condition present, or latched A1 alarm pending
=88	Gas measurement with A2 alarm condition present, or latched A2 alarm pending
888	Slow Flash (2/sec) "Overrange" if display > 99% FSD or "Check Calibration Mode active"
888	Rapid Flash (8/sec) "Acknowledgement of menu selection" or "Magnet present" during alarm or fault indication
EE	EEPROM write activity
F88	Fault Codes
- - -	"Magnet present"

4.3 Calibration

Calibration may be carried out as follows:

- Ensure that the instrument has stabilised for at least 24 hours and that there is no Hydrogen Sulphide gas present at the sensor. If background levels of gas are suspected, the sensor should be purged with clean air before calibrating the unit. It is possible to perform a rough calibration 15 minutes after powering up a new sensor (useful where a loss of detection cannot be tolerated), **but a full calibration must be preformed 24 hours later.**

  Some sensors may take a while to stabilise and it is recommended that a weekly check is made on recently installed sensors until satisfied that stability is attained.

- Place the magnet on the General Monitors Logo on the Nameplate. The instrument will display "---" for 5 seconds and then enter the menu routine. Remove the magnet. Select "ACA" by briefly re-applying the magnet when the display scrolls around. The instrument will acknowledge the selection by rapid flashing "ACA" for 1 second and display "AC".

  NOTE: Calibration mode may be terminated at this point by briefly re-applying the magnet.

- Insert an ampoule corresponding to 50% FSD Hydrogen Sulphide into a General Monitors field calibrator and place the calibrator over the sensor. Ensure a snug fit. Tighten the breaker until the ampoule shatters. When the instrument detects the gas it will display "CP".

  Alternatively, a GM Portable Calibrator (see 7.8) containing the specified ppm value of H_2S may be used.

- When the instrument displays "CC", remove the field calibrator and discard all glass fragments safely.

- As the remaining gas in the sensor disperses, the instrument will exit Calibration mode and return to normal operation. The display should read "0".

- If the above procedure is unsuccessful, refer to the Trouble Shooting section in this manual.

4.4 New Sensor Calibration

New sensor calibration may be carried out as follows:

- Ensure that the instrument has stabilised for at least 24 hours and that there is no Hydrogen Sulphide gas present at the sensor. If background levels of gas are suspected, the sensor should be purged with clean air before calibrating the unit. It is possible to perform a rough calibration 15 minutes after powering up a new sensor (useful where a loss of detection cannot be tolerated), **but a full calibration must be preformed 24 hours later.**

- Some sensors may take a while to stabilise and it is recommended that a weekly check is made on recently installed sensors until satisfied that stability is attained.

- Place the magnet on the General Monitors Logo on the Nameplate. The instrument will display " - - -" for 5 seconds and then enter the menu routine. Remove the magnet. Select "ncl" by briefly re-applying the magnet when the display scrolls around. The instrument will acknowledge the selection by rapid flashing "ncl" for 1 second. Re-confirm by briefly re-applying the magnet when the display shows "ncl" or return to the previous level by briefly applying the magnet when the display shows "rtn". The unit will display "AC" following confirmation.

  NOTE: Calibration mode may be terminated at this point by briefly re-applying the magnet.

- Insert an ampoule corresponding to 50% FSD Hydrogen Sulphide into a General Monitors field calibrator and place the calibrator over the sensor. Ensure a snug fit. Tighten the breaker until the ampoule shatters. When the instrument detects the gas it will display "CP".

  Alternatively, a GM Portable Calibrator (see 7.8) containing the specified ppm value of H_2S may be used.

- When the instrument displays "CC", remove the field calibrator and discard all glass fragments safely.

- As the remaining gas in the sensor disperses, the instrument will exit Calibration mode and return to normal operation. The display should read "0".

- This calibration procedure resets "number of calibrations" to 1.

- If the above procedure is unsuccessful, refer to the Trouble Shooting section in this manual.

4.5 Calibration Check

- Place the magnet on the General Monitors Logo on the Nameplate. The instrument will display " - - -" for 5 seconds and then enter the menu routine. Remove the magnet. Select "CCA" by briefly reapplying the magnet when the display scrolls around. The instrument will acknowledge the selection by rapid flashing "CCA" for 1 second and the display will then slow-flash the gas concentration. The analogue output will remain at calibration level.

  NOTE: Calibration Check mode may be terminated at this point by briefly re-applying the magnet.

- Insert an ampoule corresponding to 50% FSD Hydrogen Sulphide into a General Monitors field calibrator and place the calibrator over the sensor. Ensure a snug fit. Tighten the breaker until the ampoule shatters. The instrument will measure and display gas concentration. Observe the gas reading settles at the required level, normally within 2 to 4 minutes. Should the final reading fall outside the required limits (±10% FSD + ampoule tolerance ±1.5ppm) a full calibration is advisable. If so, proceed as follows, **with the test ampoule still in place:**

  Place the magnet on the General Monitors logo on the Nameplate. The instrument will display "- - -" for 5 seconds and then show "ACA". Select by briefly re-applying the magnet. The instrument will acknowledge the selection by rapid flashing "ACA" for 1 second. The instrument will then display "AC", followed shortly by "CP". Continue as described in Calibration.

- The display will continue to slow-flash the reading and the analogue output remains at calibration level until the gas has been removed and the concentration at the sensor has dropped below 5% FSD, when the instrument will exit Calibration Check mode and return to normal operation.

- If the above procedure is unsuccessful, refer to the Trouble Shooting section in this manual.

Important:
The Smart Transmitters should be check regularly by applying gas. This is the only way to ensure the system is fully operational and a schedule should be established to make certain such a check is carried out. General Monitors recommend that this should be done at least every 90 days, even in ideal conditions and much more frequently when the risk is high, in the early days of an installation, or where conditions are adverse.

4.6 Power up Routine

Immediately following power-up, the instrument will carry out "Display Test", then blank the display for 1 second, display "Software Revision" and then display "Power up in progress" followed by normal operation. The analogue output will be at 4.0mA and the Fault open collector output energised.

4.7 Special Power up Routine

If the instrument is powered up with the magnet present it will display “EEPROM write activity” for 1 second, followed by “Power up in progress” as above. The magnet present will cause the Modbus Parameters to be reset to factory default. The magnet may be removed immediately.

If the instrument is powered up with the magnet Present AND the Remote Calibration input active it will display “EEPROM write activity” for 1 second, followed by “Power up in progress” as above. This condition will cause the Power-up EEPROM CRC check to be bypassed and the Modbus Parameters, all calibration and menu Parameters to be reset to factory default. On exit from Power up, the instrument will enter Calibration mode. This feature is available to allow recovery in the field, should the EEPROM contents have been corrupted due to a power failure coinciding with an EEPROM write cycle. The magnet may be removed and the Remote Calibration input de-activated immediately.

5.0 Maintenance

WARNING - Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

5.1 Maintenance

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

Sensors exposed to the elements may require a little grease on the accessory mounting threads. The grease must be free from silicones (Refer to Sensor Poisons) and have a high melting point. Alternatively P.T.F.E. 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 suitable. The accessories should be thoroughly dried, with compressed air if necessary, before refitting to 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 carried out:

- All Smart Transmitter assemblies for suitability of mounting positions so that modifications to plant layout have not affected these.
- Security of mounting
- Sensor flame arrestors for clogging due to water, oil, dust, paint or other contaminants.
- Sensor accessories where fitted.
- Condition of fastening of cables.
- Air filters, where fitted. Ensure that replacement filters are clean and dry.
- Operation of complete system on stand-by supplies, where fitted, for the full prescribed time.

5.2 Storage

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

When prolonged storage is anticipated, modules should be sealed, together with a desiccant, into plastic bags and double wrapped for protection.

Hydrogen Sulphide sensors should be stored as above, but note that the red cap and desiccant supplied with the sensor should be in position throughout the storage period or when the sensor is off power for long periods.

6.0 Trouble Shooting

6.1 Fault codes and Remedies

Faults are stacked according to priority, i.e.: if more than one Fault exists at a particular time, the display will show the Fault with the highest priority (lowest number in priority column). As the Faults are being cleared, the Fault with the next highest priority will be displayed, until all Faults have been cleared.

Latching Faults, except for F07, may be cleared by briefly applying the magnet to the General Monitors Logo on the Nameplate if the Fault condition no longer exists. Non-latching Faults will clear automatically once the Fault condition ceases to exist.

Recovery from F04, F05, F06 and F08 will cause the unit to enter Power up mode as the sensor may have been disconnected or insufficiently biased during the fault condition.

Fault Code	Function	Priority	Mode	Remedy
F01	Analogue output open circuit	6	non-latching	Check wiring and fuse.
F02	Fail to calibration	9	latching	Ensure calibration gas supply is adequate. Re-calibrate. If persistent, replace sensor.
F03	Low response	8	latching	Ensure calibration gas supply is adequate. Re-calibrate. If persistent replace sensor.
F04	Sensor heater open circuit	5	non-latching	Check wiring and sensor. Replace sensor if necessary.
F05	Sensor heater short circuit	4	non-latching	Check wiring and sensor. Replace sensor if necessary.
F06	Power low	2	non-latching	Ensure power supply voltage at the instrument's terminal block is within specification.
F07	EEPROM CRC error	1	latching	Ensure 50% FSD calibration gas is available. Power down the instrument. Activate the Remote Cal input and place the magnet on the General Monitors Logo on the Nameplate. Re-apply power, remove the magnet and de-activate Remote Cal. Wait for the instrument to complete its power-up routine. The instrument will automatically enter calibration mode. Calibrate as normal. All user selectable parameters will have returned to their factory default settings and must be re-programmed as required. If F07 persists, the fault condition is terminal and requires the instrument to be returned to General Monitors.
F08	Sensor short circuit	3	non-latching	Check wiring and sensor, Replace sensor if necessary.
F09	Calibration (check) time-out	7	latching	Ensure calibration gas supply is adequate. Re-calibrate and apply or remove calibration gas in timely fashion as prompted by the display. If persistent, replace sensor.

6.2 Alarms

Alarms are stacked below Faults according to priority i.e.: if a Fault and (latched) Alarm(s) exist at a particular time, the display will show the Fault. As the Fault is cleared, the Alarm with the next highest priority will be displayed.

Latched Alarms may be cleared by briefly applying the magnet to the General Monitors Logo on the Nameplate if the Alarm condition no longer exists. Non-latching Alarms will clear automatically once the Alarm condition ceases to exist.

6.3 Modbus RTU Serial Interface problems

If the Modbus Node Address or any other Modbus parameter of the instrument is unknown, proceed as follows:

Power down the instrument. Place the magnet on the General Monitors Logo on the Nameplate. Ensure the Remote Cal input is NOT activated. Re-apply power and remove the magnet. Wait for the instrument to complete its power up routine. All user selectable Modbus parameters will have returned to their factory default settings and may be re-programmed as required.

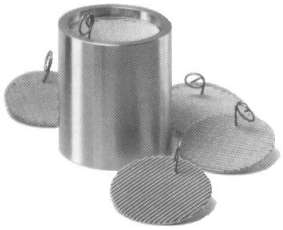
Safety Warning

Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

7.0 Ancillary Equipment

7.1 Dust Guard Assembly (P/N 10110)

Dust Guard Kit (with 12 replaceable screens)



The dust guard is a simple, threaded (1 3/16-18 UNEF 2B) stainless steel 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 with a nominal 40 micron mesh. This General Monitors accessory is specially designed to prevent dust and particulate matter from reaching the sensor flame arrestor. Such debris can plug the sinter 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 eliminated and sensor response is virtually unchanged. The dust guard is also available in a kit (PIN 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.

7.2 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 disc at one end. The body material is 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 will then act as a gas diffusion barrier until the disc has dried out again. Sensor response time is affected by the dust guard. It should not be removed during sensor calibration.

7.3 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 arrestor. The splash guard is recommended for areas where heavy rain or frequent equipment hosedowns occur. It also makes an effective barrier against high winds. Sensor response time is affected by the splash guard. It should not be removed during sensor calibration.

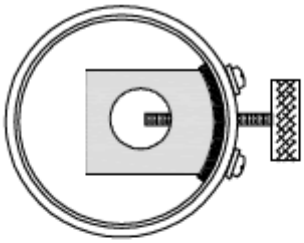
7.4 Sensor Flow Chamber (P/N 10066)

The General Monitors Sensor Flow Chamber is constructed of 2024T aluminium (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 litres per minute (1 cu. ft/hr.)

7.5 Duct Mounting Plate (P/N 10041 Dash-1 or –2)

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 fitted with a Neoprene O-ring seal. The sensor is mounted in a 1 3/16-18 UNEF threaded hole in the centre of the plate. 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.

7.6 Field Calibrator (P/N 50000)



The General Monitors Field Calibrator provides a simple and efficient means of calibrating H_2S sensors in the field.

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

Operating Instructions

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

b) Insert an ampoule of the desired concentration into the hole in the aluminium 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 until display shows code as per calibration instructions.

f) Remove the calibrator and dispose of the glass fragments safely.

7.7 Ampoules of Hydrogen Sulphide (P/N 50004)

These glass ampoules are manufactured under strict control procedures for use with the Field Calibrator (P/N 50000). They are marked with a gas concentration in ppm H_2S which corresponds to the concentration when released within the Field Calibrator.

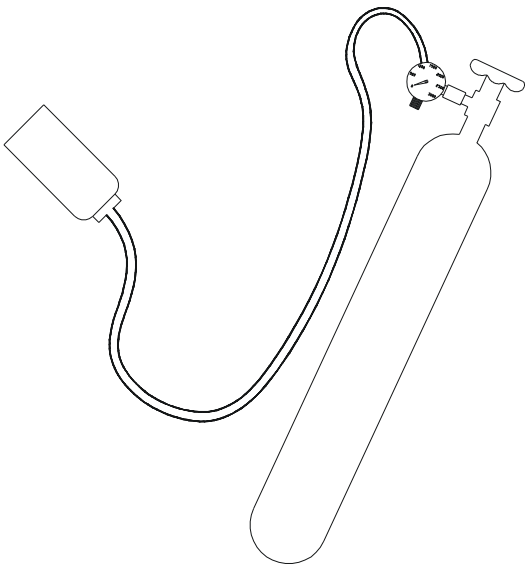
Ampoules may start to lose concentration after a specified period. The Ampoule will state: "EXP (date)". Please adhere to this cut-off date.

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 distinguished by the addition of a suffix to the part No. See table for details.

Part Number	Suffix	Concentration ppm H_2S
50004	-25	4
50004	-11	5
50004	-3	10
50004	-9	20
50004	-21	25
50004	-13	50
50004	-5	100

7.8 Portable Flow Calibrator Model 1400250



The General Monitors Portable Flow Calibrator is a compact, accurate and safe field calibrator which is used as an alternative to the H_2S Field Calibrator for sensors located in high humidity environments. The calibrator uses gas bottles filled with known concentrations of H_2S in dry air. Spare gas bottles are inexpensive and may be returned for refilling. Refer to the table below for the respective part numbers for ordering calibrators and replacement cylinders.

Concentration (ppm)	Flow Calibrator Assembly	Replacement Cylinders
10	1400250-1	1400255-1
20	1400250-2	1400255-2
25	1400250-3	1400255-3
35	1400250-4	1400255-4
50	1400250-5	1400255-5
70	1400250-6	1400255-6
100	1400250-7	1400255-7

These part numbers for the associated equipment are given below:

Description	Part No.
Case (holds two cylinders)	914-135
Regulator (200 ml/min flow rate)	922-016
Teflon Tubing	925-430
Cup with Screen	1400152
Cable Tie	060-331

Operating Instructions

1. Securely fasten the regulator to the gas cylinder and ensure that the tubing and cup are undamaged and securely attached to the regulator outlet.

2. Turn the main valve on the cylinder counter clockwise until the pressure is indicated on the gauge. Gas flow is now controlled by the low pressure ON/OFF valve. CAUTION: **Do not readjust the factory setting of the regulator.**

3. With the control module in Calibration Mode, place the cup securely over the sensor (or sensor accessory where relevant) and turn the gas on.

4. Calibrate the channel in the usual manner (Refer to Section 4 – Operating Instructions).

5. Switch off the gas and close the main valve by rotating the knob in a clockwise direction (finger tight only) so as to avoid leakage during storage.

8.0 Modbus RTU Serial Interface

8.1 General

The Modbus communications interface is based on the RS485 standard. It is implemented as a 2 wire, half-duplex, balanced differential interface which conforms to the EIA-485 specification. Each slave device must have its unique address so that more than one device can be connected to an independently addressed on the same RS485-link.

The Smart Transmitter Interface implements the RTU protocol as described in the "Modicon Protocol Reference Guide PI-MBUS-300 Rev. G. The Modbus RTU is an asynchronous NRZ format. The RTU mode and serial format must be the same for all devices on a Modbus network. The instrument acts as a Modbus communications "Slave".

Two Modbus connections (Modbus 1 and Modbus 2), are provided, sharing the node address and all other Modbus parameters.

The device receives and transmits on both connections simultaneously, requiring the host for Modbus 2 to be quiescent when Modbus 1 connection is active and vice versa.

The Modbus interface factory defaults are set to Node Address 1, 19K2 baud, no parity and 1 stop bit. When the instrument is powered up, the Modbus setup defaults to the settings used before it was powered down. The interface supports a maximum of 2 bits for stop bit and parity information. A selection of 2 stop bits causes no parity to be implemented.

The Modbus Interface and Menu Interface can be used simultaneously for Modbus read commands only. For write commands, the operation is mutually exclusive. Any attempts to perform a Modbus write are inhibited while the Menu Interface is active. This is indicated by returning the Slave Device Busy response (Exception Code 6).

8.2 Modbus Message Characteristics

Baud rate	2K4, 4K8, 9K6 or 19K2
Byte length (11 bits) max	11 / (Baud rate) ms
Inter message spacing or Modicon specification min	3.5 bytes
Inter Byte spacings per Modicon specification min/max	0 bytes / 1.5 bytes
Number of Bytes per message min/max	7 / 15

8.3 Modbus Exception Codes

Code Name	Description	Hex value
Illegal function	Function code is not recognised by the slave	01
Illegal data address	Data address specified is not supported by the slave	02
Illegal data value	Data value specified is not supported by the slave	03
Slave device busy	The slave is engaged in completing a long duration programme command	06

8.4 Modbus Read/Write - Commands

Function Code	Description	Access Type
1	Read coil status	Read
2	Read input status	Read
3	Read holding registers	Read
4	Read input registers	Read
5	Force single coil	Write
6	Preset single register	Write
15	Force multiple coils	Write
16	Preset multiple registers	Write

Any of commands with Function Code 1, 2, 3, 4 allow data to be read from the instrument. The message structure for each read command specifies a start register address. A maximum of 5 consecutive registers can be accessed including the start register address. Each register configures the data as 2 bytes with the most significant byte first. If more than 5 registers are addressed or if there is an attempt to access any register outside the valid read register address space, the Illegal Data Address response (Exception Code 2) is returned.

Any of the commands with Function Code 5, 6 15, 16 allow write data to be written to the instrument. The message structure for each write command specifies a register address to which data is written. The message structure for each multiple write command (15, 16) specifies a register address with the byte count set at 2 to allow single register access. If more than 1 register is addressed or if there is an attempt to access any register outside the valid write register address space, the Illegal Data Address response (Exception Code 2) is returned. Broadcast mode uses address 0 and sends the same data to all attached slaves.

The issue of a write command to a single valid write register normally causes all of the data specified to be overwritten. In certain situations, it is impossible to force a condition due to the presence of an external event e.g. attempts to clear a fault while the fault condition is still present results in the fault not being cleared. For other situations, any attempts to assign unused, read-only or out of range values will have no effect. It is advisable to issue a read of the same register range to verify the true data value present subsequent to the write cycle.

8.5 Modbus Register Configuration

Registers 1, 2, 4, 5, 6 and 8 contain the value of the single parameter specified, the remaining registers contain composite parameters. Attempts to write a data value out of range for these parameters will result in the Illegal Data Value response (Exception Code 3). Unused bits are set to 0.

Register	Function	Access Type	Hex address	Scaling
1	Analogue output current	Read	00	0mA =0x8000 20mA =0xFFFE
2	Sensor response at calibration in Kohms	Read	01	0 =0x8000 10000 =0xFFFE
3	Alarm, fault and analogue output status	Read	02	NA
4	Option setup (1, 5, & 9)	Read	03	0 =0x8000 100 =0xFFFE
5	A1 alarm trip level setup	Read/write	04	0 =0x8000 100 =0xFFFE
6	A2 alarm trip level setup	Read/write	05	0 =0x8000 100 =0xFFFE
7	Open collector outputs and analogue output current at calibration setup	Read/write	06	NA
8	Number of successful calibrations	Read/write	07	0 =0x0000 65535 =0xFFFF
9	Modbus setup	Read/write	08	NA
10	Clear latched alarms and faults	Write	09	NA

8.5.1 Register 3

A bit value of 1 denotes that the corresponding element is active. A bit value of 0 denotes that the corresponding element is inactive. All of the 16 bits in the register are simultaneously accessed during a read.

Description	Alarm/Fault Type	Bit Position
A2 Alarm	latching/non-latching	15
A1 Alarm	latching/non-latching	14
Analogue output at cal level	-	13
-	-	12
-	-	11
-	-	10
F09 calibration (check) time-out	latching	9
F08 Sensor short circuit	non-latching	8
F07 EEPROM CRC error	latching	7
F06 Power low	non-latching	6
F05 Sensor heater short circuit	non-latching	5
F04 Sensor heater open circuit	non-latching	4
F03 Low response	latching	3
F02 Fail to calibrate	latching	2
F01 Analogue output open circuit	non-latching	1
-	-	0

8.5.2 Register 7

Description	Bit position	Dec. value	Function
-	15-6	0	-
Analogue output at calibration	5-4	0 1 2	0.0mA 1.5mA 2.0mA
A2 alarm open collector output normally energised/de-energised	3	0 1	de-energised energised
A1 alarm open collector output normally energised/de-energised	2	0 1	de-energised energised
A2 alarm open collector output normally latching/non-latching	1	0 1	Non-latching Latching
A1 alarm open collector output normally latching/non-latching	0	0 1	Non-latching Latching

8.5.3 Register 9

Description	Bit position	Dec. value
Node address	15-8	1-255
1 stop bit 2 stop bits	7	0 1
No parity Odd parity Even parity	6-5	0 1 2
-	4-2	0
Baud rate 19200 Baud rate 9600 Baud rate 4800 Baud rate 2400	1-0	0 1 2 3

The Node address specified in the high data byte is not written during a broadcast write of the register.

8.5.4 Register 10

The clear register is written a value of 1 to clear a latched Fault or Alarm indicated in the status register. Each issue of the clear command clears a single latched Fault or Alarm in order of priority, provided the Fault or Alarm condition no longer exists.

Safety Warning

Installation and maintenance must be carried out by suitably skilled and competent personnel only.

9.0 Appendix A

Cables to be screened and armoured to BS5308 Part 2 or equivalent. References to Sq. mm and AWG are not to be taken as direct equivalents.

9.1 Maximum Sensor Cable Length

Maximum Sensor Cable length for various conductor sizes:

Conductor Size		Maximum Cable Length	
Sq. mm	**AWG**	**metres**	**feet**
0.75	20	185	500
1.0	18	250	780
1.5	16	370	1000
2.0	14	500	1580
2.5	12	620	2400

9.2 Maximum Smart Transmitter Cable Length

Maximum Sensor Transmitter Cable length for various conductor sizes and power supply voltages with a 100mA load on each of the three open collector outputs

Note: When open collector outputs are not connected, use values in parenthesis.

Conductor Size		Maximum Cable Length				Power Supply Rating			Cable Drop
sq mm	**AWG**	**metres**		**feet**		**VDC**	**mA max avg**		**total VDC**
0.75 1.0 1.5 2.0 2.5	20 18 16 14 12	120 160 240 320 400	(195) (255) (390) (510) (635)	325 500 650 1020 1550	(530) (820) (1050) (1670) (2550)	35.0	430 775pk	(130) (475pk)	5.0
0.75 1.0 1.5 2.0 2.5	20 18 16 14 12	260 340 520 680 850	(450) (600) (900) (1200) (1500)	700 1050 1400 2220 3400	(1220) (1890) (2420) (3820) (5870)	35.0	465 715pk	(165) (415pk)	10.0
0.75 1.0 1.5 2.0 2.5	20 18 16 14 12	415 550 830 1100 1375	(750) (1000) (1500) (2000) (2500)	1120 1740 2230 3530 5410	(2020) (3140) (4020) (6350) (9750)	35.0	495 675pk	(195) (375pk)	15.0
0.75 1.0 1.5 2.0 2.5	20 18 16 14 12	260 340 520 680 850	(450) (600) (900) (1200) (1500)	700 1050 1400 2220 3400	(1220) (1890) (2420) (3820) (5870)	30.0	465 715pk	(165) (415pk)	5.0
0.75 1.0 1.5 2.0 2.5	20 18 16 14 12	415 550 830 1100 1375	(750) (1000) (1500) (2000) (2500)	1120 1740 2230 3530 5410	(2020) (3140) (4020) (6350) (9750)	30.0	495 675pk	(195) (375pk)	10.0

Conductor Size		Maximum Cable Length				Power Supply Rating			Cable Drop
sq mm	AWG	metres		feet		VDC	mA max avg		total VDC
0.75 1.0 1.5 2.0 2.5	20 18 16 14 12	540 725 1080 1450 1800	(960) (1285) (1920) (2575) (3200)	1475 2285 2930 4630 7120	(2620) (4065) (5210) (8235) (12660)	30.0	565 685pk	(265) (385pk)	15.0
0.75 1.0 1.5 2.0 2.5	20 18 16 14 12	135 185 270 370 430	(245) (335) (490) (670) (830)	380 585 750 1185 1825	(690) (1065) (1365) (2150) (3325)	24.0	495 665pk	(195) (365pk)	5.0

Customer Satisfaction Questionnaire

Attention Field Operations:

We would appreciate your help in assessing and thus improving the quality of our Equipment and Service and would therefore be grateful if you would complete the Questionnaire below and return it to:

General Monitors Ireland Ltd,
Ballybrit Business Park,
Galway,
Republic of Ireland.

Thank you for your assistance

Client _____

Client Order No. _____

General Monitors Sales Order No. _____

	(Please tick appropriate box)	Yes	No
1.	Was the equipment the correct option?	☐	☐
2.	Are sensors correct type and range?	☐	☐
3.	Is mechanical assembly good? (everything proper fit and tight)	☐	☐
4.	Did you receive the necessary accessories to commission the equipment?	☐	☐
5.	Has the equipment been commissioned?	☐	☐
6.	Any problems encountered during commissioning?	☐	☐
7.	Is the equipment functioning correctly at present?	☐	☐

If you have answered **NO** to any of the above, please provide further details overleaf. **Thank you.**

Completed by: _____ Date: _____