ENMET

Creative Gas Detection Solutions

EX-6100 Combustible Gas

Sensor/Transmitter with Pellistor/Catalytic Type Sensor
Operation and Maintenance Manual

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List of Figures and Tables

1.0 Introduction

The ENMET EX-6100 Fixed Gas Detectors for the detection of Flammable gases is ATEX Flameproof Certified for use in Group IIC hazardous locations. Directive 94/9/EC ATEX and the equivalent rating of Class1, Division 1, Groups A, B, C and D.

Harmonized Standards Used:	
EN60079-0:2006 Electrical apparatus for explosive gas atmospheres – Part 0: General requirements.	
EN60079-1:2007 Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d".	
Notified Body for Hazardous Area Certification: SIRA Certification Service Rake Lane, Eccleston, Chester, CH4 9JN. Notified Body Number: 0518	**Notified Body for ATEX Quality Assurance Notification:** Baseefa Rockhead Business Park Staden Lane, Buxton SK17 9RZ, UK Notified Body Number: 1180
Hazardous Area Certificate Number: SIRA 08ATEX1031X ⟨Ex⟩ II 2 G Ex d IIC T4 (Ta = -20°C + 60°C) T5 (Ta = -20°C + 50°C) T6 (Ta = -20°C + 35°C)	**ATEX Quality Assurance Notification Number:** 2056

NOTE: *All specifications stated in this manual may change without notice.*

1.1 Unpack

Unpack the EX-6100 and examine it for shipping damage. If such damage is observed, notify both ENMET customer service personnel and the commercial carrier involved immediately.

Regarding Damaged Shipments

NOTE: *It is your responsibility to follow these instructions. If they are not followed, the carrier will not honor any claims for damage.*

- This shipment was carefully inspected, verified and properly packaged at *ENMET* and delivered to the carrier in good condition.
- When it was picked up by the carrier at *ENMET*, it legally became your company's property.
- If your shipment arrives damaged:
  - Keep the items, packing material, and carton "As Is." Within 5 days of receipt, notify the carrier's local office and request immediate inspection of the carton and the contents.
  - After the inspection and after you have received written acknowledgment of the damage from the carrier, contact *ENMET* Customer Service for return authorization and further instructions. Please have your Purchase Order and Sales Order numbers available.
- *ENMET* either repairs or replaces damaged equipment and invoices the carrier to the extent of the liability coverage, usually $100.00. Repair or replacement charges above that value are your company's responsibility.
- The shipping company may offer optional insurance coverage. *ENMET* only insures shipments with the shipping company when asked to do so in writing by our customer. If you need your shipments insured, please forward a written request to *ENMET* Customer Service.

Regarding Shortages

If there are any shortages or questions regarding this shipment, please notify *ENMET* Customer Service within 5 days of receipt at the following address:

ENMET
680 Fairfield Court
Ann Arbor, MI 48108
734-761-1270 Fax 734-761-3220
Toll Free: 800-521-2978

1.2 Check Order

Check, the contents of the shipment against the purchase order. Verify that the EX-6100 is received as ordered. [Each EX-6100 is labeled with its target gas.] If there are accessories on the order, ascertain that they are present. Check the contents of calibration kits. Notify ENMET customer service personnel of any discrepancy immediately.

1.3 Serial Numbers

Each EX-6100 is serialized. These numbers are on tags on the equipment and are on record in an ENMET database.

2.0 Features of the EX-6100

The **EX-6100** is an ATEX and IECEx certified fixed gas detector for use in potentially explosive atmospheres. The unit may be optionally fitted with a protective weather guard as shown in the photograph.

The unit comprises an instrument housing having two cable gland entries and containing the connection terminals, electronics and display window.

The housing containing the gas sensor has an M27 thread and is screwed into the bottom of the unit. The sensor housing itself is a certified component and must not be removed in service.

Behind the display window are- See **Figure 1** for location of features:

Feature	Description
Display	A 4-digit LCD display
Magnetic Switches	Four magnetically operated switches that are activated through the display window using a magnetic pen that is supplied with the unit.
Visual Indicators	LED indicators for POWER, ALARM & KEY PRESS
Power supply	8 to 24 volts dc (non-intrinsically safe)
Analogue output	4 to 20mA dc
Communications Output	RS232
Relay	Relay version has 3 factory-fitted relays. Each provides a set of voltage free changeover contacts to perform the following control functions contact outputs for Alarm Level 1, Alarm Level 2 and Fault
Gland (Strain Relief)	entry threads available – 20mm, ½" or ¾" NPT

Magnetic switches control the instrument maintenance functions. The magnetically operated switches allow the unit to be calibrated while power is still applied without the need to remove the cover from the unit.

Versions without relays fitted are also available.

The self-adhesive label on the outer surface of the enclosure indicates whether the relays are fitted as shown below:

NOTE: When used in environments where the instrument is exposed to salt spray or diesel it is recommended that the EX-6100 is always fitted with its protective weather guard. The weather guard is attached with tamperproof screws to ensure that it is not inadvertently removed.

GAS DETECTOR TYPE NO CONTROL RELAYS	GAS DETECTOR TYPE CONTROL RELAYS FITTED

Inlet/Outlet Port 1 of 2

Inlet/Outlet Port 1 of 2

2 x 0.27 (2 x 7) dia. Mounting Holes

Display

Menu Switches

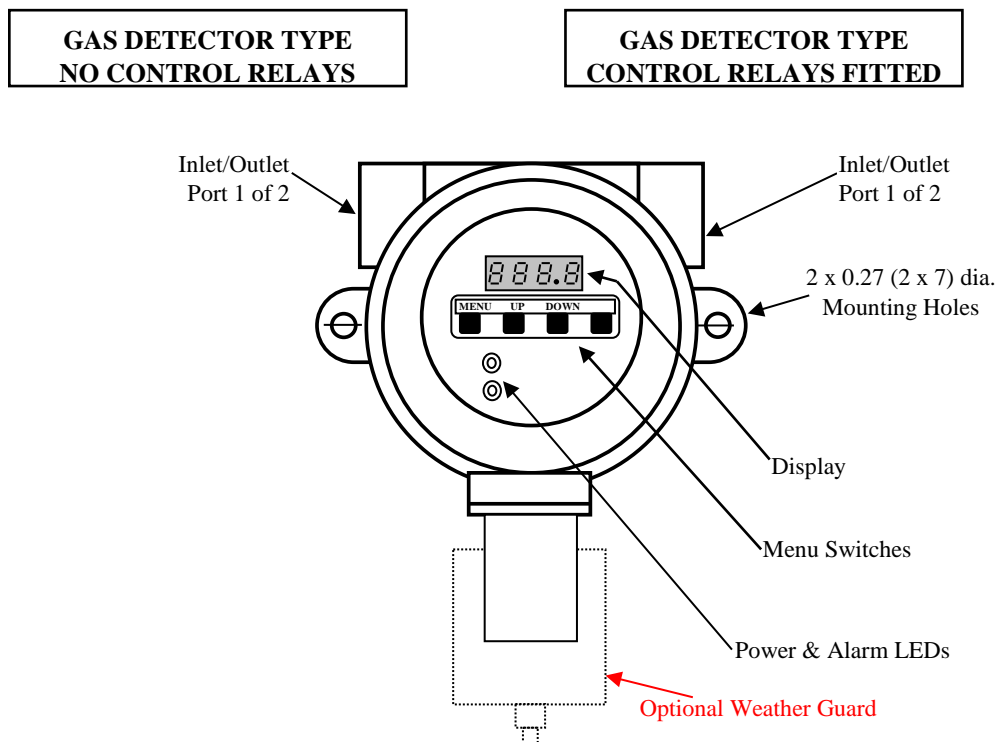Power & Alarm LEDs

Optional Weather Guard

Figure 1: EX-6100 Features

3.0 Installation of the EX-6100
CAUTION: Area must be declassified during installation.

The **EX-6100** gas sensor/transmitter (S/T) is a 3-wire, 24 VDC 4-20 mA S/T for the detection of combustible gas. The S/T is meant to be used in conjunction with an appropriate power supply and controller. The **EX-6100** sensor/transmitter is in an enclosure rated for use in a ATEX and IIC, Class I, Division 1, Groups B, C, D, classified area. Appropriate wiring, conduit and fittings are required for proper installation in a explosion proof rated environment.

CAUTION: Since the sensor/transmitter detects gas only at the sensor location, pay attention to the possible sources of gas, the density of the gas, locations where the gas may be confined and locations where the gas may damage or injure property or personnel, when choosing locations of sensor/transmitters.

Take into consideration environmental factors when deciding on S/T location. Avoid locations where the S/T may be damaged by liquid immersion, excessive heat or other known hazards. Also, take precautions to insure condensation inside of the conduit does not enter the S/T.

3.1 Mounting the EX-6100 Enclosure
Mount the enclosure, using the two mounting holes provided see **Figure 2**. Pay attention to the source and density of the gas being detected when choosing the location. Mount the S/T near the ceiling for lighter than air gases /vapors and near the floor for heavier then air gas/vapors. Contact *ENMET* if you have questions regarding your application.

CAUTION: Before connecting S/T to controller remove the power source to controller. Failure to do so may cause damage to sensitive components.
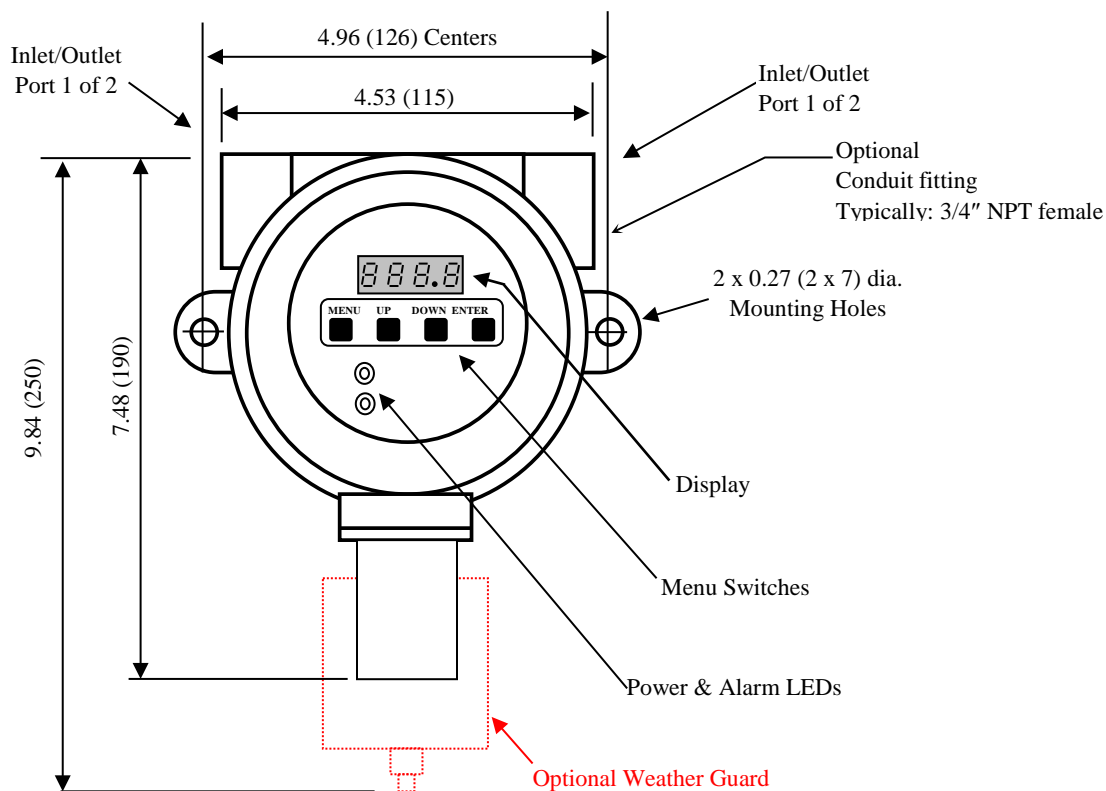
Approximate Measurements in Inches (mm)
Maximum Depth = 5 Inches (127mm)

Figure 2: EX-6100 Mounting

3.2 Wiring the EX-6100 to a Control Unit
CAUTION: Area must be declassified during installation.

If the **EX-6100** is installed in a hazardous location as defined by the National Electrical Code, then *ALL* wiring must be in accordance with the National code and any local governing codes.
Open the enclosure, and remove the 2 screws that retain the display overlay to the circuit board.

Turn cover securing stud counter-clockwise to allow cover to open.
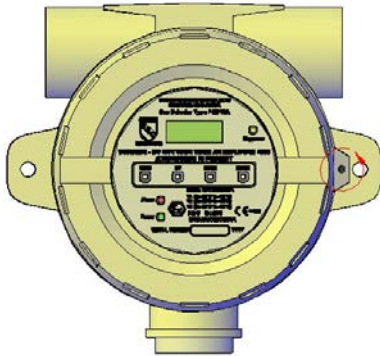
Remove cover by rotating counter-clockwise.
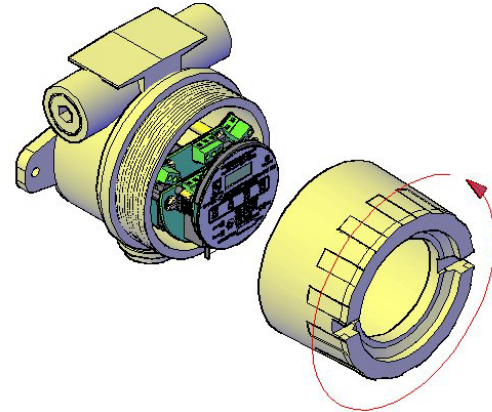
Figure3: Access to EX-6100 for Connection to a Control Unit

The cable entry threads are 20mm, ½" or ¾" NPT female.

The **EX-6100** enclosure is manufactured from die cast aluminum*. Therefore, the use of glands, conduit fittings and blanks made from brass should be avoided because if moisture is present, bi-metallic corrosion may occur due to the chemical reaction between the two materials.

Glands and fittings plated with nickel, tin or zinc will provide improved protection but in harsh environments the use of stainless steel is recommended.
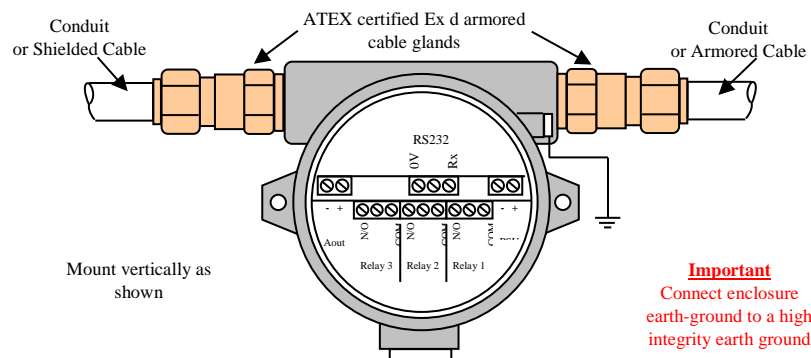
Figure 4: Armored Cable Gland Installation

Relays - three relays are provided:
Alarm 1 and Alarm 2 are associated with the alarm points.
Alarm 3 is associated with fault conditions.
All relays are factory set to de-energize state non-alarm.
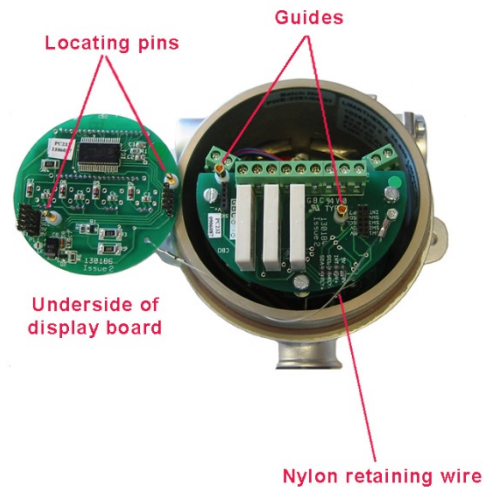
Figure 5: Unplugging the Display Board for Connection Purposes

3.2 Power Supply

The **EX-6100** is powered from an 8 – 24-volt dc, 5 W maximum output supply. This may be either:

a) An independent supply powering one or more units.
b) A supply that is an integral part of a control card within a monitoring panel.

3.3 Analogue Output

The analogue output provides a means of indicating to external equipment (e.g. data loggers, remote displays, control cards) the gas levels currently being detected by the system. The output is in the form of the industry standard 4 to 20mA current source. The analogue output is factory set such that 4mA represents zero gas and 20mA represents the full-scale gas level of the **EX-6100**.
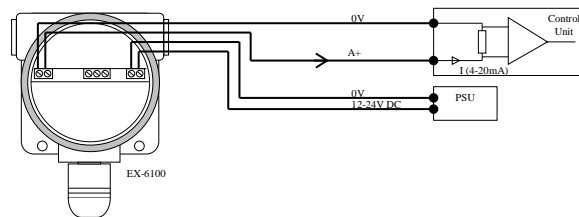
Figure 6: Analogue Output

3.4 RS232 Output

This output is designed to be compatible with a PC fitted with an RS232 serial communications port. Suitable software is available for installation in the PC. Contact *ENMET* for details.
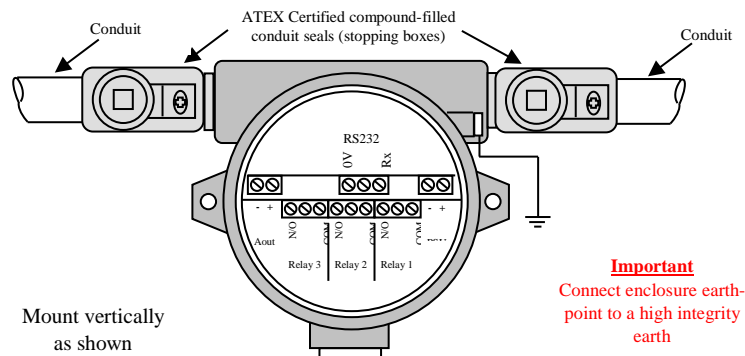
Figure 7: EEx d Conduit Installation

3.5 Following Completion of the Installation:
  a) Replace the top display board using the locating pins on the underside of the board to ensure that it makes connection with the remainder of the electronics - see Figure 8.
  b) Ensure that the front cover has not been contaminated with dirt - paying attention to the thread. Replace the cover by rotating it several times clockwise until it reaches its limit then secure using the set screw – do not over tighten.
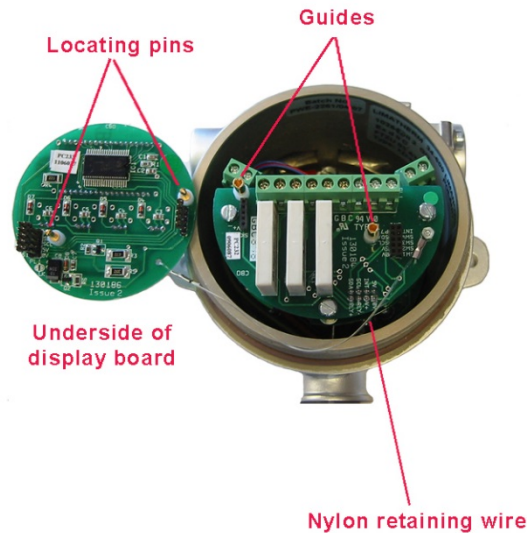
Figure 8: Replacing the Display Board

3.6 Applying power
Caution: The cover must be in place before applying power

Once the installation is complete and the covers are secure then power can be applied. The power source should be between 8 and 24 volts dc.

When power is first applied to the **EX-6100**, an initialization procedure is performed as follows:

All segments on the LCD are shown	8.8:8.8
The software version is displayed	1.3.0
The manufacturer code is displayed	SSCL
The sensor type is displayed	P
Warm up count down	Ł 30

The detected gas level present is displayed and the **EX-6100** becomes operational.

3.7 Indicators
Three LED indicators are visible from the front panel of the instrument. These are:

Color	Identity	Operation
Red	Alarm	Illuminates when either alarm level has been reached.
Green	Power	Always ON when power is connected.
Yellow	Key press	Illuminates when the magnetic switches are operated.

3.8 Initial Gas Testing

EX-6100 units are factory calibrated as detailed on the calibration certificate supplied with the instrument. However, it is always advisable after installation to confirm that the instrument reads zero with no gas present and responds accurately when presented with an appropriate concentration of the target gas.

The **EX-6100** display becomes operational within 60 seconds however; the sensor should be allowed to stabilize for the period of five to ten minutes before attempting to check the zero setting and gas response.

Refer to Figure 9 showing the arrangement for applying the test gas to the **EX-6100**.
1. Before application of the test gas, check that the **EX-6100** reads zero with no known gas present in the atmosphere. If necessary, carry out adjustment of the zero setting as described in section 5.1.1
2. Apply the test gas and allow a sufficient time for the sample to reach the gas detector and for the sensor response to stabilize.

Carrying out the above procedure, and comparing the results with previous readings, reference the certificate of calibration, will confirm that the EX-6100 is functioning correctly, both physically and electrically. There is therefore no requirement for any further maintenance other than to clean the display window as required.

In the unlikely event that the response has changed from the previous readings, recalibrate the unit. See Section 5.1.1 and 5.1.2.

With Weather guard

Calibration Adaptor with Weather guard,
part number 04546-012

Calibration Adapter,
part number 03700-057

Sampling Tube

Flow Regulator

Certified Test Gas
Cylinder
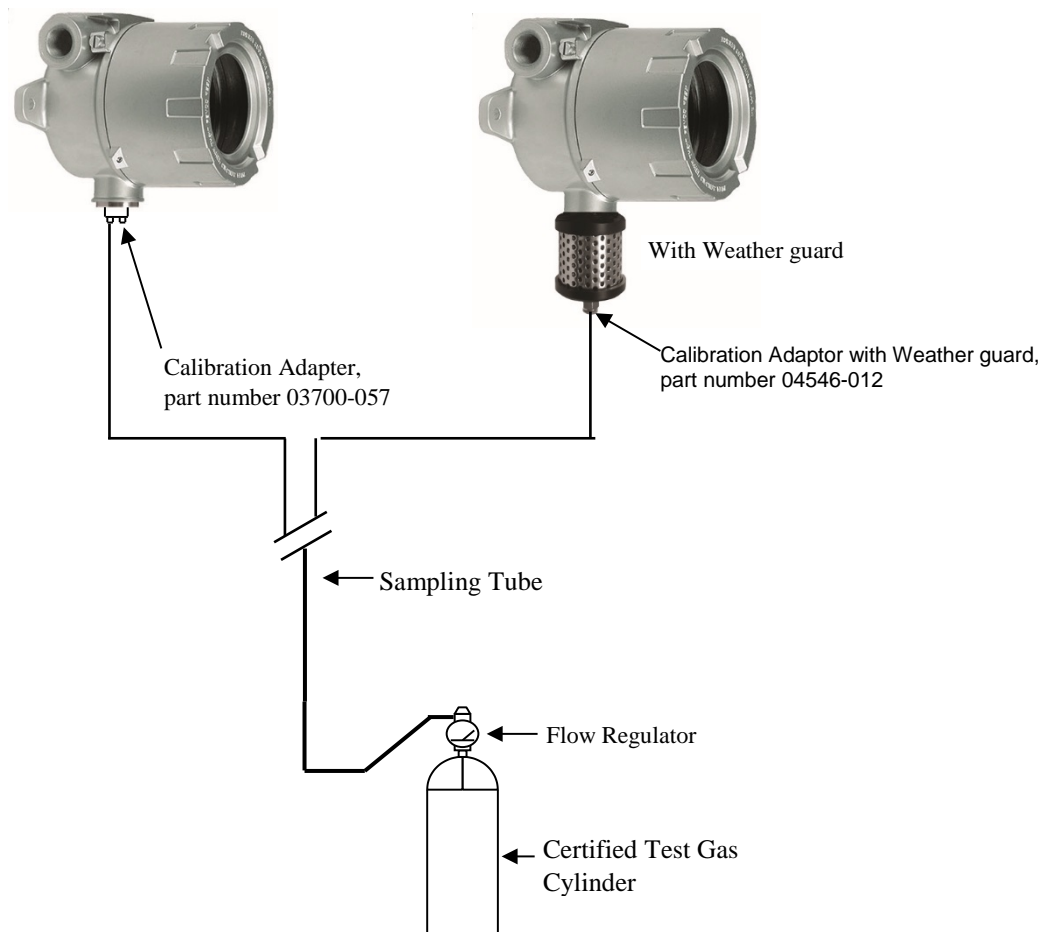
Figure 9: Appling Test Gas to EX-6100

3.8.1 Suggested calibration Test gas levels.
Flammable sensor 0 – 100% LEL
Zero   contaminant free air (must contain oxygen).
Span   50%LEL balance air.

4.0 Operation

The **EX-6100** incorporates magnetically operated switches to allow non-intrusive operation of the menu system. To *'press'* the switch requires movement of the stylus pen over the appropriate button. The key press LED will light to indicate that the button press is being detected. In some instances, it may be necessary to hold the pen over the button for sufficient time to allow the microcontroller to determine the key that has been *pressed*.

Description

EX-6100 GAS DETECTOR
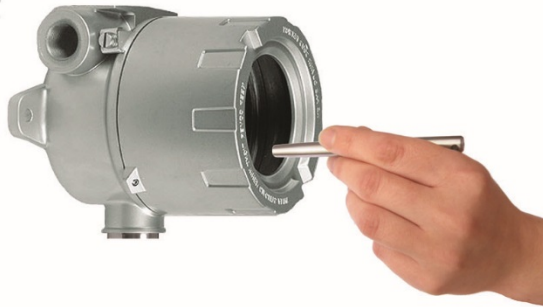
EX-6100 GAS DETECTOR FITTED WITH PROTECTIVE WEATHERGUARD

Figure 10: Operation of Magnetic Switches

The menu system featured within the **EX-6100** allows all calibration and configuration activities to be performed.

Table 1: Magnetic Keypad Functionality

Button	Function
MENU	Open / Close Menu
UP	Next / Increase
DOWN	Previous / Decrease
ENTER	Accept selection

This section of the manual discusses how the zero and calibration menu options can be accessed. Additional menu option associated with the operational parameter may be changed via the menu mode section 11.

5.0 Calibration

```
8 8 8.8
MENU  UP  DOWN  ENTER
 ■    ■    ■     ■
 1    2    3     4
```
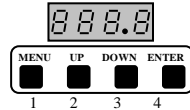
5.1 Sensor Calibration
This feature allows the sensor to be calibrated. Ensure that the correct sensor type is selected in the configuration prior to calibration. Refer to section for details of the menu system operation.

5.1.1 Sensor Zero
Tap the magnet over the menu switch, the display will change to **Pass** wait approximately 10 seconds and the display will show **E 1**.
Tap the magnet over the enter switch the display will flash **E: 1** and **0**
- If the zero is accepted the display will show ---- Tap the magnet over the menu switch to exit.
- If the zero calibration was not within acceptable range the display will show F2. A recalibration is required; you may need a cylinder of 20.9 air.

5.1.2 Sensor Span
Tap the magnet over the menu switch, the display will change to **Pass**, wait approximately 10 seconds and the display will show **E 1**.

Tap the magnet over the up switch, the display will change to **E 2**.

Tap the magnet over the enter switch the display will flash **E: 2** and XX (XX = the calibration gas level).
If the calibration gas you have does not match the displayed value, place the magnet over the up or down switch to adjust the value.

Tap the magnet over the enter switch, the display will flash **E: 2**
Apply the calibration gas.

The display will flash **E: 2** and a number (sensor response to gas) when the number stops changing place the magnet over the up or down switch, the display will lock at the stable reading, *example* 49 or 53.
Place the magnet over the enter switch. The display will show ---- if the calibration was successful.
Tap the menu switch to exit and remove the calibration gas.

Caution: Be sure that the calibration gas you use matches the type and concentration of calibration gas display on the **EX-6100** See Accessories Section 10 for *ENMET* Gas Cylinder part numbers.

Contact *ENMET* if there are any questions.

6.0 Sensor Replacement

*WARNING***:** Power must be removed from the EX-6100 before this or any internal procedure. Failure to do so may cause damage to equipment, bodily injury or death.

6.1 Combustible sensor
Step1
Turn cover securing stud counter-clockwise to allow cover to open.
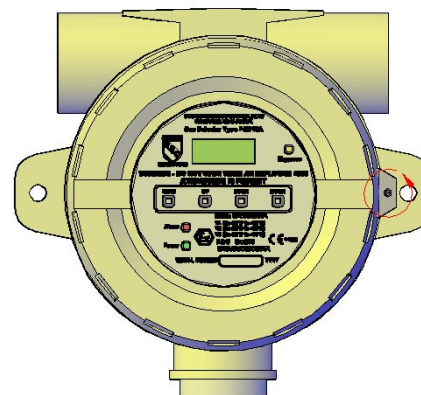
Step 2
Remove cover by rotating counter-clockwise
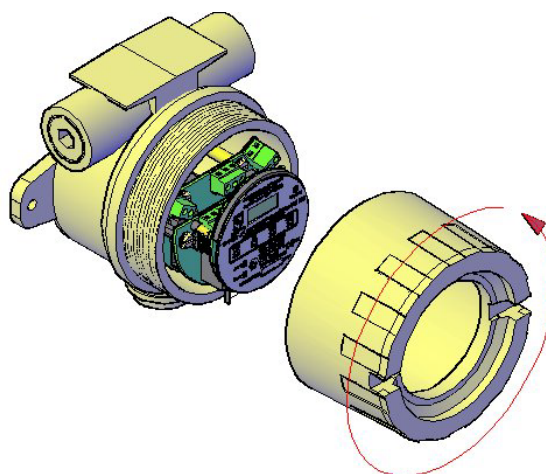
Step 3
Remove the display board - which can be left to dangle on its retaining wire. Remove the PCBs from the support pillars and the ribbon cable from the board remaining in the enclosure.
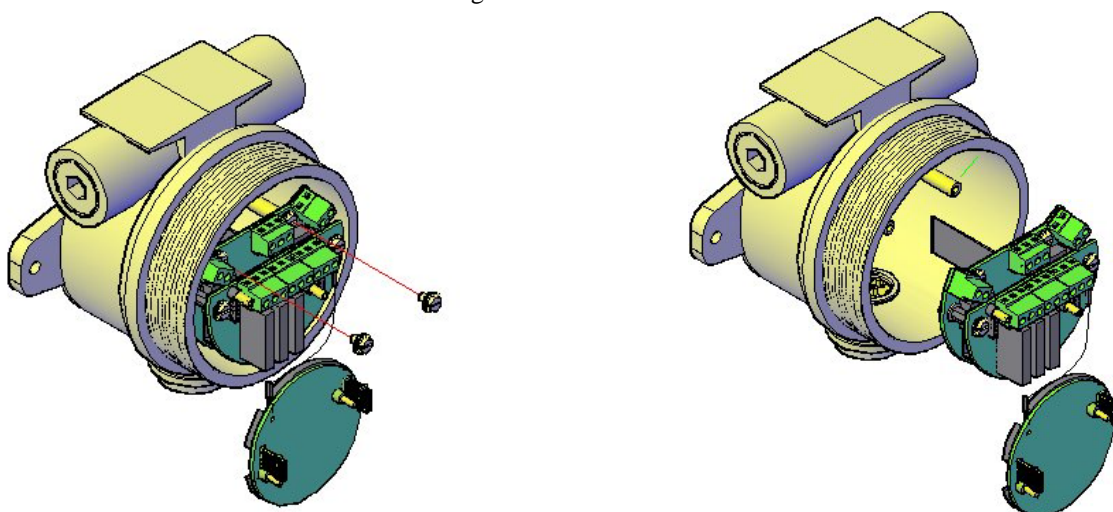
Step 4

Remove the sensor board from the rear of the sensor – do not disconnect the wires from the main board.
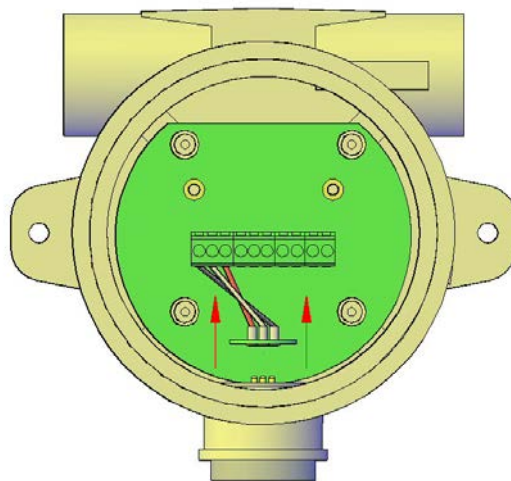
Step 5

Remove sensor insert using maintenance tool or slip joint pliers.
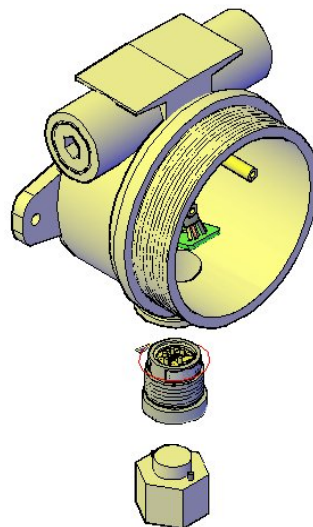
Step 6

Mark the sensor pin position & undo the snap ring that retains the sensor in its housing.
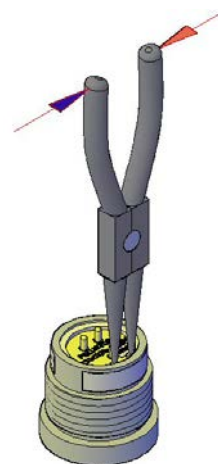
Step 7

Replace the sensor taking note of the pin marking in step 6.

Step 8

Apply Loctite 243 or a compound equal strength to the threads. Insert the sensor housing into the **EX-6100** enclosure using the maintenance tool or slip joint pliers.

Loctite

Maintenance Tool
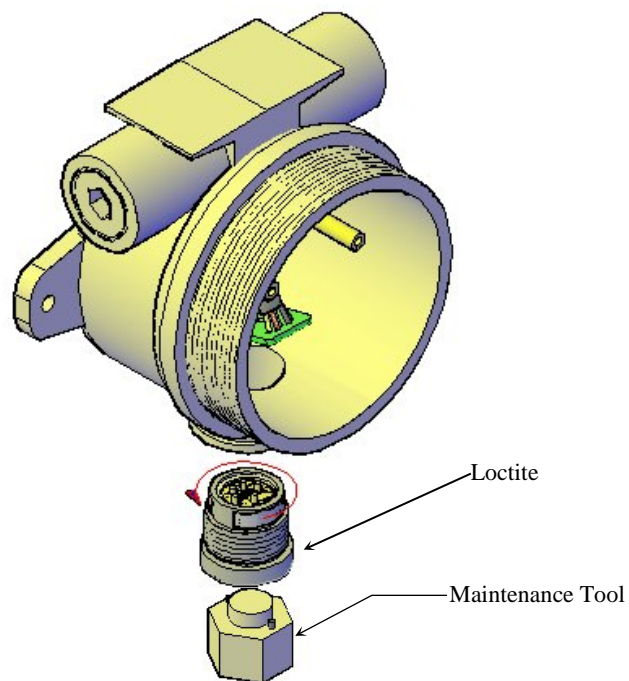
Step 9

Fix the sensor board back into postion.
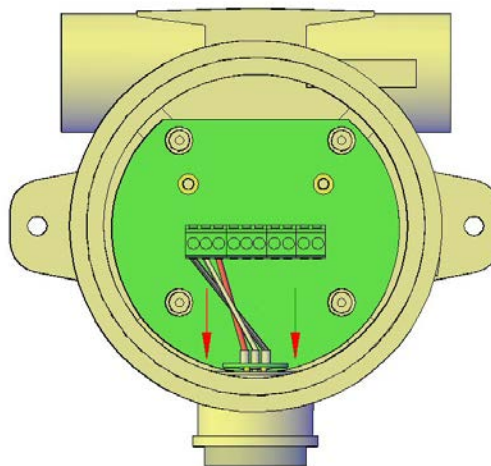
Step 10
Fix ribbon cable, the boards removed from the support pillars and finally the display board back into position.
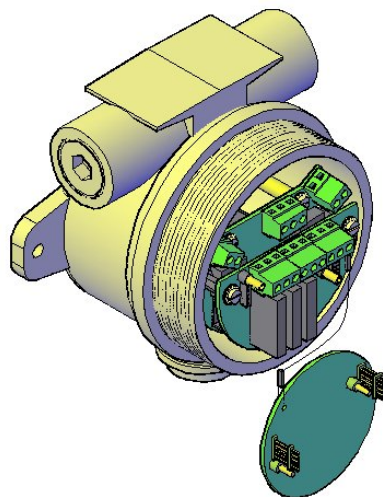
Step 11
Replace cover and fully tighten.
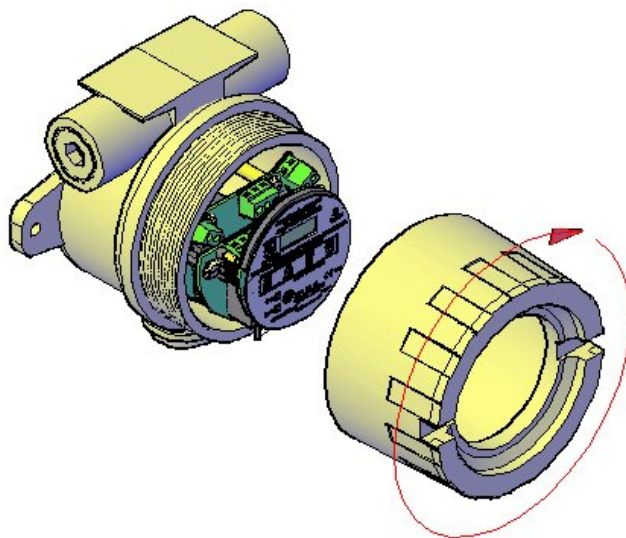
Step 12
Turn the cover securing stud clockwise until secure.
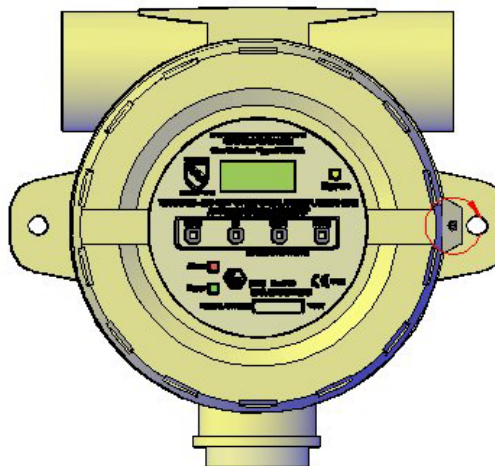
Reconnect the instrument to power and calibrate per section 5.0

7.0 Fuses

A 1Amp anti-surge fuse, housed within a surface mounted holder, is located within the **EX-6100** to prevent overloading of the electronic circuitry in the event of an internal fault.

In the event of the internal fuse blowing, access can be gained using the following procedure:
1. Switch OFF the supply to the **EX-6100**.
2. Release the grub screw located near the lip of the enclosure cover.
   NOTE: It is not necessary to remove the grub screw to release the enclosure front cover.
3. Remove the enclosure front cover by rotating it several times in a counter-clockwise direction.
4. Unplug the display board from within the enclosure.
5. Remove the 3 screws located around the edge of the next board.
6. Unplug this board.
7. The surface mounted fuse holder can now be located on the board below. Replace only with a fuse of the same type and rating: 1Amp Anti-surge 'Nano fuse'

Assembly is the reverse of the above procedure.

8.0 Specifications

Materials	Instrument Body – Aluminum Pressure Die Casting Sensor Insert – Stainless Steel Grade 316 Magnetic Pen – Stainless Steel Grade 316 Weather guard – Stainless Steel Grade 304 & Nylon 66
Cable entries	2 x 20mm
Weights	EX-6100 (excluding weather guard) – 1.5Kg Magnetic Pen – 60 grams Weather guard – 200 grams
Gas type	Flammable gases including Methane and Hydrogen
Input voltage	8 to 24 volts dc
Input power	5 Watts maximum
Internal fuse	1 Amp antisurge 'Nano fuse'
Analogue output	4 to 20mA (10-bit resolution)
Relays	Relay 1 – Alarm 1 Relay 2 – Alarm 2 Relay 3 – Fault Contact Rating 300Vac, 3 Amps (Non-inductive load)
RS232 output	Communications with PC at 19200 bauds
Sensor type	Pellistor, 2.5v dc, 170mA
Measurement range	0 – 100% LEL
Response time	< 10 seconds
Measurement resolution	1% LEL
IP rating	Enclosure IP66, Sensor IP65
Display	4 Digit, 7 segment liquid crystal
Keypad	4-Button magnetically operated
Software	Software configuration provided via LCD display and multifunction keypad
Operating temperature	- 20 to +60 $^{\circ}$C
Humidity range	0 to 95% RH non-condensing
Operating pressure	Atmospheric + or - 10%
Performance standards	EN 60079-29-1:2007

9.0 Certification
The **EX-6100/FGD10 Series** of Gas Detectors are ATEX and IECEx certified for use in potentially explosive atmospheres and is marked as follows:

```
WARNING – DO NOT OPEN WHEN AN EXPLOSIVE GAS
              ATMOSPHERE IS PRESENT

           GAS DETECTOR TYPE FGD10 **

STATUS SCIENTIFIC        IECEx SIR 08.0009X
CONTROLS LTD.            T4 (Ta -20°C to +60°C)
MANSFIELD               T5 (Ta -20°C to +50°C)
NG18 5ER.UK.            T6 (Ta -20°C to +35°C)

                       ⟨Ex⟩  II 2 G Ex d IIC  CE 1800
                       SIRA 08ATEX1031X
SERIAL No. XXXXXX       CIRCUIT RATING: 24VDC, 5W
YYYY                   RELAY CONTACT RATING:
                       300VAC. 3A MAX.
```

** Denotes additional characters that define the gas detector configuration e.g. Enclosure type and sensor arrangement.
YYYY – Denotes year of manufacture.

Special Conditions of Safe Use
Only Loctite 243 or a compound of equal strength shall be reapplied to the threads of the sensor after replacing the sensing element

Electrical data
Power supply - 8Vdc to 24Vdc, 5W
Relay contact rating – 300Vac, 3 Amps

Installation instructions
The cable entry devices and blanking elements of unused apertures shall be of a certified flameproof type, suitable for the conditions of use and correctly installed.

With the use of conduit, a suitable certified sealing device such as a sealing fitting with compound shall be provided immediately at the entrance to the flameproof enclosure.

10.0 EX-6100 Accessories and Calibration Gas
EX-6100 accessories and calibration gas *ENMET* part number

Description of Accessory	Part Number
Sensor	03070-007
Calibration Adaptor	03700-057
Regulator Assembly	02506-004
Calibration Gas, 50%LEL Methane	03220-050
Calibration Gas, 50%LEL Propane	03221-050
Calibration Gas, 50%LEL Hydrogen	03227-050
Calibration Gas, 50%LEL Butane	03282-050
Weather Guard	04546-012
Maintenance Tool, Sensor	73413-210

11.0 Menu Mode

Several calibration modes exist in the **EX-6100** and these are accessible via the instruments simple menu system. To select a calibration mode, follow this procedure:

- Press the MENU button, **E: 1** appears on the display.
- Press UP or DOWN until the required menu option is displayed.
- Press ENTER to select the calibration mode.
- To exit the menu press MENU.

While the instrument is in menu mode – any data displayed on the screen will alternate between the cal number and the reading.

The following features are available via the '**EX-6100**' menu system:

The **EX-6100** uses a password system to restrict the end user from carrying out certain changes that may compromise the use of the equipment. Menu Mode should only be entered by qualified personal. Contact *ENMET* for further information.

Table 3: EX-6100 Menu Options

Menu Option	Section
E: 1 – Sensor Zero	11.2.1
E: 2 – Sensor Span	11.2.2
E: 3 – Sensor FSD	11.2.3
E: 4 – Output Zero (4mA)	11.2.4
E: 5 – Output Span (20mA)	11.2.5
E: 7 – Firmware Version	11.2.7
E: 9 – Engineer Diagnostics	11.2.9
E: 13 – Relay 1	11.2.11
E: 14 – Relay 2	11.2.12
E: 29 – Relay 3	11.2.19
E: 80	NOT USED
E: 81	NOT USED

Table 3a: EX-6100 Menu Options

Menu Option	Section
E:6 – Decimal Places	11.2.6
E:8 – Restore	11.2.8
❶ E:12 – Cross Reference	11.2.10
E:15 – Alarm Level 1	11.2.13
E:16 – Alarm Level 2	11.2.14
E:19 – Positive Zero Suppression	11.2.15
E:20 – Negative Zero Suppression	11.2.16
E:27 – Hysteresis	11.2.17
❷ E:28 – Firmware Update	11.2.18
E:30 – Password	11.2.20
E:31 – Warm-Up Timer	11.2.21

❶ Contact ENMET before entering this menu option.
❷ *Do Not* enter this menu option.

11.2.1 E: 1 – Sensor Zero
Refer to section 5.1.1 for sensor calibration details.

11.2.2 E: 2 – Sensor Span
Refer to section 5.1.2 for sensor calibration details.

11.2.3 E: 3 – Sensor FSD
This menu option allows the full-scale gas level to be selected.
From the menu system select menu option: **E: 3** and press ENTER.
- Using the INCREASE and DECREASE buttons; adjust the FSD to the required level.
- Press ENTER, '- - - - 'will be displayed to indicate that the new setting has been accepted.
  Note: Pressing MENU instead of ENTER will exit the menu without changing the FSD.
- Press MENU to close the menu system.

11.2.4 E: 4 – Output Zero (4mA)
Refer to section Appendix A for output calibration details.

11.2.5 E: 5 – Output Span (20mA)
Refer to section Appendix A for output calibration details.

11.2.6 E: 6 – Decimal Places
The number of decimal places that are used to display the detected gas levels can be changed via this menu option.
- From the menu system select menu option: **E: 6** and press ENTER.
- Using the NEXT and PREVIOUS buttons, select the required number of decimal places.
- Press ENTER.
  NOTE: Pressing MENU instead of ENTER will exit the menu without changing the number of decimal places to which the gas level will be displayed.
- Press MENU to close the menu system.

Note: when the sensor type is first selected, the optimum number of decimal places for a given sensor type and range is automatically selected. Increasing the number of decimal places to which detected gas levels are displayed does not increase the sensitivity or accuracy of the instrument and in some cases, may degrade the instruments perceived stability.

11.2.7 E: 7 – Firmware Version
The Firmware version is displayed in the form X. Xyy, where X is numerical and y is a letter.
- Press MENU to close the menu system.

11.2.8 E: 8 – Sensor Selection
This menu option allows the sensor type to be selected. The available sensor options are listed below:

Table 4: EX-6100 Sensor Selections

OPTION	TYPE	RANGE	COMMENTS
PELL	Pellistor	0-100%LEL	General hydro carbons
tc1	Pellistor	0-100%Vol	Methane
NCH4	Pellistor	0-100%LEL	Linearized Methane
NH2	Pellistor	0-100%LEL	Linearized Hydrogen

The sensor type is selected as follows:
- From the menu system select menu option: **E: 8** and press ENTER.
- Using the NEXT and PREVIOUS buttons, select the required sensor.
- Press ENTER.
  NOTE: Pressing ENTER while in menu option **E: 8** will reset the factory defaults for the displayed sensor. A calibration must be performed even if the sensor type was not changed.
- Press MENU to close the menu system.

NOTE: It is important that the sensor selected via this menu option corresponds to the sensor that is installed. Incorrect settings here may result in the inability of the instrument to detect gas.

11.2.9 E: 9 – Engineer diagnostics
This feature is a view-only feature. No configuration changes are possible from within this menu.
The information is for use of *ENMET* personnel.'
- From the menu system select menu option: **E:9** and press ENTER.
- Using the NEXT button, display the required setting. The displayed values are as follows:
    1. E:90 – Gas Level
    2. E:93 – Active Sensor A to D counts
- Press MENU to close the menu system

11.2.10 E: 12 – Cross reference
Contact *ENMET* before entering this menu option.
This option is used to allow the user to calibrate the sensor with a commonly available gas (e.g. methane or propane) but use the unit to detect a different gas (e.g. methanol or acetone etc.). This is achieved by adjusting the cross-reference factor per the difference in signal that is detected for the calibration gas compared to the target gas.
- Select menu mode **E:12** and press ENTER.
- Using the UP and DOWN buttons set the required cross-reference factor as required.
- Press ENTER to store the new value, Pressing MENU instead of ENTER aborts the feature.
- Press MENU to return the instrument to its standard mode of operation.
NOTE: the default setting of 1.00 is used – no cross sensitivity to target gas.

11.2.11 E: 13 – Relay 1
The unit is fitted with a relay that is operated in conjunction with the alarm level. The user can select if the relay is normally Energized, E' or normally de-energized, 'd' when the unit is **not** in an alarm condition.
- From the menu system, select menu option: **E:13** and press ENTER.
- The display will show the following:
    - E:r Normally energized, rising alarm
    - d:r Normally de-energized, rising alarm
    - E:F Normally de-energized, falling alarm
    - d:F Normally de-energized, falling alarm
- The mode of operation can be changed by pressing the UP button.
- Press ENTER to accept the new relay mode of operation.

NOTE: Pressing MENU instead of ENTER leaves the unit without change.
- Press MENU to return the instrument to its standard mode of operation.

11.2.12 E:14 – Relay 2
The unit is fitted with a relay that is operated in conjunction with the alarm level. The user can select if the relay is normally Energized, 'E' or normally de-energized, 'd' when the unit is **not** in an alarm condition.
- From the menu system select menu option: **E: 14** and press ENTER.
- The display will show the following:
    - E:r Normally energized, rising alarm
    - d:r Normally de-energized, rising alarm
    - E:F Normally de-energized, falling alarm
    - d:F Normally de-energized, falling alarm
- The mode of operation can be changed by pressing the UP button.
- Press ENTER to accept the new relay mode of operation.

NOTE: Pressing MENU instead of ENTER leaves the unit without change.
- Press MENU to return the instrument to its standard mode of operation.

11.2.13 E: 15 – Alarm Level 1
The gas level that will cause Relay 1 to change state is set via this menu option.
- From the menu system select menu option: **E: 15** and press ENTER.
- Using the UP and DOWN buttons, adjust the displayed reading so that it matches the desired alarm set point.
- Press ENTER to accept the new alarm level.

NOTE: Pressing MENU instead of ENTER aborts the feature.
- Press MENU to return the instrument to its standard mode of operation.

11.2.14 E: 16 – Alarm Level 2
The gas level that will cause Relay 2 to change state is set via this menu option.
- From the menu system select menu option: **E: 16** and press ENTER.
- Using the UP and DOWN buttons, adjust the displayed reading so that it matches the desired alarm set point.
- Press ENTER to accept the new alarm level.

NOTE: Pressing MENU instead of ENTER aborts the feature.
- Press MENU to return the instrument to its standard mode of operation.

11.2.15 E: 19 – Positive Zero Suppression
This option is used to allow the user to suppress small amounts of positive sensor zero drift. The setting can be set between 0 and 10% of the sensor range as set by the FSD value.
- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:19**
- Press ENTER.
- Using the INCREASE and DECREASE buttons, set the required zero suppression value.
- Press ENTER to store the new value.

NOTE: Pressing the MENU button rather than the ENTER button exits without any change.
- Press MENU to close the menu system.

11.2.16 E: 20 – Negative Zero Suppression

This option is used to allow the user to suppress small amounts of negative sensor zero drift. The setting can be set between 0 and 10% of the sensor range as set by the FSD value.

- Press MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:20**
- Press ENTER.
- Using the INCREASE and DECREASE buttons, set the required zero suppression value.
- Press ENTER to store the new value.

NOTE: Pressing the MENU button rather than the ENTER button exits without any change.

- Press MENU to close the menu system.

11.2.17 E: 27 – Hysteresis

This option sets the alarm hysteresis. The relays will chatter if this level is set to 100.
95% is the usual setting for Pellistor sensors.

11.2.18 E: 28 – Firmware update

Do Not Enter this Menu

11.2.19 E: 29 – Relay 3

The unit is fitted with a relay that is operated in conjunction with a fault condition. The user can select if the relay is normally Energized, 'E' or normally de-energized, 'd' when the unit is **not** in a fault condition.

- From the menu system select menu option: **E: 29** and press ENTER.
- The display will show the following:
  - o E:r Normally energized, rising alarm
  - o d:r Normally de-energized, rising alarm
  - o E:F Normally energized, falling alarm
  - o d:F Normally de-energized, falling alarm
- The mode of operation can be changed by pressing the UP button.
- Press ENTER to accept the new relay mode of operation.

NOTE: Pressing MENU instead of ENTER leaves the unit without change.

- Press MENU to return the instrument to its standard mode of operation.

11.2.20 E: 30 – Password

Use this menu option to enable / disable the password feature.
Place the **EX-6100** in the password menu as follows:

- Press the MENU to open the menu system.
- Using the NEXT and PREVIOUS buttons, select menu option: **E:30**
- Press ENTER.
- The display shows either **On** or **OFF**
- Press the UP button to select the desired setting.
- Press ENTER to accept the setting.

NOTE: Pressing MENU instead of ENTER leaves the unit without change.

- Press MENU to return the instrument to its standard mode of operation.

NOTE: If the password is in operation then the user will be prompted with PASS whenever the menu key is pressed. Pressing the MENU key again will result in the restricted user access, i.e. only the zero and span options will be available.
Entering the correct password will give access to the full menu facility.

11.2.21 E: 31 – Warm-up timer

The sensor goes through a stabilization period when power is first applied. This option allows the user to adjust the time that is applied before readings are displayed / transmitted.

- From the menu system select menu option: **E: 31** and press ENTER.
- Using the INCREASE and DECREASE buttons, set the required warm-up time.
- Press ENTER to store the new value.

NOTE: Pressing the MENU button rather than the ENTER button exits without any change. Normally warm time is 45 seconds.

Appendix A
A.1 Analog Output Calibration
The analogue output is that of a current source. In order to calibrate the output, it is necessary to monitor the output signal. This can be performed in one of two ways:

Current measurement:
Connect an ammeter (or multimeter set to measure current in the mA range) in series with the analogue output.

FGD10
Analogue Output
(4 – 20mA)

Control
Unit

Meter range:
0.004A – 0.020A
4mA – 20mA

mA
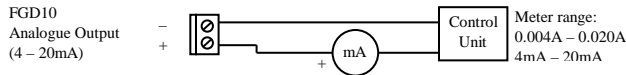
Advantage: Direct measurement of output.
Disadvantage: The analogue output must be disconnected to allow the connection of the meter.

Voltage measurement:
Permanently connect a 10R resistor in series with the analogue output. When calibration is required, connect a voltmeter (or multimeter set to measure voltage in the mV range) across the 10R resistor.

FGD10
Analogue Output
(4 – 20mA)

10R

Control
Unit

Meter range:
0.04V – 0.20V
40mV – 200mV

mV
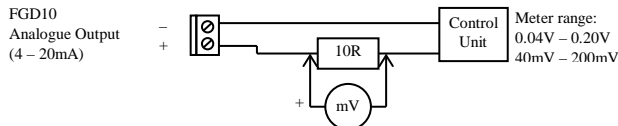
Advantage: No need to disturb wiring between **EX-6100** and control unit.
Disadvantage: Measurement accuracy dependent upon resistor tolerance.

A.1.1 Analogue Output Zero
- Monitor the current sourced from the analogue output of the **EX-6100** using a suitable method.
- From the menu system select menu option: **E: 4** and press ENTER.
- Using the INCREASE and DECREASE buttons; adjust the output to the required level (4mA or 40mV).
- Press ENTER.

NOTE: Pressing the MENU button rather than the ENTER button exits the zero feature without performing the calibration.
- Press the MENU button to close the menu system.

NOTE: The ZERO factor will be displayed momentarily on exit.

A.1.2 Analogue Output Span
Always zero the analogue output prior to performing a span operation.
- From the menu system select menu option: **E: 5** and press ENTER.
- Using the INCREASE and DECREASE buttons; adjust the output to the required level.
- Press ENTER button.

NOTE: Pressing the MENU button rather than the ENTER button exits the span feature without performing the calibration.
- Press the MENU button to close the menu system.

NOTE: The ANALOGUE OUTPUT SPAN factor will be displayed momentarily on exit.

A.2 Error Codes
Not applicable to the Pellistor Catalytic Sensor variant

A.3 Communications Protocol

The communications protocol used by the **EX-6100** is used for communications between devices connected via an RS232 connection at 19200 bauds, 8 data bits 1 stop bit, no parity. This point-to-point, P2P, protocol is a frame-based protocol.

A.3.1 Hardware connections

PC 9-way 'D' connector	EX-6100 connection
2	Tx
3	Rx
5	0V

PC 25-way 'D' connector	EX-6100 connection
3	Tx
2	Rx
7	0V

A.3.2 Control Byte Constants

The following control byte constants are used in the P2P protocol.

Read,	RD	= 0x13	(00010011)
Data Link Escape,	DLE	= 0x10	(00010000)
Write,	WR	= 0x15	(00010101)
Acknowledge,	ACK	= 0x16	(00010110)
Negative Acknowledge,	NAK	= 0x19	(00011001)
Single Data Frame,	DAT	= 0x1A	(00011010)
End of Frame,	EOF	= 0x1F	(00011111)
Write Password 1,	WP1	= 0xE5	(11100101)
Write Password 2,	WP2	= 0xA2	(10100010)

A.4 Frame Structure

The start of a frame is indicated by a DLE byte followed by the type of frame to follow (RD, WR, ACK, NAK, DAT). The end of frame is indicated by a DLE byte followed by an EOF byte.

NOTE: Each of the constants has bit 4 set and so is slip-resistant (i.e. if shifted this bit will be out of position). The values have a Hamming Distance of 2 (each code is at least 2 bits different from every other code).

Any DLE bytes that occur between a frame's start and end are prefixed with another DLE (*byte-stuffing*).
Following the EOF is a 16-bit checksum of the entire frame, each byte is added to produce the checksum.

A.4.1 Variables

Each piece of accessible data on a device is referred to as a *Variable*. Each variable is referenced by a *Variable ID*. A variable ID may be any number of bytes long.
The available Variables and their corresponding Variable IDs depend on the type of device, but here are a few examples for the **EX-6100**:

General Configuration	0x00
Live Data	0x01
Zero Sensor	0x02
Span Sensor	0x03
Version Information	0x04
Firmware Update	0x05

The structure of the data returned in each variable usually depends both on the type of device and the version of firmware running on the device.
Refer to device documentation for more information.

A.4.2 Reading a Variable

Send a read frame with the Variable ID to be read:

DLE	RD	var-id	DLE	EOF	Csum hi	Csum lo

Byte stuffing

Device response on success, where requested variable data < 255 bytes:

DLE	DAT	data-len	data	DLE	EOF	Csum hi	Csum lo

Byte stuffing

Device response on failure:

DLE	NAK	reason

Where 'reason' is a single byte failure code, the meaning of which depends on the device type, i.e.
Reason = 1, Not Readable,
Reason = 2, Read Out of Range

A.4.3 Read example - read live data

The following example is based on V4.x.xE where the data is either byte or integer types only.
Send the following bytes:

DLE, RD, Variable ID, DLE, EOF, Checksum High byte, Checksum low byte i.e.

0x10, 0x13, 0x01, 0x10, 0x1F, 0x00, 0x53

Device response on success:

DLE, DAT, Data length, Data, DLE, EOF, Checksum High byte, Checksum low byte, i.e.

0x10	DLE
0x1A	DAT
0x0D	Data length
0x03	Version
0x01	Display mode
0x07	Sensor Type
0x00, 0x00	Gas reading (signed integer x 100) = 0
0xAE, 0x0B	Current sensor temperature (signed integer x 100) = 29.9
0x92, 0x08	Active sensor signal (unsigned integer) = 2194
0xD7, 0x04	Reference sensor signal (unsigned integer) = 1239
0x10	DLE
0x1F	EOF
0x02	Checksum high byte
0x9F	Checksum low byte

A.4.4 Writing a Variable

Send a write frame with the Variable ID to be written:

LE	WR	WP1	WP2	var-id	DLE	EOF	Csum hi	Csum lo

Byte stuffing

Device response on success:

DLE	ACK

Where data to write is < 255 bytes, send a DAT frame:

DLE	DAT	data-len	data	DLE	EOF	Csum hi	Csum lo

Byte stuffing

Device response on write success:

DLE	ACK

Device response on write failure:

DLE	NAK	reason

Where 'reason' is a single byte failure code, the meaning of which depends on the device type, i.e.
Reason = 1, Not Writable
Reason = 2, Write Out of Range
Reason = 3, Bad Data Length
Reason = 4, Incorrect Version

Notes:

12.0 Terms and Conditions

12.1 Ordering Information

Address orders to:

ENMET
Attention: Customer Service Department
680 Fairfield Court
Ann Arbor, MI 48108

Email Orders: orderentry@enmet.com
Phone: 734-761-1270   Fax: 734-761-3220
You may also contact our customer service department by email info@enmet.com. MINIMUM ORDER IS $50.00.

12.2   Delivery

Unless Seller otherwise specifies, delivery will be made: FOB Ann Arbor, MI and/or FOB Bowling Green, KY. Title and risk of loss shall pass to Buyer at that point. Shipping and handling charges will be Prepaid and Added to Buyer's invoice. Buyer may request shipping be charged to their own account with a preferred carrier. Seller shall have the right to choose means of transportation and to route shipment when specific instructions are not included with Buyer's order. Seller agrees to deliver the goods and services, within the time, in accordance with specifications, at the prices specified on the face hereof. Buyer's orders to this quotation are not subject to cancellation or deferment of delivery without indemnification of loss to the Seller resulting there from. Seller shall not be liable to Buyer for any loss or damage sustained on account of this delay or nonperformance due to causes beyond Seller's control and without his fault or negligence. Where performance of the terms here is contingent upon timely delivery of goods or services by the Buyer and such delivery is in default, Seller shall be indemnified for any damage or loss resulting there from, and/or by extension of Seller's delivery commitment, as applicable.

12.3   Payment Terms

Payment Terms are Net 30 Days from the date of shipment from Seller unless otherwise noted. All shipping and handling costs will be charged to Buyer on a Prepaid and Add basis. Buyer has the option of paying for shipping by charging its own account with a carrier

12.4   Warranty Information and Guidelines

The Seller warrants new instruments to be free from defects in workmanship and material under normal use for a period of one year from date of shipment. The warrant covers both parts and labor excluding calibration and expendable parts such as filters, detector tubes, batteries, etc. If the inspection by the Seller confirms that the product is defective, it will be repaired or replaced at no charge, within the stated limitations, and returned prepaid to any location in the United States. The Seller shall not be liable for any loss or damage caused by the improper use or installation of the product. The Buyer indemnifies and saves harmless the Seller with respect to any loss or damages that may arise through the use by the Buyer or others of this equipment. This warranty is expressly given in lieu of all other warranties, either expressed, implied or statutory, including that of merchantability, and all other obligations, or liabilities of ENMET, LLC for damages arising out of or in connection with the use or repair or performance of the product. In no event shall ENMET, LLC, be liable for any indirect, incidental, special or consequential damages or for any delay in the performance by ENMET, LLC, which may arise in connection with this equipment. ENMET neither assumes nor authorizes any representatives or other persons to assume for it any obligation or liability other than that which is set forth herein. Buyer agrees to indemnify and save harmless Seller for any damage or loss from lawsuits against Seller by reason of manufacture of sale of materials, parts, or use of processes resulting from Buyer's design specifications. Any patent, design, pattern, tool, die, jig, fixture, drawing, test equipment, or process furnished by Seller; whether possessed by the Seller before the date of this quotation, or devised or acquired by Seller during performance of the terms of this quotation, shall remain the property of the Seller except by specific stipulation on the face hereof. Seller reserves the right, without liability, for damage or loss, to destroy Buyer's drawings, specifications, patterns and special tools supplied by Buyer for performance of the terms on the face hereof, unless Buyer gives notice of the disposition of such items.

12.5   Return Policy

All returns for credit must be approved in advance by ENMET, LLC. Such returns are subject to a minimum $50.00 or 20% restocking charge, whichever is greater. **Approval of equipment for return is totally at the discretion of ENMET, LLC.** All requests for return/exchange must be made no later 30 days of the original shipping date from ENMET. The actual amount of any resulting credit will not be determined prior to a complete inspection of the equipment by ENMET. Calibration gas cylinders cannot be returned or restocked.

13.0   Instructions for Returning an Instrument for Service

Contact the ENMET Service Department for all service requests.
Phone: 734-761-1270
Email: repair@enmet.com

Fill out the "Service Request Form" found at the end of this manual and return with your instrument for all needs. Please send your instrument for service to the site in which the product was purchased. A new "Service Request Form" may be requested if the one found in the manual is not available. All instruments should be shipped prepaid to ENMET.
Address for Service:

Michigan Location:

ENMET
Attention: Service Department
680 Fairfield Court
Ann Arbor, MI 48108

Kentucky Location:

ENMET
62 Corporate Court
Bowling Green, KY 42103

Providing the "Service Request Form" assists in the expedient service and return of your unit and failure
to provide this information can result in processing delays. *ENMET* charges a one hour minimum billing for all approved repairs with additional time billed to the closest tenth of an hour. All instruments sent to *ENMET* are subject to a minimum evaluation fee, even if returned unrepaired. Unclaimed instruments that *ENMET* has received without appropriate paperwork or attempts to advise repair costs that have been unanswered after a period of 60 days may, be disposed of or returned unrepaired COD and the customer will be expected to pay the evaluation fee. Serviced instruments are returned by UPS/FedEx Ground and are not insured unless otherwise specified. If expedited shipping methods or insurance is required, it must be stated in your paperwork.

NOTE: *Warranty of customer installed components.*

For Warranty Repairs, please reference *ENMET's* "Warranty Information and Guidelines" (found earlier in this section).

ENMET

Phone: 734.761.1270
Fax: 734.761.3220

Service Request Form

Product Name or Number:
Product Serial Number:

Describe Problem or Needed Service:

Warranty Claim? ☐ Yes ☐ No

CUSTOMER INFORMATION

Billing Address:

Shipping Address:

Contact Name: _____ **Phone #:** _____

Email: _____ **Fax #:** _____

PO/Reference #: _____

PAYMENT METHOD

☐ COD   ☐ VISA/MasterCard   ☐ American Express

_____ _____ _____
Card Number   Exp. Date   Security Code:

Name as it Appears on Card: _____

RETURN SHIPPING METHOD

☐ UPS Ground | ☐ UPS 3 Day Select | ☐ UPS Next Day Air | ☐ UPS ND Air Saver | ☐ UPS 2 Day Air

UPS Account #: _____

☐ FedEx Ground | ☐ FedEx Air Express Saver | ☐ FedEx Air Overnight Std. | ☐ FedEx Air 2 Day | ☐ FedEx Air Overnight P-1

FedEx Account #: _____

Insure Shipment: ☐ Yes ☐ No

Insurance Amount: $ _____