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**EX-6120 SERIES, COMBUSTIBLE GAS
EX-6165 SERIES, CARBON DIOXIDE
SENSOR/TRANSMITTER
INFRARED (IR)
MANUAL**

Manual Part Number
80003-123
April 2013

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1.0 Introduction

The **ENMET EX-6120, 6165 SERIES IR** 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 Class I, Division 1, Groups A, B, C and D

Harmonised 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  II 2 G Ex d IIC T4 (Ta = -20°C + 60°C)	ATEX Quality Assurance Notification Number: 2056

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

1.1 Unpack

Unpack the **EX-6120, 6165 SERIES IR** 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 our company 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. 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 Corporation

680 Fairfield Court
 Ann Arbor, MI 48108
 734-761-1270 734-761-3220 Fax

1.2 Check Order

Check the contents of the shipment against the purchase order. Verify that the **EX-6120, 6165 SERIES IR** is received as ordered. [Each **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR** is serialized. These numbers are on tags on the equipment and are on record in an **ENMET** database.

2.0 Features of the EX-6120, 6165 SERIES IR

The **EX-6120, 6165 SERIES IR** 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 or not the relays are fitted as shown below:

IMPORTANT – When used in environments where the instrument is exposed to salt spray or diesel it is recommended that the EX-6120, 6165 SERIES IR is always fitted with its protective weather guard. The weather guard is attached with tamperproof screws to ensure that it is not inadvertently removed.

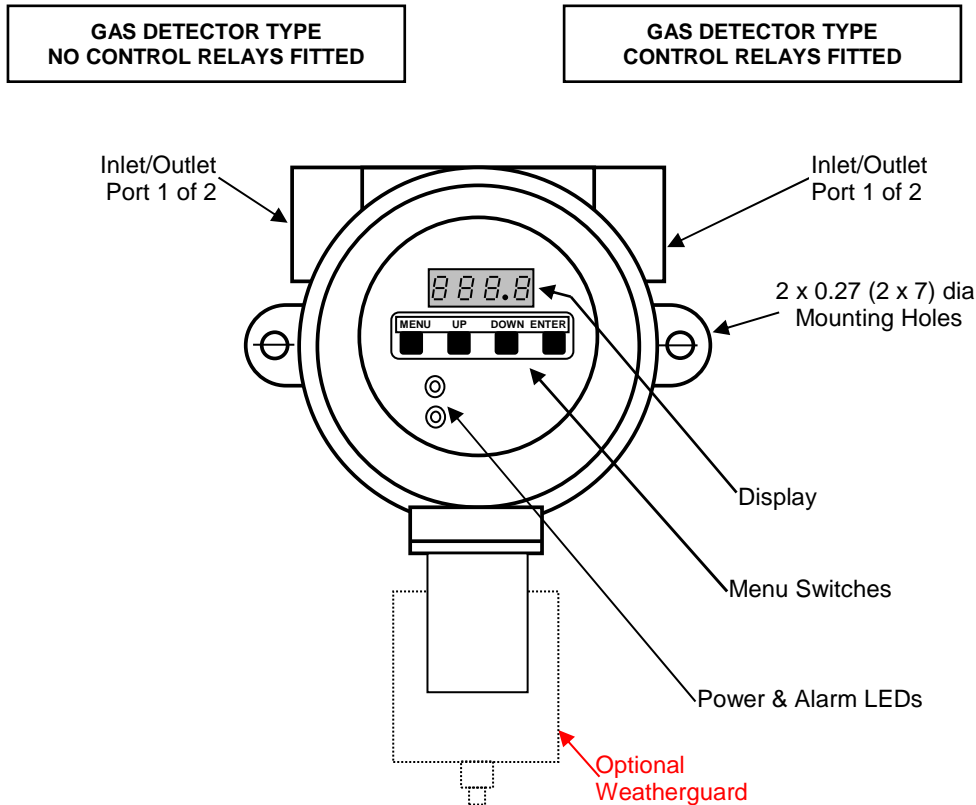


Figure 1: EX-6120, 6165 SERIES IR Features

3.0 Installation of the EX-6120, 6165 SERIES IR

CAUTION: Area must be declassified during installation.

The **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR** sensor/transmitter is in an enclosure rated for use in area listed below:

Certificate Numbers	IECEX SIR08.0009X, Code EX d IIC SIRA 08atex1031x, Code EX d IIC
Standards	IEC 60079-0 : 2004 (Edition 4) EN 60079-0 : 2006 IEC 60079-1 : 2007-4 (Edition 6) EN 60079-1 : 2007
Temperature Codes	T4 (Ta-20 to +60 deg C)
Zones	1 & 2
Equivalent Rating	Class I, Division 1, Group A, B, D & D

Appropriate wiring, conduit and fittings are required for proper installation in an 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-6120, 6165 SERIES IR Enclosure

Mount the enclosure, using the two mounting holes provided see **Figure 2**. Pay particular 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.

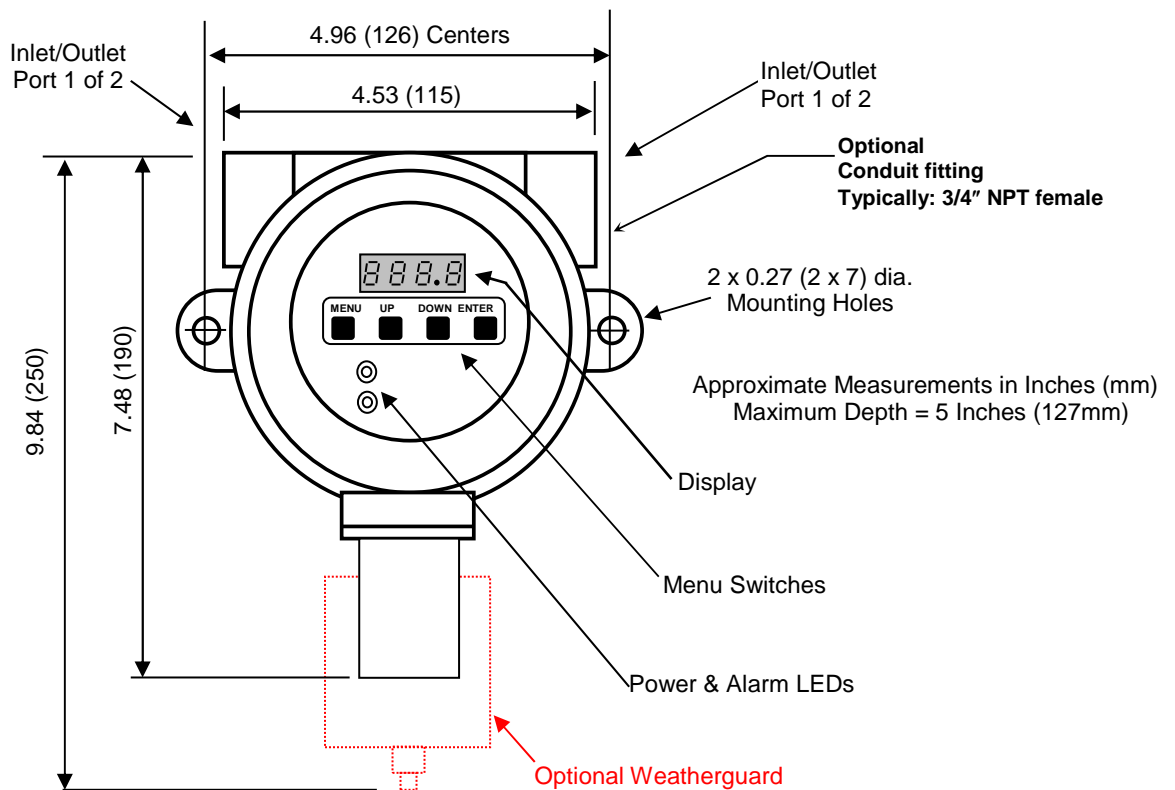


Figure 2: EX-6120, 6165 SERIES IR Mounting

3.2 Wiring the EX-6120, 6165 SERIES IR to a Control Unit

CAUTION: Area must be declassified during installation.

If the **EX-6120, 6165 SERIES IR** 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.

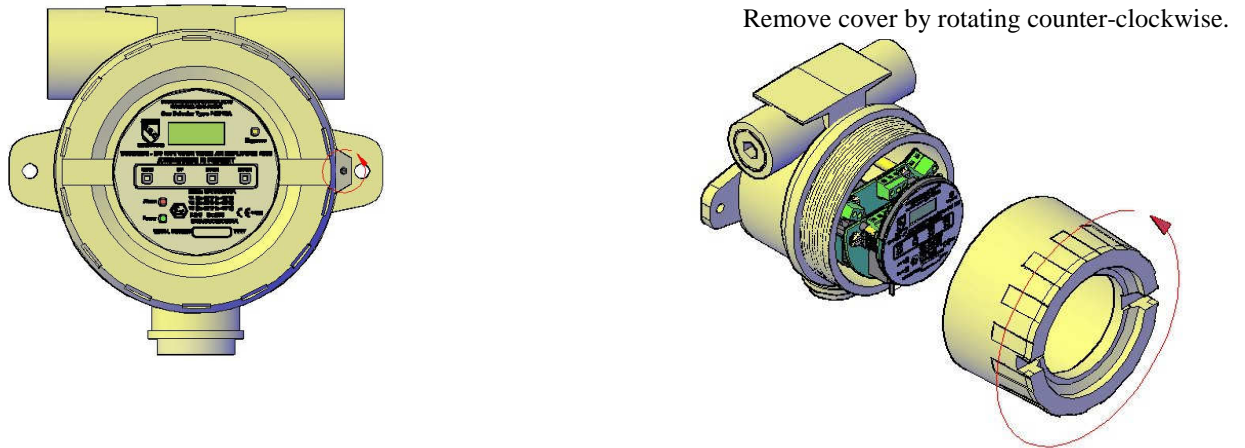


Figure3: Access to EX-6120, 6165 SERIES IR for Connection to a Control Unit

The cable entry threads are 20mm, 1/2” or 3/4” NPT female.

The **EX-6120, 6165 SERIES IR** 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.

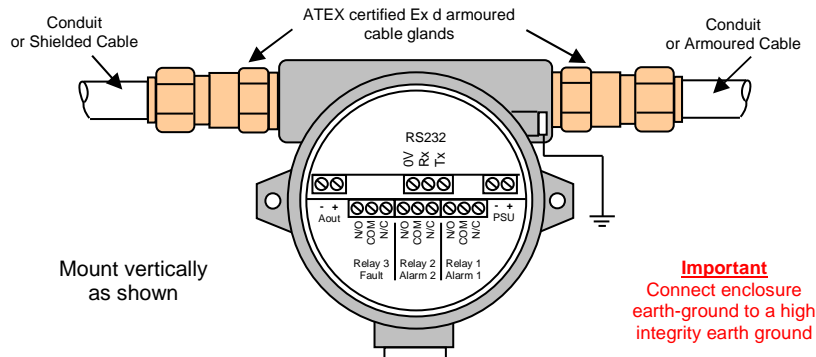


Figure 4: Armored Cable Gland Installation

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.

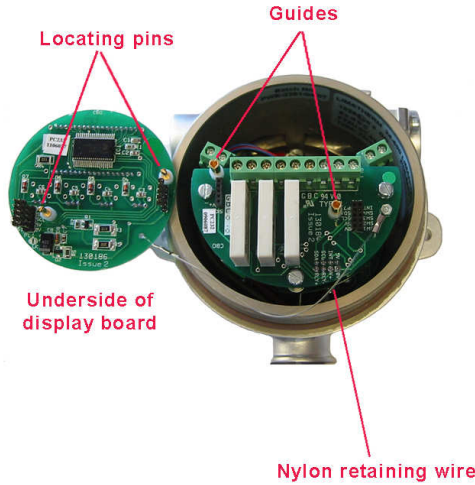


Figure 5: Unplugging the Display Board for Connection Purposes

3.2 Power Supply

The **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR**.

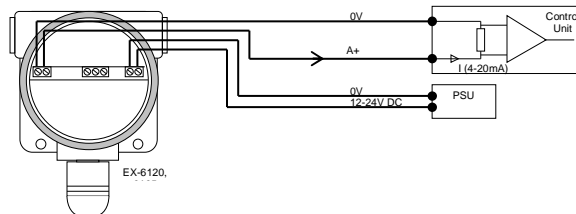


Figure 6: Analogue Output

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** Corporation for details.

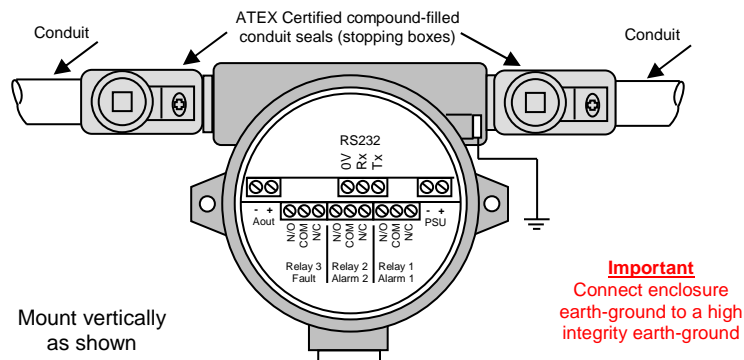


Figure 7: EEx d Conduit Installation

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 particular 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.

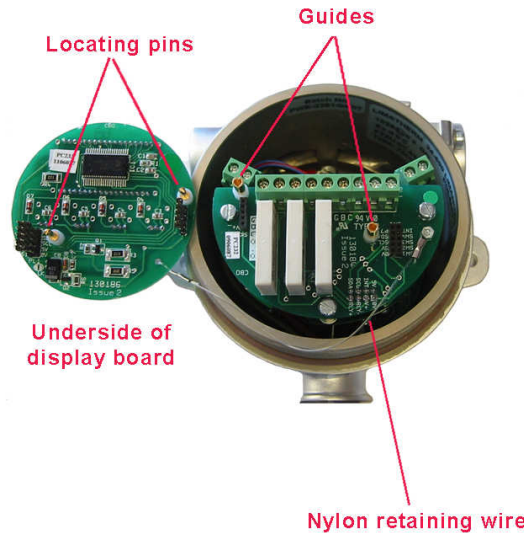


Figure 8: Replacing the Display Board

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-6120, 6165 SERIES IR**, an initialization procedure is performed a example follows:

All segments on the LCD are shown	8.8:8.8
The software version is displayed	1.0.5
The manufacturer code is displayed	SSCL
The sensor type is displayed	Ch4L
Warm up count down	E 50

The detected gas level present is displayed and the **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR 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-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR**.

1. Before application of the test gas, check that the **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR** 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.

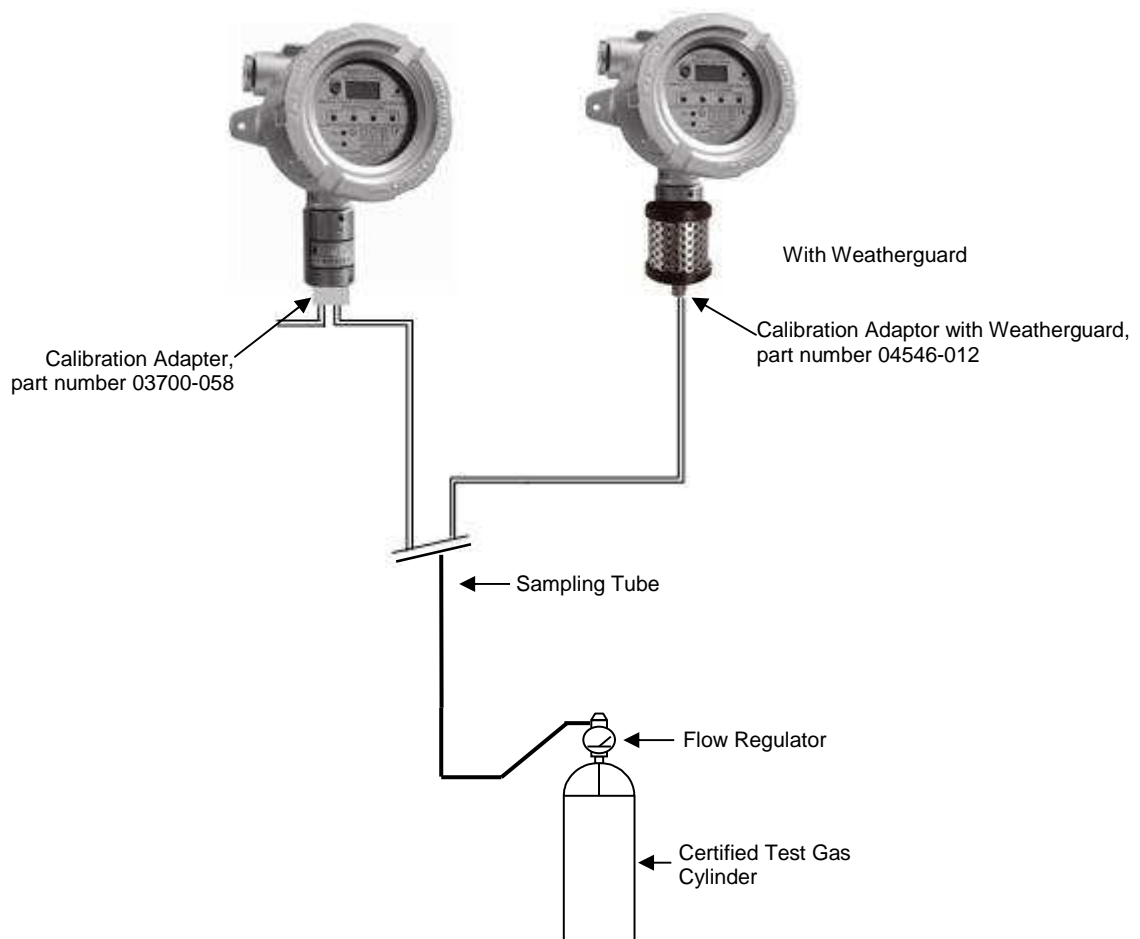


Figure 9: Applying Test Gas to EX-6120, 6165 SERIES IR

3.8.1 Suggested calibration Test gas levels.

Hydrocarbon sensor:

Zero contaminant free air.

Span 50% of the target gas (for 0 – 100% LEL range).

Carbon Dioxide sensor:

Zero Nitrogen.

Span Approximately 50% of Range.

4.0 Operation

The **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR GAS DETECTOR

EX-6120, 6165 SERIES IR GAS DETECTOR FITTED WITH PROTECTIVE WEATHERGUARD



Figure 10: Operation of Magnetic Switches

The menu system featured within the **EX-6120, 6165 SERIES IR** allows all calibration and configuration activities to be performed.

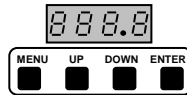
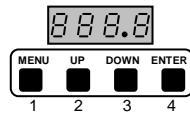


Table 1: Magnetic Keypad Functionality

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



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**, Tap the magnet again on **menu** display will show **E 1**.

Tap the magnet over the **enter** switch the display will then alternate **E: 01** Wait approximately 1 minute and **Tap enter**.

- 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.

Note: 1. Carbon Dioxide sensors, except for high % range, should be zeroed in air due to the background levels of CO₂ present. These sensors are best zeroed while being exposed to 100% nitrogen.

2. Where a purging gas has to be applied, use a flow rate of between 0.5 and 1.0 L/min. Allow sufficient time for the sensor to respond.

5.1.2 Sensor Span

Tap the magnet over the **menu** switch, the display will change to **Pass**, Tap the magnet again on **menu** 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).

Caution: Be sure that the calibration gas you use matches the type and concentration of calibration gas display on the **EX-6120, 6165 SERIES IR**

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.

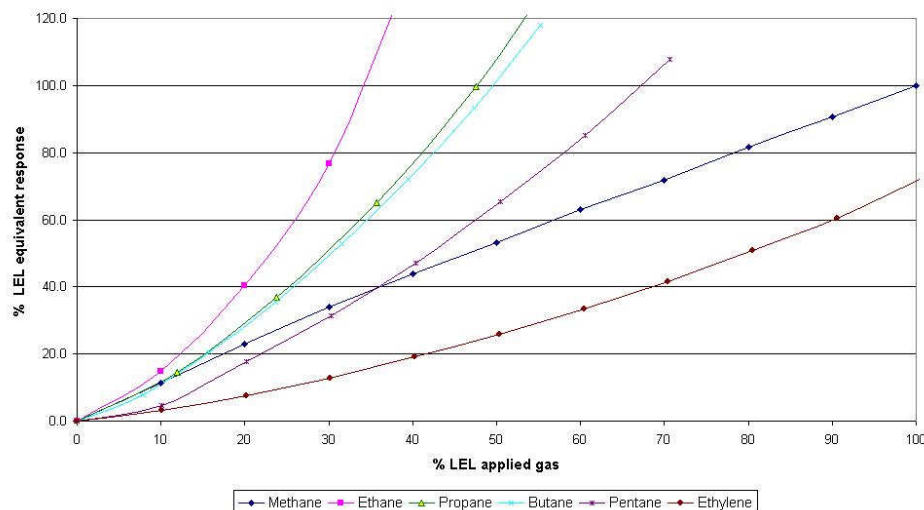
Tap the magnet over the **enter** switch, the display will flash **E: 2**

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 **enter** switch. The display will show ---- if the calibration was successful.

Tap the **menu** switch to exit and remove the calibration gas.

Table 2: EX-6120, 6165 SERIES IR Relative response curves based on a Methane Calibration



See Accessories Section 10 for **ENMET** Gas Cylinder part numbers.

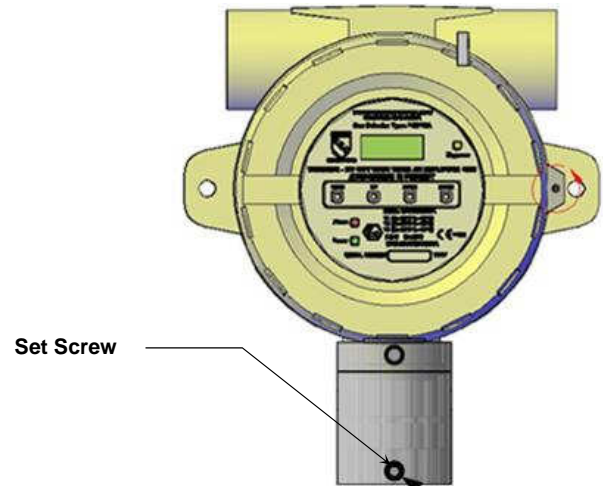
6 Sensor Replacement

WARNING: Power must be removed from the EX-6120, 6165 SERIES IR before this or any internal procedure. Failure to do so may cause damage to equipment, bodily injury or death.

6.1 Inferred Sensor

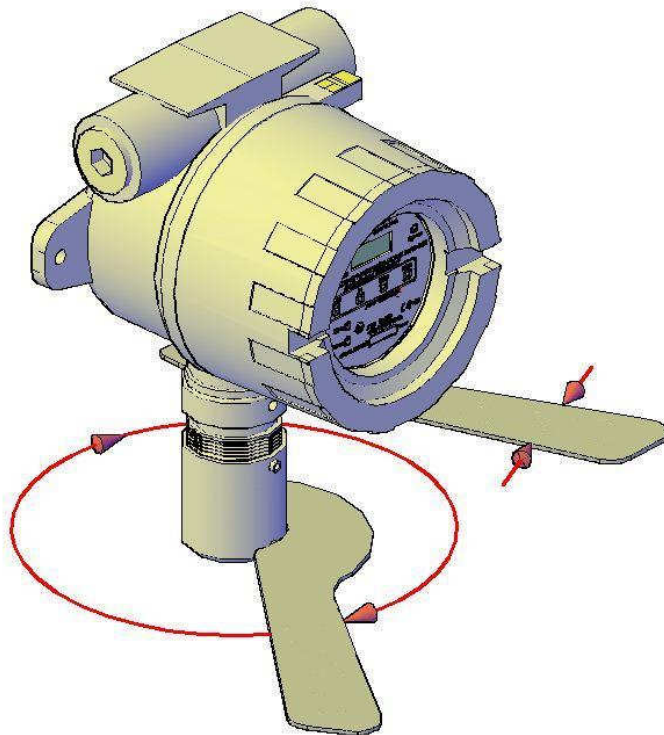
Step 1

Remove the set screw counter-clockwise.



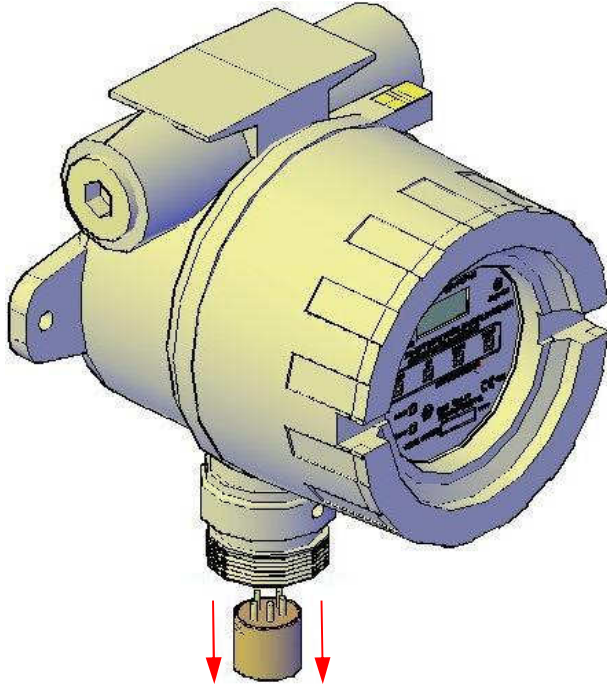
Step 2

Turn cover securing stud counter-clockwise to allow cover to open.

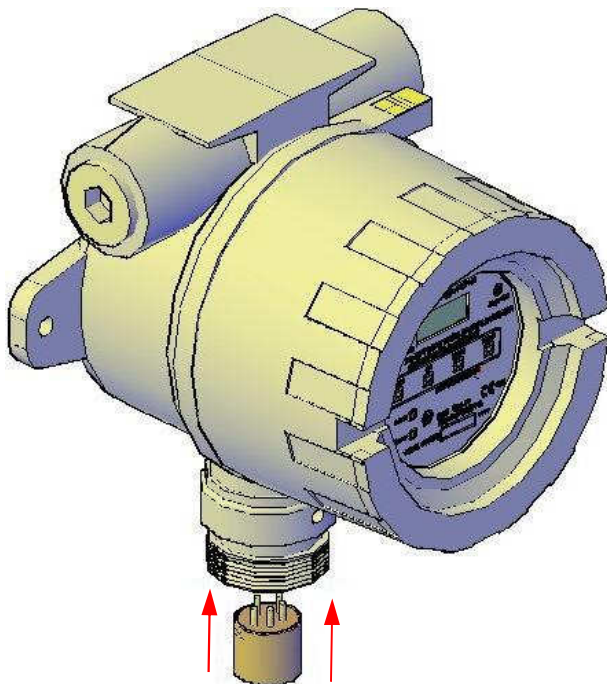


Step 3

Remove the sensor by pulling downwards.

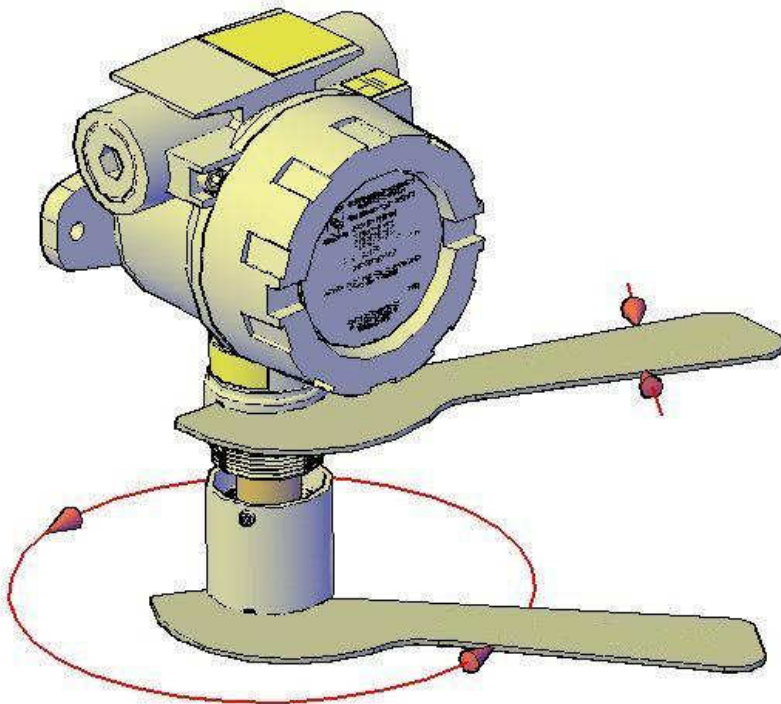
**Step 4**

Carefully locate the pins in the sockets then push the new sensor upwards.



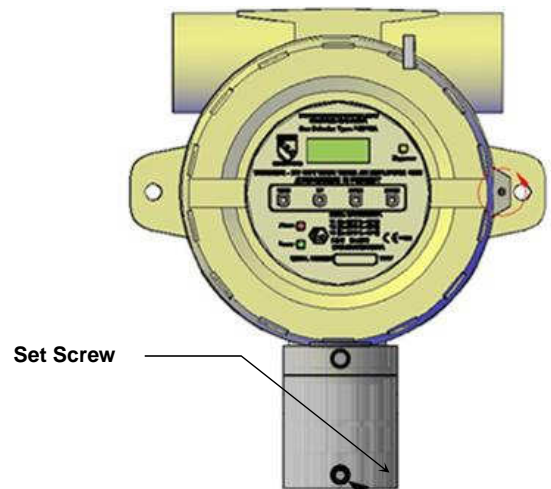
Step 5

Replace the sensor housing by rotating in a clockwise direction until fully tightened.



Step 6

Rotate the set screw in a clockwise direction until fully tightened.



7 Fuses

A 1Amp anti-surge fuse, housed within a surface mounted holder, is located within the **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR**.
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'

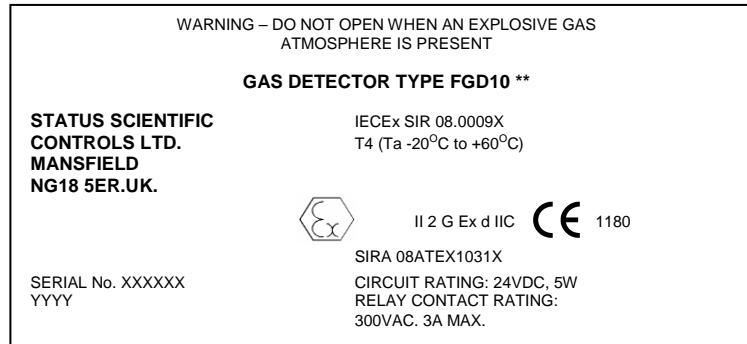
Assembly is the reverse of the above procedure.

8 Specifications

Materials	Instrument Body – Aluminium Pressure Die Casting : Sensor Housing – Stainless Steel Grade 303 Weather guard – Stainless Steel Grade 304 & Nylon 66
Cable entries	2 x 20 mm, or : 2 x ½ NPT, or 2 x ¼ NPT
Weights	EX-6120, 6165 SERIES IR (excluding weather guard) – 2.0 Kg (3.3 lb) : Magnetic Pen – 60 grams Weather guard – 200 grams
Gas type	: Infrared – (Note: IR Sensors have not response to Hydrogen)
Input voltage	: 8 to 24 volts dc
Input power	: 5 Watts maximum
Internal fuse	: 1 Amp antisurge 'Nanofuse'
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 baud
Sensor type	: NDIR Infrared
Measurement range	Hydrocarbon Sensor (Methane Calibration) : 0 – 100% LEL (5% vol. CH ₄) or 0 – 100% volume CH ₄ Carbon Dioxide Sensor Ranges form 0-1000ppm up to 0-100% Volume CO ₂
Response time	: Typically T ₉₀ < 30 seconds (CH ₄)
Measurement resolution	: 1% LEL or 1% volume (CH ₄)
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 °C
Humidity range	: 0 to 95% RH non-condensing
Operating pressure	: Atmospheric + or - 10%
Performance standards	: EN 60079-29-1:2007

9 Certification

The **EX-6120, 6165 SERIES IR (FGD10 Series)** of Gas Detectors are ATEX and IECEx certified for use in potentially explosive atmospheres and is marked as follows:-



** 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 EX-6120, 6165 SERIES IR Accessories and Calibration Gas

EX-6120, 6165 SERIES IR partial list of typical accessories and calibration gas **ENMET** part number

Description of Accessory	Part Number
Sensor	Contact ENMET Corp
Calibration Adaptor(for sensors without weather guard)	03700-058
Regulator Assembly	02506-004
Calibration Gas, 50%LEL Methane (for 0 – 100% LEL CH4)	03220-050
Calibration Gas, 2000ppm CO2 (for 0 – 500ppm CO2)	03220-2000
Weather Guard	04546-012
Maintenance Tool, Sensor	73413-210

11 Menu Mode

The **EX-6120, 6165 SERIES IR** 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.

To enter the menu mode Sequence Tap:

Menu, Up, Down, Enter, Up, Enter, Up, Menu

If no inputs (taps) the **EX-6120, 6165 SERIES IR** returns to operational mode.

Several calibration modes exist in the **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR' menu system:

Table 3: EX-6120, 6165 SERIES IR 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 : 6 – Decimal Places	11.2.6
E : 7 – Firmware Version	11.2.7
E : 8 – Restore	11.2.8
E : 9 – Engineer Diagnostics	11.2.9
❶ E : 12 – Cross Reference	11.2.10
E : 13 – Relay 1	11.2.11
E : 14 – Relay 2	11.2.12
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 : 29 – Relay 3	11.2.19
E : 30 – Password	11.2.20
E : 31 – Warm-Up Timer	11.2.21

❶ Contact ENMET Corporation 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 that 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-6120, 6165 SERIES IR Sensor Selections

OPTION	TYPE	RANGE	COMMENTS
CH4L	Infrared	0-100%LEL	Methane
CH4H	Infrared	0-100% v/v	Methane
HC	Infrared	0-100%LEL	General hydro carbons
HHC	Infrared	0-100% v/v	General hydro carbons
CO2P	Infrared	0-5000 ppm	Carbon Dioxide
CO2L	Infrared	0-5% v/v	Carbon Dioxide
CO2H	Infrared	0-100% v/v	Carbon Dioxide

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** Corporation 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:
E : 90 Gas level
E : 93 Active sensor A to D counts
- Press MENU to close the menu system.

11.2.10 E : 12 – Cross reference

Contact **ENMET** Corporation 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 according to 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.

Contact **ENMET** Corporation for details.

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 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 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:
 - E:r Normally energized, rising alarm
 - d:r Normally de-energized, rising alarm
 - E:F Normally 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.

11.2.20 E : 30 – Password

Use this menu option to enable / disable the password feature.

Place the **EX-6120, 6165 SERIES IR** 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 when ever 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.

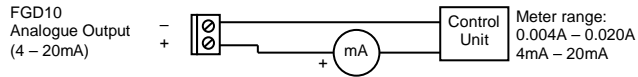
Appendix A

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.



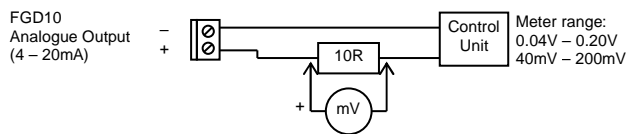
Advantage: Direct measurement of output.

Disadvantage: The analogue output has to 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.



Advantage: No need to disturb wiring between **EX-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR** 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-6120, 6165 SERIES IR** is used for communications between devices connected via an RS232 connection at 19200 baud, 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-6120, 6165 SERIES IR connection
2	Tx
3	Rx
5	0V

PC 25-way 'D' connector	EX-6120, 6165 SERIES IR 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-6120, 6165 SERIES IR**:

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, NotReadable,

Reason = 2, ReadOutOfRange

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:

DLE	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, NotWritable

Reason = 2, WriteOutOfRange

Reason = 3, BadDataLength

Reason = 4, IncorrectVersion

WARRANTY

ENMET 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 from **ENMET**. The warranty covers both parts and labor excluding instrument calibration and expendable parts such as calibration gas, filters, batteries, etc... Equipment believed to be defective should be returned to **ENMET** within the warranty period (transportation prepaid) for inspection. If the evaluation by **ENMET** 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 by the most economical means, e.g. Surface UPS/FedEx Ground. If an expedient means of transportation is requested during the warranty period, the customer is responsible for the difference between the most economical means and the expedient mode. **ENMET** shall not be liable for any loss or damage caused by the improper use of the product. The purchaser indemnifies and saves harmless the company with respect to any loss or damages that may arise through the use by the purchaser or others of this equipment.

This warranty is expressly given in lieu of all other warranties, either expressed or implied, including that of merchantability, and all other obligations or liabilities of **ENMET** which may arise in connection with this equipment. **ENMET** neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than that which is set forth herein.

NOTE: When returning an instrument to the factory for service:

- Be sure to include paperwork.
- A purchase order, return address and telephone number will assist in the expedient repair and return of your unit.
- Include any specific instructions.
- For warranty service, include date of purchase
- If you require an estimate, please contact **ENMET** Corporation.

There are Return for Repair Instructions and Form on the last pages of this manual. This Form can be copied or used as needed.

Manual Part Number
80003-123
April, 2013

Notes:



PO Box 979
680 Fairfield Court
Ann Arbor, Michigan 48106-0979
734.761.1270 Fax 734.761.3220

Returning an Instrument for Repair

ENMET instruments may be returned to the factory or any one of our Field Service Centers for regular repair service or calibration. The **ENMET** Repair Department and Field Service Centers also perform warranty service work.

When returning an instrument to the factory or service center for service, paperwork must be included which contains the following information:

- A purchase order number or reference number.
- A contact name with return address, telephone and fax numbers
- Specific instructions regarding desired service or description of the problems being encountered.
- Date of original purchase and copy of packing slip or invoice for warranty consideration.
- If a price estimate is required, please note it accordingly *and be sure to include a **fax number***.

Providing the above information assists in the expedient repair and return of your unit.

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 with the evaluation fee.

Service centers may have different rates or terms. Be sure to contact them for this information.

Repaired 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.

If a component is purchased and installed in the field, and fails within the warranty term, it can be returned to **ENMET** and will be replaced, free of charge, per **ENMET's** returned goods procedure.

If the entire instrument is returned to **ENMET** Corporation with the defective item installed, the item will be replaced at no cost, but the instrument will be subject to labor charges at half of the standard rate.



Repair Return Form

Mailing Address:

ENMET Corporation
PO Box 979
Ann Arbor, Michigan 48106

Shipping Address:

ENMET Corporation
Attn: Repair Department
680 Fairfield Court
Ann Arbor, Michigan 48108

Phone Number: 734.761.1270
FAX Number: 734.761.3220

Your Mailing Address:

Your Shipping Address:

Contact Name: _____ Your Phone: _____
Your PO/Reference Number: _____ Your FAX: _____

Payment Terms: **COD**

(Check one) **VISA / MasterCard** _____
Card number ExpirationCard Code
 American Express _____
Card number ExpirationCard Code

Name as it appears on the credit card _____

Return Shipping Method:

- UPS: Ground 3 Day Select Next Day Air ND Air Saver 2-Day Air
- UPS Account number: _____
- Federal Express: Ground Express Saver P-1 Standard 2-Day Air
- FedEx Account number: _____

Would you like ENMET to insure the return shipment?

No Yes **Insurance Amount:** \$ _____