HLM-1000-EX
Combustible Gas Transmitter

User Manual

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Combustible Gas Transmitter

for Hazardous Locations Use

MODEL HLM-1000-EX
LEL MONITOR

THE SYSTEM

The CSA approved HLM-1000 Combustible Detector Head is used in the detection of combustible gases. Its modern circuitry and reliable gas sensing element provide all that is required to allow the standard linear 4-20mA signal to be directly interfaced to any control unit capable of using this signal. The simplicity of installation, operation, durability of construction and the low cost make the HLM-1000 ideal for any new or retrofit applications.

ORDER N°	E90524
APPROVALS	CSA APPROVED FILE #LR60959
INPUT VOLTAGE	NOMINAL 24 VDC @ 0.150 AMPS MINIMUM 12 VDC @ 0.225 AMPS MAXIMUM 30 VDC @ 0.125 AMPS
OUTPUT SIGNAL	4-20mA (NON-LATCHING, NON-ISOLATED)
ACCURACY	5% OF READING
REPEATABILITY	2% OF READING
DRIFT	LESS THAN 3% PER MONTH
OPERATING TEMPERATURE	-40°C TO +75°C
HUMIDITY RANGE	0 - 99% NON-CONDENSING
PRESSURE LIMITS	600 - 900 MM HG
VELOCITY LIMITS	0 - 1000 FT/M
MINIMUM OXYGEN CONTENT **	10% VOLUME

1. USE 3 CONDUCTOR SHIELDED WIRING IN CONDUIT
2. WIRE LOOP RESISTANCE UP TO 8 OHMS MAY BE USED. THIS APPLIES TO THE CURRENT CARRYING CONDUCTORS, TERMINALS 24 VDC AND COMMON. THE SIGNAL TERMINAL (F.B.) CAN BE CONNECTED USING RESISTANCE UP TO 1000 OHMS.

** ALL CATALYTIC COMBUSTIBLE GAS SENSORS REQUIRE A CERTAIN AMOUNT OF OXYGEN

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1. SPECIFICATIONS

- INPUT VOLTAGE: NOMINAL 24 VDC @ 0.150 AMPS
MINIMUM 12 VDC @ 0.225 AMPS
MAXIMUM 30 VDC @ 0.125 AMPS
- OUTPUT SIGNAL: 4-20 mA (NON-LATCHING)
- ACCURACY: ± 5% OF FULL SCALE
- REPEATABLILITY: ± 2% OF FULL SCALE
- DRIFT: LESS THAN 3% PER MONTH
- OPERATING TEMPERATURE: -40°C TO +75°C
- HUMIDITY RANGE: 0-99% NON-CONDENSING
- PRESSURE LIMITS: 600 – 900 MM HG
- VELOCITY LIMITS: 0 –1000 FT/M
- MINIMUM OXYGEN CONTENT*: 10% VOLUME
- WIRING REQUIREMENTS:

  1. SHIELDING WIRING IN CONDUIT
  2. WIRE LOOP RESISTANCE UP TO 8 OHMS MAY BE USED. THIS APPLIES TO THE CURRENT CARRYING CONDUCTORS, TERMINALS 24 VDC AND COMMON. THE SIGNAL TERMINAL (F.B.) CAN BE CONNECTED USING RESISTANCE UP TO 1000 OHMS.

*ALL CATALYTIC COMBUSTIBLE GAS SENSORS REQUIRE A CERTAIN AMOUNT OF OXYGEN TO FULLY CATALYZE ANY COMBUSTIBLE GAS PRESENT IN AN AIR SAMPLE AND PRODUCE AN ACCURATE OUTPUT.

2. GENERAL DESCRIPTION

The Model HLM-1000-EX Combustibles Detector Head is used in the detection of Combustible Gases in a Class I, Division 1, Groups B, C and D Hazardous Location.

Its modern circuitry and reliable gas sensing element provide all that is needed to allow it's standard linear 4-20mA signal to be directly interfaced to any Control Unit capable of using this signal. Also the simplicity of installation, operation, durability of construction and low cost make it attractive to the user.

3. DETAILED DESCRIPTION

The Combustible Detector Head is constructed of 3 main sections: Explosion-Proof Enclosure, Combustible Gas Sensor and Signal Transmitter – (See Figure A).

A. EXPLOSION PROOF ENCLOSURE

The enclosure is rated for Class I, Division 1, Groups B, C and D. It is easily wall mounted in almost any location.

B. COMBUSTIBLE GAS SENSOR

Detection is by catalytic oxidation on a heated platinum element. The HLM-1000-EX sensor is installed at the point where gas is to be detected. One leg of the sensor element is the catalytic element in a balanced Wheatstone bridge. The second element is non-catalytic and is installed in the same environment for thermal compensation. The two elements are surrounded by a sintered stainless steel flame arrestor to form a complete detector head assembly.

C. TRANSMITTER

The transmitter's electronics include a series of precision resistors and the ZERO Adjust potentiometer complete the Wheatstone bridge circuit. Sensor output is fed to an amplifier which steps the voltage up to the 0-1 volt range, for actuation of the control unit and possible alarm circuits. The SPAN potentiometer is provided to set the sensitivity to a correct value, using a known calibrating gas sample. Additionally, the sensor bridge voltage is set by the factory and should not be adjusted.

NOTE: The amplifier is of the NON-LATCHING type and services only to transmit the signal as the gas concentration varies. The Control Unit will have to have provisions built in to interpret the signal to it's own alarm requirements.

4. INSTALLATION

A. **COMBUSTIBLE DETECTOR HEAD** (SEE FIGURE A)

1. The sensor assembly consists of a brass (1/2″ NPT with 3/4″ NPT bushing) or aluminum (3/4″ NPT) housing with a flame arrestor. It is provided with three connection wires for the sensor to transmitter connection.

   Always mount the Detector Head with the sensor pointing downward.

2. Select a Detector Head location that is typical of the atmosphere, or is as close as possible the anticipated source of gas. For light gases such as hydrogen or methane, a location close to the ceiling is often chosen. For heavy gases or for vapours from liquids, a position close to the floor is usually used.

B. **WIRING** (SEE FIGURE A AND B FOR WIRING CONNECTIONS)

All wiring connections from the Control Unit are routed to the Detector Head terminals on the transmitter. The printing on the transmitter circuit board identifies terminals.

From the Detector Head to the Process Control Unit three wires are run from terminals on the transmitter (+24 VDC, COM, 4-20 mA) to corresponding terminals on the Control Unit or BAS, PLC, etc. Wires from several Detector Heads can be run in the conduit if desired.

Referring to Figure A, the following connections are made from the Detector head to the Process Control Unit.

The Detector Head requires an input/output from the Control Unit of:

a) 12 to 30 VDC to the (+) positive terminal (rated @ 0.30 Amps maximum)
b) Common to the (-) negative terminal
c) Feedback 4-20mA monitoring from the Control Unit to the (FB) feedback terminal.

The sensor requires an input of 6.0 volts (± 0.1 Volt) from the transmitter to operate correctly. This voltage is critical since performance and life will be significantly affected. Note that sensor voltage is factory set using the bridge voltage control on the transmitter.

The feedback loop is monitored by the Control Unit to activate alarms or any other peripheral devices. The feedback loop of 4-20mA corresponds to 0-100% LEL gas concentration that is being detected.

If there is any physical break in any of the wiring from the Detector Head and the Process

Control Unit, an imbalance will occur causing the range to drop outside of the 4-20mA output. Therefore the Control Unit will have to recognize this and be able to respond. If there is any drift in the Detector Head circuit or variation from the gas detector element (ie, broken connection), this will be shown by a change in the 4-20 mA feedback loop.

NOTE: This is not to be confused with the 100-500mV voltage at the test jacks on the amplifier.

Wire loop resistance up to 8 ohms may be used. This applies only to the current-carrying Conductors, terminals + 24 VDC and COM; the signal terminal (4-20 mA) can be connected using resistance up to 1000 ohms. Use minimum #16 AWG Triad shielded cable.

Be sure that all connections are electrically tight and secure. Avoid intermediate splices or joints; if any are used, they must be soldered.

5. OPERATION

Combustible Circuits (See Figure A)

1. Check to make sure all connections are complete and correct between the Detector Head and Control Unit.
2. Apply power to the system.
3. Proceed to the Detector Head, with a volt/millivolt meter with test probes, a small screwdriver, a source of combustible gas and a portable combustible gas indicator. For each transmitter, proceed as follows:

CAUTION

THE AREA MUST BE FREE OF FLAMMABLE GAS IF THE COVER IS TO BE REMOVED.

a) Verify absence of combustible gas, using a portable gas indicator.

b) Open the Detector Head Enclosure. Measure voltage between GRN and RED sensor wires (Terminals 1 and 3). It should BE 6.0 VDC ± 0.1 VDC. If the voltage is outside the limits, check the terminals and wiring for loose connections. If the voltage cannot be brought within the limits using the bridge volts control on the transmitter, replace the transmitter. When measuring, use an accurate voltmeter, as an error of even 0.1 volt can have a significant effect on sensor life and performance.

c) Plug meter probes into test jacks. Observe output, which should be 100 mV. If it is not, adjust to 100 mV using the ZERO Potentiometer, which will correspond to 0% LEL.

d) Expose sensor to a small amount of combustible gas. Observe that output rises up from 100 mV to a higher value such as 300 mV or above, and that it returns to 100 when the gas is removed.

e) During the above adjustments, if possible have a second person observe the Control Unit and verify its operation.

f) If the detector head requires calibration please see Calibration Section 7.

6. MAINTENANCE

A. INTERCHANGEABILITY OF COMPONENTS

1. Transmitters are readily removed from the enclosure by first disconnecting the incoming and sensor wires and unscrewing the retaining screws. Transmitters of the same type are fully interchangeable between stations.

2. Combustible sensors as supplied for replacement are tested as general purpose sensors and are usable at any location requiring that type of sensor.

B. REPAIR AND TROUBLESHOOTING

If trouble occurs, interchange sensor or transmitter with an adjacent Detector Head or replacement part known to be normal. If trouble follows the sensor or transmitter it is in the transmitter, sensor or associated wiring.

1. Connect another sensor temporarily to sensor terminals of transmitter. If this corrects the problem, replace the sensor.
2. If sensor replacement does not help, connect another transmitter temporarily.
3. If system still does not work with a good sensor and a good transmitter, problem must be in the wiring.

C. PARTS REPLACEMENT

1. Sensor

Sensor replacement procedure is as follows:

a. Power down the system and disconnect sensor wires from transmitter.
b. Unscrew sensor from housing. Discard sensor if it is proven to be defective.
c. Install new sensor in same position, and connect wires in same way. Be very sure that connections are tight and electrically solid.
d. Turn system on. Re-zero and calibrate new sensor according to the directions contained in the following Calibration Section.

2. Transmitter

a. Power down the system and disconnect the Sensor and the Control Unit wires.
b. Remove all three hold-down screws.
c. Reinstall a new transmitter in reverse order. Ensure that all connections are tight and electrically solid.
d. Turn system on, re-zero and calibrate new sensor according to the directions contained in the following Calibration Section.

D. ROUTINE MAINTENCE

Maintenance consists primarily of periodic checks to be sure that the system remains on zero, and is responsive to gas. The following schedule is suggested:

1. Daily

    a. Verify instrument operation at the Control Unit by checking its indicated value on its meter (usually zero), it must be within 5% of the calibrated value. If not, follow the Re-calibration procedure outlined in Section 7.

2. Weekly

    a. Repeat Daily Maintenance Procedure

NOTE: AFTER AN ALARM CONDITION OR SENSOR EXPOSURE TO ANY CONTAMINATING GAS THE DETECTOR HEAD MUST BE REDCALIBRATED.

7. CALIBRATION

The HLM-1000-EX must be calibrated regularly using known gas samples, representative of the gas being detected. Calibration consists of exposing the HLM-1000-EX sensor to the known gas sample and adjusting the electronic circuitry to generate an output equivalent to the concentration of calibration gas.

For maximum accuracy, the concentration of the calibration gas should be a significant percentage of the measuring range. Prepared gas mixtures in pressurized disposable cylinders and calibration kits are available from Arjay / Enmet.

The frequency of calibration is entirely dependant upon each individual application. A good indication of how often the HLM-1000-EX should be calibrated is the amount of adjustment required when a calibration is performed. If the HLM-1000-EX must consistently be adjusted a significant amount, the calibration interval should probably be more frequent.

1. If necessary, disable the appropriate alarm devices at the control unit to prevent nuisance alarms while the HLM-1000-EX is being calibrated.
2. Connect an adjustable valve or regulator to a cylinder of calibration gas, suitable for calibrating on the HLM-1000-EX measuring range.
3. Using flexible tubing, connect the cylinder's valve, through a 0-1 lpm flowmeter to a calibration adapter.
4. Unscrew and remove the domed lid from the HLM-1000-EX enclosure.

CAUTION: THE AREA MUST BE FREE OF FLAMMABLE GASES IF THE DOMED LID IS TO BE REMOVED.

5. Locate the two voltmeter test jacks on the circuit board. Connect a voltmeter suitable for measuring a 0-500 millivolt range to the test jacks. Plug the positive voltmeter probe into the red test jack and the negative voltmeter probe into the black test jack.
6. Record the voltmeter reading while the sensor is exposed to gas free air.

NOTE: If the atmosphere surrounding the HLM-1000-EX sensor is uncertain, apply zero air to the sensor using the calibration adapter.

7. Locate the Zero control on the HLM-1000-EX upper circuit board. Using a small slotted screwdriver, adjust the Zero control until the voltmeter reading is 100mV ± 5mV.
8. Connect the calibration adapter to the sensor holder, placing it over the combustible sensor dust cover. Open the valve on the calibration gas cylinder and adjust until the flowmeter reads 0.5-1.0 SCFH, (the calibration flowrate).
9. The voltage indicated by the voltmeter will begin to increase. Allow at least two minutes for this reading to stabilize.
10. Locate the Span control on the HLM-1000-EX upper circuit board. Using a small slotted screwdriver, adjust the Span control until the voltmeter reading begins to increase. Keep adjusting the Span control until the maximum voltmeter reading is reached.
11. Adjust the Span control until the voltmeter reads as calculated below:

$$\text{Calibration Voltage} = 100 + 400 \frac{\text{(Cal Gas Concentration)}}{\text{(Full Scale Concentration)}} \text{ mV} \pm 5\text{mV}$$

Example: Range 0-100% LEL, Calibration Gas = 50% LEL Methane

$$\text{Calibration Voltage} = 100 + 400 \frac{\text{(50 \%LEL)}}{\text{(100\%LEL)}} \text{ mV} \pm 5\text{mV}$$
$$= 300 \text{ mV} \pm 5\text{mV}$$

12. Close the valve on the calibrating gas, remove the calibration adapter, and allow the sensor to stabilize to normal air conditions.
13. The voltmeter reading should gradually return to 100mV ± 5mV. If it does not, steps 7 through 13 must be repeated.
14. Calibration is now complete. Remove the calibration adapter and voltmeter probes. Replace the domed lid on the enclosure and enable any alarm devices at the control unit that may have been disabled.

NOTE: If the desired reading could not be obtained using the Span control, The sensor must be replaced. Refer to Section 6 for instructions to replace the sensor.

8. PARTS LIST

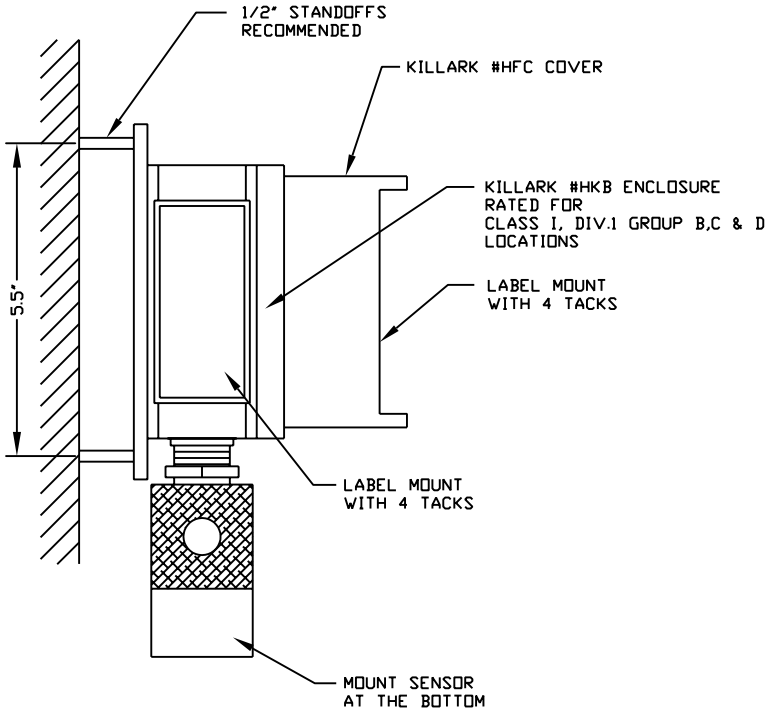
DESCRIPTION

Sensor, Combustibles (Note: Specify ½ ″ NPT or ¾ ″ NPT)

Remote transmitter for Methane (6.0 VDC)

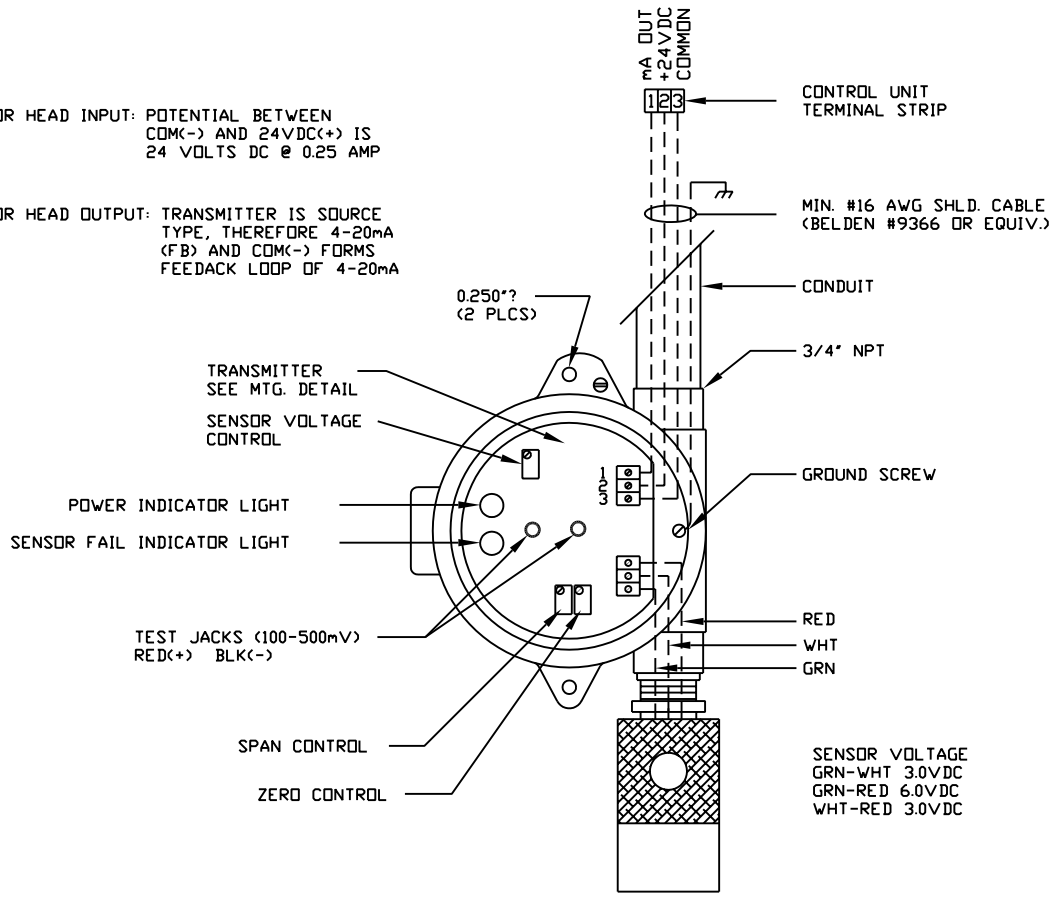
Complete combustible Detector Head

Calibration kit (specify serial number of instrument, gas to be detected)

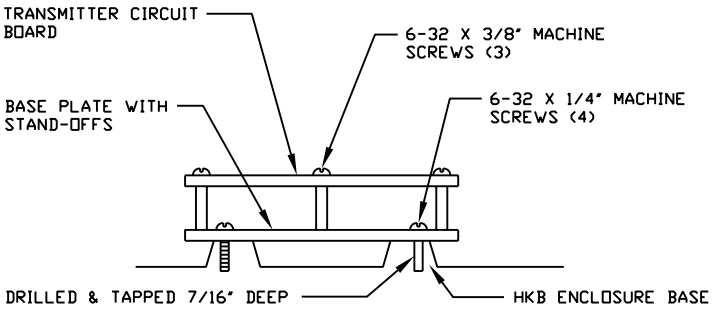


DETECTOR HEAD INPUT: POTENTIAL BETWEEN COM(-) AND 24VDC(+) IS 24 VOLTS DC @ 0.25 AMP

DETECTOR HEAD OUTPUT: TRANSMITTER IS SOURCE TYPE, THEREFORE 4-20mA (FB) AND COM(-) FORMS FEEDACK LOOP OF 4-20mA



NOTE: ALWAYS MOUNT SENSOR POINTING DOWN



REV	DATE	DESCRIPTION	CHK'D	APP'D
1	7/02/02	ADDED OUTPUT TERMINALS		

REVISIONS

ENMET CANADA LTD.

PROJECT:

DWG. STATUS	BY	DATE D	M	Y
DRAWN	C.M.P.	29	11	01
CHECKED				
APPROVED				

TITLE: HLM 1000-EX
FIELD WIRING CONNECTIONS
AND COMPONENT DETAIL

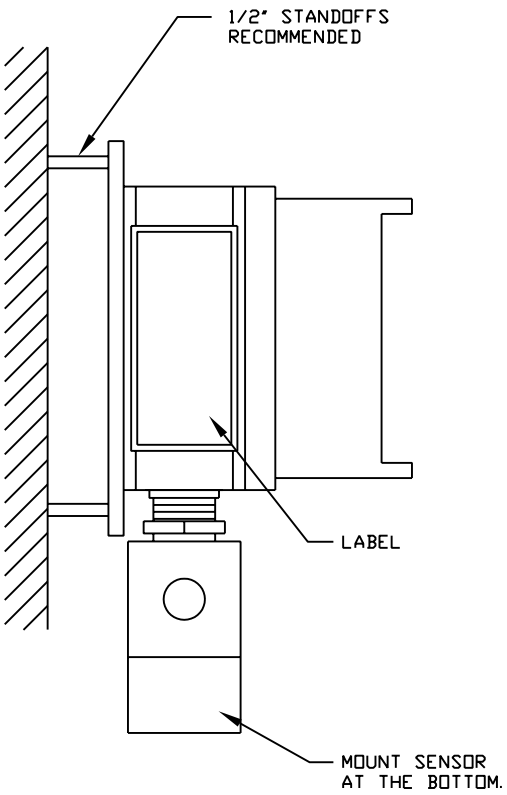
SCALE N.T.S.

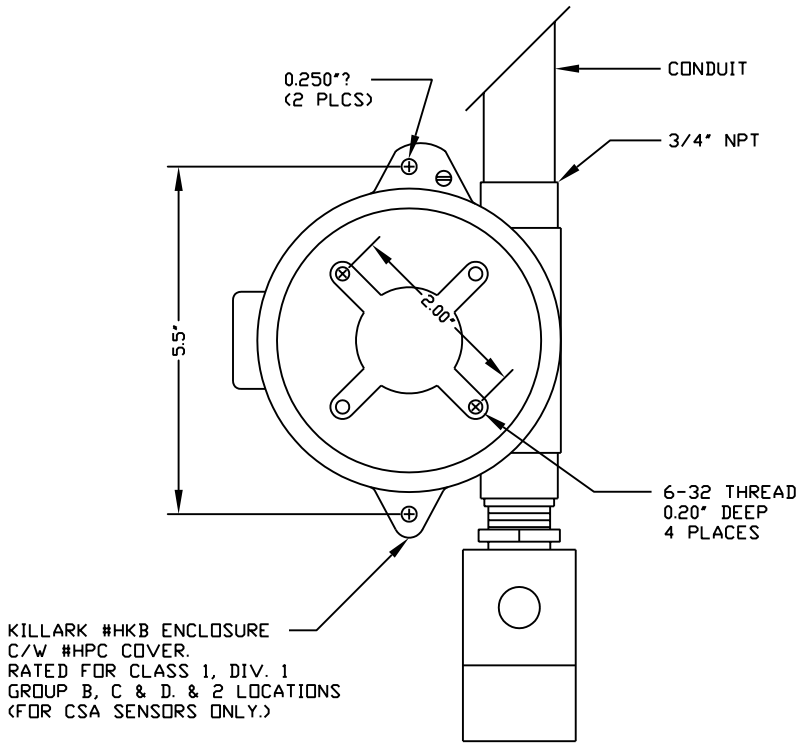
REF. NOS.

DWG. NO. 20010380

SHT. 1

REV. 1





REV	DATE	DESCRIPTION	CHK'D	APP'D

REVISIONS

ENMET CANADA LTD.

PROJECT:

DWG. STATUS	BY	DATE D	M	Y
DRAWN	C.M.P.	29	11	01
CHECKED				
APPROVED				

TITLE: FIGURE B
HLM 1000-EX/TX
MOUNTING DETAIL

SCALE N.T.S.

REF. NOS.

DWG. NO. 20010381

SHT. 1

REV. 0