

# Instructions

**95-8573**

DuctWatch™ Gas Monitor  
Model PIRDUCT



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**CAUTION**

*If this equipment is used in a manner not specified in this manual, safety protection may be impaired.*

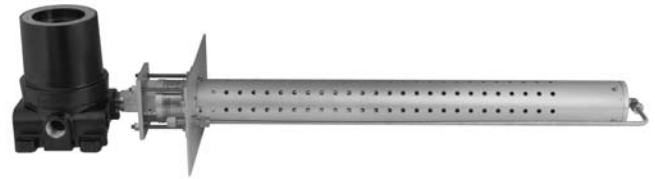
**APPLICATION**

The Model PIRDUCT DuctWatch™ is an infrared (IR) based flammable gas monitoring solution designed for combustion turbine enclosure monitoring and similar air handling ductwork applications. The PIRDUCT is easy to install and commission, and does not require expensive extractive sampling system hardware. Providing a full scale measurement range of 0 to 15% LFL (0 to 7500 ppm) methane vapor concentration, the PIRDUCT delivers a new level of flammable hydrocarbon gas protection for high airflow environments.

The PIRDUCT assembly is designed for mounting on any flat surface, and is provided pre-assembled with an aluminum mounting plate, seal gasket, and electrical termination junction box. A minimum internal duct width of 3 feet (1 meter) is required for proper installation.

**FEATURES**

- In-situ design improves gas response time and simplifies installation
- Continuous self-test automatically indicates a fault or fouled optics condition
- No calibration required
- Standard 4-20 mA signal output is proportional to 0 to 15% LFL (0-7500 PPM) methane
- Standard 24 Vdc power

**SPECIFICATIONS****INPUT VOLTAGE—**

+24 Vdc nominal (range +18 to +32 Vdc).  
Ripple must not exceed 0.5 volts peak-to-peak.

**POWER CONSUMPTION (Watts)—**

<b>Input Voltage:</b>	<b>18 Vdc</b>	<b>24 Vdc</b>	<b>32 Vdc</b>
Nominal	3.5	4.6	6.2
Maximum	4.0	5.5	7.0

**DETECTION RANGE—**

0 to 15% LFL methane (0-7500 ppm).

**GASES—**

Will respond to most hydrocarbon gases. Outputs linearized for 0 to 15% LFL methane.

**CURRENT OUTPUT (Non-Isolated)—**

Linear 4 to 20 mA current source.

- 4 to 20 mA output indicates 0 to 15% LFL detection range (linearized for methane)
- 23.2 mA indicates over-range condition
- 0 to 2.4 mA levels indicate calibration, fault and fouled optics conditions.

Refer to Table 1 for a detailed description of current outputs.

Maximum loop resistance: 580 ohms at +24 Vdc. See Figure 1 for further information.

Table 1—Current Loop Output Levels and Corresponding Status Indications

Current Level	Status
23.2 mA	Over-range (18% LFL)
20.0 mA	Full scale (15% LFL)
4.0 mA	Zero gas level (0% LFL)
2.2 mA	Zero calibration in progress
2.0 mA	Span calibration in progress
1.8 mA	Calibration complete - remove gas
1.6 mA	Calibration fault
1.0 mA	Fouled optics
0.8 mA	24 Vdc line low (less than 17.5 Vdc)
0.6 mA	Calibrate input active at power-up (probable wiring fault)
0.4 mA	Active channel fault
0.2 mA	Reference channel fault
0.0 mA	CPU system fault, warmup

**NOTE**

The following specifications for Accuracy, Stability and Repeatability are based on a 0 to 15% LFL methane calibration.

**ACCURACY (Room Temperature)—**

±0.5% LFL from 0 to 7.5% LFL, ±0.75% LFL from 7.5% to 15% LFL.

**RESPONSE TIME—**

Without Hydrophobic Screen:

T50 within 6 seconds; T90 within 12 seconds.

With Hydrophobic Screen:

T50 within 8 seconds; T90 within 15 seconds.

**STABILITY—**

Zero: ±0.3% LFL from -40°F to +167°F (-40°C to +75°C).

Span: ±0.75% LFL at 50% of full scale from -13°F to +167°F (-25°C to +75°C),

±1.5% LFL at 50% of full scale from -40°F to -13°F (-40°C to -25°C).

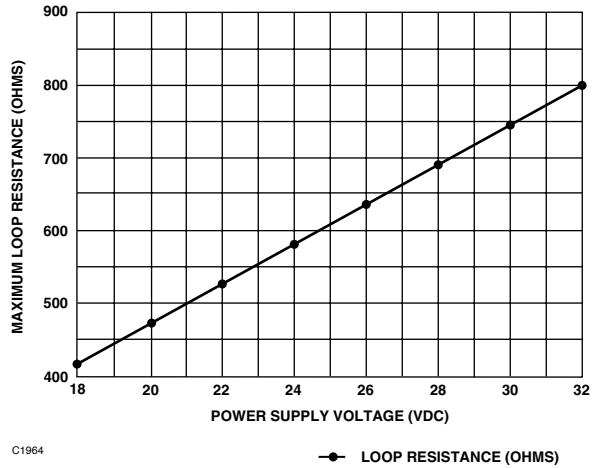


Figure 1—4 to 20 mA Current Loop Resistance

**WIRING—**

The PIRDUCT detector has five 22 AWG wires, 20 inches long for wiring into a termination box or the Infiniti transmitter.

- Red = + 24 volts dc
- Black = - (common)
- White = 4 to 20 milliampere signal output
- Yellow = Calibration input
- Green = Chassis ground

Power Wiring: 18 AWG minimum is recommended for power wiring. Larger diameter wire may be required to maintain a minimum of 18 Vdc (including ripple) at the sensor for all operating conditions (see Figure 2). For maximum EMI/RFI protection, shielded cable is recommended.

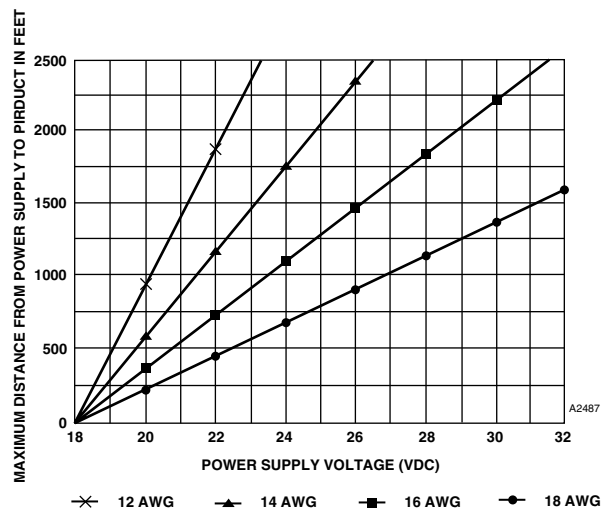


Figure 2—PIRDUCT Wiring Requirements

**OPERATING TEMPERATURE RANGE—**  
–40°F to +167°F (–40°C to +75°C).

**STORAGE TEMPERATURE RANGE—**  
–67°F to +185°F (–55°C to +85°C).

**HUMIDITY (Non-Condensing)—**  
0 to 99% relative humidity (Det-Tronics verified).  
5 to 95% relative humidity (FM/CSA verified).

**RFI/EMI PROTECTION—**  
EN50081-1. Class B, EN50270.  
Operates properly with 5 watt walkie talkie keyed at 1 meter.

**INGRESS PROTECTION—**  
IP66 (DEMKO certified per EN60529).


**ENCLOSURE MATERIALS—**  
Weather Protection Baffles: Aluminum.  
Electronics Assembly: Aluminum.  
  
Aluminum (clear anodized) content: 0.8% to 1.2% Mg,  
0.15% to 0.40% CU.

**CERTIFICATION—**

**PIRDUCT Detector**

FM: Class I, Div. 1, Groups B, C & D (T5).  
Class I, Div. 2, Groups A, B, C & D (T3C).  
Performance verified.  
(See Appendix A for approval description.)

CSA: Class I, Div. 1, Groups B, C & D (T5).  
Class I, Div. 2, Groups A, B, C & D (T3C). Performance verified.

CENELEC/CE: **CE** 0539  II 2 G  
Ex d IIB+H<sub>2</sub> T4-T6  
DEMKO 09 ATEX 147623X  
T6 (T<sub>amb</sub> = –55°C to +50°C)  
T5 (T<sub>amb</sub> = –55°C to +60°C)  
T4 (T<sub>amb</sub> = –55°C to +75°C)  
IP66.

EN Standards: EN 60079-0: 2006  
EN 60079-1: 2007  
EN 61779-1: 2000  
EN 61779-4: 2000  
EN 60529: 1991+A1: 2000  
EN 50270: 2006

**Special Conditions for Safe Use ('X'):**  
The DuctWatch Gas Monitor, Model PIRDUCT has an ambient temperature rating for performance of –40°C to +75°C.

The DuctWatch Gas Monitor, Model PIRDUCT is to be used only in conjunction with a suitable CENELEC certified combustible gas detector control unit for compliance with EN 61779 Series standards.

The DuctWatch Gas Monitor, Model PIRDUCT has a threaded wire feed through incorporating flying leads. This feed through is to be screwed into the cable entry opening of a suitable certified (EEx d or EEx e) enclosure in which the flying leads are to be terminated.

The captive front end screws are to be tightened to 1 Nm.

**PIRTB Termination Box**

FM: Class I, Div. 1, Groups B, C & D (T6).  
Class I, Div. 2, Groups A, B, C & D (T6).

CSA: Class I, Div. 1, Groups B, C & D (T6).  
Class I, Div. 2, Groups A, B, C & D (T6).

CENELEC/CE: See Appendix B for details.

**WARNING**

*Always ensure that the detector/termination box hazardous (classified) location ratings are applicable for the intended use.*

**ELECTRICAL TERMINATION ENCLOSURES—**  
All standard models include a pre-assembled Det-Tronics PIRTB termination box or DCU junction box for optimum ease of installation, commissioning, and calibration. The use of PIRDUCT with electrical termination enclosures other than Det-Tronics PIRTB or DCU junction boxes may or may not be compatible depending upon the enclosure specifications.

**SHIPPING WEIGHT (Approximate)—**  
10 pounds (4.5 kilograms).

**DIMENSIONS—**  
See Figure 3 for dimensions of the PIRDUCT Detector and Figure 4 for dimensions of the Termination Box. See Figure 5 for dimensions of the mounting plate.

**TERMINALS—**  
Termination box terminals UL/CSA rated for 14 to 22 AWG wire; terminals DIN/VDE rated for 2.5 mm<sup>2</sup> wire.

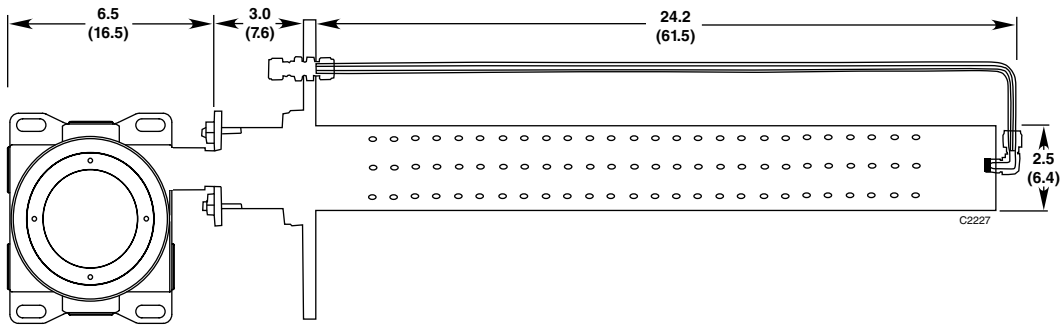


Figure 3—Dimensions of PIRDUCT Detector in Inches (cm)

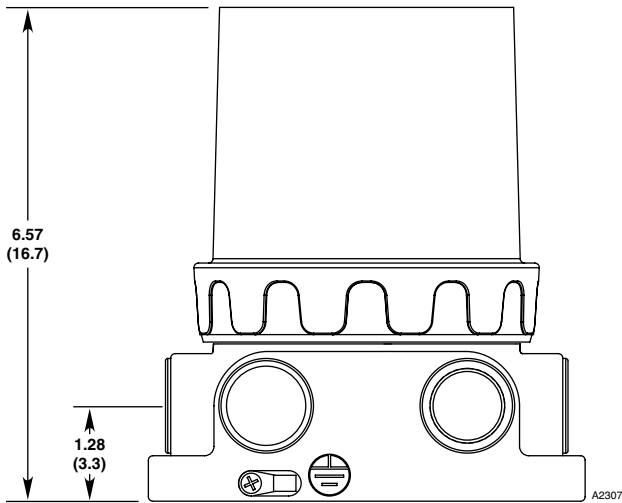
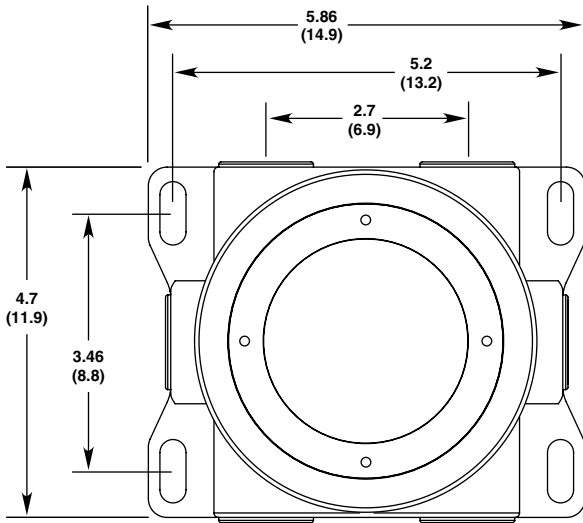


Figure 4—Termination Box Dimensions in Inches (cm)

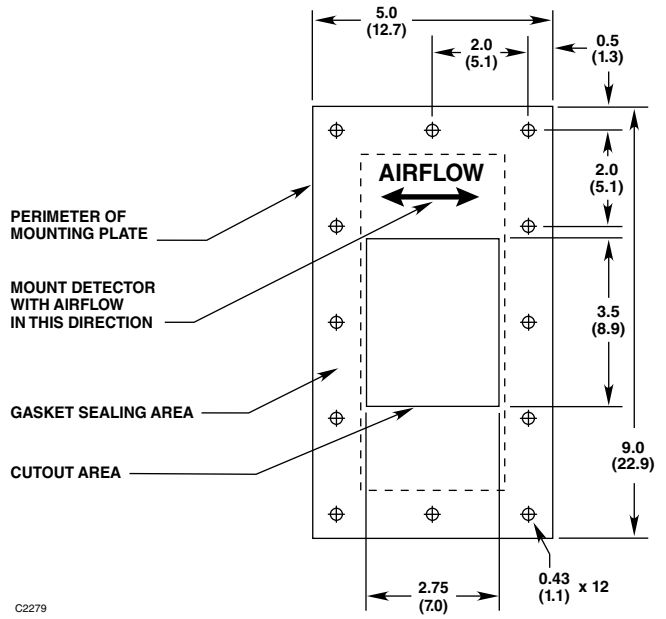


Figure 5—Dimensions of PIRDUCT Mounting Plate in Inches (CM)

## DESCRIPTION

### MEASUREMENT METHOD

PIRDUCT operates on the infrared absorption principle. A beam of modulated light is projected from an internal infrared source to a reflector, which sends it back to a pair of infrared sensors. One of the sensors is designated reference and the other active, with different optical filters in front of the two sensors to make them selective to different infrared wavelengths. The reference wavelength is unaffected by combustible gases, while the active wavelength is absorbed by combustible gases. The ratio of the active to the reference wavelength is computed within the PIRDUCT detector to determine the concentration of gas present. This value is then converted into a 4 to 20 milliamperes current output for connection to external display and control systems.

### DETECTION METHOD

PIRDUCT is an in-situ gas monitor intended for applications with continuous air movement within gas turbine acoustic enclosures, air handling ductwork or similar enclosed spaces. The PIRDUCT is position sensitive and must be installed in the proper orientation for acceptable performance. As air flows through the enclosure or ductwork, it will intersect the PIRDUCT optics, and dangerous methane vapors present within the airflow will be detected and measured by PIRDUCT.

### CURRENT LOOP OUTPUT

During normal operation, the PIRDUCT detector has a current output from 4 to 20 milliamperes that is proportional to gas concentrations from 0 to 15% LFL. A current output other than 4 to 20 milliamperes indicates a fault, over-range condition, or calibrate mode. Refer to Table 1 in the "Specifications" section for details.

### WIRING TERMINATION BOX (MODEL PIRTB)

The PIRDUCT is furnished with a Wiring Termination Box that uses a tall cover with a viewing window. This termination box ensures optimum ease of installation and calibration. It includes a magnetic reed calibration switch and calibration LED (visible through a viewing window on the cover) to allow one person, non-intrusive calibration of the detector. The use of electrical termination enclosures other than Det-Tronics PIRTB or DCU junction boxes may or may not be compatible depending upon the enclosure specifications.

## OPERATING MODES

### Warmup

When power is applied to the detector, it enters a Warmup mode (for approximately one minute) in which it performs diagnostic checks and allows the sensors to stabilize before beginning normal operation. The current output during this period is 0 milliamperes. At the end of the warmup period with no faults present, the detector automatically enters the Normal operating mode. If a fault is present after the warmup, the detector current output will be less than 4.0 mA. Refer to Table 1 in the Specifications section for fault diagnostic information.

### Normal

In the normal operating mode, the 4 to 20 milliamperes signal level corresponds to the detected gas concentration. The detector continuously checks for system faults or initiation of calibration, and automatically changes to the appropriate mode.

### Fault

Faults detected during warmup, normal operation, or calibration are indicated by the current loop output as shown in Table 1.

### Calibration

All PIRDUCT models are factory calibrated using 7.5% LFL methane. Routine field calibration is normally not required, but can be performed. Calibration is required if the detector optics are ever disassembled. A calibration gas inlet nozzle is provided to enable introduction of calibration gas.

#### NOTE

*To successfully complete a full PIRDUCT calibration, a method of routing the methane calibration gas to the calibration gas inlet nozzle on the instrument is required.*

#### NOTE

*A full PIRDUCT calibration may require temporary shutdown/removal of air movement to enable the calibration gas to remain within the detector's measurement chamber for a sufficient time to ensure proper calibration.*

When installed with the Model PIRTB wiring termination box, field calibration of the PIRDUCT is easily performed using a non-intrusive, one-person calibration procedure. Calibration is initiated by actuating an internal magnetic reed switch. A calibration LED, easily visible through the viewing window on the cover of the termination box, signals the operator through the calibration process.

The factory default setting for the output current during calibration is an inhibited state. See Table 1 for specific information.

## INSTALLATION

### IMPORTANT

*Hydrocarbon-based grease will emit hydrocarbon vapors which will be measured by PIRDUCT and will result in inaccurate gas level readings. Use only low vapor pressure silicone grease when lubricating threads on the PIRDUCT detector and associated termination box. Do not get this grease on the optics of the detector. A suitable grease is listed in the "Spare Parts" section at the end of this manual.*

### IMPORTANT

*In applications where both PIRDUCT and catalytic type sensors are used, ensure that the silicone grease used to lubricate the PIRDUCT detector threads does not come into contact with the catalytic sensors or poisoning of the catalytic sensors will result. It is strongly recommended that maintenance personnel wash their hands between handling the two types of sensors.*

## DETECTOR LOCATION

Selecting the proper mounting location is crucial for proper gas detection. Following are some basic installation recommendations:

1. Detectors should be installed approximately six duct widths downstream from bends, duct openings, or deflection plates. These locations provide fairly uniform, non-turbulent airflow, and are homogenous with respect to air/gas mixing. See Figure 6.

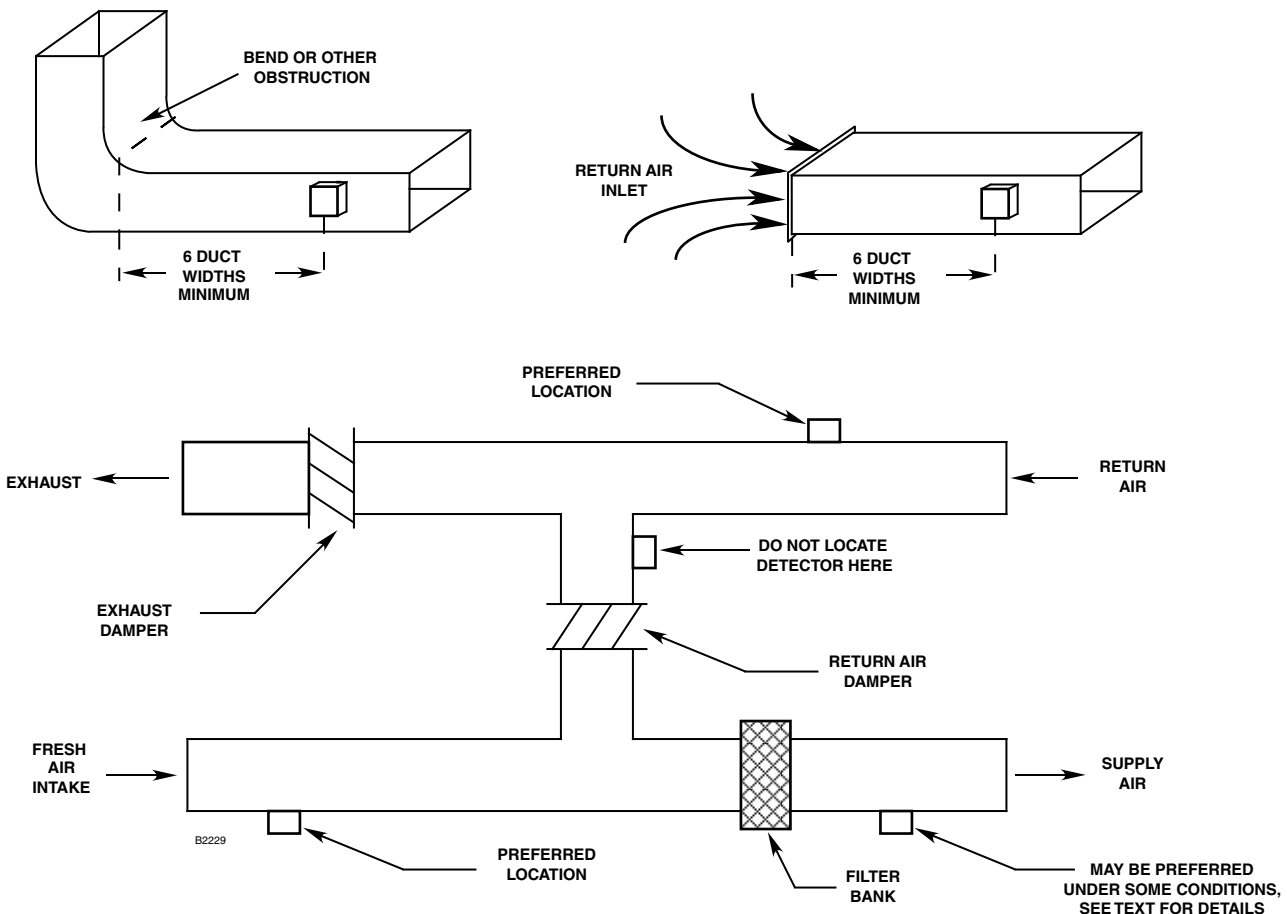


Figure 6—Detector Placement

- If airflow filters exist, it may be preferable to locate detectors on the upstream side of the filter. If a filter becomes blocked, insufficient air flow may cause improper operation of the detector. However, if the unfiltered airflow is unsuitable for direct exposure to the detector (due to the effects of contaminants, corrosive materials, moisture, heat, etc.) then an installation location downstream of the filter may be preferable.
- Locate detectors so that dampers do not restrict air flow at the detector location.
- Locate detectors where they can be conveniently observed and readily serviced.
- If in-situ calibration is required, determine required peripheral equipment (tubing, fittings, etc.) and ensure that installation requirements can be accommodated.

**NOTE**

*The PIRDUCT is a position sensitive instrument. It must be installed in the proper orientation to achieve proper vapor detection. See Figure 7. Ensure that the installation location selected will accommodate the instrument in the proper mounting orientation.*

**NOTE**

*Refer to Appendix A for FM mounting requirements.*

**MOUNTING PROCEDURE**

**CAUTION**

*The PIRDUCT mounting orientation is position sensitive. In all cases, the PIRDUCT must be installed with the air inlet holes facing into the airflow. The proper orientation is indicated on the PIRDUCT mounting plate.*

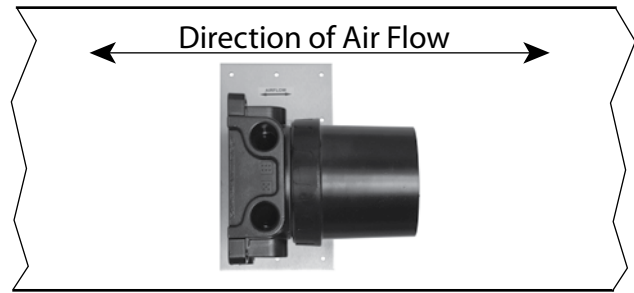
**NOTE**

*The PIRDUCT mounting plate is intended for installation to flat surfaces only. Although the horizontal mounting plane orientation is recommended, the PIRDUCT is compatible with horizontal or vertical mounting, provided the air inlet holes are installed facing upstream, e.g. directly into the airflow.*

**NOTE**

*The PIRDUCT mounting plate includes a seal gasket to ensure that no leakage of duct air occurs. In the event that duct wall insulation is present, it may be necessary to remove*

**CORRECT**



**IMPORTANT:** MOUNTING PLATE **MUST** BE ORIENTED AS SHOWN. ONCE THE MOUNTING PLATE IS SECURED TO THE DUCT WALL, THE TERMINATION BOX CAN BE ROTATED TO ANY CONVENIENT POSITION.

**INCORRECT**



Figure 7—Orientation of PIRDUCT Mounting Plate Relative to Direction of Airflow through Duct

*insulation to properly mount the PIRDUCT mounting plate.*

- When the proper mounting location has been identified, mark and drill the PIRDUCT assembly mounting holes in the proper pattern. Refer to Figure 5 for the mounting hole pattern dimensions.
- Install the PIRDUCT into the duct. Secure the mounting plate to the duct wall using appropriate fasteners (self-tapping screw with outside diameter not exceeding 0.2 inch).

**NOTE**

*Gas turbine enclosure walls are typically about 4 to 5 inches thick with substantial steel surfaces inside and out. Ensure that the PIRDUCT is securely and solidly installed in all cases.*

- Install optional calibration gas delivery hardware if desired.

## GENERAL WIRING REQUIREMENTS

### NOTE

The wiring procedures in this manual are intended to ensure proper functioning of the device under normal conditions. However, because of the many variations in wiring codes and regulations, total compliance to these ordinances cannot be guaranteed. Be certain that all wiring complies with applicable regulations relating to the installation of electrical equipment in a hazardous area. If in doubt, consult the authority having jurisdiction before wiring the system.

The use of shielded cable in conduit or shielded armored cable is recommended for optimum RFI/EMI protection. In applications where the wiring cable is installed in conduit, the conduit must not be used for wiring to other electrical equipment. To assure proper operation of the detector, the resistance of the connecting wire must be within the specified limits. The maximum distance between the detector and power source is determined by the power supply capability and wire size. Refer to Figure 2 in the "Specifications" section to determine the proper wire size and maximum wiring distance allowed.

It is important that moisture not be allowed to come in contact with the electrical connections of the system.

The use of proper piping techniques, breathers, glands, and seals are required to prevent water ingress and/or maintain the explosion-proof rating.

## DETECTOR WIRING PROCEDURE

### IMPORTANT

*Do not apply power until the wiring procedure is complete and has been verified.*

Four or five conductor cable with an overall foil shield is recommended for wiring the PIRDUCT. The shield should be open at the detector termination box and connected directly to earth ground or to DC common via non-polarized capacitor at the signal receiver or controller. Ensure that the shield wire is clipped short and insulated with electrical tape to prevent accidental grounding at the open end.

### IMPORTANT

The maximum distance between the detector termination box and the transmitter/control device is limited by the resistance of the connecting wiring, which is a function of the gauge of the wire being used. It is important to maintain a minimum of +18 volts dc (including ripple) at the PIRDUCT detector. When determining the appropriate wire size and maximum separation distance for the installation, refer to Figure 2 in the "Specifications" section of this manual. Be sure to take into account the total distance from the power supply to the PIRDUCT to ensure that the power requirements are met.

1. The termination box should be electrically connected to earth ground.
2. Wire the PIRDUCT. Figures 8 through 11 show various system configurations using the PIRDUCT detector. Refer to the appropriate figure as a guide to system connection.

Figure 8 shows typical wiring for stand alone operation.

Figure 9 shows typical wiring for PIRDUCT with Det-Tronics supplied termination box.

Figure 10 shows the termination box terminals and calibration switch.

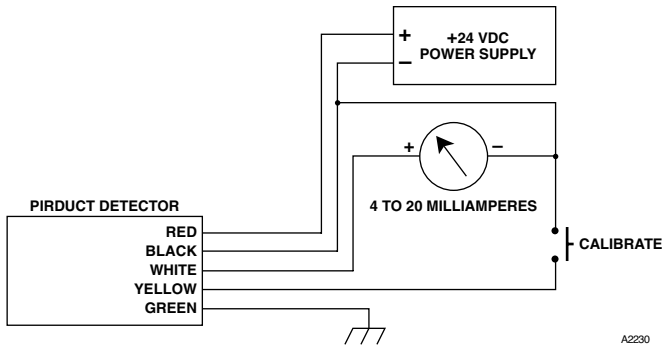
Figure 11 shows a PIRDUCT wired to a DCU in an Eagle Quantum Premier system.

The PIRDUCT wiring color code is:

Red lead	=	+24 volts dc
Black lead	=	– (common)
White lead	=	4 to 20 mA signal output
Yellow lead*	=	Calibration input
Green lead	=	Chassis ground

\* If the calibration wire (yellow lead) is not being used, do not connect this wire to ground. Trim excess length and insulate wire so no shorting can occur.

3. Check the detector wiring to ensure proper connections, then pour the conduit seals and allow them to dry (if conduit is being used).
4. Place the cover on the termination box.



NOTE:  
CALIBRATION PUSHBUTTON, CURRENT METER AND POWER SUPPLY ARE NOT SUPPLIED.

Figure 8—Typical PIRDUCT Wiring, Stand Alone Configuration

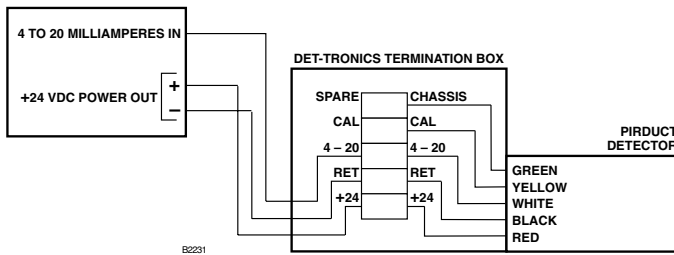


Figure 9—Typical Wiring, PIRDUCT with PIRTB Termination Box

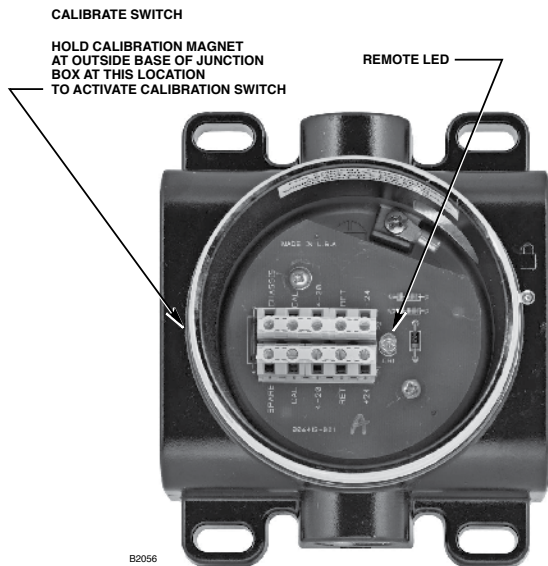


Figure 10—PIRTB Termination Box Terminals and Calibration Switch

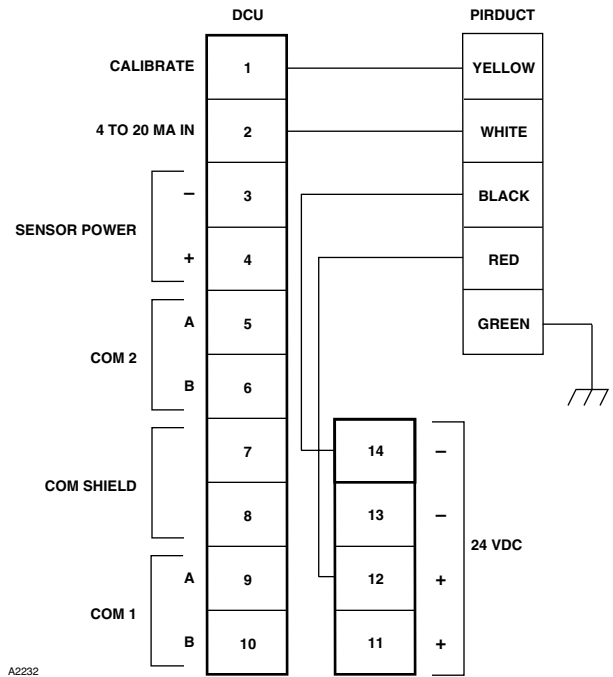


Figure 11—PIRDUCT Wired to DCU in an Eagle Quantum Premier System

## STARTUP PROCEDURE

1. Inhibit the output loads that are actuated by the system to prevent activation of these devices.
2. Check that the detector has been wired properly.
3. Apply power to the system and allow the detector to operate for a minimum of 2 hours. Check for 4 mA output and re-zero as required.
4. Place the system in normal operation by reactivating the output loads.

## CALIBRATION

The PIRDUCT detector is factory calibrated for methane and, unlike catalytic detectors, does not require routine calibration to ensure proper operation. Guidelines for when calibration should be performed or checked are listed in Table 2.

Table 2—Calibrate or Check

Function	Calibrate Check	
Startup		X
Constant zero offset	X	
Periodic Functional Testing (at least once a year)		X

The PIRDUCT supports two different calibration options:

1. Zero only calibration. This procedure adjusts only the 4.0 mA (zero % gas) signal output of the PIRDUCT. It requires the presence of clean, hydrocarbon free air, and does not require application of 7.5% LFL methane calibration gas.
2. Zero and Span (full) calibration. This procedure adjusts both the 4.0 mA (zero % gas) signal output and the 50% full scale signal output. It requires the presence of clean, hydrocarbon free air, and the application of 7.5% LFL methane calibration gas.

The calibration initiation command is used to start both procedures. In the event the operator wishes to perform a Zero-only calibration, the magnetic calibration switch is re-actuated at the proper time to bypass the span calibration procedure.

#### **IMPORTANT**

*For proper Zero calibration, the PIRDUCT must be calibrated in hydrocarbon free air. For proper Span calibration, the PIRDUCT must be calibrated in still air.*

#### **Functional (Response) Test**

A functional test is recommended when acceptable to determine if span calibration is necessary.

#### **NOTE**

*The functional test may require temporary shutdown/removal of air movement to enable the calibration gas to remain within the detector's measurement chamber to obtain an appropriate signal response.*

To conduct a functional test, inhibit output loads as necessary, then apply 7.5% LFL calibration gas to the PIRDUCT. Check the current output for the appropriate response (12 milliamperes signal output). Calibration is recommended if the signal output during the test is not within  $\pm 0.2$  mA of 12.0 mA signal level.

Zero drift can be indicated by a constant signal level offset in one direction either slightly above or below 4 milliamperes. The presence of background gas would be indicated by a small but constantly changing output.

## **CALIBRATION EQUIPMENT**

The following equipment is required for span calibration of the PIRDUCT detector (calibration kits from Det-Tronics contain the items below):

- 7.5% LFL methane calibration gas kit including regulator (minimum 2.5 liter/minute flow rate)
- Calibration gas delivery tubing.

## **CALIBRATION PROCEDURES**

The procedures in this section explain calibration sequences for applications where PIRDUCT is used with the Det-Tronics supplied termination box (containing a magnetic reed switch and LED). For applications where the PIRDUCT detector is used with the Eagle Quantum Premier system, refer to the system instruction manual (form number 95-8533) for calibration procedure.

When PIRDUCT is used as a stand alone unit or with transmitters or controllers other than those supplied by Det-Tronics, the current loop output must be monitored in order to calibrate (for both inhibited and live current loop configurations).

When PIRDUCT is used with a Det-Tronics termination Box, the magnetic switch and LED in the termination box are used to initiate and annunciate the calibration sequence. The current loop output also indicates the calibration sequence (for both inhibited and live current loop configurations).

#### **IMPORTANT CALIBRATION NOTES**

- Ensure that the detector has been operating for at least two hours before calibrating.
- Do not open the explosion-proof enclosure when power is applied to the system unless the appropriate permits have been procured.
- The calibration sequence is initiated by momentarily connecting the calibration lead to the negative lead (common) of the power supply using the Cal Magnet or an external switch. If the Det-Tronics PIRTB box with magnetic Cal Switch is being used, this is accomplished by holding the Cal Magnet near the side of the PIRTB box for one second. The location of the Cal Switch is shown in Figure 10.
- The calibration sequence can be exited at any time during the span calibration by holding the Cal Magnet near the Cal Switch in the PIRTB box for one second.

- At all times other than when calibration is being performed, all calibration ports must be capped. This prevents dirt and water from entering the direct path into the optics. Failure to protect the optics can result in a fouled optics fault. If a permanent gas delivery system is used, the delivery tube must be plugged when not in use.

### Calibration Procedure - Zero Calibration Only

**IMPORTANT**

*For proper Zero calibration, the PIRDUCT must be calibrated in hydrocarbon free air.*

See Table 3 for an overview of the calibration sequence.

1. Be sure that only clean air is present at the sensor. (The microprocessor begins taking zero readings immediately upon entering the Calibrate mode.) If the possibility of background gases exists, purge the sensor with clean air to ensure accurate calibration.
2. Initiate calibration by either momentarily activating the Calibrate pushbutton (shown in Figure 8) or by holding the Cal Magnet near the Cal Switch in the PIRTB box for one second.
  - The LED will go on steady.
  - The current output will drop to 2.2 milliamperes.
3. Wait for the zero calibration point to stabilize (typically 1 minute).  
After successful zero calibration:
  - The LED will begin flashing,
  - The current will drop to 2.0 milliamperes.

Proceed to step 4.

If zero calibration fails:

- The LED will turn off,
- The current output will drop to 1.6 milliamperes.

Reset the detector by cycling power to the detector or by holding the Cal Magnet near the Cal Switch in the PIRTB box for one second. Begin calibration again at step 1.

4. Apply the calibration magnet or activate the calibrate pushbutton for one second. The detector will return to normal operation using the span data from the last calibration.

### Calibration Procedure - Zero and Span

**IMPORTANT**

*For proper field calibration, the PIRDUCT must be calibrated in still air.*

See Table 3 for an overview of the calibration sequence.

1. Be sure that only clean air is present at the sensor. (The microprocessor begins taking zero readings immediately upon entering the Calibrate mode.) If the possibility of background gases exists, purge the sensor with clean air to ensure accurate calibration.
2. Initiate calibration by either momentarily activating the Calibrate pushbutton (shown in Figure 8) or by holding the Cal Magnet near the Cal Switch in the PIRTB box for one second.
  - The LED will go on steady.
  - The current output will drop to 2.2 milliamperes.

Table 3—Calibration Sequence (Inhibited Current Output)

Description	Current	LED	Operator Action
Normal operation/no gas present	4.0 mA	Off	If the possibility of background gases exists, purge the sensor with clean air to ensure accurate calibration.
Initiate calibration	2.2 mA	On steady	Apply the calibration magnet or activate the calibrate pushbutton for one second.
Zero calibration complete	2.0 mA	Flashing	Apply 7.5% LFL methane calibration gas.
Span calibration complete *	1.8 mA	Off	Shut off and remove calibration gas and cap the calibration nozzle (or replace it with the allen head plug).
Calibration fault indication	1.6 mA	Off	See Troubleshooting Section.

\* Span calibration can be aborted (Zero Only Calibration) by applying the calibration magnet or activating the calibrate pushbutton for one second. The device will use the span data from the last calibration.

3. Wait for the zero calibration point to stabilize (typically 1 minute).

After successful zero calibration:

- The LED will begin flashing,
- The current will drop to 2.0 milliamperes.

Proceed to step 4.

If zero calibration fails:

- The LED will turn off,
- The current output will drop to 1.6 milliamperes.

Reset the detector by cycling power to the detector or by holding the Cal Magnet near the Cal Switch in the PIRTB box for one second. Begin calibration again at step 1.

4. Apply 7.5% LFL methane calibration gas to the detector. A 2.5 liter per minute flow rate is recommended.

- The LED will continue flashing (if used).
- The current will remain at 2.0 milliamperes as the gas concentration increases.

5. The detector will automatically accept the span calibration when the detected gas level is stable (typically 1 to 2 minutes).

After successful span calibration:

- The LED will turn off (if used),
- The current will drop to 1.8 milliamperes.

Proceed to step 6.

If for any reason a successful calibration is not accomplished within 10 minutes, a calibration fault will occur:

- The LED will turn off,
- The current output will drop to 1.6 milliamperes.

Turn off the gas, then reset the detector by cycling power to the detector or by holding the Cal Magnet near the Cal Switch. Begin calibration again at step 1.

6. After successful calibration, close the valve on the calibration gas canister and remove the flexible tube from the detector. The detector will return to normal operation after the gas level has dropped to near 0.

### **IMPORTANT**

*The calibration port must be capped to prevent dirt and water from entering the direct path into the optics. Failure to protect the optics can result in a fouled optics fault. If a permanent gas delivery system is used, the delivery tube must be plugged when not in use.*

## **MAINTENANCE**

The PIRDUCT detector requires less routine maintenance than other combustible gas detectors. This is accomplished through its design that allows no undisclosed internal failures, and an optics protection system that is extremely resistant to fouling by external contamination. The most significant benefit of this design is reduced calibration requirements. When installed and used per the manufacturer's recommendations, the PIRDUCT does not require routine calibration, although an annual calibration inspection is recommended as a good practice. More frequent calibrations may be performed at the discretion of the user without adverse impact.

Other recommended maintenance practices include periodic visual inspections of the sensor and/or weather protection system. External contaminants and/or debris, if allowed to accumulate, can reduce sensitivity by physically blocking vapor access to the sensor. Common examples include plastic bags, litter, heavy oil and tar, paint, mud, and snow. This simple visual inspection of all gas sensors is a good idea, especially for outdoor installations.

In the unlikely event that the PIRDUCT detector indicates a fouled optics condition, it is possible to disassemble and clean the optics. However, it is recommended that a spare device be kept on hand to enable complete exchange of the electronics/optics module in the field, enabling the disassembly and cleaning operation to be performed in a clean lab environment.

### **IMPORTANT MAINTENANCE NOTES**

- *Hydrocarbon-based grease will emit hydrocarbon vapors, which will be measured by PIRDUCT and will cause inaccurate gas level readings. **Use only silicone grease (not hydrocarbon-based grease) when lubricating threads on the PIRDUCT detector and associated termination box.** A suitable grease is listed in the "Spare Parts" section at the end of this manual.*

- *In applications where both PIRDUCT and catalytic type sensors are used, ensure that the silicone grease used to lubricate the PIRDUCT detector threads does not come into contact with the catalytic sensors or poisoning of the catalytic sensors will result. It is strongly recommended that maintenance personnel wash their hands between handling the two types of sensors.*

## DISASSEMBLY AND CLEANING PROCEDURE

The PIRDUCT detector should be inspected periodically to ensure that its performance is not impaired by fouled optics or by clogging of the filter or hydrophobic screen. Depending upon accessibility, it may be necessary to extract the detector from the duct in order to perform inspection. Inspection and/or periodic maintenance involves three different areas of the detector — the filter/baffle, the hydrophobic screen, and the detector optics.

### **IMPORTANT**

*Remove power before disconnecting and removing the PIRDUCT detector for maintenance.*

### **NOTE**

*It is not necessary to remove the electronics assembly from the detector base assembly in order to clean the detector optics.*

**Filter/Baffle.** Perform a visual inspection of the filter/baffle, checking for a variety of environmental contaminants including nests of insects, spiders, etc. Disassemble the PIRDUCT and clean as necessary.

**Hydrophobic Screen.** While clogging of the hydrophobic screen is rare in most installations, the flow of gas through the screen could be inhibited by an accumulation of extremely fine particles of airborne contaminants. To inspect the hydrophobic screen, disassemble the PIRDUCT as described below. If the screen appears to be fouled or damaged, replace it.

### **IMPORTANT**

*The hydrophobic screen should be replaced whenever the mirror assembly and reflector tubes are cleaned or replaced, or when the screen appears fouled upon visual inspection.*

**Optics.** Cleaning of the optical surfaces is required only if an optical fault is indicated (1.0 milliampere current output signal from the PIRDUCT detector). This procedure is most easily accomplished on a bench.

### **IMPORTANT**

*If the PIRDUCT optics system is disassembled, **calibration is required** after re-assembly.*

Required materials: Clean, flat work surface, foam tipped swabs (no cotton), isopropyl alcohol, screwdriver or hex wrench.

### **CAUTION**

*The PIRDUCT contains semiconductor devices that are susceptible to damage by electrostatic discharge. An electrostatic charge can build up on the skin and discharge when an object is touched. Therefore, use caution when handling the device, taking care not to touch electronic components or terminals. If the electronics assembly is removed, it should be placed in an anti-static bag or box while stored or transported. A static safeguarded work area is highly recommended (if available) for disassembly and cleaning of the PIRDUCT.*

1. Loosen the two captive screws on the end of the filter assembly, then remove the filter assembly as shown in Figure 12.
2. Loosen the two captive screws on the mirror assembly (Figure 12) and remove the mirror assembly from the reflector tubes. See Figure 13. Note the orientation of the mirror assembly and reflector tubes. They should later be re-assembled in the same way (mirror assembly not rotated 180°).
3. Remove the hydrophobic screen and reflector tubes from the mounting tubes as shown in Figure 13. Do not remove the electronics mounting cover.
4. Thoroughly douse the interior of the mirror assembly as well as the foam tipped swab with isopropyl alcohol. Use the swab to gently cleanse the surfaces of the reflecting mirrors inside the mirror assembly. After cleaning with the swab, flush out the mirror assembly using a liberal amount of isopropyl alcohol. Tip the mirror assembly with mirror openings downward to remove accumulated isopropyl alcohol and particle contaminants. Repeat the alcohol flush to remove any remaining contaminants. Allow the mirror assembly to air dry in a dust-free location.

### **IMPORTANT**

*Do not insert any sharp object into the mirror assembly. Scratching of the mirrors will void the PIRDUCT warranty. Do not use cotton tipped swabs or buds as they are likely to leave fiber residue.*

5. Clean the two reflector tubes and windows using the procedure described above. When the mirror assembly, windows, and reflector tubes are thoroughly dry, proceed with re-assembly.
6. Make sure that the retainers that hold the reflector tubes in place are evenly spaced on the tubes and not blocking any holes. Carefully reinstall the reflector tubes on the mounting tubes and seat the reflector tubes securely into the windows in the base.
7. Slide the hydrophobic screen over the reflector tubes. Be careful not to crumple or fold the hydrophobic screen.
8. Insert the ends of the two reflector tubes into the larger holes in the mirror assembly and ensure that they are fully seated. The setscrews on the mirror assembly must line up with the slots on the reflector tubes. See Figure 14. Be sure that the holes in the reflector tubes are facing outward to allow unrestricted gas entry.
9. Tighten the two captive screws on the mirror assembly. See Figure 12. Tighten the screws evenly. Do not over-tighten (apply 1 N-m minimum torque).
10. Slide the filter assembly over the mirror assembly and rotate until it is seated securely. If it is not oriented correctly, the filter assembly will not slide onto the unit. Fasten the two captive screws. See Figure 12.
11. Attach the gas supply tube.
12. Calibrate the detector with 7.5% LFL methane following the instructions in the "Calibration" section of this manual.

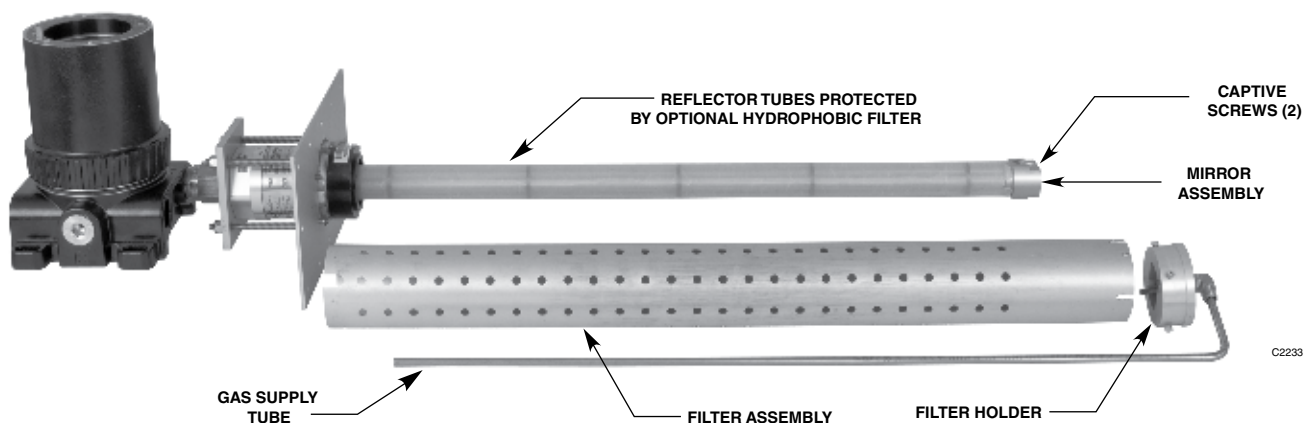


Figure 12—PIRDUCT with Filter Assembly Removed

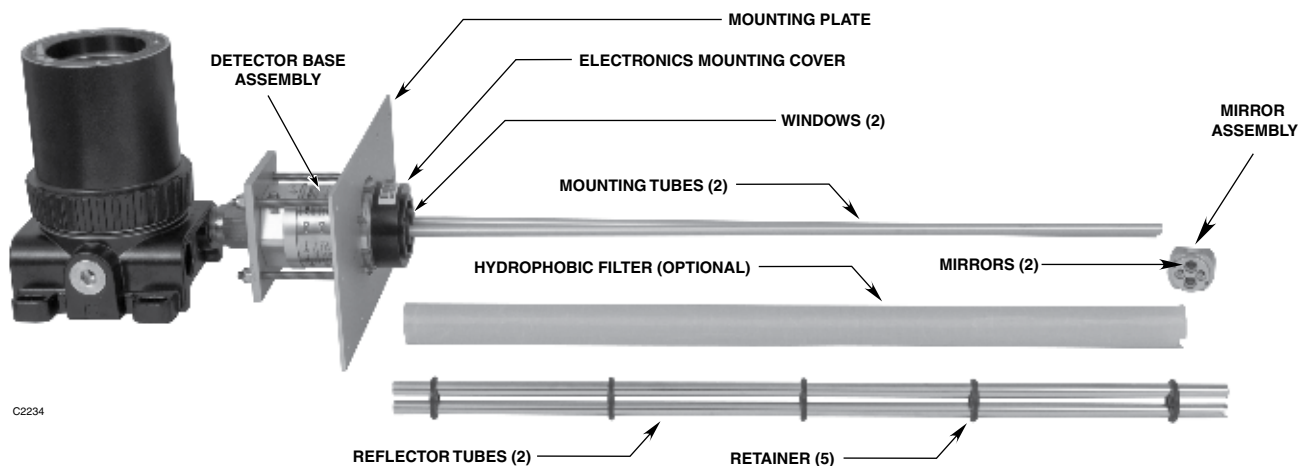


Figure 13—PIRDUCT Disassembled for Cleaning

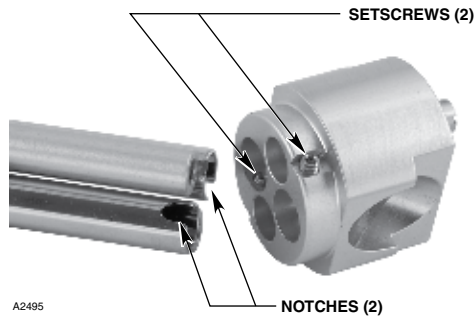


Figure 14—Setscrews on Mirror Assembly Line Up with Notches on Reflector Tubes

## TROUBLESHOOTING

Use Table 4 to isolate and correct malfunctions with the PIRDUCT Detector.

## DEVICE REPAIR AND RETURN

The PIRDUCT IR Hydrocarbon Gas Detector is not designed to be repaired in the field. If a problem should develop, first carefully check for proper wiring, programming and calibration. If it is determined that the problem is caused by a mechanical or electronic failure, the device must be returned to the factory for repair.

Prior to returning devices or components, contact the nearest local Detector Electronics office so that a Returned Material Identification (RMI) number can be assigned. A written statement describing the malfunction must accompany the returned device or component to expedite finding the cause of the failure.

Pack the unit or component properly. Use sufficient packing material in addition to an anti-static bag or aluminum-backed cardboard as protection from electrostatic discharge.

Return all equipment transportation prepaid to the factory in Minneapolis.

Table 4—Troubleshooting Guide

Current Level	Status	Corrective Action
2.4 to 3.9 mA	Negative Gas Indication	<b>NOTE:</b> This phenomenon is typically caused either by the presence of background gas during zero calibration, or by condensation on the device optics. If low level background hydrocarbon gas was present during calibration, the result will be a signal output level below 4 mA when the background gas clears. To correct this, the device must be re-zeroed with all background gas removed.
1.6 mA	Calibration fault	Use 7.5% LFL methane for calibration. If the fault is still present, perform disassembly and cleaning procedure, then recalibrate.
1.0 mA	Fouled optics	Perform disassembly and cleaning procedure, then recalibrate.
0.8 mA	+24 Vdc line low (less than +17.5 Vdc)	Ensure that input voltage is correct and that power connections are good. If fault does not clear, replace the electronics assembly.
0.6 mA	Calibrate input active at power-up	Ensure that calibration line is not shorted and that the calibration switch is open. If fault does not clear, replace the unit.
0.4 mA	Active channel fault	Replace the unit.
0.2 mA	Reference channel fault	Replace the unit.
0.0 mA	CPU system fault, warmup	Ensure that power is applied and that the warmup period is complete (1 minute). If fault does not clear, replace the unit.

# ORDERING INFORMATION

## PIRDUCT Model Matrix

MODEL	DESCRIPTION	
PIRDUCT	Point Infrared DuctWatch Gas Monitor	
	TYPE	THREAD TYPE
	A	3/4" NPT
	B	M25
	TYPE	SIGNAL OUTPUT
	1	4-20 mA w/o hydrophobic filter
	2	4-20 mA with factory fitted hydrophobic filter
	TYPE	APPROVALS
	W	FM, CSA, ATEX, CE
	TYPE	WIRING TERMINATION JUNCTION BOX
	1	Factory-fit with PIRTBA5NW3V (standard 4-20 mA) AL j-box, 3/4" NPT
	2	Factory-fit with PIRTBA5LW3V (standard 4-20 mA) AL j-box, 25 mm
	3	Factory-fit with EQ2253DCU (EQP sys only) AL j-box, 3/4" NPT
	4	Factory-fit with EQ2207DCU (EQP sys only) AL j-box, 25 mm
	5	No factory-fit wiring termination j-box provided

### CALIBRATION EQUIPMENT

PIRDUCT calibration kits consist of a sturdy carrying case containing two 3.6 cubic foot (103 liter) cylinders of 7.5% LFL methane gas, a regulator and pressure indicator, three feet of tubing, and a nozzle for direct application to the detector.

Calibration Kit 006468-007  
 Spare Cylinder of 7.5% LFL Methane Gas 226166-012

### SPARE PARTS

Description	Part Number
Hydrophobic Filter Replacement Kit	006876-002
Calibration Magnet	102740-002
Silicone Grease for PIRDUCT threads (6 cc syringe)	006680-001
Grease for termination box threads	102868-001

### ASSISTANCE

For assistance in ordering a system to meet the needs of a specific application, contact:

Detector Electronics Corporation  
 6901 West 110th Street  
 Minneapolis, Minnesota 55438 USA  
 Operator: (952) 941-5665 or (800) 765-FIRE  
 Customer Service: (952) 946-6491  
 Fax: (952) 829-8750  
 Web site: [www.det-tronics.com](http://www.det-tronics.com)  
 E-mail: [det-tronics@det-tronics.com](mailto:det-tronics@det-tronics.com)

## APPENDIX A

### Factory Mutual (FM)

The following items, functions and options describe the FM approval.

### APPROVAL

PIRDUCT Infrared Hydrocarbon Gas Detector Model PIRDUCT Series.

Explosion-proof for Class I, Division 1, Groups B, C, & D (T5) Hazardous (Classified) Locations per FM 3615.

Non-incendive for Class I, Division 2, Groups A, B, C & D (T3C) Hazardous (Classified) Locations per FM 3611.

Performance verified for 0 to 15% LFL Methane-in-air atmospheres per FM 6320.

#### NOTE

*Model PIRDUCT must be used in conjunction with an FM Approved control device.*

PIRDUCT Termination Box Part Number 006414-XXX

Explosion-proof for Class I, Division 1, Groups B, C, & D (T6) Hazardous (Classified) Locations per FM 3615.

Non-incendive for Class I, Division 2, Groups A, B, C & D (T6) Hazardous (Classified) Locations per FM 3611.

#### NOTE

*Approval of the PIRDUCT and termination box does not include or imply approval of the apparatus to which the PIRDUCT may be connected and which processes the electronic signal for eventual end use.*

### Special Conditions for Safe Use of PIRDUCT —

When installed in a gas turbine exhaust duct, the duct width cannot exceed 8.2 feet (2.5 meters) and the cross sectional area cannot exceed 67.2 feet<sup>2</sup> (6.25 meters<sup>2</sup>). The distance between PIRDUCT and the exhaust duct inlet must be at least four times the width of the exhaust duct. In addition, an FM Approved gas detector must be used for monitoring the fuel line of the gas turbine for potential leaks.

### ATTACHMENTS/OPTIONS

Aluminum Explosion-proof Enclosure.

3/4 inch NPT and M20 Conduit Entry Thread Types. (Metric straight thread is for use in non-North American applications.)

Calibration Kit (006468-007)

7.5% LFL Calibration Gas (226166-012)

Calibration Nozzle (102821-001)

Regulator (162552-002)

Tubing (101678-007)

### CALIBRATION

The DuctWatch Model PIRDUCT can be calibrated as a stand-alone device.

PIRDUCT Termination Box (006414-xxx) can be used to calibrate the PIRDUCT Detector.

#### NOTE

*It is required that calibration of PIRDUCT be conducted as well as calibration of the system in which it is installed.*

## APPENDIX B

### CE MARK

The Model PIRDUCT DuctWatch Infrared Hydrocarbon Gas Detector was tested and found to be compliant with EN50270 when wired in conduit or with shielded cable. All screen drains shall be terminated to the chassis.

### ATEX CERTIFICATION

#### PIRDUCT DuctWatch IR Hydrocarbon Gas Detector

CE 0539 Ex II 2 G  
Ex d IIB+H<sub>2</sub> T4-T6  
DEMKO 09 ATEX 147623X  
T6 (T<sub>amb</sub> = -55°C to +50°C)  
T5 (T<sub>amb</sub> = -55°C to +60°C)  
T4 (T<sub>amb</sub> = -55°C to +75°C)  
IP66.

EN Standards: EN 60079-0: 2006  
EN 60079-1: 2007  
EN 61779-1: 2000  
EN 61779-4: 2000  
EN 60529: 1991+A1: 2000  
EN 50270: 2006

Read and understand instruction manual before operating.

#### Special Conditions for Safe Use of PIRDUCT —

The performance ambient temperature rating is limited to -40°C to +75°C.

The PIRDUCT IR Hydrocarbon Gas Sensor must be used in conjunction with a CENELEC certified combustible gas detector control unit for compliance with EN 61779 Series standards.

The flying leads shall be terminated in a CENELEC certified terminal box (Ex d or Ex e) for use in a hazardous location. To maintain the IP66 ingress protection rating, the flying leads must be installed in a certified flameproof enclosure, with an ingress protection rating of IP66.

The captive front end screws are to be tightened with 1 Nm.

#### PIRTB Termination Box

CE 0539 Ex II 2 G  
Ex d IIC T5-T6  
DEMKO 02 ATEX 131326  
T6 (T<sub>amb</sub> = -55°C to +60°C)  
T5 (T<sub>amb</sub> = -55°C to +75°C)  
IP66.

Performance conforms to EN 61779 Series standards.

All cable entry devices and blanking elements shall be certified in type of explosion protection flameproof enclosure "d", suitable for the conditions of use and correctly installed. Unused apertures shall be closed with suitable certified blanking elements.

For ambient temperatures above 60°C, use field wiring suitable for maximum ambient temperature.



95-8573



X3301 Multispectrum  
IR Flame Detector



PointWatch Eclipse®  
IR Combustible Gas Detector



Eagle Quantum Premier®  
Safety System



Eagle Logic Solver  
Safety System

Detector Electronics Corporation  
6901 West 110th Street  
Minneapolis, MN 55438 USA

T: 952.941.5665 or 800.765.3473

F: 952.829.8750

W: <http://www.det-tronics.com>

E: [det-tronics@det-tronics.com](mailto:det-tronics@det-tronics.com)



A UTC Fire & Security Company

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