

Instructions

95-8573

DuctWatch™ Gas Monitor
Model PIRDUCT

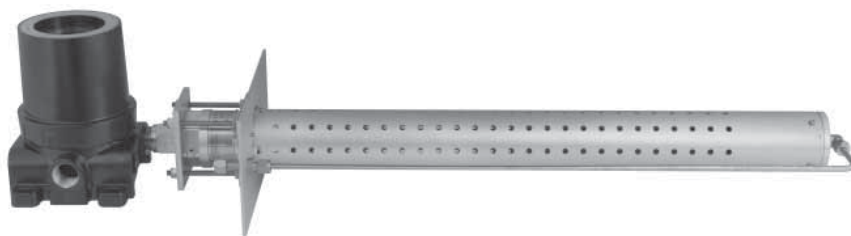


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CAUTION

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

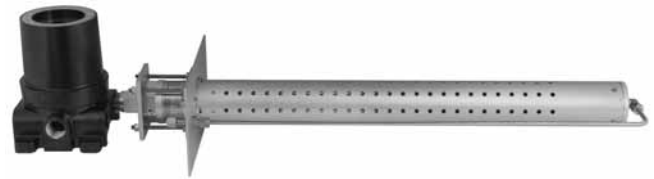
APPLICATION

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 DuctWatch 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 (7500 ppm) methane vapor concentration, the DuctWatch delivers a new level of flammable hydrocarbon gas protection for high airflow environments.

The DuctWatch 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).

POWER CONSUMPTION (Watts)—

Input Voltage:	18 vdc	24 vdc	32 vdc
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—

T50 within 10 seconds; T90 within 30 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).

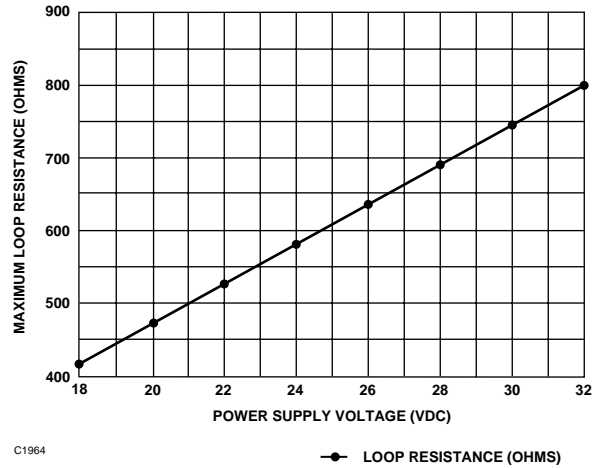


Figure 1—4 to 20 ma Current Loop Resistance

WIRING—

The DuctWatch 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.

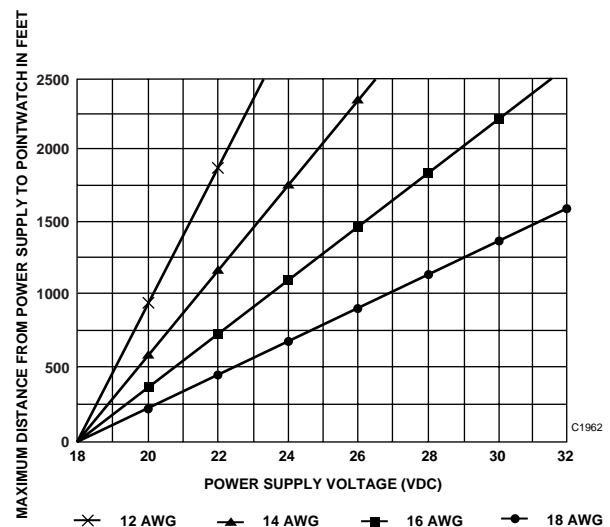


Figure 2—DuctWatch Wiring Requirements

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—

DuctWatch 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
EEx d IIB +H₂ T4-T6
DEMKO 03 ATEX 136208X
T6 (T_{amb} = –55°C to +50°C)
T5 (T_{amb} = –55°C to +60°C)
T4 (T_{amb} = –55°C to +75°C)
IP66.

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 DuctWatch 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 mm² wire.

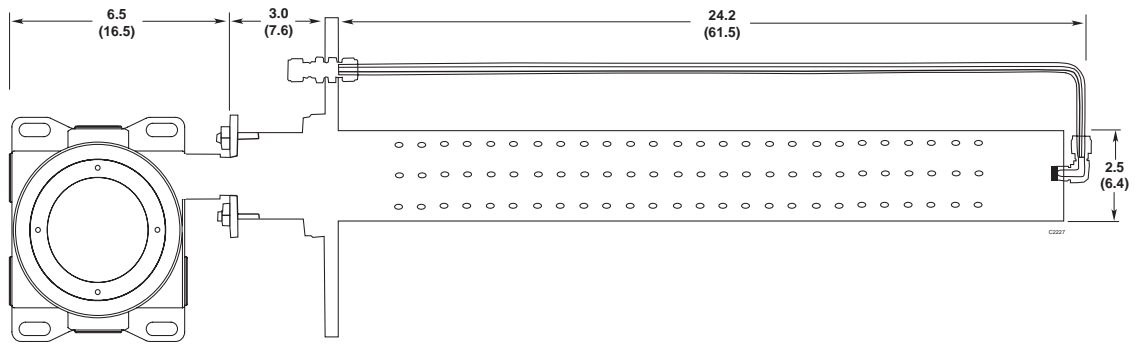


Figure 3—Dimensions of DuctWatch Detector in Inches (cm)

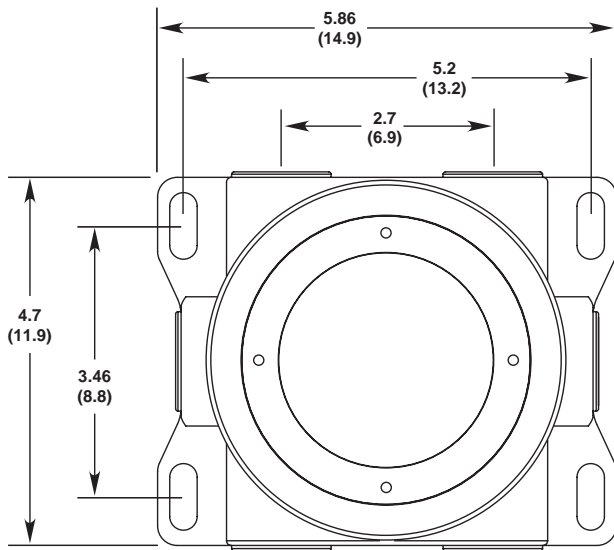


Figure 4—Termination Box Dimensions in Inches (cm)

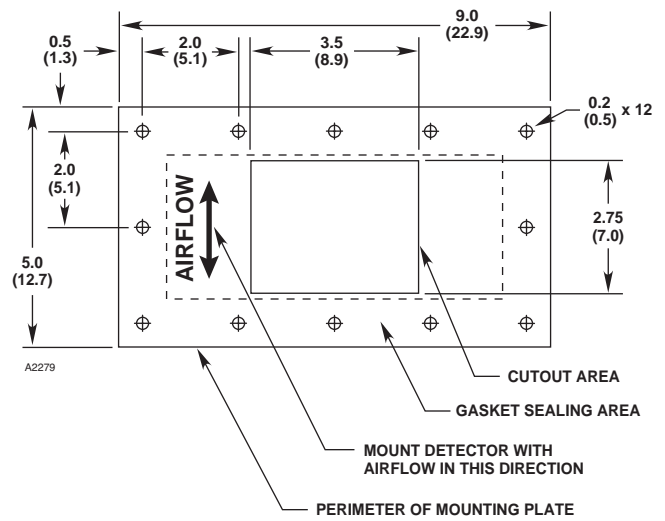
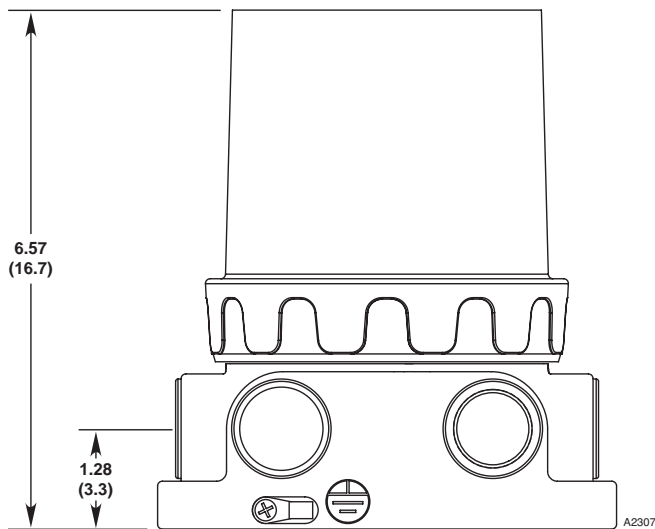


Figure 5—Dimensions of DuctWatch Mounting Plate in Inches (CM)



DESCRIPTION

MEASUREMENT METHOD

DuctWatch 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 DuctWatch 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

DuctWatch 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 DuctWatch 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 DuctWatch optics, and dangerous methane vapors present within the airflow will be detected and measured by DuctWatch.

CURRENT LOOP OUTPUT

During normal operation, the DuctWatch 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 DuctWatch 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 indicate a fault.

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 DuctWatch 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 on the end of the DuctWatch to enable introduction of calibration gas. It is protected by a tethered plastic cover, which should always be installed during normal operation.

NOTE

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

NOTE

A full DuctWatch 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 DuctWatch 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 DuctWatch and will result in inaccurate gas level readings. Use only low vapor pressure silicone grease when lubricating threads on the DuctWatch 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 DuctWatch and catalytic type sensors are used, ensure that the silicone grease used to lubricate the DuctWatch 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.

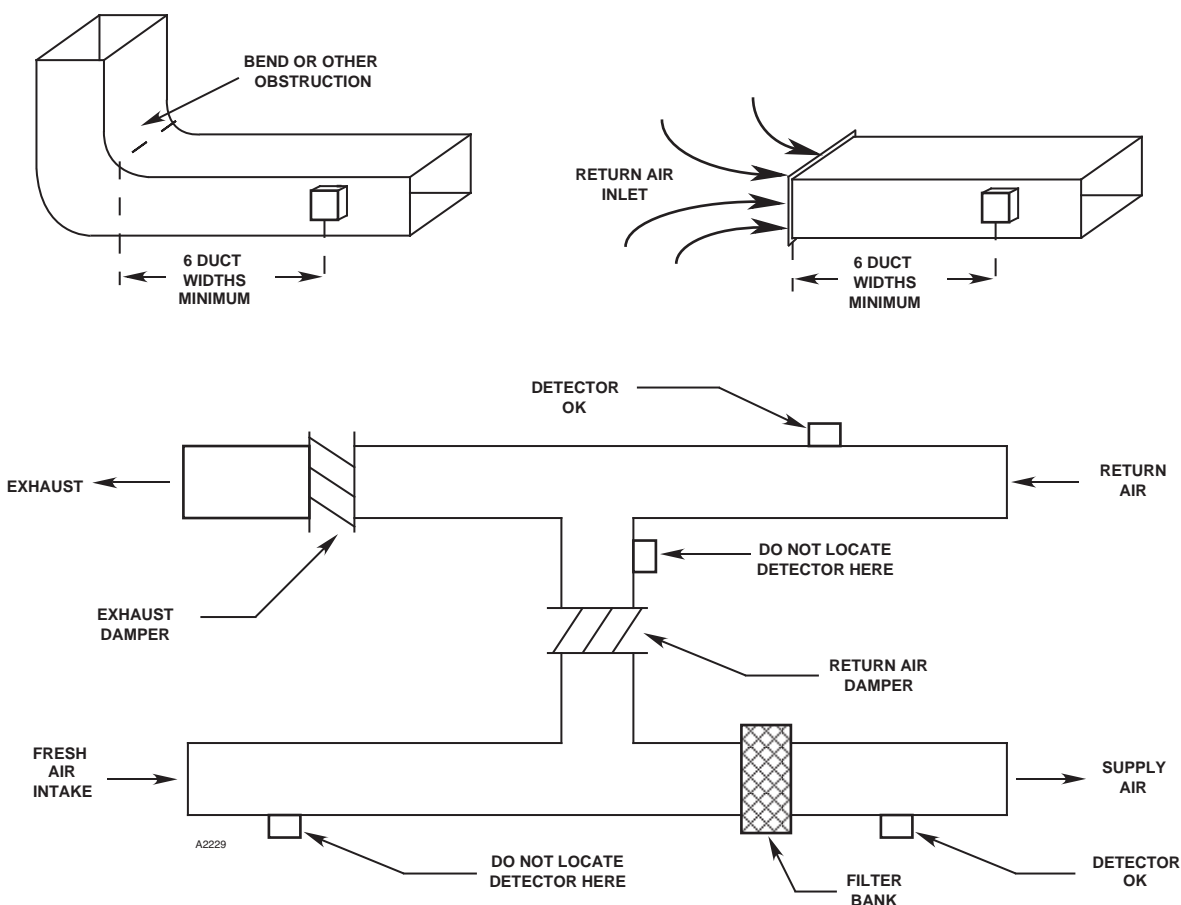


Figure 6—Detector Placement

2. 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.
3. Locate detectors so that dampers do not restrict air flow at the detector location.
4. Locate detectors where they can be conveniently observed and readily serviced.
5. If in-situ calibration is required, determine required peripheral equipment (tubing, fittings, etc.) and ensure that installation requirements can be accommodated.

NOTE

The DuctWatch 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.

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.



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.



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

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 DuctWatch. 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 DuctWatch 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 DuctWatch to ensure that the power requirements are met.

1. Determine the best mounting location for the detector (refer to the "Detector Location" section above).
2. The termination box should be electrically connected to earth ground.
3. Wire the DuctWatch. Refer to Figures 8 through 11 for various system configurations using the DuctWatch 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 DuctWatch with Det-Tronics supplied termination box. Figure 10 shows the termination box terminals and calibration switch. Figure 11 shows a DuctWatch wired to a DCU in an Eagle Quantum Premier system. The DuctWatch 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.

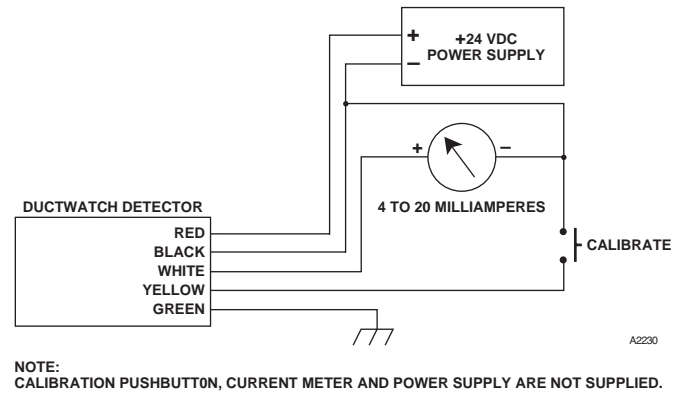


Figure 8—Typical DuctWatch Wiring, Stand Alone Configuration

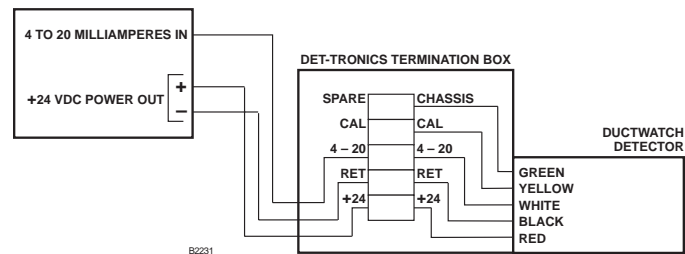


Figure 9—Typical Wiring, DuctWatch with PIRTB Termination Box

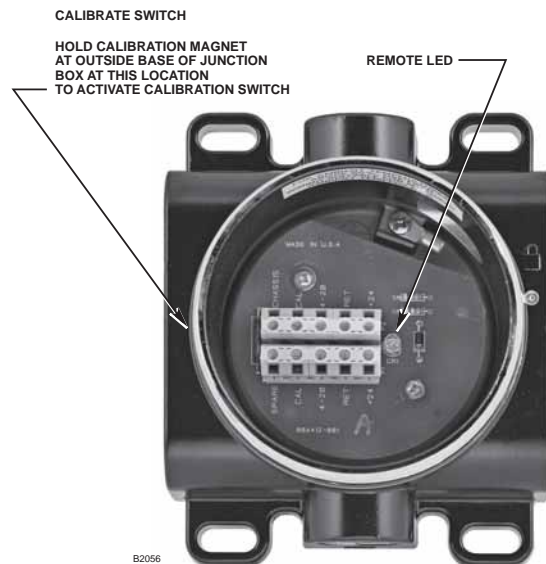


Figure 10—PIRTB Termination Box Terminals and Calibration Switch

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

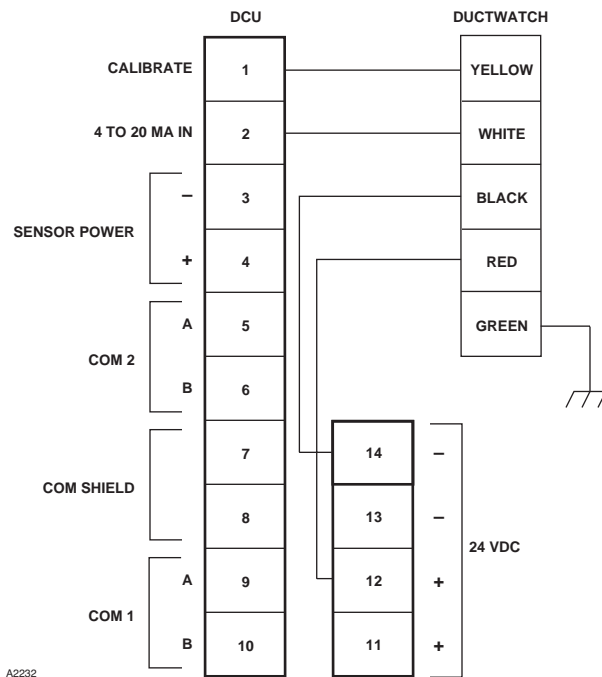


Figure 11—DuctWatch Wired to DCU in an Eagle Quantum Premier System

NOTE

The DuctWatch 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 insulation to properly mount the DuctWatch mounting plate.

1. When the proper mounting location has been identified, mark and drill the DuctWatch assembly mounting holes in the proper pattern. Refer to Figure 5 for the mounting hole pattern dimensions. Be sure to mark and drill the holes in the proper orientation.
2. Install the DuctWatch 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 DuctWatch is securely and solidly installed in all cases.

3. Install optional calibration gas delivery hardware if desired.
4. The DuctWatch termination box should be electrically connected to earth ground.
5. Connect the field conductors to the proper terminals in the termination box.
6. Check the connections inside the termination box and place the cover on the termination box.

MOUNTING PROCEDURE

CAUTION

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

NOTE

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

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 DuctWatch 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.

The DuctWatch supports two different calibration options:

1. Zero only calibration. This procedure adjusts only the 4.0 mA (zero % gas) signal output of the DuctWatch. 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 DuctWatch must be calibrated in hydrocarbon free air! For proper Span calibration, the DuctWatch must be calibrated in still air!

Bump Test

A bump test is recommended when acceptable to determine if span calibration is necessary. To conduct a bump test, inhibit output loads as necessary, then apply 7.5% LFL calibration gas to the DuctWatch. Check the current output for the appropriate response (12 milliamperes signal output). Calibration is recommended if the signal output during the gas bump test is not within ± 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.

Table 2—Calibrate or Check

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

CALIBRATION EQUIPMENT

The following equipment is required for span calibration of the DuctWatch 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 DuctWatch is used with the Det-Tronics supplied termination box (containing a magnetic reed switch and LED). For applications where the DuctWatch detector is used with the Eagle Quantum Premier system, refer to the system instruction manual (form number 95-8533) for calibration procedure.

When DuctWatch 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 DuctWatch 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 DuctWatch 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 DuctWatch 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, remove the flexible tube from the detector, and replace the nozzle cap. 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 DuctWatch 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 DuctWatch 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 DuctWatch 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 DuctWatch and will cause inaccurate gas level readings. **Use only silicone grease (not hydrocarbon-based grease) when lubricating threads on the DuctWatch 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 DuctWatch and catalytic type sensors are used, ensure that the silicone grease used to lubricate the DuctWatch 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 DuctWatch detector should be inspected periodically to ensure that its performance is not impaired by fouled optics or by clogging of the filter. 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 two areas of the detector — the filter/baffle and the detector optics.

IMPORTANT

Remove power before disconnecting and removing the DuctWatch 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 DuctWatch and clean as necessary.

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

IMPORTANT

If the DuctWatch 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 DuctWatch 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 DuctWatch.

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.
3. Remove the 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.
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. Insert the two reflector tubes into the larger holes in the mirror assembly and ensure that they are fully seated. Make sure that the retainers that hold the reflector tubes in place are evenly spaced on the tubes and not blocking any holes.
7. Carefully reinstall the reflector tubes on the mounting tubes and seat the reflector tubes securely into the windows in the base.
8. 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).
9. 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.
10. Calibrate the detector with 7.5% LFL methane following the instructions in the "Calibration" section of this manual.

IMPORTANT

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

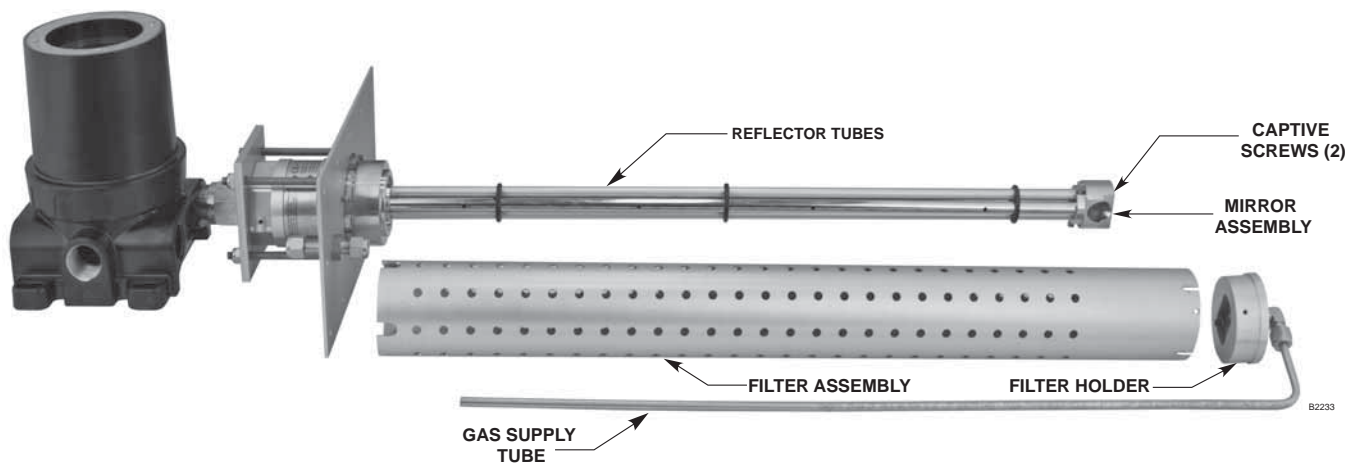


Figure 12—DuctWatch with Filter Assembly Removed

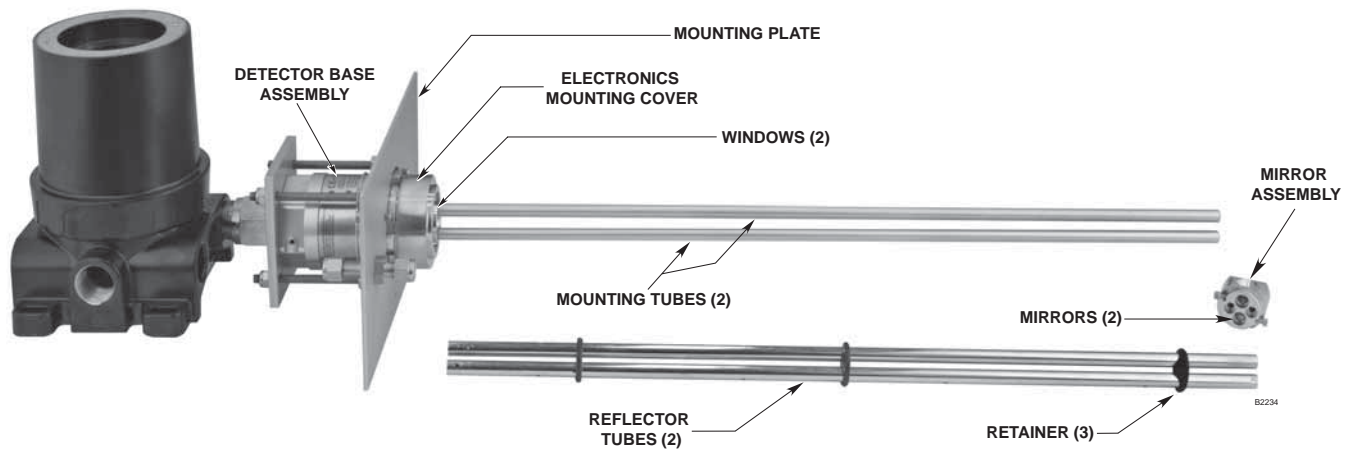


Figure 13—DuctWatch Disassembled for Cleaning

TROUBLESHOOTING

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

DEVICE REPAIR AND RETURN

The DuctWatch 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 Service Order 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	NOTE: 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

DuctWatch OS Matrix

MODEL	DESCRIPTION		
PIRDUCT	Point IR DuctWatch Gas Monitor (aluminum) with Duct-Mount Plate		
	TYPE	THREAD TYPE	
	A	3/4" NPT	
	B	M25	
	TYPE	SIGNAL OUTPUT	
	1	4-20 mA	
	TYPE	APPROVALS	
	W	FM, CSA, CENELEC/ATEX, CE	
	TYPE	WIRING TERMINATION JUNCTION BOX	
	1	Factory-fit with PIRTBA2NW2L (standard 4-20 ma) alum j-box, 3/4" NPT	
	2	Factory-fit with PIRTBA2MW2L (standard 4-20 ma) alum j-box, 25mm	
	3	Factory-fit with EQ2253DCU (EQP sys only) alum j-box, 3/4" NPT	
	4	Factory-fit with EQ2207DCU (EQP sys only) alum j-box, 25mm	
	5	No factory-fit wiring termination j-box provided	

CALIBRATION EQUIPMENT

DuctWatch 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
Calibration Magnet	102740-002
Silicone Grease for DuctWatch 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
 E-mail: detronics@detronics.com

APPENDIX A

Factory Mutual (FM)

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

APPROVAL

DuctWatch 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.

DuctWatch 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 DuctWatch and termination box does not include or imply approval of the apparatus to which the DuctWatch 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 feet² (6.25 meters²). 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.

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

NOTE

It is required that calibration of DuctWatch 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
EEx d IIB +H₂ T4-T6
DEMKO 03 ATEX 136208X
T6 (T_{amb} = -55°C to +50°C)
T5 (T_{amb} = -55°C to +60°C)
T4 (T_{amb} = -55°C to +75°C)
IP66.

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 (EEx d or EEx e) for use in a hazardous location.

PIRTB Termination Box

CE 0539 Ex II 2 G
EEx d IIC T5-T6
DEMKO 02 ATEX 131326
T6 (T_{amb} = -55°C to +60°C)
T5 (T_{amb} = -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.



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: dettronics@dettronics.com



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