Instructions 95-8400-01

PathWatch™ Open Path IR Beam Detector
PW9200A1 Series

DET-TRONICS

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Table of Contents

DET-TRONICS®

INSTRUCTIONS

PathWatch™ Open Path IR Beam Detector PW9200A1 Series

Section 1 General Information

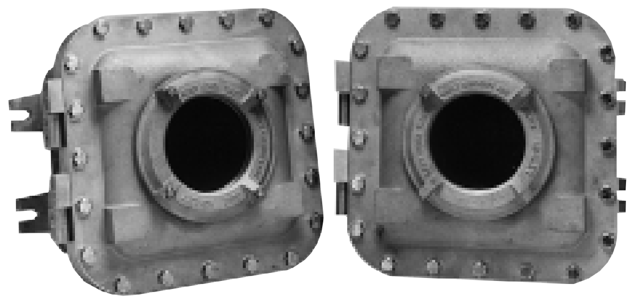
The installation, operation and maintenance instructions contained in this manual are for use by qualified personnel only. All personnel assigned to this equipment should read the instructions provided before initiating any procedures. The manual should be maintained on file so that it is available to installation, operation and maintenance personnel. To avoid injury to personnel or damage to the equipment, do not perform any procedures other than those described in this manual unless instructed by the factory or qualified by training.

The information contained in this manual is proprietary to Detector Electronics Corporation and is intended for the sole purpose of installing, operating and maintaining the PathWatch™ Open Path IR Beam Detector.

GENERAL DESCRIPTION

The PathWatch™ open path leak detector is an electro-optical instrument that monitors hydrocarbon vapors along an open surveillance path. The instrument is designed to operate remotely and to enable vapor detection in difficult locations. Vapor detection is based on changes in infrared absorption in the spectral region of 3 to 4 microns.

The system consists of a transmitter and a receiver, which can be separated by a distance of 100 meters or more and are optically aligned. The transmitter projects an infrared beam through the area under surveillance to the receiver. In the receiver, the infrared beam alternately passes through two narrow band interference filters, a hydrocarbon wavelength and a reference wavelength. A ratio of the reference signal to the hydrocarbon signal is computed to provide an output signal proportional to the total hydrocarbon content in the beam path. Because it is an open path system, the instrument's measurement is a function of gas concentration (expressed in ppm) times the length of the surveillance path (expressed in meters). Thus, the instrument's output indicates the average vapor concentration over the entire path length.



A hydrocarbon alarm relay is activated when the ratio signal exceeds the adjustable threshold, which corresponds to a selected average vapor concentration in the path. A separate instrument status alarm relay is activated when the infrared signal transmission is weak or blocked, or when an instrument malfunction occurs.

FEATURES

- Active system provides more sensitivity than other beam detectors.
- Incorporates premium, fundamental-band IR absorption filters.
- No inherent source of drift.
- Monitors areas from 20 meters to 100 meters long.
- Single pass, straight line approach ensures maximum beam integrity.
- Single sensor for both active and reference channels.
- Internal fault alarm.
- Dual sensitivity and dual vapor options for different environments.
- Easy alignment with wide margin for error.
- Capable of "around-the-corner" monitoring.
- Rugged, easy to use pan-tilt mounting bracket.
- Calibrated with real gas.
- Eye safe beam.
- Rugged, explosion-proof construction.
- Cooled IR sensor and air purge port offers potential for operation in high temperature environments.
- Modular design for easy service.
- Optical surfaces easily protected from the elements.
- CSA certified.

SPECIFICATIONS

HOUSING SIZE—
Transmitter and receiver dimensions are identical: 12-1/4 inches (W) x 11-1/2 inches (H) x 9-1/2 inches (D).

WEIGHT—
Transmitter: 38 lb (17.2 kg).
Receiver: 42 lb (19 kg).

MOUNTING—
3/8-16 bolts (4 per housing) to a pan-tilt mount. The mount interfaces between the instrument housings and the user supplied vertical mounting pipes (4.5 inch O.D.).

OPERATING VOLTAGE—
Standard: 105 to 125 VAC, 50/60 Hz.

The incoming power line is fused internally to protect the instrument from damage. These fuses are accessible on the front panel. On the 4 to 20 ma Output Board, the 4 to 20 ma module is also fused.

POWER CONSUMPTION—
Transmitter: 30 watts.
Receiver: 60 watts.

OPERATING TEMPERATURE—
In ambient air with instrument shaded from direct sunlight: –4°F to +110°F (–20°C to +43°C) at 60 Hz, –4°F to +100°F (–20°C to +38°C) at 50 Hz.

OPERATING DISTANCE (transmitter to receiver)—
Maximum: 328 feet (100 meters).
Minimum: 66 feet (20 meters).

VOLUME MONITORED—
A cylinder with a diameter of approximately 8 cm and a length determined by the separation distance of the transmitter and receiver.

SENSITIVITY (using heavy HC filters)—
100 ppm-meters minimum for heavy hydrocarbons.

WARNING

If the instrument is furnished with heavy hydrocarbon filters, it will not respond to ethylene or methane. Contact the factory for information on sensitivity to these vapors.

RESPONSE TIME—
63% of final reading within 10 to 20 seconds after a step change in hydrocarbon vapor concentration.

HYDROCARBON VAPOR ALARM OUTPUT—
SPST relay, rated at 7 amperes continuous, 120 vac/240 vac or 28 vdc. Also rated at 1/3 HP at 120 vac, 1/2 HP at 240 vac. Contacts are closed under normal clean air conditions and open when vapors are detected.

OBSTRUCTION/FAULT STATUS OUTPUT—
SPST relay, rated at 7 amperes continuous, 120 vac/240 vac or 28 vdc. Also rated at 1/3 HP AT 120 vac, 1/2 HP AT 240 vac. Contacts are closed under normal conditions and open when the beam is interrupted or a malfunction occurs.

ANALOG OUTPUT—
A 0 to 10 vdc analog output is available from the instrument with 0 vdc corresponding to clean air. The analog output increases as the hydrocarbon vapor increases with +10 vdc corresponding to full scale hydrocarbon vapor concentration along the monitored path. The concentration corresponding to full scale is adjustable over a ±50% range.

HAZARDOUS ENVIRONMENT CERTIFICATION—
Canadian Standards Association certified for operation in Class I, Division 1, Groups C and D environments and CSA enclosures Type 3 and 4.

FUNCTIONAL DESCRIPTION

A functional description of the operation of the PW9200 is detailed in the following paragraphs and is illustrated in Figure 1.

TRANSMITTER

The transmitter projects a beam of light toward the receiver along the path to be monitored. A tungsten halogen lamp is mounted at the focal point of a parabolic reflector in the transmitter housing.

RECEIVER

The receiver contains the optical, mechanical, and electrical components for receiving the light emitted by the transmitter and processing the signal to an output that is proportional to the average hydrocarbon content present in the volume monitored.

Receiver Lens

Light enters the receiver through the infrared transmitting lens. The lens focuses the incoming light onto the face of the infrared photodetector.

Filterwheel Motor

This motor is a small 115 vac shaded pole ball bearing motor. The filterwheel is attached to the motor shaft.

Filterwheel

The filterwheel is located between the receiver lens and the photodetector. It contains the DENOMINATOR (active) and NUMERATOR (reference) optical interference filters. Rotating at a rapid rate, the filterwheel chops the incoming light beam and alternately passes infrared light at the two distinct wavelengths to the photodetector.

Sync Pickoff

The sync pickoff is a small U-shaped optical switch, which is mounted on the rear panel printed circuit board and straddles the filterwheel. It senses when each filter is in front of the infrared photodetector and generates the synchronization signal.

Photodetector

The infrared photodetector is mounted at the focal point of the receiver lens. The photodetector converts the intensity of the incoming infrared light to a proportional electrical signal. It alternately senses the light intensity at both wavelengths during each revolution of the filterwheel. The photodetector is thermo-electrically cooled to increase the sensitivity to infrared light.

Amplifiers

The signal at the photodetector is amplified by the preamplifier circuitry. The gain of the preamplifier can be adjusted with a potentiometer to optimize the signal strength for long or short operating distances.

The amplified signal is fed to the AGC amplifier, which maintains the signal within the proper operating range.

Signal Processing Electronics

The signal from the AGC Amplifier is separated into two outputs: active (DENOMINATOR) and reference (NUMERATOR).

Ratiometer

The ratiometer circuit generates an analog output by calculating the ratio of the NUMERATOR (reference) signal to the DENOMINATOR (active) signal.

Optional 4 To 20 Milliampere Converter

This option converts the 0 to 10 vdc voltage (RATIO output) into a 4 to 20 ma current. A load resistor is connected between the RATIO output and the analog ground and can be any value between 0 and 500 ohms.

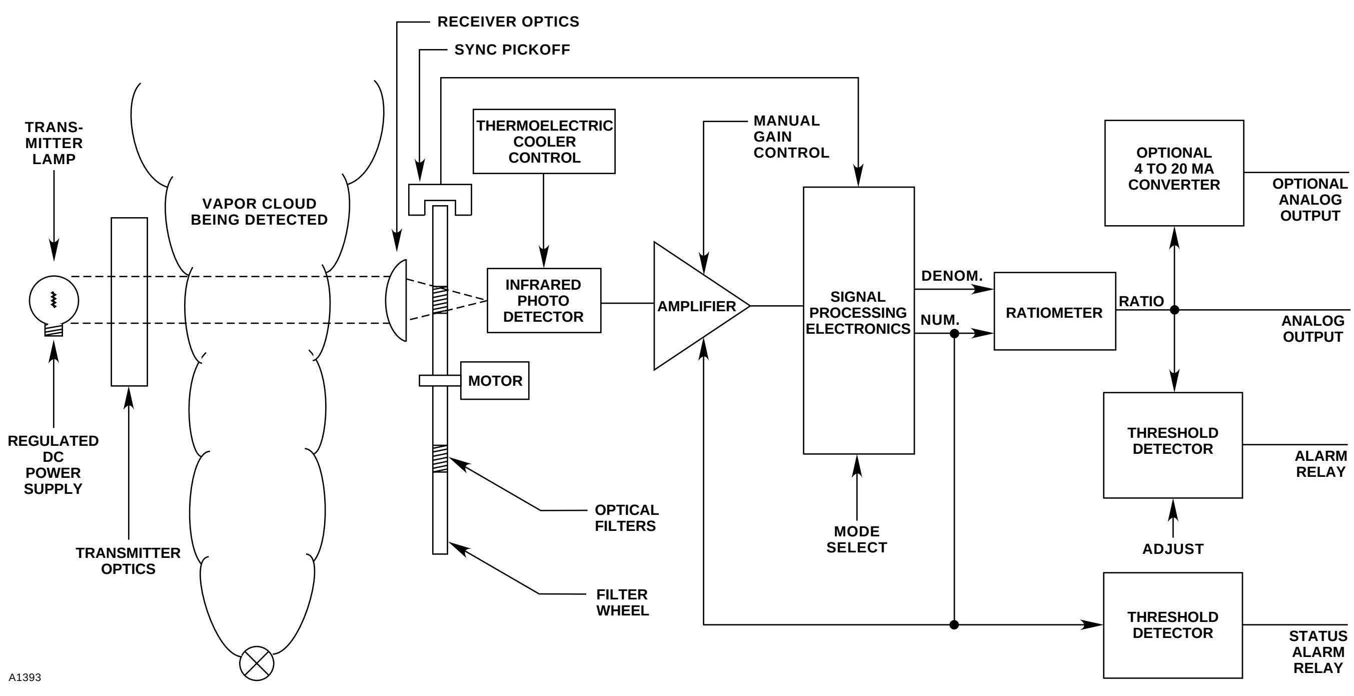


Figure 1—Functional Block Diagram

Threshold Detector:
Hydrocarbon Vapor Alarm Relay

The threshold detector activates when the RATIO voltage increases above a preset value. Activation of the threshold detector causes the vapor alarm relay to energize. The threshold level at which the hydrocarbon vapor alarm relay is energized can be adjusted and tested on the front panel.

Threshold Detector:
Obstruction/Instrument Status Alarm Relay

The threshold detector activates when the NUMERATOR (reference) voltage approaches zero. When the threshold detector activates, the obstruction/instrument status alarm relay to de-energizes. Because the relay is energized in normal operation and is de-energized when the beam is blocked or when an instrument malfunction occurs, the alarm is fail-safe.

Section 2
Operation

SAFETY INFORMATION

EXPLOSION-PROOF INTEGRITY

WARNING

The PW9200 housings or associated junction boxes must never be opened when circuits are alive and hazardous vapor conditions may exist. Ensure that no hazardous vapor conditions exist in procedures where the cover, window assembly or junction box is to be opened when circuits are alive.

CAUTION

If power is to be disconnected for an extended period, e.g. over one week, the instrument should be removed to a protected environment.

Special precautions must be taken with the PW9200 to ensure the integrity of the explosion-proof housings. When the instrument is in operation, the window assemblies must be securely tightened. The cover bolts must be torqued to 20 foot pounds.

Scratches may affect the strength of the instrument windows, so care must be taken to avoid scratching them during installation, operation and servicing. Similarly, the mating surfaces of the cover and the housing flange should not be scratched and these surfaces should be protected during servicing.

The light beam projected by the PW9200 transmitter could cause combustible materials within its path to ignite or raise the temperature of an object within its path above the self-ignition temperature of some gases. Check the temperature code for the transmitter wattage used (see instrument nameplate) and do not install the instrument at any location where this dangerous condition could occur.

PERSONNEL SAFETY

The American Conference of Governmental Industrial Hygienists (ACGIH) has established threshold limit values (TLVs) or maximum allowable exposures to bright light sources during an eight hour workday. According to ACGIH, "these values are to be used as guides to the control of exposure to light and should not be regarded as the fine line between safe and dangerous levels".

WARNING

It is possible to exceed the ACGIH limit values by viewing the instrument's light source directly from the center of the light beam at distances less than approximately ten feet from the source. DO NOT stare directly into the light source at close range.

As with the sun, which greatly exceeds the Threshold Limit Values established by the ACGIH, the eye's self-protection mechanism (blinking) activates and automatically prevents overexposure. However, close range viewing of the transmitter beam must be avoided.

FRONT PANEL CONTROLS

Front panel controls are described in the following paragraphs and are illustrated in Figure 2. Access to the front panel controls is gained by removing the receiver window assembly.

OUTPUT ZERO POTENTIOMETER

The ZERO adjustment potentiometer is used to set the analog output (RATIO) to zero volts when the instrument views hydrocarbon-free air.

MODE SWITCH

The MODE selector switch permits adjustment of the instrument's response time and testing of the alarm circuits.

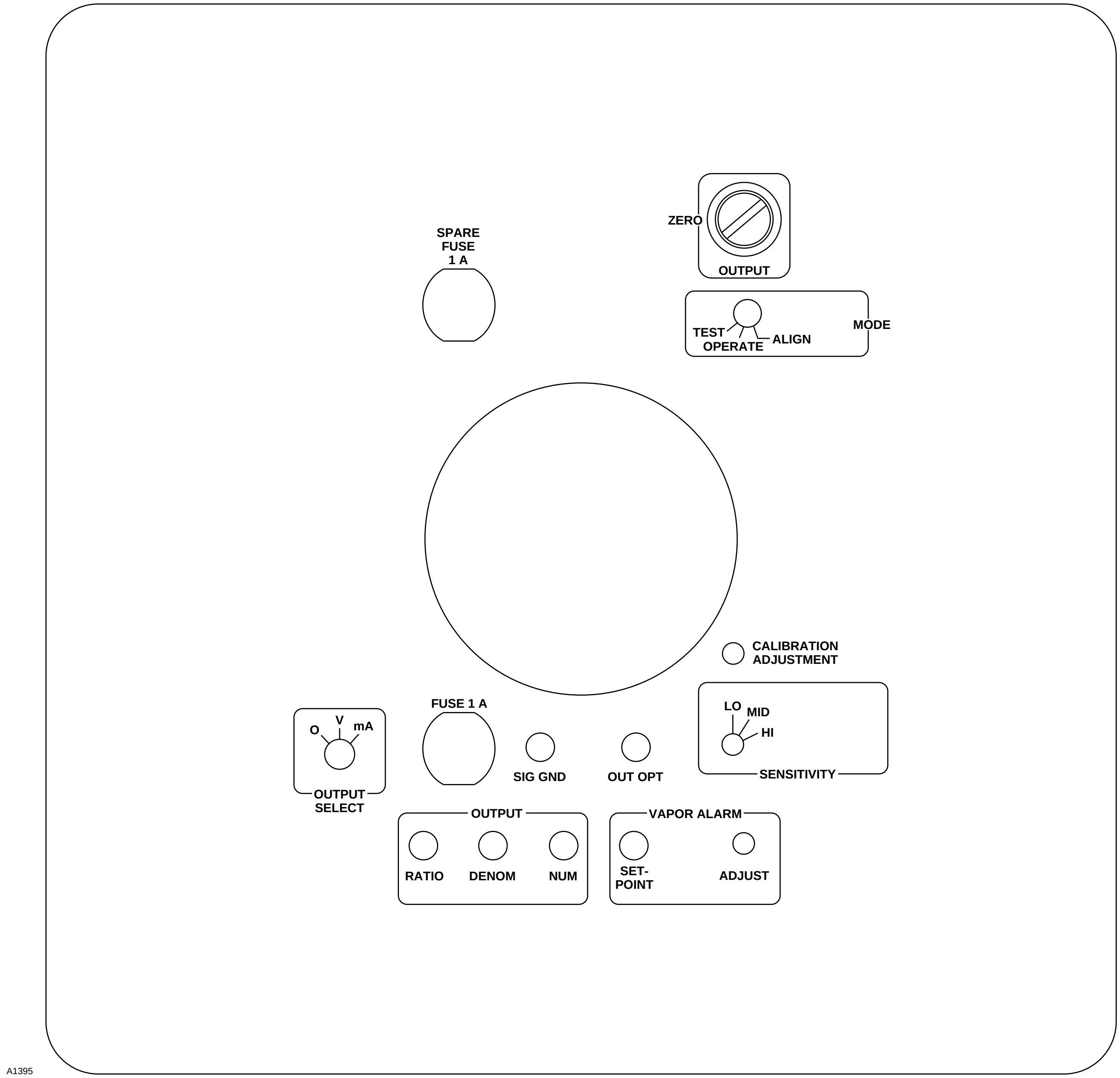


Figure 2—Front Panel Controls

Align

A shorter response time (approximately 2 seconds) is used only during the alignment and testing process.

Operate

A longer response time (approximately 20 seconds) is used during normal operation to compensate for short term signal variations and to prevent the hydrocarbon alarm from activating on short duration vapor clouds.

Test

Test mode activates the hydrocarbon alarm circuits.

CALIBRATION ADJUSTMENT POTENTIOMETER

The CALIBRATION ADJUSTMENT potentiometer is used to scale the RATIO output voltage for the desired span. During factory calibration, the RATIO output voltage is set to correspond to the desired ppm reading at full scale.

SENSITIVITY SWITCH

The SENSITIVITY selector permits adjustment of the range or span of the instrument's sensitivity. It is recommended that the selector be set for Hi. Mid and Lo are used for specialized applications.

Hi

This position sets the instrument for the highest sensitivity available. PW9200 instruments are factory set and calibrated at HI sensitivity.

Mid

This position decreases the sensitivity of the instrument by a factor of 3.

Lo

This position decreases the sensitivity of the instrument by a factor of 10.

HC ALARM

Adjust

The HC ALARM Adjustment potentiometer is used to set the threshold at which the RATIO voltage energizes the hydrocarbon alarm relay. The HC ALARM is adjustable from 10% full scale to 100% full scale.

Setpoint (grey)

The HC ALARM Set Point test jack is used to access the HC alarm threshold setting.

OUTPUT

The OUTPUT test jacks permit access to the NUMERATOR, DENOMINATOR and RATIO outputs:

Ratio (brown)

RATIO output (ratio of the two IR beams): 0 to 10 volts.

Denom (red)
DENOMINATOR output (intensity of the HC beam): 0 to 600 mv.

Num (green)

NUMERATOR output (intensity of the reference beam): 0 to 600 mv.

SIG GND (green)

The SIG GND test jack permits access to signal ground.

OUT OPT (violet)

The OUT OPT test jack permits access to the optional RATIO output (used only with the options P.C. board).

FUSE

The power line fuse has been located on the front panel for accessibility.

OUTPUT SELECT SWITCH

This switch is used to select the type of RATIO output that is available at the junction box:

O - Optional output mode

This position is available for optional processing data output.

V - Voltage output mode

This position sets the RATIO output for 0 to 10 vdc.

MA - Milliamp output mode

This position sets the RATIO output for 4 to 20 ma, if this option has been installed.

INSTALLATION

INSPECTION

Since the instrument could be subjected to shock or vibration during shipping, an inspection of the connections and filterwheel is recommended.

Prior to the initial setup of the instrument, open the housing (see “Access to Internal Components” procedure) and check that the printed circuit board(s) are securely held in the connector(s). If a board has become dislodged, return it to the proper connector. The synchronous demodulator board is on the right of the filterwheel and the options board is on the left (See Figure 3). Observe the location of the keys and do not attempt to insert the printed circuit board(s) backwards. Be certain that the board is firmly seated in the connector and that both the top and bottom are held by the card guides. Check that the ribbon connectors on the AGC/TE cooler board and on the rear panel board are fully engaged and that the latches are locked. Rotate the filterwheel to check that it spins freely. Check that the two receiver connectors are securely engaged.

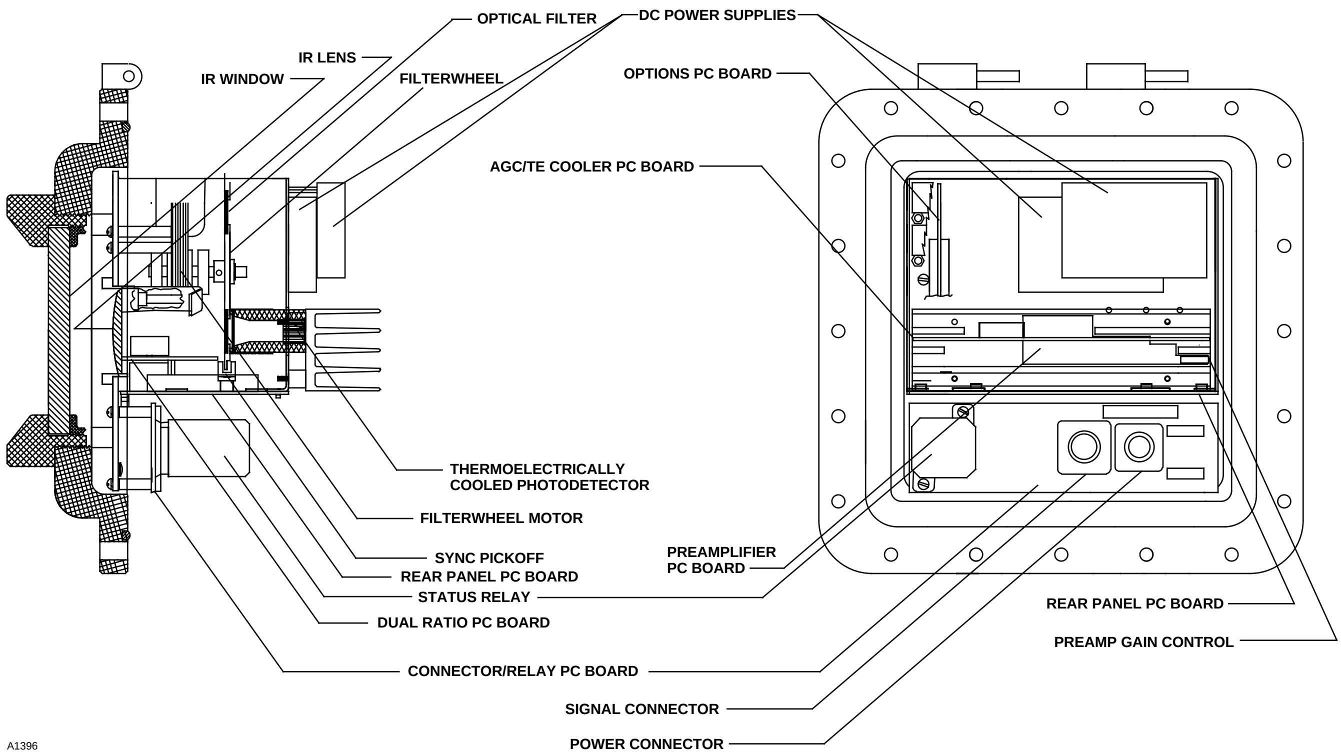


Figure 3—Location of Receiver Boards and Assemblies

SITE REQUIREMENTS

If the instrument is located where it is exposed to direct sunlight, a sunshield should be installed to keep the instrument housing temperature within the specified operating limit.

If the instrument is installed in a high temperature, high humidity or corrosive atmosphere, instrument air or dry nitrogen purge is recommended.

Do not install the instrument so that the receiver directly faces an intense heat source.

CAUTION

If power is to be disconnected for an extended period, (e.g., over one week) the instrument should be removed to a protected environment.

MOUNTING

The PW9200 is installed so that the transmitter and receiver face each other. If a mirror is used with the PW9200, see APPENDIX for special mount assembly and alignment procedures.

The transmitter and receiver are bolted to the pan-tilt mount, illustrated in Figures 4 and 5. This mount permits height, horizontal pan and vertical tilt adjustments to optically align the instrument for maximum signal strength. The pan-tilt mount attaches to a user supplied 4 inch I.D. (4.5 inch O.D.) vertical pipe, which must be securely stabilized to assure retention of alignment over time and temperature fluctuations. The vertical pipe should also be isolated against external vibration.

1. Loosen the bolt holding the alignment target to the back of the front plate and rotate the target 180°. Add the two other 1/4-20 x 3/4 inch screws, nuts and lockwashers provided and secure the target.

2. Slide the alignment scope (packed between the plates of the mount) marked “R” onto the grooved bracket of the mount marked “R”. Roughly center the alignment scope on the bracket and firmly tighten the scope mount clamp screws. Repeat for the scope and mount marked “T”. Be sure to match the serial number of the scope to the serial number of the mount.

NOTE

Do not discard the protective end caps for the scopes. They should be replaced when optical alignment has been completed.

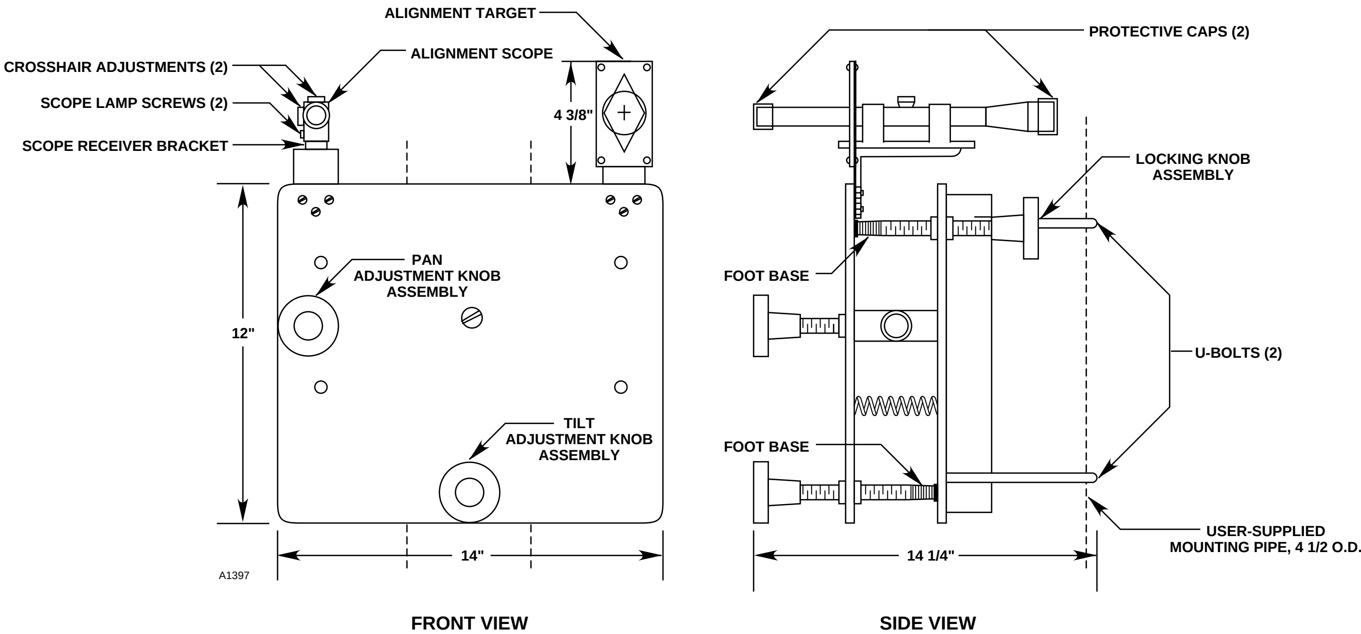


Figure 4—Pan Tilt Mount

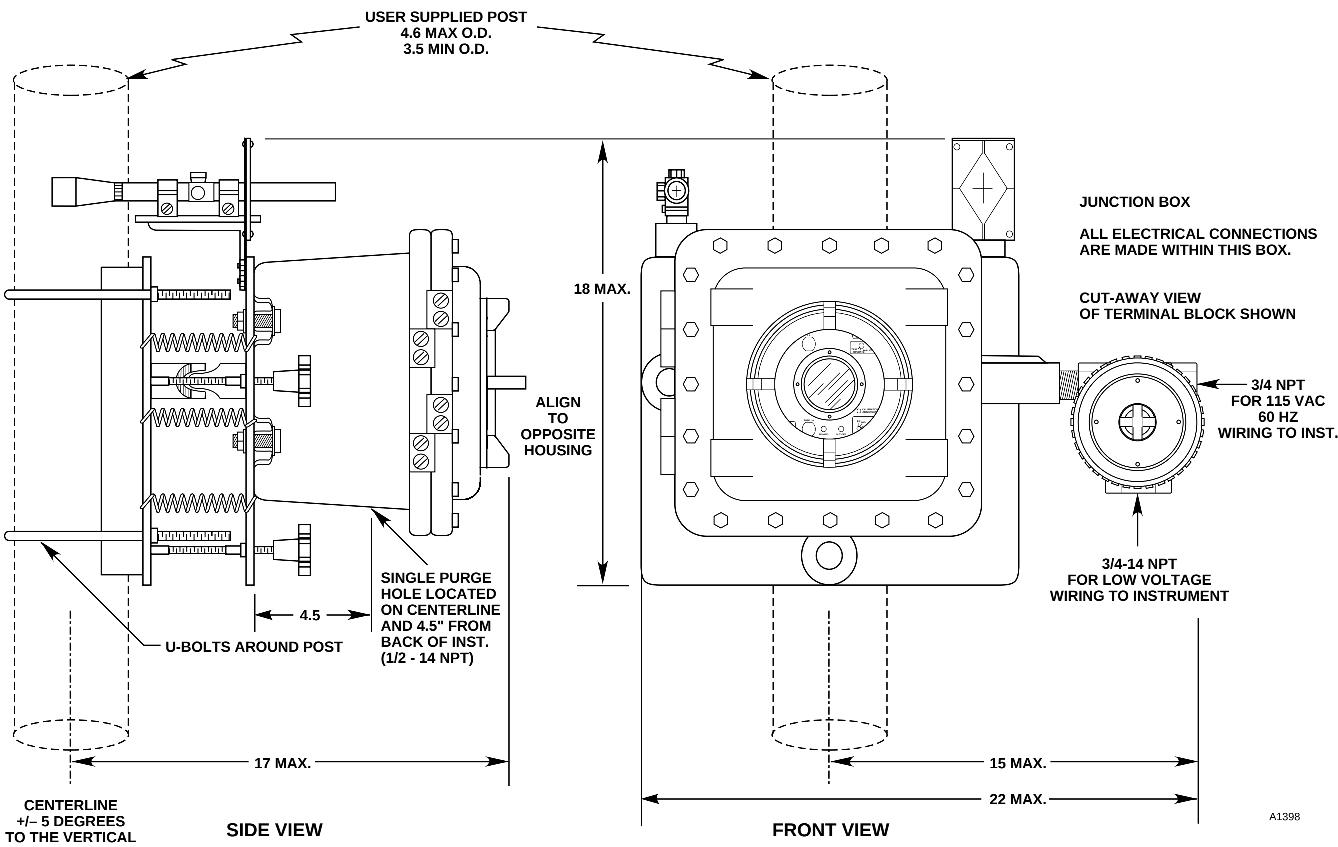


Figure 5—Detector Mounting

INITIAL SETUP

When the inspection procedures and special precautions detailed above have been carefully observed, the initial setup of the PW9200 is accomplished by following Steps 1 through 9 below:

NOTE

Signal ground of the electronics is not tied to the housing case and therefore, is not tied to earth ground. Optimum immunity to 60 cycle noise could require tying signal ground to earth ground external to the instrument.

CAUTION

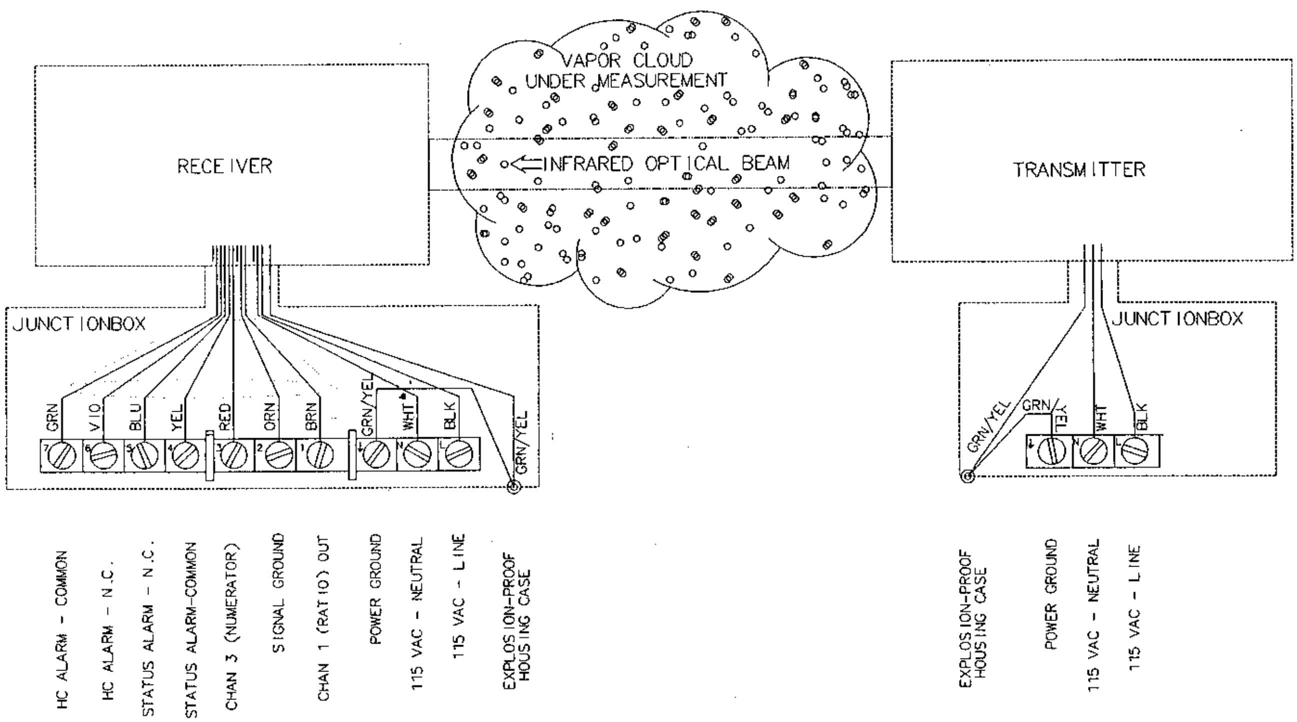
Do not remove protective window covers until Step 7. Do not mount the instrument until power is available. In order to minimize the possibility of condensation forming inside the instrument, once mounted, the instrument should not be left without power for extended periods of time.

1. Attach the pan-tilt mounts to a user supplied 4.5 inch O.D. mounting pipe with the two U-bolts supplied. Tighten the U-bolts securely at the desired height.

2. Attach the transmitter and the receiver to the pan-tilt mounting plates using the 3/8-16 x 1-1/2 inch stainless steel bolts, nuts and washers provided with the instrument, as shown in Figure 5. Be sure to attach the receiver to the mount marked “R” and to attach the transmitter to the mount marked “T”, and to match the serial number of the instrument with the serial number of the mount. The mounting surface should be vertical with the transmitter and receiver roughly facing each other.

3. Connect external wiring as shown in Figure 6. Strip the insulation back 1/4 inch. Insert the stripped wire into the terminal under the appropriate number. Tighten the screw above the number by turning it clockwise using a screwdriver with a 1/8 inch blade. All terminals in the junction box are numbered. Low voltage signal lines and high voltage power lines from the junction box should be in separate cables, if possible. If the signal and power lines are not in separate cables, the high voltage power wires (115 vac line and power ground) must be shielded from the signal lines for safety reasons. Any conduit installed must be of a flexible, explosion-proof type, which will allow panning and tilting of the housings for optimum alignment.

RATIO, NUMERATOR AND SIGNAL GROUND wiring from the junction box should be connected to external readout devices of at least 5,000 ohms impedence. If 4 to 20 ma output is installed, external readout devices must have less than 500 ohms impedence.



NOTE:

N.C. AND N.O. REFERS TO THE CONDITION OF THE RELAY CONTACTS (NORMALLY OPEN OR NORMALLY CLOSED) WHEN THE INSTRUMENT IS OPERATING PROPERLY AND DOES NOT OBSERVE ANY TARGET VAPORS.

Figure 6—System Interwiring Diagram

WARNING

If both conduit entrances to the junction box are not used, the unused entrance must be fitted with an explosion-proof pipe plug with at least five full threads engaged.

4. Connect HYDROCARBON ALARM relay and STATUS ALARM relay signal terminals (4, 5, 6 and 7) to external readout devices (e.g., indicator lamps, alarm buzzers, motors, computer interface, etc.). The hydrocarbon alarm relay contacts open when a preset concentration of hydrocarbon vapor is exceeded. The status alarm relay contacts open when an obstruction or instrument failure is detected.

5. Connect transmitter and receiver to the power source. DO NOT apply power.

6. Be sure that the cover bolts are tight. Check tightness of junction boxes and window assemblies.

7. Remove protective window covers from both the transmitter and the receiver. Do not discard.

8. As power is first applied to the instrument, the transmitter lamp should light and a faint rotation noise may be heard within the receiver housing.

9. Allow at least one hour warmup time with the instrument operating continuously before proceding to alignment.

NOTE

The instrument is designed for continuous operation. Excessive application and disconnection of power to the transmitter will shorten the life of the lamp.

OPTICAL ALIGNMENT/ SIGNAL STRENGTH

NOTE

The cross hairs of the alignment scopes have been factory set for alignment of the transmitter and receiver. If a mirror is used with the PW9200, a special alignment procedure is provided in the APPENDIX.

IMPORTANT

Optimum alignment must be maintained to ensure reliable operation of the instrument. If the instrument is misaligned, the RATIO output will be noisy and erratic.

After the instrument has been operating continuously for at least one hour, alignment of the transmitter and receiver is best accomplished as follows:

1. Adjust the locking knob assembly on the back plate of each mount so that the end of the shaft is at least 1-1/2 inch from the front plate. (See Figure 4 for illustration of the pan-tilt mount.)

2. With the transmitter and receiver roughly facing each other, view the alignment target attached to the receiver mount through the alignment scope attached to the transmitter mount. Adjust the pan and tilt of the transmitter housing until the cross hairs of the transmitter alignment scope are centered on the target attached to the receiver mount.

3. Adjust the pan and tilt of the receiver housing until the cross hairs of the receiver alignment scope are centered on the target attached to the transmitter mount.

4. Remove the receiver window assembly by rotating counterclockwise. Avoid touching the window with bare hands. Move the window assembly to a safe place, being careful not to scratch the window.

5. Set the MODE selector switch on the front panel to the ALIGN position.

6. Using the test jacks on the front panel, connect a digital voltmeter (with a resolution of at least 1 MVDC) between the NUMERATOR (blue) and SIGNAL GROUND (green).

   NOTE

   All voltage readings must be taken with a dc voltmeter with a 10 megohm input impedence. Use of other devices will give inaccurate readings.

   If the NUMERATOR signal is greater than 100 mV, proceed with fine alignment as described in Step 10.

7. If the NUMERATOR signal is less than 100 millivolts, gross alignment may be obtained by two people working together. Replace the window assembly. One person should remain at the receiver to adjust the pan and tilt of the housing. The second person should stand at a distance of about six feet from and facing the receiver and sight the reflection of the transmitter lamp in the receiver window. (Be careful to stand slightly to one side of the beam path, so that the beam is unobstructed.) The first person should adjust the pan and/or tilt of the receiver until the reflection of the transmitter lamp is visible on the receiver window. The second person should gradually back away from the receiver, keeping the reflection centered through pan and tilt adjustments until

the reflection is visible in the receiver window when standing at the transmitter.

8. Remove the window assembly and check the signal at the NUMERATOR test jack (blue) on the digital voltmeter. If the signal is greater than 100 millivolts, proceed with fine alignment as described in Step 10.

9. If the NUMERATOR signal is still less than 100 millivolts, gross alignment can be obtained by scanning the receiver. Set the pan adjustment of the receiver to one side as far as it will go by turning the pan knob fully clockwise. Beginning with the tilt adjustment set as far up as it will go (tilt knob fully clockwise). Slowly move the tilt of the receiver down as far as it will go by turning the tilt knob counterclockwise. Watch for a sharp increase in the signal strength (greater than 50 mV on the digital voltmeter). Change the pan of the receiver by moving the pan knob a quarter turn clockwise. Slowly move the tilt from bottom to top. Repeat this scanning procedure until the digital voltmeter indicates a NUMERATOR signal greater than 100 millivolts.

10. Make small adjustments in the receiver pan and tilt to maximize the amplitude of the NUMERATOR voltage.

11. Make small adjustments in the transmitter pan and tilt to maximize the amplitude of the NUMERATOR voltage at the receiver.

12. Move the high lead of the voltmeter to the RATIO test jack (brown) on the front panel and read the output voltage. The RATIO voltage should be 0.1 ± 0.1 vdc. If the output is not within this range, adjust the OUTPUT ZERO potentiometer on the front panel to bring the voltage within the desired range. Clockwise turns will increase and counterclockwise turns will decrease the RATIO output voltage.

13. Replace the receiver window assembly and read the NUMERATOR voltage at terminal 3 in the junction box. The NUMERATOR output obtained should be between 0.3 vdc and 0.5 vdc. If the NUMERATOR output is within this range, proceed to Step 15. If the NUMERATOR output obtained exceeds 0.5 volts or is less than 0.3 volts after following all steps of the Optical Alignment/Signal Strength procedure, the preamplifier gain must be adjusted as described in Step 14.

14. To adjust the preamplifier gain, follow the Access to Internal Components procedure (see "Maintenance" section) and locate the preamplifier P.C. board within the heat sink fins. The preamplifier gain adjustment potentiometer is located on the preamplifier P.C. board and can be reached by inserting a screwdriver between the fins from the bottom of the heat sink (as viewed when the housing cover is open, but attached to the housing by its hinges).

    If the NUMERATOR output voltage is less than 0.3 vdc, turn the preamplifier gain potentiometer clockwise. If the NUMERATOR output voltage is greater than 0.5 vdc, turn the preamplifier gain potentiometer counterclockwise.

15. Once optimum alignment has been obtained, carefully adjust the locking knob assembly on the back of each mount so that the end of the shaft just makes contact with the back of the front plate. **DO NOT** over tighten the locking knob assembly.

16. View the target attached to the transmitter mount through the receiver alignment scope to verify that the cross hairs are centered on the target. If the cross hairs are not centered and optimum alignment is verified, adjust the cross hairs to center on the target using the adjustment knobs provided on the scope. Replace the protective end caps on the alignment scope.

17. Repeat Step 16 for the transmitter alignment scope.

NOTE

Optimum alignment must be accurately maintained to ensure proper operation of the instrument. Careful adjustment of the alignment scope cross hairs will enable verification of alignment accuracy.

18. Recheck that the NUMERATOR output has not been affected by steps 15 through 17.

19. Remove the receiver window assembly and return the MODE selector switch on the front panel to the OPERATE position. Replace the window assembly.

OPERATION/PERFORMANCE CHECK

NOTE

All voltage readings must be taken with a dc voltmeter with a 10 megohm input impedence. Use of other devices will give inaccurate readings.

Proper operation should be verified periodically by performing the checks and tests described below:

ALIGNMENT

View the transmitter through the receiver alignment scope to verify that the cross hairs of the scope are centered on the target attached to the transmitter mount. If the cross hairs are not centered on the target, alignment has changed. Adjust the pan and/or tilt of the receiver until the cross hairs of the alignment scope are centered on the target. Check the transmitter alignment scope to verify that the cross hairs are centered on the target attached to the receiver mount. If not centered, adjust as with the receiver.

NOTE

Accurate alignment must be maintained for reliable operation of the instrument. If alignment is changing, the vertical mounting pipe may not be sufficiently stable, or it is being moved during operation. This problem must be corrected to ensure that alignment is maintained.

SIGNAL STRENGTH

The NUMERATOR output read from terminal 3 in the junction box should be between 0.3 vdc and 0.5 vdc. If the NUMERATOR voltage is less than 0.3 volts, realign the instrument as described in the "Optical Alignment/Signal Strength" procedure. If the NUMERATOR output obtained exceeds 0.5 volts, the preamplifier gain must be adjusted as described in Step 14 of the "Optical Alignment/Signal Strength" procedure.

OUTPUT ZERO

The OUTPUT ZERO (RATIO) is factory set for hydrocarbon-free air. The OUTPUT ZERO should be checked periodically and the ZERO potentiometer should be adjusted when necessary.

1. With the instrument viewing hydrocarbon-free air and both transmitter and receiver windows in place, record the RATIO voltage at the junction box. If the RATIO voltage is not 0.1 ± 0.1 vdc, the OUTPUT ZERO potentiometer should be adjusted as described in the following steps.

2. Remove the receiver window and locate the OUTPUT ZERO potentiometer on the front panel.

3. If the RATIO voltage recorded in step 1 was higher than 0.1 ± 0.1 vdc, rotate the ZERO potentiometer counterclockwise until the RATIO voltage is within the desired range.

4. If the RATIO voltage recorded in Step 1 was lower than 0.1 ± 0.1 vdc, rotate the ZERO potentiometer clockwise until the RATIO output is within the desired range.

HEAVY HYDROCARBON RESPONSE CONFIDENCE TEST

To verify that the instrument is responding to the presence of heavy hydrocarbon vapor in the path:

1. With power applied to the instrument, connect a digital voltmeter between the RATIO (brown) and SIGNAL GROUND (green) test jacks on the front panel.

2. Hold a piece of clear plastic (roughly 8 mils thick) in the path of the light beam. Be careful not to block the beam with anything other than the plastic film.

3. The RATIO voltage should increase sharply. If the RATIO voltage does not increase, contact the factory for assistance.

4. Repeat Steps 1 and 2 and check the resistance between terminals 6 and 7 in the receiver junction box. The resistance should increase from zero to infinity.

STATUS ALARM CONFIDENCE TEST

To verify that the instrument status alarm circuit is working properly:

1. With power applied to the instrument, block the beam with an opaque object.

2. The Status Alarm should activate within 120 seconds. The resistance between terminals 4 and 5 in the receiver junction box should increase from zero to infinity. If the status alarm does not activate, contact the factory for assistance.

INSTRUMENT OUTPUT

The 0 to 10 vdc RATIO output is available on all PW9200 instruments at the RATIO test jack (brown) on the front panel and at the receiver junction box when the OUTPUT SELECT switch is set to position V.

An optional 4 to 20 ma output can be ordered with the instrument or can be field installed at any time after purchase. The 4 to 20 ma output option converts the standard 0 to 10 vdc RATIO output to a 4 to 20 ma output. If installed, the 4 to 20 ma output will be available at the receiver junction box when the OUTPUT SELECT switch on the front panel is set to the MA position. The 4 to 20 ma current may be tested by opening the user installed RATIO wire in the junction box (terminal 1) and connecting a current meter between the RATIO wire and terminal 1. The 4 to 20 ma output will drive a user supplied load of 0 to 500 ohms. The 4 to 20 ma output is surge protected.

The RATIO output in this manual is indicated in 0 to 10 vdc. For instruments using the 4 to 20 ma output, the standard 0 to 10 vdc output can be read at the RATIO test jack (brown) on the front panel or at the receiver junction box when the OUTPUT SELECT switch is set to the V position. In addition, a voltage to current transfer curve is provided. See Figure A2.

CALIBRATION

The PathWatch system involves "line" rather than "point" detection, monitoring the path between the transmitter and the receiver. The instrument's measurement is a function of the gas concentration (expressed in ppm) times the length of the path or cloud (expressed in meters). Thus, the instrument's calibration is in units of PPM-Meters (PPM-M). Because it is an open path system, the instrument's output reflects the average concentration over the entire path length.

Simulated gas clouds and controlled gas concentrations are used to factory calibrate the PW9200. The response of a typical instrument is plotted on calibration graphs, which are included in the APPENDIX. A calibration tube and a specified concentration of gas can be used to check the instrument's calibration against the graph. The calibration graph is used to determine the average ppm concentration in the operational path length.

CALIBRATION EQUIPMENT

The optional calibration equipment for the PW9200 is illustrated in Figure 7.

(1) Calibration Adapter
(1) Calibration Tube with flowmeter and hoses

If calibration equipment is not purchased, contact the factory for calibration equipment or service.

PROCEDURE

The calibration of the instrument should be routinely checked at least every twelve months, when there has been a change in the type of hydrocarbon being monitored, or when the operating path is changed significantly. The instrument should be installed, aligned and operating for at least one hour before checking the calibration. This procedure is best performed by two people.

NOTE
In order to ensure accurate calibration, this procedure should be accomplished when the path is known to be free of hydrocarbon vapors.

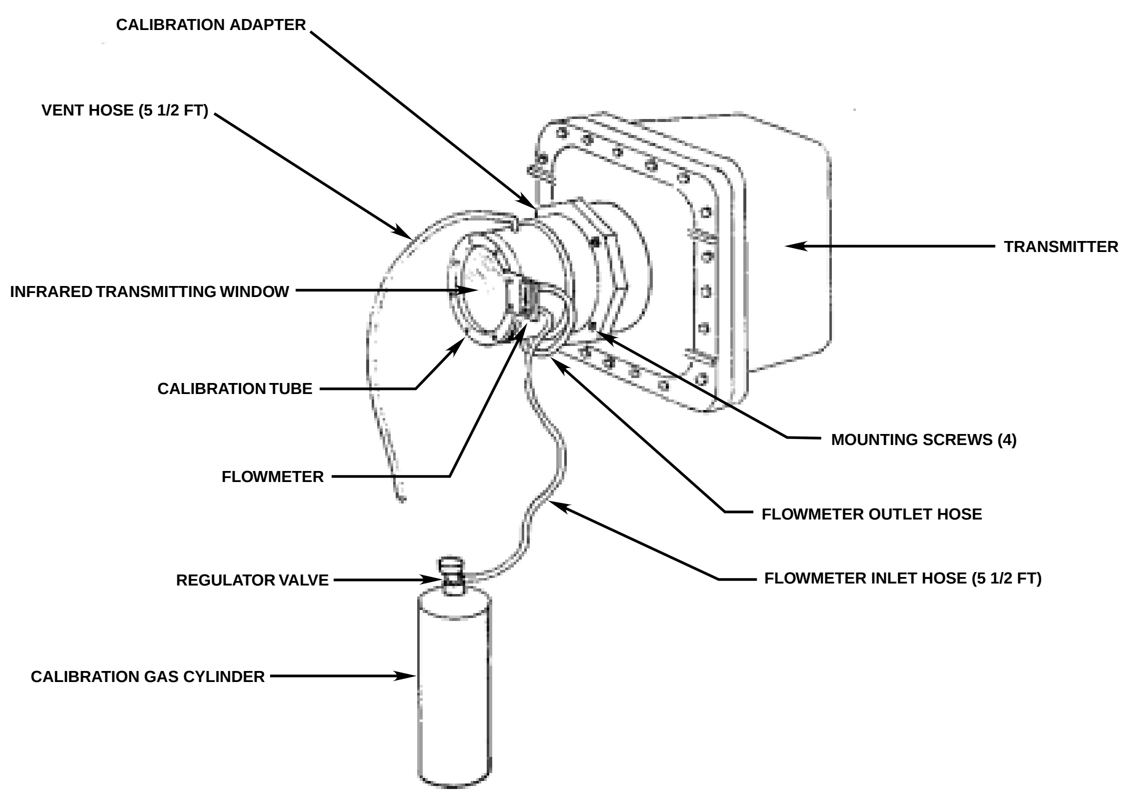


Figure 7—Calibration Equipment

1. Attach the Flowmeter Outlet Hose to the appropriate hose fitting on the Calibration Tube as shown in Figure 8.

2. Remove the two protective caps from the Calibration Tube. To make certain that it is completely free of any residual hydrocarbon vapors, purge the Calibration Tube with oil-free compressed air at no more than 5 psi and 10 SCFH for 2 minutes. Do not block the vent. Do not pressurize or evacuate the calibration tube while purging.

3. Remove the receiver window assembly. Set the MODE switch on the front panel to the OPERATE position. If 4 to 20 ma output option is used, set the OUTPUT SELECT switch on the front panel to V and break the connection at the junction box between the RATIO output (terminal 1) and its field wire to remove the current load.

4. Install the Calibration Adapter on the transmitter window mounting ring with the four 10-32 x 3/4 inch screws provided with the adapter.

5. Insert the calibration tube into the adapter, so that the flowmeter is vertical on the right side of the tube. Make sure that the tube is seated squarely and securely in the adapter.

6. Attach the vent hose and flowmeter inlet hose to the calibration tube as shown in Figure 8. For heavier than air gases, the flowmeter outlet hose is connected to the hose fitting on the bottom of the calibration tube and the vent hose is connected to the hose fitting on the top. For lighter than air gases, these two connections are reversed.

7. Adjust the OUTPUT ZERO potentiometer on the receiver until the RATIO voltage is 0.1 ± 0.1 vdc.

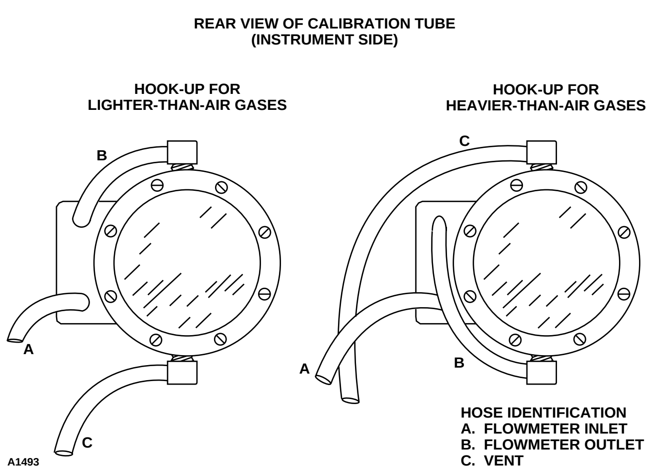


Figure 8—Calibration Hookup

8. Attach the calibration gas cylinder to the flowmeter inlet hose, making sure that the regulator is shut. At the junction box, attach a digital voltmeter with a resolution of at least 1 millivolt dc between the RATIO output (terminal 1) and SIGNAL GROUND (terminal 2).

WARNING

DO NOT pressurize or evacuate the calibration tube. Make sure vent hose is not blocked or crimped.

9. With the gas cylinder regulator set at no more than 2 psi, open and adjust the regulator and flow meter valves so that the flow indicator on the calibration tube reads 5 SCFH.

10. Wait at least five minutes and observe the RATIO output voltage. The reading should be within the range indicated on the calibration graph. If the RATIO output is not within the calibration range, use the CALIBRATION ADJUSTMENT potentiometer on the front panel of the receiver to bring the RATIO output within the desired range.

11. Close the gas regulator. Remove the flowmeter inlet hose from the gas cylinder regulator.

12. Remove the calibration tube from the calibration adapter and replace the protective end caps. Remove the calibration adapter from the window mounting ring.

13. With clean air present in the path, re-adjust the OUTPUT ZERO potentiometer on the receiver so that the RATIO voltage is 0.1 ± 0.1 vdc.

14. If the 4 to 20 ma output option is used, return the OUTPUT SELECT switch on the front panel to the MA position. Reconnect the RATIO field wire in the junction box.

USE OF THE CALIBRATION GRAPH

The instrument output is related to the presence of hydrocarbon vapor in the path in terms of a unit called PPM-Meters (PPM-M). Because it is an open path system, the instrument's measurement is a function of the gas concentration (expressed in PPM) times the length of the vapor cloud (expressed in meters).

In interpreting the instrument's output, two possible conditions exist:

A. The hydrocarbon vapor cloud is larger than the path length.

B. The hydrocarbon vapor cloud is smaller than the path length.

NOTE

If the cloud length cannot be approximated from the installation parameters, it must be assumed that the cloud length is equal to the path length.

The calibration graphs provided in the APPENDIX correlate the RATIO output voltage to the PPM-M product. To determine the average vapor concentration in the cloud or path, divide the PPM-M product by the cloud or path length in meters.

For Example:

Condition A - Cloud larger than path, or cloud length unknown. (Gas is propane, PathWatch has Heavy HC filters. See Figure A6.)

Assume: - RATIO output of 2 vdc
- Path length of 50 meters (cloud is equal to path)

Read: Calibration Graph indicates that 2 vdc output corresponds to approximately 1000 PPM-M

Then: 1000 PPM-M ÷ 50 M

Result: 20 PPM average vapor concentration over the 50 meter path.

Condition B - Cloud smaller than path

Assume: – RATIO output of 2 vdc
– Cloud length of 10 meters

Read: Calibration graph indicates that 2 vdc output corresponds to approximately 1000 PPM-M

Then: 1000 PPM-M ÷ 10M

Result: 100 PPM average vapor concentration over the 10 meter cloud.

All factory calibrations are performed with the SENSITIVITY switch set in the HI position (maximum sensitivity).

HYDROCARBON VAPOR ALARM THRESHOLD ADJUSTMENT

In critical applications, it is recommended that the calibration be checked before setting the alarm threshold. Based on the specific application of the instrument, select the concentration in ppm at which the Hydrocarbon Vapor Alarm will activate. It is important to remember that the open path detector measures the average gas concentration over a continuous series of points along a path. Because the gas concentration over a 100 to 300 foot path could vary from only a few ppm to explosive levels and because the user must know when the gas concentration at any location along the path is approaching an explosive level, the threshold must be set at a much lower level than a point detector. Typically, the open path detector is set to alarm for an average concentration in the 0.05% to 0.10% LFL range for heavy hydrocarbons.

To determine the equivalent RATIO output (volts) for the selected concentration (ppm), refer to the calibration graph provided in the APPENDIX.

1. Multiply the path length (M) by the selected vapor concentration (PPM) to arrive at PPM-M.

NOTE

If the cloud length can be approximated from the installation conditions, a more accurate result is obtained by multiplying the CLOUD length (M) by the selected vapor concentration (PPM) to arrive at PPM-M.

2. From the calibration graph, read the equivalent RATIO output voltage for the PPM-M product determined in Step 1.

To set the hydrocarbon vapor alarm threshold:

3. Attach a digital voltmeter between the HC ALARM SETPOINT jack (grey) and SIG GND (green) on the front panel of the receiver.

4. Adjust the HC ALARM ADJUST potentiometer on the front panel so that the Hydrocarbon Alarm set point voltage matches the RATIO output determined from the calibration graph in Step 2, above.

Section 3
Maintenance

GENERAL PRECAUTIONS

As with all precision electro-optical equipment, care must be taken to avoid sharp blows to the instrument. Do not drop it or allow heavy objects to strike it. Do not touch the windows, lenses, lamps, filters or other optical surfaces with bare hands. Customary precautions for the use of explosion-proof instrumentation in hazardous environments should be observed. Ensure that no hazardous vapor conditions exist in procedures where either the cover, window assembly or junction box are to be opened when circuits are alive.

WARNING

Live line voltage is exposed at several points within the PW9200. This is potentially dangerous and contact by maintenance personnel must be avoided.

The threads of the housing cover and window assembly are lubricated to eliminate the possibility of seizing. The threads should be checked periodically and lubrication should be added when necessary. When adding lubrication to the threads, care must be taken to ensure that the lubrication does not touch the window surface.

GENERAL INFORMATION

The receiver electronics are comprised of six printed circuit boards and electrical wiring and components located on the receiver baseplate and the motorbox. Two of the printed circuit boards are permanently mounted and the other four are easily removed and replaced as indicated below:

P.C. BOARD	PERMANENT/REMOVABLE
Preamplifier	permanent
AGC/TE cooler	removable
Synchronous demodulator	removable
Rear panel	removable
Options	removable
Connector/Relay	permanent

The receiver functions described in Section 1 and Figure 1 of this manual are located on a printed circuit board or assembly as shown below:

RECEIVER FUNCTION	LOCATION
Infrared Photodetector	Detector/Preamp assembly
Sync Circuitry	Rear panel p.c. board and sync demod p.c. board
Amplifier	Preamp p.c. board and sync demod p.c. board
Signal Processing Electronics	AGC/TE cooler and sync demod p.c. board
Ratiometer	Rear panel p.c. board
Threshold Detector	Rear panel p.c. board
OR Gate Function	Connector/relay p.c. board
Obstruction/Status Alarm Relay	Connector/Relay p.c. board
Adjustable Threshold Detector	Rear panel p.c. board
HC Alarm Set	Rear panel p.c. board (accessed from front panel)
HC Vapor Alarm Relay	Connector/Relay p.c. board
4 to 20 mA Converter	4 to 20 ma output p.c. board

Assemblies and printed circuit boards are available as spare parts. To facilitate troubleshooting and corrective maintenance of the PW9200, users are advised to stock LEVEL ONE and LEVEL TWO from the “Recommended Spare Parts List.”

ACCESS TO INTERNAL COMPONENTS

All internal components of the transmitter and receiver are mounted to the cover of the housing (see Figure 3). Access to these components is obtained either by swinging open the cover on its hinges or by removing the cover and associated components from the housing.

1. Disconnect all power to the instrument.

2. Remove the 20 bolts that hold the cover to the housing.

3. Swing open the cover to permit access to the connector(s). DO NOT OPEN the receiver cover more than three inches to prevent undue stress on the connector(s). The transmitter cover will open more than three inches.

4. Disconnect the connector plug(s) from the receptacle(s). The transmitter has one connector and the receiver has two connectors. The instrument can be inspected or serviced on-site while the cover is opened and attached by its hinges. If service is to be performed off-site, the cover and attached components can be removed from the housing as described in Step 5.

5. With the cover swung open, lift up to disengage the hinges. Care must be taken to avoid scratching the flanges or damaging the internal components.

Each time the instrument housing is opened for maintenance, the desiccant pack should be checked. When the desiccant pack is expanded only slightly, no change is necessary. If the desiccant is expanded to twice or more of its original size, the desiccant should be replaced. Extra desiccant packets are available from Detector Electronics (see "Recommended Spare Parts List." DO NOT replace the desiccant until all other maintenance procedures have been completed. Remove the old desiccant by cutting the strings that attach it to the power supply wiring. Remove the plastic bag on the replacement packet and tie it to the power supply wiring. Be sure that the desiccant packet is securely attached to the power supply wiring so that it cannot come loose inside the housing. Close the cover immediately after replacing the desiccant.

To reattach the cover to the instrument housing:

1. Holding the cover completely open, slide the cover pins onto the housing hinges. Do not tighten the hinge screws.

2. If necessary, replace the desiccant pack.

3. Reconnect the plug(s) and receptacle(s) in the housing and close the cover. Guide the cable to ensure that it is not pinched.

P.C. BOARD AND ASSEMBLY REPLACEMENT

(See Figure 3 for locations)

SYNCHRONOUS DEMODULATOR AND OPTIONS P.C. BOARDS

The sync demod board is located to the right and the options board is located to the left of the filterwheel motor inside the motorbox. Remove either board by pulling it out of its connector on the rear panel p.c. board and sliding it through the card guides out of the motorbox. To replace the sync demod or options board, make sure that the notch on the board matches the key in the connector and slide the board along the card guides into the motorbox. Make sure that the board is seated firmly in the connector.

REAR PANEL P.C. BOARD

The rear panel p.c. board is attached to the side of the motorbox next to the connector/relay p.c. board. The sync demod and options boards must be removed before the rear panel board can be removed.

To remove:

1. On the connector/relay p.c. board, remove the STATUS ALARM and HC ALARM relays from their sockets.

2. Release the ribbon connector that connects the rear panel board to the connector/relay board.

3. Remove the six sockethead screws that hold the rear panel board to the motorbox tabs.

4. Pull the top of the rear panel board away from the motorbox to release the two connectors at the top of the board.

5. Being careful not to touch the sync pickoff with the filterwheel, remove the board.

To replace:

1. Being careful not to touch the sync pickoff with the filterwheel, slide the board into place.

2. Firmly press the connectors at the top of the board into the mating connectors on the motorbox.

3. Attach and lock the ribbon connector to the connector/relay p.c. board.

4. Replace the six socket head screws that hold the rear panel board to the motorbox tabs.

5. Replace the STATUS ALARM and HC ALARM relays in their sockets on the connector/relay p.c. board.

AGC/TE COOLER P.C. BOARD

The AGC/TE cooler board is mounted in the detector/preamp assembly within the fins of the heat sink.

To remove:

1. Release the ribbon connector that connects the AGC/TE cooler board to the preamplifier board, which is permanently attached to the bottom of the heat sink.

2. Holding the ribbon connector to the side, pull the AGC/TE cooler board so that the connector to the motorbox disengages. Slide the board out of the heat sink fins.

To replace:

1. Position the board so that the two parts of the connector to the motorbox are lined up.

2. Holding the ribbon connector to the side, slide the board into the fins of the heat sink as far as it will go so that the connector to the motorbox engages.

3. Attach and lock the ribbon connector from the preamplifier board.

DETECTOR/PREAMP ASSEMBLY

The detector/preamp assembly is comprised of the infrared photodetector mounted inside a baffle, an optical filter, the heat sink and the permanently mounted preamplifier p.c. board. The detector/ preamp assembly is located on the top of the motor-box beside the power supplies.

NOTE

Exposure to direct light (particularly fluorescent light) can cause permanent damage to the infrared photodetector. Care should be taken to avoid exposing the photodetector to light when the detector/preamp assembly is removed from the instrument.

To remove:

1. Remove the four 6-32 sockethead screws that hold the assembly to the motorbox.

2. Lift the assembly up until the baffle clears the motorbox.

To replace:

1. Position the assembly over the motorbox so that the connector and hole for the baffle are aligned.

2. Slide the assembly into place.

3. Replace the four 6-32 sockethead screws that hold the assembly to the motorbox.

SYNC PICKOFF

The sync pickoff is mounted in a socket, which is located in the center of the rear panel p.c. board. The sync pickoff is removed by pulling if from the socket. To replace the sync pickoff, install with the red dot up (toward the motorbox connectors).

SCHEDULED MAINTENANCE

It is recommended that the following maintenance procedures be performed periodically as described:

Maintenance Procedure	Interval 12 mo.	Interval 24 mo.
Clean exterior optical components	X	
Clean interior optical components		X
Replace filterwheel motor	X	
Replace 15 watt lamp		X
Calibration check	X	
Replace desiccant	X	

CLEANING OF OPTICAL COMPONENTS

Exterior (12 month interval)

Due to the gradual accumulation of dust, chemical deposits or other foreign matter, the exterior optical surfaces must be cleaned every twelve months. In some applications, cleaning of the windows may be required more frequently. The need for cleaning can usually be detected by a gradual decrease in the NUMERATOR and DENOMINATOR output signals and/or by visual inspection of the optical surfaces.

1. Disconnect all power to the instrument.

NOTE

If possible, direct a flow of clean, oil-free compressed air onto the optical surfaces before and after cleaning.

2. Clean the outer surfaces of the transmitter and receiver windows with clean cotton swabs and alcohol. Finish with clean optical tissue. DO NOT TOUCH the windows or other optical surfaces with bare hands.

3. Reconnect the instrument and re-apply power.

Interior (24 month interval)

Interior optical components (inside surface of window, lens, filters and sync pickoff) should be cleaned every two years. Although it is possible to perform all these procedures on-site, a lab environment is preferable as it is cleaner and easier to work in. (See “Access to Internal Components.”)

WINDOWS

Interior windows are reached by removal of the transmitter and receiver window assemblies. Clean as described in "Exterior optical cleaning" procedure above.

LENS, SYNC PICKOFF AND OPTICAL FILTERS

1. Remove the motor and filterwheel following "Replacement of Filterwheel Motor" procedure.

2. The lens is located in the center of the receiver baseplate. Using clean cotton swabs and alcohol, clean both sides of the lens. Finish with clean optical tissue.

3. The sync pickoff is located at the center of the rear panel p.c. board on the inside of the motorbox. The optical surfaces are located on the inside of the U-shaped device. Using clean cotton swabs and alcohol, clean both optical surfaces of the sync pickoff. Remove any excess alcohol and completely dry the surfaces with clean, dry cotton swabs.

4. The optical filters are located in the filterwheel, which is attached to the motor shaft. Clean both sides of each filter using clean cotton swabs and alcohol. Finish with clean optical tissue.

REPLACEMENT OF FILTERWHEEL MOTOR (12 Month Interval)

It is recommended that this procedure be performed in a lab environment. (See ACCESS TO INTERNAL COMPONENTS.) Cleaning of interior optical components should be done after the filterwheel motor is removed.

1. The receiver housing cover and internal components should be placed so that the open side of the motorbox faces the technician. The assembly should be securely propped during this procedure to avoid damage to the internal components.

2. Disconnect motor connectors.

3. While holding the motor still, remove the four 6-32 sockethead screws on the front panel that attach the motor and standoffs to the front panel.

4. Avoiding contact with the sync pickoff on the rear panel p.c. board, carefully slide the motor and attached filterwheel out of the motorbox. Viewing ports have been provided on each side of the motorbox to permit visual inspection of the position of the filterwheel relative to the sync pickoff.

5. Remove the nut that holds the hub to the filterwheel and detach the filterwheel from the hub. DO NOT TOUCH filters with bare hands.

6. Remove the nut from the replacement motor hub and slide the filterwheel onto the replacement motor shaft. Make sure that the side of the filterwheel with the filter retaining rings/fan blades is facing toward the body of the motor. Replace the nut, using low strength thread locking compound on the threads of the hub. Make sure the compound is thoroughly dried before rotating the filterwheel.

7. Replace the motor/filterwheel assembly ensuring that the filterwheel edge is straddled by the sync pickoff. Check that the filterwheel does not come into contact with the sync pickoff during rotation.

8. Replace the four sockethead screws that hold the motor to the back of the instrument front panel. Reconnect motor connectors.

REPLACEMENT OF TRANSMITTER LAMP (Variable Interval)

The 15 watt lamp used in the PW9200 should be replaced at a 24 month interval.

WARNING

Do not inspect the transmitter while the lamp is operating. To avoid possible eye damage, disconnect instrument power before checking.

To replace the transmitter lamp, use the following procedure:

1. Disconnect all power to the instrument.

2. As an additional precaution, disconnect power wires at the junction box.

3. Remove the window assembly from the transmitter housing by rotating counterclockwise (CCW). DO NOT TOUCH the window with bare hands.

4. Move the window assembly to a safe place, being careful not to scratch the window.

5. Remove the old lamp by pulling it out of the lampholder. DO NOT TOUCH the transmitter reflector with bare hands.

6. Insert the new lamp by pushing it into the lampholder, aligning the pins and holes in the lamp socket and gently wiggling until it is held firmly by the two clamps. Replacement lamps are available from the factory. (See "Recommended Spare Parts List".)

NOTE

DO NOT TOUCH the lamp envelope with bare fingers. Use the lamp wrapper provided with the new lamp, clean white gloves, or clean optical tissue when inserting a new lamp. Also, be careful to avoid touching the inner surface of the reflector.

7. Be sure that the lamp is centered in the reflector and does not touch the edge of the reflector opening. If the lamp is touching the reflector, gently apply sideways pressure to bend the lamp/socket assembly until it is no longer touching the reflector opening and is centered. Use clean gloves, tissue, etc., and do not touch the reflector surface or lamp envelope with bare hands, since acid from the fingertips will etch the lamp envelope and reduce the life of the lamp.

8. Replace the window assembly and tighten down securely until at least five full threads are engaged.

9. Check tightness of cover bolts and window assemblies on both housings.

10. Reconnect power wires in the junction box.

11. Close and recheck tightness of junction box cover.

12. Re-apply power.

13. Repeat "Optical Alignment" procedure.

TROUBLESHOOTING

For assistance in rectifying setup problems and simple malfunctions, consult the Troubleshooting Table below.

SYMPTOM: Transmitter lamp does not light.

POSSIBLE CAUSE: No power to transmitter.
CHECK: Voltage into transmitter. Should be nameplate voltage rating (±10%).
REMEDIAL ACTION: If wrong voltage, check external fusing or defective power wiring to transmitter.

POSSIBLE CAUSE: Fuse blown in transmitter.
CHECK: Fuse.
REMEDIAL ACTION: Replace fuse.

POSSIBLE CAUSE: Defective lamp.
CHECK: Voltage into transmitter before concluding that lamp is defective.
REMEDIAL ACTION: See Replacement of Transmitter Lamp procedure.

SYMPTOM: Transmitter lamp consistently burns out before 6 months.

POSSIBLE CAUSE: Constant high line voltage.
CHECK: Voltage into transmitter. Should be nameplate voltage rating (±10%).
REMEDIAL ACTION: Reduce power line voltage.

POSSIBLE CAUSE: Excessive vibration or shock at the transmitter.
CHECK: Environment at transmitter.
REMEDIAL ACTION: Alter mechanical environment at transmitter location with vibration isolators, etc.

POSSIBLE CAUSE: Repeated application and removal of power to transmitter.
CHECK: History since installation.
REMEDIAL ACTION: Maintain power to the instrument at all times.

SYMPTOM: Transmitter lamp lights, but no output voltage on NUMERATOR (blue) relative to GROUND (green) test jack.

POSSIBLE CAUSE: No power to receiver.
CHECK: Voltage into receiver. Should be nameplate voltage rating (±10%).
REMEDIAL ACTION: If wrong voltage, check external fusing and power wiring to receiver.

POSSIBLE CAUSE: Fuse blown in receiver.
CHECK: Listen for faint sound of filterwheel motor in receiver.
REMEDIAL ACTION: If filterwheel is not turning, replace fuse.

POSSIBLE CAUSE: Filterwheel motor failure.
CHECK: Is filterwheel rotating?
REMEDIAL ACTION: If filterwheel does not rotate after replacing fuse, see "Replacement of Filterwheel Motor" procedure.

POSSIBLE CAUSE: Transmitter and receiver not properly aligned.
CHECK: Voltage on NUMERATOR (blue) test jack when a flashlight or 60 watt light bulb is held in front of receiver window. Voltage should increase from zero.
REMEDIAL ACTION: Repeat Alignment procedure.

SYMPTOM: Voltage at NUMERATOR (blue) test jack relative to GROUND (green) is not within 0.3 to 0.5 vdc after proper alignment and output zero adjustment.

POSSIBLE CAUSE: Improper preamplifier gain setting for path length.
REMEDIAL ACTION: See Step 14 of “Optical Alignment/Signal Strength” procedure.

SYMPTOM: RATIO is noisy or erratic.

POSSIBLE CAUSE: Instrument not optically aligned.
CHECK: Voltage at NUMERATOR test jack. Voltage should be 0.3 to 0.5 vdc.
REMEDIAL ACTION: If NUMERATOR voltage is low, realign as described in “Optical Alignment” procedure.

SYMPTOM: RATIO voltage is negative or 4 to 20 ma output is below 4 ma.

POSSIBLE CAUSE: The ZERO adjustment potentiometer located on the front panel is not set properly.
CHECK: Setting of ZERO potentiometer.
REMEDIAL ACTION: Adjust ZERO potentiometer until RATIO output is 0.1 ± 0.1 vdc.

POSSIBLE CAUSE: Instrument malfunction.
CHECK: NUMERATOR and DENOMINATOR voltages when a bare flashlight bulb or bare 60 watt light bulb is held in front of receiver window.
REMEDIAL ACTION: Replace each printed circuit board (one at a time) and recheck voltages. Contact factory if fault cannot be located.

SYMPTOM: RATIO voltage is steady and does not appear to be responding to heavy hydrocarbons within the monitored path.

POSSIBLE CAUSE: Malfunction of signal processing circuitry.
CHECK: Response of RATIO when a piece of plastic film (roughly 8 mils thick) is placed in front of the receiver window. The RATIO voltage should increase to at least +2 vdc.
REMEDIAL ACTION: Substitute spare boards and assemblies until defective part is located and RATIO responds properly to plastic film. Defective part can be returned to factory for analysis and repair.

POSSIBLE CAUSE: Object in beam.
REMEDIAL ACTION: Remove obstruction.

SYMPTOM: HC Alarm does not activate when hydrocarbon vapors are present in monitored path, or HC Alarm activates too often.

POSSIBLE CAUSE: Improper HC Alarm threshold setting.
CHECK: Voltage at HC ALARM SETPOINT jack relative to GROUND. Refer to Calibration graph in APPENDIX for concentration indicated by alarm threshold setting.
REMEDIAL ACTION: Adjust setpoint if required. See “Hydrocarbon Vapor Alarm Threshold Adjust-ment” procedure.

POSSIBLE CAUSE: Malfunction of HC Alarm circuitry.
CHECK: RATIO voltage relative to voltage on HC ALARM SETPOINT jack. If RATIO voltage exceeds alarm setpoint and alarm does not activate, a malfunction of alarm circuitry exists.
REMEDIAL ACTION: Replace rear panel p.c. board and HC alarm relay on connector/relay board.

SYMPTOM: RATIO output obtained during calibration check is not within the range indicated by the calibration graph.

POSSIBLE CAUSE: Excessive hydrocarbon background at installation site.
CHECK: Hydrocarbon background along instrument path length with an independent hydrocarbon vapor analyzer.
REMEDIAL ACTION: Wait until hydrocarbon background along path length of instrument is low, then recheck calibration.

POSSIBLE CAUSE: Calibration shift after factory calibration due to some parameter within the instrument, or to some change in the installation parameters.
CHECK: Calibration to be sure that calibration check was performed properly and calibration point obtained is repeatable.
REMEDIAL ACTION: If calibration check is repeatable and not within calibration range, adjust CALIBRATION ADJUSTMENT potentiometer on front panel with calibration tube filled and installed.

If malfunctions cannot be corrected by carefully following the procedures described in this manual, contact the factory for assistance. In many cases, sufficient information to correct the malfunction can be provided over the telephone. If it is necessary to contact the factory by telephone, it is helpful to have the operation and maintenance manual accessible and to obtain the following readings for the service technician:

Instrument S/N _______________

Options purchased ____________________________

Measure and record the channel voltages under two conditions:

1. Normal operating conditions

2. With the receiver window blocked with opaque material (e.g. cardboard disk).

NORMAL	BLOCKED
RATIO _________ vdc	RATIO _________ vdc
DENOM _________ vdc	DENOM _________ vdc
NUM _________ vdc	NUM _________ vdc

HC alarm Setpoint _________ vdc

Path length _________ feet or _________ meters

Both field and factory service are available from Detector Electronics. If it becomes necessary to return an instrument to the factory, extreme care must be taken in packing the instrument for shipment. The monitor should be enclosed in a plastic bag, surrounded with at least two inches of foam or shipping pellets on all sides and shipped in a heavy duty carton. Lack of sufficient cushioning can cause extensive damage to internal components. It is not usually necessary to return the transmitter and, if carefully packed, just the receiver housing cover and attached components can be shipped.

DEVICE REPAIR AND RETURN

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.

ORDERING INFORMATION

RECOMMENDED SPARE PARTS

Description	Qty	Part Number
Level One (highly recommended)		
Transmitter lamp (15 watt)	1	102642-001
Filterwheel motor (115 vac)	1	005618-001
One ampere fuse	5	107407-002
Alarm relay, 115 vac	2	102590-001
Desiccant pack	1	102669-001
Test power cable	1	
Level Two (Recommended)		
Sync demod p.c. board		
Single channel	1	005586-001
Dual channel	1	005586-002
AGC/TE cooler p.c. board	1	005583-001
Rear panel p.c. board		
Single channel	1	005595-001
Dual channel (standard)	1	005595-002
Dual channel (fast)	1	005595-003
Detector/preamp assembly	1	005580-001
4 to 20 ma p.c. board		
Single channel	1	005592-001
Dual channel	1	005592-002
2 inch diameter lens	1	005616-001

For assistance in ordering a system to meet the needs of a specific application, please 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.detronics.com
E-mail: detronics@detronics.com

Appendix

This APPENDIX contains:

Optical Alignment Procedure for Installations Using a Mirror
Receiver Interconnections
Voltage to Current Transfer Curve
Calibration Graphs of a Typical Instrument.

OPTICAL ALIGNMENT PROCEDURE FOR INSTALLATIONS USING A MIRROR

After the Initial Setup procedures have been followed and the instrument has been operating continuously for at least one hour, alignment of the transmitter, receiver, and mirror is best accomplished by two people using the following procedure:

1. Attach the mirror pan-tilt mount with U-bolts to the user supplied 4.5 inch O.D. mounting pipe at the desired height. Roughly set the mirror for the appropriate angle, and securely tighten the U-bolt.

NOTE

The cross hairs of the alignment scopes have been factory set for alignment of the transmitter and receiver WITHOUT MIRRORS at the operating distance indicated in the Test Record. If this separation distance is not the same as the actual installation because mirrors are used, the cross hairs of the alignment scopes will need to be reset after the instrument is properly aligned.

IMPORTANT

Optimum alignment must be maintained to ensure reliable operation of the instrument.

2. With the transmitter roughly facing the mirror, view the mirror through the alignment scope attached to the transmitter mount. Adjust the pan and tilt of the transmitter housing until the cross hairs of the transmitter alignment scope are centered on the mirror.

3. Adjust the pan and tilt of the receiver housing until the cross hairs of the receiver alignment scope are centered on the mirror.

4. One person should remain at the mirror to adjust the pan and tilt. The second person should stand about six feet from the mirror and find the reflection of the transmitter lamp in the mirror. The first person should adjust the pan and tilt of the mirror so that the second person is moved into the direct line between the mirror and the receiver, keeping the reflection of the transmitter lamp in sight. Once on the direct line, the second person should back away from the mirror toward the receiver, keeping the reflection sighted. The first person should adjust the pan and tilt of the mirror so that the second person keeps the reflection in sight as he gradually backs up to the center of the receiver.

5. Remove the receiver window assembly by rotating it counterclockwise. Avoid touching the window with bare hands. Move the window assembly to a safe place, being careful not to scratch the window.

6. Set the MODE selector switch on the front panel to the “align” position.

7. Using the test jacks on the front panel, connect a digital voltmeter (with a resolution of at least 1 millivolt dc) between the NUMERATOR and Signal Ground (SIG GND) and note the signal strength.

8. Make small adjustments in the receiver pan and tilt to maximize the amplitude of the voltage at the receiver.

9. Make small adjustments in the transmitter pan and tilt to maximize the amplitude of the voltage at the receiver.

10. Make small adjustments in the mirror pan and tilt to maximize the voltage at the receiver.

11. Replace the receiver window assembly and read the output at the junction box. The output obtained should be between 0.3 and 0.5 vdc.

NOTE

For any given path length, the signal strength will decrease as the angle formed by the transmitter/mirror/receiver configuration increases. If the output obtained is not within the specified limits after following all steps of the “Optical Alignment/Signal Strength” procedure. The preamplifier gain must be adjusted as described in Step 12. If the output is correct, proceed to Step 13.

12. To adjust the preamplifier gain, follow the “Accessing Internal Components” procedure (see “Maintenance” Section) and locate the preamplifier p.c. board within the heat sink fins. The preamplifier gain adjustment potentiometer is located on the preamplifier p.c. board and can be reached by inserting a screwdriver between the

fins from the bottom of the heat sink (as viewed when the cover is open, but attached to housing by its hinges).

If the output voltage is less than the specified minimum, turn the preamplifier gain potentiometer clockwise. If the output voltage is greater than 0.5 vdc, turn the preamplifier gain potentiometer counterclockwise.

13. Once optimum alignment has been obtained, carefully adjust the locking knob assembly on the back of all three mounts so that the swivel foot on the end of the shaft just makes contact with the back of the front plate. DO NOT overtighten the locking knob assembly.

14. View the mirror through the receiver alignment scope to verify that the cross hairs are centered on the mirror. If the cross hairs are not centered, and optimum alignment is verified, adjust the cross hairs to center on the mirror using the adjustment knobs provided on the scope. Replace the protective end caps on the alignment scope.

15. Repeat Step 14 for the transmitter alignment scope.

NOTE

Optimum alignment must be accurately maintained to ensure proper operation of the instrument. Careful adjustment of the alignment scope cross hairs will enable verification of alignment accuracy.

16. Recheck that the output has not been affected by Steps 13 through 15.

17. Remove the receiver window assembly and return the MODE selector switch on the front panel to the “operate” position. Replace the window assembly.

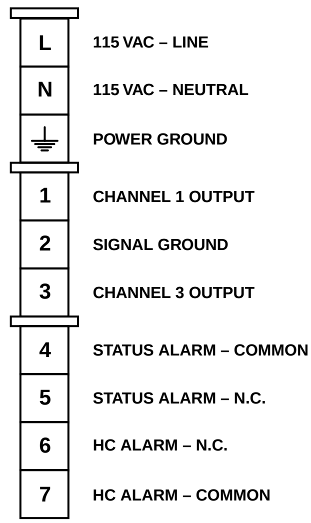


Figure A1—Terminal Block Wiring

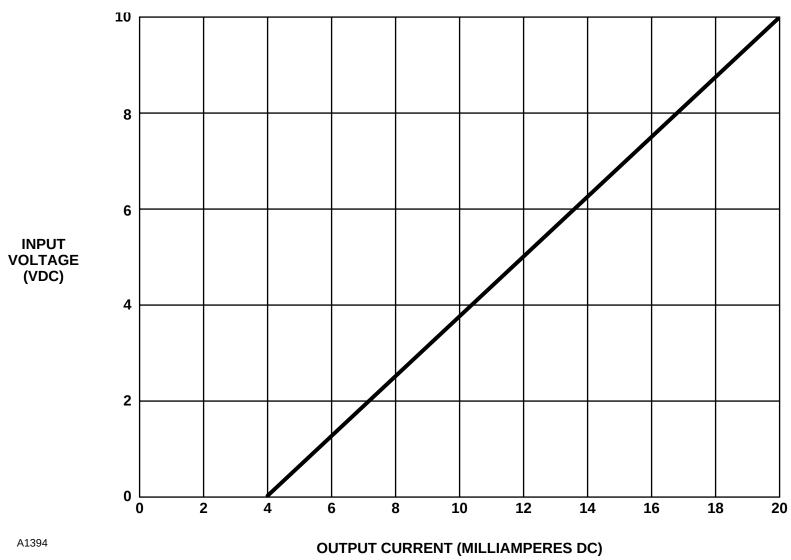


Figure A2—Voltage - Current Transfer Curve of the 4 to 20 Milliampere Converter

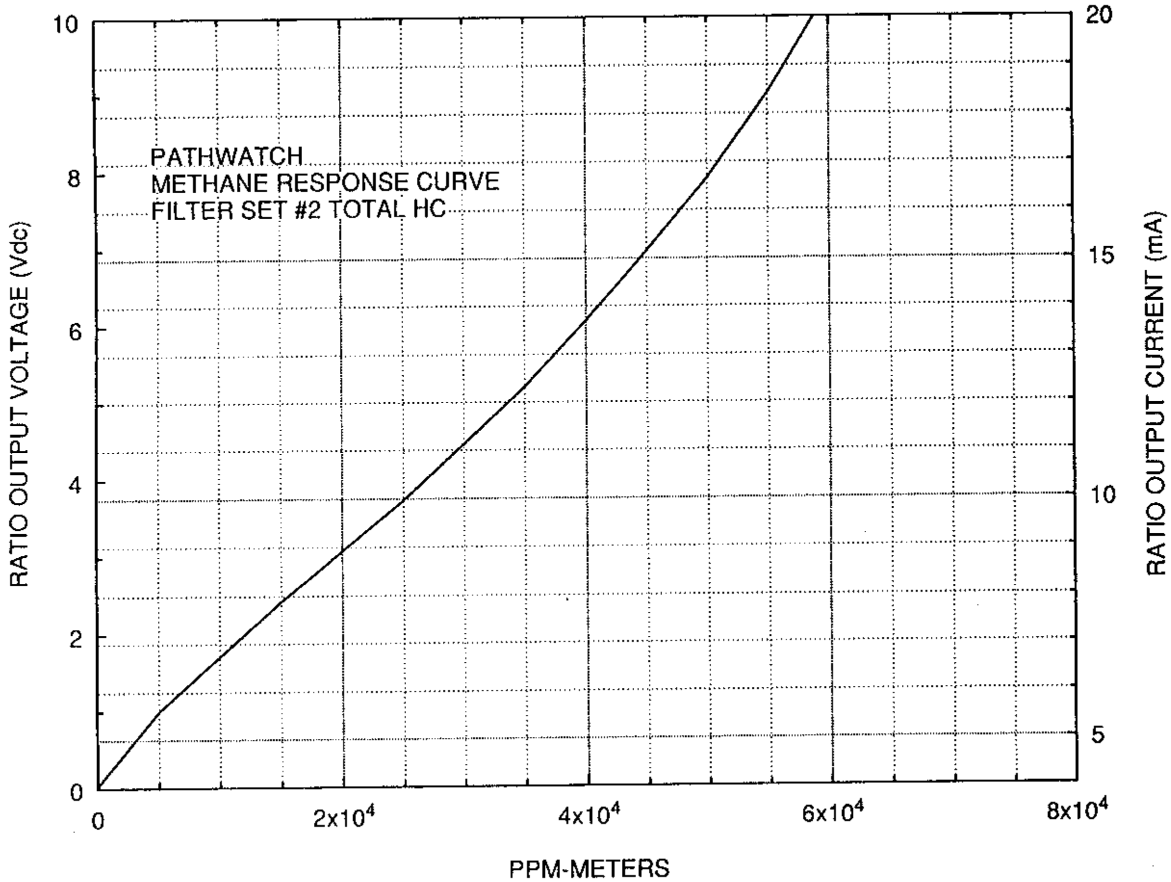


Figure A3

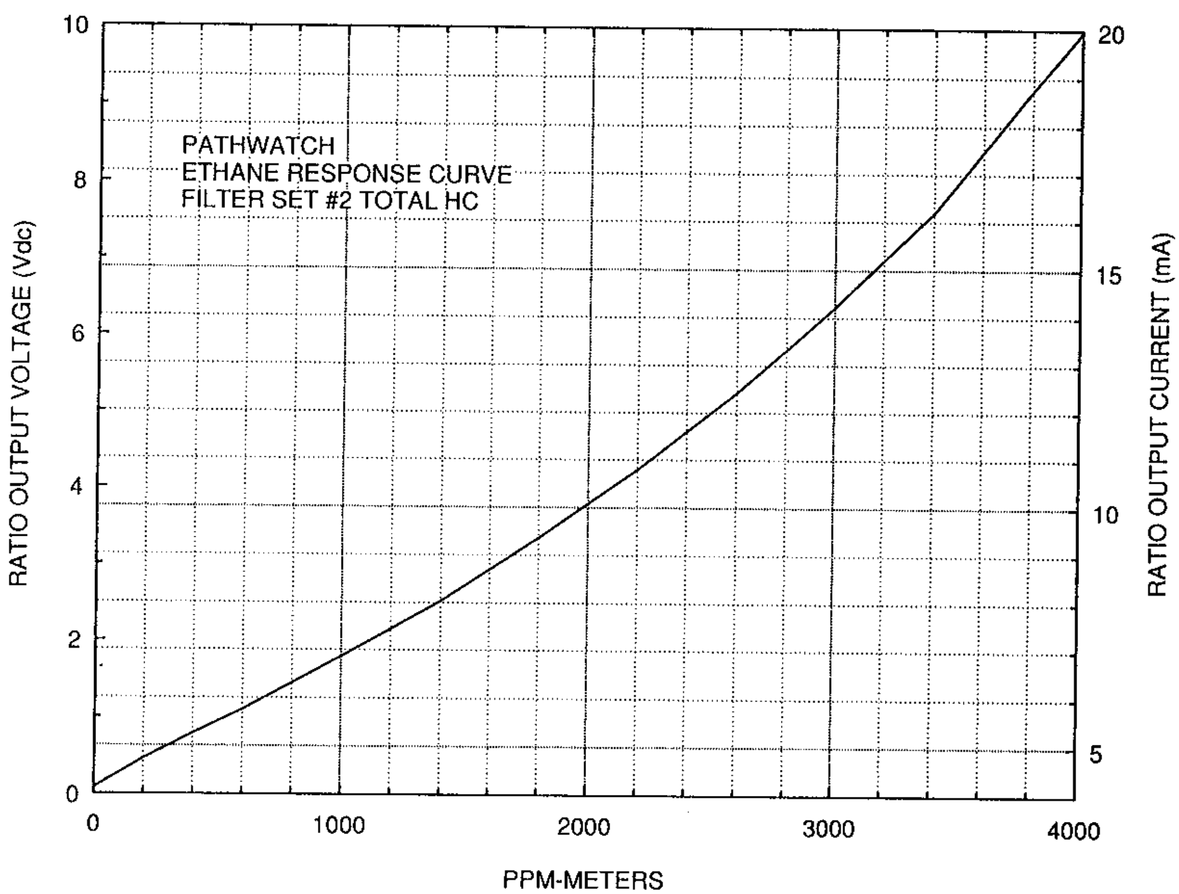


Figure A4

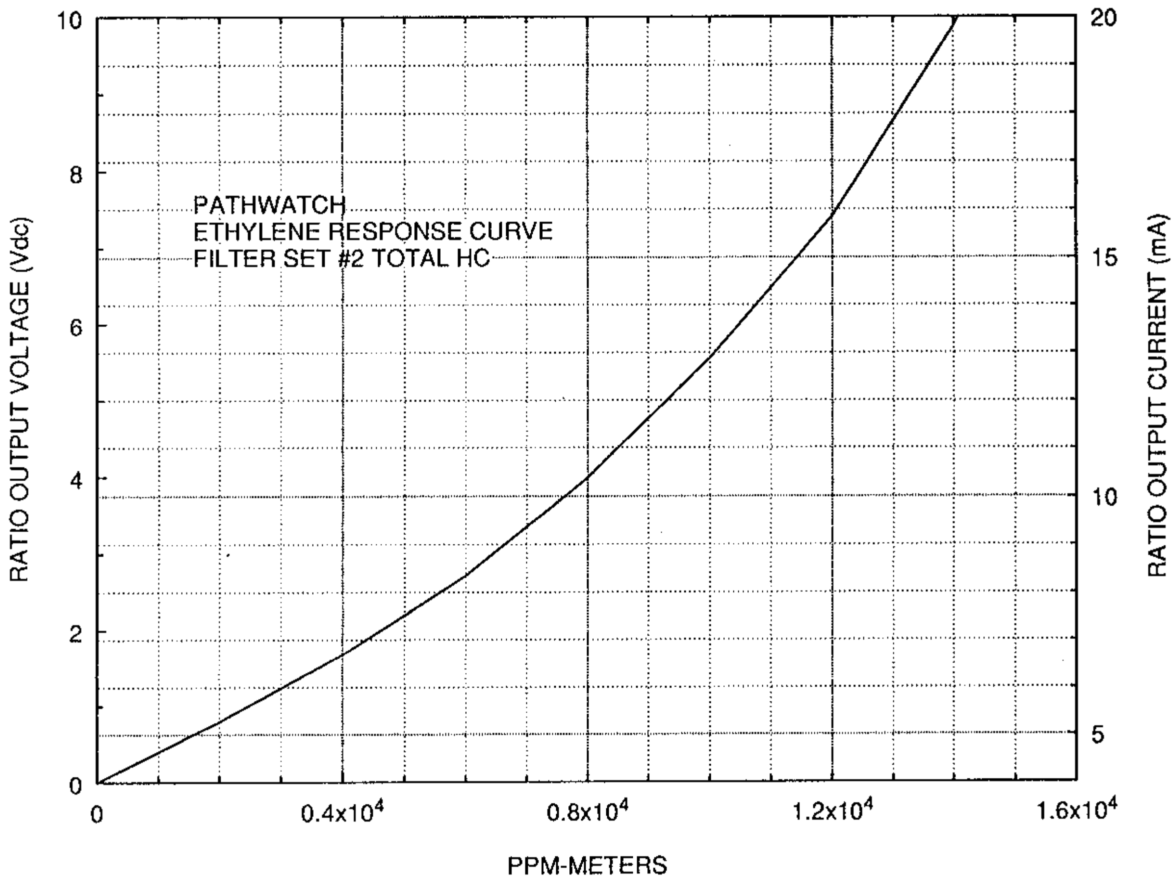


Figure A5

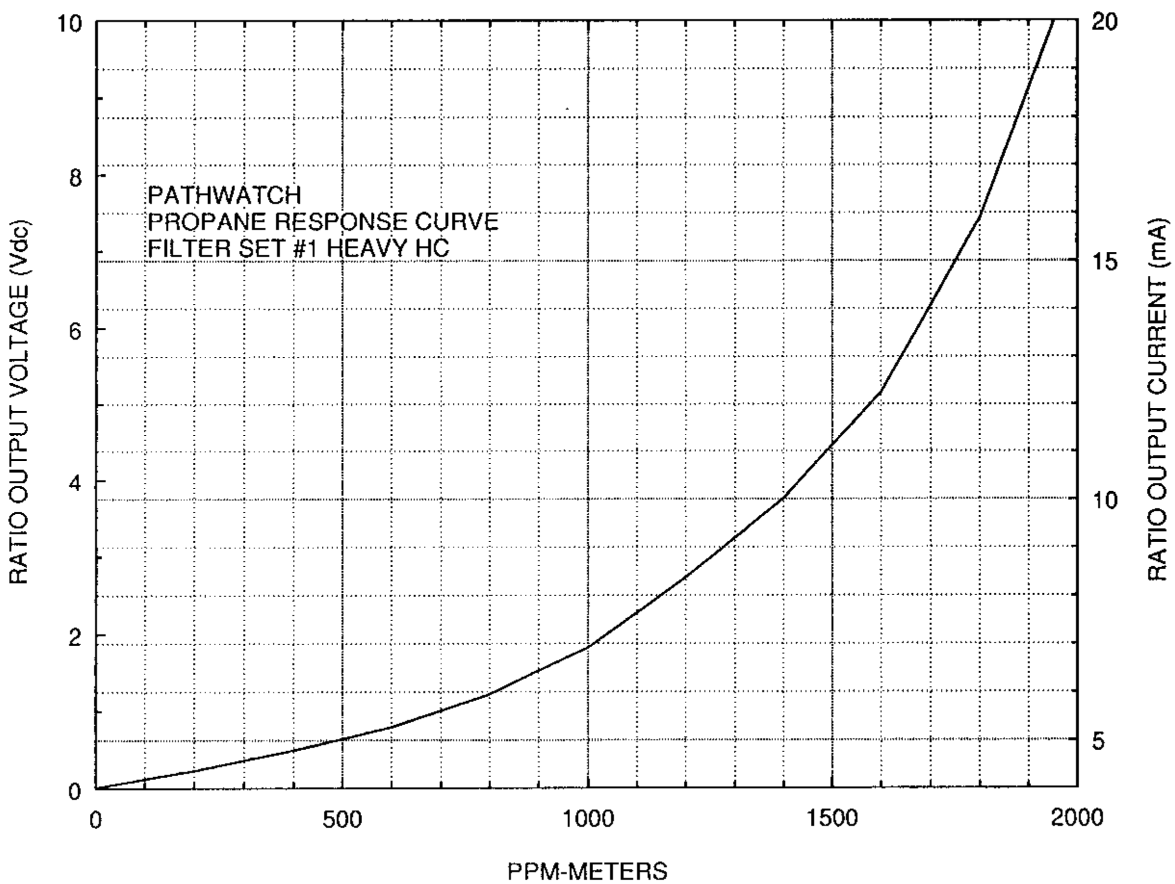


Figure A6

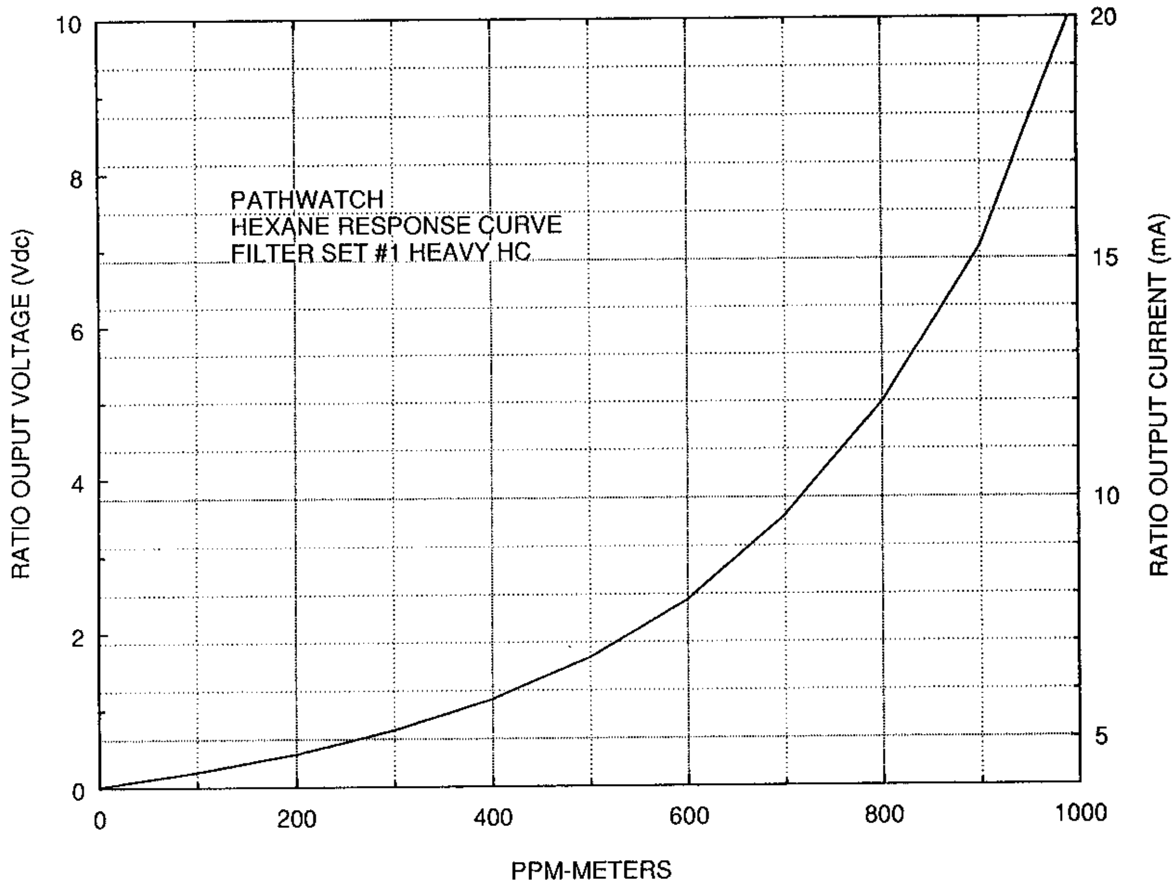


Figure A7

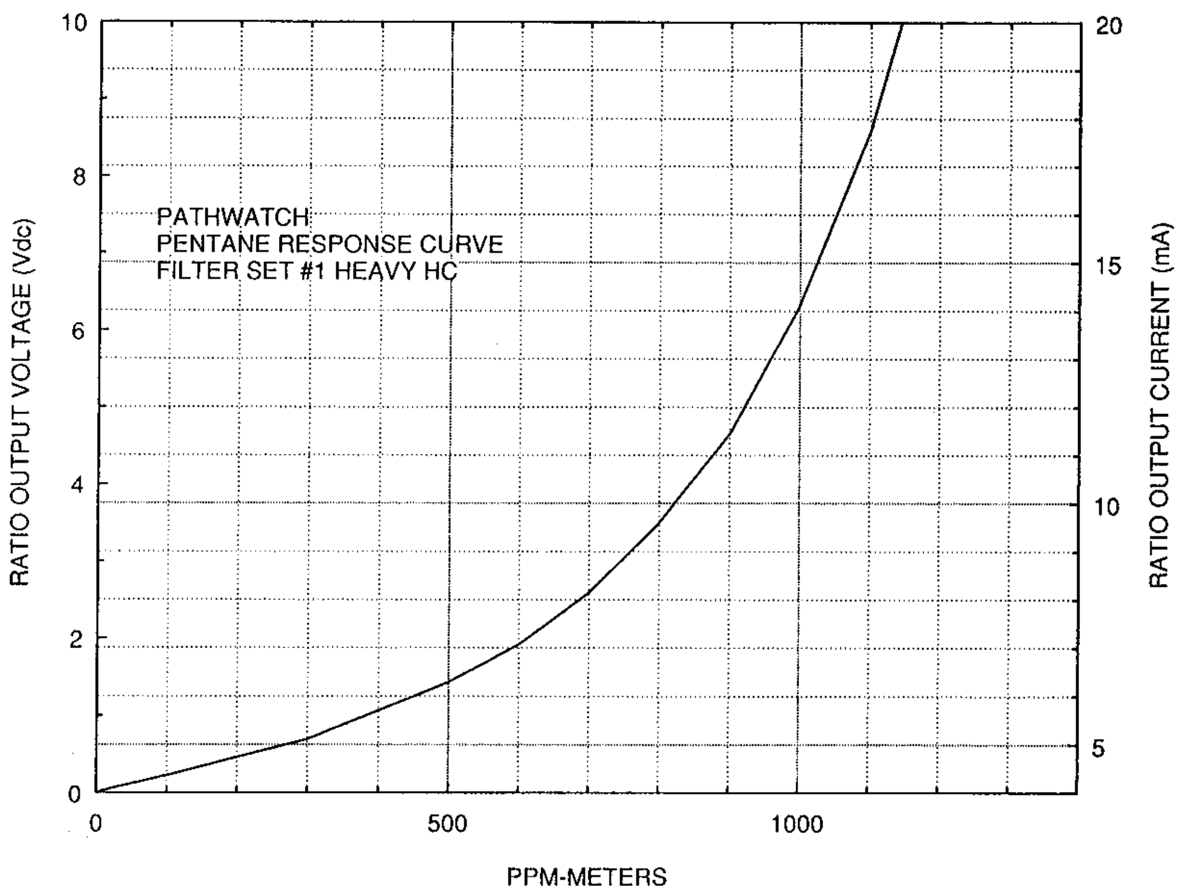


Figure A8

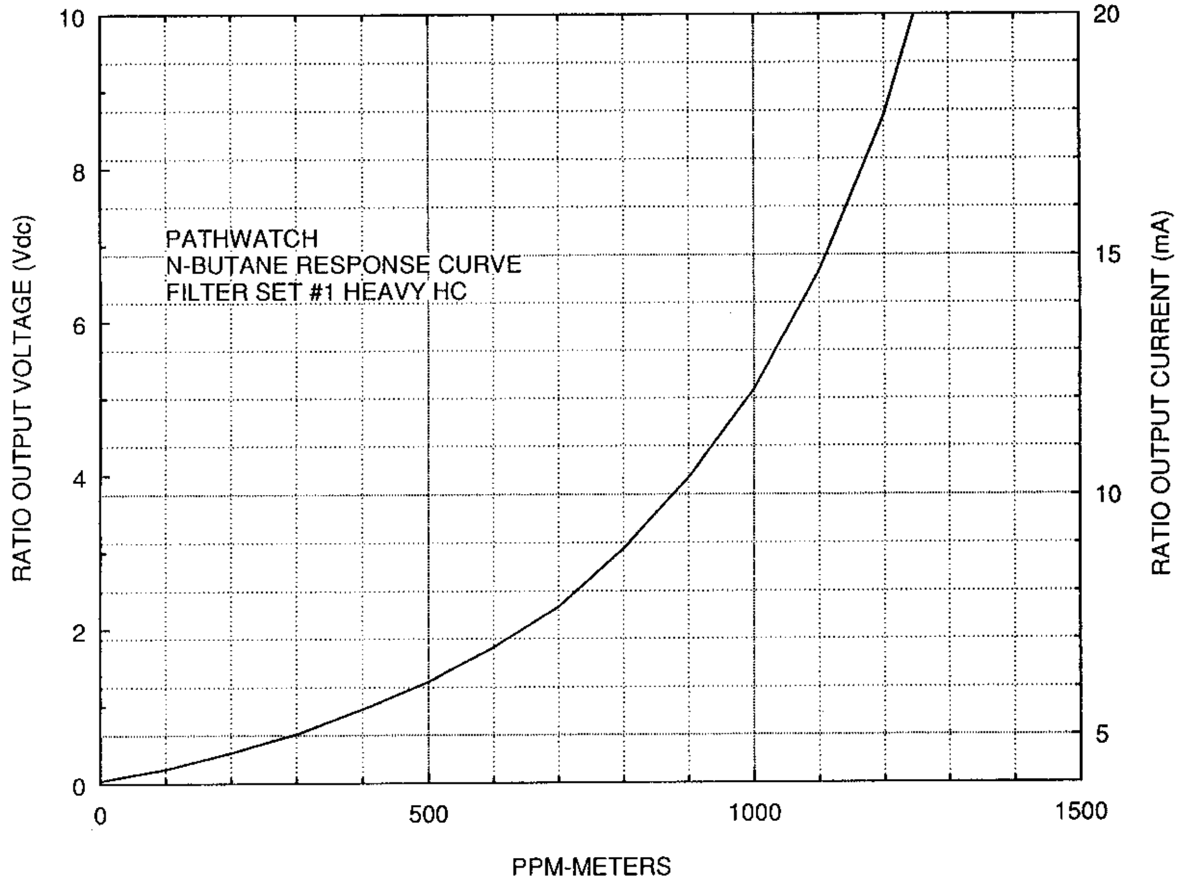


Figure A9

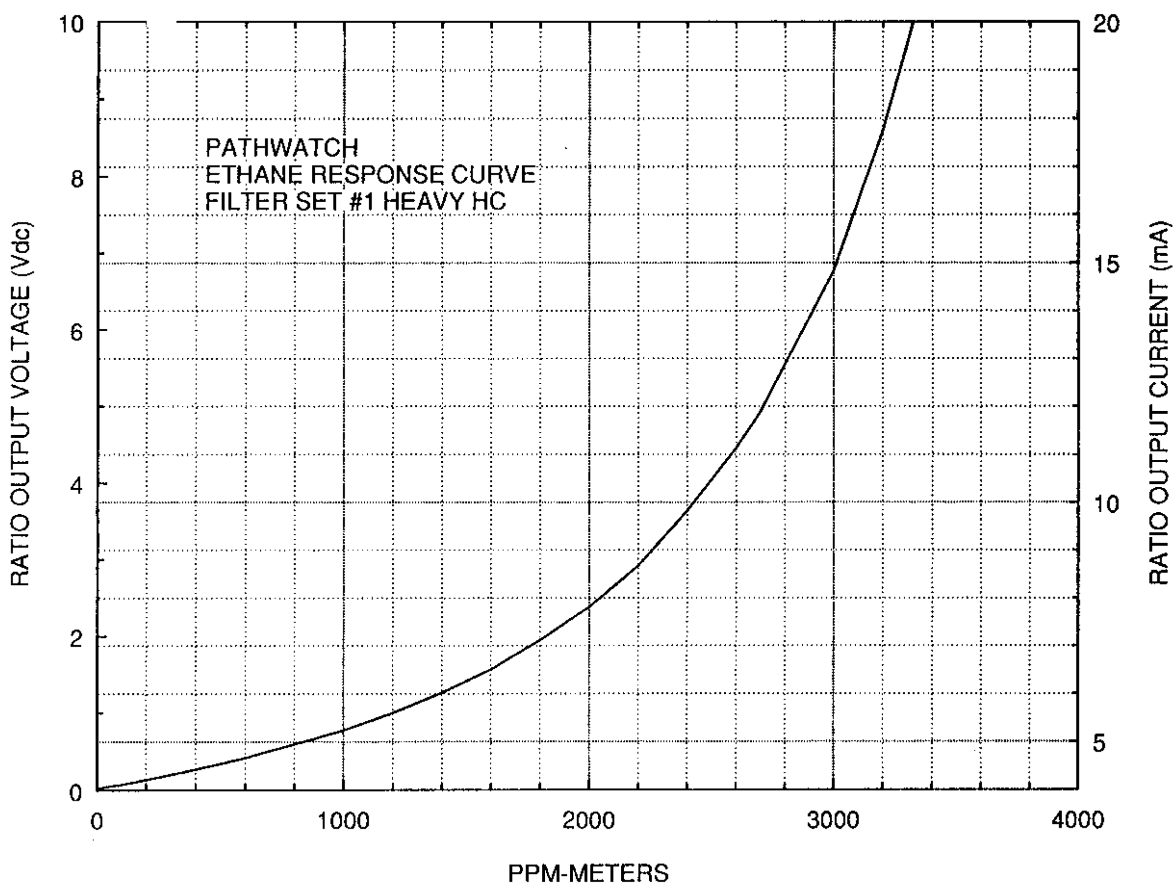


Figure A10