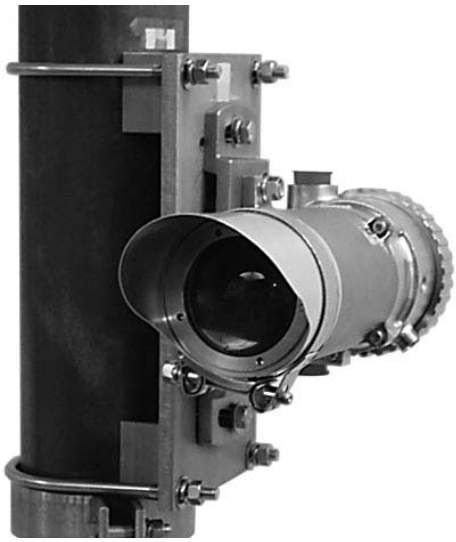
DET-TRONICS®

INSTRUCTIONS

Infrared Hydrocarbon Gas Detector
Open Path Eclipse™
Model OPECL

IMPORTANT

Be sure to read and understand the entire instruction manual before installing or operating the gas detection system. This product is intended to provide early warning of the presence of a flammable or explosive gas mixture. Proper device installation, operation, and maintenance is required to ensure safe and effective operation.



APPLICATION

The Open Path Eclipse™ Model OPECL is an open path infrared gas detection system that provides continuous monitoring of combustible hydrocarbon gas concentrations in the range of 0 to 5 LEL-meters. Standard system outputs include an electrically isolated/non-isolated 4-20 mA dc current output, with HART communication and RS-485 MODBUS communication.

The system consists of two stainless steel modules — a transmitter and a receiver, along with mounting fixture hardware. Both modules are powered from an external 24 volt DC supply. The receiver provides the measurement signal outputs, and is furnished with an onboard "status indication" LED and an internal magnetic calibration switch. The transmitter houses redundant xenon flashlamps. Both modules are installed at approximately the same elevation and must be aligned to point directly at one another. No direct electrical interconnection between the two modules is required.

The Open Path Eclipse is ideal for use in harsh outdoor environments and is certified for use in Class I, Division 1 and Division 2 hazardous areas. It can be used as a stand-alone detector, or as part of a larger facility protection system using other Det-Tronics equipment such as the R8471 Series Controller or the Eagle Quantum Premier Fire and Gas Detection/Releasing System.

OPERATION OVERVIEW

THEORY OF OPERATION

The OPECL transmitter module illuminates a direct linear path ending at the OPECL receiver module. As flammable hydrocarbon gases intersect the light beam between the two modules, certain IR wavelengths are absorbed by the gas, while other IR wavelengths are not. The amount of IR absorption is determined by the concentration of the hydrocarbon gas. A pair of optical detectors and associated electronics located in the receiver module measure the absorption. The change in intensity of the absorbed light (active signal) is measured relative to the intensity of light at a non-absorbed wavelength (reference signal). The microprocessor computes the gas concentration and converts the value into a 4 to 20 milliampere current output signal, which is then communicated to external control and annunciation systems. No filter wheel motors or other moving parts are utilized in either module.

LAMP REDUNDANCY

The OPECL transmitter provides a unique operational feature. A xenon lamp illuminates the linear detection path from the transmitter to the receiver. In the event that the primary lamp fails, the back-up lamp is brought into service. The receiver recognizes this condition by the change in flash pulse coding and responds by initiating a “failed lamp” warning signal to indicate that the back-up lamp is in use. Total system operation is maintained, with no loss of sensitivity or detection performance. In this mode of operation, the following occur:

1. The indicator LED turns amber.

2. The 4-20 mA signal drops from a normal 4 mA to 2.4 mA. The analog output value is overridden if the gas level exceeds 0.5 LEL-meters. All gas alarm signals will occur as when operating with the primary lamp.

3. HART and MODBUS communication warn of a “failed lamp” condition.

Service should be arranged as soon as possible. A new transmitter module should be installed.

DETECTABLE GASES

OPECL is capable of detecting most hydrocarbon gases and vapors including methane, ethane, propane, butane, and propylene. Gas type and other operational parameters are selected via digital communications. The factory calibrated setting is methane.

OUTPUTS

An isolated 4 to 20 mA current loop corresponding to 0 to 5 LEL-meters is provided for connection to analog input devices such as gas controllers, logic controllers, or distributed control systems (DCS). (Relay outputs will be available in a future release.)

COMMUNICATION

The standard OPECL system provides an analog 4-20 mA signal output, with HART and RS-485 MODBUS serial communication from the receiver module.

RECORDING CAPABILITY

Non-volatile memory is provided to save the 10 most recent calibrations, alarm/fault events, and minimum/maximum operating temperature history. A real time clock is provided to record operating service time and to time stamp events. This information is accessible using HART and MODBUS communication.

OPERATION

MODULE IDENTIFICATION

While the OPECL transmitter and receiver modules appear physically identical, each module is labeled as “transmitter” or “receiver” on the rear cover. The physical mounting requirements for both modules are generally identical. However, there are functional and electrical characteristic differences as identified in Table 1.

Table 1—Functional and Electrical Comparison of Transmitter and Receiver

Characteristic	Transmitter (Tx)	Receiver (Rx)
Functional Description	Contains primary and backup xenon flashlamps, and generates optical energy to enable hydrocarbon detection.	Contains opto-electronics, signal processing and output drivers, and diagnostic electronics.
Power Consumption	6.0 watts nominal @ 24 Vdc. 12.2 watts peak @ 24 Vdc.	6.0 watts nominal @ 24 Vdc. 12.2 watts peak @ 24 Vdc.
Electrical Connections	2 power connections only. (+24 Vdc and –24 Vdc).	From 3-7 connections depending upon specific configuration (separate power and signal cables recommended).
Onboard HART Communication Port	Factory use only.	Recommended for connection to handheld HC275/375 HART communicator for system setup, commissioning, and diagnostics.
Onboard LED Indicator	Indicates normal, fault, and backup lamp operation status. Green indicates normal operation. Red indicates fault condition. Amber indicates operation in “back-up lamp” mode.	Indicates normal, alarm, fault, and calibration status. Green indicates normal operation. Blinking red indicates low gas alarm condition. Steady red indicates high gas alarm condition. Amber indicates operation in “back-up lamp” mode or system fault. Calibration status is indicated by a steady red indication after Calibration command. LED operation for fault status is non-latching. LED operation for gas alarms is configurable for latching/non-latching.
Magnetic Calibration Switch (See Figure 1 for switch location.)	Non-functional	Momentary activation provides reset function for latched alarm outputs. Activation for longer than 2 seconds will initiate calibration.
Factory Default Settings	No programmable options	Factory calibrated for methane, 0-5 LEL-meters full scale. See Table 2 for receiver factory default settings. HART communication is required to change the factory default settings.

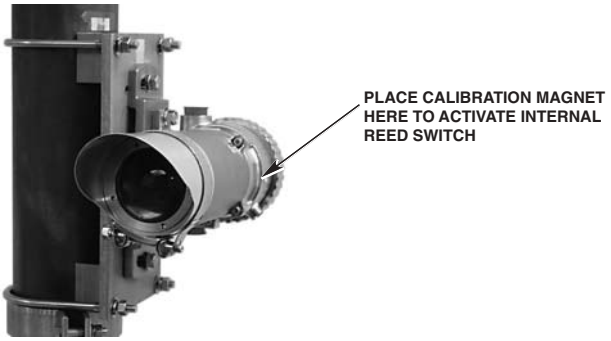


Figure 1—Location of Magnetic Switch

Table 2—Factory Default Settings

	Default	Options
Gas Type	Methane	Methane, Ethane, Propane, Butane
Measurement Range	0-5	0-2, 0-5
Low Alarm Threshold	1	1 to 3
High Alarm Threshold	2	1 to 3
Beam Block Delay	60 Seconds	3600 Seconds
Fault Mode	PIR9400	Eclipse, PIR

OPERATING MODES

The OPECL has four operating modes: warm-up, normal, alignment and calibrate.

Warm-up

Warm-up mode is entered upon application of 24 Vdc operating power. During warm-up, the 4-20 mA current loop output will indicate warm-up, the indicating LED is yellow, and the alarm outputs are disabled. The warm-up mode lasts nominally two minutes after power-up.

Normal

After warm-up mode is completed, the device automatically enters the Normal mode, and all analog and alarm outputs are enabled.

Alignment

The OPECL modules must be properly aligned before normal operation is attained. There are two alignment procedures:

1. Basic Alignment requires the OPECL Alignment Kit. A handheld HART communicator is recommended, but not required.
2. Full Alignment requires the OPECL Alignment Kit and a handheld HART communicator.

Calibrate

After alignment is completed, zero calibration is required. Fugure calibration of the OPECL is normally not required; however, the user has the option to verify proper calibration or to perform calibration procedures if necessary. Refer to the "Calibration" section in this manual for details.

4 TO 20 MA CURRENT LOOP OUTPUT

OPECL provides an isolated, linear current loop output that is proportional to the detected gas level. Fault and calibration status are also indicated by this output.

The factory default for full-scale 5 LEL-meters output is 20 mA. MODBUS interfaces also have the ability to calibrate the 4 mA and 20 mA levels.

FAULT INDICATION

Faults and status conditions are indicated using the 4-20 mA analog signal output. Refer to Table 3. Signaling modes include two predefined and one user defined mode. PIR9400 mode (default) provides compatibility with the DEC R8471J Gas Controller. OPGD-Rx mode is available as well as a user defined mode for third party compatibility.

Table 3—Detector Status Conditions Indicated by Current Level

Status	4-20 mA Level (±0.1)	
	PIR9400	OPGD-Rx
Normal Gas: –0.5 to 6 LEL•M	2.4 to 23.3	
Warmup	0	
Zero Calibration	2.2	
Calibration Fault	1.6	
Beam Block	1.0	
Back-up Lamp Active*	2.4	
Calibrate Active at Startup	0.6	
EE Error	1.2	
Ref. ADC Saturated	0.2	
Active ADC Saturated	0.4	
24 VDC Fault	0.8	
Zero Drift	2.4	
Flash CRC Error	1.2	
RAM Error	1.2	

*Device is still functional. Gas overrides this indication.

SPECIFICATIONS

INPUT VOLTAGE (Both Modules)—
24 Vdc nominal. Operating range is 18 to 30 Vdc. Ripple cannot exceed 0.5 volts P-P.

POWER CONSUMPTION (Per Module)—

Transmitter

6.0 watts nominal @ 24 Vdc, 6.5 watts @ 30 Vdc.
12.2 watts peak @ 24 Vdc, 19.6 watts peak @ 30 Vdc.

Receiver Without Relays

6.0 watts nominal @ 24 Vdc, 6.8 watts @ 30 Vdc.
12.2 watts peak @ 24 Vdc, 20.5 watts peak @ 30 Vdc.

TRANSMITTER LAMPS
Two xenon flashlamps, field-replaceable module.

WARMUP TIME—
1 minute for transmitter. 30 seconds for receiver from power-up when correctly aligned.

CURRENT OUTPUT—
Linear 4 to 20 mA (current source/sink, isolated/non-isolated) rated at 600 ohms maximum loop resistance @ 24 Vdc operating voltage.

VISUAL STATUS INDICATOR—
Tri-color LED:
Red = gas alarm
Green = power on / OK
Yellow = fault / back-up lamp mode.

ALARM SETPOINT RANGE—
Low Alarm: 1 to 3 LEL-meters (default = 1)
High Alarm: 1 to 3 LEL-meters (default = 2).

Alarm setpoint is programmable using HART and MODBUS communications.

DETECTION RANGE—
20 to 60 meters; 10 to 20 meters with accessory.

CALIBRATION—
OPECL systems are span calibrated for methane at the factory.

Zero calibration is accomplished in the field by one of three methods:

– On-board magnetic reed switch
– MODBUS communication
– HART communication.

Span calibration can be adjusted using HART or MODBUS communication.

Refer to the “Calibration” section of this manual for details.

RESPONSE TIME—
T90: <5 seconds.

TEMPERATURE RANGE—
Operating: –20°C to +60°C (–4°F to +140°F).
Storage: –55°C to +85°C (–67°F to +185°F).

HUMIDITY—
5 to 99% relative humidity; designed for outdoor applications.

OPERATING PRESSURE—
91.5 - 105.5 kPA non-compensated.

MEASUREMENT RANGE—
0-5 LEL-meters.

INTERFERENCE RESISTANCE—
Immune to sun and flare radiation, up to 750 W/m^2 ≥ 3° to optical axis and common contaminants.

SELF-DIAGNOSTIC TEST—
Fail-Safe operation ensured by performing all critical tests once per second.

MODULE HOUSING MATERIAL—
CF8M stainless steel (castable 316 equivalent).

CONDUIT ENTRY OPTIONS—
Two entries, 3/4 inch NPT or 25 mm.

HART COMMUNICATION PORT—
Intrinsically safe port on receiver to connect HART devices.

OPTICS PROTECTION—
Stainless steel brow provides a degree of protection against windblown dirt and rain. Heated optics mitigate against ice and dew formation. Heater can be turned off for indoor applications or reduced power.

WIRING—
Field wiring screw terminals are UL/CSA rated for up to 14 AWG wire, and are DIN/VDE rated for 2.5 mm^2 wire. Screw terminal required torque range is 3.5–4.4 in.-lbs. (0.4-0.5 N·m). Transmitter requires power only. Receiver can be wired using 3 or 4 wires.

CERTIFICATION—

CSA: Class I, Div. 1, Groups C & D (T4).
Class I, Div. 2, Groups A, B, C & D (T4).
DEMKO: EEx d e ib IIC, T5.
ATEX: 135898X
EN 50014: 1997 E, A1 & A2.
EN 50018: 2000 E.
EN 50019: 2000 E.
EN 50020: 2002 E.

On-board HART port:
EEx ia IIC T6.
Maximum separation distance between receiver and communicator is 610 meters.

INGRESS PROTECTION—

IP67.

DIMENSIONS—

Module

Length: 11.5 inches (29 cm).
Diameter: 3.5 inches (9 cm) nominal.
4.5 inches (11 cm) maximum.

Mounting Plate

Height: 11.5 inches (29 cm)
Width: 6 inches (15 cm).
Designed to attach to a 4 inch nominal diameter pipe.

Refer to Figure 2 for mounting dimensions.

SHIPPING WEIGHT—

Transmitter with mounting plate: 35 pounds (16 kg).
Receiver with mounting plate: 35 pounds (16 kg).

WARRANTY—

3 year limited warranty from date of manufacture.

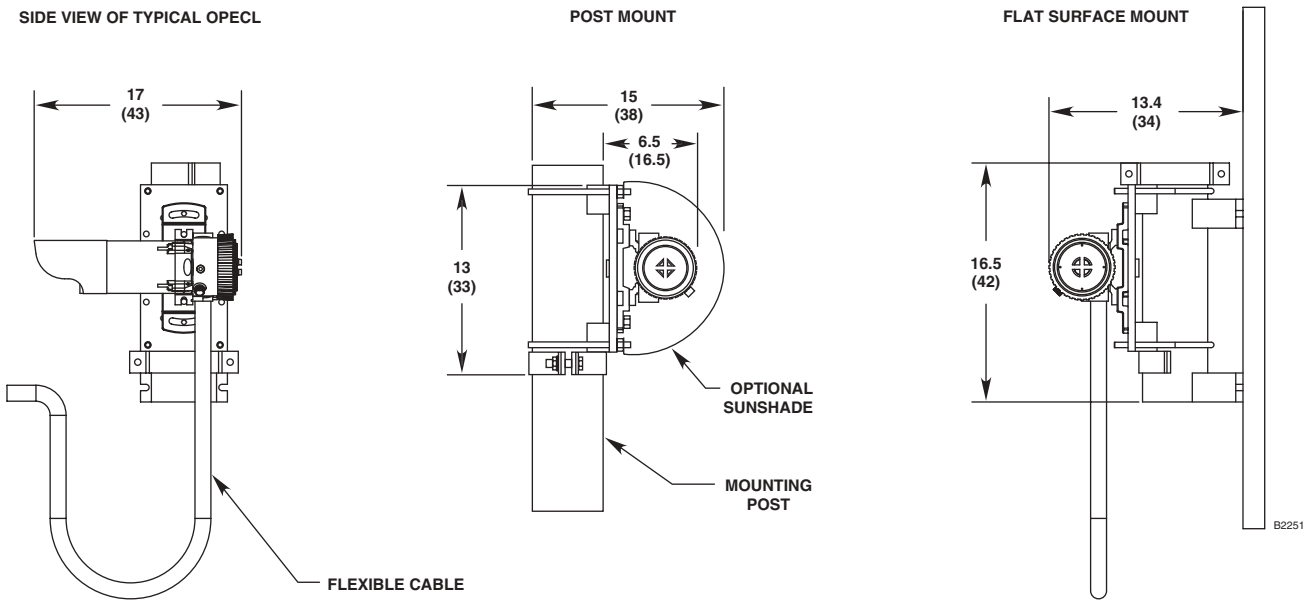


Figure 2—Dimensions of OPECL in Inches (cm)

IMPORTANT SAFETY NOTES

CAUTION

The wiring procedures in this manual are intended to ensure proper functioning of the system 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 the NEC as well as all local ordinances. If in doubt, consult the authority having jurisdiction before wiring the system. Installation must be done by a properly trained person.

CAUTION

This product has been tested and approved for use in hazardous areas. However, it must be properly installed and used only under the conditions specified within this manual and the specific approval certificates. Any device modification, improper installation, or use in a faulty or incomplete configuration will render warranty and product certifications invalid.

CAUTION

The system contains no user serviceable internal components. Service or repair should never be attempted by the user. Device repair should be performed only by the manufacturer or trained service personnel.

LIABILITIES

The manufacturer's warranty for this product is void, and all liability for proper function of the system is irrevocably transferred to the owner or operator in the event that the device is serviced or repaired by personnel not employed or authorized by Detector Electronics Corporation, or if the system is used in a manner not conforming to its intended use.

CAUTION

Observe precautions for handling electrostatic sensitive devices.

NOTE

The Open Path Eclipse is intended for detection of hydrocarbon vapors only. The device will not detect hydrogen gas.

INSTALLATION

IDENTIFICATION OF VAPOR(S) TO BE DETECTED

It is necessary to identify the flammable vapor(s) of interest at the job site in order to determine the proper calibration gas setting for Open Path Eclipse. In addition, the physical and fire hazard properties of the vapor, such as vapor density and flashpoint should be identified and used to assist in selecting the optimum detector mounting locations within the area. The detector must be installed by qualified personnel only, following local electrical equipment installation practices.

SYSTEM LOCATION CONSIDERATIONS

The OPECL system is designed for installation in hazardous industrial areas. Each module is normally installed using a solid vertical steel post or flat surface mounting adapter to support the weight of the module. The modules must be strategically located so that the hydrocarbon vapor(s) to be detected will intersect the light beam generated by the transmitter module. Dispersion characteristics and behavior of the vapor cloud resulting from a gas leak can be difficult to estimate due to the significant number of variables that exist at different applications. Identification of expected gas leakage source(s), leak scenario identification, and onsite leak simulation are the steps generally recommended to provide the most accurate means of identifying optimum system installation locations.

In all cases, the beam path and surrounding area should be kept free of obstructions that could block the infrared beam or hinder the free movement of air within the area. A clear beam path of 20 CM diameter or greater is recommended. The system is immune to the effects of exposure to both direct and reflected sunlight.

Avoid installation in areas with obstructions such as steam vents and plumes, smoke stacks and chimneys, walkways and personnel areas, splash and sprayed water, parking, loading, cranes, vehicle-related areas such as bus stops, road junctions, and vegetation such as trees, shrubs, etc.

Det-Tronics Field Service Engineering group routinely provides jobsite application surveys and analysis for customers, and their services are highly recommended if guidance on optimum installation locations is required. Additional guidance on the positioning of gas detectors for optimum coverage is contained in BS6959 and other national codes. Consult these codes of practice when determining where detectors are to be located.

Consideration of the following system location guidelines is also recommended:

LED Visibility

Select a mounting orientation where the Open Path Eclipse status indication LED is visible to personnel within the area.

Module Separation Distance

The transmitter and receiver modules must be installed directly facing each other across the area to be protected. Physical obstructions in the direct line of sight between the modules are not permitted. The overall line of sight distance between the modules must not exceed a maximum separation distance of 60 meters (198 feet). The minimum module separation distance is 20 meters (66 feet), unless special modifications are provided.

System Mounting Elevation

In all cases, the modules should be installed at the same elevation above grade to ensure that alignment capability and foul weather performance are not compromised. For detection of lighter than air vapors such as methane, installation of modules at approximately 2 meters above grade minimizes typical beam block conditions due to human activities, while enabling satisfactory detection capability. For detection of heavier than air vapors, installation of detectors below the expected leakage source is generally recommended unless nuisance beam blocks will occur at an unacceptable rate. In this case, identification and analysis of application specific conditions should be completed to determine the optimum installation elevation.

Sources of Heavy Contamination

Avoid locations where high levels of contaminants will persistently be blown onto the detector windows. Potential sources of heavy contamination include generator / turbine exhausts, flarestacks, drilling equipment, process vents / chimneys, etc. If sources of heavy contamination cannot be avoided, consider fitting extra shielding and/or providing good access for routine cleaning.

Snow and Ice in Ambients Below –20°C

The heated optics on both modules will melt snow or ice on the windows in ambient temperatures down to approximately –20°C. Below this temperature, snow or ice blown onto the window will not be melted until the ambient temperature rises. If longterm outdoor operation in very cold climates is intended, extra shielding / covers are recommended to prevent accumulation of snow and ice on the windows.

Deluge and Flooding

The modules are rated IP66 and will not be damaged by occasional deluge or flooding. However, during such an event, the unit will completely lose it's IR signal and will enter the "Beam-Block / Fault" state. In addition, when the deluge / flooding subsides, there is the possibility that contaminants will be left on the windows. Install the modules away from areas particularly prone to deluge or flooding.

Areas Prone to Subsidence and Settling

Avoid installation of the modules in areas where problems with subsidence, settling or thawing of permafrost can occur or cause significant movement. If such locations cannot be avoided, the foundations of the mounting structure should be engineered to minimize any angular movements.

Areas Prone to Earthquakes

In the event of an earthquake, there is a chance that the modules will become misaligned with respect to each other. As long as the modules do not suffer from direct mechanical impact damage during an earthquake, they should remain undamaged by such events. After an earthquake, it is recommended that the system alignment be checked. Antivibration mounts are unlikely to be of any benefit and are not recommended.

Misalignment by Accidental Impact

Locations where there is a significant likelihood of equipment, personnel or moving objects accidentally knocking the modules out of alignment should be avoided where possible. If such locations cannot be avoided, measures including improved mechanical protection and warning notices should be considered.

MODULE MOUNTING RECOMMENDATIONS

After optimum system module mounting locations are identified, the preferred module mounting configuration must be selected. Each module must be affixed to a solid, non-vibrating structure capable of supporting a minimum of 100 lbs (46 kg), located within the system's maximum rated separation distance. Module mounting options include:

- A vertical post with a nominal outside diameter of 4.5" (11.43 cm). Acceptable outside diameter range is 4.0 to 5.0 inches. Ensure that each post is capable of supporting a minimum of 50 lbs (23 kg). See Figure 3.
- For flat surface mounting, the OPECL flat surface mount adapter is available. Ensure that the flat surface is capable of supporting a minimum of 100 lbs (46 kg). See Figure 4. For mounting hole pattern, refer to Figure 5.

In all cases, the maximum movement of the supporting structure under all anticipated operating conditions must be no more than ±0.5 degrees. When using a vertical post, the post should be absolutely stable and without vibration. Generally, when the post is set into the ground, the portion below grade should be set in concrete at least 1 meter deep.

When using the flat surface mounting adapter, ensure that the two vertical mounting surface planes are aligned sufficiently to enable proper module alignment. It is possible that some existing flat surfaces may not allow proper system alignment using the OPECL mounting and alignment harware.

System modules are shipped disassembled from the mounting hardware. Before proceeding with module installation, ensure that all required module installation components are present, including:

2 OPECL modules,

2 module mounting brackets,

2 pan-tilt plates,

4 U-bolts complete with

8 washers and nuts, and

2 plate support collars.

For flat surface mounting, two OPECL flat surface mount adapters (ordered separately) must be installed prior to starting the module installation procedure.

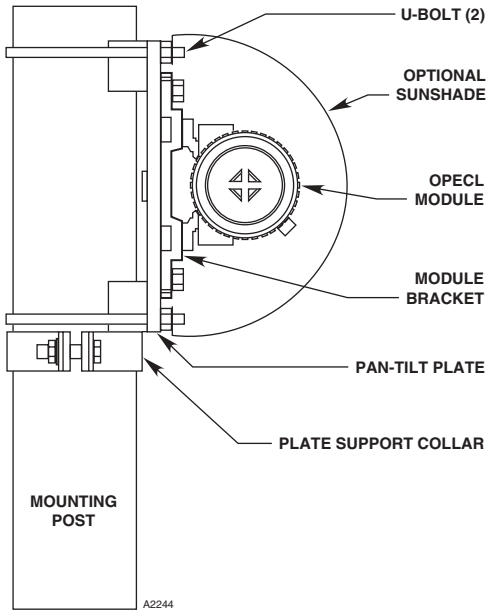


Figure 3—OPECL Gas Detector Mounted to Vertical Post

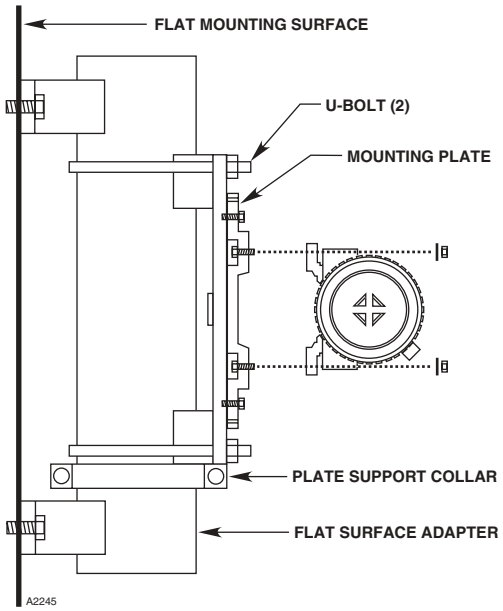


Figure 4—OPECL Gas Detector Mounted to Flat Surface using Flat Surface Adapter

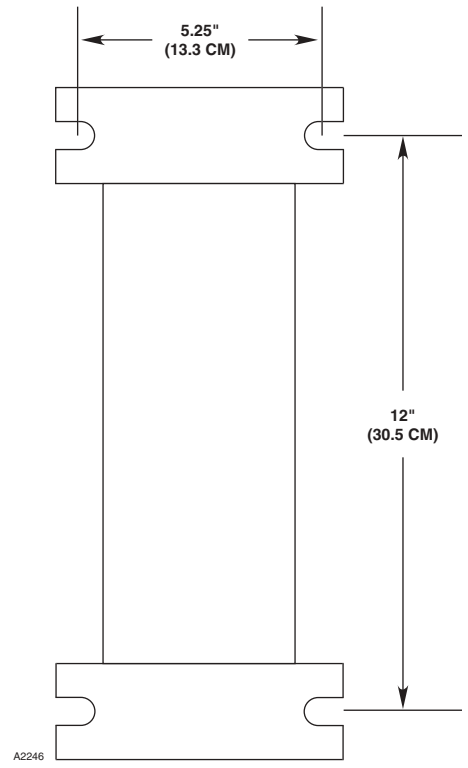


Figure 5—Hole Pattern for Flat Surface Mount Adapter

MODULE INSTALLATION PROCEDURE (Must be Completed for both Transmitter and Receiver Modules)

1. Install the Plate Support Collar onto the vertical post at the desired height. Refer to Figure 6. Ensure that the plate support collars for both modules are installed at the same distance above grade/floor elevation to ensure ease of optical alignment later. Tighten the plate support collar nuts and bolts to adequately support the entire assembly.

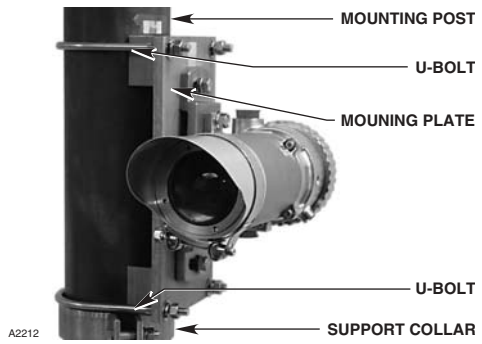


Figure 6—OPECL Detector Attached to Mounting Post

2. Install the Mounting Plate on the vertical post using (2) U-bolts, (4) washers, and (4) nuts. Tighten the nuts snugly by hand only at this time so that the plate is adequately supported but may be rotated if required.

3. Install the OPECL module onto the Mounting Plate. Tighten snugly to support the weight of the device.

4. Double check to ensure that the module is adequately supported and is ready for electrical wiring.

IMPORTANT

Do not allow any water or other contaminants to enter the OPECL electrical termination enclosure if a delay is expected.

24 VDC POWER SUPPLY REQUIREMENTS

Calculate the total gas detection system power consumption rate in watts from cold start-up. Select a power supply with adequate capability for the calculated load. Ensure that the selected power supply provides regulated and filtered 24 Vdc power for the entire system. If a back-up power system is required, a float-type battery charging system is recommended. If an existing source of 24 Vdc power is being utilized, verify that system requirements are met.

WIRING CABLE REQUIREMENTS

Always use proper cabling type and diameter for input power as well as output signal wiring. 14 to 18 AWG shielded stranded copper wire is recommended.

Always install a properly sized master power fuse or breaker on the system power circuit.

NOTE

The use of shielded cable in conduit or shielded armored cable is recommended for optimum RFI/EMI protection. In applications where the wiring is installed in conduit, dedicated conduit is recommended. Avoid low frequency, high voltage, and non-signaling conductors to prevent nuisance EMI problems.

CAUTION

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

POWER WIRING SIZE AND MAXIMUM LENGTH

1. The OPECL detector must receive 18 Vdc minimum to operate properly. 24 Vdc minimum is recommended.

2. Always determine voltage drops that will occur to ensure that 24 Vdc is delivered to the OPECL.

3. Normally, nothing smaller than 18 AWG (0.75 mm^2) is recommended by Det-Tronics for OPECL power cabling.

Wire size requirements are dependent upon power supply voltage and wire length.

The maximum distance between the OPECL detector and its power supply is determined by the maximum allowable voltage drop for the power wiring loop. If the voltage drop is exceeded, the device will not operate. To determine the maximum power loop voltage drop, subtract the minimum operating voltage for the device (18 Vdc) from the minimum output voltage of the power supply.

To determine the actual maximum wire length:

1. Divide the maximum allowable voltage drop by the maximum current draw of the OPECL (0.64 A),

2. Divide by the resistance of the wire (ohms/foot value available in wire manufacturer's specification data sheet),

3. Divide by 2.

For example: Consider an installation using 18 AWG wiring with a power supply providing 24 Vdc.

Power supply voltage = 24 Vdc,
OPECL minimum operating voltage = 18 Vdc

24 – 18 = 6 Vdc

Maximum Voltage Drop = 6
Maximum Current = 0.64 A
Wire Resistance in Ohms/Foot = 0.006523

6 ÷ 0.64 ÷ 0.006523 ÷ 2 = 718 feet

WIRING PROCEDURE

For systems using conduit, modules must be wired using a short piece of suitable flexible conduit to allow optical alignment of the modules. Ensure that all cables are terminated properly. Open Path Eclipse screw terminal torque range is 3.5–4.4 in.-lbs. (0.4–0.5 N·m).

Cable shield, if used, should be properly terminated. If not terminated, clip the shield wire off short and insulate it within the detector housing to prevent the shield wire from accidentally contacting the detector housing or any other wire.

Figure 7 shows the wiring terminal strip located inside the detector's integral junction box. Figure 8 shows the wiring terminal configuration for the OPECL receiver. Figure 9 shows the wiring terminal configuration for the OPECL transmitter. (The transmitter requires only operating power.) Figures 10 through 13 show the 4 to 20 mA output of the OPECL receiver in various wiring schemes. Figure 14 shows the OPECL wired to a Model R8471J Controller.

NOTE

The OPECL housing must be electrically connected to earth ground. A dedicated earth ground lug is provided for this purpose.

NOTE

For proper HART communication, it is required that an analog signal loop resistance of 250 to 500 ohms be present at the receiver analog output terminals. See Figure 15 for benchtop test wiring.

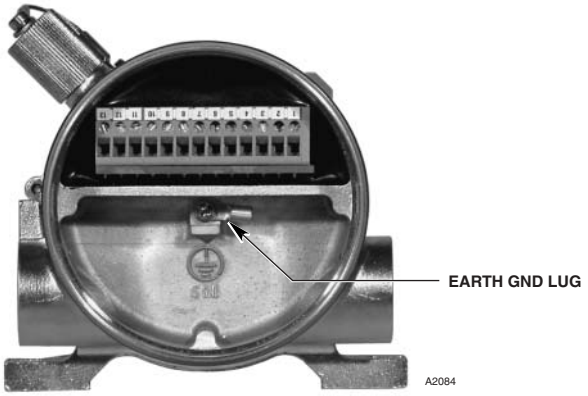


Figure 7—Terminal Strip Located Inside Wiring Compartment

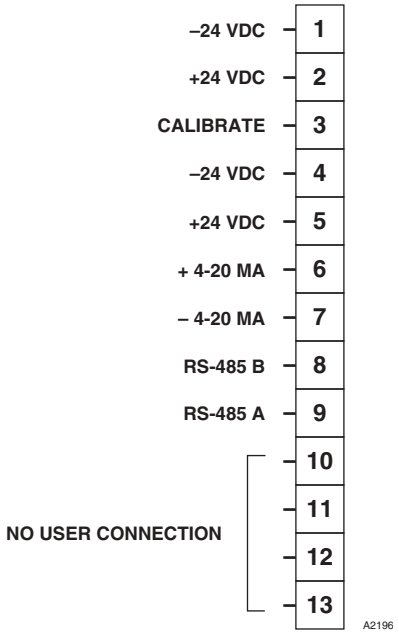
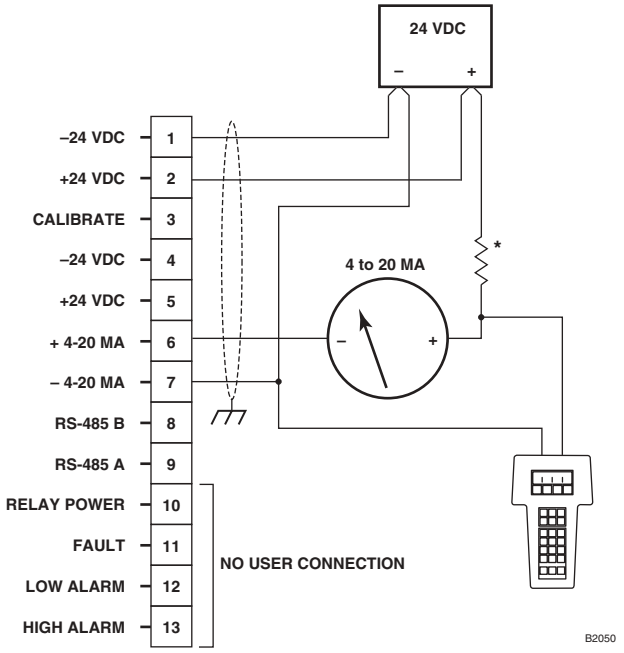


Figure 8—Receiver Wiring Terminal Identification



*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.

Figure 10—Detector Wired for Non-Isolated 4 to 20 ma Current Output (Sinking)

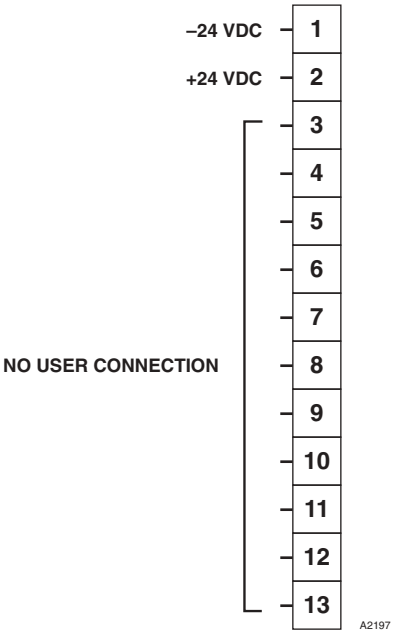
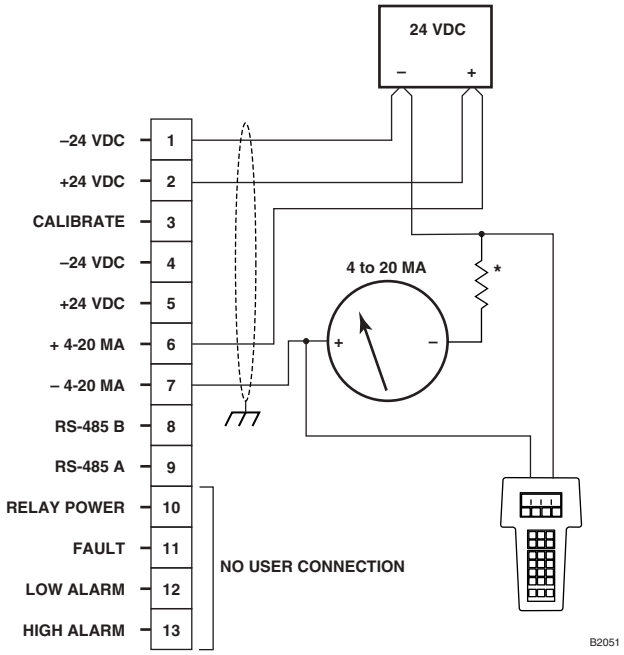
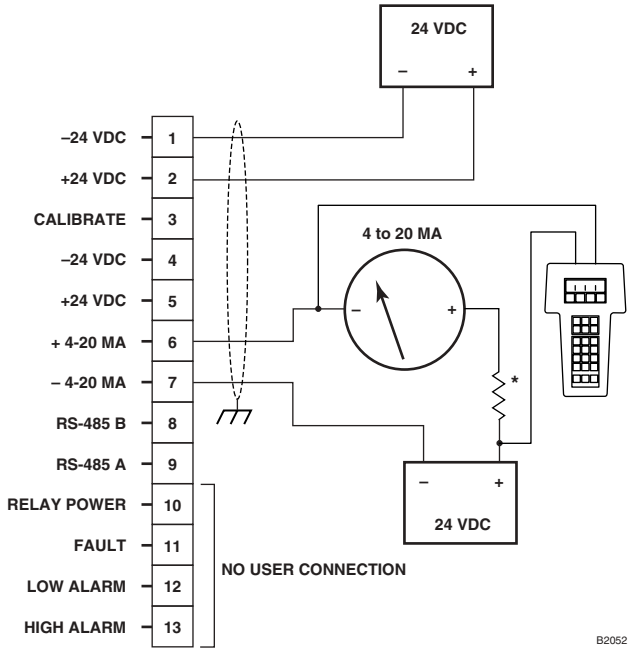


Figure 9—Transmitter Wiring Terminal Identification



*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.

Figure 11—Detector Wired for Non-Isolated 4 to 20 ma Current Output (Sourcing)



*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.

Figure 12—Detector Wired for Isolated 4 to 20 ma Current Output (Sinking)

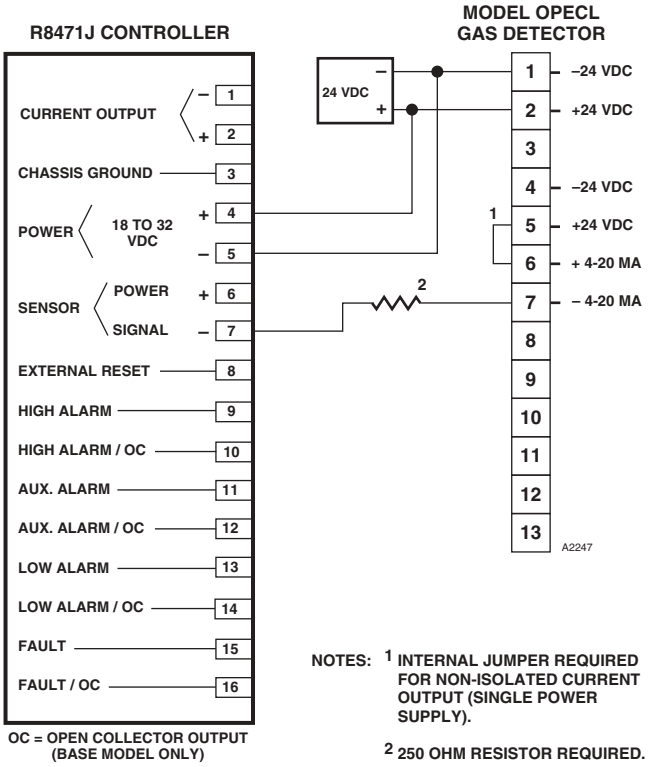
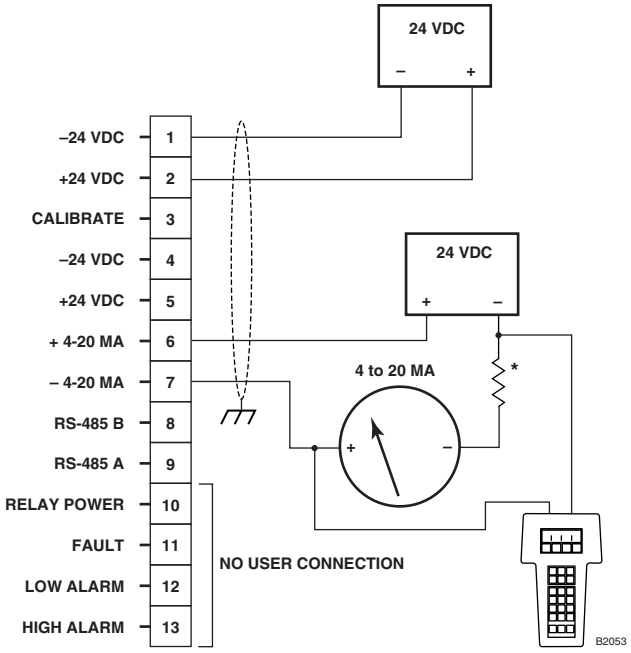


Figure 14— Model OPECL Receiver Wired to a Model R8471J Controller



*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.

Figure 13—Detector Wired for Isolated 4 to 20 ma Current Output (Sourcing)

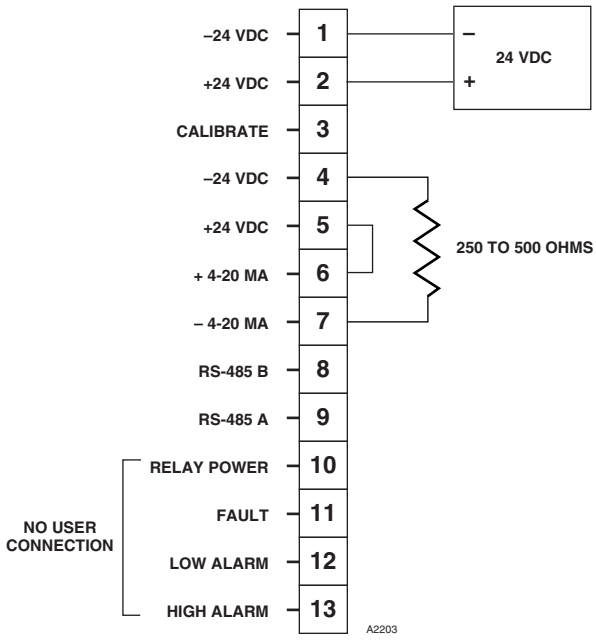


Figure 15—Wiring the Model OPECL for Benchtop Testing/Programming Using HART Protocol

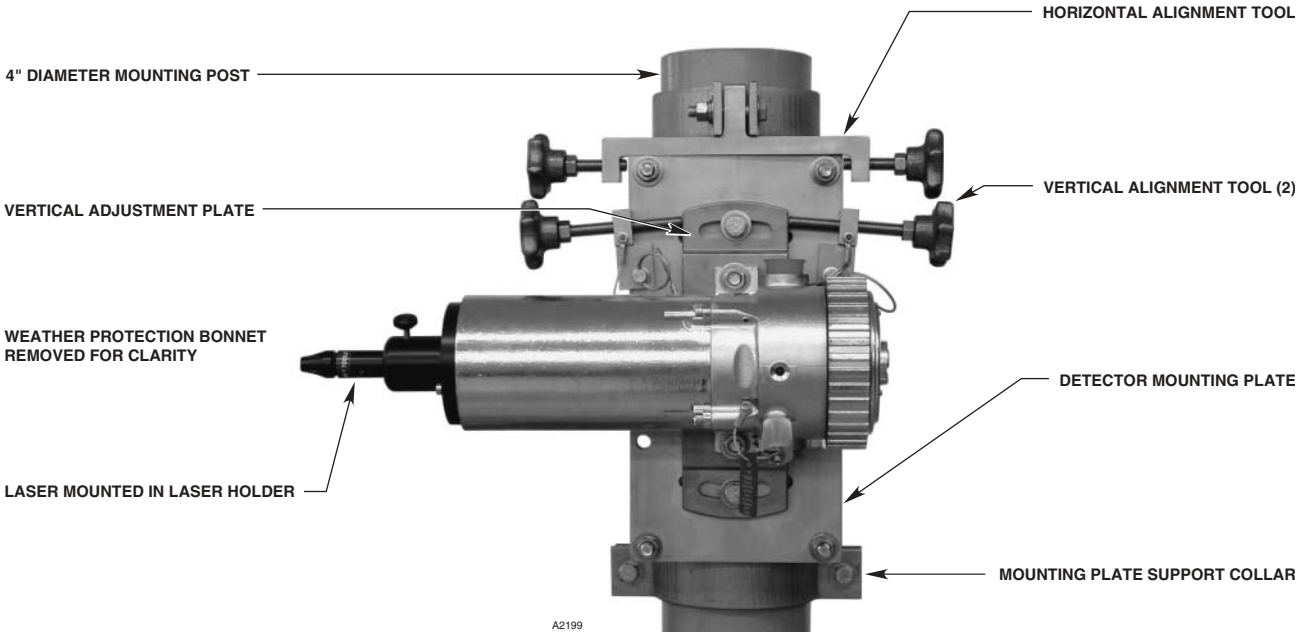


Figure 16—OPECL Detector with Optional Alignment Tools and Laser Aimer Installed

STARTUP

When the OPECL is installed and wired as described in the "Installation" section, it is ready for commissioning. If the application requires that specific changes be made to the factory settings, HART communication will be required.

NOTE

Ensure that alarm devices are bypassed during commissioning.

ALIGNMENT

OVERVIEW

The OPECL modules must be properly aligned before normal operation can be attained. There are two alignment procedure options:

1. **Basic Alignment Procedure.** This option requires the OPECL alignment kit, but does not require a handheld HART communicator.

2. **Full Alignment Procedure.** This option requires the OPECL alignment kit and a handheld HART communicator with the OPECL device descriptor (DD) software menu. The full alignment procedure is recommended whenever maximum optical signal strength is required at the receiver.

BASIC ALIGNMENT PROCEDURE

Equipment Required

1. Properly installed and powered OPECL system (transmitter and receiver). Easy access to both modules is highly recommended.

2. OPECL Alignment Kit (PN 007726-001). Kit includes a battery powered laser, a laser holder, alignment target and target holder.

3. Alignment Adjuster Kit (PN 007745-001). Optional kit includes a battery powered laser, a laser holder, alignment target and target holder, and removable vertical and horizontal adjusters. Recommended for maximum ease in achieving proper alignment. See Figure 16.

4. Calibration magnet.

Ensure that system power is turned off and metal visors are slid to the rear to prevent damage, then complete the following steps:

1. Ensure that both system modules are properly installed on their respective mounting plate/post assemblies at a separation distance within the specified range, and are correctly wired.

2. Ensure that both system modules are mounted at approximately the same height above grade level, and that each module is roughly aligned to directly face the other module's lens surface.

3. Ensure that the four nuts on each module's mounting U-bolts are sufficiently tightened to properly support the module, yet allow horizontal (left/right) adjustment of the plate/module by hand without binding.

4. Ensure that the mounting bracket nuts are sufficiently tightened to properly support the module's up/down angle without deflection, yet allow the module to be vertically adjusted by hand without binding. It is recommended to tighten the lower bracket nut slightly more than the upper bracket nut.

5. Attach the laser aimer holder to the front face of the Transmitter by threading the holder's two captive screws into the respective threaded holes on the Transmitter faceplate. Insert the battery-powered laser into the holder. Do not turn on the laser yet.

6. Attach the alignment target holder to the front face of the Receiver. Insert the alignment target into the holder.

7. Turn on the laser aimer and slowly move the transmitter module left or right as required until the laser spot hits the the alignment target as close as possible to dead center. Tighten the U-bolt nuts so that no left/right movement will occur.

8. Slowly move the transmitter module up or down as required until the laser spot hits the alignment target as close as possible to dead center. Tighten the module mounting bracket nuts so that no up/down movement will occur. As this point, the laser spot should be aimed dead center on the alignment target. Turn the laser off.

9. Exchange the laser and aiming target locations by removing the laser from the laser holder and inserting it into the Receiver's target holder. Relocate the alignment target into the Transmitter's holder.

10. Repeat steps 7 and 8 with the laser installed on the Receiver module.

11. Remove the laser, laser holder, target, and target holder from both modules.

12. Bypass all external gas alarm devices that are connected to the receiver outputs, and apply 24 Vdc power to the modules.

13. Upon completion of warm-up mode (approximately 2 minutes), the receiver should display a green LED, indicating that the system is in normal operating mode. If the green LED is not displayed, confirm that the transmitter is generating a visible light flash, that the receiver is powered up, that the modules are within the specified mounting distance, and then repeat steps 1 to 10 above.

NOTE

If monitoring the 4-20 mA signal output, do not be alarmed if the signal is greater than 4.0 mA. This is common and will be corrected by performing a zero calibration.

14. Perform a zero calibration using the calibration magnet. Any faults or alarms that may be present as a result of the alignment process will be cleared.

15. When the zero calibration is successfully completed, Basic Alignment is completed.

NOTE

If Full Alignment will be performed, stop here and go directly to Step 1 in the "Full Alignment Procedure".

16. Confirm proper operation by blocking the light beam with a solid object such as cardboard until a beam block fault is generated (default setting is 60 seconds).

17. Confirm proper operation by installing the optical test film into the light beam and checking for a low gas alarm condition. The alarm condition should clear when the film is removed from the beam.

FULL ALIGNMENT PROCEDURE

Completion of the Full Alignment procedure is recommended when maximum optical signal strength is required at the receiver module — typically in outdoor applications and areas with high levels of optical contamination or fog. It is necessary to complete the Basic Alignment procedure before starting the Full Alignment procedure.

In addition to the equipment needed for Basic Alignment, Full Alignment requires the use of a handheld HART communication device such as the intrinsically-safe Emerson Model 375 HART communicator. The use of Alignment Kit p/n 007745-001 is also highly recommended to enable precision control of the vertical and horizontal alignment orientation of the OPECL Receiver module. The OPECL transmitter is not adjusted in the Full Alignment procedure.

HART Communicator Notes

- For hazardous areas, ensure that the HART communicator is certified for use in classified areas.
- The HART communicator must include the Device Descriptor (DD) software menu for OPECL. The use of a HART communicator without the proper DD's may establish generic mode HART communication, but will not allow Full Alignment to be completed. Refer to the HART Appendix for additional information.
- A minimum level of understanding with regard to the operation and navigation of the HART communicator is required to complete the Full Alignment procedure. Please refer to the appropriate HART communicator instruction manual for basic operating instructions if needed. Additional information on the use of the HART communicator is provided in the HART Appendix in this document.
- For proper HART communication to occur, a 250-500 ohm resistive load is required in the 4-20 mA signal loop (as shown in Figures 10 to 13).

After completion of Step 15 in the Basic Alignment procedure, begin the Full Alignment procedure.

1. Install the horizontal and vertical alignment tools from the Alignment Kit as shown in Figure 16. Ensure that the horizontal alignment tool clamp is tightened on the mounting post.

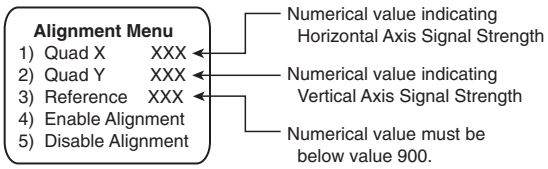
2. Connect the handheld HART communicator to the Receiver module's onboard HART communication port.

3. Turn on the HART communicator and inspect for OPECL device recognition. When HART communication is established, the OPECL Receiver Root menu will be displayed on the communicator display screen.

4. From the Root Menu, select the Test Menu (selection 5).

5. From the Test Menu, select the Alignment Menu (selection 6).

6. The Alignment Menu will display the following screen:



7. If the value displayed to the right of "Reference" is greater than 900, stop Full Alignment. Too much optical energy is present at the receiver, and the separation distance must be increased to a minimum of 20 meters. If the reading is below 900, proceed to step 8.

8. From the Alignment Menu, select Enable Alignment (selection 4). This places the receiver in Alignment mode, resulting in:
   A. an Amber LED on the receiver.
   B. default analog signal of 1 milliampere, causing a fault condition to be displayed on the Detronics R8471J gas controller.
   C. no signal levels above the default signal level or alternative level as programmed.

NOTE

When the Alignment mode is enabled, the HART communicator occassionally displays a message stating "Non-zero status codes found. Ignore the next 50 occurences?" When this occurs, enter "Yes", and continue the Full Alignment procedure.

9. Numerical values are displayed on the right side of the Alignment Menu screen to indicate the relative optical signal strength for each axis. The numerical value displayed to the right of "Quad X" indicates horizontal (left/right) signal strength. The numerical value displayed to the right of "Quad Y" indicates vertical (up/down) signal strength. The optimum value is zero (0.00). It is normal for a fair amount of signal instability to be present; therefore it is recommended to monitor the value for a minimum of 15-30 seconds to determine the average reading. If the readings average zero, no adjustments are necessary. Proceed to step 12.

10. If the Quad X reading does not average zero, slowly adjust the horizontal adjustment knobs as necessary to achieve an average reading of zero at Quad X. Make alignment adjustments in very small increments, and always monitor the value for a minimum of 15-30 seconds after making any adjustment to determine the relative average indication change. Generally, only slight adjustments are required to achieve maximum signal strength.

NOTE

Do not attempt to tighten any adjustment knob if the opposing knob is tightened hard against the mounting plate hardware. It is necessary to slightly loosen the opposing adjuster in all cases before attempting to tighten an adjuster.

11. If the Quad Y reading does not average zero, slowly adjust the vertical adjustment knobs as necessary to achieve an average reading of zero at Quad Y. Make alignment adjustments in very small increments, and always monitor the value for a minimum of 15-30 seconds after making any adjustment to determine the relative average indication change. Generally, only slight adjustments are required to achieve maximum signal strength. Do not attempt to tighten any adjustment knob if the opposing knob is tightened hard against the mounting plate hardware. It is necessary to slightly loosen the opposing adjuster in all cases before attempting to tighten an adjuster.

12. When an average numerical indication of "0" (zero) is displayed for the Quad X and Quad Y values, slowly hand-tighten the adjustment knobs on each axis simultaneously. When the knobs are tight, the OPECL mounting plate should be firmly held in place by the adjusters.

13. Tighten all Mounting Plate U-bolt nuts and vertical adjustment bracket bolts. Double check the Quad X & Y values to ensure that there has been no module movement.

14. Remove the Alignment Kit adjustment tools.

15. From the Alignment Menu, select Disable Alignment (selection 5). This places the receiver in normal mode, generating a green LED indication and a live 4 mA signal level.

16. Perform a zero calibration.

17. Confirm proper operation by blocking the light beam with a solid object such as cardboard until a beam block fault is generated (default time delay is 60 seconds).

18. Bypass all system alarms and confirm proper operation by placing the optical test film into the light beam and inspecting for a low gas alarm condition. The alarm condition should clear when the film is removed from the beam.

19. The system is fully aligned.

CALIBRATION

CALIBRATION OVERVIEW

Although routine calibration of the Open Path Eclipse is normally not required, the device supports non-intrusive field zero calibration capability. Span calibration is not required.

Zero Calibration

Zero Calibration is a one-step process consisting of clean air (zero) condition adjustment only, which is performed automatically by the device. This procedure adjusts the "clean air" signal output only, and is normally used if the 4 milliampere signal level has drifted. The cause of drift is typically due to the presence of background gas during calibration. Ensure that the optical path is clear of hydrocarbons prior to calibration initiation to ensure an accurate zero (clean air) condition.

IMPORTANT CALIBRATION NOTES

NOTE

Ensure that the detector has been operating for at least two hours before calibrating.

NOTE

Always ensure that the OPECL optics are totally free of all hydrocarbons before initiating calibration.

CALIBRATION INITIATION

Calibration may be initiated by any of the following means:

- The onboard magnetic calibration switch
- Digital communication via MODBUS communication (consult factory for details)
- Remote calibration line.

Calibration Using Magnetic Switch

The Open Path Eclipse provides an onboard magnetic calibration/reset switch for non-intrusive calibration capability. The magnetic switch is actuated by holding a calibration magnet at the specified located on the device bulkhead. See Figure 1 for switch location. An onboard tri-color LED provides status indication during calibration.

For zero calibration, the magnetic switch must be actuated for 2 seconds to initiate calibration (signaled by a solid red LED). Upon initiation, the OPECL automatically performs the zero calibration adjustment, and then signals with a green LED when this operation is complete.

Digital Communication Calibration

MODBUS communication may be utilized to initiate OPECL calibration (consult factory).

DETAILED CALIBRATION PROCEDURE USING MAGNETIC SWITCH

Zero Calibration

1. Apply magnet for 2 seconds minimum to initiate calibration.
   A. The onboard LED turns to steady red.
   B. The current output decreases to 1 mA.

2. When zero calibration is complete:
   A. The onboard LED changes from steady red to steady green.
   B. Calibration is complete and current output returns to 4 mA.

MAINTENANCE

ROUTINE INSPECTION

The Open Path Eclipse detector should be inspected periodically to ensure that external obstructions such as plastic bags, mud, snow, or other materials do not block the path and thereby impair the performance of the device.

OPTICS CLEANING

Cleaning of the OPECL optical surfaces is normally required only if an optical fault is indicated.

Thoroughly douse both window surfaces using a liberal amount of isopropyl alcohol to clear away contaminant particles. Repeat the alcohol flush to remove any remaining contaminants.

PROTECTIVE CAPS AND COVERS

Ensure that the HART Communication Port cover and the wiring compartment cover are installed and fully engaged.

TROUBLESHOOTING

A Fault status is indicated by a yellow LED and also by the 4 to 20 mA output. Refer to Table 4 for assistance in correcting malfunctions with the Open Path Eclipse Detector.

Table 4—Troubleshooting Guide

Fault Condition	Corrective Action
Low 24 volts	24 vdc operating voltage is out of range. Verify proper wiring to the detector and correct voltage output from the power source. Power supply faults are self-clearing when the condition is corrected. If the fault does not clear, consult the factory.
Dirty Optics	Perform cleaning procedure, then recalibrate as required. (Refer to “Maintenance” for details.)
Calibration Fault	If the calibration process is allowed to time-out, the fault is set and can only be reset with a successful calibration.
Negative Signal Output	This fault is indicated when the signal output drops below 0.5 LEL•M. Normally detection capability is not compromised in this condition. The device was probably zero calibrated with background gas present. If the condition persists, purge with clean air and repeat the zero calibration.
Calibration line active at start-up	The only way to clear this fault is to correct the wiring and reapply power. Be sure that the calibration line is not shorted and that the calibration switch is open. If the fault does not clear, consult the factory.
EE Error	If power is interrupted while the unit is updating its internal data logs, an EE Error may occur. Cycling power will correct this fault.
Other Faults	Consult the factory.

DEVICE REPAIR AND RETURN

The Open Path Eclipse 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 an 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.

Return all equipment transportation prepaid to the factory in Minneapolis.

ORDERING INFORMATION

OPEN PATH ECLIPSE DETECTOR

When ordering, please specify:

3/4 inch threads, 0 to 5 LEL-meters, 4 to 20 mA or
M25 threads, 0 to 5 LEL-meters, 4 to 20 mA.

ALIGNMENT EQUIPMENT

Part Number	Description
007726-001	Open path alignment kit consists of a diode laser aiming apparatus and a precision aligned laser holder.
007745-001	Optional alignment tool kit consists of Rotational Pivot Lock (horizontal), Top Pivot Lock (vertical), and Bottom Pivot Lock (vertical).

SPARE PARTS

Calibration Magnet	102740-002
Silicone Free Grease	005003-001
O-Ring, 3.75” i.d., for wiring compartment cover	107427-040
O-Ring, 3.25” i.d., for front flange (internal)	107427-052

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.detronics.com
E-mail: detronics@detronics.com

APPENDIX A

HART COMMUNICATION

Digital communication with the Open Path Eclipse is necessary to monitor internal status and to modify the factory settings. This appendix provides guidance on establishing HART communication, and describes the communication menu structure when using the Open Path Eclipse with the HART HC275/375 handheld communicator.

INTERCONNECTING THE HART HC275/375 HANDHELD WITH THE OPEN PATH ECLIPSE

Unscrew the protective cap from the HART communication port on the side of the Open Path Eclipse receiver. Connect the HC275/375 to the two terminals inside the port. Press the "on" key to switch on the HC275/375 handheld communicator. The Online menu is the first menu to appear when the Communicator is properly connected to the Open Path Eclipse. This menu is structured to provide important information about the connected device immediately on powering up the Communicator. This menu displays up-to-date device information including primary variable, analog output, lower range value, and upper range value.

NOTE

The HART protocol incorporates a concept called the "Device Description Language" that enables all suppliers of HART instruments to define and document their products in a single consistent format. This format is readable by handheld communicators, PC's and other process interface devices that support DDL. DDL enables full interoperability of devices, regardless of manufacturer, allowing full functionality from any HART device.

In the event that your Communicator does not establish communications with the Open Path Eclipse, you may need to ensure that the appropriate DDL's for the Open Path Eclipse are included within your Communicator. To review the device descriptions programmed into your HART Communicator:

1. From the Main menu, press to access Offline menu.

2. From the Offline menu, press New Configurations to access the list of device descriptions programmed into your HART Communicator. The Manufacturer menu displays a list of each manufacturer with device descriptions currently installed in your Communicator's Memory Module. The standard 12 MB Memory Module is recommended, as it allows for more device descriptions.

3. Select a manufacturer, and the Model menu displays, containing a list of currently installed device models provided by the selected manufacturer.

4. Review the different manufacturers and models to determine the installed HART-compatible devices in your Communicator.

If you cannot find the Open Path Eclipse device on your Communicator, the device revision you are looking for is not programmed into the Memory Module. In this instance, you are limited to what is available using the generic interface built into your HART Communicator.

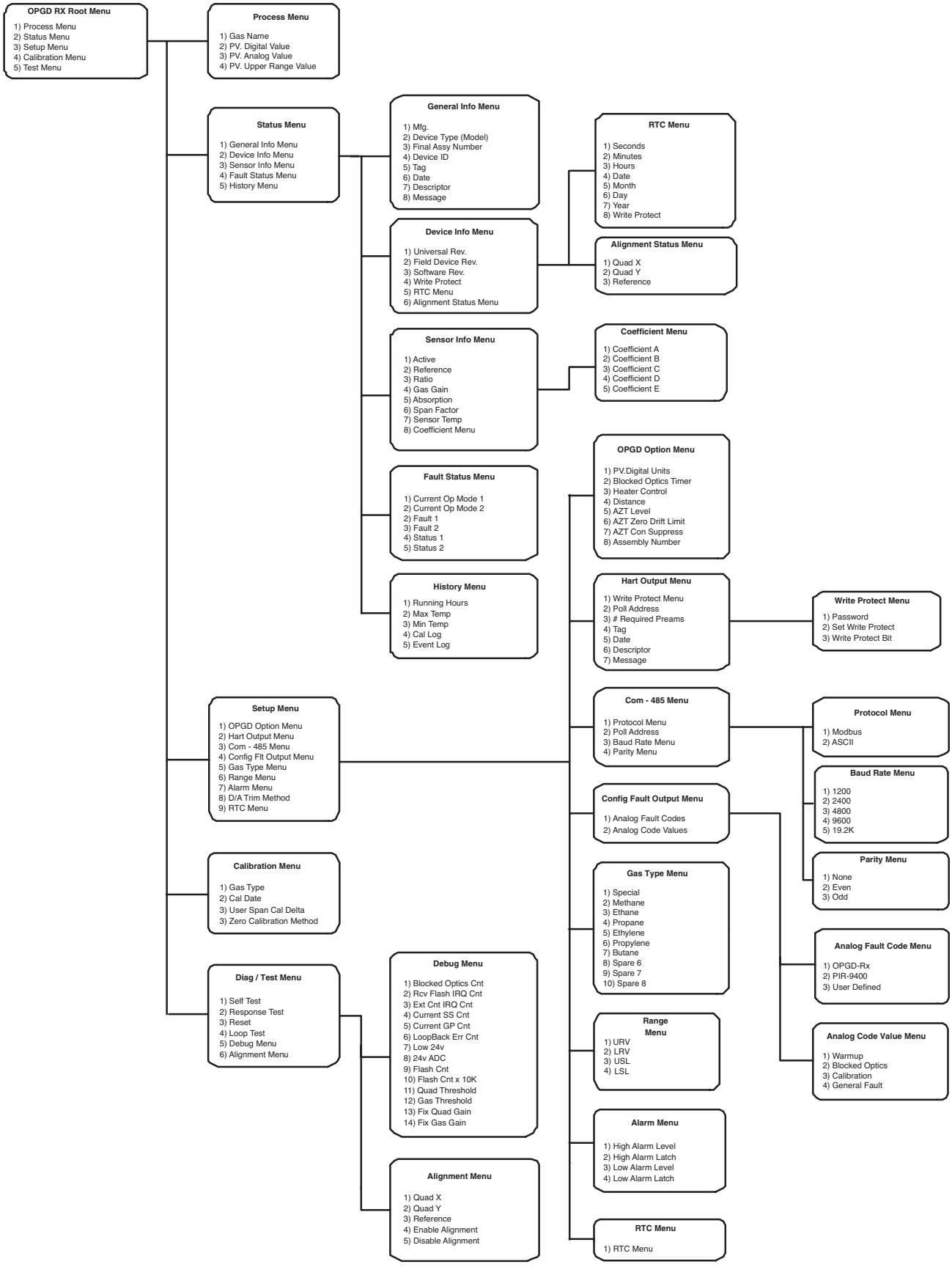
The HART Communication Foundation (www.ccsi.com/hart) manages a library of Manufacturer Device Descriptions, which are distributed to programming sites for inclusion in master devices. A complete listing of the HCF DD Library is available for download in manufacturer and device type sequence.

NOTE

If a device is found, the HART Communicator displays the Online menu. If no device is found, the Communicator displays the Main menu. If no device is found, check the connections, verify the presence of a minimum of 250 ohms load resistance in series in the loop, and retry by selecting 'Online.' To poll multiple devices in the loop, refer to the HC275 Handheld Communicator manual.

OPEN PATH ECLIPSE HART MENU STRUCTURE

This section displays the menu trees for the Open Path Eclipse. The Menu tree shows the primary commands and options available when using menu selections.



CONNECTIONS AND HARDWARE

The HC275/375 can interface with the Open Path Eclipse from the onboard I.S. communication port, from the control room, or from any wiring termination point in the analog output signal loop. To communicate, connect the HART communicator in parallel with the Open Path Eclipse analog signal or load resistor. The connections are non-polarized.

NOTE

The HC275/375 needs a minimum of 250 ohms resistance in the loop to function properly. The HC275/375 does not measure loop current directly.

ONLINE MENU

When HART communication is established with the receiver, the first menu displayed is the OPGD RX Root menu:

OPGD RX Root Menu
1) Process Menu
2) Status Menu
3) Setup Menu
4) Calibration Menu
5) Test Menu

To select any of the 5 menu options shown, highlight the desired option using the up/down arrow key, and then press the “right arrow” key.

COMMONLY USED HART COMMANDS

The most commonly used HART commands for the Model OPECL are:

1. Setting the real time clock
2. Setting alarm thresholds & latch/nonlatch functions
3. Setting the analog fault code menu
4. Performing full system alignment
5. Performing zero calibration
6. Assigning a nonvolatile tag name to the receiver
7. Defining a nonvolatile descriptor for future reference
8. Interrogating the history menu for information including total running hours, max/min exposed temperature, calibration and event logs.