Instructions

Infrared Carbon Dioxide Gas Detector
PointWatch Eclipse®
Model PIRECL
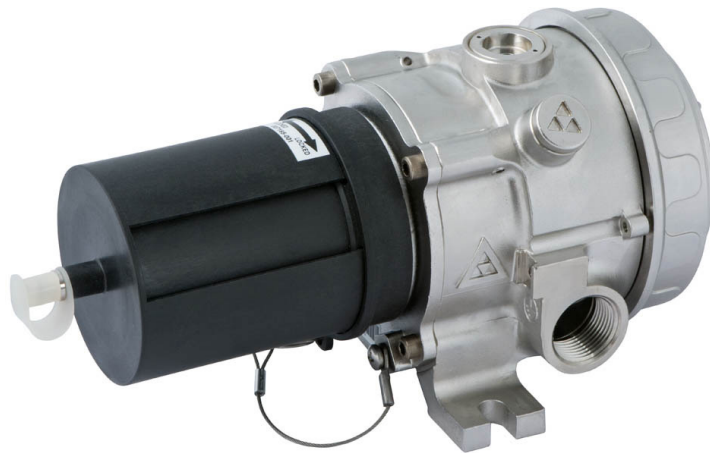
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Infrared Carbon Dioxide Gas Detector

PointWatch Eclipse®

Model PIRECL

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 carbon dioxide gas. Proper device installation, operation, and maintenance is required to ensure safe and effective operation. If this equipment is used in a manner not specified in this manual, safety protection may be impaired.
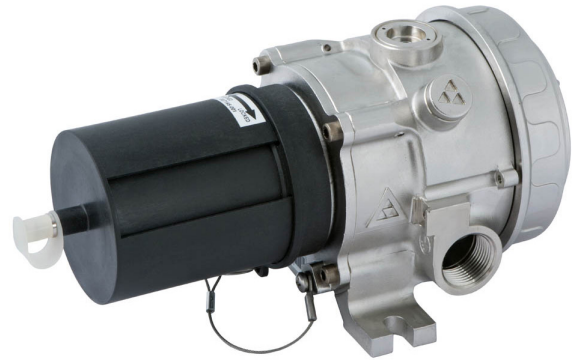
APPLICATION

NOTE

The normal outdoor level of CO_2 is approximately 370 ppm. Indoor levels are typically less than 1000 ppm, but can be higher depending on the efficiency of the ventilation system. Keep this in mind when varied CO_2 levels are detected within a building.

The PointWatch Eclipse® Model PIRECL CO_2 Detector is a diffusion-based, point-type infrared gas detector that provides continuous monitoring of Carbon Dioxide (CO_2) gas concentrations in the range of 0-2%/volume (0-20000 ppm).

Two basic configurations are available:
*   4-20 mA output with HART communication protocol and RS-485 MODBUS communications.

*   4-20 mA output with HART communication protocol and RS-485 MODBUS communications, with two alarm relays and one fault relay.

All units are powered from 24 Vdc, and are furnished with an onboard "status indication" LED, an internal magnetic calibration switch and an external calibration line for use with the optional PIRTB remote calibration termination box.

The Eclipse CO_2 detector is ideal for use in harsh outdoor environments and is certified for use in Class I, Division 1 (CSA), and Zone 1 (ATEX/IECEx) hazardous areas. It can be used as a stand-alone detector, or as part of a larger facility protection system.

OPERATION OVERVIEW

THEORY OF OPERATION

Carbon dioxide gas is diffused through the weather baffle assembly into the internal measurement chamber, which is illuminated by an infrared (IR) source. As the IR passes through the gas within the chamber, 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 carbon dioxide gas. A pair of optical detectors and associated electronics 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). See Figure 1. The microprocessor computes the gas concentration and converts the value into a 4 to 20 milliampere current output or digital process variable signal, which is then communicated to external control and annunciation systems.
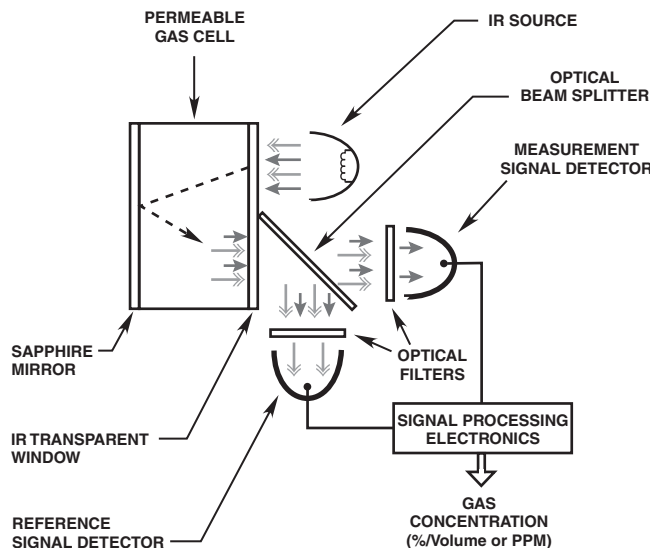
Figure 1—Measurement Scheme for Infrared Gas Detector

DETECTABLE GASES

The model PIRECL detector is capable of detecting CO_2 (Carbon Dioxide).

OUTPUTS

Standard

The standard version provides an isolated/non-isolated 4-20 mA current loop for connection to analog input devices.

Optional Relays

An optional relay output board providing two programmable alarm relay outputs and one fault relay output can be factory installed with the standard version. All relays are sealed and provide form C (NO/NC) contacts. The high and low alarm relay settings are programmable and can be set for latching or non-latching operation. The low alarm cannot be set above the high alarm threshold. Alarm configuration can be done with the HART or MODBUS interface.

The onboard tri-color LED indicates a LOW alarm condition via a flashing red color, and a HIGH alarm condition via a steady red color. The Eclipse internal magnetic switch or HART Field Communicator can be used to reset latched alarms. A short-duration magnetic switch activation of 1 second will reset latched alarms. Holding the magnetic switch closed for 2 seconds will start the calibration sequence. The external calibration line will not reset latched alarm relays.

When the optional relay output board is specified, the PIRECL's approval rating is Ex d only.

NOTE
Refer to "Alarm Relays" in the Specifications section of this manual for important information regarding alarm relays.

DATA LOGGING CAPABILITY

Non-volatile memory is provided to save the 10 most recent calibrations, alarm/fault events, and minimum/maximum operating temperature history. An hour meter (running operational hours since startup) is provided to record operating service time and to give an indication of the relative time between events. This information is accessible using HART or MODBUS communication.

OPTIONAL THIRD PARTY ADDRESSABLE MODULES

The PIRECL is electrically compatible with third party addressable modules, provided the module fits within the PIRECL wiring compartment. Whenever a third party addressable module is installed, the PIRECL's Ex e rating is void, and only the Ex d rating is valid. Installation of a third party addressable module requires a specially labeled PIRECL model to ensure valid product approvals.

SPECIFICATIONS

INPUT VOLTAGE (All Models)—
24 Vdc nominal. Operating range is 18 to 32 Vdc.
Ripple cannot exceed 0.5 volts Peak-to-Peak.

POWER CONSUMPTION (All Models)—
Detector without Relays
4.0 watts nominal @ 24 Vdc
7.5 watts peak @ 24 Vdc
10.0 watts peak @ 32 Vdc.

Detector with Relays
5.5 watts nominal @ 24 Vdc
8.0 watts peak @ 24 Vdc
10.0 watts peak @ 32 Vdc.

TEMPERATURE RANGE—
Operating: See CSA, ATEX/CE, and IECEx Appendices.
Storage: –55°C to +85°C (–67°F to +185°F).

HUMIDITY—
0 to 99% relative humidity (Det-Tronics verified).

GAS DETECTION RANGE—
0-2%/vol factory default

DETECTABLE GAS—
Carbon Dioxide (CO_2)

DETECTOR CONFIGURATION OPTIONS—
A significant number of PIRECL configuration parameters are field programmable including measurement range, alarm setpoints, tag number, special notations, password protection, etc. Details are provided in the HART Communication Appendix. Two PIRECL field configuration programming methods are supported:

–   HART Communication
–   RS-485 MODBUS Communication

THIRD PARTY ADDRESSABLE MODULE (Optional)—
Input Voltage: 30 Vdc.
Input Current: 30 mA.

WARM-UP TIME (All Models)—
Device enters normal mode after two minutes upon cold power-up. One hour warm-up time is recommended for optimum performance. Signal output level during warm-up is programmable.

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

VISUAL STATUS INDICATOR (All Models)—
Tri-color LED:
Red =   Low alarm, high alarm, or calibration.
              See Table 1 for Details.
Green =   Power on / OK
Yellow =   Fault or warm-up.

RELAY OUTPUTS (Optional)—
Available on Ex d approved models only.

ALARM RELAYS—
Low and High
Form C Type (NO/NC).
De-Energized during Normal mode, Energized on Alarm.
Contact Rating: 5 amperes at 30 Vdc.
Programmable for Latching or Non-Latching Operation.
Setpoint Range (both): 10-60% of range.
Factory Default Settings:
Low: 40% of range – Non-latching
High: 60% of range – Non-latching
Alarm relay programming can be accomplished using HART or MODBUS.

CAUTION
*The PIRECL CO_2 Gas Detector should be used in conjunction with an appropriate certified Control Unit and configured for a non-latching high alarm. The control unit must **always** latch and require a deliberate manual action to clear a high gas alarm. When used as a stand alone device, the high alarm must always be programmed for latching operation.*

FAULT RELAY—
Form C Type (NO/NC). Energized during Normal mode, De-Energized on Fault or loss of power.
Contact Rating: 5 amperes at 30 Vdc.
Non-Latching Operation only — not programmable.

DIGITAL OUTPUT (Optional)—
Modbus digital communication.

CALIBRATION—
All units are factory set and calibrated to carbon dioxide.

Routine calibration of the Eclipse CO_2 detector after completion of initial commissioning is supported, but not absolutely required. Generally, an annual gas bump test or full calibration will ensure proper sensitivity and response.

NOTE
Frequent visual inspections of the detector are recommended to confirm that there are no external impediments to proper detection capability.

Four methods of initiating Calibration are supported:
– On-Board magnetic reed switch
– HART communication
– Remote calibration line for remote switch
– MODBUS communication

RESPONSE TIME (Det-Tronics Verified)—
T50 = 6 seconds.

VIBRATION—
PIRECL successfully passes Sinusoidal Vibration Testing in accordance with MIL-STD-810C, Method 514.2, Paragraph 4.5.1.3, Figure 514.2-7 Curve AW, and C22.2 No. 152-M1984, and also DET NORSKE VERITAS Certification Notes – No. 2.4 dated May 1995.

ACCURACY (Det-Tronics Verified)—
0-20000 ppm or 0-2%/vol:
±10% Full Scale @ 25°C.

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

INGRESS PROTECTION—
IP66/IP67 (DEMKO Verified).

DETECTOR HOUSING MATERIAL—
316 stainless steel (CF8M).

SURFACE PREPARATION—
Electropolish.

CONDUIT ENTRY OPTIONS—
Two entries, 3/4 inch NPT or M25.

HART COMMUNICATION PORT (Optional)—
Intrinsically Safe (I.S.). For live maintenance, follow Control Drawing 011975-001 in Appendix H.

OPTICS PROTECTION—
The three-layer weather baffle assembly is UV-resistant, static-dissipating black Polythalimide plastic. The standard weather baffle version, recommended for most outdoor and indoor applications, includes an internal hydrophobic filter. The standard weather baffle includes a 3/16" (4.8mm) barb fitting for attaching a 3/16" I.D. hose during calibration.

Heated optics minimize condensation to ensure reliable operation through temperature extremes.

WIRING TERMINALS—
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).

ELECTRICAL SAFETY CLASSIFICATION—
Installation Category (Overvoltage Category) II & Pollution Degree 2 per ANSI/ISA-S82.02.01, EN 61010-1 & IEC 61010-1.

CERTIFICATION—

For complete approval details, refer to the appropriate Appendix:

Appendix A - CSA
Appendix B - ATEX/CE
Appendix C - IECEx
Appendix D - INMETRO

DIMENSIONS—
See Figure 2.

SHIPPING WEIGHT (Approximate)—
11.5 pounds (5.2 kg).

WARRANTY—
Five year limited warranty from date of manufacture. See Appendix G for details.
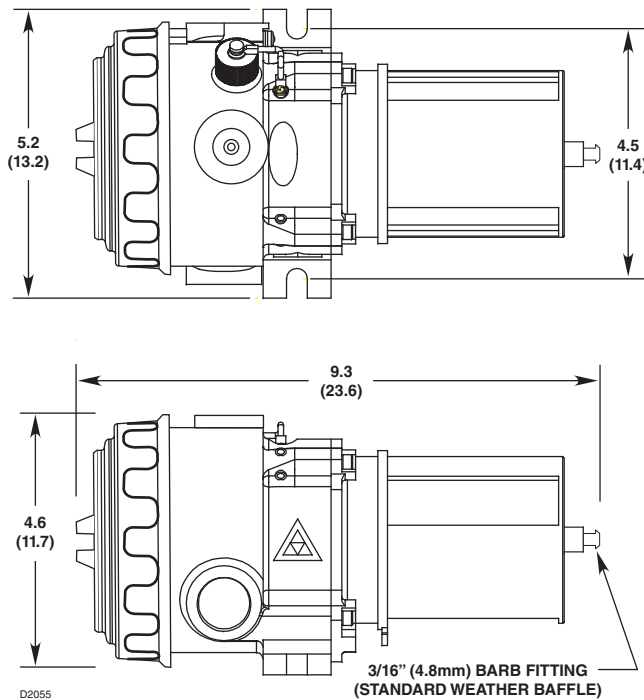
Figure 2—Dimensions of Eclipse Detector in Inches (Centimeters)

IMPORTANT SAFETY NOTES

CAUTION
The wiring procedures in this manual are intended to ensure proper functioning of the device under normal conditions. However, because of the many variations in wiring codes and regulations, total compliance to these ordinances cannot be guaranteed. Be certain that all wiring complies with 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 detector contains no user serviceable 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 detector 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 device is used in a manner not conforming to its intended use.

CAUTION
Observe precautions for handling electrostatic sensitive devices.

NOTE
The PointWatch Eclipse CO_2 model is intended for detection of carbon dioxide only. The device will not detect hydrogen or hydrocarbon gases.

INSTALLATION

Before installing the PointWatch Eclipse detector, define the following application details:

WIRING

The detector must be installed per local installation practices. For IEC/ATEX hazardous areas, it may be acceptable to utilize Ex e wiring practices with the PIRECL (non-relay versions).

IDENTIFICATION OF DETECTOR MOUNTING LOCATIONS

Identification of the most likely leak sources and leak accumulation areas is typically the first step in identifying the best detector mounting locations. In addition, identification of air current / wind patterns within the protected area is useful in predicting gas leak dispersion behavior. This information should be used to identify optimum sensor installation points.

Because CO_2 is heavier than air, the sensor should be placed close to the floor for optimal detection. Note that air currents may cause CO_2 gases to rise under some conditions. Heated gases may also exhibit the same phenomenon.

The most effective number and placement of detectors varies depending on the conditions at the job site. The individual designing the installation must often rely on experience and common sense to determine the detector quantity and best locations to adequately protect the area. Note that it is typically advantageous to locate detectors where they are accessible for maintenance, and also where the Eclipse status indication LED can easily be seen. Locations near excessive heat / vibration sources should be avoided if possible.

Final suitability of possible gas detector locations should be verified by a job site survey. Gas detector area of coverage is a subjective evaluation, and may require long-term empirical data to confirm effectiveness. A typical rule of thumb is that one detector can cover a 900 square foot area.

However, this rule of thumb is subject to change depending upon specific application properties and requirements.

NOTE
For additional information on determining the quantity and placement of gas detectors in a specific application, refer to the IEC 60079-29-2 standard.

PHYSICAL INSTALLATION REQUIREMENTS

The detector is provided with built-in mounting feet that will accept 3/8 inch (M8) diameter mounting bolts. Always ensure that the mounting surface is vibration-free and can suitably support the total weight of the detector without assistance from electrical cabling or conduit system.

The detector must be installed per local installation practices. For IEC/ATEX hazardous areas, it may be acceptable to utilize Ex e wiring practices with the Eclipse.

Device Mounting Orientation

It is highly recommended that the Eclipse be installed in the horizontal position. The detector is not position-sensitive in terms of its ability to detect gas. However, the weather baffle assembly provides superior performance when the Eclipse is installed with the baffle in a horizontal position.

LED Visibility

Select a mounting orientation where the PIRECL status indication LED is visible to personnel within the area.
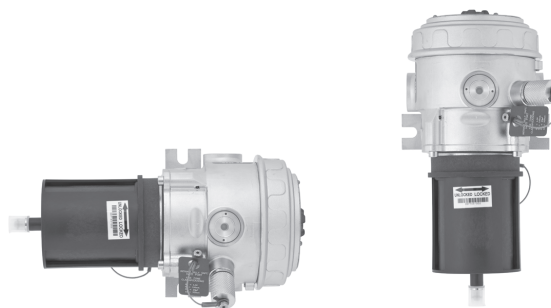
CORRECT   **INCORRECT**

Recommended Orientation of Eclipse Detector

Calibration Gas Port Cover

A protective cover for the calibration gas injection port is provided to ensure that contaminants are not accidently introduced into the Eclipse optics. Ensure that this cover is properly installed over the port when calibration is not being performed.

NOTE
Failure to install the calibration gas port cover or the use of a damaged cover may result in nuisance faults and require cleaning the detector optics.

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 output 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 required. 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 Eclipse 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 Eclipse.

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

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

The maximum distance between the Eclipse 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.

$$\text{Maximum Power Loop Voltage Drop} = \boxed{\begin{array}{c} \text{Power Supply Voltage} \\ \text{Minus} \\ \text{Minimum Operating Voltage} \end{array}}$$

To determine the actual maximum wire length:

1. Divide the maximum allowable voltage drop by the maximum current draw of the Eclipse (0.31 A),

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

3. Divide by 2.

$$\text{Maximum Wire Length} = \boxed{\begin{array}{c} \text{Maximum Voltage Drop} \\ \div \\ \text{Maximum Current} \\ \div \\ \text{Wire Resistance in Ohms/Foot} \\ \div \\ 2 \end{array}}$$

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

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

$$24 - 18 = 6 \text{ Vdc}$$

Maximum Voltage Drop = 6
Maximum Current = 0.31 A
Wire Resistance in Ohms/Foot = 0.006523

$$6 \div 0.31 \div 0.006523 \div 2 = 1484 \text{ feet}$$

NOTE
For CSA/ATEXIECEx Certified systems using HART communication, the maximum wiring distance is 2000 feet.

FACTORY INSTALLED WIRING
TO RELAY BOARD
(DO NOT REMOVE)

CAPTIVE SCREWS (3)

RELAY TERMINAL BLOCK

A2133
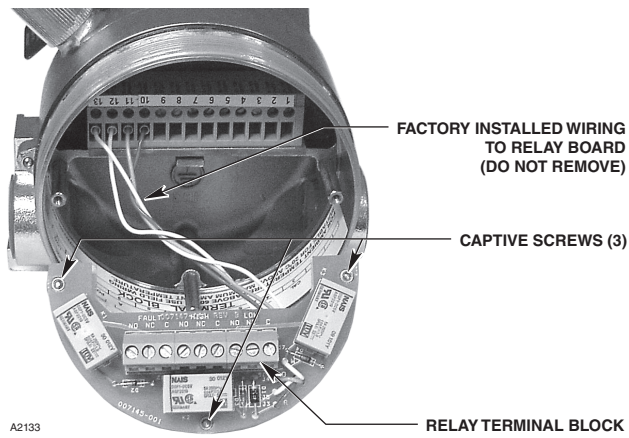
Figure 3—Eclipse Wiring Termination Compartment
with Optional Relay Board Removed

OPTIONAL RELAYS

Optional relay contacts are "dry", meaning that the installer must provide the voltage to the common terminal of the relay output.

AC voltage should not be switched directly using the Eclipse relays. The use of an external relay is required if AC voltage must be switched by the Eclipse relays.

In order to change alarm relay settings from the factory default settings, it is recommended to utilize a HART Field Communicator. Contact the factory for further assistance.

NOTE
Refer to "Alarm Relays" in the Specifications section of this manual for important information regarding alarm relays.

The relay board must temporarily be removed from the Eclipse termination compartment to connect the relay output field wiring cables. After the relay wiring is connected, re-install the relay board using the three captive screws. Refer to Figure 3.

WIRING PROCEDURE

Ensure that all cables are terminated properly. PointWatch Eclipse screw terminal torque range is 3.5–4.4 in.-lbs. (0.4–0.5 N·m).

Conductor insulation should be stripped off with a bare conductor length of 0.2 inch (5 mm) minimum and 0.7 inch (18 mm) maximum.

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 4 shows the wiring terminal strip located inside the detector's integral junction box.

Figure 5 shows the wiring terminal configuration for the Eclipse CO_2 without relays.

Figure 6 shows the wiring terminal configuration for the Eclipse CO_2 with relays.

Figures 7 through 10 show the 4-20 mA output of the Eclipse detector in various wiring schemes.

Figure 11 shows the Eclipse wired for benchtop testing/ programming using HART protocol.

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

REMOTE CALIBRATION WIRING

If it is desired to initiate calibration using the remote calibrate line, the use of the Det-Tronics Model PIRTB Termination Box is highly recommended for optimum ease of installation and calibration. The PIRTB module includes a magnetic reed switch, indicating LED, and wiring terminal block. Refer to "Remote Calibration Option" in the "Description" section of this manual for details.

Figure 12 shows the location of the wiring terminals, reed switch and LED inside the calibration termination box. See Figure 13 for wiring details.

WARNING
Do not attempt to physically connect or touch the calibration lead wire to DCV common in the field to begin calibration. This practice is often less than precise, and may result in a spark or other undesirable results. For optimum ease of installation and calibration, always utilize a Det-Tronics junction box with magnetic reed-switch, indicating LED, and termination block (Model PIRTB).
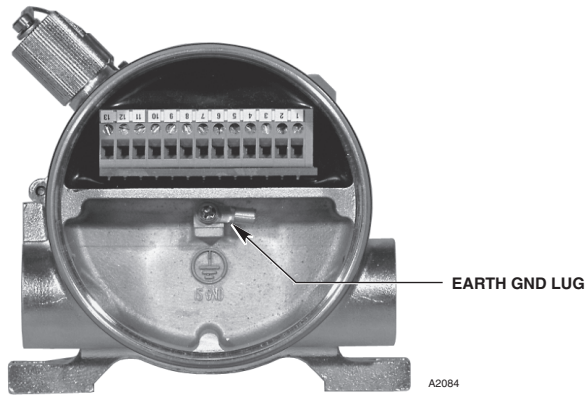
Figure 4—Terminal Strip Located Inside Wiring Compartment

EARTH GND LUG

A2084

24 VDC –	1
24 VDC +	2
CALIBRATE	3
24 VDC –	4
24 VDC +	5
+ 4-20 MA	6
– 4-20 MA	7
RS-485 B	8
RS-485 A	9
RELAY POWER (RED)	10
FAULT (ORANGE)	11
LOW ALARM (WHITE)	12
HIGH ALARM (YELLOW)	13

WIRING TO OPTIONAL
RELAY BOARD
NO USER CONNECTION

24 VDC –	1
24 VDC +	2
CALIBRATE	3
24 VDC –	4
24 VDC +	5
+ 4-20 MA	6
– 4-20 MA	7
RS-485 B	8
RS-485 A	9
RELAY POWER	10
FAULT	11
LOW ALARM	12
HIGH ALARM	13

NO USER CONNECTION

A2054
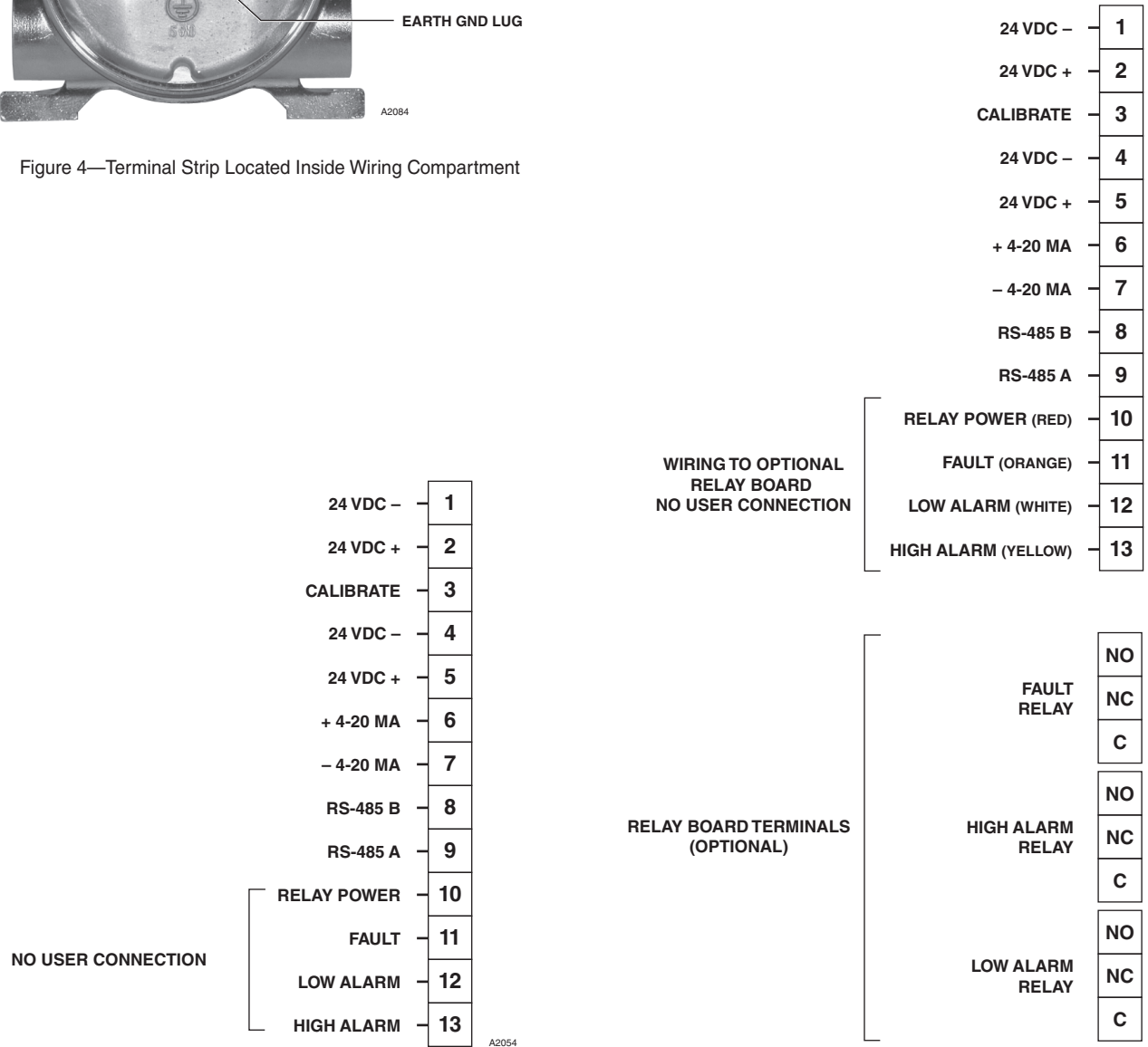
Figure 5—Wiring Terminal Identification
for Eclipse without Relays

RELAY BOARD TERMINALS
(OPTIONAL)

FAULT RELAY	NO
	NC
	C
HIGH ALARM RELAY	NO
	NC
	C
LOW ALARM RELAY	NO
	NC
	C

B2054

Figure 6—Wiring Terminal Identification
for Eclipse with Relays
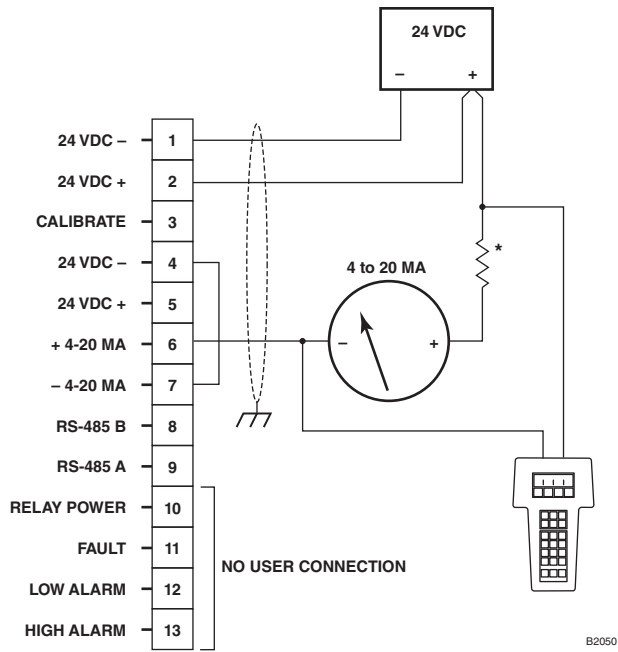
24 VDC
−   +

24 VDC − 1
24 VDC + 2
CALIBRATE 3
24 VDC − 4
24 VDC + 5
+ 4-20 MA 6
− 4-20 MA 7
RS-485 B 8
RS-485 A 9
RELAY POWER 10
FAULT 11
LOW ALARM 12
HIGH ALARM 13

4 to 20 MA
−   +

*

NO USER CONNECTION

B2050

*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.
 DO NOT INSTALL RESISTOR WITHIN PIRECL ENCLOSURE IN EEx e APPLICATIONS.

Figure 7—Eclipse Detector Wired for Non-Isolated
4-20 mA Current Output (Sinking)
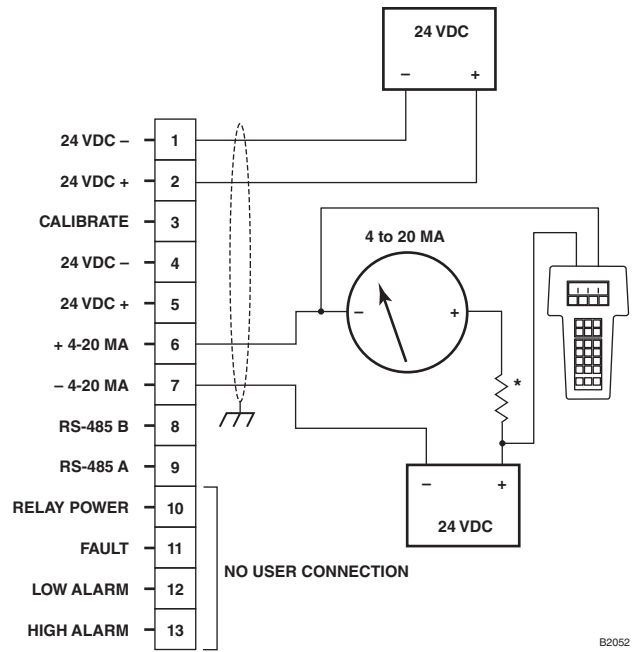
24 VDC
−   +

24 VDC − 1
24 VDC + 2
CALIBRATE 3
24 VDC − 4
24 VDC + 5
+ 4-20 MA 6
− 4-20 MA 7
RS-485 B 8
RS-485 A 9
RELAY POWER 10
FAULT 11
LOW ALARM 12
HIGH ALARM 13

4 to 20 MA
−   +

*

−   +
24 VDC

NO USER CONNECTION

B2052

*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.
 DO NOT INSTALL RESISTOR WITHIN PIRECL ENCLOSURE IN EEx e APPLICATIONS.

Figure 9—Eclipse Detector Wired for Isolated
4-20 mA Current Output (Sinking)
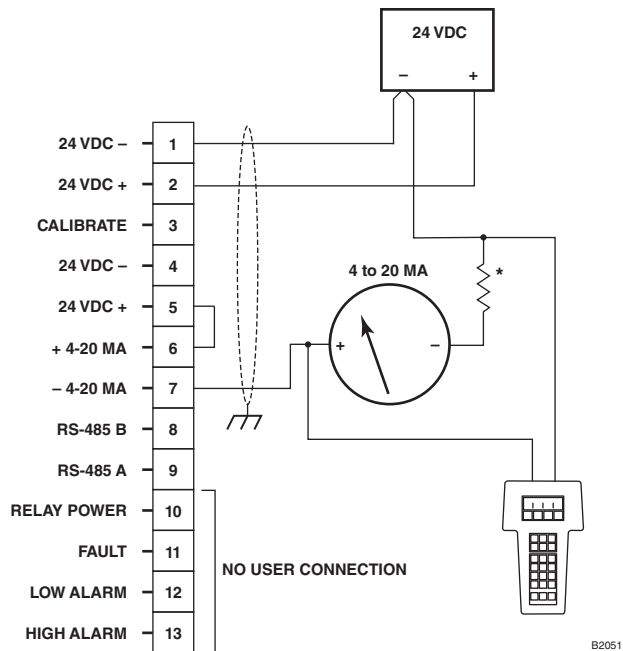
24 VDC
−   +

24 VDC − 1
24 VDC + 2
CALIBRATE 3
24 VDC − 4
24 VDC + 5
+ 4-20 MA 6
− 4-20 MA 7
RS-485 B 8
RS-485 A 9
RELAY POWER 10
FAULT 11
LOW ALARM 12
HIGH ALARM 13

4 to 20 MA
+   −

*

NO USER CONNECTION

B2051

*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.
 DO NOT INSTALL RESISTOR WITHIN PIRECL ENCLOSURE IN EEx e APPLICATIONS.

Figure 8—Eclipse Detector Wired for Non-Isolated
4-20 mA Current Output (Sourcing)
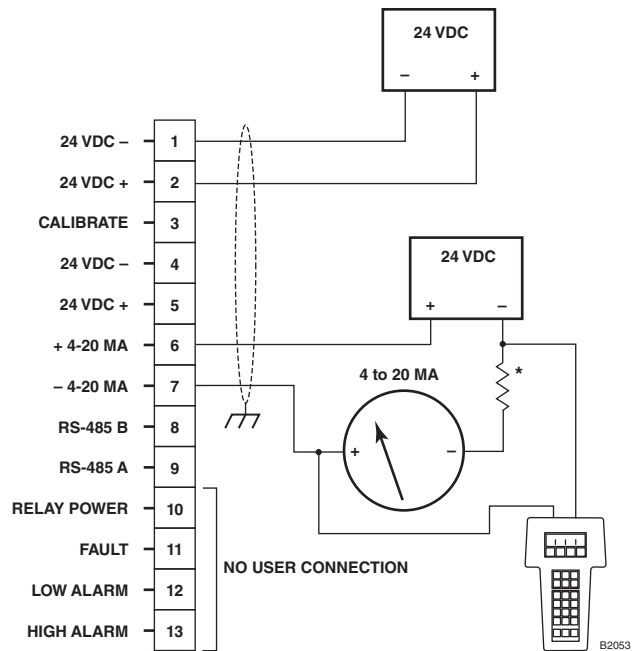
24 VDC
−   +

24 VDC − 1
24 VDC + 2
CALIBRATE 3
24 VDC − 4
24 VDC + 5
+ 4-20 MA 6
− 4-20 MA 7
RS-485 B 8
RS-485 A 9
RELAY POWER 10
FAULT 11
LOW ALARM 12
HIGH ALARM 13

24 VDC
+   −

4 to 20 MA
+   −

*

NO USER CONNECTION

B2053

*TOTAL LOOP RESISTANCE = 250 OHMS MINIMUM, 600 OHMS MAXIMUM.
 DO NOT INSTALL RESISTOR WITHIN PIRECL ENCLOSURE IN EEx e APPLICATIONS.

Figure 10—Eclipse Detector Wired for Isolated
4-20 mA Current Output (Sourcing)

24 VDC –	**1**
24 VDC +	**2**
CALIBRATE	**3**
24 VDC –	**4**
24 VDC +	**5**
+ 4-20 MA	**6**
– 4-20 MA	**7**
RS-485 B	**8**
RS-485 A	**9**
RELAY POWER	**10**
FAULT	**11**
LOW ALARM	**12**
HIGH ALARM	**13**

24 VDC

250 TO 500 OHMS

NO USER CONNECTION

A2203
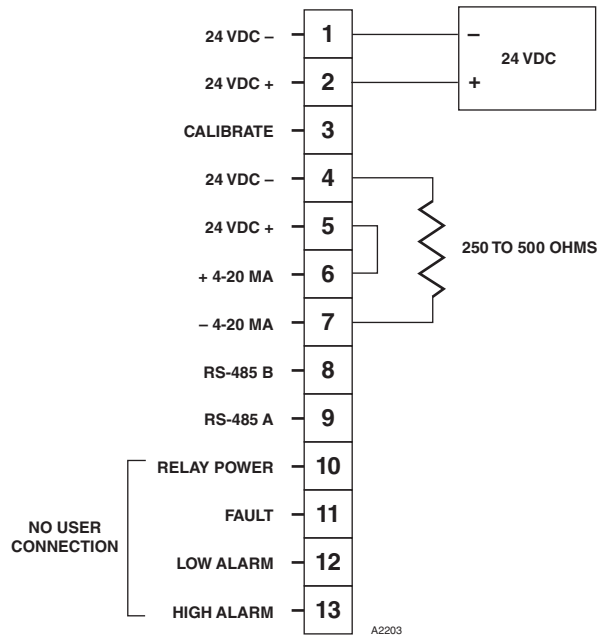
Figure 11—Wiring the Eclipse Detector for Benchtop Testing/ Programming Using HART Protocol

CALIBRATE SWITCH

HOLD CALIBRATION MAGNET AT OUTSIDE BASE OF JUNCTION BOX AT THIS LOCATION TO ACTIVATE CALIBRATION SWITCH

REMOTE LED

B2056
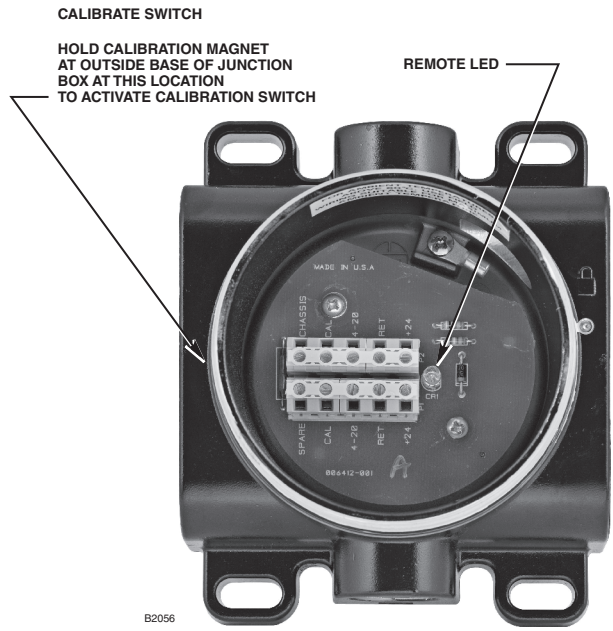
Figure 12—Remote Calibration Switch and LED in Optional Det-Tronics PIRTB Termination Box

24 VDC –	**1**
24 VDC +	**2**
CALIBRATE	**3**
24 VDC –	**4**
24 VDC +	**5**
+ 4-20 MA	**6**
– 4-20 MA	**7**
RS-485 B	**8**
RS-485 A	**9**
RELAY POWER	**10**
FAULT	**11**
LOW ALARM	**12**
HIGH ALARM	**13**

24 VDC

MAGNETIC REED SWITCH FOR REMOTE CALIBRATION

SPARE		
CAL		CAL
SIGNAL		SIGNAL
24 VDC –		24 VDC –
24 VDC +		24 VDC +

SPARE

TYPICALLY NO CONNECTION

NO USER CONNECTION FACTORY WIRING ONLY

A2057
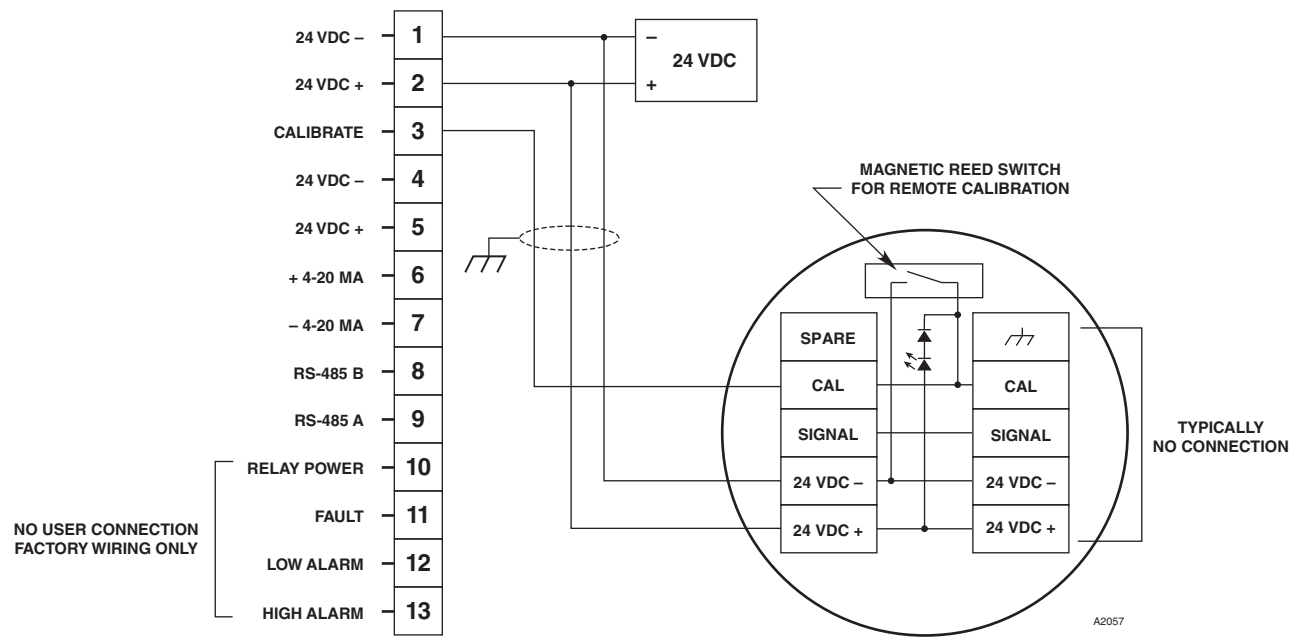
NOTE: IF REQUIRED, POWER AND 4 TO 20 MA SIGNAL OUTPUT MAY BE ROUTED THROUGH REMOTE CALIBRATION MODULE USING SHIELDED CABLING.

Figure 13—PIRTB Wired to PointWatch Eclipse

DESCRIPTION

INTERNAL MAGNETIC SWITCH

An internal magnetic switch is provided for resetting latched alarms and initiating calibration. See Figure 14 for switch location. Momentary switch activation will reset alarms, while holding the switch closed for 2 seconds or longer will start the calibration sequence. The switch can also be used to enter "live" calibration mode or terminate the calibration sequence (see "Calibration" section).

HART COMMUNICATION

An optional intrinsically safe HART communication port provides a non-intrusive means for connecting the HART Communicator to the Eclipse. Refer to Figure 15.

Alternatively, the HART communicator can be connected across a 250 ohm resistor in the 4-20 mA loop.

NOTE
A 250 ohm resistor must be present within the 4-20 mA loop for HART communication to work. In many cases, this resistor is already present in the control panel. For a bench test or a situation where the 4-20 mA loop is not active, this resistor must still be installed for HART communication to function properly (see Figure 11).

If a PIRTB Remote Calibration Termination Box is utilized, the HART Communicator can be connected at the PIRTB. Note that this connection requires removal of the PIRTB cover.

Connect the HART Communicator, then turn it on by pressing the ON/OFF key. The communicator will indicate when the connection is made. If the connection is not made, the communicator will indicate that no device was found. Refer to the HART Appendix in this manual for complete information.

WARNING
For Division applications, do not open cover when explosive gas atmosphere may be present.

Refer to Appendix E in this manual for complete information regarding HART communication with Eclipse.

Figure 15—Eclipse Models with Optional I.S. HART Port

Figure 14—PointWatch Eclipse

Table 1—LED Status Indication

LED	Device Status
Green	Normal operation.
Red	Blinking indicates Low Alarm. On steady indicates High Alarm.
Yellow	Fault condition or warmup.

TRI-COLOR LED

An onboard tri-color LED is provided for indicating faults, alarms, and calibration status. See Table 1. LED operation for fault status is non-latching. LED operation for alarms is configurable for latching/non-latching.

WEATHER BAFFLE ASSEMBLY

The black weather baffle is provided to prevent debris and water from entering the optics, while allowing gas to enter readily. An O-ring is provided on the main Eclipse body to ensure a proper seal with the weather baffle.

The weather baffle version with hydrophobic filter is for most outdoor and indoor applications, especially wet and/or dirty applications. When compared to the weather baffle version without the hydrophobic filter, it provides optimum protection against airborne water and dirt, with minimal reduction in speed of gas alarm response.

The weather baffle assembly is not field-serviceable, but is easily replaceable. To remove the plastic weather baffle from the Eclipse body, rotate it one quarter turn counter-clockwise and pull.

The weather baffle is furnished with a calibration gas nozzle for direct injection of gas to the sensor, allowing the operator to apply gas to the detector without going through the weather baffle.

NOTE
Always cover the calibration gas nozzle with the cap during normal operation, and ensure that the cap is not damaged.

CLOCK

An hour meter is provided to give a relative indication of time for historical logs. The meter is zeroed at the time of manufacture and only increments while power is applied. HART or MODBUS communication is required to view the running hours.

HISTORY LOGS

All history logs are saved in non-volatile memory and retained through power cycles. HART or MODBUS communication is required to view the history logs.

Event Log (Alarms and Faults)

An event log saves the ten most recent alarms and a selected group of faults with an hour meter time stamp. HART or MODBUS communication is required to view the log. Types of logged events include:

• Low Alarms

• High Alarms

• Optics Fault

• Warm-up

• Calibration Fault

Calibration Log

A log of the ten most recent calibrations with time stamp is saved. HART or MODBUS communication is required to view the log. Types of calibration records include:

• Zero Only Calibration

• Complete Calibration

• Failed Calibration

Min/Max Temperature History

Ambient minimum and maximum exposed temperature measurements are stored in non-volatile memory, and are accessible via HART or MODBUS communication. The measurements are time tagged with respect to total hours of powered operation. The temperature log may be reset, in which case all min/max exposed temperature logs are cleared.

REMOTE CALIBRATION OPTION

In most applications, it is recommended to install the PointWatch Eclipse CO_2 model where it will contact the gas of interest as quickly as possible. Unfortunately, the best location for early warning can often result in accessibility problems for the operator when calibration is required. In these applications, the Model PIRTB Termination Box is highly recommended to provide the ability to calibrate the detector from a remote location.

The PIRTB consists of a termination/circuit board, housed within an explosion-proof junction box. The circuit board contains a magnetic reed switch for initiating calibration, an indicating LED to signal the operator when to apply and remove the calibration gas, and a wiring terminal block. A version of the junction box is furnished with a small viewing window that enables calibration to be performed without hazardous area de-classification. The PIRTB may be installed up to 100 feet away from the Eclipse. Refer to Figure 16 for remote calibration configuration options.

NOTE
The remote calibration switch is intended for initiating calibration only. Resetting latching alarm outputs using the remote calibration switch cannot be accomplished without entering the Calibration mode.

The following recommendations are provided to enhance operator ease and convenience of remote calibration configurations:

1. Install the Eclipse in such a manner that the onboard LED is visible whenever possible. This will aid in checking device status "at a glance."

2. The Eclipse is provided with a calibration gas nozzle on the weather baffle, which allows the use of permanently attached calibration gas delivery tubing (either polyethylene or stainless steel). The tubing is typically routed in parallel with the remote calibration cabling to the same location as the PIRTB termination box. This arrangement enables a technician to initiate calibration and deliver the calibration gas to the Eclipse from a single location.

3. When permanently installed calibration gas tubing is utilized, always install a shut-off valve at the open end to prevent unwanted gas or debris from entering the tubing.

4. Always purge the permanent tubing with pure nitrogen prior to and immediately after calibration to ensure that residual carbon dioxide gases are cleared. Always close the shutoff valve after post-calibration purging is complete. This will ensure that all the carbon dioxide gas is eliminated from the Eclipse optics.

5. Note that permanently installed calibration gas tubing will increase the calibration gas consumption rate as a function of total tubing length.

Other methods of remote Eclipse calibration include utilizing HART or MODBUS communications. Refer to the HART and MODBUS appendices for details.

Figure 16—Remote Calibration Configuration Options
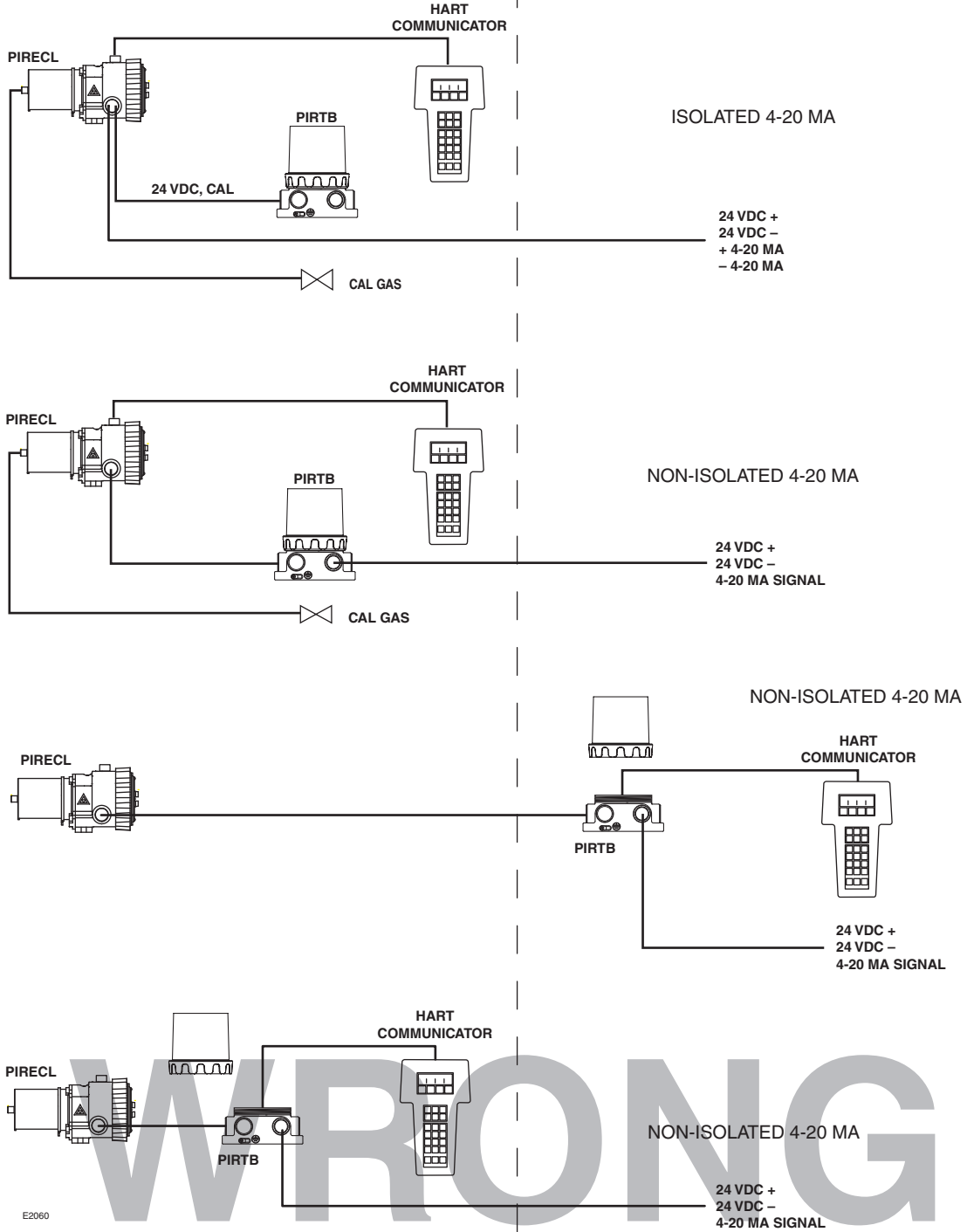
NOTE: THE TOTAL WIRING DISTANCE FROM THE HART COMMUNICATOR THROUGH THE POINTWATCH ECLIPSE TO THE SIGNAL RECEIVER MUST NOT EXCEED 2000 FEET (610 METERS).

OPERATION

FACTORY DEFAULT SETTINGS

The PointWatch Eclipse CO_2 model is shipped from the factory pre-calibrated and set for carbon dioxide at 0-2%/vol (0-20000 ppm).

OPERATING MODES

The Eclipse has three operating modes: warm-up, normal, 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 (2) 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.

Calibrate

Calibration of the Eclipse is normally not required; however, the user has the option to verify proper calibration or to perform calibration procedures if necessary. Guidelines for when to perform a calibration or a response test are listed in Table 2. The user has the choice of three methods to place the device into the Calibrate mode. Refer to the "Calibration" section in this manual for details.

Table 2—Calibration or Response Test

Function	Calibration	Response Test
Startup		X
Replace any part	X	
Constant zero offset	X	
Periodic Functional Testing (at least once a year)		X

4-20 mA CURRENT LOOP OUTPUT

Eclipse 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 setting for full-scale 2%/vol output is 20 mA. HART and MODBUS interfaces also have the ability to calibrate the 4 mA and 20 mA levels.

When the default setting is selected, the CO_2 % Volume for a given current reading can be calculated using the formula:

$$\% CO_2 = (X - 4) \times 0.125 \qquad X = \text{Current reading in milliamperes}$$

Example: Device reads 12 mA.
$\% CO_2 = (12 - 4) \times 0.125 = 1\%/vol$

Normally, the current loop output is proportional to the selected standard gas type only.

FAULT INDICATION

There are three modes of signaling faults using the 4-20 mA analog signal output:

* Eclipse (Factory default setting)
* User Defined
* PIR9400

Fault signaling mode can be selected using the HART or MODBUS interface. Table 3 shows the current levels for each fault mode.

Eclipse Fault Mode

Eclipse mode follows conventional fault signaling practice. The current loop output indicates the presence of a fault, but does not attempt to identify a specific fault with a specific current output value. Identification of a specific fault type is done through the HART Communicator or MODBUS.

User Defined Fault Mode

This mode is intended for users who wish to program unique current levels for faults and calibration signals. User defined current levels can be set from 0.0 to 24.0 mA. and can be programmed from HART or MODBUS interfaces. Four unique current levels are available: warm-up, general fault, calibration, and blocked optics.

PIR9400 Fault Mode

PIR9400 mode is provided for compatibility with existing Det-Tronics PointWatch gas detectors. When using the Eclipse CO_2 detector, this mode is **not recommended** because HART communication will be lost when the milliamp signal goes below 1 mA.

Table 3—Output Levels of 4-20 mA Current Loop and Corresponding Status Indications

Condition	Eclipse Fault Mode	User Defined Fault Mode	PIR9400 Fault Mode (Not Recommended)
Gas Level (-10% to 120% Full scale)	2.4 to 20.5	2.4 to 20.5	2.4 to 20.5
Warm-up	1.00	Warm-up	0.00
Reference Sensor Saturated	1.00	General Fault	0.20
Active Sensor Saturated	1.00	General Fault	0.40
Calibration line active on power-up	1.00	General Fault	0.60
Low 24 volts	1.00	General Fault	0.80
Low 12 volts	1.00	General Fault	1.20
Low 5 volts	1.00	General Fault	1.20
Dirty Optics	2.00	Blocked Optics	1.00
Calibration Fault	1.00	General Fault	1.60
Calibration complete	1.00	Calibration	1.80
Span calibration, apply gas	1.00	Calibration	2.00
Zero calibration in progress	1.00	Calibration	2.20
Negative signal output fault	1.00	General Fault	2.40
Flash CRC	1.00	General Fault	1.20
Ram Error	1.00	General Fault	1.20
EEPROM Error	1.00	General Fault	1.20
IR Source Failure	1.00	General Fault	1.20

STARTUP

When the Eclipse 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 configuration settings, HART or MODBUS communication will be required. Refer to the appropriate Appendix for details.

NOTE
Ensure that controller alarm outputs are inhibited for a minimum of 10 seconds after system power-up to prevent unwanted output actuation.

NOTE
The safety function (gas input-to-actuation/notification) must always be verified upon completion of installation and/or modification.

PIRECL STARTUP/COMMISSIONING CHECKLISTS

Electrical Checklist

- All 24 Vdc power conductors are properly sized and are properly terminated.

- The 24 Vdc power supply provides sufficient load capacity for all gas detectors.

- Using a DC voltmeter, 24 Vdc has been measured at the detector.

- All signal output conductors are properly terminated, and the jumper wire is installed if a non-isolated signal output is desired.

- All relay contact output signal conductors are properly terminated if applicable.

- All screw terminals have been tightened and all wires pull-tested to confirm proper termination has been accomplished.

Mechanical Checklist

- PIRECL detector is mounted to a solid surface not prone to high vibration, shock, traumatic impact or other undesirable condition.

- PIRECL detector is installed in proper orientation (horizontal).

- PIRECL detector is installed to achieve weatherproof status, e.g. conduit seals or cable glands have been properly installed. If there is an unused conduit entry, this entry has been sealed with a weathertight plug.

- PIRECL detector threaded covers are tightened to engage all O-rings.

- The hex head set screw is tightened to secure the cover and prevent access to the wiring compartment without the use of a tool.

Gas Detection and Measurement Checklist

- Area(s) of coverage have been identified, and optimum detector locations for installation are documented.

- Detector installation location is suitable for intended purpose, e.g. no obvious impediments to contact with the gas of interest exist or are likely to exist.

- Proper calibration gas is available to perform proof of response test or calibration during commissioning.

- HART communicator or similar field communicator is available if field programming is expected or required.

- Calibration magnet is available to initiate quick calibration or reset.

CALIBRATION

CALIBRATION OVERVIEW

Although routine calibration of the PointWatch Eclipse is normally not required, the device supports non-intrusive field calibration capability. Two (2) calibration procedure options are provided:

1. **Normal Calibration** is a two-step process consisting of applying nitrogen and mid-scale (span) adjustment. Calibration gas must be applied by the operator to enable span adjustment. Prior to calibration initiation, purge the Eclipse optics with nitrogen to ensure that an accurate zero condition is present.

   For normal calibration, the recommended calibration gas concentration is 1%/vol (10,000 ppm).

2. **Zero Only Calibration** is a one-step process consisting of nitrogen (zero) condition adjustment only, which is performed automatically by the device. This procedure adjusts the zero 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. Purge the Eclipse optics with pure nitrogen prior to calibration initiation to ensure an accurate zero condition is present.

ADDITIONAL CALIBRATION NOTES

IMPORTANT
Always ensure that the correct gas type is used for calibration. (2.5 LPM flow rate is recommended.)

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

NOTE
Always ensure that the Eclipse is zero calibrated with nitrogen.

NOTE
Under very windy conditions, it may not be possible to successfully calibrate the Eclipse. This situation is easily corrected by using the Eclipse Calibration Bag (P/N 006672-002), available from Det-Tronics.

NOTE
Always place the protective cap back on the calibration nozzle after completion of span calibration.

CALIBRATION INITIATION

Eclipse calibration may be initiated by any of the following means:

- The onboard magnetic calibration switch

- The magnetic calibration switch in the remote termination box

- HART communication.

Calibration using Magnetic Switch

1. **Onboard Switch and LED**
   The PointWatch Eclipse provides an onboard magnetic calibration/reset switch for non-intrusive calibration capability. The magnetic switch is located on the device bulkhead. See Figure 14 for switch location. An onboard tri-color LED is also provided to signal the operator when to apply and remove calibration gas.

2. **Remote Switch and Indicating LED**
   A special Remote Termination Box (Model PIRTB) is available for initiating calibration from a remote location. The PIRTB provides an internal magnetic switch and indicating LED (LED is on/off only, not tri-color). A version of the junction box is furnished with a clear window on the cover, enabling non-intrusive calibration capability.

To initiate calibration, start by applying nitrogen, then actuate the magnetic switch for two seconds. Upon initiation, the Eclipse automatically performs the zero calibration adjustment, and then signals the operator when it is time to apply calibration gas. When the span adjustment is complete, the Eclipse returns to normal mode after the calibration gas has cleared. The indicating LED (either onboard LED or PIRTB LED, if used) provides visual signals to the operator regarding the proper time to apply and remove the calibration gas.

For Zero Only Calibration, start by applying nitrogen, then actuate the magnetic switch for two seconds. When the LED indicator flashes red (a signal to apply calibration gas), re-initiate the magnetic switch. This action instructs the Eclipse to utilize the previous span setting, and return to normal mode without requiring application of calibration gas.

Digital Communication Calibration

HART or MODBUS communication may be utilized to initiate Eclipse calibration. Refer to the appropriate Appendix for details.

DETAILED CALIBRATION PROCEDURE USING MAGNETIC SWITCH

Refer to Tables 4 and 5 for a quick summary of the standard calibration sequence.

1. Apply Nitrogen gas.

2. Apply magnet for 2 seconds minimum to initiate calibration.

   A. The onboard LED turns to steady red.

   B. The LED within the PIRTB (if used) turns on.

   C. The Eclipse current output decreases from 4 mA to 1 mA when the default Eclipse calibration routine is used.

3. When Zero Calibration is complete:

   A. The onboard LED changes from steady red to flashing red.

   B. The LED within the PIRTB (if used) begins flashing.

   C. The Eclipse current output does not change from the 1 mA level when the default Eclipse calibration routine is used.

   D. Remove Nitrogen gas.

   E. The operator should now apply 1%/vol of CO_2 calibration gas to the Eclipse if conducting Normal Calibration.

   F. If conducting Zero Only Calibration, the operator should re-apply the magnet to the switch. This will conclude the Zero Only calibration sequence.

4. When Span Calibration is complete:

   A. The onboard LED changes from flashing red to "off".

   B. The operator should now close the valve and remove the calibration gas from the Eclipse.

NOTE
It is normal for the Eclipse LED to go off or turn blank (no color displayed) until the calibration gas is cleared from the optics chamber. Remove the weather baffle if necessary to clear residual gas.

   C. The LED within the PIRTB (if used) changes to steady on.

   D. The Eclipse current output does not change from the 1 mA level when the default Eclipse calibration routine is used (see Table 3).

Table 4—Quick Reference Guide for Normal Calibration Procedure Using Magnetic Switch

Description	Indicating LED (PIRECL/PIRTB)	Current Output (default setting)	Operator Action
Normal-ready to calibrate	steady green/off	≥ 4.35 mA*	Purge with pure nitrogen if required
Initiate Calibration	steady red/on-steady	1 mA	Apply Nitrogen, apply Magnet for 2 seconds min.
Zero Calibration complete	flashing red/on-flashing	1 mA	Remove Nitrogen, and apply 1% v/v CO_2 Calibration Gas to device
Span Calibration in progress	flashing red/on-flashing	1 mA	Continue cal gas flow
Span Calibration complete	off/on-steady	1 mA	Remove Calibration Gas
Output Returns to Normal	steady green/off	≥ 4.35 mA*	Calibration Completed
Normal Operation	steady green/off	≥ 4.35 mA*	None

*Depending on the ambient CO_2 concentration.

Table 5—Quick Reference Guide for Zero Only Calibration Procedure Using Magnetic Switch

Description	Indicating LED (PIRECL/PIRTB)	Current Output (default setting)	Operator Action
Normal-ready to calibrate	steady green/off	≥ 4.35 mA*	Purge with pure nitrogen if required
Initiate Calibration	steady red/on-steady	1 mA	Apply Nitrogen, and apply Magnet for 2 seconds min.
Zero Calibration complete	flashing red/on-flashing	1 mA	Re-initiate magnetic switch to terminate calibration
Return to Normal Mode	steady green/off	≥ 4.35 mA*	Remove Nitrogen to complete Zero Calibration

*Depending on the ambient CO_2 concentration.

5. Return to Normal is complete when:

   A. The onboard LED changes from "off" to steady green.

   B. The LED within the PIRTB (if used) turns off.

   C. The Eclipse current output returns to greater than/ equal to 4.35 mA after the detected calibration gas level drops below 0.1%/vol of CO_2, or the calibration abort signal is provided.

TIME OUT

If calibration is not completed within 10 minutes, a calibration-failed fault is generated, and the unit returns to normal operation using the previous calibration values.

NOTE
Under normal conditions, span calibration is typically completed in 3 minutes or less.

CALIBRATION ABORT

Calibration can be aborted at any time after zero calibration is completed. This is done by activating the onboard or PIRTB magnetic switch, or by a command from the HART or MODBUS interface. If calibration is terminated, the new zero point is retained, and a zero calibration code is saved in the calibration history buffer. The unit will immediately return to normal operation.

DIFFUSION PATHS INTO MEASUREMENT CHAMBER

MIRROR

O-RING

IR SOURCE LAMP AND WINDOW

C2059

HYDROPHOBIC FILTER

Figure 17—PointWatch Eclipse with Baffle Removed

MAINTENANCE

ROUTINE INSPECTION

The PointWatch Eclipse detector should be inspected periodically to ensure that external obstructions such as plastic bags, mud, snow, or other materials do not block the weather baffle, thereby impairing the performance of the device. In addition, the weather baffle assembly should be removed and inspected to ensure that the diffusion paths into the measurement chamber are clear. See Figure 17.

WEATHER BAFFLE CLEANING

Remove the weather baffle assembly and clean with a soft brush and soap and water. Rinse and allow to dry.

Replace the weather baffle if damaged or if fouling of the baffle vents is evident.

NOTE
Solvents may damage the weather baffle assembly. If contamination is not removed using soap and water, then replacement of the baffle may be required.

OPTICS CLEANING

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

Thoroughly douse the mirror and window using a liberal amount of isopropyl alcohol to clear away contaminant particles. Repeat the alcohol flush to remove any remaining contaminants. Allow the assembly to air-dry in a dust-free location.

O-RING

Periodically the O-ring should be inspected for breaks, cracks and dryness. To test the ring, remove it from the enclosure and stretch it slightly. If cracks are visible, it should be replaced. If it feels dry, a thin coating of lubricant should be applied. See "Spare Parts" section for recommended lubricant. When re-installing the ring, be sure that it is properly seated in the groove.

PROTECTIVE CAPS AND COVERS

The calibration nozzle cap must always be installed, except while performing calibration. Also 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 4-20 mA output. Refer to Table 6 to identify the fault type using the 4-20 mA output. (The operator must know which fault signaling mode has been programmed.) Refer to Table 7 for assistance in correcting malfunctions with the PointWatch Eclipse Detector.

REPLACEMENT PARTS

The PointWatch Eclipse IR Carbon Dioxide Gas Detector is not designed to be repaired in the field. If a problem should develop, refer to the Troubleshooting section, 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.

DEVICE REPAIR AND RETURN

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

Pack the unit properly. Always use sufficient packing material. Where applicable, use an antistatic bag as protection from electrostatic discharge.

NOTE
Det-Tronics reserves the right to apply a service charge for repairing returned product damaged as a result of improper packaging.

Return all equipment transportation prepaid to the factory in Minneapolis.

NOTE
It is highly recommended that a complete spare be kept on hand for field replacement to ensure continuous protection.

Table 6—Using the 4-20 mA Output Level to Identify a Fault Condition

Condition	Eclipse Fault Mode	User Defined Fault Mode	PIR9400 Fault Mode
Gas Level (-10% to 120% Full scale)	2.4 to 20.5	2.4 to 20.5	2.4 to 20.5
Warm-up	1.00	Warm-up	0.00
Reference Sensor Saturated	1.00	General Fault	0.20
Active Sensor Saturated	1.00	General Fault	0.40
Calibration line active on power-up	1.00	General Fault	0.60
Low 24 volts	1.00	General Fault	0.80
Low 12 volts	1.00	General Fault	1.20
Low 5 volts	1.00	General Fault	1.20
Dirty Optics	2.00	Blocked Optics	1.00
Calibration Fault	1.00	General Fault	1.60
Calibration complete	1.00	Calibration	1.80
Span calibration, apply gas	1.00	Calibration	2.00
Zero calibration in progress	1.00	Calibration	2.20
Negative signal output fault	1.00	General Fault	2.40
Flash CRC	1.00	General Fault	1.20
Ram Error	1.00	General Fault	1.20
EEPROM Error	1.00	General Fault	1.20
IR Source Failure	1.00	General Fault	1.20

Table 7—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 re-calibrate 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. Check the gas bottle to ensure that there is enough gas to complete the calibration. Are conditions too windy for a successful calibration? If so, use a PointWatch Eclipse Calibration Bag (P/N 006672-002). Always calibrate with a Det-Tronics calibration kit for Eclipse with correct regulator. Be sure that the calibration gas being used matches the configured setting. If the fault is still present, perform cleaning procedure, then re-calibrate.
Negative Signal Output	This fault is indicated when the signal output drops below 10% of scale. 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 pure nitrogen 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.
Other Faults	Consult the factory.

ORDERING INFORMATION

POINTWATCH ECLIPSE CO_2 DETECTOR

When ordering, please refer to the PIRECL CO_2 Model Matrix.

CALIBRATION EQUIPMENT

The Eclipse CO_2 calibration kits consist of a sturdy carrying case containing two 3.6 cubic foot (103 liter) cylinders of specified gas (1x N_2 and 1x CO_2), a regulator with a pressure indicator, and three feet of tubing.

Kit, Carbon Dioxide 1%/vol (10,000 ppm) and Pure Nitrogen	006468-017
PointWatch Eclipse Regulator	162552-002
Eclipse Calibration Bag	006672-002

SPARE PARTS

Carbon Dioxide, 1%/vol	227117-020
Pure Nitrogen	227117-022
Calibration Port Cover	009192-001
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)	107427-053
O-Ring, 2.44" i.d., for weather baffle	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.det-tronics.com
E-mail: det-tronics@det-tronics.com

PIRECL CO$_2$ MODEL MATRIX

MODEL	DESCRIPTION								
PIRECL	Point Infrared Eclipse Gas Detector								
	TYPE	**THREAD TYPE**							
	A	3/4" NPT							
	B	M25							
		TYPE	**OUTPUT & MEASUREMENT OPTIONS**						
		3	4-20 mA with HART protocol & RS-485: CO$_2$ 0-2%/vol Full Scale Range						
			TYPE	**OPTIONAL OUTPUTS**					
			A	HART Communication Port					
			B	HART Communication Port and Relay Board **Ex d only**					
			D	No Optional Outputs					
			E	Relay Board **Ex d only**					
				TYPE	**WEATHER PROTECTION**				
				1	Weather Baffle with Hydrophobic Filter				
					TYPE	**APPROVALS**			
					B	INMETRO (Brazil)			
					C	CSA/IECEx			
					E	ATEX/CE/IECEx			
						TYPE	**CLASSIFICATION**		
						1	Division/Zone Ex d e		
						2	Division/Zone Ex d		

APPENDIX A

CSA APPROVAL

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

APPROVAL

PointWatch Eclipse® Infrared Carbon Dioxide Gas Detector, Model PIRECL Series.

Explosion-proof for Class I, Division 1, Groups B, C, & D (T4) Hazardous (Classified) Locations per C22.2 #30, with optional intrinsically safe output for HART communication in accordance with control drawing 011975-001. Nonincendive for Class I, Division 2, Groups A, B, C & D (T3C) Hazardous (Classified) Locations per C22.2 #213. Tamb = −40°C to +75°C. Acidic atmospheres excluded. Conduit seal not required.

NOTES

Approval of the Model PIRECL does not include or imply approval of the apparatus to which the detector may be connected and which processes the electronic signal for eventual end use. In order to maintain an approved system, the apparatus to which the detector is connected must also be approved.

This Approval does not include or imply Approval of the communications protocol or functions provided by the software of this instrument or the communications apparatus or software connected to this instrument.

APPENDIX B

ATEX APPROVAL

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

APPROVAL

PointWatch Eclipse® Infrared Carbon Dioxide Gas Detector, Model PIRECL Series.

CE 0539 ⟨Ex⟩ II 2 G
Ex db eb IIC T5...T4
– OR –

Ex db eb [ib] IIC T5...T4
(with HART communication port)
DEMKO 01 ATEX 129485X.
T5 (Tamb –50°C to +40°C)
T4 (Tamb –50°C to +75°C)
IP66/IP67.

– OR –

CE 0539 ⟨Ex⟩ II 2 G
Ex db IIC T5...T4
– OR –
Ex db [ib] IIC T5...T4
(with HART communication port)
DEMKO 01 ATEX 129485X.
T5 (Tamb –55°C to +40°C)
T4 (Tamb –55°C to +75°C)
IP66/IP67.

HART Communication Port:
U_o = 3.47 V C_o = 1000 μF
I_o = 117 mA L_o = 2.3 mH
U_m = 250 V

ATEX Special conditions for safe use (general):

• The Infrared Gas Detector model PIRECL shall be installed in places where there is a low risk of mechanical damage.

• The field wiring terminal connections are certified for a single wire in size from 0.2 to 2.5 mm^2, (or two conductors with same cross section 0.2 to 0.75 mm^2).The screws must be tightened down with a torque 0.4 to 0.5 Nm.

• The metal housing of the model PIRECL Infrared Carbon Dioxide Gas Detector must be electrically connected to earth ground.

• The Infrared Gas Detector model PIRECL has an ambient temperature rating of –55°C to +75 °C.

• Alarm output latching requirement: High alarm outputs must be configured as latching, either as part of the alarm operation of the gas detector itself (in stand-alone applications), or as a function of the "high alarm" indication within the controller that is directly connected to the gas detector (for remote applications).

• Potential electrostatic charging hazard - use a wrist grounding strap or similar method at all times to control accidental ESD when disassembling, programming, or reassembling the PIRECL gas detector.

• Flameproof joints are not intended to be repaired – contact manufacturer for service or repair.

• Use M6 bolts per ISO 965 with M5 head with yield stress ≥ 65,000 psi (448 N/mm^2).

Special conditions for safe use for the [ib] HART communication port only:

• The PointWatch Carbon Dioxide Infrared Gas Detector model PIRECL shall be powered from a Safety Isolating Transformer according to EN60742 or EN61588.

• The intrinsically safe output on the HART Communicator Port is internally connected to enclosure ground and will therefore not withstand a dielectric strength test.

- For installations in which both the Ci and Li of the intrinsically safe apparatus exceeds 1% of the Co and Lo parameters of the associated apparatus (excluding the cable), then 50% of Co and Lo parameters are applicable and shall not be exceeded. The reduced capacitance shall not be greater than 1 μF for Groups IIA and/or IIB, and 600 nF for Group IIC.

Additional Safety Notes:

- The following warning is on the product: Warning: Do not open when an explosive gas atmosphere may be present. For ambient temperature above 60°C use field wiring suitable for maximum ambient temperature. For temperature below –10°C use suitable field wiring for the lowest temperature.
- The ambient temperature range is limited to –55°C to +75°C (for Ex db version) or –50°C to +75°C (for Ex db eb version).
- Cable, bushings and the conduit entries shall be of a type already certified according to relevant ATEX standard, so the protection principle employed will not be impaired.
- Unused conduit entries shall be closed using stop plugs certified for the conditions of use (IP66/IP67 minimum). The stop plugs should be removable only with the aid of a tool.
- The terminal compartment for Eclipse without relays is designed for either an increased safety "e" termination or a flameproof "d" termination of the supply cable. If a flameproof connection is chosen, then an ATEX certified cable entry device certified to EN60079 must be used. The Eclipse with relays requires Ex d cable entry devices only.
- Shielded cable is required.
- The measuring function of the Infrared Gas Detector model PIRECL CO2 version, for explosion protection, according to Annex II clause 1.5.5, 1.5.6 and 1.5.7 of the Directive 94/9/EC is NOT covered in this EC-Type Examination Certificate.

EN Standards:
EN 50270: 2006
EN 60079-0: 2012 + A11:2013
EN 60079-1: 2014
EN 60079-7: 2015
EN 60079-11: 2012
EN 60529: 1991+ A1 2000
EN 61000-6-4 (Emissions)
EN 61000-6-2 (Immunity)
EN 61010-1:2010

CE: Conforms to:
Low Voltage Directive: 2006/95/EC (until April 19th, 2016)
                       2014/35/EU (from April 20th, 2016)
EMC Directive: 2004/108/EC (until April 19th, 2016)
                       2014/30/EU (from April 20th, 2016)
ATEX Directive: 2009/94/6/EEC (until April 19th, 2016)
                       2014/34/EU (from April 20th, 2016)
Marine Equipment Directive: 96/98/EC, 2015/90/EU

APPENDIX C

IECEx APPROVAL

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

APPROVAL

PointWatch Eclipse® Infrared Carbon Dioxide Gas Detector, Model PIRECL Series.

IECEx ULD 04.0002X
Ex db eb IIC T5...T4

– OR –

Ex db eb [ib] IIC T5...T4
(with HART communication port)
T5 (Tamb –50°C to +40°C)
T4 (Tamb –50°C to +75°C)
IP66/IP67.

– OR –

IECEx ULD 04.0002X
Ex db IIC T5...T4

– OR –

Ex db [ib] IIC T5...T4
(with HART communication port)
T5 (Tamb –55°C to +40°C)
T4 (Tamb –55°C to +75°C)
IP66/IP67.

HART Communication Port:
Uo = 3.47 V   Co = 1000 µF
Io = 117 mA   Lo = 2.3 mH
Um = 250 V

IEC Conditions of Certification (general):

- The Infrared Gas Detector model PIRECL shall be installed in places where there is a low risk of mechanical damage.
- The field wiring terminal connections are certified for a single wire in size from 0.2 to 2.5 mm^2, (or two conductors with same cross section 0.2 to 0.75 mm^2).The screws must be tightened down with a torque 0.4 to 0.5 Nm.
- The metal housing of the model PIRECL Infrared Carbon Dioxide Gas Detector must be electrically connected to earth ground.
- The Infrared Gas Detector model PIRECL has an ambient temperature rating of –55°C to +75 °C.
- Alarm output latching requirement: High alarm outputs must be configured as latching, either as part of the alarm operation of the gas detector itself (in stand-alone applications), or as a function of the "high alarm" indication within the controller that is directly connected to the gas detector (for remote applications).
- Potential electrostatic charging hazard - use a wrist grounding strap or similar method at all times to control accidental ESD when disassembling, programming, or reassembling the PIRECL gas detector.
- Flameproof joints are not intended to be repaired – contact manufacturer for service or repair.
- Use M6 bolts per ISO 965 with M5 head with yield stress ≥ 65,000 psi (448 N/mm^2).

Special conditions for safe use for the [ib] HART communication port only:

- The PointWatch Carbon Dioxide Infrared Gas Detector model PIRECL shall be powered from a Safety Isolating Transformer according to EN60742 or EN61588.
- The intrinsically safe output on the HART Communicator Port is internally connected to enclosure ground and will therefore not withstand a dielectric strength test.
- For installations in which both the Ci and Li of the intrinsically safe apparatus exceeds 1% of the Co and Lo parameters of the associated apparatus (excluding the cable), then 50% of Co and Lo parameters are applicable and shall not be exceeded. The reduced capacitance shall not be greater than 1 µF for Groups IIA and/or IIB, and 600 nF for Group IIC.

IEC Standards:
IEC 60079-0: 2011
IEC 60079-1: 2014
IEC 60079-11: 2011
IEC 60079-7: 2015
IEC 60529, 2.1 Edition with Corr. 1
(2003-01 + 2 (2007-10)
IEC 60079-29-1: 2007

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

APPENDIX D

INMETRO APPROVAL

UL-BR 15.0242X
Ex d [ib] IIC T4-T5 Gb IP66/67
T5 (T$_{amb}$ –55°C to +40°C)
T4 (T$_{amb}$ –55°C to +75°C)

—OR—

Ex d e [ib] IIC T4-T5 Gb IP66/67
T5 (T$_{amb}$ –50°C to +40°C)
T4 (T$_{amb}$ –50°C to +75°C)

NOTE

All cable entry devices and blanking elements shall be Brazil certified in the type of explosion protection, flameproof enclosure 'd', suitable for the conditions of use and correctly installed, with an ingress protection rating of IP66/IP67. A screw or cover lock is provided for a secondary means of fastening the cover.

APPENDIX E

HART COMMUNICATION

Digital communication with the PointWatch Eclipse CO_2 model 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 Eclipse with the HART Handheld Communicator.

ESTABLISHING LOCAL HART COMMUNICATION WITH POINTWATCH ECLIPSE CO_2 MODEL

The HART Handheld Communicator can be connected to the 4-20 mA circuit as shown in the wiring diagrams provided in the Installation section of this manual. If the Eclipse is equipped with an I.S. HART communication port on the side of the detector, unscrew the protective cap and connect the HART Communicator test probes to the two terminals inside the port (non-polarized).

Press the "on" key to switch on the HART Handheld Communicator. The Online menu is the first menu to appear when the Communicator is properly connected to the Eclipse. This menu is structured to provide important information about the connected device. The HART protocol incorporates a concept called the "Device Description Language" (DDL) that enables HART instrument manufacturers to define and document their product in a consistent format. This format is readable by handheld communicators, PC's and other process interface devices that support DDL.

NOTES
Proper analog signal output termination and minimum loop resistance must be completed in all cases to enable HART communication. Failure to provide proper analog signal output loop resistance will preclude all HART communication.

It is possible to establish HART Communication with the PIRECL in Generic HART communication mode. In this mode, HART communication with the PIRECL detector will be established, but the Communicator will not recognize the PIRECL as a gas detector. Generic HART communication will not provide access to the PIRECL DDL menu and important set-up, diagnostics or operation functions, including gas type selection.

PROCEDURE TO DETERMINE IF ECLIPSE DDL IS PRESENT IN YOUR COMMUNICATOR

1. From the Main menu, select the Offline menu.
2. From the Offline menu, select New Configurations to access the list of device descriptions programmed into your HART Communicator. The Manufacturer menu displays a list of each manufacturer with available DDLs.
3. Select a manufacturer, and the display will show the list of available device types.
4. If you cannot find the Eclipse CO_2 device on your Communicator, the specific DDL is not programmed into the Memory Module. Your HART Communicator will require a DDL upgrade in order to access all Eclipse DDL functions.

The HART Communication Foundation (www.hartcomm.org) manages the HCF Approved DDL Library and programming sites for HCF Approved field communicators. A complete listing of the DD Library is available for download and provides manufacturer and device type file identification.

ECLIPSE CO₂ HART MENU STRUCTURE

This section displays the menu trees for the Pointwatch Eclipse CO₂ model. The menu tree shows the primary commands and options available when using menu selections.

Eclipse_CO2
- Device Variables
- Diagnostics
- Device setup

Device Setup
- Basic Setup
- Detailed Setup
- Output condition
- Review

Device Variables
- Process Variables
- Identification

Process Variables
- Gas
- PV
- Loop Current
- PV % rnge
- Range Values
- PV *

* Available with Graphic Option only

Range Values
- PV USL
- PV LSL
- PV URV
- PV LRV

Identification
- Device Info
- HART Info

Device Info
- Manufacture
- Dev id
- Model
- Revision #'s

Revision #'s
- Universal rev
- Fld dev rev
- Software rev
- Hardware rev

HART Info
- Tag
- Long tag
- Message
- Date
- Write protect
- Final asmbly num

Diagnostics
- Status/Fault Menu
- Test device
- Calibration
- History

Status/Fault Menu
- Fault 1
- Fault 2
- Status 1
- Status 2
- Operating mode
- Calibration mode

Test device
- Loop test
- Self test
- Response test
- Reset

Calibration
- Zero trim
- Calibrate Sensor
- Snsr temp
- D/A trim

Calibrate Sensor
- Calibrate
- Cal Conc
- Gas Type
- CalDate

History
- Running hrs
- Max temperatures
- Min temperatures
- Calibration log
- Event log

Basic Setup
- Gas
- PV Snsr unit
- PV URV
- Device information

Device information
- Manufacturer
- Dev id
- Tag
- Long tag
- Date
- Descriptor
- Message
- Model
- Write protect
- Final asmbly num

Review
- Model
- Manufacturer
- Tag
- Date
- Descriptor
- Message
- Gas
- Gas Type
- PV Snsr unit
- PV USL
- High Alarm Level
- High Alarm Latch
- Low Alarm Level
- Low Alarm Latch
- Cal Conc
- Analog fault codes
- Spcl Gas Vol%
- Spcl Gas coef A
- Spcl Gas coef B
- Spcl Gas coef C
- Spcl Gas coef D
- Spcl Gas coef E
- Protocol
- Poll adrr
- Baud Rate
- Parity
- Final asmbly num
- Alrm type
- Write protect
- Dev id
- Universal rev
- Fld dev rev
- Software rev
- Poll addr
- Num req preams

Detailed Setup
- Gas Type
- Sensor information
- Write protect

Sensor information
- PV USL
- Active
- Reference
- Ratio
- Absorption
- Span Factor
- Snsr temp
- Vol% @ 100% FS

Write protect
- Password
- Set Write protect
- Write protect

Config Gas Alarms
- High Alarm Level
- High Alarm Latch
- Low Alarm Level
- Low Alarm Latch

Output Condition
- Config Gas Alarms
- Config fault out
- HART output
- Com Port

Config fault out
- Analog fault codes
- Analog fault values **

HART output
- Poll adrr
- Num req preams

Com port
- Protocol
- Polling addr
- Baud Rate
- Parity

** Viewable in User Defined Fault Mode only

NOTE
Refer to "Alarm Relays" in the Specifications section of this manual for important information regarding alarm relays.

CONNECTIONS AND HARDWARE

The HART Communicator can interface with the Eclipse CO_2 from the onboard I.S. communication port, from the control room, or any wiring termination point in the analog output signal loop. To communicate, connect the HART communicator in parallel with the Eclipse CO_2 analog signal or load resistor. The connections are non-polarized.

NOTE
The HART Communicator needs a minimum of 250 ohms resistance in the loop to function properly. The HART Communicator does not measure loop resistance. Any external ohmmeter is required.

COMMONLY USED HART COMMANDS

The most commonly used HART commands for the PIRECL CO_2 are:

1. Performing basic setup functions such as:

    • Assigning a short or long tag identifier to the detector
    • Assigning unit of measure (PPM, %/vol)

2. Performing detailed setup functions such as:

    • Configuring Gas Alarm Levels (Low & High threshold)
    • Configuring Fault Codes (analog signal output levels during various fault conditions)
    • Configuration of HART and MODBUS communication protocols
    • Write-protecting the HART programming, or assigning a password to protect the setup.

3. Performing Diagnostic and Service functions such as:

    • Reset Alarms or Faults
    • Performing a signal loop output test
    • Performing a Calibration
    • Monitoring detector history/data logs

It is important for the user to understand how to correctly operate the HART Field Communicator, and how to navigate through the various programming options and either select or de-select the desired parameters. This document does NOT cover this fundamental information on the HART Field Communicator. Please refer to the Field Communicator instruction manual for specific guidance on how to operate the communicator.

TYPICAL SETUP OF A PIRECL CO$_2$

After HART communication has been established with the PIRECL, the following operational parameters are generally verified:

1. Inspect the Root menu to confirm that the gas type selected is proper for the gas hazard to be detected. The PIRECL is shipped from the factory calibrated and set for detection of carbon dioxide.
2. Inspect the Gas Alarm level thresholds and Fault output signals using the Detailed setup option, and modify these settings if required.
3. Enter a device Tag number and/or descriptor for future traceability and guidance.

While these three operations are typical, these steps may not be satisfactory for your application.

The following data provides basic guidance on HART menu navigation. Refer to the HART Field Communicator manual for additional guidance.

ONLINE MENU

When HART communication is established with the PIRECL, the first menu displayed is the Root menu:

To select any of the 3 menu options shown, highlight the desired option using the up/down arrow key, and then press the "right arrow" key.

```
1 Device Variables

2 Diagnostics

3 Device Setup
```

1 Device Variables

The Device Variables menu lists all process variables and identification information for the connected device. Refer to the Device Variables Submenu for more information.

2 Diagnostics

Selecting this menu offers device and loop tests, calibration, and status/history options. Refer to the Diagnostics menu for more information.

3 Device Setup

Device Setup menu accesses configuration parameters of the connected device. Refer to the Device Setup Submenu for more information.

DEVICE VARIABLES SUBMENU

1 Process Variables

Selecting this menu item will list all process variables and their values.
These process variables are continuously updated, and include:

    1 Gas CO2 2.0% (Gas detected)

    2 PV 0.0 Vol% (Primary variable - current gas concentration)

    3 Loop current (Loop current in milliamperes)

    4 PV % range (Primary variable - percent of range)

    5 Range Values (displays upper/lower value and upper/lower sensor limit)
        1 PV USL 2.00 Vol% (upper sensor limit)
        2 PV LSL 0.00 Vol% (lower sensor limit)
        3 PV URV 2.00 Vol% (upper range value)
        4 PV LRV 0.00 Vol% (lower range value)

    6 PV % range graph (available with graphic option only)

2 Identification

Selecting this menu offers device and HART identification information.
    1 Device Info
        1 Manufacturer
        2 Dev id
        3 Model
        4 Revision #'s
            1 Universal rev
            2 Fld dev rev
            3 Software rev

    2 HART info
        1 Tag
        2 Long tag
        3 Message (Text associated with the field device that can be used by the operator in any way)
        4 Date
        5 Write protect (This indicates whether variables can be written to the device, or whether commands that
                    cause actions to be performed in the device can or cannot occur)
        6 Final asmbly num

DIAGNOSTICS MENU

1 Status/Fault Menu

This menu option shows extensive status information about the detector. Data available includes:

    1 Fault 1
        1 xmtr flt 1

    2 Fault 2
        1 xmtr flt 2

    3 Status 1
        1 xmtr status 1

    4 Status 2
        1 xmtr status 2

    5 Operating Mode
        – calibration in progress
        – field device warmin...

    6 Calibration Mode. Latched relay outputs are reset
        – Stabilizing zero
        – Apply cal gas
        – Stabilizing span
        – Remove cal gas

1 Status/Fault Menu
2 Test Device
3 Calibration
4 History

2 Test Device

    1 Loop test (Allows the operator to manually set the analog signal output to a selected constant value)

    2 Self test (Internal tests are performed and any problems are reported in xmtr flt 1 and xmtr flt 2)

    3 Response test (The analog output is held at 4 mA to prevent the alarm relays from activating when gas is applied. Gas response is indicated by the PV)

    4 Reset (Latched relay outputs are reset)

3 Calibration

This menu option initiates the calibration routine and is used to set device calibration preferences
    1 Zero Trim. The current sensor input is used as the new zero reference.

    2 Calibrate Sensor (This is the command used to calibrate the Eclipse CO_2 Detector)
        1 Calibrate (Zero and span calibrations are performed)
        2 Cal Concentration
        3 Gas Type
        4 CalDate (Shows date of last calibration)

    3 Snsr temp (temperature of the sensor that is making the process measurement)

    4 D/A trim (internal use only)

4 History

This menu option shows extensive historical information about the detector

> 1 Running hrs (Number of hours the unit has been powered)
>
> 2 Max temperatures (Maximum temperatures recorded in the device. See max temperature submenu below)
>
> 3 Min temperatures (Minimum temperatures recorded in the device. See min temperature submenu below)
>
> 4 Cal log (Data regarding stored calibrations. See cal log submenu below)
>
> 5 Event log (Data regarding stored events. See event log submenu below)

> ### Max Temperature Submenu:
> Running hrs xxxx
> Maximum Temperature
> xxxx degC xxxx hours
> Max temp since reset
> xxxx degC xxxx hours
> Reset min&max temp?
> ABORT OK
>
> ### Min Temperature Submenu:
> Running hrs xxxx
> Minimum Temperature
> xxxx degC xxxx hours
> Min temp since reset
> xxxx degC xxxx hours
> Reset min&max temp?
> ABORT OK
>
> ### Cal Log Submenu:
> Running hrs xxxx
> Calibration history
> (Event)
> xxxxx Hrs
> 1 Previous
> 2 Next
> 3 Exit
>
> ### Event Log Submenu:
> Running hrs xxxx
> Event history
> (Event)
> xxxx Hrs
> 1 Previous
> 2 Next
> 3 Exit

DEVICE SETUP SUBMENU

1 Basic Setup

    1 Gas CO2 2.0%

    2 PV Snsr unit Vol %

    3 PV URV 2.00 Vol %

    4 Device information
        1 Manufacturer
        2 Dev id (A number is used to identify a unique field device)
        3 Tag
        4 Long tag
        5 Date
        6 Descriptor (Text associated with the field device that can be used by the operator in any way)
        7 Message (Text associated with the field device that can be used by the operator in any way)
        8 Model
        9 Write protect

---

1 Basic Setup
2 Detailed Setup
3 Output Condition
4 Review

---

2 Detailed Setup

    1 Gas Type

    2 Sensor Information
        1 PV USL (Upper sensor limit value defines the maximum usable value for the upper range of the sensor)
        2 Active (Output value of the active sensor)
        3 Reference (Output value of the reference sensor)
        4 Ratio (Ratio of the active sensor over the reference sensor)
        5 Absorption % (Gas absorption expressed in percent)
        6 Span Factor (Number used in calibrating this specific device)
        7 Snsr temp degC (Temperature of the sensor that is making the process measurement)
        8 Vol % @ 100% FS (% volume of gas equal to 100% FS)

    3 Write Protect
        1 Password (A password is required to enable writing to the device)
        2 Set Write Protect
            – Disable
            – Enable
            – Change Password
        3 Write Protect

3 Output Condition

Select and configure the output signal options for the Eclipse detector

    1 Config Gas Alarms
        1 High Alarm Level
        2 High Alarm Latch
        3 Low Alarm Level
        4 Low Alarm Latch

		Factory Default
Range	**0-20000 ppm**	**0-2%/vol**
Low Alarm Range (% of range)	5-90%	5-50%
Default	75%	40%
High Alarm Range (% of range)	10-90%	10-60%
Default	90%	60%

NOTE
Refer to "Alarm Relays" in the Specifications section of this manual for important information regarding alarm relays.

    2 Config fault out
        1 Analog fault codes (This programs the analog output used to indicate faults)
            – Eclipse
            – PIR 9400
            – User defined

    3 Hart output
        1 Poll addr (Address used by the host to identify a field device)
        2 Num req preams (Number of Request Preambles)

    4 Com Port
        1 Protocol (Protocol for RS-485 communications)
            – Modbus
            – ASCII
        2 Poll addr (Polling address for RS-485 communications)
        3 Baud Rate (Baud rate for RS-485 communications)
            – 1200
            – 2400
            – 4800
            – 9600
            – 19.2k
        4 Parity (Parity for RS-485 communications)
            – None
            – Even
            – Odd

4 Review

Press to access the Review menu. This menu lists all of the parameters stored in the connected device, including information about the measuring element, signal condition, and output. It also includes stored information about the connected device such as tag, materials of construction, and device software revision.

APPENDIX F

MODBUS COMMUNICATION

OVERVIEW

This appendix outlines the communication protocol and related memory structures that define the interface between PointWatch Eclipse Gas Detector and a system MODBUS Master. The system MODBUS Master is defined as any device capable of reading and writing to the holding register area of a MODBUS slave device. This includes proprietary software, HMI systems such as Wonderware and The FIX, PLCs and DCSs.

The Eclipse will respond as a slave device to a MODBUS Master, allowing the master to control data flow. A MODBUS memory map is defined, which divides memory into functional blocks consisting of: factory constants, configuration information, real time status, control and device defined information. Each block is then subdivided into individual variables that may be simple integers or floating point numbers.

WIRING

Typical RS-485/Modbus communication architecture is indicated in the diagram below. Eclipse units act as slave devices to a Modbus Master. Multiple Eclipse units are daisy-chained for RS-485 communication. If long cable runs are used, 120 Ohm end-of-line termination resistors may be required.
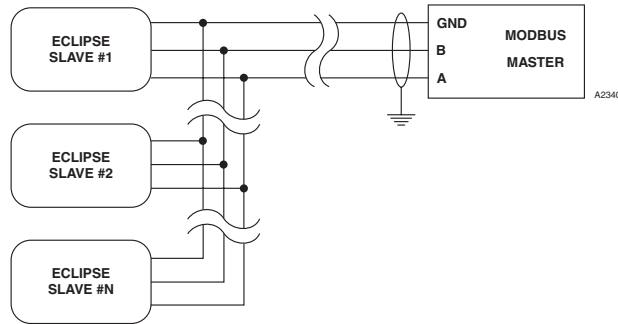
Individual Eclipse units are wired as shown below. Note the inclusion of the end-of-line termination resistor.
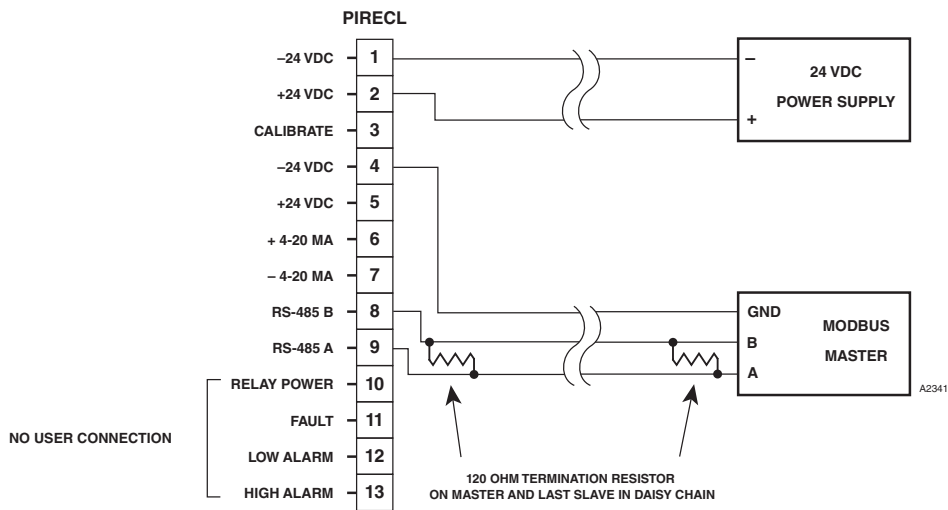
For more information, refer to the EIA RS-485-A standard.

HARDWARE LAYER

RS-485 is used for the hardware interface layer. The output drivers are capable of driving at least 32 devices. The device RS-485 output is tri-stated until a command address matches the programmed address. Default serial settings are MODBUS protocol, address 1, 9600 baud, 1 stop bit, and no parity.

MODBUS FUNCTION CODES

Supported Modbus Functions	
Function Number	**Definition**
3	Read holding registers
6	Preset single registers
16	Preset multiple registers

MEMORY MAP

Description	Starting Address	Ending Address	Size in Words	Access	Memory Type
Factory Constants	40001	40100	100	Read/Write at Factory	Flash/EEprom
Device Configuration	40101	40200	100	Read/Write	EEprom
Status Information	40201	40300	100	Read Only	Ram
Control Words	40301	40400	100	Write Only	Pseudo RAM
Event Logs	40401	40430	30	Read Only	EEprom
Calibration Logs	40431	40460	30	Read Only	EEprom
Raw Signal Buffer	40500	40979	480	Read Only	Ram

ECLIPSE MEMORY MAP

Factory Constants

This area holds values determined at the time of manufacture. Device type and firmware version is determined when the program is compiled and can't be changed. The serial number and manufacture date is written as part of the manufacturing process.

Eclipse Factory Constants		
Description	**Address**	**Value**
Device Type	40001	3 (Eclipse)
Firmware Version	40003	00.00..99.99
Serial Number	40004	Unsigned Long LSW
	40005	Unsigned Long MSW
Year (Manufacture Date)	40006	1999
Month	40007	1..12
Day	40008	1..31
Reserved	40009 to 40010	

Device Configuration (Read/Write)

This area of memory holds field adjustable parameters for the device. The Hart configuration changed bit will be set on writes to this area.

Eclipse Device Configuration		
Description	**Address**	**Value**
Modbus Polling Address	40101	1..247
Baud Rate Code	40102	See Codes
Parity Code	40103	See Codes
Gas Type	40104	See Codes
Calibration Gas Type	40105	See Codes
Calibration Method	40106	See Codes
Calibration Cuvette Length	40107	Float LSW
(1.0 to 150.0 mm)	40108	Float MSW
Analog Fault Code	40109	See Codes
4 to 20 Range	40110	Float LSW
(0 to 2%/vol)	40111	Float MSW
Cal Gas Concentration	40112	Float LSW
(1%/vol)	40113	Float MSW
Warmup Fault Level	40114	Float LSW
(0.0 to 24.0 mA)	40115	Float MSW
Blocked Optics Fault Level	40116	Float LSW
(0.0 to 24.0 mA)	40117	Float MSW
Calibration Current Level	40118	Float LSW
(0.0 to 24.0 mA)	40119	Float MSW
General Fault Current Level	40120	Float LSW
(0.0 to 24.0 mA)	40121	Float MSW
Volume in %/vol	40122	Float LSW
(Special Gas Type)	40123	Float MSW
Low Alarm Level	40134	Float LSW
(5 to 50% of scale)	40135	Float MSW
High Alarm Level	40136	Float LSW
(10 to 60% of scale)	40137	Float MSW
Low Alarm Latch	40138	See Codes
High Alarm Latch	40139	See Codes
Reserved	40140	

NOTE
Refer to "Alarm Relays" in the Specifications section of this manual for important information regarding alarm relays.

Device Status (Read only)

This area of memory holds real time status information.

Eclipse Status Information		
Description	**Address**	**Value**
General Status Bits	40201	Bit Values (See below)
Fault Status Bits	40202	Bit Values (See below)
Gas Level in %/vol	40203	Float LSW
	40204	Float MSW
Calibration Step	40205	See Codes
Active Sensor Signal	40206	Float LSW
	40207	Float MSW
Reference Sensor Signal	40208	Float LSW
	40209	Float MSW
Sensor Ratio	40210	Float LSW
	40211	Float MSW
Sensor Absorption	40212	Float LSW
	40213	Float MSW
Temperature (°C)	40214	Float LSW
	40215	Float MSW
Hour Meter	40216	Unsigned Long LSW
	40217	Unsigned Long MSW
Max Temperature	40218	Float LSW
	40219	Float MSW
Max Temp Hour	40220	Unsigned Long LSW
	40221	Unsigned Long MSW
Max Temp (Since Reset)	40222	Float LSW
	40223	Float MSW
Max Temp Hour (Since Reset)	40224	Unsigned Long LSW
	40225	Unsigned Long MSW
Ram Error Code	40226	Unsigned Integer
Volume in %/vol (Current Gas Type)	40227	Float LSW
	40228	Float MSW

Eclipse Status Information (continued)		
Description	**Address**	**Value**
Min Temperature	40239	Float LSW
	40240	Float MSW
Min Temp Hour	40241	Unsigned Long LSW
	40242	Unsigned Long MSW
Min Temp (Since Reset)	40243	Float LSW
	40244	Float MSW
Min Temp Hour (Since Reset)	40245	Unsigned Long LSW
	40246	Unsigned Long MSW
Fixed 4 to 20 mA Value	40247	Float LSW
	40248	Float MSW
Reserved	40249	
Reserved	40250	
Reserved	40251	
Reserved	40252	
Zero Ratio	40253	Float LSW
	40254	Float MSW
Span Factor	40255	Float LSW
	40256	Float MSW
5 Volt Power Supply Value (As read by ADC)	40257	Float LSW
	40258	Float MSW
12 Volt Power Supply Value (As read by ADC)	40259	Float LSW
	40260	Float MSW
24 Volt Power Supply Value (As read by ADC)	40261	Float LSW
	40262	Float MSW

General Status Bits

These bits are used to signal the current operating mode of the device.

Name	Bit	Description
Device Fault (any fault)	0	Set for all fault conditions
Calibration Active	1	Set during calibration
Warm up Mode	2	Set during warm-up
Low Alarm Active	3	Set while alarm is active
High Alarm Active	4	Set while alarm is active
Output Current Fixed	5	Set when output current is fixed
Modbus Write Protect	6	0 = Locked 1 = Unlocked
Calibration Input Active	7	True while the cal line is active
Magnetic Switch Active	8	True while the onboard magnetic switch is active
Hart Initiated Self Test	9	True when self test is initiated from the Hart interface
Reserved	10	
Response Test Active	11	True during the gas response test.
Manual Self Test Active	12	True during manual self test

Fault Status Word

These bits are used to signal the active faults of the device.

Name	Bit
Calibration Fault	0
Dirty Optics	1
Open Lamp	2
Cal Active at start	3
EE Error 1	4
EE Error 2	5
Ref ADC Saturated	6
Active ADC Saturated	7
Bad 24 volts	8
Bad 12 volts	9
Bad 5 volts	10
Zero Drift	11
Flash CRC Error	12
Ram Error	13

Control Words

Setting values in this area of memory initiates action in the device. For example, it may start a calibration sequence. The device automatically clears command word bits after the function is performed.

Eclipse Control Words		
Description	**Address**	**Value**
Command Word 1	40301	See below
Command Word 2 (Reserved)	40302	
Reserved	40303 to 40306	

Command Word 1

Description	Bit
Start Calibration	0
Abort Calibration	1
Warm up Mode	2
Low Alarm Active	3
High Alarm Active	4
Output Current Fixed	5
Modbus Write Protect	6
Calibration Input Active	7
Magnetic Switch Active	8
Hart Initiated Self Test	9
Reserved	10
Response Test Active	11
Manual Self Test Active	12
End Response Test	13
Reserved	14
Start Manual Self Test	15

Event Logs

Fault and calibration logs are held in this area of memory.

Eclipse Event Logs			
Description	Address	Value	Notes
Event Hour	40401	Unsigned Long LSW	1 of 10 logs
	40402	Unsigned Long MSW	
Event ID 1	40403	See Codes	
Event Hour	40428	Unsigned Long LSW	Last of 10
	40429	Unsigned Long MSW	
Event ID 10	40430	See Codes	
Event Hour	40431	Unsigned Long LSW	1 of 10 logs
	40432	Unsigned Long MSW	
Calibration Event ID 1	40433	See Codes	
Event Hour	40458	Unsigned Long LSW	Last of 10
	40459	Unsigned Long MSW	
Calibration Event ID 10	40460	See Codes	

VALUE CODES

Baud Rate Code

Description	Code
1200	0
2400	1
4800	2
9600 (Default)	3
19200	4

Parity Code

Description	Code
None (Default)	0
Even	1
Odd	2

Gas Type

Description	Code
Carbon Dioxide (0% - 2%/vol)	4

Calibration Gas Type

Description	Code
Same as Measured (CO_2)	0

Calibration Method

Description	Code
Standard	0

Analog Fault Code

Description	Code
Eclipse	0
PIR 9400	1
User Defined	2

Calibration Step

Description	Code
Waiting to Start	0
Waiting for Zero	1
Waiting for Signal	2
Waiting for Gas	3
Waiting for Span	4
Waiting for End	5
Calibration Terminated	6
Calibration Complete	7

Alarm Latch Configuration

Description	Code
Non-Latching	0
Latching	1

Event Log ID Codes

Description	Code
Empty	0
Blocked Beam	1
Warm-up	2
Zero Drift	3
Low Alarm	4
High Alarm	5

Calibration Log ID Codes

Description	Code
Empty	0
Zero Cal	1
Zero and Span	2
Failed Cal	3

ASCII PROTOCOL

The RS485 serial port can be configured for ASCII protocol, which is intended for applications that don't require custom software on the host side. Off the shelf terminal emulation software can be used to receive messages from the device. Percent by volume and sensor readings are sent once per second and user prompt messages are sent during the calibration process to guide the user at each step. Default serial settings are 9600 baud, 1 stop bit, and no parity. Protocol and serial parameters should be selected with the HART handheld communicator.

APPENDIX G

WARRANTY

Detector Electronics Corporation products are manufactured from high quality components and the completed device is rigorously inspected and tested before shipment; however, any electronic device is subject to failure beyond the control of the manufacturer. To ensure system reliability, it is important for the user to maintain the system as recommended by the instruction manuals and to determine the frequency of functional checking of the system required for each specific installation. The more frequent the checking, the greater the system reliability. For the highest reliability, a completely redundant system is necessary. The manufacturer warrants the PointWatch Eclipse CO_2 against defective parts and workmanship, and will replace or repair equipment returned to the manufacturer for these reasons within five years after purchase date. See manufacturer's Standard Terms and Conditions on the invoice for complete details. Please note that no other warranties, written or implied, will be honored by the manufacturer.

CAUTION

The detector contains no user serviceable components. Service or repair should never be attempted by the user. The manufacturer's warranty for this product is void, and all liability for proper function of the detector 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 device is used in a manner not conforming to its intended use.

APPENDIX H

CONTROL DRAWING

THE MODEL PIRECL INFRARED CARBON DIOXIDE (CO2) GAS DETECTORS PROVIDE A CSA CERTIFIED INTRINSICALLY SAFE OUTPUT FOR CONNECTION WITH THE HART COMMUNICATOR WHEN INSTALLED PER THE NATIONAL ELECTRICAL CODE (NEC), NFPA 70, ARTICLES 501 & 504 OR CANADIAN ELECTRICAL CODE, C22.1, SECTION 18 & APPENDIX F.

NOTE: TO PREVENT IGNITION OF EXPLOSIVE ATMOSPHERES, READ, UNDERSTAND, AND ADHERE TO THE MANUFACTURERS LIVE MAINTENANCE PROCEDURE.

NON-HAZARDOUS AREA

CLASS I, DIVISION 1, GROUPS B, C, D (T4) WITH INTRINSICALLY SAFE OUTPUT FOR HART COMMUNICATION.
CLASS I, DIVISION 2, GROUPS A, B, C, D (T4)
{AMBIENT TEMPERATURE LIMITS: −40°C TO +75°C}

INTRINSICALLY SAFE HART PORT: REFERENCE NFPA 70 (NEC), ARTICLE 504. OR C22.1 (CEC), APPENDIX F.

	FOR ZONE CLASSIFICATIONS	FOR DIVISION CLASSIFICATIONS
Uo	3.47 V	3.47V
Io	117 mA	116.8mA
Co	1000 µF	
Lo	2.3 mH	
Um	250 V	

CONTROL DEVICE △2

2000 FT (610m) MAX. CABLE DISTANCE.

REFERENCE NFPA 70 (NEC) ARTICLE 501 OR C22.1 (CEC), SECTION 18.

MODEL PIRECL (CO2)

ROSEMOUNT/EMERSON HART COMMUNICATOR
(NOTE: THIS DRAWING SUPERCEDES ALL ROSEMOUNT/EMERSON HART COMMUNICATOR CONTROL DRAWINGS)

△2 APPROVAL OF THE MODEL PIRECL (CO2) DOES NOT INCLUDE OR IMPLY APPROVAL OF THE APPARATUS TO WHICH THE DETECTOR MAY BE CONNECTED AND WHICH PROCESSES THE ELECTRONIC SIGNAL FOR EVENTUAL END USE.

1. CSA CERTIFIED DRAWING – NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO APPROVAL AGENCY.

REV	ECO NO.	DESCRIPTION	DATE	APPROVED
B	12376	UPDATE ZONE CLASSIFICATIONS (ZONE B-1)		
A	10144	NEW RELEASE.	05/01/12	KAT

DRAWN KAT DATE 04/27/12
CHECKED DATE
APP'D EB DATE 05/01/12
APP'D DATE

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE :
DIMENSION		TOLERANCE	
INCH	(MM)	INCH	(MM)
0.0	(0)	±.02	±(0.5)
0.00	(0.0)	±.01	±(0.25)
0.000	(0.00)	±.005	±(0.13)

ANGLE ±1°
REMOVE ALL BURRS   BREAK ALL EDGES AND SHARP CORNERS

FIRST USED ON PIRECL
BILL OF MAT'L REQ. NO

DET-TRONICS®
DETECTOR ELECTRONICS CORP.
MINNEAPOLIS, MINNESOTA 55438

THIS DRAWING AND SPECIFICATION CONTAIN PROPRIETARY INFORMATION AND ANY REPRODUCTION DISCLOSURE OR USE THEREOF IS EXPRESSLY PROHIBITED WITHOUT THE WRITTEN PERMISSION OF DETECTOR ELECTRONICS CORPORATION.

SHEET 1 OF 1	DO NOT SCALE DRAWING	SCALE NONE	SIZE A	DRAWING NO. 011975−001	REV B

TITLE CNTRL DWG, PIRECL CO2,CSA

CADDS NAME: 011975−01B

FlexSonic® Acoustic
Leak Detector

X3301 Multispectrum
IR Flame Detector

PointWatch Eclipse® IR
Combustible Gas Detector

FlexVu® Universal Display
with GT3000 Toxic Gas Detector

Eagle Quantum Premier®
Safety System

DET-TRONICS

Carrier