# INSTALLATION AND OPERATION MANUAL

# FOR

# *The Flare Monitor*


**Release 1.0**
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# 1.0 INTRODUCTION

## 1.1 PURPOSE OF THE MANUAL

This manual provides a description of the installation and operation of a Flare Monitor, including:

- Sensor specifications
- Sensor options and accessories
- Installation and operating procedures
- Maintenance and calibration procedures

## 1.2 SYSTEM DECRIPTION

**Overview**

Smokeless flares incinerate flammable hazardous vent gas with the assistance of supplemental high-velocity air or steam to prevent the formation of soot or smoke. Excessive injection of air or steam reduces combustion efficiency resulting in the release of hazardous VOC gasses while inadequate injection of air or steam results in the formation of undesirable soot and smoke. Although modern flares are designed for high flow rates associated with an emergency condition, they most commonly operate at high-turn-down, low-flow-rates, making it challenging for the flare to operate at optimal combustion efficiency. Furthermore, steam flow rates based on vent gas mass flow as recommended by the American Petroleum Institute publication API521 are intended as a guideline for flare design, are not intended for operational control, are associated with decreased combustion efficiency at typical high turn-down, low flow conditions, and are complicated by the need for different flow rates for different vent gas compositions. Clearly, a simple real-time measure of combustion efficiency and smoking condition is required for effective operational control.

The Flare Monitor (FM) is a dual-wavelength infrared optical sensor (see figure 2) that measures the ratio of carbon to available oxygen within the hot flame. This measured parameter is associated with combustion efficiency and smoking for all hydro-carbon flames. The FM assures maximum destruction of hazardous VOCs and smoke-free operation by controlling the flow of air or steam to just below the incipient smoke point for optimum combustion efficiency. Unlike other optical devices, the Williamson model FM Flare Monitor does not require on-site calibration, is unaffected by flame size and position, is unaffected by steam flow, and is controlled to the same setpoint value regardless of vent gas composition, flow rate, or flare configuration. This combination of characteristics makes the Williamson model FM the first and only practical optical devise for automatic control of air or steam flow for petrochemical smokeless flares.

The standard enclosure is rated NEMA4X / IP65. A flameproof / explosion-proof enclosure for use in areas designated as hazardous is optional. The FM may be installed as a stand-alone transmitter or with an optional Interface Module. An optional AC power supply is available for the stand-alone configuration. Conduit connections are 3/4-inch. The FM includes a ball-and-socket swivel mounting bracket and through-the-lens visual aiming to permit alignment to the top of the flare.

The FM provides a continuous analog output and a built-in contact alarm set to trigger at the incipient smoke point for hydro-carbon based flames. The optional Interface Module (IM) includes two analog output signals, two contact alarms, a TTL alarm and RS232 and RS485 digital communications. Measured parameters of significance include the primary control signal, flame intensity, and ambient temperature.

The FM indicates a dimensionless value between 0 and 2000. A value between 700 and 1295 indicates high combustion efficiency. A value greater than 1300 indicates a smoking condition. Because the signal naturally bounces up and down significantly, steam or air should be adjusted manually or using a PID controller to keep this value near about 1000.

The Williamson sensor is configured as a temperature sensor, and so this control parameter is reported by the sensor as a temperature value, but it is not a temperature value and no units are displayed. However, for the purpose of the displayed parameter and the output and alarm parameters, this value is called the “Filtered Temperature” and the “Unfiltered Temperature” value. The Filtered Temperature value has signal conditioning applied in the form of time average and decay-rate-based peak hold. The Unfiltered Temperature value is the raw signal without any time average or peak hold applied.

The Williamson Flare Monitor features a unique single-detector design for added sensitivity, long-term stability, and drift-free operation. Routine calibration is not necessary.

### 1.2.2 Configuration and Operation

The Williamson Flame Monitor (FM) is a dual-wavelength optical device that senses the infrared energy emitted by a flame.

Environmental Configuration:
The Flame Monitor (FM) is available in a weather-proof configuration, designated "N4" and rated NEMA4X and IP65, or in an explosion-proof / flame-proof / weather-proof configuration, designated "EXP" and rated rated NEMA7/9, Class 1, Division 1, Groups B, C & D and Class II, Division I, Groups E, F & G, NEMA4X; Ex d IIB+H2, IP66; ATEX, IECEx, FM, UL, cUL/CSA Certified. ATEX or IECEx T6 Equipment Certification is available. The N4 version is suitable for areas classified as non-hazardous. The EXP version is suitable for use in most areas designated as hazardous.

Interface Configuration:
Each FM may be configured as a stand-alone transmitter or with an optional remote interface module, model IM. The IM provides an improved human interface, the ability to monitor multiple measured parameters and the ability to interact with the FM from a remote location.

Power Accessories and Connections:
When the IM is used, the FM is powered by the power supply built into the IM. Otherwise, the FM operates on 24 Vdc, 300 mA. For plants that do not have 24 Vdc available, Williamson offers several power accessories as listed in the table below. Conduit connections are 3/4-inch.

Operation:
When the ratio of carbon to available oxygen within the flame permits near-optical combustion efficiency, the measured value is between 700 and 1295; therefore, the measured parameter should be controlled to a setpoint of 1000. When the measured parameter value exceeds 1300, then the flame is smoking.

The measured parameter value is unsteady, and so a decay-rate peak hold feature is enabled. This produces a more stable measured parameter value without affecting the ability to quickly sense a smoking condition.

A second measured parameter value, Signal Dilution, is proportional to the flame intensity and may be monitored as a troubleshooting parameter and to confirm proper alignment to the flame.

| Optical Configuration | |
|---|---|
| D/35<br>D/75 | Standard Optical Resolution<br>Hi-Resolution for Closely-Spaced Flares |
| **Environmental Configuration** | |
| N4<br>EXP | Non-Hazardous Area Classification<br>Hazardous Area Classification |
| **Interface Configurations** | |
| **Analog** | |
| Four or Six-Wire Transmitter | • Power 24 Vdc, 300 mA<br>• One Analog Signal<br>• One Relay Alarm |
| **Digital** | |
| Six-Wire Stand-Alone | • Power 24 Vdc, 300 mA<br>• Four Measured Parameters via RS485 Digital Communications |
| Six-Wire with IM | • Power 90-260 Vac (0.13A)<br>• Two Analog Signals<br>• Two Relay Alarms<br>• One TTL Alarm<br>• Four Measured Parameters via RS232 and RS485 Digital Communications |
| **Power Accessories (Optional Accessories)** | |
| Stand-Alone Transmitter | 24 Vdc, 300 ma power requirement. |
| Interface Module Model IM | 90-260 Vac Power Supply with Human Interface and Complete I/O Capability. |
| Power Supply Options | **PSD** = DIN Rail Mounted Power Supply<br>**PSN4** = Power Supply in N4 / IP65 Enclosure<br>**PSEXP** = Power Supply in EXP Enclosure |

**Table 1 – Flare Monitor Configurations and Power Accessories**

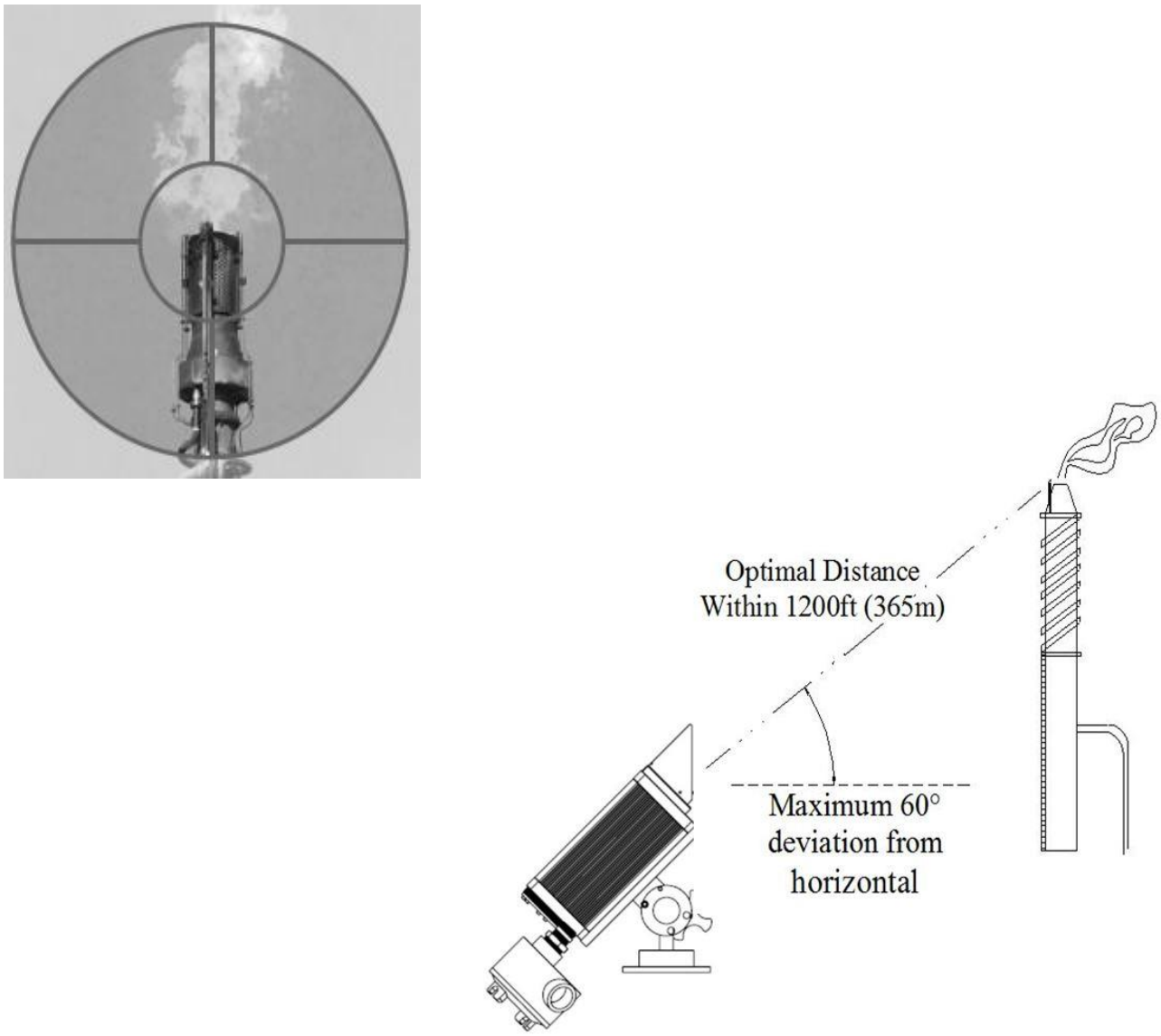


**Figure 1 - Typical Flare Monitor Installation**

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# 2.0 SYSTEM SPECIFICATIONS

## 2.1 GENERAL SPECIFICATIONS AND FUNCTIONS

| FLARE MONITOR FUNCTIONS | |
|---|---|
| **Measured Parameters** | The measured parameters can be assigned to a mA or relay output.<br>• Filtered Temperature (primary control signal with all signal conditioning filters applied)<br>• Unfiltered Temperature (no signal conditioning filters applied – use for diagnostics)<br>• Ambient Temperature<br>• Signal Dilution (proportional to Flame Intensity)<br>• Signal Strength (not used for this model) |
| **Signal Conditioning** | • Average Time<br>• Peak Hold Decay Rate<br>• Alarm Setpoint |
| **Diagnostics** | • System Self-Test (enabled during each power up of the system)<br>• Analog Output Test (force outputs to specific values to verify proper operation)<br>• Alarm Tests (change the state to verify the alarm functions)<br>• Menu Access (for security, can lock access to the menu system) |

**Table 2 – Standard Flare Monitor Functions**

| FLARE MONITOR SPECIFICATIONS | |
|---|---|
| **Control Output** | 0 to 2000 (this is a dimensionless value) |
| **Type of Sighting** | Visual Sighting |
| **Field of View** | D/17 standard optical resolution, 29ft at 500ft (8.8 m at 150 m) |
| **Working Distance** | 0 to 1800 feet (0 to 550 m) |
| **CE Certification** | EMI / RFI for heavy industry, LVD (Low Voltage Directive) |
| **Ambient Temperature Limits** | **Flare Monitor:** -40 to 150°F (-40 to 65°C) |
| **Input Power** | **Stand-Alone Flare Monitor:** 24Vdc (300mA) |
| **Input and Output Signals** | **Analog Mode**<br>• 4-20mA or 0-20mA (1000ohm max. impedance. Shunt resistors produce voltage outputs.)<br>• mA output of Pilot Signal or Signal Dilution<br>• SPST (2A at 120 or 250Vac) Relay output of Pilot Status – Lit or Out<br>**Digital Mode**<br>• Bi-directional RS485 communications<br>• RS232 w/ a converter<br>**System Configuration with Interface Module**<br>**2 Programmable Analog Outputs**<br>• 4-20mA or 0-20mA (1000ohm max. impedance. Shunt resistors produce voltage outputs.)<br>• mA output of Pilot Signal and/or Signal Dil.<br>**Bi-directional Serial Communications**<br>• RS232 and/or RS485 ( only 1 bi-directional )<br>**2 Programmable Relay Alarms**<br>• SPDT (2A at 120 or 250Vac)<br>• Select alarm parameter and set point<br>**1 Programmable TTL Alarm**<br>• TTL rating is 2 ma at 5Vdc<br>• Select alarm parameter and set point |
| **Mounting** | Adjustable swivel bracket with 1-1/2 inch pipe thread and four-hole mount. |
| **Enclosure Rating** | **Flare Monitor N4:** Corrosion Resistant, Epoxy Powder Coated Cast Aluminum Enclosure with NEMA4x (IP65) Rating<br>**Flare Monitor EXP:** Corrosion Resistant, Epoxy Powder Coated Cast Aluminum Enclosure with NEMA7/9 (IP66), Class I, Division I, Groups B, C, D and Class I Division I, Groups E, F, G, NEMA4X; ATEX, IECEx, FM, UL/cUL Ratings |
| **Dimensions (L x W x H)** | **Flare Monitor N4:** 16in x 7in x 8in (406mm x 178mm x 203mm)<br>**Flare Monitor EXP:** 10.7in x 5.4in x 10in diameter (272mm x 137mm x 254mm diamter) |
| **Nominal Weight** | **Flare Monitor NEMA 4 and Swivel Bracket:** 7.8 lbs. (3.5 kg)<br>**Flare Monitor EXP and Swivel Bracket:** 11.6 lbs. (5.3 kg)<br>**Flare Monitor EXP SS and Swivel Bracket:** 25 lbs. (11.3 kg) |

**Table 3 – Flare Monitor Specifications**

# 3.0 INSTALLATION PROCEDURES

## 3.1 PLANNING THE SENSOR INSTALLATION

Proper installation can improve performance, reduce maintenance, and increase operating life.

The basic installation steps are:

1. Mount the FM in a location to properly view the pilot and shroud (sections 3.2.1 and 3.2.2).

2. Mount the optional interface module for easy access and operation.

3. Connect the FM power and signal cables (section 3.3). The system will power-up once the proper connections are established.

4. Verify proper FM operation. For most installations, no adjustments are required.

5. When required, review the sensor adjustments in section 4 and the troubleshooting procedures in section 5.

### 3.1.1 Mounting and Site Selection

The Flare Monitor swivel base is typically mounted to a 1-1/2" pipe, or, using U-bolts, to a hand rail, or to a base plate located at or near ground level allowing for convenient access. The dimensions are shown in Figure 2. Some recommended guidelines for mounting the Flare Monitor are as follows:

- The sensor must be mounted such that it has a clear view of the Flare flame.

- The closer the sensor is mounted to the flame, the higher the sensor sensitivity.

- The optimal mounting distance is 300 feet/100 meters to 1000 feet/300 meters from the stack.

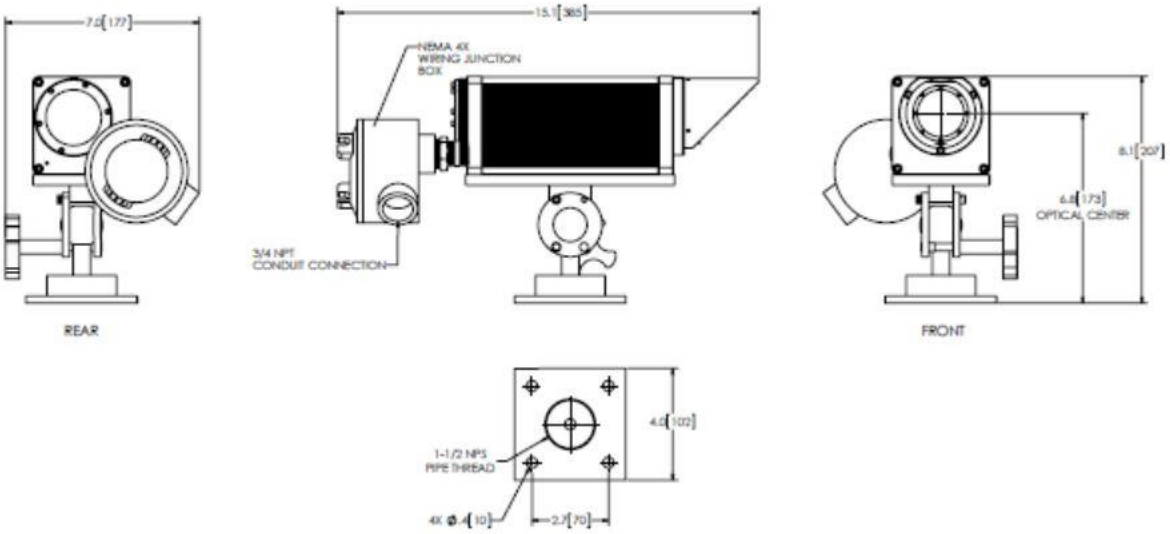
- Avoid viewing the sun. For installations in the northern hemisphere, mount the sensor at any point south of the east-west line passing through the base of the flare. For installations in the southern hemisphere, mount the sensor at any point north of the east-west line passing through the base of the flare. For installations within the tropics, a direct eastern or a direct western view should be avoided.

- Because the soot (smoke) produced by a flame is approximately 30% reflective in the infrared region, it is possible for sunlight to reflect into the sensor and increase the sensor response when smoke is being produced by the flame. This phenomenon only serves to enhance the sensor sensitivity to a smoking condition and has no impact on the ability of the sensor to prevent soot (smoke) from forming. Reflected sunlight has no impact on the sensor reading when the flame is not smoking.

- The Williamson model FM will operate correctly so long as some portion of the flame is viewed. However, when the wind knocks the flame down on the far side of the stack so that no part of the flame is visible to the Williamson sensor, then the reading will be lost. For this reason, it is recommended that the Williamson model FM sensor not be mounted directly upwind from the prevailing wind direction. For best results, the sensor should be mounted down-wind from the prevailing wind direction or, if upwind, at an angle of more than 45 degrees from the prevailing wind direction. If it is necessary to assure that a reading is continuously produced regardless of wind direction, then two Williamson model FM sensors should be installed with an angle of 60 degrees or more of separation around the stack.

- To minimize the likelihood of damage due to lightning strikes, the Flare Monitor should be electrically isolated from surrounding metal structures (including electrical conduit).

## FLARE MONITOR DIMENSIONS – STANDARD CONFIGURATION




## FLARE MONITOR DIMENSIONS – EXPLOSIONPROOF CONFIGURATION

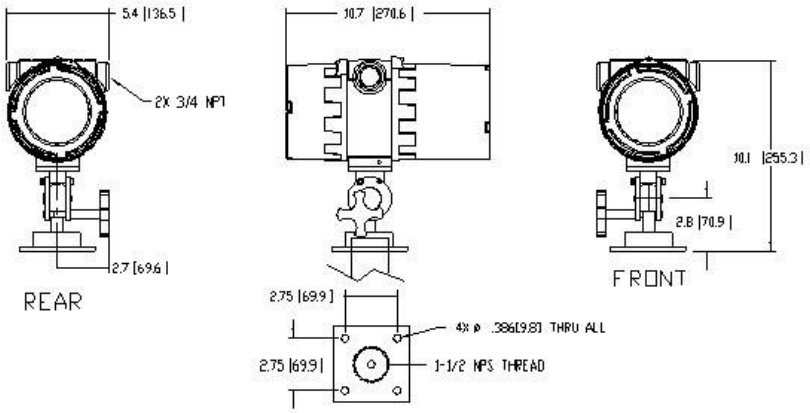



**Figure 2 – Sensor Dimensions**

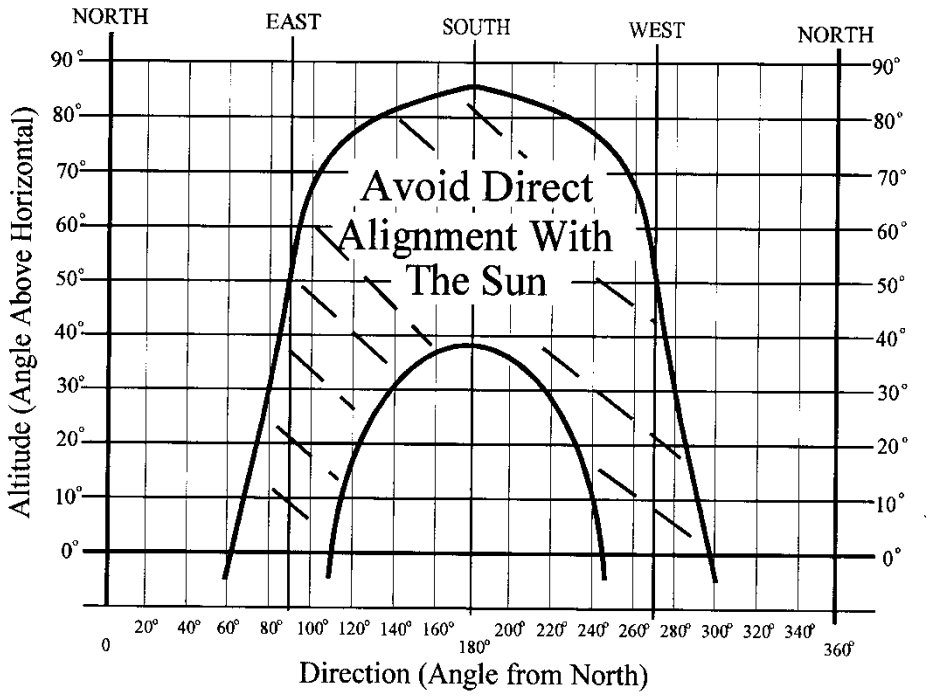



**Figure 3 – Avoiding Interference from the Sun**

### 3.1.2 Aligning the Sensor to the Target

To align the sensor, view through the lens located in the top left corner and adjust the mounting bracket so that the top of the stack is centered in the target area with a clear line of sight. Replace the cover when not in use. (Figure 1) At any distance, D, the target diameter, d, equals the distance divided by 17; d = D/17.

| Target Diameter at Working Distance | | | |
|---|---|---|---|
| Feet (d) at Feet (D) | | Meters (d) at Meters(D) | |
| 18 | 300 | 6 | 100 |
| 59 | 1000 | 18 | 300 |
| 88 | 1500 | 26 | 450 |
| 106 | 1800 | 32 | 550 |

**Table 3 – Flare Monitor Field of View**

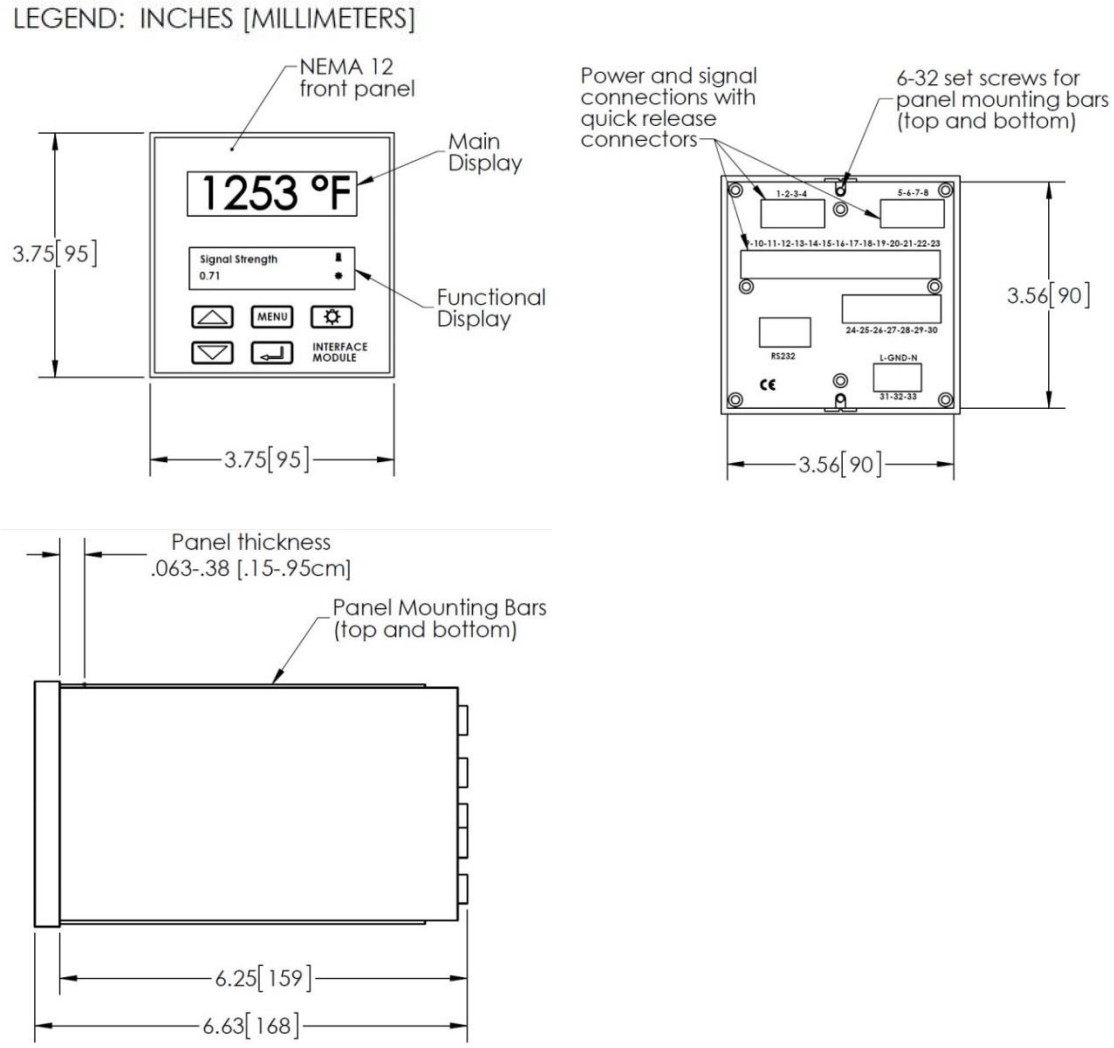
### 3.1.3 Verifying Proper Operation

Under most conditions, once the system has been aligned so that the flare flame appears within the sensor's field of view, no adjustments are required.

To confirm operation of the sensor, reducing the high velocity air or steam should raise the signal and increasing the high velocity air or steam should lower the signal. The expected value of the "Filtered Temperature" parameter when no smoke is present is below 1300. A value greater than 1300 is expected when smoke exists. A high combustion efficiency should produce a value between 700 and 1295.

When aimed to a 500°F blackbody furnace, the sensor should read 1292 +/- 10 with a Signal Dilution value of 2:1 or greater to be considered in specification.

## 3.2 INTERFACE MODULE (IM)




The Interface Module (IM) provides a remote human interface with two displays, two analog output signals, two form-C alarms, one TTL alarm, an analog input signal and digital communications. These human interfaces permit the operator to view measured values, to view sensor settings, and to navigate the setup menu. The IM also includes an AC to DC power supply, and it is required for connecting a laptop with ProView software. The two IM displays work as follows:

- **Interface Module Functional Display:** The Enter key is pressed and held to scroll through select measured parameter values. The arrow keys are used to scroll through measured parameter values and active sensor settings. Press the menu button to access the setup menu, and use the enter button and arrow keys to navigate and edit the sensor settings.

**Interface Module Interchangeability**
When an Interface Module is used, the analog output parameters and the alarm parameters are stored in the Interface Module (IM). All other parameter values are stored in the sensor itself. When interchanging IMs, be sure to confirm that the analog output parameters and the alarm parameters are configured appropriately for your needs.

## 3.3 ELECTRICAL INSTALLATION

Each FM may be installed in one of three different configurations.

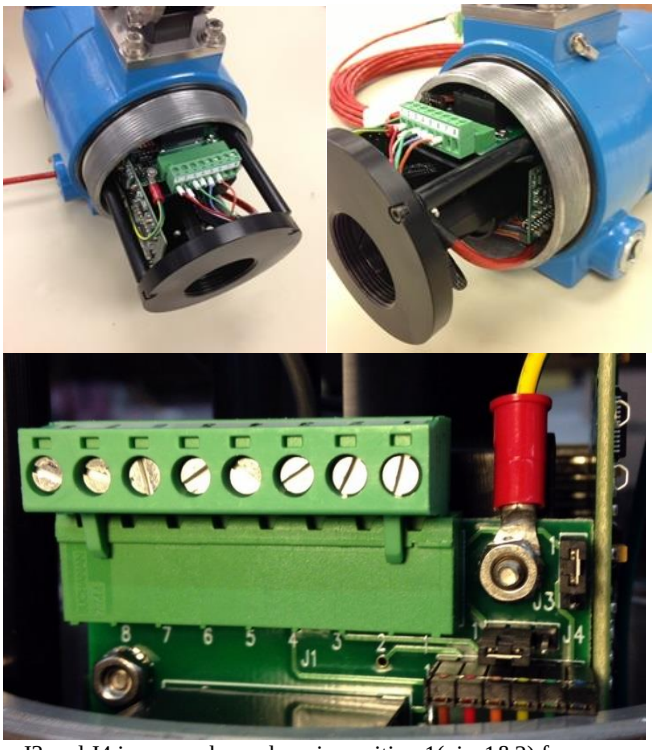
1. Stand Alone Analog Configuration (Table 5)
2. Stand Alone Digital Configuration (Table 5)
3. With the optional Interface Module (Table 6)

When power is properly applied to the FM or to the IM, the system displays will illuminate and go through the power up routine. The **stand-alone sensor** must be powered using 24Vdc (300mA). When using the IM, put the sensor in the Digital mode, connect the FM to the IM, and apply 90 to 260Vac power to the IM. Table 6 and Figure 7 provide complete details for making electrical connections to the IM's rear panel.

Converting between Analog and Digital Modes

**Nema4** Version Sensors are converted between Analog and Digital using the J2 and J3 jumpers on the board as shown in Figure 5, as well as the Mode parameter in the Configure I/O submenu.

**EXP** Version Sensors are converted between Analog and Digital configurations using the Mode parameter, in the Configure I/O submenu group. The human interface on the rear of the sensor or on the IM is used to make this adjustment. If using a stand-alone sensor in digital mode, the conversion from digital to analog must be made via digital command; otherwise, the IM human interface may be used.




J3 and J4 jumpers shown here in position 1(pins1&2) for Digital Mode. For Analog Mode with Relay Alarm Output, move both jumpers to position 2 (pins 2&3). For Analog Mode with Analog Input, J3 and J4 should remain in position 1

**Figure 4 – EXP Housing Terminal Connections**

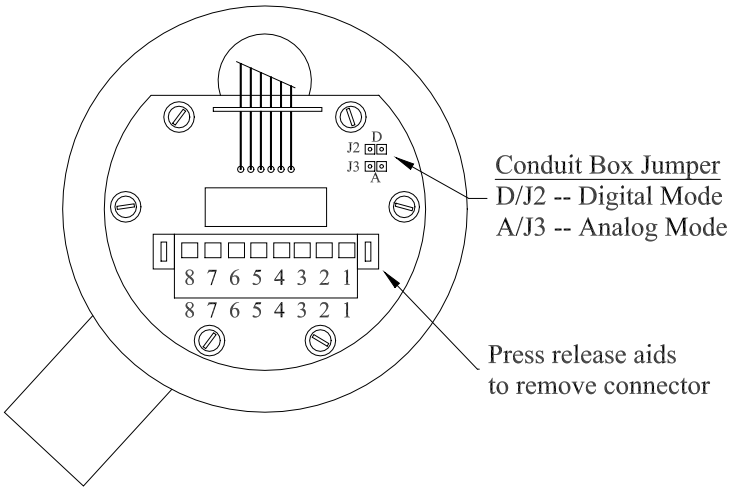
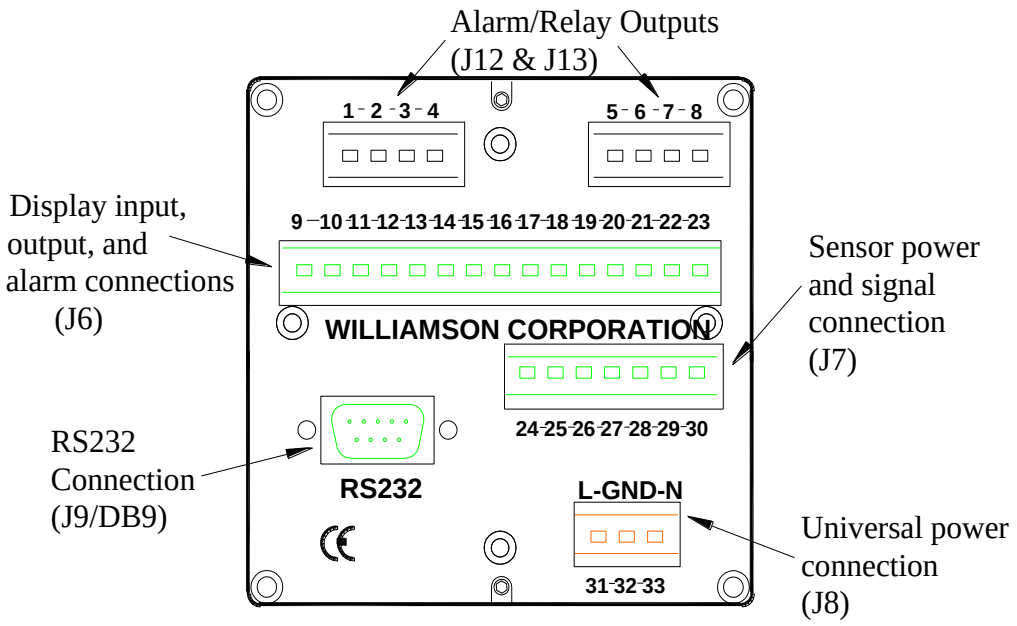



**Figure 5 – NEMA4 Housing Terminal Connections**

| | Flare Monitor Wiring Diagram | | |
|---|---|---|---|
| Power Supply Terminal | Relay Board Terminal | **Stand Alone Configuration With Analog Output and Alarm** | **Stand Alone Configuration with a Digital Output, or System Configuration With The Interface Module (IM)** |
| 10 | 1 | +24Vdc / 300mA Max | +24Vdc (300mA) (Connect to Term. 30 on IM) |
| 9 | 2 | 24Vdc Return (Circuit Common) | 24Vdc Return (Circuit Common) (Connect to Term. 29 on IM) |
| 8 | 3 | mA Output + (0-20mA or 4-20mA) | RS485 Full Duplex Receive + (Connect to Term. 26 on IM) |
| 7 | 4 | mA Output Return | RS485 Full Duplex Receive - (Connect to Term. 25 on IM) |
| 6 | 5 | Not Used | RS485 Full Duplex Transmit + (Connect to Term. 28 on IM) |
| 5 | 6 | Not Used | RS485 Full Duplex Transmit - (Connect to Term. 27 on IM) |
| 4 | 7 | Relay Common (C) | Not Used |
| 3 | 8 | Relay Normally Open (N.O.) | Not Used |
| | | Earth Ground (Shield) | Earth Ground (Shield) (Not used when Earth Ground is made at the sensor) |

**Table 5 – Flare Monitor Wiring Diagram**




**Notes:**

1. 20 to 16 AWG shielded cable is recommended

**Figure 6 - Interface Module Connections**

## 3.4 INTERFACE MODULE ELECTRICAL HOOK UP CONNECTIONS

| ID | FUNCTION | NOTES | | |
|---|---|---|---|---|
| **J12** | **ALARM / RELAY OUTPUT 1** | Relay Rating: 4 amps at 250Vac, or 2.5 amps at 30Vdc<br>Relay Activation Time: 15ms max<br>Reset Time: 5ms max<br>Failsafe Operation: Normal = Power Off or Above Setpoint<br>Energized = Power On & Below Setpoint | | |
| 1 | Normally Closed (N.C.) | | | |
| 2 | Common (C.) | | | |
| 3 | Common (C.) | | | |
| 4 | Normally Open (N.O.) | | | |
| **J13** | **ALARM / RELAY OUTPUT 2** | See above. | | |
| 5 | Normally Closed (N.C.) | | | |
| 6 | Common (C.) | | | |
| 7 | Common (C.) | | | |
| 8 | Normally Open (N.O.) | | | |
| **J6** | **DISPLAY INPUT, OUTPUT, & ALARM FUNCTIONS (Green Connector)** | | | |
| 9 | Analog Input | Input = 4-20mA or 0-20mA. Use shunt resistor for voltage input (0-10 V max). | | |
| 10 | Circuit Common | Output = 4-20mA or 0-20mA. Use shunt resistor for voltage output (0-10 V max). | | |
| 11 | Analog Output 2 | | | |
| 12 | Circuit Common | | | |
| 13 | Analog Output 1 | | | |
| 14 | Circuit Common | Note: all Circuit Commons are common to each other. | | |
| 15 | TTL Alarm Output | Rating = 2mA at 5Vdc maximum | | |
| 16 | Circuit Common | Note: all Circuit Commons are common to each other. | | |
| 17 | Hold Reset | Short to Circuit Common for reset. | | |
| 18 | Circuit Common | Note: all Circuit Commons are common to each other. | | |
| 19 | Display Hold or Digital Pulse Output | Short to Circuit Common to initiate desired function. (Output values remain live) | | |
| 20 | RS485 Full Duplex Receive - | Maximum Distance = 4000 feet | | |
| 21 | R485 Full Duplex Receive + | | | |
| 22 | RS485 Full Duplex Transmit - | | | |
| 23 | RS485 Full Duplex Transmit + | | | |
| **J7** | **SENSOR CONNECTION (Green Connector)** | | | |
| | **Interface Module** | **Wire** | **Sensor** | |
| 24 | Earth Ground (shield) | Clear | Shield | Capacitively isolated from circuit common |
| 25 | RS485 Full Duplex Receive - | Black | D | Sensor Connections.<br>Maximum Length: 4000 feet. |
| 26 | RS485 Full Duplex Receive + | Green | C | |
| 27 | RS485 Full Duplex Transmit - | Orange | F | |
| 28 | RS485 Full Duplex Transmit + | Blue | E | |
| 29 | 24Vdc Return (circuit common) | White | B | Sensor Power |
| 30 | +24Vdc | Red | A | |
| **J8** | **AC POWER LINE IN (Green Connector)** | | | |
| 31 | AC IN Hot (L) | Isolated from circuit common. | | |
| 32 | AC IN Earth Ground | Universal Power Supply. Input power 86-260Vac 50/60Hz (2.5 Amps). | | |
| 33 | AC IN Neutral (N) | | | |
| **J9** | **RS232 CONNECTION (DB9 Connector)** | | | |
| DB9 | (1) N.C. | RS232 Connections<br>(USB Connections pending) | | |
| | (2) PC RS232 TX | | | |
| | (3) PC RS232 RX | | | |
| | (4) N.C. | | | |
| | (5) Circuit Common | | | |
| | (6) N.C. | | | |
| | (7) PC RS232 CTS | | | |
| | (8) PC RS232 RTS | | | |
| | (9) N.C. | | | |

## 3.5 ALARM FUNCTION WIRING

| Stand-Alone Alarm Status | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Jumper Configuration** | **Alarm Logic** | **Diagnostic Test Mode** | | | **Loss of Power** | **Below Setpoint** | **Above Setpoint** |
| | | **Disabled** | **On** | **Off** | | | |
| **Mechanical Relay N.O. Setting** | **Normal** | Open | Closed | Open | Open | Closed | Open |
| | **Reverse** | Open | Closed | Open | Open | Open | Closed |
| **Mechanical Relay N.C. Setting** | **Normal** | Closed | Open | Closed | Closed | Open | Closed |
| | **Reverse** | Closed | Open | Closed | Closed | Closed | Open |
| **TTL Alarm** | **Normal** | 0 volts | 5 volts | 0 volts | 0 volts | 5 volts | 0 volts |
| | **Reverse** | 0 volts | 5 volts | 0 volts | 0 volts | 0 volts | 5 volts |

| RAO Alarm Status | | | | | | |
|---|---|---|---|---|---|---|
| **Alarm Logic** | **Diagnostic Test Mode** | | | **Loss of Power** | **Below Setpoint** | **Above Setpoint** |
| | Disabled | On | Off | | | |
| **Normal** | Open | Closed | Open | Open | Closed | Open |
| **Reverse** | Open | Closed | Open | Open | Open | Closed |

| Dual Alarm RAO Alarm Status | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Alarm Logic** | **Jumper Position: J4 (Alarm 1) & J5 (Alarm 2)** | **Diagnostic Test Mode** | | | **Alarm1 = Pins 6&7, Alarm2 = Pins 6&8** | | |
| | | **Disabled** | **On** | **Off** | **Loss of Power** | **Below Setpoint** | **Above Setpoint** |
| **Normal** | Shorting Pins 2&3 [Default] | Closed | Open | Closed | Closed | Open | Closed |
| | Shorting Pins 1&2 | Open | Closed | Open | Open | Closed | Open |
| **Reverse** | Shorting Pins 2&3 | Open | Closed | Open | Open | Closed | Open |
| | Shorting Pins 1&2 | Closed | Open | Closed | Closed | Open | Closed |

| Interface Module Alarm Status | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Alarm Terminal Positions** | | **Diagnostic Test Mode** | | | **Loss of Power** | **Below Setpoint** | **Above Setpoint** |
| | | **Disabled** | **On** | **Off** | | | |
| **Mechanical Relays** | **Normally Closed Position** (Alarm 1 Pins 1&2, Alarm 2 Pins 5&6) | Closed | Open | Closed | Closed | Open | Closed |
| | **Normally Open Position** (Alarm 1 Pins 3&4, Alarm 2 Pins 7&8) | Open | Closed | Open | Open | Closed | Open |
| **TTL Alarm** | **Normal** | 0 volts | 5 volts | 0 volts | 0 volts | 5 volts | 0 volts |
| | **Reverse** | 0 volts | 5 volts | 0 volts | 0 volts | 0 volts | 5 volts |

# 4.0 NAVIGATING THE SENSOR MENU

## 4.1 DISPLAY MODE

In the display mode, parameter values may be viewed but not changed.

**Measured Parameters**

| Measured Parameter | Analog Output | Digital Output | Alarm Output | Description |
|---|---|---|---|---|
| **Filtered Temperature** | Yes | Yes | Yes | The primary control parameter with signal-conditioing filters applied. This signal is proportional to the tendency of the flame to smoke. A value higher than 1300 indicates a smoking condition. A value between 700 and 1295 indictaes a high combustion efficiency. Although the Williamson set up menu refers to this as a a temperature value , the measured parameter is actually dimensionless and no units are shown. |
| **Unfiltered Temperature** | Yes | Yes | Yes | Intended for use with setup and troubleshooting procedures. |
| **Signal Strength (Emissivity)** | Yes | Yes | Yes | Intended for use with troubleshooting. |
| **Signal Dilution (IR Energy)** | Yes | Yes | Yes | A measure of infrared energy. This signal is proportional to flame intensity. A value below 1 indicates that the sensor can not see any flame. |
| **Rate of Change** | Yes | Yes | Yes | A measure of the rate of rise of the filtered signal. |
| **Ambient Temp** | Yes | Yes | Yes | The temperature inside the sensor housing. |
| **Peak Ambient Temperature** | No | Yes | No | The maximum running ambient temperature value. |
| **Motor Current** | No | Yes | No | A reading greater than 12 mA or a highly erratic reading indicates poor motor health. |
| **Out of Range** | No | Yes | Yes | Indicates that the current reading is outside of the specified range of the sensor. |
| **ESP Status** | No | Yes | Yes | Indicates that the current reading is being suppressed because the Signal Strength or Signal Dilution values are outside of the specified limits. |
| **External Temp** | No | Yes | No | Analog Input value for Alarm Setpoint Temperature |

## 4.2 SET UP MODE – MAIN MENU

When in the operating display mode, a filling thermometer icon is present. When in the set up mode, the filling thermometer icon disappears.

- Press the Menu button to enter the set up mode at the Main Menu level.
- Use the Arrow keys to scroll between submenu groups.
- Use the Enter button to enter a submenu group.
- Use the Menu button to exit the set up mode.

| Submenu Groups: Main Menu Level | | | | | | |
|---|---|---|---|---|---|---|
| Signal Conditioning | Configure I/O | Configure Alarms | Configure ESP | Diagnostics | System Specifications | Configure Network |

### 4.2.1 Set Up Mode, Submenu Level

- Press Enter to enter a Submenu group from the Main Menu level.
- Use the arrow keys to scroll between parameters and to change parameter values.
- Use the Enter button to unlock a parameter value and to lock in a new parameter value.
- Use the Menu button to exit a parameter without changing the value, and to return to the Main Menu level

### 4.2.2 Signal Conditioning Submenu Group

| Parameter (options) | Values [Default Value] | Description |
|---|---|---|
| **Average Time** | Disabled – 240.0 sec **[1.0]** | Applied to the Filtered Temperature. This parameter must be set to a low value for a fast response time to sudden smoking condition. |
| **Temperature Reset** | **[Ramp],**<br>Snap,<br>Resume | During the time average period after the sensor reading first enters the range of measurement, the Filtered Temperature value:<br>Ramps from the Spec Bot Temp<br>Snaps to the instantaneous Unfiltered Temperature value<br>Resumes from the previous Filtered Temperature value saved from before the sensor reading went out of range. |
| **Temperature Hold**<br>• **[Disabled]** | | Holds the Peak or Valley Temperature Value. |
| • Peak Hold – Time Reset | **[Disabled]** to 360 seconds | The peak temperature is held for the peak hold time. |
| • Peak Hold – Decay Rate | 1 to **[300°F]**/second | The peak value falls at the specified rate. |
| • Peak Hold – Temp Reset | Range of sensor | The held value is reset when the unfiltered temperature value rises through the specified temperature. |
| • Valley Hold – Time Reset | **[Disabled]** to 360 seconds | The low reading is held for the valley hold time. |
| • Valley Hold – Decay Rate | 1 to **[300°F]**/second | The low temperature rises at the specified rate. |
| • Valley Hold – Temp Reset | Range of sensor | The held value is reset when the unfiltered temperature value falls through the specified temperature. |
| Note: Interface Module Pin 17 resets the held temperature value when shorted to ground | | |
| **Temperature Scale** | [**Fahrenheit]** or Celsius | The sensor is scaled to indicate a 0-2000 with a dimensionless scale. If configured to indicate in Degress C, then the sensor will read over a range of 18-1903. This model does NOT read temperature. |
| **E-Slope Offset** | -1.000 to +1.000 | As required to set smoke point to 1300. |
| **Rate of Change Multiplier** | 0 to 100 | ROC = change in Temperature X ROC Multiplier.<br>Adjusts sensitivity for hot spot detection feature. |
| **Reset Group Default Values** | | Sets Signal Conditioning parameters to Default values. |
| **Return to Main Menu** | | Navigates to the Main Menu level of the set up mode. |
| **Return to Display Mode** | | Navigates out of set up mode. |

### 4.2.3 Configure I/O Submenu Group

| Parameter (options) | Values [Default Value] | Description |
|---|---|---|
| **Sensor Output** | Digital, Analog | Use Digital Mode for use with IM Interface Module |
| **Output 1 Parameter**<br>• Filtered Temperature | | |
| • Unfiltered Temperature | | |
| • Ambient Temperature | 32-200°F or 0-93.3°C | This output range is fixed |
| • Signal Strength (Emissivity)<br>Sig Strength Scale | **[0-2000]**, 0-1500, 0-1000, 0-500 | 2000 = 2.000, 1000 = 1.000, 1500 = 1.500, 500 = 0.500 |
| • Signal Dilution (IR Energy) | 0-1600 | This output range is fixed. |
| • ROC (Rate of Change) | 0-1000 | This output range is fixed. Used for hot spot detection |
| **Output 1 Scale** | 4-20 mA, 0-20 mA | A shunt resistor can convert to voltage output. |
| **Output 1 Range*** | | *Only available when Output 1 is set to Filtered Temp or Unfiltered Temp. |
| • Spec Range | Range of sensor | |
| • Custom Range | | |
| 0/4 mA Temp (O1) | Inside of Spec Range | The 0/4 mA value must be at least 1 degree lower than the 20 mA value. |
| 20 mA Temp (O1) | Inside of Spec Range | |
| **Output 2 Parameter**<br>• Filtered Temperature | | |
| • Unfiltered Temperature | | |
| • Ambient Temperature | 32-200°F or 0-93.3°C | This output range is fixed. |
| • Signal Strength (Emissivity)<br>Sig Strength Scale | **[0-2000]**, 0-1500, 0-1000, 0-500 | 2000 = 2.000, 1000 = 1.000, 1500 = 1.500, 500 = 0.500 |
| • Signal Dilution (IR Energy) | 0-1600 | This output range is fixed. |
| • ROC (Rate of Change) | 0-1000 | This output range is fixed. Used for hot spot detection. |
| **Output 2 Scale** | 0-20 mA, 4-20 mA | A shunt resistor can convert to voltage output. |
| **Output 2 Range** | | *Only available when Output 2 is set to Filtered Temp or Unfiltered Temp |
| • Spec Range | 0-2000 | |
| • Custom Range | | |
| 0/4 mA Temp (O2) | Inside of Spec Range | The 0/4 mA value must be at least 1 degree lower than the 20 mA value. |
| 20 mA Temp (O2) | Inside of Spec Range | |
| **Pin 19 Input**<br>(Actions occur when pin 19 is shorted to ground) | **[Display Hold],**<br>Transmit Temp,<br>Transmit All | Freezes the displayed value<br>Digitally transmits the Filtered Temperature Value<br>Digitally transmits a string of measured parameters. |
| **Input Parameter**<br>• **[Disabled]** | | |
| • E-Slope Offset,<br>Input Scale | -1.000 to + 1.000<br>**[4-20 mA],** 0-20 mA | Higher / Lower value Decreases / Increases Reading<br>An E-Slope of 1.000 = E-Slope Offset of 0.000 |
| • Emissivity<br>Emissivity Range<br>Input Scale | <br>**[0-1500],** 0-1000, 0-500<br>**[4-20 mA],** 0-20 mA | <br>Higher / Lower value Decreases / Increases Reading<br>1500 = 1.500, 1000 = 1.000, 500 = 0.500 |
| • Alarm 1 Temp<br>Input Scale | Range of Sensor<br>**[4-20 mA],** 0-20 mA | Adjusts the temperature alarm setpoint value. |
| **Reset Group Default Values** | | Sets I/O parameters to Default values. |
| **Return to Main Menu** | | Navigates to the Main Menu level of the set up mode. |
| **Return to Display Mode** | | Navigates out of set up mode. |

### 4.2.4 Configure Alarms Submenu Group

| Parameter (options) | Values [Default Value] | Description |
|---|---|---|
| **Alarm 1 Parameter [Disabled]**<br>• Filtered Temperature<br>Alarm 1 Temperature | 0-2000 | Alarms when Filtered Temperature is above the selected value. |
| • Out of Range | | Alarms when the sensor reading is out of the range. |
| • Ambient Warning<br>Alarm 1 Ambient | 32-200°F or 0-93.3°C | Alarms when the ambient temperature is above selected value. |
| • Signal Dilution*<br>Alarm 1 Sig Dilution | 1 to 9000 | Alarms when the measured SD is above the selected value. |
| • Signal Strength*<br>Alarm 1 Sig Strength | 0.000 to 2.000 | Alarms when the measured SS is above the selected value. |
| • ESP Status | | Alarms when the measured SS or SD values are out of bounds. |
| • Rate of Change<br>Alarm 1 ROC | **[0]** - 1000 | Alarms when the measured ROC value is above selected value. |
| **Alarm 2 Parameter [Disabled]**<br>• Filtered Temperature<br>Alarm 2 Temperature | Range of Sesnor | Alarms when Filtered Temperature is above the selected value. |
| • Out of Range | | Alarms when the sensor reading is out of the range. |
| • Ambient Warning<br>Alarm 2 Ambient | 32-200°F or 0-93.3°C | Alarms when the ambient temperature is above selected value. |
| • Signal Dilution*<br>Alarm 2 Sig Dilution | 1 to 9000 | Alarms when the measured SD is above the selected value. |
| • Signal Strength*<br>Alarm 2 Sig Strength | 0.000 to 2.000 | Alarms when the measured SS is above the selected value. |
| • ESP Status | | Alarms when the measured SS or SD values are out of bounds. |
| • Rate of Change<br>Alarm 2 ROC | **[0]** - 1000 | Alarms when the measured ROC value is above selected value. |
| **TTL Alarm Parameter [Disabled]**<br>• Filtered Temperature<br>TTL Alarm Temperature | 0-2000 | See Alarm Functions Table for detailed description of alarm operation.<br>Alarms when Filtered Temperature is above the selected value. |
| • Out of Range | | Alarms when the sensor reading is out of the range. |
| • Ambient Warning<br>TTL Alarm Ambient | 32-200°F or 0-93.3°C | Alarms when the ambient temperature is above selected value. |
| • Signal Dilution<br>TTL Alarm Sig Dilution | 1 to 9000 | Alarms when the measured SD is above the selected value. |
| • Signal Strength*<br>TTL Alarm Sig Strength | 0.000 to 2.000 | Alarms when the measured SS is above the selected value. |
| • ESP Status | | Alarms when the measured SS or SD values are out of bounds. |
| • Rate of Change<br>TTL Alarm ROC | **[0]** – 100 | Alarms when the measured ROC value is above selected value. |
| **Reset Group Default Values** | | Sets Alarm parameters to Default values. |
| **Return to Main Menu** | | Navigates to the Main Menu level of the set up mode.. |
| **Return to Display Mode** | | Navigates out of set up mode. |

### 4.2.5 Configure ESP Submenu Group

| Parameter (options) | Values [Default Value] | Description |
|---|---|---|
| **ESP Sample & Hold** | **[Disabled],** Enabled, Diagnostic | Enabled holds filtered temperature at last valid value while SS or SD values are out of bounds. Diagnostic mode also indicates on the display the filter parameter causing the hold. |
| **Signal Strength Filter**<br>Lo Sig Strength<br>Hi Sig Strength | **[Disabled],** Enabled<br>0.000 – 2.000<br>0.000 – 2.000 | When enabled, the sensor will calculate a temperature value only when the measured signal strength (emissivity) value is within the specified range. |
| **Signal Dilution Filter**<br>Lo Sig Dilution<br>Hi Sig Dilution | **[Disabled],** Enabled<br>1-9000<br>1-9000 | When enabled, the sensor will calculate a temperature value only when the measured signal dilution (infrared energy) value is within the specified range. |
| **Sig Strength Avg Time** | 0.1 – 24.0 seconds **[1.0]** | Applied to measured signal strength (emissivity) value. |
| **Sig Dilution Avg Time** | 0.1 – 24.0 seconds **[1.0]** | Applied to measured signal dilution (infrared energy) value. |
| **Reset Group Default Values** | | Sets ESP parameters to Default values. |
| **Return to Main Menu** | | Navigates to the Main Menu level of the set up mode. |
| **Return to Display Mode** | | Navigates out of set up mode. |

### 4.2.6 Diagnostics Submenu Group

| Parameter (options) | Values [Default Value] | Description |
|---|---|---|
| **Output 1 Test** | **[Disabled],** 4 mA, 12 mA, 20 mA | Tests the operation of Output 1. Typically used to confirm set up of data acquisition device. |
| **Output 2 Test** | **[Disabled],** 4 mA, 12 mA, 20 mA | Tests the operation of Output 2. Typically used to confirm set up of data acquisition device. |
| **TTL Test** | **[Disabled],** TTL On, TTL Off | Tests the operation of the TTL alarm. |
| **Alarm 1 Test** | **[Disabled],** Alarm 1 On, Alarm 1 Off | Tests the operation of Alarm 1. |
| **Alarm 2 Test** | **[Disabled],** Alarm 2 On, Alarm 2 Off | Tests the operation of Alarm 2. |
| **Menu Access** | **[Immediate],** Delayed | Serves as a lock out feature. Hold Menu button 5 seconds to unlock. |
| **Return to Main Menu** | | Navigates to the Main Menu level of the set up mode. |
| **Return to Display Mode** | | Navigates out of set up mode. |

### 4.2.7 System Specification Submenu Group

| Parameter | Description – *Items in this submenu group may be changed using ProCal software only.* |
|---|---|
| Customer ID | Identifier Field. |
| Sensor Type | Indicates the sensor technology. |
| Model Number | Indicates an abbreviated sensor part number. |
| Sensor Serial Number | Indicates the specific unit serial number. |
| Specified Bottom Temperature | Indicates the lowest temperature value within the range of the sensor. |
| Specified Top Temperature | Indicates the highest temperature value within the range of the sensor. |
| Field of View | Indicates the viewing diameter at the focal distance. |
| Manufacture Date | Indicates the date of manufacture. |
| Last Calibration Date | Indicates the date of most recent factory calibration. |
| Next Calibration Date | Typically set to 2 years after the Last Calibration Date. |
| Warrantee Expiration Date | Indicates the warrantee expiration date. |
| Sensor Firmware | Indicates the sensor firmware revision. |
| Module Firmware | Indicates the firmware revision for the Interface Module, when applicable. |
| Module Serial Number | Indicates the serial number of the Interface Module, when applicable. |
| Return to Main Menu | Navigates to the Main Menu level of the set up mode. |
| Return to Display Mode | Navigates out of set up mode. |

### 4.2.8 Configure Network Submenu Group

| Parameter | Values [Default Value] | Description |
|---|---|---|
| Host Baud Rate | **[38400],** 9600, 19200 | Communication with the IM requires a 38400 baud rate. |
| Host Protocol | **[Standard],** Fieldbus | Communication with the IM requires Standard Protocol. |
| Host Address | **[Disabled],** 1-255 | Assign a Host Address when using Multi-Drop Communication. |
| Host Serial | **[RS232],** RS485 | When an IM is used, the selected serial communication is send-receive and the other is always streaming. |
| Host RS485 | **[Full Duplex],** Half Duplex | Communication with the IM requires Full Duplex communication. |
| Reset Group Default Values | | Sets Configure Network parameters to Default values. |
| Return to Main Menu | | Navigates to the Main Menu level of the set up mode. |
| Return to Display Mode | | Navigates out of set up mode. |

## 4.3 SYSTEM STATUS MESSAGES

The table below provides a list of the system status messages and their associated conditions visible on the Interface Module.

| STATUS MESSAGES | | | | |
|---|---|---|---|---|
| **Status** | **Condition** | **Main Display (5 LEDs)** | **Functional Display (2x16 LCD)** | **Analog Output** |
| **Ambient Warning** | Sensor's measured ambient temperature is above the sensor's ambient limit. | No Change | Ambient Warning | No Change |
| **Initializing** | The sensor does not respond to polling from the interface module. This message is also displayed as the initial communications are being established between the sensor and display. | Dashes on LEDs | 'Initializing | 0 or 4mA |
| **Establishing Communications** | The sensor does not respond to polling from the interface module. This message is also displayed as the initial communications are being established between the sensor and display. | Dashes on LEDs | 'Establishing Communications | 0 or 4mA |
| **Menu Lockout Enabled** | This feature prevents inadvertent access to the sensor menu system, and it is enabled by using the menu access item in the diagnostics menu group. When this item is set to delay, the operator is required to press and hold the menu button for 7 seconds in order to get into the menu system. During the first 5 seconds of this 7-second delay the lockout message is displayed. | No Change | Menu Lockout Enabled | No Change |
| **Filling Thermometer Icon** | Sensor is in the display mode and operating correctly. This icon disappears when in the setup mode. | No Change | Appears in Display Mode only | No Change |

**Table 10 – System Status Messages**

# 5.0 TROUBLESHOOTING AND MAINTENANCE

## 5.1 GENERAL MAINTENANCE

The FM is a precision electro-optic system. Once properly installed, the system should require no routine maintenance other than an occasional cleaning of the sensor's optical window with window cleaner or alcohol using a clean, soft cloth. Based upon historical performance, a few electro-optic components may need routine replacement after 8 to 10 years of operation, depending upon the operating and environmental conditions.

## 5.2 SYSTEM TROUBLESHOOTING

**Adjacent Flares:** Align the Flare Monitor so that the flame from only one flare is viewed. If necessary, a mechanical obstruction may be fitted more than 14 inches in front of the FM to prevent it from viewing an adjacent flame.

**Ambient Temperature Range:** The Flare Monitor system is designed for continuous operation in environments with ambient temperatures from -40° to 150°F (-40° to 65°C). When ambient temperatures exceed 150°F, the Flare Monitor will indicate an "Ambient Warning" and the system should be cooled. In some locations, a sun / radiation shield may be used to maintain ambient temperatures within the Flare Monitor enclosure.

**Rain, Snow, Dew, Fog and Freezing Rain:** Heavy rain, snow and fog will partially obstruct the sensor's view of the flare. As the degree of optical obstruction increases, then the Signal Dilution value will gradually decrease. Once this value drops below 1:1, then the sensor will not be able to make a reading. The Signal Dilution value is available as an alarm parameter for early indication of a pending optical obstruction. For installations where optical obstruction is a frequent concern, the sensor should be moved closer to the stack to increase the measured energy level. In areas where snow accumulation is a frequent concern, the sensor should be mounted under a shield to prevent optical obstruction.

**Lightning:** In areas where lightning strikes are a concern, the Flare Monitor should be electrically isolated from metal structures, and an output signal isolator module should be used. The Flare Monitor is commonly mounted on handrails that are a part of a large, multi-story structure. In this case, the handrail should be wrapped with a nonconductive rubber pad. Electrical conduit should include a nonconductive section to minimize the likelihood of lightening damage.

**Sun:** Whenever possible, the sensor should be installed where it will not view a direct image of the sun (see Figure 3). Direct sunlight on the sensor or its lens system will not cause any long-term ill effects. Direct sunlight upon the sensor's housing, may raise the internal temperature of the Flare Monitor enclosure(s) by as much as 15°F (8°C). In some cases a sun shield may be desirable to prevent overheating of the sensor.

Reflected sunlight does not impact the sensor reading during normal operation; however, the sensor will respond more aggressively to a smoking condition when strong sunlight conditions exist due to solar energy reflections off carbon particles in the smoke.

**Northern (Southern) Hemisphere Installations:** If the sensor is aligned such that it is viewing in any northerly (southerly) direction [15 degrees or more North (South) of due East or West], then the sensor will never view the sun regardless of mounting angle above horizontal. [For installations within the 25th latitude from the equator, a northern (southern) component of as much as 25 degrees may be required.]

**Wind:** The Flare Monitor system is designed to operate effectively in heavy winds so long as a view of at least some of the flame is available every few seconds. Occasionally the wind may blow the Flare flame behind the stack and out of the sensor's field of view. The sensor is equipped with a peak hold feature to compensate for an intermittent loss of view of the flame. The default value for the peak hold decay rate is 10 degrees (points) per second. If wind conditions at the point of installation cause the flame to drop behind the stack and out of the sensor's view for more than a few seconds at a time, then the installation of a second sensor mounted to view the stack from a different angle is recommended. In this case, the second sensor should be mounted at least 60 degrees from the original sensor.

## 5.3 TROUBLESHOOTING GUIDELINES

| TROUBLESHOOTING GUIDELINES | |
|---|---|
| **SYMPTOM** | **POSSIBLE CAUSE/RECOMMENDED ACTION** |
| **Verify Operation** | Periodically check alignment and lens cleanliness. Compare the current Signal Dilution value with the 'base-line' value when viewing a typical flare flame. |
| **Invalid Condition Occurs** During a rainstorm, snowstorm, or heavy fog. | 1. Clean the sensor window.<br>2. Install a snow shield.<br>3. Move the sensor closer to the flare.<br>4. Decrease the Peak Hold Decay Rate. |
| **Invalid Condition Occurs** during heavy winds, or when the sensor's view is blocked for a short time. | 1. Decrease the Peak Hold Decay Rate.<br>2. Move the sensor closer to the flare.<br>3. Install a second sensor at a different viewing angle. |
| **Invalid Condition Occurs** upon ambient temperature drop. | 1. Clear condensation from sensor window, or wait for condensation to evaporate.<br>2. Insulate the sensor. |
| **No Signal** from sensor. | 1. Verify the **proper power** is applied to the system (the displays should be lit).<br>2. Verify that the **fuses** in the interface module are not blown.<br>3. Verify that the **analog/digital mode jumpers** are in the proper position.<br>4. Verify that the sensor's **lens/window is clean**.<br>5. Verify the **proper wiring** connections for the power and the output signals. Use the Diagnostics submenu features.<br>6. Verify the **cable connection** of the sensor to the remote monitor (if included).<br>7. Verify the sensor is properly **aligned** to the measured target.<br>8. Verify that your **current meter fuse** is intact. |
| An **Incorrect Signal** is indicated. | 1. Verify that the **output devices are properly calibrated** to the sensor's linear output signal, and verify the configured output settings. Use the Diagnostics submenu features.<br>2. Verify the sensor is properly **aligned** to the measured target.<br>3. Verify that the sensor's **lens/window is clean**.<br>4. Verify that the sensor is not receiving input energy from **reflections** off the target surface or an image of the **sun** from behind the target.<br>5. Contact Williamson for instructions to use the Advanced ESP Filtering feature. |
| **Intermittent** sensor operation . | Check for **loose, intermittent electrical connections**. |

**Table 14 – Troubleshooting Guidelines**

# 6.0 CERTIFICATIONS

# IECEx Certificate of Conformity

**INTERNATIONAL ELECTROTECHNICAL COMMISSION**
**IEC Certification Scheme for Explosive Atmospheres**

for rules and details of the IECEx Scheme visit www.iecex.com

| | | | |
|---|---|---|---|
| Certificate No.: | IECEx PRE 16.0064 | Issue No: 0 | Certificate history: Issue No. 0 (2016-09-02) |
| Status: | Current | Page 1 of 3 | |
| Date of Issue: | 2016-09-02 | | |
| Applicant: | Williamson Corporation<br>70 Domino Dr.<br>Concord, MA 01742<br>United States of America | | |
| Equipment:<br>*Optional accessory:* | Williamson Temperature Sensors | | |
| Type of Protection: | Ex d | | |
| Marking: | Ex d IIB+H2 T6 Gb or Ex d IIC T6 Gb - 20°C < Ta < +65°C (Sensors)<br>Ex d IIC T6 Gb - 20°C < Ta < +60°C (PS- EXP)<br>Ex d IIB T6 Gb - 20°C < Ta < +60°C (IM- EXP) | | |

*Approved for issue on behalf of the IECEx Certification Body:* Bjørn Spongsveen

*Position:* Certification Manager

*Signature: (for printed version)*

*Date:*

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

DNV Nemko Presafe AS
Gaustadalleen 30
P.O.Box 73 Blindern
0314 Oslo
Norway

Presafe
A DNV & NEMKO COMPANY

# IECEx Certificate of Conformity

Certificate No: IECEx PRE 16.0064 Issue No: 0

Date of Issue: 2016-09-02 Page 2 of 3

Manufacturer: **Williamson Corporation**
70 Domino Dr.
Concord, MA 01742
**United States of America**

Additional Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:

The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

| | |
|---|---|
| **IEC 60079-0 : 2011**<br>Edition:6.0 | Explosive atmospheres - Part 0: General requirements |
| **IEC 60079-1 : 2007-04**<br>Edition:6 | Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d" |

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:

*A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in*

Test Report:

NO/PRE/ExTR16.0052/00

Quality Assessment Report:

NO/PRE/QAR16.0020/00

# IECEx Certificate of Conformity

Certificate No: IECEx PRE 16.0064 Issue No: 0

Date of Issue: 2016-09-02 Page 3 of 3

**Schedule**

**EQUIPMENT:**

*Equipment and systems covered by this certificate are as follows:*

The Williamson Temperature sensors and power supplies are housed in IECEx certified flameproof enclosures manufactured by Adalet. The enclosures are part of the Adalet XIHLX and XDHLX series; are made of cast aluminum, rated IP66 under certificates number IECEx UL08.0005U. There is an IECEx certified cable gland connected to the enclosure (on fiber connection of SRU models only) and the end user is advised to use an IECEx cable gland if an additional cable gland is needed.

The Williamson IM - XP interface module is housed in another IECEx certified flameproof enclosure manufactured by Adalet. The enclosure is part of the Adalet series XCEX; it is made of cast aluminum, rated IP66 and Ex certified under certificate IECEx UL 16.0081U.

The Laser Aiming option is not available in any of Williamson's products which are certified for use in hazardous environments.

**CONDITIONS OF CERTIFICATION: NO**

To view an electronic version of this certificate click this link, http://iecex.com/ and enter Williamson Corporation for the name

# *EU Declaration of Conformity*

We, **Williamson Corporation 70 Domino Drive, Concord, MA 01742, USA** declare under our sole responsibility that the following products,

**Williamson Temperature Sensors, Power Supply, and Interface Module**
**(see appendix for specific model details)**

manufactured by **Williamson Corporation 70 Domino Drive, Concord, MA 01742, USA** to which this declaration relates, is in conformity with the provisions of the European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

Lindsay Jenkins — Quality Management Representative

Lindsay Jenkins — 29-June-2016 (date of issue)

# ATEX Directive (2014/34/EU)

## ATEX Notified Body for Quality Assurance and Ex Product Certificates

**DNV Nemko Presafe AS** (Notified Body Number 2460)
Gaustadalléen 30
0373 Oslo
Norway

## ATEX QA Notification (QAN) - Presafe 16 ATEX 8505Q

## Ex Product Certificate - Presafe 15 ATEX 7348

**Temperature Sensors**
 II 2 G Ex d IIB+H2 T6 Gb or Ex d IIC T6 Gb-20°C ≤Ta≤+65°C

**Power Supply (PS-EXP)**
 II 2 G Ex d IIB+H2 T6 Gb or Ex d IIC T6 Gb-20°C ≤Ta≤+60°C

**Interface Module (IM-EXP)**
 II 2 G Ex d IIB T6 Gb -20°C ≤Ta≤+60°C

**Harmonized Standards Used:**
EN 60079-0: 2009, EN 60079-0: 2012 and EN 60079-1: 2007

# Appendix

The following models have been assessed and approved for use in hazardous environments.

| Model | Description | Assembly Drawing | Ex Code |
|---|---|---|---|
| Gold 31-EXP | This is a single wavelength fiber optic, 1 micron pyrometer | 900-4150-001 | Ex d IIC T6 Gb |
| Gold 32-EXP | This is a single wavelength fiber optic, 2 micron pyrometer | 900-4150-001 | Ex d IIC T6 Gb |
| Pro SW-EXP[1] | This is a single wavelength visual aiming pyrometer | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| Pro SP-EXP[1] | This is a single wavelength visual aiming pyrometer | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| Pro TC-EXP[1] | This is a two color visual aiming pyrometer | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| Pro DW-EXP[1] | This is a dual wavelength visual aiming pyrometer | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| Pro MW-EXP[1] | This is a multi-wavelength visual aiming pyrometer | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| SRU1W-EXP | This is a fiber optic pyrometer designed to measure the wall temperature in a Sulfur Thermal Reactor | 900-4150-001 | Ex d IIC T6 Gb |
| SRU1WT-EXP | This is a fiber optic pyrometer designed to measure the wall temperature in a Sulfur Thermal Reactor | 900-4150-001 | Ex d IIC T6 Gb |
| SRU2W-EXP | This is a fiber optic pyrometer designed to measure the wall temperature in a Sulfur Thermal Reactor | 900-4150-001 | Ex d IIC T6 Gb |
| SRU2WHT-EXP | This is a fiber optic pyrometer designed to measure the wall temperature in a Sulfur Thermal Reactor | 900-4150-001 | Ex d IIC T6 Gb |
| SRU3G-EXP | This is a fiber optic pyrometer designed to measure the gas temperature in a Sulfur Thermal Reactor | 900-4150-001 | Ex d IIC T6 Gb |
| PM-35-EXP[1,2] PM-75-EXP[1,2] | This is a sensor designed to monitor if a pilot flame is lit on top of a flare stack. | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| FI2-35-EXP[1,2] FI2-100-EXP[1,2] FI2-200-EXP[1,2] | This is a flame size and intensity monitor as well as a pilot monitor | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| FM-17-EXP[1,2] | This is a flare monitor used to measure the efficiency of combustion. | 900-5150-001 | Ex d IIB+H2 T6 Gb |
| IM-EXP | This is an interface module that provides power, multiple outputs and alarms. | 900-1250-000 | Ex d IIB T6 Gb |
| PS-EXP | This is a power supply for a sensor. | 900-1350-000 | Ex d IIC T6 Gb |

[1] The "EXP" may be replaced by "EXPSS" for models using a stainless steel enclosure.
[2] The middle numbers indicate the optical resolution of the unit and may change to other values for new applications.

Note: The Laser Aiming option is not available in any models certified for use in hazardous environments.

## Williamson Installation Instructions for Hazardous Environments

**WARNING:** Power MUST BE disconnected before opening the enclosure.

**WARNING:** The maintenance interval must be determined by the user and is governed by the amount and type of particulates in the system where the unit is installed. The user should visually check the element in the first few months of operation to determine how quickly particulates are accumulating.

**WARNING:** Do not open when an explosive atmosphere is present.

All Conduit Connections must be sealed for proper operation of the Williamson sensor. Explosion-proof connections must be used when installed in a hazardous area. Must use ATEX and IECEx certified cable gland(s) with the following minimum ratings: ATEX: Ⓔx II 2 G Ex d IIC IP66; IECEx: Ex d IIC IP66. Any Ex blanking element certified to EN60079-1 may be used for ATEX applications.

The Equipment is to be marked as follows:

| | |
|---|---|
| ATEX | CE(2460) Ⓔx II 2 G Ex d IIC T6 Gb IP66 (Gold 31-EXP, Gold 32-EXP, SRU1W-EXP, SRU1WT-EXP, SRU2W-EXP, SRU2WHT-EXP, SRU3G-EXP, PS-EXP) |
| | CE(2460) Ⓔx II 2 G Ex d IIB+H2 T6 Gb IP66 (Pro SW-EXP[1], Pro SP-EXP[1], Pro TC-EXP[1], Pro DW-EXP[1], Pro MW-EXP[1], PM-35-EXP[1,2] , PM-75-EXP[1,2], FI2-35-EXP[1,2], FI2-100-EXP[1,2], FI2-200-EXP[1,2], FM-17-EXP[1,2]) |
| | CE(2460) Ⓔx II 2 G Ex d IIB T6 Gb IP66 (IM-EXP) |
| IECEx | Ex d IIC T6 Gb IP66 (Gold 31-EXP, Gold 32-EXP, SRU1W-EXP, SRU1WT-EXP, SRU2W-EXP, SRU2WHT-EXP, SRU3G-EXP, PS-EXP) |
| | Ex d IIB+H2 T6 Gb (Pro SW-EXP[1], Pro SP-EXP[1], Pro TC-EXP[1], Pro DW-EXP[1], Pro MW-EXP[1], PM-35-EXP[1,2] , PM-75-EXP[1,2], FI2-35-EXP[1,2], FI2-100-EXP[1,2], FI2-200-EXP[1,2], FM-17-EXP[1,2]) |
| | Ex d IIB T6 Gb (IM-EXP) |

[1] The "EXP" may be replaced by "EXPSS" for models using a stainless steel enclosure.
[2] The middle numbers indicate the optical resolution of the unit and may change to other values for new applications.

Ambient Temperature Range : All Sensors : -20°C ≤ Ta ≤ + 65° C
Power Supplies and IM-EXP: -20°C ≤ Ta ≤ + 60° C

Electrical Ratings: All sensors - 24Vdc, 300mA max
Power Supplies and IM-EXP: 90-260Vac, 2amp max, 50/60 Hz

**Standards**

For all sensors and power supplies: IEC 60079-0 (6th ed) and IEC 60079-1 (6th ed), EN 60079-0: 2012 and EN 60079-1: 2007.

For the IM-EXP: IEC 60079-0 (5th ed) and IEC 60079-1 (6th ed), EN 60079-0: 2009 and EN 60079-1: 2007.

Williamson Corporation
70 Domino Drive
Concord, MA 01742, USA


**NOTICE**

THE INTERNAL GROUND SCREW PROVIDED IN THIS ENCLOSURE MUST BE USED FOR THE EQUIPMENT GROUNDING CONNECTION. THE EXTERNAL GROUND SCREW IS PROVIDED FOR USE ONLY AS A SUPPLEMENTAL CONNECTION WHERE REQUIRED (OR PERMITTED) BY LOCAL CODES OR AUTHORITIES.