



IPES-IR/UV Flame Detector Operating Manual

80010-001 Rev A



ESP SAFETY INC

Technology of the Future...Protection for today

IPES-IR/UV Flame Detector Operating Manual

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It is important that this entire manual be thoroughly read and understood prior to installing or operating the IPES-IR/UV. Any deviation from the recommendations in this manual may impair system performance and compromise safety.

1.0 Introduction

Introduction

The IPES-IR/UV flame detector's advanced detection technology incorporates optical filters configured for maximum sensitivity to radiation produced by flame or fire and ensures rapid flame recognition and alarm signaling. The IPES-IR/UV has a field of view of not less than 90 degrees. Upon fire recognition, it signals a change in state from normal operation to fire in any original equipment manufacturers OEM or proprietary alarm and response system.

In addition, via integrated infrared (IR) and ultraviolet (UV) sensors, the IPES-IR/UV monitors in specific regions of both spectral ranges. In the infrared spectrum, the device is configured for sensitivity to wavelengths in the range of 4.2 to 4.6 microns, allowing optimal sensitivity to hydrocarbon fires, and other types such as metal fires while rejecting false signals from incandescent lamps, sunlight and hot objects. For ultraviolet radiation, the device is configured for sensitivity in the range of 180 to 250 nanometers, making the sensor "blind" to sunlight and radiation from heated objects but still able to "see" the UV radiation emitted by a flame. With these settings, the IPES-IR/UV selects and alarms from those characteristic wavelength emissions from the IR-to-UV spectrum that indicate actual flame or fire.

The combination of multiple sensors and wavelength range settings makes the IPES-IR/UV an excellent choice for elimination of false positive indicators caused by non-flame sources of radiation such as artificial lighting, direct and indirect sunlight, lightning, arc welding and metal grinding.

Our Mission

ESP Safety, Inc.'s mission is to provide complete turn-key protection solutions beginning with the design stage, through system installation and commissioning, and on-going field service in hazardous environments. Our line of industry-leading products, services, and systems benefits society, saves lives, and preserves capital resources.

ESP Safety, Inc. Contact Information

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2.0 Description

Application

The IPES-IR/UV's design and explosion-proof ratings make it an excellent choice for indoor and outdoor applications, including:

- Drilling and production platforms
- Shipping tankers, freighters, and other vessels
- Fuel loading facilities
- Refineries, bulk terminals, and tank farms
- LNG/LPG processing and storage facilities
- Compressor stations and pipeline facilities
- Petrochemical, paint, and fertilizer plants
- Power plants and gas turbine facilities
- Transportation facilities (airports and subways)
- Oil and gas fired boilers/furnaces
- Aircraft hangars

Specifications

The IPES-IR/UV meets industry certifications and requirements for Hazardous Locations.

Detection Type: Optical

Detection Method: IR and UV radiation

Spectral Range: 4.2 to 4.6 micron (IR); 180 to 250 nm (UV)

Power Supply: 18 to 32 VDC

Power Consumption: Stand By: 2 W max; Alarm State: 3 W max

Fire Relay Outputs: Single pole contact, normally open, rated 5 A @ 30 VDC; normally closed contact is available on terminal.

* Normally closed configuration is not compliant with NFPA 72, ULC/ORD – C386 and FM.

Fault Relay Outputs: Single pole contact, normally closed, rated 5A @ 30 VDC; open on fault detection or loss of power. Normally open relay also available on terminal.

Communications:

Analog output: 4-20 mA

Digital signal: RS-485 with Modbus protocol

Wiring: 14 AWG (2.08 mm²) or 16 AWG (1.31 mm²). Shielded cable is recommended.

Operating Temperature: -40°F to +185°F (-40°C to +85°C)

Storage Temperature: -76°F to +185°F (-60°C to +85°C)

Humidity: 95%, non-condensing

Hazardous Location Classification: Please refer to section 13.0 Certifications

Conduit Entry: 3/4" NPT approved Haz Loc bushing

Enclosure Materials: 316 SS or 6061 Aluminum

Enclosure Screws: Please refer to section 13.0 Certifications

Weight: SS = 11 lbs (5.0 kg); Aluminum = 5.5 lbs (2.5 kg)

3.0 Safety Considerations



Before installing and operating the IPES-IR/UV, be sure to read this entire manual. Failure to follow these guidelines could result in impaired product performance and safety hazards.

Guidelines

For maximum safety:

- Only persons who have thoroughly read and understood this manual, are trained in safety techniques, and have electric-safety certificates are permitted to install and operate the IPES-IR/UV.
- Never operate the IPES-IR/UV if the casing is damaged.
- Do not separate the IPES-IR/UV when energized.
- Refer to the Appendices and diagrams in this manual to ensure that the wiring is in compliance with local ordinances and the NEC.
- Perform regular testing and maintenance as outlined in the Maintenance section.
- Ensure that fire-alarm and fire-extinguishing systems and controls are switched off before any testing or maintenance to avoid unwanted operation of alarms and fire-extinguishing equipment.

Also see the individual sections in this manual for relevant specific safety guidelines.

Explosion Protection Means

The table below describes design features that protect the IPES-IR/UV against explosions:

Feature	Protection Means
<i>Enclosure of Current Carrying Parts</i>	The casing includes spigot joints with controlled gaps to meet explosion-proof requirements for installation in Class I, Division I, Group B, C and D, and T5 locations.
<i>Case Mechanical Strength</i>	The high mechanical strength of the case is able to withstand high explosive pressures without rupture or failures of mechanical parts. The case design is in accordance with FM 3600 and FM 3615.
<i>Manufacturing Control Of Casing</i>	Refer to Appendix A1 for manufacturing details. Important parameters include: <ul style="list-style-type: none"> • Maximum width and minimum length of spigot joints • Surface roughness of the joined parts • The number of complete intact threads at the conduit entry point

Feature	Protection Means
<i>Ignition Temperature</i>	The ignition temperature of the surrounding environment is limited by the outside surface temperature of the housing, which does not exceed 275°F (135°C).
<i>Securing of Bolts, Joints and Grounding</i>	Spring washers, lock washers, and lock nuts maintain the integrity of the bolted connections by preventing loosening of the bolts.
<i>Joined Parts Protection</i>	Anti-seize lubricant is applied on the critical joints as described on Appendix A1.
<i>Casing Ingress Protection</i>	The design of the casing is protection class IP 66 in accordance with IEC 60529-004.
<i>Sealing Cables at Conduit Entry</i>	Use approved hazardous location sealed conduit fittings. For outdoor installations, ensure sealing meets IP66 requirements.

Additional Considerations

It is important to identify false alarm sources and any conditions that could prevent the IPES-IR/UV from responding appropriately to a fire. The following should be considered:

False Alarm PreventionArc Welding and Gas Welding

Do not perform arc or gas welding within the field of view of the IPES-IR/UV. System bypass is mandatory for gas welding and is highly recommended for all welding activity. Refer to the section on FM Compliance below for results of testing with false stimuli.

Walkie-Talkies

Owing to potential EMI and RFI interference, walkie-talkies should not be used within 1 foot of the IPES-IR/UV.

Fire Types

The IPES-IR/UV can detect hydrocarbon fires from petrochemical sources, metal fires, and fires from wood and paper products. In addition, the detector is FM-approved for detecting methane, propane, n-Heptane, JP4, and methanol fires.

FM Compliance**IPES-IR/UV**

Meets FM (US and Canada) certifications and requirements for Hazardous Location classification: Class I, Division I, Group B, C and D and T5 Case design accords with FM 3600 and FM 3615. Ta = -40°C to +85°C (-40°F to +185°F) IP66

Standards

TITLE	AUTHOR-NUMBER	DATE
National Fire Alarm Code	ANSI/NFPA 72	2002
Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling	ANSI/FM - 3260	2004
Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling	FM Approvals - 3260	2000
Electrical Equipment For Use In Hazardous (Classified) Locations – General Requirements	FM Approvals – 3600	1998
Explosion proof Electrical Equipment – General Requirements	FM Approvals – 3615	2006
Flame Detectors	ULC/ORD - C386	1990
Standard for Smoke Detectors for Fire Alarm Systems	CAN/ULC - S529	2002
Threaded Conduit Entries	CSA C22.2 No. 0.5 (Reaffirmed)	1982 (1999)
Explosion-Proof Enclosures for Use in Class I Hazardous Locations	CSA C22.2 No. 30 (Reaffirmed)	1986 (2003)
Degrees of Protection Provided by Enclosures (IP Code)	ANSI/IEC 60529 CSA-C22.2 No. 60529	2004 2005
Explosive Atmospheres, General Requirements	ANSI/ISA 60079-0	2009
Explosive Atmospheres, Equipment protection by flameproof “d” enclosures	ANSI/ISA 60079-1	2009

**Flame Response
Sensitivity**

When an IPES-IR/UV detector is exposed to a series of test fires along the center line of the sensor as described in the table below, the alarm response of the IPES-IR/UV is below the 30-second response time required under FM Standard 3260.

Fuel	Distance	Fire Size	Average Time
n-Heptane	82 ft. (25 m.)	1 ft. x 1 ft. (32.5 cm.) pan	4.52 sec.
Denatured ethyl alcohol (85.4%)	82 ft. (25 m.)	1 ft. x 1 ft. (32.5 cm.)	4.9 sec.
JP4	82 ft. (25 m.)	2 ft. x 2 ft. (60 cm.) pan	Instantaneously

False Stimuli Exposure

When the IPES-IR/UV is exposed to the fires specified above, and are in the presence of the following false stimuli sources – modulated at approximately 1.5 Hz, and un-modulated – no false alarm activation or instability occurs at the minimum distances listed below.

Source	Distance
Heater	12 inches (30.48 cm.)
Arc welder	9.8 feet (3 m.)
Fluorescent	6 inches (15.24 cm.)
Halogen	6 inches (15.24 cm.)
Incandescent	6 inches (15.24 cm.)
Direct sunlight	Detectors not affected by frequency range of visible light
Indirect sunlight	Detectors not affected by frequency range of visible light

Field of View

The IPES-IR/UV’s viewing angle is varied from the center line up, down, left and right. The detector is exposed to each of the test fires described in “Flame Response Sensitivity” above at a distance described in the table below.

Fuel	Horizontal (Left)	Horizontal (Right)	Vertical (Up)	Vertical (Down)	Min, Distance	Avg. Time
n-Heptane	45°	45°	45°	45°	56.1 ft. (17.1 m.)	4.61 sec.
Denatured ethyl alcohol 85.4%	45°	45°	45°	45°	41 ft. (12.5 m.)	4.55 sec.
JP4	45°	45°	45°	45°	82 ft. (25 m.)	Instantaneously

4.0 Performance Characteristics

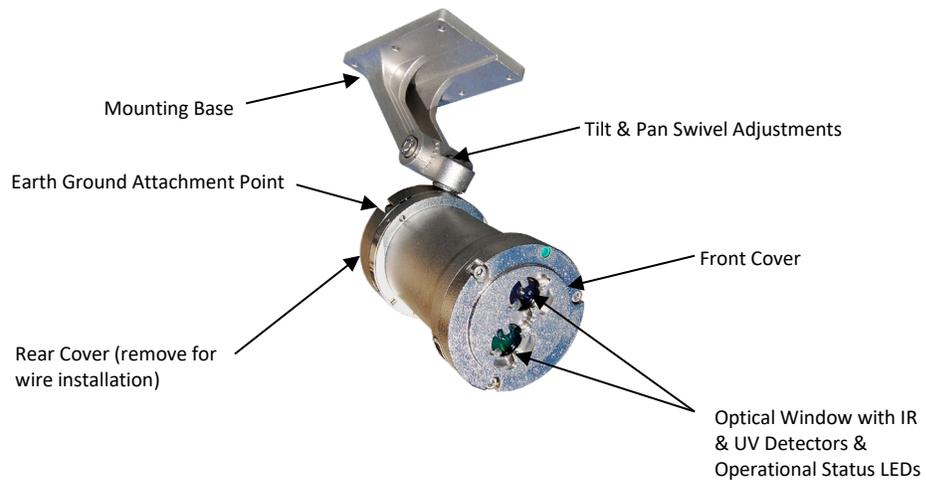


Figure 4-1: Appearance of the IPES-IR/UV

- Appearance** The IPES-IR/UV consists of an explosion-proof casing containing sensors which convert electromagnetic radiation from flames into electrical signals by use of electronic amplifiers and filters, digital-analog converters, a microprocessor, and LED indicators.
- Response Time** The IPES-IR/UV response time to detecting radiation emitted by test sources of n-Heptane combustion in a 12" x 12" (0.3m by 0.3m) pan, and ethyl alcohol combustion in a 12" x 12" (0.3m by 0.3m) pan, at a distance of 82 feet (25 meters) does not exceed 30 seconds.
- The sensitivity and response time can be varied in order to reduce the noise when the IPES-IR/UV identifies a fire, or the distance to the probable place of fire is short ("near/far" and "slow/fast" modes). Can be set using the ESP Commander program.
- Generation of Alarm Signals** The IPES-IR/UV incorporates optical filters configured for maximum sensitivity to radiation produced by flame or fire, ensuring rapid flame recognition and alarm signaling. Upon fire recognition within its 90-degree field of view, the IPES-IR/UV signals a change in state from normal to fire in any Original Equipment Manufacturer's (OEM) or proprietary alarm and response system.
- In addition, via integrated infrared (IR) and ultraviolet (UV) sensors, the IPES-IR/UV monitors in specific regions of both spectral ranges. In the infrared spectrum, the device is configured for sensitivity to wavelengths in the range of 4.2 to 4.6 microns, allowing optimal sensitivity to combustible gas fires while rejecting false signals from incandescent lamps, sunlight and hot objects. For ultraviolet radiation, the device is configured for sensitivity to wavelengths in the range of 180 to 250 nanometers, making the sensor "blind" to sunlight and radiation from heated objects but still able to "see" the UV radiation emitted by a flame. With these settings, the IPES-IR/UV selects and alarms from those characteristic wavelength emissions from the IR-UV spectrum that indicate actual flame or fire.
- The analog signals from the sensors are filtered, amplified, and then converted to digital signals which are then processed in a microcontroller via a special algorithm. This ensures the reliability of the alarm signals.
- The IPES-IR/UV takes the following parameters into consideration when generating an alarm signal:
- Magnitude of signals from different optical channels
 - Ratios between the signal amplitudes of different channels
 - Signal modulation frequency
 - Phase relationships among the channels

Elimination of False Alarms

The combination of multiple sensors and wavelength range settings makes the IPES-IR/UV an excellent choice for elimination of false positive indicators caused by non-flame sources of radiation such as artificial lighting, direct and indirect sunlight, lightning, arc welding and metal grinding.

See additional important considerations for eliminating false alarms in section 3.0 Safety.

An Alarm condition will normally override a Fault condition unless a loss of operating power impairs the detector's ability to generate or maintain an alarm. The IPES-IR/UV reports both Fault and Alarm conditions exclusive of each other. This means both a Fire and Fault can be reported at the same time if they occur simultaneously.

Serviceability

The IPES-IR/UV remains serviceable in non-heated rooms or under sheds at temperatures from -40°F to $+185^{\circ}\text{F}$ (-40° to $+85^{\circ}\text{C}$).

LED

Normal, Fire and Fault conditions are indicated by two red LEDs located on the cover. Refer to Table 4-1: Determining LED Conditions, below.

Optical Integrity

To maintain reliability of the IPES-IR/UV, the detector automatically performs a self-test. This routine test does not require the use of a test lamp. This test determines whether any dust or other contamination has formed on the detecting windows which would scatter the infrared radiation.

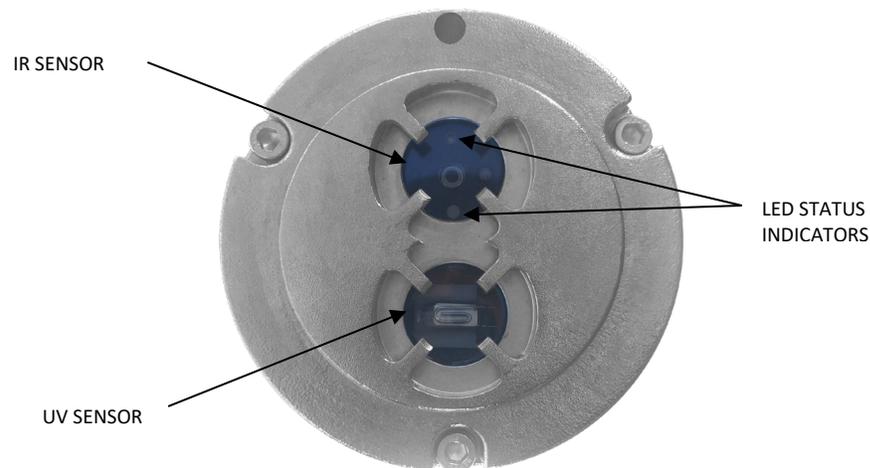


Figure 4-2: IR & UV Detectors and LED Indicators

Table 4-1: Determining LED Conditions

After completing all installation steps, refer to the illustration and LED indicator table below to determine LED conditions.

Status	Fire Relay Condition		Fault Relay Condition	Output signal, mA	Status LED condition	Status LED
	Normally closed	Normally open				
No power supply voltage	Closed	Open	Open	0	Off	
Normal	Closed	Open	Closed	4	Solid Green	
Normal IR Self Test	Closed	Open	Closed	4	Blinking YELLOW (alternating). The IR sensor self-test function occurs every 25 minutes. The two LED status indicators blink 3x alternately	
Normal UV Self Test	Closed	Open	Closed	4	Blue Halo at UV Sensor Solid Green LED Status Indicator The faint blue light is at the UV sensor is constant (always on).	

Status	Fire Relay Condition		Fault Relay Condition	Output signal, mA	Status LED condition	Status LED
	Normally closed	Normally open				
Fault or Optical Interference (dust)	Closed	Open	Open	2	Solid Amber LED.	
Fire (no fault)	Open	Closed	Closed	20	Simultaneous Solid Red LED and Solid Green LED	
Fire (with fault)	Open	Closed	Open	16	Simultaneous Solid Red LED and Solid Amber LED * The amber LED will revert to green when the fault condition clears, at which point the mA output will go from 16mA to 20mA	
Test Mode (no radiation)	Closed	Open	Open	2	LED status indicators are OFF	
Test Mode (radiation applied)	Closed	Open	Open	2	Simultaneous Solid Red LED lights. Lights will remain as long as radiation is applied to the sensors, at which point the LED indicators will be OFF. They will remain off until the magnetic test collar is removed.	

Analog Signal

Analog signal (4-20 mA)	
Signal level	Detector State
(±0.1) mA	Circuit opening
(1 ± 0.1) mA	Initialization
(2 ± 0.1) mA	Fault
(4 ± 0.1) mA	Normal
(8 ± 0.1) mA	Pre-Fire (IR Channel Engaged)
(12 ± 0.1) mA	Pre-Fire (UV Channel Engaged)
(16 ± 0.1) mA	Fire (w/ Fault)
(20 ± 0.1) mA	Fire (no Fault)
(2 ± 0.1) mA	Test

Digital Signal

Informational digital signals are standard RS-485 communication with Modbus:

- Hardware self-test Fault
- Optical interference Fault
- Fire detected

(The digital channel protocol Modbus RTU is described in Appendix B.)

Relay Dry Contact Signal

Relay dry contact signal:

- Operation of the normally open Fire relay dry contacts *
 - FIRE relay – two-directional single-pole contact, which allows the state to be changed at the output to normally closed or normally open by wiring the terminal. The contact relay is rated for currents ranging from 10 mA to 5 A at DC voltage of 30 V.
 - The output signal “Fire” can be cleared after eliminating the source of the alarm signal.
- * A normally closed condition of the Fire relay contacts does not comply with the requirements of NFPA 72 or ULC/ORD – C386 and is not approved by FM approvals.
- Operation of the normally open Fault relay dry contacts
 - FAULT relay – can be set to NO or NC at the terminal. The relay is designed to handle currents of 10 mA to 5 A at DC voltage of 30 V.

Refer to Table 4-1: Determining LED Conditions above.

Operating Modes**Possible detector configurations using ESP Commander**

The IPES-IR/UV has the following detector operating modes:

- “Near/far” and “slow/fast” modes – To provide maximum sensitivity.
- “Latching/non-latching mode” – To select either latching or non-latching functionality of the fire relay, which provides latching alarm state for the fire-alarm relay in compliance with NFPA 72 and ULC/ORD – C386.

The manufacturer’s default settings correspond to far and fast. To change the manufacturer’s settings connect the flame detector to the computer and use the ESP Commander program.

5.0 Installation**Component Parts
and Delivery Set**

The IPES-IR/UV detector component parts and delivery set consists of the following:

- One IPES-IR/UV Detector with one mounting base.
(10010-001/10011-001 Stainless Steel or 10010-002/10011-002 Aluminum)
- One Operating Manual 80010-001
- Accessory Kit (bolts, nuts, washers, etc.). Refer to Appendix A-1, Drawing 80025-001, for further details.
- Optional magnetic collar (delivered only by special request).

Compare the contents of the set to the packing list to be sure all items were received. If any items are missing, contact ESP Safety Inc.

Visual Examination

Before installing the IPES-IR/UV, examine the detector to be sure that:

- The nameplates and warning labels are in place.
- The external surfaces of the elements and joined surfaces of the casing are free of dents or damage. (Refer to Appendix A1, Drawing 80033-001, and Appendix A2, Drawing 80025-001.)
- The tamper-proof screw is intact on the front cover (See Appendix A2, Drawing 80025-001.)

**Pre-Installation
Steps**

Make sure all removable parts are joined to the casing as tightly as possible.



Warning: Do not open, separate or disassemble casing when energized! Separating the casing can result in serious damage to the detector which could go undetected, resulting in failure to detect fires.

Installation**Positioning the Detector**

1. Position the detector to provide an unobstructed view of the area to be protected. The detector’s 90° viewing angle is most sensitive along the central axis; therefore, position the central axis so that it has the best unobstructed view of the place of probable fire. Use line of sight or laser level for more precise targeting.

2. Identify all high risk fire sources, to determine the number of detectors needed for adequate coverage.
3. Locate the detector(s) for ease of cleaning and servicing. Ensure that probable fire sources are within the detector(s) field of view and detection range.
4. When installing multiple detectors in the same area, be aware of overlapping fields of view and detector hierarchy. Overlapping fields of view can be used to provide additional protection against false positives or false negatives, depending on the control system logic connected to the detectors.

Note: To mitigate false positives, position the detector so that its field of view does not cover any areas outside the hazardous area.

5. Mount the detector on a rigid surface which minimizes vibrations. Use the mounting hardware provided along with the rubber bushings to further isolate the detector from vibrations (see Appendix A-2, Drawing 80025-001, Sheet 1).

Note: ESP Safety Inc recommends bolting the mounting base plate to the mounting surface. If bolting is not possible, the mounting plate can be welded to the mounting surface if it is a similar metal (either 316 Stainless Steel or 6061 aluminum). Before welding, be sure to remove the detector from the base plate before attempting any weld operation.

Moisture Damage Protection

- It is the responsibility of the installer to take proper precautions during installation to protect the electrical connections and components from moisture.
- Anti-seize lubricant is provided for easy assembly and corrosion protection of the joints between the enclosure/cover and enclosure/base. After disassembly, wipe these surfaces clean with a soft cotton or wool cloth and then re-apply a thin layer of lubricant prior to assembly. See Appendix A-2 (Drawing 80025-001, Sheet 1).
- If installing wiring cable in conduit, do not use conduit for wiring to other equipment.
- Care should be taken to not install the detector where heavy condensate, rain, or fog can cover the lens and reduce the sensitivity of the detector.

If possible, conduct fire tests to confirm detection.



Caution: All cable/conduit entries must be sealed with an appropriate and certified sealing plug and cable gland. The use of industrial grade, armored field cable is recommended.

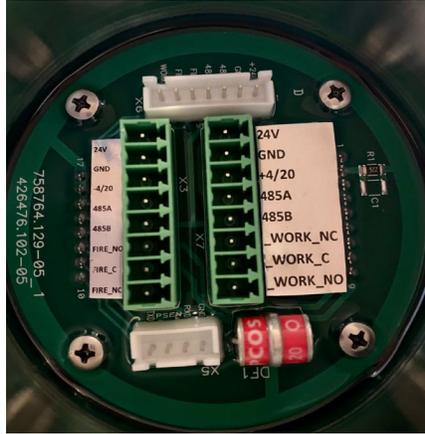


Figure 5-1: View of IPES-IR/UV with Base Removed

Table 5-1: Arrangement of Electrical Connections

Arrangement of Electrical Connections

Arrange the electrical connections as described in Table 5-1, Table 5-2 and Figure 5-3 below.

To connect the IPES-IR/UV to external devices, use armored control cables 4 x 1.5, which are used in all classes of explosive zones including indoor and outdoor sites, channels, tunnels, ground (trenches) with corrosive medium, and in zones containing roaming currents.

Wiring Requirements

- The temperature rating of all field wiring conductors shall be at least 10° C greater than the maximum ambient temperature
- Communications: 14 AWG (2.08 mm 2) or 16 AWG (1.31 mm 2) shielded cable, twisted pair is recommended to protect against EMI and RFI interference; Power: 14 AWG (2.08 mm 2) or 16 AWG (1.31 mm 2) wires.
- Ground wire shall be 14 AWG (2.08 mm 2)
- The wiring color and type shall comply with local codes, ordinances, and the NEC. It is recommended that the local authority be consulted in case of doubt.
- Follow the wiring instructions in this manual to ensure correct functioning of the detector.

Setting the Modbus Address and Baud Rate

To ensure proper communications, a unique address must be assigned to each device, as duplicate addresses are not automatically detected. Modules with duplicate addresses will report with the same address, confusing latest updates. Record all addresses and device types after completing the installation.

Refer to Appendix B for setting the Modbus address and baud rate.

**Completing the
Installation**

For the following, refer to the illustrations in Appendix A2 (Drawing 80025-001, Sheets 1 & 2).

1. Unscrew the M5 Socket Head Cap screws from the base. Remove the detector from the base.
2. Detach NPT conduit bushing from base.
3. Install the base on a suitable work platform and secure using the 4 mounting screws, washers, nuts, and rubber grommets.
4. Run the power, control, and ground wires from the conduit into the conduit bushing and connect to the wiring terminals in the base. Follow Figure 5-2, Arrangement and Functions of Mounting Connection Terminals, for details.
5. Tighten the conduit bushing to 4-1/2 +- 1 turns of engagement. **Seal** the conduit entry with an approved hazardous location conduit sealant.
6. Run the earth ground wire to the external ground stud on the base.
7. After completing all wiring, refer to Table 4-1 to verify the functionality of the front cover LEDs.
8. Inspect base and re-apply a thin film of anti-seize compound if required; re-install the detector on the base and evenly tighten the M5 screws to 40 in-lbs.
9. Upon completing the installation, check the resistance of the earth ground lug to ground which should not exceed 1 ohm.



Figure 5-2: Arrangement and Functions of Mounting Connection Terminals

Arrangement and Function of Mounting Connection Terminals

The arrangement and function of mounting connection terminals used to connect the IPES-IR/UV to a control system are shown below.

Table 5-2: Connecting Terminals

Receptacle	Pin	Function
X3	+24V	24VDC from system power source (External User Provided)
	GND	System Ground from system power source (External User Provided)
	-4/20	Industry Standard +4-20mA current loop output
	RS485A	RS-485 MODBUS
	RS485B	RS-485 MODBUS
	FIRE_NO_	Alarm Relay Normally Open (Relay closes when in Fire Alarm Mode)
	FIRE_Common FIRE_NC	Alarm Relay Common Alarm Relay Normally Closed. (Relay opens when in Fire Alarm mode)
X7	+24V	Output to next device if required
	GND	Output to next device if required
	+4/20	Industry Standard +4-20mA current loop output
	RS485A	Output to next device if required
	RS485B	Output to next device if required
	R_WORK NO	Fault / Obstruction Relay Normally Open (Relay closes when in Fault Alarm Mode)
	R_WORK Com R_WORK NC	Fault Relay Common Fault Rea/Obstruction Relay Normally Closed (Relay opens when in Fault Mode)
X5		Factory Use
X6		Factory Use

- 1) When using an RS-485 bus connection, it is advisable to connect the IPES-IR/UV to the bus via the terminal box. To connect the detector to the terminal box, use a cable not longer than 1.64 feet (0.5 m). The cable characteristics should meet the requirement of the cable entries mounted on the IPES-IR/UV casing and those of the terminal box.
- 2) Arrange the power-supply system so that the power-supply voltage across the device terminals ranges from 18 to 32 V (taking into account the IPES-IR/UV consumption).

Connection to RS485 Digital Circuit

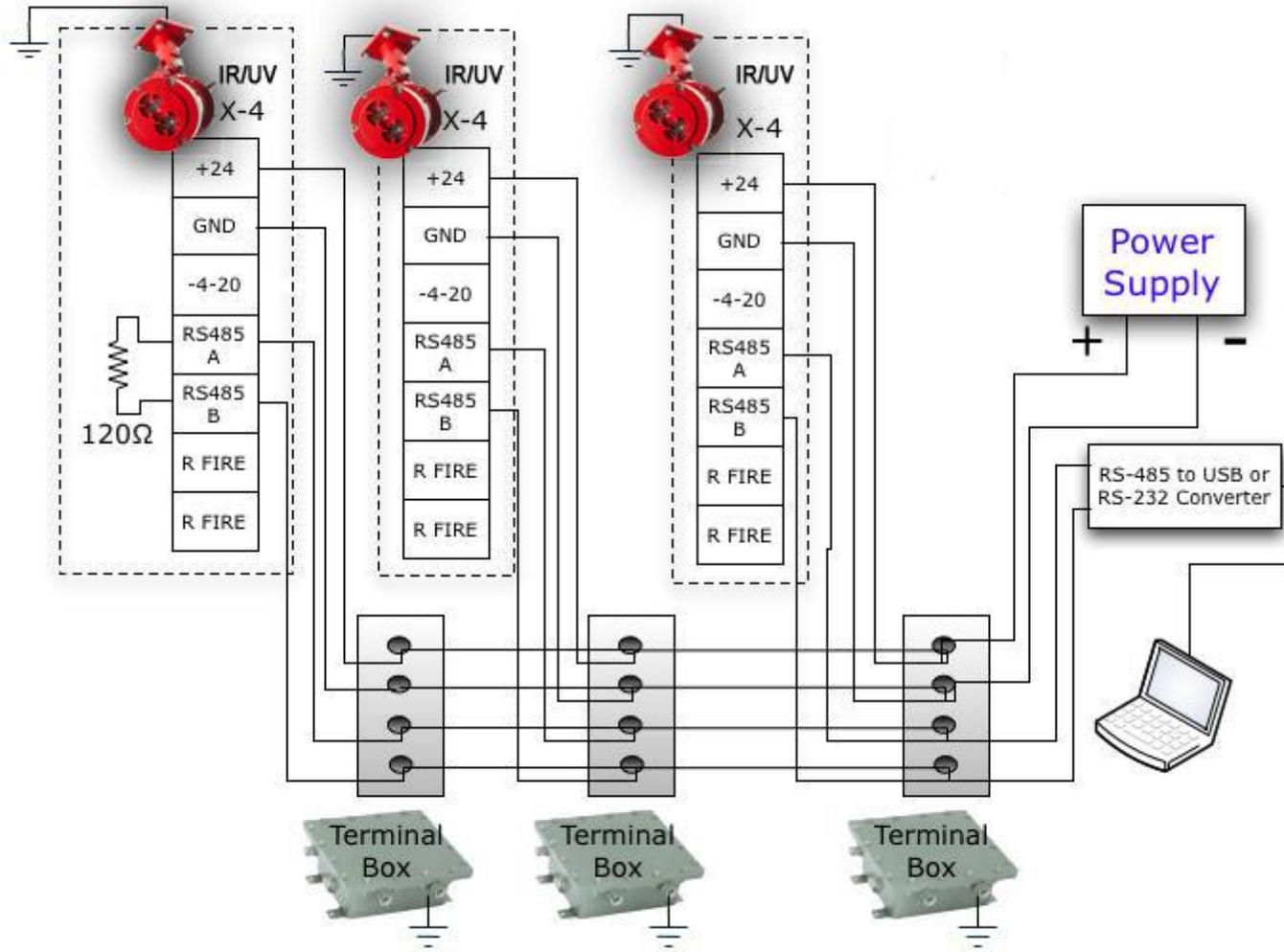


Figure 5-3:
IPES-IR/UV Connection to Digital Circuit RS 485

6.0 Startup and Operation

Installation Review Prior to Startup

Once the mounting, cabling, and alarm relay installation has been completed, the IPES IR/UV is ready to begin the power-on sequence.

Before applying power to the system for the first time, review the steps below:

- Verify that the IPES IR/UV has been properly mounted.
- Verify that all conduit / cable gland entries have been tightened and sealed if necessary.
- Verify that all sensor wiring has been installed correctly.
- Verify that the enclosure has been connected to an earth/ground.
- Verify that the IPES IR/UV cover is securely installed
- Disconnect or power down all output devices and alarms to prevent false actuation.

Once you are ready to begin startup, verify that the power supply is connected properly and verify the power supply voltage with the IPES IR/UV is disconnected at the source. The IPES IR/UV is powered by 24 VDC (18 to 32 VDC voltage range).

After completing the above, the IPES IR/UV is ready to be powered on.

Startup

Performance Test

After installation is complete, conduct a performance test as follows, to ensure that the detector is functioning properly.

Test Equipment

ESP Safety, Inc.'s ITES Test Lamp (part number 50020-001) is designed to assist in the functional testing of the detectors without the need to remove the detector from the application. The Test Lamp generates directed modulated radiation with sufficient intensity to signal a flame or fire response to the detector, indicated by a continuous LED on the IPES-IR/UV.

Each Test Lamp is supplied pre-assembled with an emission source, housing, batteries, and an Operating Manual.



**ITES Test Lamp
(Part Number 120-0007)**

Procedure

Perform this test on all detectors in the system.

1. Apply power to the detector. After 1 to 5 seconds, the output current will increase to 4 mA, and the indicating LEDs will start blinking.
2. If it is necessary to isolate the detector fire relay from the alarm system, apply the magnetic collar over the enclosure as shown in Figure 6-1. Placing the collar over the enclosure as shown allows the fire relay contacts to remain in the non-alarm state during testing.
3. Perform the test with the ITES Test Lamp as follows:
 - a) Position the Test Lamp at a distance of 0.5 to 1 meters from the front cover of the detector.
 - b) Turn the Test Lamp on and adjust the beam of light so it covers the front cover of the detector.
 - c) The detector's front red indicator LED will light, confirming detection. If the Test Lamp is turned off, the red indicator will stay lit for up to 10 seconds, depending on the detector's internal switch configuration.
 - d) The Test Lamp can be used to verify the field of view of the detector up to a distance of 2 meters away.
4. If any detector fails this test, refer to Section 7.0, Troubleshooting.
5. Once testing is complete, remove the magnetic collar before reconnecting the detector to the fire-alarm or burglar-fire alarm system.

NOTES:

- Always make sure that the Test Lamp has fresh batteries.
- Keep the Test Lamp lens free from dust, dirt, and moisture. If necessary, clean the lens with a soft wool or cotton cloth.

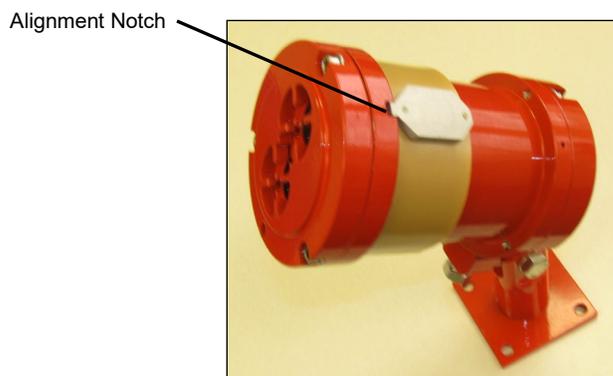


Figure 6-1: IPES IR/UV with Magnetic Switch Collar

Operation



It is important that this entire manual be thoroughly read and understood prior to operating the IPES-IR/UV detector, to avoid compromising performance and safety. Only personnel trained in safety techniques who have electric-safety certificates and experience in dangerous explosive zones, and are familiar with the design of the IPES-IR/UV and have thoroughly read and understood this Operating Manual, should operate the IPES-IR/UV.

Always observe all local site safety precautions while working with the IPES-IR/UV.

- Ensure that the detector is equipped with internal and external grounding devices and grounding marking.
- See Section 5.0, Installation, Tables 5-1 and 5-2, and Figure 5-3 for the recommended circuits and digital outputs to connect the detector to fire-alarm and burglar-fire alarm systems.
- Within 1 to 5 seconds after switching on the IPES-IR/UV, it will produce an electrical current of 4 mA. The indicating LEDs will begin blinking.

7.0 Troubleshooting



The sensor module ("front" half of the detector) contains no user-serviceable components and should never be opened. The terminal compartment is the only part of the enclosure that should be opened by the user in the field.

Troubleshooting Table

If testing reveals a Fault condition or failure to detect a flame, follow the troubleshooting procedures in the table below. The table describes a variety of possible failures and corrective actions.

If the troubleshooting procedures do not correct the problem, contact ESP Safety Inc.

Table 7-1: Troubleshooting Symptoms, Causes and Procedures

Failure Symptoms	Possible Cause	Corrective Procedure
Red LEDs do not glow.	No power supply.	Detach the base with the cable entry from the IPES-IR/UV casing and ensure that the terminals are supplied with voltage of 24±6 V.
Fault relay contacts are open; signaling LEDs blink frequently.*	Optical interference (dust)	Wipe the protection windows with a soft cloth wetted with denatured isopropyl alcohol (IPA) and then wipe with a clean dry cloth to remove any residual dirt.
IPES does not react to the test flame.	Optical interference (dust, or contaminated with substances) preventing passage of radiation to the detector.	Wipe the protection windows with a soft cloth wetted with denatured isopropyl alcohol (IPA) and then wipe with a clean dry cloth to remove any residue of dirt.

* Refer to Table 4-1, Determining LED Conditions, in Section 4.0 Performance Characteristics.

8.0 Maintenance



Fire-alarm and burglar-fire alarm systems must be switched off during testing to avoid operation of fire-fighting equipment.

Maintenance Activities

IPES-IR/UV maintenance includes the following activities:

- Visual examination
- Cleaning
- Checking the grounding and explosion-protection systems
- Performance test.

This section describes maintenance activities to be performed once a day or every six months. Automatic testing is also discussed.

Daily Maintenance

Visual Examination

Perform a daily examination of the IPES-IR/UV, checking for any visible mechanical damage such as dents to the enclosure or a cracked lens. If any damage is noted, immediately pull the detector from service and replace with a new detector.

Every Six Months

Every six months, or as required, perform the following:

Cleaning

Clean the IPES-IR/UV every six months (if there is no visible severe contamination) or as required if the signal "Fault" arises; also clean the surface of the detector if it is covered with dust. To clean the detector:

- **Enclosure** - Remove dust from the enclosure with a brush or a soft cloth slightly wetted with denatured isopropyl alcohol (IPA). After wiping the surface with alcohol, wipe again with a clean dry cloth to remove any residual dirt.
- **Protection windows** – Clean with a soft cloth wetted with denatured isopropyl alcohol (IPA). After wiping the surface with alcohol, wipe again with a clean dry cloth to remove any residual dirt.

Grounding and Explosion-Protection Systems

Check to be sure that the joints are sufficiently tight. Thoroughly clean the external grounding wire and apply anti-seize lubricant (supplied by the manufacturer) on the critical joints as referenced in Appendix A1 (Drawing 80033-001).

Perform this test on all detectors in the system.

1. Apply power to the detector. After 1 to 5 seconds, the output current will increase to 4 mA, and the indicating LEDs will start blinking.
2. If it is necessary to isolate the detector fire relay from the alarm system, apply the magnetic collar over the enclosure as shown in Figure 6-1. Placing the collar over the enclosure as shown allows the fire relay contacts to remain in the non-alarm state during testing.

3. Perform the test with the ITES Test Lamp as follows:
 - a) Position the Test Lamp at a distance of 0.5 to 1 meters from the front cover of the detector.
 - b) Turn the Test Lamp on and adjust the beam of light so it covers the front cover of the detector.
 - c) The detector's front red indicator LED will light, confirming detection. If the test lamp is turned off, the red indicator will stay lit for up to 10 seconds, depending on the detector's internal switch configuration.
 - d) The Test Lamp can be used to verify the field of view of the detector up to a distance of 2 meters away.
4. If any detector fails this test, refer to Section 7.0, Troubleshooting.
5. Once testing is complete, remove the magnetic collar before reconnecting the detector to the fire-alarm or burglar-fire alarm system.

NOTES:

- Always make sure that the Test Lamp has fresh batteries.
- Keep the Test Lamp lens free from dust, dirt, and moisture. If necessary, clean the lens with a soft wool or cotton cloth.

Automatic Testing

If the lens becomes dirty or coated, a change in radiation transmissibility could reduce the detector's sensitivity. To safeguard against this, the IPES-IR/UV continuously tests the lens for optical clarity and sends a Fault alarm when the radiation transmissibility reaches a critical threshold.

In addition, the sensors are routinely tested every 25 to 45 minutes by use of internal test lamps. If the IR or UV sensor does not pass the self-test, a Fault alarm is sent. This routine test does not require the use of an external Test Lamp.

9.0 Transportation and Storage

Transportation

When shipped in the factory-supplied carton, the model IPES-IR/UV can be shipped via any method of transportation from the manufacturer's site to any destination regardless of distance.

Storage

Until use, store the detector in the manufacturer's original carton. The storage facility should be free of dust, acid and alkaline vapors, corrosive gases and other harmful substances.

10.0 Warranties

ESP Safety, Inc. ("ESP") warrants the IPES-IR/UV Flame Detector to be free from defects in material and workmanship under normal use and service for a period of five (5) years, beginning on the date of shipment to the buyer. This warranty extends only to the sale of new and unused products to the original buyer. ESP's warranty obligation is limited, at ESP's option, to refund of the purchase price, repair, or replacement of a defective product or a component thereof, to the extent that the product is properly returned to ESP within the warranty period.

This warranty does not include:

- a) fuses, disposable batteries or the routine replacement of parts due to the normal wear and tear of the product arising from use;
- b) any product or component which in ESP's opinion, has been misused, altered, abused, tampered with, improperly maintained or used, neglected or otherwise damaged by accident or abnormal conditions of operation, handling or use, or to have deteriorated due to aging of any component made of rubber or any other elastomer; or
- c) any damage or defect attributable to repair of the product by any person other than an authorized dealer, or the installation of unapproved parts on the product.

The obligations set forth in this warranty are conditional on:

- a) proper storage, installation, calibration, use, maintenance and compliance with the product manual instructions and any other applicable recommendations of ESP;
- b) the buyer promptly notifying ESP of any defect and, if required, promptly making the product available for correction. No goods shall be returned to ESP until receipt by buyer of shipping instructions from ESP. A return authorization number must be obtained from ESP prior to shipment; and
- c) all warranty returns being shipped directly to ESP Safety, Inc.;
- d) the right of ESP to require that the buyer provide proof of purchase such as the original invoice, bill of sale or packing slip to establish that the product is within the warranty period.

THE BUYER AGREES THAT THIS WARRANTY IS THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ESP SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES. ESP WILL NOT BE LIABLE FOR LOSS OR DAMAGE OF ANY KIND CONNECTED TO THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY. IN NO EVENT SHALL ESP'S LIABILITY HEREUNDER EXCEED THE PURCHASE PRICE ACTUALLY PAID BY THE BUYER FOR THE PRODUCT.

To the extent any provision of this warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Expected Service Life of Unit The average expected life of the IPES-IR/UV is not less than 10 years.

11.0 Repair and Return

Field Repair

The IPES-IR/UV Flame Detector is not intended to be repaired in the field. If a problem should develop, refer to the troubleshooting section of this manual. If it is determined that the problem falls within this warranty, please return the product to ESP as instructed hereunder.

Return Material Authorization (RMA) Number

Contact ESP Safety Inc. at +1-408-886-9746 to obtain a Return Material Authorization (RMA) number. Please provide the following information during your call:

- Your Company Name
- Product Type
- Serial Number
- Date of Shipment
- Brief explanation of malfunction

Pack the unit properly to ensure that no shipping damage occurs and ship to:

ESP Safety, Inc.
555 North
First Street
San Jose, CA
95112 USA

Write the RMA number on the front of the shipping carton.

12.0 Parts Ordering Information

The following items for the IPES-IR/UV may be ordered:

- IPES Mounting Hardware, part number 120-0048
- IPES Test Lamp, part number 120-0007
- Magnetic collar, part number 120-0006

Order from:

ESP Safety Inc
555 North First Street
San Jose, CA 95112
Ph: 408-886-9746
Fax: 408-688-0848

Please note that shipping charges will be added to your order.

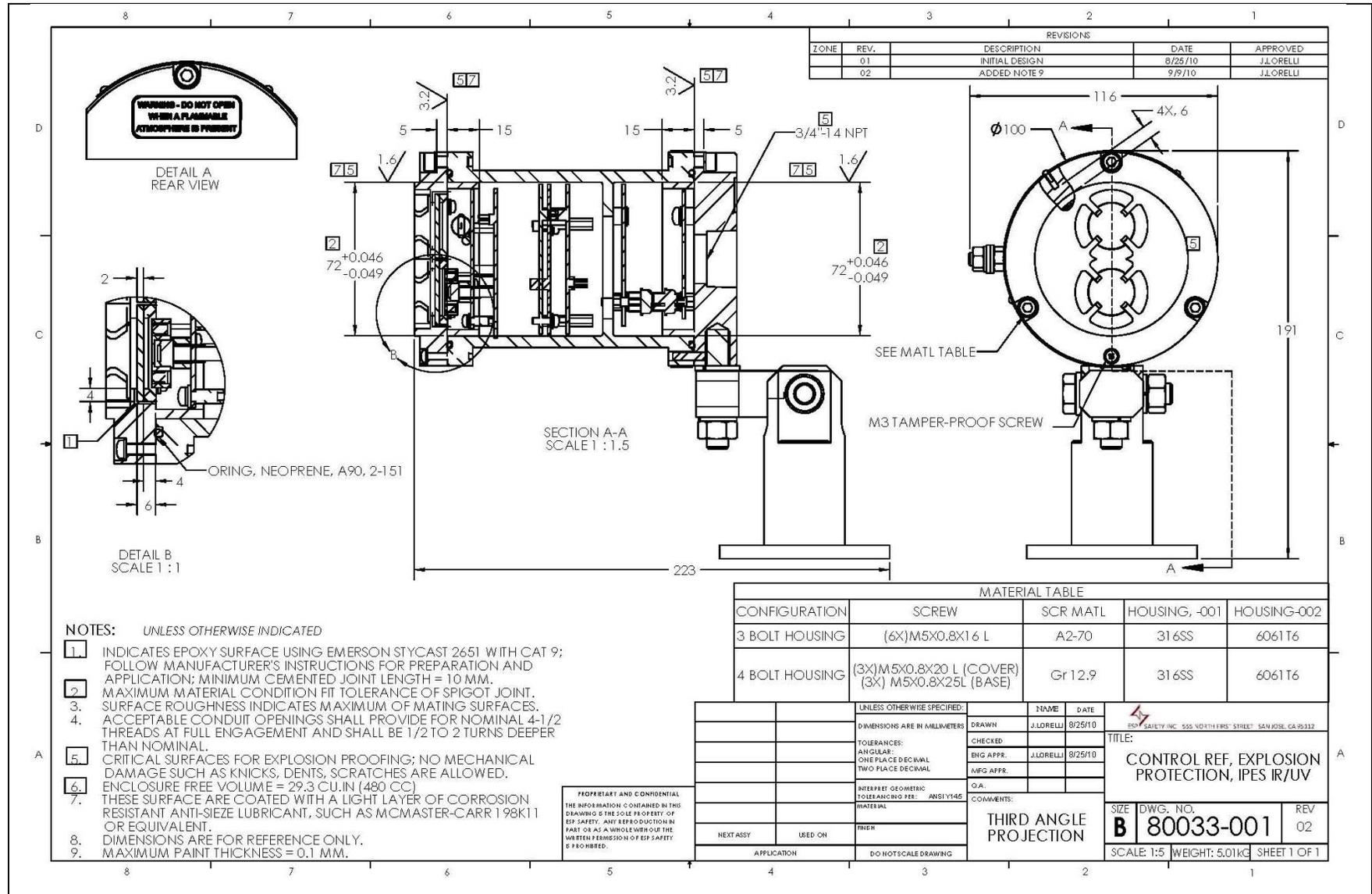
13.0 Certifications

The IPES-IR/UV meets the following certifications:

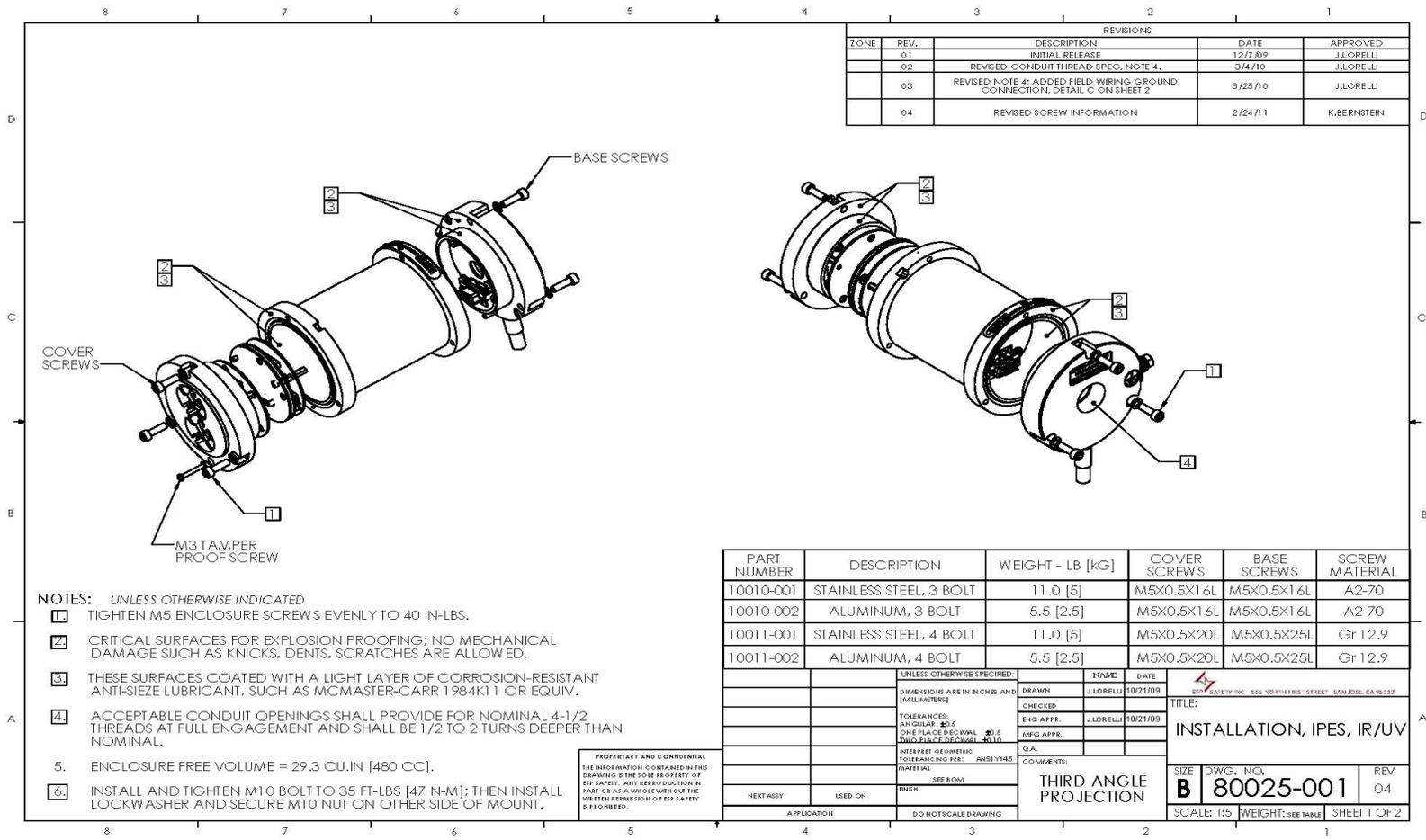
<p>FM (U.S. & Canada)</p> <p>Hazardous Locations</p> <p>Zone Locations</p>	 <p>Class I, Zone 1, AEx d IIC, T5, Gb</p> <ol style="list-style-type: none"> 1. ISO Class 12.9, M5 X 20 socket-head cap screws (Yield Stress 1100 MPa) shall be used to replace the cover fasteners. 2. ISO Class 12.9, M5 X 25 socket-head cap screws (Yield Stress 1100 MPa) shall be used to replace the base fasteners.
<p>Fire Protection Equipment</p>	<p>Approval Standards: FM3260 (2000); FM3600 (1998); FM3615 (2006); ANSI/ISA 60079-0 (2009); ANSI/ISA 60079-1 (2009); CAN/CSA-C22.2 No. 60079-0 (2007); CAN/CSA-C22.2 No. 60079-1 (2007)</p> <p>Supporting Standards: ANSI/FM3260 (2004); ANSI/NFPA 72 (2002); ULC/ORD – C386 (1990); CAN/ULC – S529 (2002); CSA C22.2 No. 0.5 (reaffirmed 1999); C22.2 No. 32 (reaffirmed 2003); ANSI/IEC 60529 (2004); CSA-C22.2 No. 60259 (2005)</p>
<p>ABS</p>	 <p>Class I, Division 1, Groups B, C & D, T5 Ta = -40°C to +85°C (-40°F to +185°F) IP66</p>
<p>ATEX/CE</p>	 <p>Flameproof “d”</p> <p>Ex d IIC T5 Gb Ta = -40°F to +185°F (-40°C to +85°C)</p> <p>Supporting Standards: EN 60079-0:2009; EN 60079-1:2007</p> <p>ATEX Certificate Number: FM10ATEX0043X</p> <p>Specific Conditions of Use:</p> <ol style="list-style-type: none"> 1. ISO Class A2-70, M5 X 16 socket-head cap screws (Yield Stress 450 MPa) shall be used to replace the cover fasteners. 2. ISO Class A2-70, M5 X 16 socket-head cap screws (Yield Stress 450 MPa) shall be used to replace the base fasteners. 3. Consult the manufacturer if dimensional information on the flameproof joints is necessary. <p>Certificate of Conformity: CE Mark for EMC (TUV)</p> <p>CE Mark for ATEX</p> <p>IP66</p>

<p><i>IEC/</i> <i>IECEX</i></p>	<p>Flameproof “d”</p> <p>Ex d IIC T5 Gb Ta = -40°F to +185°F (-40°C to +85°C)</p> <p>Supporting Standards: IEC 60079-0:2007; IEC 60079-1:2007</p> <p>IECEX Certificate Number: IECEX FMG 10.0016X</p> <p>Specific Conditions of Use:</p> <ol style="list-style-type: none">1. ISO Class A2-70, M5 X 16 socket-head cap screws (Yield Stress 450 MPa) shall be used to replace the cover fasteners.2. ISO Class A2-70, M5 X 16 socket-head cap screws (Yield Stress 450 MPa) shall be used to replace the base fasteners.3. Consult the manufacturer if dimensional information on the flameproof joints is necessary.
<p><i>Ingress Protection</i></p>	<p>IP66 = Dust Tight, Powerful Jetting</p>

Appendix A1: IPES-IR/UV Explosion Protection Means



Appendix A-2: IPES-IR/UV Installation



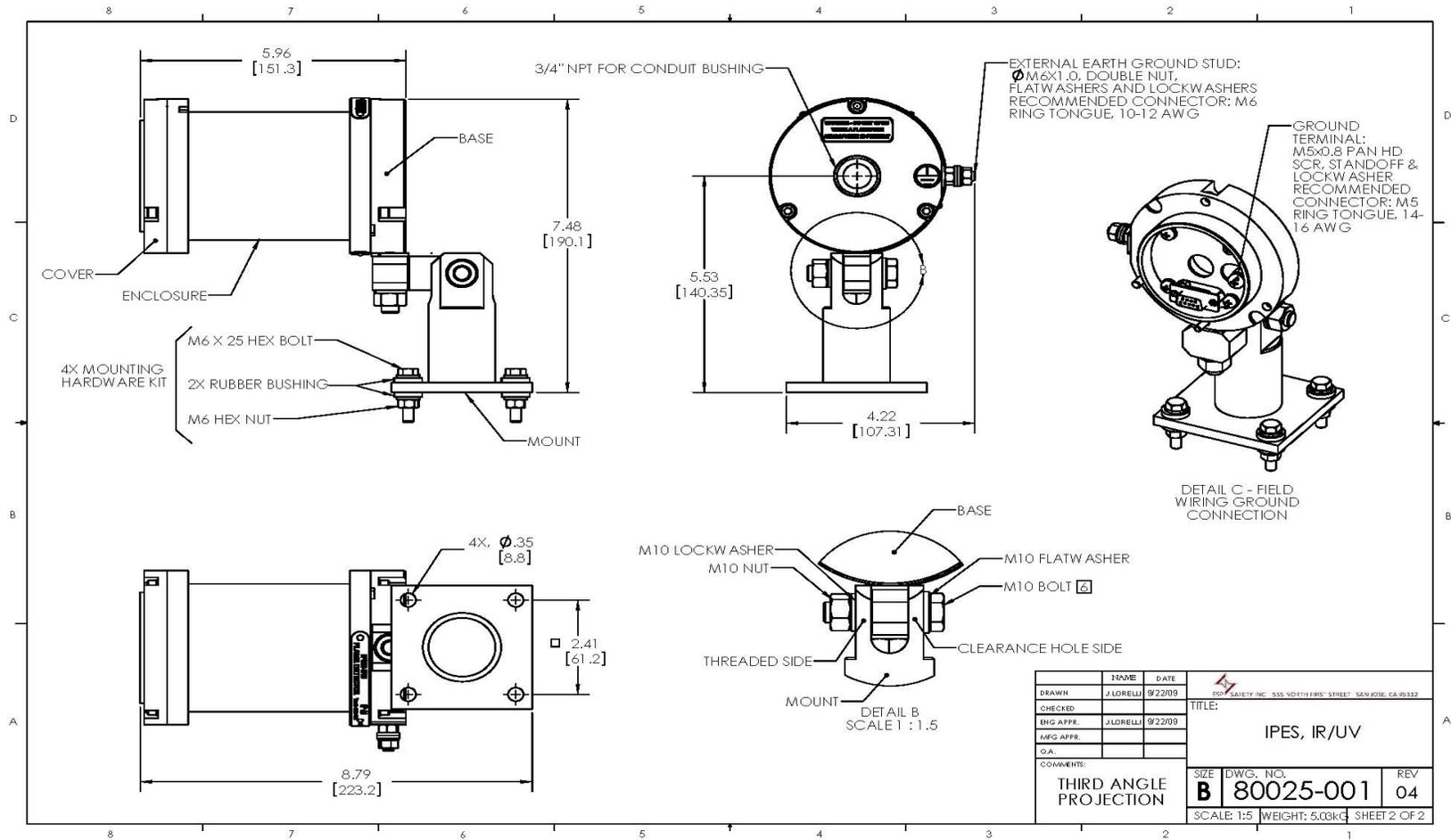


Figure A-2: Installation

Appendix B: IPES Digital Communications Protocol**IPES Commands**

In addition to supporting analog signals (current loop and relays), IPES-IR/UV flame detectors are also capable of digital communications with remote consoles. IPES-IR/UV detectors use a standard RS-485 interface with a Modbus RTU protocol layer defining the transactions between the IPES-IR/UV and the console. Refer to the document “MODBUS APPLICATION PROTOCOL SPECIFICATION v1.1b” available online at www.modbus.org for complete details of the Modbus protocol.

**Setting Address/
Baud Rate
Command**

The factory default Modbus address for the IPES-IR/UV is 247. The factory default baud rate for each detector is 9600.

The following 8-byte Modbus command must be sent to the IPES-IR/UV in order for the Modbus address and baud rate to be changed:

Set address/baud rate command	
Byte	Description
0	Current Modbus address (247 if IPES-IR/UV set to factory default)
1	6 (Modbus function code for writing to the device)
2	0
3	0
4	New Modbus address (must be in the range 1 to 247)
5	New baud rate (must be one of the following values): 1 – 1200 baud 2 – 2400 baud 4 – 4800 baud 8 – 9600 baud 16 – 19200 baud
6	Low byte of 16-bit CRC
7	High byte of 16-bit CRC



The Modbus address and baud rate are stored in non-volatile memory with a write endurance of 10000 erase-write cycles. Repeated transmission of the set address/baud rate command to the IPES-IR/UV detector can potentially degrade the memory beyond its ability to retain the data being written to it. The address and baud rate should be changed only when necessary to connect the IPES-IR/UV detector to a remote console.

The IPES-IR/UV will respond to the host by transmitting an identical packet to the host at the original baud that was used to receive the command. After the response has been transmitted, the IPES-IR/UV will change its Modbus address and baud rate to the ones specified in the command. At that point, the remote console must change its baud rate in order to communicate further with the detector. The new Modbus address and baud rate are stored in non-volatile memory and these parameters will be retained through power cycles.

**Poll Status
Command**

The following 8-byte Modbus command may be sent in order to poll the status of the IPES-IR/UV:

8-byte Modbus command	
Byte	Description
0	Current Modbus address (247 if IPES-IR/UV set to factory default.
1	4 (Modbus function code for reading from the device)
2	0
3	1
4	0
5	1
6	Low byte of 16-bit CRC
7	High byte of 16-bit CRC

The IPES-IR/UV responds with a 7-byte packet with the following format:

7 byte Poll Status Command	
Byte	Description
0	Current Modbus address
1	4 (Modbus function code for reading from the device)
2	2
3	Status: Bit 0: 1 = fast detection, 0 = slow detection Bit 1: 1 = high sensitivity, 0 = medium sensitivity Bit 2: 1 = latching on, 0 = latching off Bit 3: 1 = fire relay enable, 0 = fire relay disable Bit 4: 1 = fault relay enable, 0 = fault relay disable Bit 5: 1 = heater enable, 0 = heater disable Bit 6: mfr use Bit7: mfr use
4	Detector status Bit 0: 1 = fire detected, 0 = no fire detected Bit 1: 1 = hardware fault, 0 = no hardware fault Bit 2: 1 = dust fault, 0 = no dust fault Bits 3-7: not used.
5	Low byte of 16-bit CRC
6	High byte of 16-bit CRC



Sending any commands other than those specified is not permitted.