IPES Single-Channel IPES-UV Flame Detector

Addendum to

80010-001 R06

ESP SAFETY INC

Technology of the Future...Protection for today

IPES-UV Single Channel Detector
Flame Detector

Addendum to Operating Manual
820-0010 R06

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This document is issued as an addendum to the IPES-IR/UV Operating Manual. End-users of IPES-UV flame detectors should refer to this document and Operating Manual 80010-001 R06 when installing, servicing or operating the ESP Safety IPES-UV flame detector.

Table of Contents

Refer to Operating Manual 80010-001 R06 for the Following Sections:

1.0 IPES-UV Single-Channel UV Detector

IPES-UV Single Channel Detector

Principles of Operation

The IPES-UV monitors for flames in the ultraviolet (UV) spectrum by analyzing the electromagnetic radiation within its viewing field. The presence of a flame in the detector's viewing field is characterized by an increase in emissions of UV, visible and IR radiation.

The detection optics of the IPES-UV is configured for sensitivity in the range of 180 to 250 nanometers. This selective bandwidth range in conjunction with algorithms programmed into the on-board microprocessor eliminates false alarms caused by sunlight and radiation from heated objects but still able to "see" the UV radiation emitted by a flame.

Upon detection of a flame, the IPES-UV produces a signal to activate an alarm, actuate a fire suppression system or engage a process shutdown.

Description

The IPES can be configured to operate as a single-channel detector, monitoring for flames strictly in the ultraviolet (UV) spectrum. The detection optics of the IPES-UV is configured for sensitivity in the range of 180 to 250 nanometers. This selective bandwidth range in conjunction with algorithms programmed into the on-board microprocessor eliminates false alarms caused by sunlight and radiation from heated objects but still able to "see" the UV radiation emitted by a flame

Application

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

Detection Type: Optical

Detection Method: UV radiation

Spectral Range: 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 request*

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

Specifications

Fault Relay Outputs: Single pole contact, normally open, rated 5A @ 30 VDC; closed in normal work, open on fault detection or loss of power

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: ¾" 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)

2.0 IPES-UV Performance Characteristics

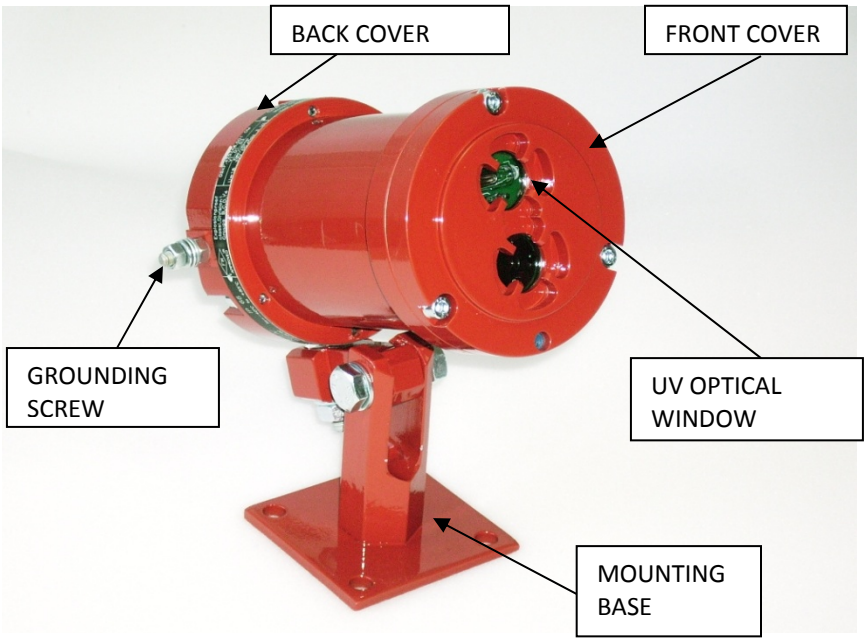

Figure 2-1: Appearance of the IPES-UV

Appearance

The IPES-UV consists of an explosion-proof casing containing a UV sensor which converts 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-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 90 feet (27 meters) does not exceed 30 seconds.

The sensitivity and response time can be varied in order to reduce the noise when the IPES-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-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-UV signals a change in state from normal to fire status in any Original Equipment Manufacturer's (OEM) or proprietary alarm and response system.

The detection optics of the IPES-UV is configured for sensitivity in the range of 180 to 250 nanometers. This selective bandwidth range in conjunction with algorithms programmed into the on-board microprocessor eliminates false alarms caused by sunlight and radiation from heated objects but still able to "see" the UV radiation emitted by a flame.

The IPES–IR/UV takes the following parameters into consideration when generating an alarm signal:

- A FLAME alarm signal is generated by the IPES-UV detector when the magnitude of the flame signal exceeds the pre-set detector threshold setting. The threshold settings are selected by adjusting the detector's sensitivity & response modes.

The IPES-UV single-channel setting provides the fastest response time of all ESP Safety flame detectors. However, the single-channel UV setting is susceptible to false alarm sources and UV signal inhibition. This setting should only be selected if the end-user is assured that all sources of false alarms and signal inhibitors have been addressed.

Sources of False Alarms

The IPES-UV single-channel detector may generate an alarm signal when exposed to the following false alarm sources:

- Arc Welding
- Lightning
- X-ray & Gamma radiation
- Corona Discharges
- Halogen Lamps

Signal Inhibitors

The UV signal can be inhibited or diminished by the presence of a variety of substances between the flame source and the detector optics.

- Smoke
  The presence of dense smoke will diminish the UV flame signal. Elevated placement of UV flame detectors will reduce the effects of smoke on the IPES-UV.

- UV Absorbing Gases
  In high concentrations, certain gases, compounds or vapors may diminish or restrict the UV signal of a flame detected by the IPES-UV detector. Consult with the end-user if large quantities of these gases may be released as a result of a flame incident. Following is a partial list of UV-absorbing gases:

  Acetaldehyde
  Acetone
  Acrylonitrile
  Ethyl Acrylate
  Methyl Acrylate
  Ethanol
  Ammonia
  Aniline
  Benzene
  1,3 Butadiene
  2—Butanone
  Butylamine
  Chlorobenzene
  1-Chloro-1-Nitropropane
  Chloroprene
  Cumene
  Cyclopentadiene
  O-Dichlorobenzene
  P-Dichlorobenzene
  Methyl Methacrylate
  Alpha-Methylstyrene
  Naphthalene
  Nitroethane
  Nitrobenzene
  Nitromethane
  1-Nitropropane
  2-Nitropropane
  2-Pentanone
  Phenol
  Pyridine
  Hydrogen Sulfide
  Styrene
  Tetrachloroethylene
  Toluene
  Trichloroethylene
  Vinyl Toluene
  Xylene

- Windows
  Decreased UV flame signals may result if there is a glass (including Plexiglas & clear acrylic) window between the IPES-UV flame detector and the flame source.

- Line-of-Sight Obstructions
  All optical flame detectors, including the IPES-UV, require a clear line of sight between the detector and the flame source.

- Lens Contaminants
  Smudges, dust and dirt buildup on the detector lens will reduce the sensitivity of the IPES-UV detector. Excessive build-up will result in a FAULT alarm.

Serviceability

The IPES-UV remains serviceable in non-heated rooms or under sheds at temperatures from –40°F to +185°F (–40° to +85°C).

LED

Normal, Fire and Fault conditions are indicated by a red LED located on the cover. Refer to Table 2-1: Determining LED Conditions, below.

Optical Integrity

To maintain reliability of the IPES, the optical devices are automatically self-tested for radiation transmission every 25 to 45 minutes. 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.

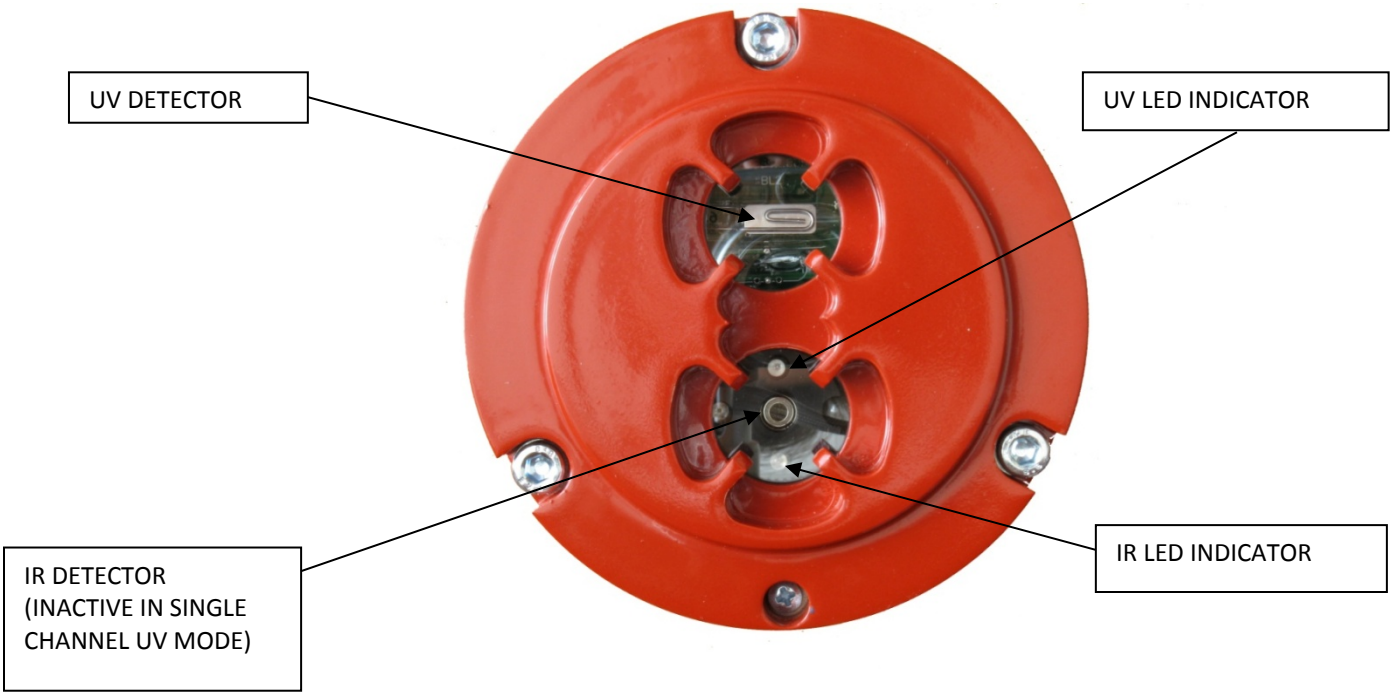

Figure 2-2: UV Detector and LED Indicator

Table 2-1: Determining LED Conditions

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

N	IPES status	Fire relay dry contacts condition		Fault relay dry contacts condition	Output signal, mA	Indicator LED condition
		Normally closed	Normally open			
1	No power supply voltage	Closed	open	open	0	Off
2	Fault or optical interference (dust)	Closed	open	open	2	Every 25 to 45 seconds two LEDs blink with the following frequencies: the first LED blinks 5 times with a period of 0.5 seconds, the second one blinks 3 times with a period of 1 second. Both LEDs are off during the pause between blinking.
3	Normal (no faults or fires during operation)	Closed	open	closed	4	When no radiation is present: Every 25 to 40 seconds the two LEDs blink alternately 3 times with a period of 1 second. Both LEDs are off during the pause between blinking.
						When UV radiation is present: The UV LED indicator (see figure 2-2) will be on continuously, the IR LED indicator will be off.
4	Fire, no Fault	Open	closed	closed	18	Both LEDs light continuously.
5	Fire, with Fault	Open	closed	open	18	Both LEDs light continuously.
6	Test mode (magnetic collar is on)	Closed	open	open	2	Magnetic collar is on. Fire relay is blocked.

Analog Signal

Signal level	Detector State
(±0.1) mA	Circuit opening
(2 ± 0.1) mA	Fault
(4 ± 0.1) mA	Normal
(18 ± 0.1) mA	Fire
(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 using the ESP Commander program. 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 – single-direction pole contact which is normally open. The relay is designed to handle currents of 10 mA to 5 A at DC voltage of 30 V.

Refer to Table 2-1: Determining LED Conditions above.

Operating Modes

Possible detector configurations using ESP Commander

The IPES–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.