APPROVAL REPORT

IPES-IR3 FLAME DETECTOR FOR FIRE DETECTION AND FOR USE IN HAZARDOUS (CLASSIFIED) LOCATIONS (PRODUCT MODIFICATIONS)

Prepared for:

Electronstandart-pribor
No 35/2, Slavy Avenue
Saint Petersburg 192286
RUSSIAN FEDERATION

Project ID: 3037106
Supplements Project ID: 3037880
Class: 3260, 3615 - FMCU
Date of Approval: 21 April 2010
Authorized by:
Robert L. Martell, Asst. VP, Director of Electrical

FM Approvals
1151 Boston-Providence Turnpike
PO Box 9102
Norwood, MA 02062

IPES-IR3 FLAME DETECTOR FOR FIRE DETECTION AND FOR USE IN HAZARDOUS (CLASSIFIED) LOCATIONS (PRODUCT MODIFICATIONS)

from

Electronstandart-pribor
No 35/2, Slavy Avenue
Saint Petersburg 192286
RUSSIAN FEDERATION

I INTRODUCTION

1.1 Electronstandart-pribor requested approval of their modified IPES-IR3 flame detector for fire detection and as Explosionproof for Class I, Division 1, Groups B, C and D, T4 Ta = -40°C to +85°C; IP66, hazardous (classified) locations for US and Canada in accordance with the standards listed in section 1.4. The IPES-IR3 is presently FM Approved under Project ID 3037880. The manufacturer has added a very high sensitivity (VHS) feature and requested testing with additional fuels. Only testing necessary to address the changes is addressed in this report.

1.2 This Report may be freely reproduced only in its entirety and without modification.

1.3 This examination and approval is limited to the equipment listed and described in this report. Any other configurations described in the product literature are not considered approved.

1.4 **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
Explosionproof 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

1.5 **Listing:** The equipment as listed in the *Approval Guide*, an online resource of FM Approvals, for US and Canada, will be updated as shown below. Deletions are shown as ~~strikethrough~~, additions as **bold underline**.

IPES-IR3 Flame Detector (Firmware V1 11 04). Approved for use at Fast/Slow ~~and Far/Near~~ settings **and sensitivity modes of Very High, High or Medium**. Operates from 18 to 32Vdc with relay outputs or 4-20mA outputs for connection to a compatible Approved control panel, providing separate circuits for alarm signaling and for power. Fuels tested for response include the following: n-Heptane, Isopropyl Alcohol, JP4 Jet Fuel, **Diesel, Ethanol, Gasoline, Kerosene, Methanol, Methane**. Operating temperature range is -40°C to +85°C (-40°F to +185°F). Enclosure is rated IP66 for indoor and outdoor use.
Hazardous (Classified) Location rating: Explosionproof for Class I, Division 1, Groups B, C and D, T4 Ta = -40°C to +85°C; IP66

II DESCRIPTION

2.1 This section will provide a brief description of the features added to the FM Approved IPES-IR3 flame detector. A complete product description may be found in approval report Project ID 3037880 and in the Operating Manual attached to this report.

2.2 The very high sensitivity (VHS) mode may be requested when the IPES-IR3 is purchased from the manufacturer, and thus pre-programmed, or may be programmed by the end user via the RS-485 interface. When the detector is programmed for VHS, DIP switches S1 and S2 become inactive. S2 affects the distance mode now referred to as High Sensitivity and Medium Sensitivity; previously referred to as Far and Near respectively.

2.3 The following fuels, in addition to those previously included, are now being specified in the Operating Manual for the detector's response to fire: gasoline, kerosene, diesel, methanol, ethanol, methane.

2.4 The IPES-IR3 detectors are now equipped with a "Before Fire" feature which was not mentioned in the previous version of the Operating Manual under Project ID 3037880. This feature was programmed into the test samples by the manufacturer during testing and will be featured in production line product. This feature is not selectable by the end-user.

III EXAMINATIONS AND TESTS

3.1 Samples of the IPES-IR3 detector were submitted for examination and testing. The added fuels and sensitivity feature affected performance testing only. As no changes were made to the mechanical construction of the product or components used for product assembly, it was determined that only the following testing was required.

- Baseline Sensitivity
- Flame Response Sensitivity
- False Stimuli Response
- Field of View

The samples were considered to be representative of the product line and were examined, tested, and compared to the manufacturer's drawings. Examination and tests were conducted at FM Approvals in W. Glocester, RI, with manufacturer's representatives on-site for assistance. The

test samples were configured for very high sensitivity (VHS) by the manufacturer via a laptop. Testing parameters were based on the standards identified in 1.4 and the manufacturer's specifications. All data is on file at FM Approvals along with other documents and correspondence applicable to this program.

3.2 **Baseline Sensitivity** – Four samples of the IPES-IR3 detector were subjected to a series of small scale n-heptane based test fires along the centerline (0° viewing angle) using a 1.75 inch (44.45mm) diameter pan at a distance of 264 inches (6.7m). The response time range was 2.36 to 24.50 seconds and was determined by conducting a minimum of three consecutive tests. The response times are within the manufacturer's specifications and the range obtained during the flame response sensitivity tests. The "Before Fire" feature was observed during this testing when the detector was processing the algorithm to determine if it was observing a real fire. These results are considered satisfactory.

3.3 **Flame Response Sensitivity** – Four samples of the IPES-IR3 detector set for VHS were exposed to a series of test fires as described below along the centerline (0° viewing angle) of the sensor.

Fuel	Pan Size: ft. x ft. (m x m)	Distance: ft. (m)	Response Time Range: sec.
n-heptane	1 x 1 (0.3 x 0.3)	211 (64)	3.8 – 11.8
JP4	1 x 1 (0.3 x 0.3)	201 (61)	8.8 – 23.2
	2 x 2 (0.6 x 0.6)	206 (62.8)	3.8 – 13
Diesel	1 x 1 (0.3 x 0.3)	151 (46)	3.0 - 21
	2 x 2 (0.6 x 0.6)	151 (46)	3.6 – 19.2
Ethanol	1 x 1 (0.3 x 0.3)	151 (46)	2.2 – 22
Gasoline	1 x 1 (0.3 x 0.3)	200 (61)	6.4 – 17.8
	2 x 2 (0.6 x 0.6)	196 (60)	3.2 – 13
Kerosene	1 x 1 (0.3 x 0.3)	164 (50)	8.8 – 16.1
	2 x 2 (0.6 x 0.6)	196 (60)	4.1 – 11.5
Methanol	1 x 1 (0.3 x 0.3)	151 (46)	2.0 – 13.6
Methane	1ft x 2ft sand burner	171 (52)	10 – 17.6
Methane	Plume fire; 3/8in orifice, 3ft high	151 (46)	2.8 – 12.9

The response sensitivity distances of the detectors corresponds with the average response times specified by the manufacturer for each fuel / pan size combination and is considered satisfactory.

3.4 **False Stimuli Response Tests** – Four samples of the detectors were tested in the presence of both modulated and non-modulated artificial sources of light and other heated bodies, and then were exposed to a manufacturer's specified n-heptane fire in the presence of each of the false stimuli. False stimuli sources consisted of: resistive heater, 110 A arc welder, a 20 W florescent light, 500 W halogen light, a 100W incandescent light. Repeat testing with direct sunlight and indirect sunlight as conducted under Project ID 3037880 was considered unnecessary.

3.4.1 Detectors were exposed to false stimuli sources unmodulated and modulated at approximately 1.5 Hz. The results are satisfactory in that no false alarm or instability occurred at the minimum distances listed in the following table.

Source	Distance
Heater	3 feet (0.9m)
Arc welder	9 feet (2.7m)
Fluorescent	0 feet (0m)
Halogen	3 feet (0.9m)
Incandescent	1 foot (0.3m)

3.4.2 When exposed to the n-heptane fire at the manufacturer's specified distance of 82 feet (25m) in the presence of the non-modulated false stimuli sources at a distance of 16 feet (5m), the detectors continued to function and respond to fire normally. This is considered satisfactory.

3.5 **Field of View** – The detector viewing angle was varied 45° from the center line up, down, left and right. One sample detector was exposed to each of the 1ft x 1ft (0.3m x 0.3m) and to the methane plume test fires described in section 3.2 at 50% of the centerline distances. The response time was within the manufacturer's specifications and within the requirements of the standard for each fuel. This is considered satisfactory.

IV MARKING

The label drawing currently on file for this product has not changed as a result of this examination.

V REMARKS

5.1 Installations shall comply with the latest edition the manufacturer's instruction manual.

5.2 All installation wiring shall be in accordance with the relevant edition of the National Electrical Code (ANSI/NFPA 70) or the Canadian Electrical Code C22.1, as applicable.

5.3 The product(s) discussed in this report were certified by FM Approvals for Canada under a Type 3 Certification System as identified in ISO Guide 67.

5.4 Although the detector is capable of RS-485 digital signal protocol, this option has not been tested and is not covered in this approval.

5.5 An engineering study of the hazard, detector location, and detector characteristic response is necessary for any application of radiant energy-sensing fire detectors.

5.6 As is characteristic of all radiant energy-sensing fire detectors, dust, dirt, condensation, and other foreign material on the lens may impair response to fire. This factor must be considered in the application of this model of flame detector.

VI FACILITIES AND PROCEDURES AUDIT

The manufacturing site in Gatchina Leningradskaya oblast', Russian Federation, is subject to follow-up audit inspections. The facilities and quality control procedures in place have been found to be satisfactory to manufacture product identical to that examined and tested as described in this report.

VII MANUFACTURERS RESPONSIBILITIES

Documentation considered critical to this Approval is on file at FM Approvals and listed in the Documentation File, Section VIII of this report. No changes of any nature shall be implemented unless notice of the proposed change has been given and written authorization obtained from FM Approvals. The Approved Product Revision Report, Form 797, shall be forwarded to FM Approvals as notice of proposed changes.

VIII DOCUMENTATION

The following drawings currently filed under Project ID 3037880 are being updated as shown below as a result of this examination:

Drawing No.	Previous Revision Level	New Revision Level	Drawing Title
GSKF.425248.002 OM	12/23/09	02/09/10	Operating Manual IPES-IR3

IX CONCLUSION

The apparatus listed in Section 1.5 meets FM Approvals requirements. Since a duly signed Master Agreement is on file for this manufacturer, Approval is effective the date of this report.

EXAMINATION AND TESTING BY: FM Approvals Staff:
Cheryl Gagliardi, Bob Elliott, Ray Wood, Steve Francisco, Dana Capron
Electronstandardt-pribor Staff:
Ms. Elena Oleshchenko, Mr. Oleg Zverev, Mr. Peter Makayuda

PROJECT DATA RECORD: 3037106

ATTACHMENTS: Operating Manual GSKF.425248.002 OM, Rev. 02/09/10

REPORT BY:

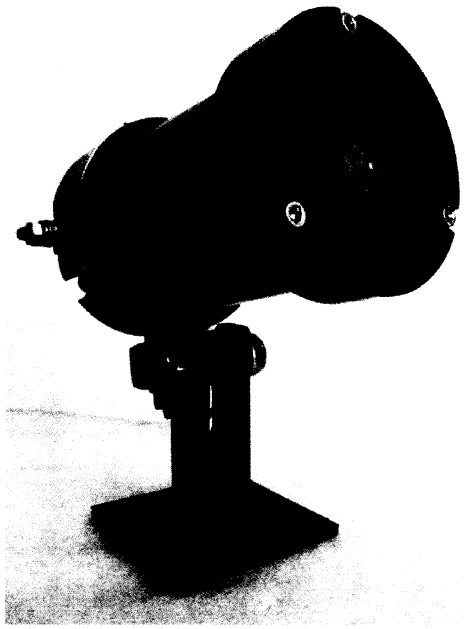
Cheryl A. Gagliardi
Senior Engineer
Electrical Systems

REPORT REVIEWED BY:

Patrick J. Byrne
Technical Team Manager
Electrical Systems

Flame Detector IPES-IR3
Operating Manual

GSKF.425248.002 OM



APPROVED by _____ FEB 09 2010

Oleg G. Zverev Technical director

Table of Content

1. Introduction

This Operating Manual specifies performance characteristics of the flame detector (hereinafter IPES-IR3), which are guaranteed by the Manufacturer (JSC "Electronstandart-pribor"). The Operating Manual is designed to familiarize the users with the IPES design and performance as well as its operation rules.

Prior to beginning working with IPES-IR3, read attentively this Operating Manual.

2. Purpose

IPES-IR3 is intended to transfer alarm signals to control and indicating fire-fighting and guard fire-fighting equipment under fire initiation in the detector's field of view.

IPES -IR3 are to be used in the zones where process facilities of pump stations of oil-trunk pipelines, tank farms, loading racks, and the like are installed (Class I, Division 1, Groups B, C and D, T4 Ta = -40°C to +85°C; IP66).

IPES field of application is dangerously explosive areas of indoor and outdoor facilities complying with IEC 60079-10 and other normative documents regulating operation of electric equipment in dangerously explosive zones.

IPES –IR3 is classified as:

a) optical – by the principle of operation;
b) infrared range – by the spectral range of electromagnetic radiation;
c) supplied via an individual wire – by the method of power supply;
d) addressed – by the addressability.

IPES-IR3 is supplied with power 24 V DC source (from 18 to 32 V); ripple amplitude is no more than 1,0 V.

IPES-IR3 is designed to work in non-heated rooms or under sheds at temperatures from minus 40 to +85°C and relative humidity of up to 93% at 40 °C.

IPES-IR3 is a multirange detector reacting to IR radiation in three spectral regions.

IPES-IR3 feature is presence of the inner test radiation source. This source is powered with impulse voltage once for 30 minutes and its radiation is detected by sensors. This design allows to perform end-to-end functional tests of IPES-IR3 automatically and thus **there is no necessary to use outer radiation test sources or open flame for functional tests.**

3. Basic performance data and characteristics.

3.1 Overall dimensions of IPES-IR3 (with a bracket) are not more than: 235×190×120 mm.

3.2 Weight of IPES-IR3 (with a bracket) is not more than 3.5 kg.

3.3 In the process of operation, IPES generate the following output signals:

- operation of dry relay contacts for closing – "Fire";
- operation of dry relay contacts for opening - "Fault";

(relay contacts provide commutation of currents ranging from 10 mA to 5 A at DC voltage up to 30 V).

- informational analog signals with the following values:

a) (2 ± 0,5) mA – "Fault";

b) (4 ± 0,5) mA – normal;

c) (18 ± 0,5) mA – "Fire";

d) (8 ± 0,5) mA – "Test".

- informational digital signal transferred via standard communication channel RS-485 under protocol MODBUS RTU containing the information that corresponds to the analog output.

3.4 The detector responds to fires caused by n-heptane, isopropyl alcohol and JP4 jet fuel etc. See Appendix A for the complete list of fuels and fire test results.
Field of View – The detector viewing angle was varied from the center line up, down, left and right. The detector was exposed to each of the test fires at a distance described in the table below, 50% of the centerline distance. The response time was within specifications and within the requirements of the standard.

3.5 Output signal "Fire" can be fixed after eliminating the source of the alarm signal.

3.6 Maximum value of the IPES-IR3 sensor background illumination produced by luminescent lamps, at which IPES-IR3 remains serviceable without generating false signals, is not less than 2500 lx.

3.7 Maximum value of the IPES-IR3 sensor background illumination produced by incandescent lamp, at which IPES remains serviceable without signals generation is not less than 250 lx.

3.8 Power supplied by IPES-IR3 under standby conditions is not more than 2 VA, under alarm conditions – not more than 3 VA, under a self-testing mode – not more than 5 VA.

3.9 IPES-IR3 remains serviceability under supply voltage changing by ± 6 V.

3.10 Electric insulation between short-circuit output leads and a case keeps sinusoidal ac voltage 0,5 kV (frequency 50 Hz) during 1 min under the ambient temperature (25 ± 10)°C and relative humidity 80%.

3.11 Insulation electrical resistance of IPES-IR3 between -circuit output leads and a case is not lower than:

- 20 MOhm at the temperature (25 ± 5)°C and relative humidity till 80 %;
- 5 MOhm at the upper operation limit temperature 85 °C;
- 1 MOhm at the temperature of 40°C and relative humidity 95%.

3.12 IPES-IR3 provides 24-hours uninterrupted operation.

3.13 IPES-IR3 remains serviceability at the highest operation ambient temperature (85 °C).

3.14 IPES-IR3 remains serviceability at the lowest operating ambient temperature (minus 40 °C) complying with transportation conditions.

3.15 11 IPES-IR3 remains serviceability in case of presence of moisture condensates on it owing to temperature decrease under relative air humidity not less than 95%.

3.16 IPES-IR3 remains serviceability under influence of direct mechanical shock of 7 J.

3.17 IPES-IR3 remains serviceability under influence of single impact half-sine pulses with peak acceleration of 50 m/s^2 and pulse duration from 10 to 20 ms.

3.18 The IPES-IR3 case corresponds to a group IP66.

3.19 IPES-IR3 remains serviceability under influence of electrostatic discharges with amplitude not lower than:

8kV for contact ones;

15kVfor air ones.

3.20 IPES-IR3 remains serviceability under influence of radiofrequency electromagnetic fields with the following parameters.

- root-mean-square values of electromagnetic field density with an amplitude modulation depth of 80 % and frequency 1 kHz are not lower than 10 V/m and 5 V/m under frequencies from 0,1 to 150 MHz and from 150 to 500 MHz, accordingly.

3.21 Average mean-time-between-failures of IPES-IR3 is not lower than 60'000 h.

3.22 Average service life of IPES is no less than 10 years.

3.23 Safety.

IPES-IR3 is made in an explosion-proof version; the type of implosion protection is "Explosion-proof casing" according to FM 3615, its class of implosion protection is "explosion-proof for Class I, Division 1, Groups B, C and D, T4 Ta = -40°C to +85°C; IP66, hazardous (classified) locations for US and Canada".

Explosion protection of IPES is ensured by:

1. Enclosing of the IPES current-carrying parts into an explosion-proof casing with slit implosion protection at the points where parts and units of the explosion-proof casing join each other; the casing should be able to withstand the explosion pressure and prevent propagation of explosion into the explosive environment. The points of parts mating are marked in the drawings with word "Explosion" and permissible values of the explosion-protection parameters:
   maximum width and minimum length of the slits,
   roughness of the surfaces forming the explosion-proof joints,
   number of complete intact threads,
   and axial length and pitch of thread of the threaded explosion-proof joints according to FM 3615;
2. Limiting the heating temperature of the detector's outer parts (not higher than 135°C);
3. Sealing of cables in the cable entry with a special rubber ring according to FM 3615;
4. Preventing all the bolts securing the parts and providing the IPES explosion protection, as well as the current-carrying and earthing clamps, against spontaneous unscrewing by using spring washers or lock-nuts;
5. Ensuring high mechanical strength of the IPES according to FM 3600;
6. Providing the IPES casing cover with warning

"D0 NOT SEPARATE WHEN ENERGIZED";

7. Protecting all the surfaces marked with word "Explosion" with consistent grease.

8. IPES-IR3 casing protection class is not lower than IP66 according to IEC 529-89.

4. Component parts and delivery set.

a) IPES-IR3 with a mounting bracket;

b) Operating Manual GSKF.425248.002 OM– 1 copy;

c) Kit of fasteners;

d) Magnetic C-shape Test tool is optional. It will be delivered only by a special request.

5. IPES design and performance

5.1. IPES-IR3 consists of an explosion-proof casing containing sensors converting electromagnetic radiation of flame into electric signal, electronic amplifiers, filters, digital-analog converters, microprocessor, indicators, and optical isolators used to test the channels for serviceability (see Appendix B).

Embedded optical filters of receivers determine the range of maximum spectral sensitivity of the detectors: in three ranges of IR radiation – from 4,0 to 5,0 um. The sensors and optical filters are chosen so that IPES-IR3 is maximally sensitive to the radiation produced by fire provided flare light from incandescent lamps, sunlight and hot objects is maximally suppressed.

Amplifiers and electric filters provide necessary values of electric signals at the ADC input and noise suppression. Digital signals are processed in a microcontroller via a special algorithm in order to make the alarm signals more reliable. Parameters taken into consideration in generating the alarm signal are:

- **magnitudes of signals from different optical channels,**
- **ratios between the signal amplitudes of different channels,**
- **signal modulation frequency,**
- **phase relationships among the channels.**

After processing the signals a decision is made to form output signals at the analog current output (4…20 mA), digital output RS-485[1] with interface Modbus RTU, relay contacts "FIRE", relay contacts "FAULT".

In order to improve the IPES-IR3 reliability the amount of dust on the optical devices is tested by measuring the variation in the intensity of radiation in a special optical isolator (radiation passes through the detecting windows). To test the detectors' serviceability, integral test radiation sources sending radiation directly to the detectors are used. If the signal values produced under tests is more than the target threshold value the device is serviceable. Under performance check of optical channels the signal "FIRE" is not generated. If there is fault in the channel (optical signals are low) the signal "FAULT" is generated in indicating LEDs, relay contacts, output analog and digital signals. The IPES-IR3 status is indicated by red light of

[1] RS-485 protocol option has not been verified by FM

LEDs mounted on the IPES front panel. In the same time IPES-IR3 continues to analyze incoming optical signals.

Principle of operation of protective glass dusting control is based on ability of the subjects situated in immediate proximity to them, as well as accumulation dust on the glass surfaces, to scatter the infrared radiation.

The dust control canal has been calibrated at the manufacturing plant thus that during incidence of glass transmission more then 50% the device signal "accuracy" is removed.

IPES-IR3 has the mode of very high sensitivity (VHS). Its activation is performed with the help of the software presented by the Manufacture (optional). The mode VHS can set (or canceled) more than once under connection of the IPES to PC with an interface RS-485 by choosing of this option in the program menu.

If this mode is not active under self-testing three test radiation sources flash three times, if this mode is active - two times. Under this mode switches S1 and S2 are not active, i.e. its positions don't change VHS parameters.

For visual indication of IPES status its face part has an indicator LED.

5.2. Detection sensitivity.

Detection sensitivity is the maximum distance at which the detector will reliably detect a specific size of fire & typical type of fuel. The sensitivity values of IPES-IR3 to different fire sources are presented in Appendix A.

5.3 False Alarms Prevention.

The detector will not provide an alarm or a warning signal as a reaction to the radiation sources specified below in Appendix A.

6. Relays and output circuits

6.1 Analog signal of 0..20 mA

Table 1.

Signal level (±0,1 mA)	Detector state
0 mA	Circuit opening
2 mA	Fault
4 mA	Normal
18 mA	Fire
8 mA	Test

6.2 Digital signal RS-485 – protocol Modbus RTU, Hart, Ethernet[2].

[2] RS-485 protocol option has not been verified by FM

The digital channel protocol Modbus RTU is described in Appendix C.

6.3 Relay signal.

Signals from dry contacts of two relays: "FIRE" and "FAULT".

The "FIRE" relay has a two-directional single-pole contacts; this allows one to make the contacts at the output normally closed[3] or normally open by changing the position of jumper X1.

The "FAULT" relay has one-directional single-pole contacts (normally open). The relays are designed for commutation of currents of 10 mA to 5 A at DC voltage of 30 V.

The output signals and states of relay contacts and indicating LEDs for different modes of IPES-IR3 are presented in Table 5.

The functions and location of switches, jumpers, and leads used to connect IPES to RCD of fire-alarm and burglar-fire alarm systems are given in Appendix D1 and D2.

The arrangement of sensitivity and operation speed switches as well as jumpers used to set the state of contacts of relay "Fire" on the IPES-IR3 back plane (viewed from the side where the elements are mounted) are given in Appendix D1.

Switcher S1 fixes the "fast/slow" mode and determines the time of signal accumulation. Position ON corresponds to the 4-sec accumulation period; position OFF corresponds to the 2-s accumulation period.

Switcher S2 fixes the "high sensitivity/medium sensitivity" mode. Position OFF corresponds to the sensitivity – the "high sensitivity" mode.

Switcher S3 being in position ON does not fix the alarm state, i.e., the "alarm" state is cancelled after the signal causing the IPES operation is eliminated. If the switcher is OFF, the "alarm" can be reset only by switching on/off the power supply or by resetting by using the Magnetic C-shape Test Tool or digital channel.

Switchers S4 and S5 are used for activation/deactivation of relays.

Table 2.

N	IPES status	"Fire" relay contacts status	"Fault" relay contacts status	Output signal	Indicating LED status
1	No power-supply voltage	open	open	0	off
2	After switching on during 45 s	open	open	2	First 5 s continuous yellow light and then flashing one
3	Dirtying of optical items or presence any items at the	open	open	2	Alternate flashing of yellow and green lights

[3] This option does not comply with the requirements of NFPA 72 or ULC/ORD-C386-90 and is not approved by FM Approvals.

N	IPES status	"Fire" relay contacts status	"Fault" relay contacts status	Output signal	Indicating LED status
	distance of 5-10 cm from protecting window.				
4	Fault	open	open	2	Continuous lighting of yellow light
5	Normal	open	closed	4	Continuous lighting of green light
6	Before fire	open	open	4	Switching from green light to red one (one time per one second)
7	Fire	closed	closed	18	Continuous lighting of red light
8	Test mode	open	closed	8	Depending on the presence of radiation, one of modes 1-4 is possible
9	Test mode with a put Magnetic C-shape Test Tool	Open	Open	2	Continuous lighting of yellow light

7. Industrial safety precautions.

7.1 Only persons familiarized with the present Operating Manual, trained in safety techniques, and having electric-safety certificates are permitted to work with IPES-IR3.

7.2 Never operate IPES-IR3 if its casing is mechanically damaged.

7.3 Do not separate when energized.

8. Pre-starting procedure

8.1 Prior to mounting IPES-IR3 examine it by sight. Pay special attention to:

-IPES-IR3 explosion-protection marking and warning inscriptions;

-intactness of the casing;

-availability of all the fasteners (bolts, nuts, washers) according to the scheme of IPES-IR3 arrangement at the plant;

-presence and intactness of the seal at the IPES-IR3 casing (Appendix B2).

8.2 How to ensure explosion protection under assembly.

Install IPES-IR3 at the facilities under control according to the scheme of the system that comprises IPES-IR3; the scheme should be approved in accordance with established procedure:

Make electric connections as described in Appendices D1, D2, D3.

8.2.1 Connecting of IPES-IR3 installed in dangerous explosive zones to external devices installed in explosion-proof zones by using armored control cables 4 x 1,5.

Cable can be used in dangerously explosive zones of all classes including premises, outdoor sites, channels, tunnels, ground (trenches) with corrosive medium, and in zones containing roaming currents.

8.2.2 While assembling IPES-IR3 check the condition of external surfaces of the explosion-protection elements: the presence/absence of dents or damages on the casing-base mating surfaces (Appendix B).

8.2.3 Removable parts should adjoin the casing as tightly as the design allows.

8.2.4 Seal the cable in the cable entry maximally thoroughly, since just this determines the explosion proofness of the IPES-IR3 entry device.

8.2.5 Install IPES on the mounting fittings by using rubber shock-absorption bushings and bolts taken from the accessory kit.

8.2.6 Earth the IPES casing by using an external earthing clamp in accordance with Appendix B.

Thoroughly clean the external earthing wire; prevent the point where it is connected to the external earthing clamp against corrosion by applying of consistent grease.

8.2.7 The procedure of installing IPES-IR3 and connecting it to RCD of fire-alarm and burglar-fire alarm systems is as follows (Appendices B1 and B2):

- unscrew 3 screws (pos.4) and detach a base (pos.2) with cable entry from the IPES-IR3 casing (pos.1);
- unscrew the screw with nut lock (pos.6), which connects a bracket (pos.5) and the base to the cable entry; detach the bracket;
- mount the connecting cable in a cable entry (pos.3) and connect the conductors to the respective clamps on the interconnecting board;
- set the bracket on the IPES-IR3 workstation and install the base on it; fix the base with a screw and a nut lock;
- set the switches and a jumper of the "Fire" contact relay status mounted on the IPES-IR3 switching board to the necessary position (see Appendix D.1);
- install the IPES-IR3 casing on the base and screw up the 3 screws;
- while installing IPES-IR3 on its workplace. Keep in your mind that IPES-IR3 is mostly sensitive along the central axis, therefore, should be directed towards the place of probable fire;

- while installing IPES-IR3 orient it so as to prevent direct illumination from powerful radiation sources (sun, headlight, etc.)

The Manufacturer presets the following operating modes of the detectors:

- **"slow" mode;**
- **"high sensitivity" mode;**
- **IPES-IR3 mode without latching of the state of generating alarm signals.**

Appendix D1 presents the arrangement of switches in the entry chamber, which are used to change the above-mentioned presetting.

Upon the completion of installation, check the resistance of the earthing device; it should not exceed 4 Ohm.

9. Operating procedure.

9.1 Only persons familiarized with the IPES-IR3 design and its Operating Manual and trained in safety precautions in working with electric equipment including that installed in dangerous explosive zones are permitted to operate IPES-IR3.

9.2 While working with IPES-IR3, undertake all the safety measures.

9.3 IPES-IR3 should be equipped with internal and external earthing devices and earthing marking.

9.4 The recommended circuits of connecting IPES-IR3 to RCD of fire-alarm and burglar-fire alarm systems and digital outputs of IPES-IR3 are given in Appendices C.1,C2 and C.3.

9.5 After switching on IPES-IR3 electric current of 2 mA will arise at its output, and the indicating LEDs will start continuous yellow lighting during 4s and then yellow flashing till 45 s, then after initial test finish continuous green lighting.

10. Maintenance.

IPES-IR3 maintenance consists of:

- visual examination;
- cleaning;
- checking the earthing and explosion-protection systems;
- performance test.

Visual examination of IPES-IR3 should be performed daily; in the process, IPES should be checked for the absence of visible damages.

Self-testing of IPES-IR3 is performed one time for 20-30 min. It provides regular end-to-end self-checking of IPES-IR3 serviceability. Therefore it is no necessary to use external test radiation sources or open flame for serviceability inspection.

IPES-IR3 should be cleaned either every six months (if there is no severe visible contamination) or as required, in case signal "Fault" arises or the IPES-IR3 surface is covered with dust. To clean IPES, remove dust from the casing with a brush or coarse calico slightly wetted with water and clean the IPES windows with coarse calico wetted with rectified alcohol. After wiping the surface with alcohol, wipe it again with a dry cloth in order to remove residual dirt. Alcohol consumption for one cleaning is 3 g. Under servicing the device must be powered off.

To check the earthing system, make sure that the joints are sufficiently tight and the contacts are covered with consistent grease.

11. Performance test.

The test consists of checking the IPES-IR3 functional characteristics. It should be performed regularly, every 6 months, using open flame (a lighter, a candle, spirit lamp) or the test flashlight ITES. In testing RCD of fire-alarm and burglar-fire alarm systems should be switched off in order to avoid operation of fire-fighting equipment.

Open flame is placed in front of IPES-IR3 that must be actuated for 5...10 s, i.e. indicating LEDs must light, output signal show corresponding values.

In case the special test radiation source ITES is used in the performance test, observe its Operating Manual.If it is necessary to make the output signal free of the alarm signal, put on the IPES-IR3 a Magnetic C-shape Test Tool taken from SPTA. In this case, the IPES-IR3 operation is controlled only by sight with observing the indicating LEDs, which should flash with red color in the presence of the "Fire" signal.

If IPES does not detect the flame, proceed as described in section "Troubleshooting".

12. Troubleshooting.

Possible failures and methods for their elimination are listed in Table 3.

Table 3.

N	Failure symptoms	Possible source of the defect	Remedy method
1	Red LEDs do not light	No power supply	Detach the base with the cable entry from the IPES-IR3 casing and make sure that the terminals are supplied with voltage of 24±6 V.
2	Relay contacts "Fault" are open, signaling LEDs switch from green over yellow light periodically.	Protection glasses are dusted.	Wipe the protection windows with cloth wetted with alcohol and then with a dry clean cloth.
3	Relay contacts "Fault" are open, continuous yellow lighting of a signaling LED.	Device fault, for example fault of one IR channel.	Device must be send to the manufacturer for repair.
4	IPES does not react to the test flame	The glasses are partly dusted or contaminated with substances preventing passing the radiation to the detectors.	See No. 2

13. Transportation and storage.

13.1 IPES-IR3 packed at the Manufacturer's site can be transported at any distance by any transport type. During the transportation shipping containers should be protected against atmospheric precipitations. The freight should be arranged and secured in the vehicles so as to ensure its stable position during the transportation. Freight displacement during the transportation is impermissible.

13.2 Railway carriages, containers, and truck bodies used to transport IPES-IR3 should be free of traces of cement, coal, chemicals, etc.

13.3 Store IPE-IR3S packed in Manufacturer's containers during the warranty period. IPES-IR3 in storage facilities should be free of dust, acid and alkali vapors, corrosive gases and other harmful substances.

14. Guarantees

14.1 Manufacturer JSC "Electronstsndart-pribor", 192286, Saint Petersburg, 35 Slava pr., building 2 guarantees that IPES-IR3 will meet the Specifications provided the Costumer observe the rules of operation, transportation, and storage given in this Operating Manual.

14.2 Warranty period is 18 months since commissioning, but no more than 24 months since the date of production.

14.3 Warranty storage period is 6 months since the production date.

14.4 During the warranty period, the Manufacturer will eliminate detected failures or replace damaged IPES-IR3s free of charge.

Appendix A. FM approvals description and report

RESPONSE CHARACTERISTICS.

Very high sensitivity

Fuel	Pan size	Distance, feet (m)	Average response time (seconds)
n-Heptane	1×1 foot	211 (64,3)	9
JP4	1×1 foot	201 (60)	12
JP4	2×2 foot	206 (62,8)	8
Gasoline	1×1 foot	200 (60)	14
Gasoline	2×2 foot	196 (60)	4
Kerosene	1×1 foot	164 (50)	11
Kerosene	2×2 foot	196 (60)	6
Diesel	1×1 foot	151 (46)	15
Diesel	2×2 foot	151 (46)	10
Methanol	1×1 foot	151 (46)	9
Ethanol	1×1 foot	151 (46)	11
Methane	Plume Diameter 3/8 inch, height 3 foot	151 (46)	10
Methane	Methane sand burner 1×2 foot	171 (52)	15

High sensitivity

Fuel	Pan size	Distance, feet (m)	Average response time (seconds)
n-Heptane	1×1 foot	143 (43,5)	5
Isopropyl Alcohol	1×1 foot	99 (30)	6
JP4	2×2 foot	115 (35)	12

FM approvals description and report (continued)

Medium sensitivity

Fuel	Pan size	Distance, feet (m)	Average response time (seconds)
n-Heptane	1×1 foot	108 (32,9)	5
Isopropyl Alcohol	1×1 foot	87 (26,5)	5
JP4	1×1 foot	60 (18,2)	6
JP4	2×2 foot	95 (29)	7

FM approvals description and report (continued)

Response characteristics in the presence of false alarm sources.

Very high sensitivity

False alarm source	Distance Feet (m)	Fire source	Distance, feet (m)	Average response time (seconds)	
				unmodulated	modulated
1,5 kW heater	16 (5)	n-Heptane (1×1 foot)	82 (25)	2.0	2.0
100W incandescent light	16 (5)	n-Heptane (1×1 foot)	82 (25)	2.1	2.2
500W halogen light	16 (5)	n-Heptane (1×1 foot)	82 (25)	2.3	2.3
Arc welding (100 A, #7118, 3/16')	16 (5)	n-Heptane (1×1 foot)	82 (25)	2.0	2.1
Two 20W flourescent light	16 (5)	n-Heptane (1×1 foot)	82 (25)	2.0	2.1
Sunlight exposure (direct, reflect)	-	n-Heptane (1×1 foot)	82 (25)	2.0	2.2

Medium sensitivity

False alarm source	Distance Feet (m)	Fire source	Distance, feet (m)	Average response time (seconds)	
				unmodulated	modulated
1,5 kW heater	10 (3)	n-Heptane (1×1 foot)	108 (33)	10.4	5.2
100W incandescent light	10 (3)	n-Heptane (1×1 foot)	108 (33)	3.1	3.4
500W halogen light	10 (3)	n-Heptane (1×1 foot)	108 (33)	3.7	5.2
40W flourescent light	10 (3)	n-Heptane (1×1 foot)	108 (33)	6.2	5.5
Arc welding (115 A, #7018, 1/8')	10 (3)	n-Heptane (1×1 foot)	108 (33)	6.0	5.9
Sunlight exposure (direct, reflect)	-	n-Heptane (1×1 foot)	108 (33)	4.0	4.5

FM approvals description and report (continued)

FALSE ALARM IMMUNITY.

Very high sensitivity

False alarm source	Distance Feet (m)	Modulated response	Unmodulated response
1,5 kW heater	3 (0,9)	No alarm	No alarm
Arc welding (100A, #7118, 3/16')	9 (2,7)	No alarm	No alarm
100W incandescent lamp	1 (0,3)	No alarm	No alarm
500W halogen lamp	3 (0,9)	No alarm	No alarm
Two 20W fluorescent lamp	0 (0)	No alarm	No alarm
Sunlight (direct, reflect)	-	No alarm	No alarm

High sensitivity

False alarm source	Distance Feet (m)	Modulated response	Unmodulated response
1,5 kW heater	3,2 (1)	No alarm	No alarm
Arc welding (115A, #7018, 1/8')	10 (3)	No alarm	No alarm
100W incandescent light	3,2 (1)	No alarm	No alarm
500W halogen light	6,5 (2)	No alarm	No alarm
10W fluorescent light	0,25 (0,08)	No alarm	No alarm
Sunlight exposure (direct, reflect)	-	No alarm	No alarm

FM approvals description and report (continued)

Medium sensitivity

False alarm source	Distance Feet (m)	Modulated response	Unmodulated response
1,5 kW heater	7,3 (2,2)	No alarm	No alarm
Arc welding (115A, #7018, 1/8')	10 (3)	No alarm	No alarm
100W incandescent light	3,2 (1)	No alarm	No alarm
500W halogen light	6,5 (2)	No alarm	No alarm
10W flourescent light	0,25 (0,08)	No alarm	No alarm
Sunlight exposure (direct, reflect)	-	No alarm	No alarm

FM approvals description and report (continued)

FIELD OF VIEW.

Very high sensitivity

Fuel	Size	Distance, feet (m)	Horizontal (degrees)	Avg. horiz. response time (seconds)	Vertical (degrees)	Avg. vert. response time (seconds)
n-Heptane	1×1 foot	105 (32)	+45 -45	4.4 6.4	+45 -45	5.9 8.5
JP4	1×1 foot	98 (30)	+45 -45	4.2 13.5	+45 -45	4.3 7.5
Gasoline	1×1 foot	98 (30)	+45 -45	5.7 10.4	+45 -45	4.9 5.5
Kerosene	1×1 foot	98 (30)	+45 -45	6.3 18.9	+45 -45	7.0 14.0
Diesel	1×1 foot	75 (23)	+45 -45	6.5 18.6	+45 -45	5.2 8.9
Methanol	1×1 foot	75 (23)	+45 -45	2.7 4.2	+45 -45	3.0 3.1
Ethanol	1×1 foot	75 (23)	+45 -45	3.0 3.7	+45 -45	2.4 2.6
Methane	Plume Diameter 3/8 inch, height 3 foot	75 (23)	+45 -45	2.5 2.8	+45 -45	2.6 2.8

FM approvals description and report (continued)

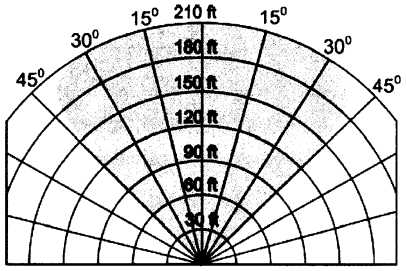
High sensitivity

Fuel	Size	Distance, feet (m)	Horizontal (degrees)	Avg. horiz. response time (seconds)	Vertical (degrees)	Avg. vert. response time (seconds)
n-Heptane	1×1 foot	71,5 (22)	+45	6.8	+45	6.4
			-45	13.6	-45	8.5
Isopropyl Alcohol	1×1 foot	50 (15)	+45	5.7	+45	4.2
			-45	8.2	-45	4.2

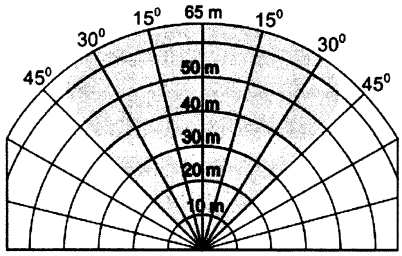
Medium sensitivity

Fuel	Size	Distance, feet (m)	Horizontal (degrees)	Avg. horiz. response time (seconds)	Vertical (degrees)	Avg. vert. response time (seconds)
n-Heptane	1×1 foot	60 (18)	+45	4.8	+45	17.4
			-45	4.5	-45	3.8
Isopropyl Alcohol	1×1 foot	44 (14)	+45	19.5	+45	7.3
			-45	7.3	-45	6.9
JP4	1×1 foot	30 (9)	+45	20.9	+45	20.8
			-45	11.9	-45	12.8

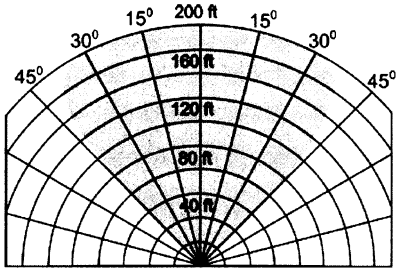
FM approvals description and report (continued)



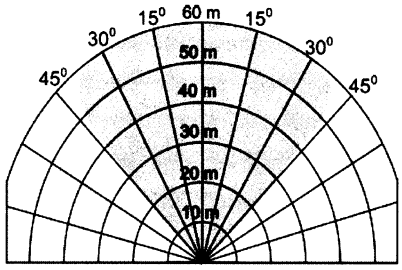
Field of View at Indicated Distance in Feet for **n-Heptane** at **Very High** Sensitivity (1 x 1 foot)



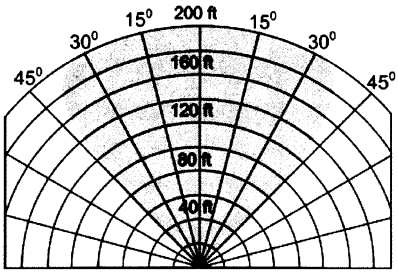
Field of View at Indicated Distance in Meters for **n-Heptane** at **Very High** Sensitivity (1 x 1 foot)



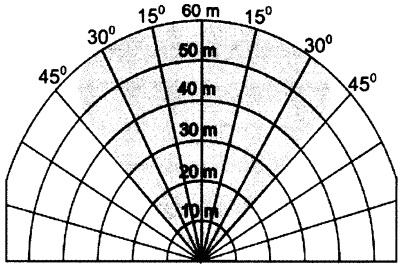
Field of View at Indicated Distance in Feet for **JP4** at **Very High** Sensitivity (1 x 1 foot)



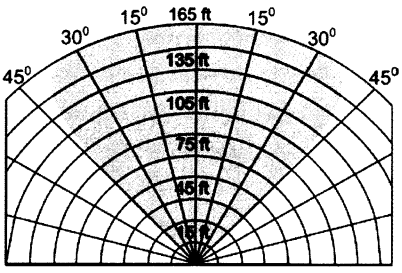
Field of View at Indicated Distance in Meters for **JP4** at **Very High** Sensitivity (1 x 1 foot)



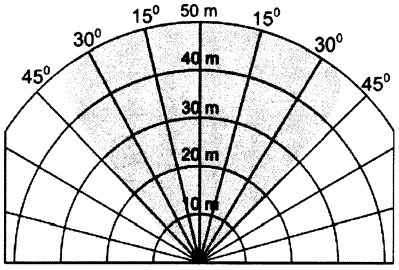
Field of View at Indicated Distance in Feet for **gasoline** at **Very High** Sensitivity (1 x 1 foot)



Field of View at Indicated Distance in Meters for **gasoline** at **Very High** Sensitivity (1 x 1 foot)

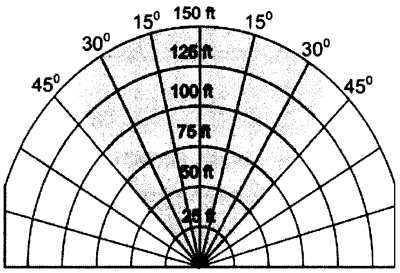


Field of View at Indicated Distance in Feet for **kerosene** at **Very High** Sensitivity (1 x 1 foot)

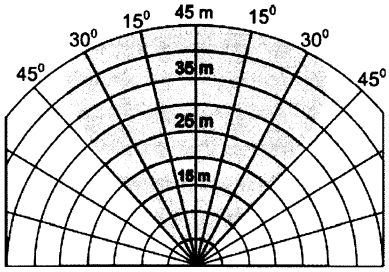


Field of View at Indicated Distance in Meters for **kerosene** at **Very High** Sensitivity (1 x 1 foot)

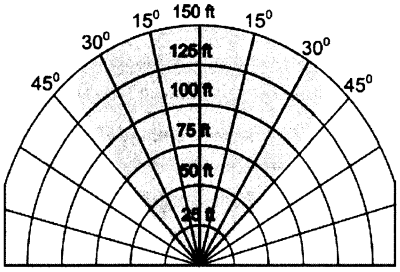
FM approvals description and report (continued)



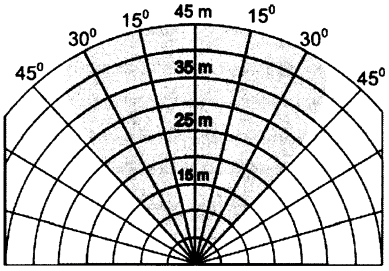
Field of View at Indicated Distance in Feet for **diesel** at **Very High** Sensitivity (1 x 1 foot)



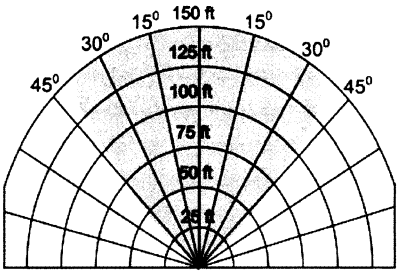
Field of View at Indicated Distance in Meters for **diesel** at **Very High** Sensitivity (1 x 1 foot)



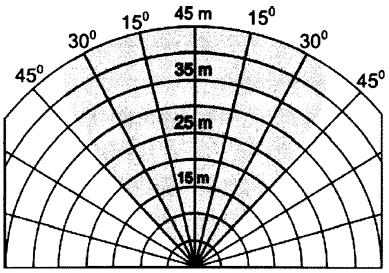
Field of View at Indicated Distance in Feet for **methanol** at **Very High** Sensitivity (1 x 1 foot)



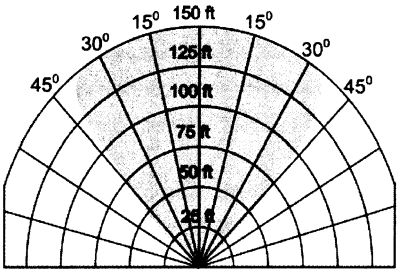
Field of View at Indicated Distance in Meters for **methanol** at **Very High** Sensitivity (1 x 1 foot)



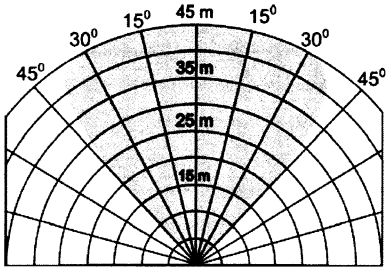
Field of View at Indicated Distance in Feet for **ethanol** at **Very High** Sensitivity (1 x 1 foot)



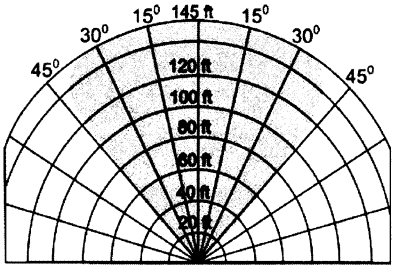
Field of View at Indicated Distance in Meters for **ethanol** at **Very High** Sensitivity (1 x 1 foot)



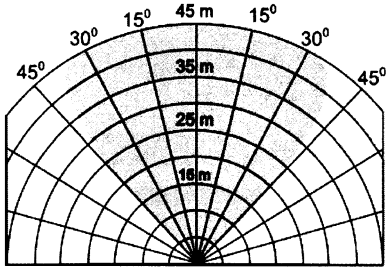
Field of View at Indicated Distance in Feet for **Methane plume** at **Very High** Sensitivity (3/8 inch, 3 feet)



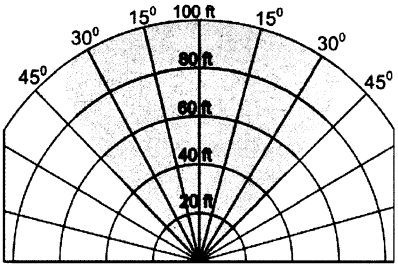
Field of View at Indicated Distance in Meters for **Methane plume** at **Very High** Sensitivity (3/8 inch, 3 feet)



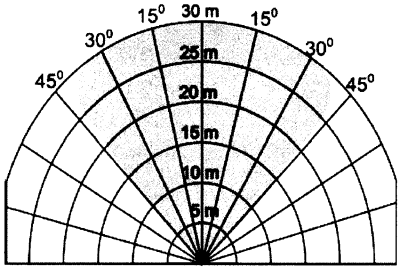
Field of View at Indicated Distance in Feet for **n-Heptane** at **High** Sensitivity (1 x 1 foot)



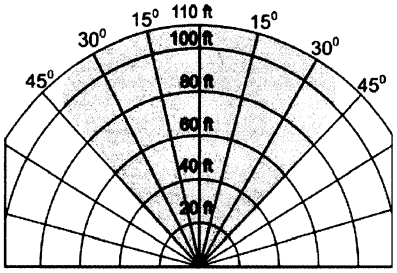
Field of View at Indicated Distance in Meters for **n-Heptane** at **High** Sensitivity (1 x 1 foot)



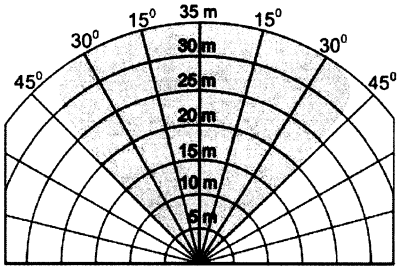
Field of View at Indicated Distance in Feet for **Isopropyl** at **High** Sensitivity (1 x 1 foot)



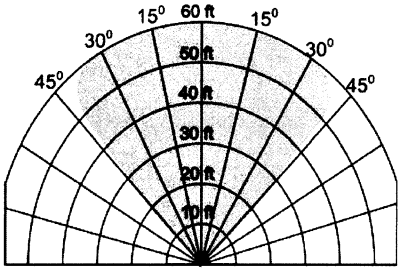
Field of View at Indicated Distance in Meters for **Isopropyl** at **High** Sensitivity (1 x 1 foot)



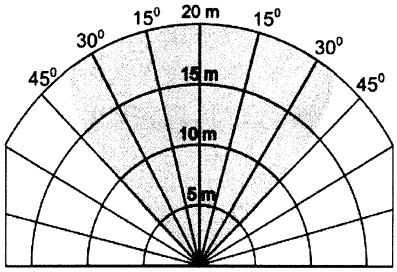
Field of View at Indicated Distance in Feet for **n-Heptane** at **Medium** Sensitivity (1 x 1 foot)



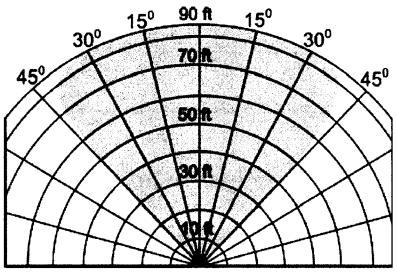
Field of View at Indicated Distance in Meters for **n-Heptane** at **Medium** Sensitivity (1 x 1 foot)



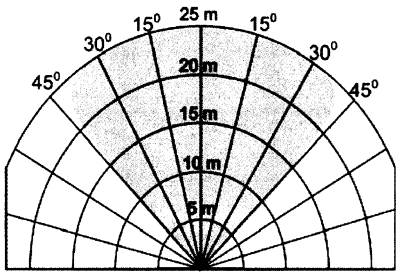
Field of View at Indicated Distance in Feet for **JP4** at **Medium** Sensitivity (1 x 1 foot)



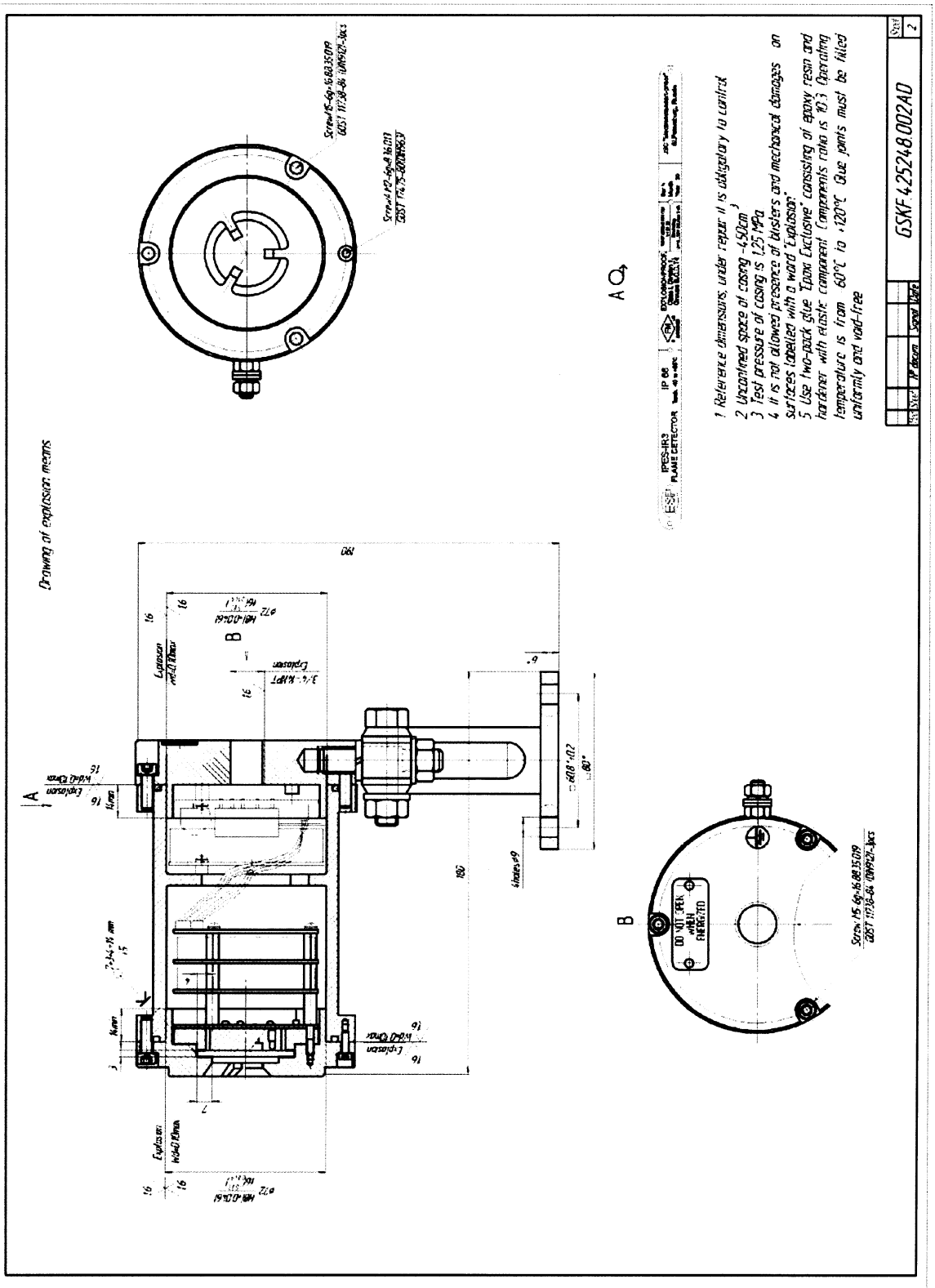
Field of View at Indicated Distance in Meters for **JP4** at **Medium** Sensitivity (1 x 1 foot)



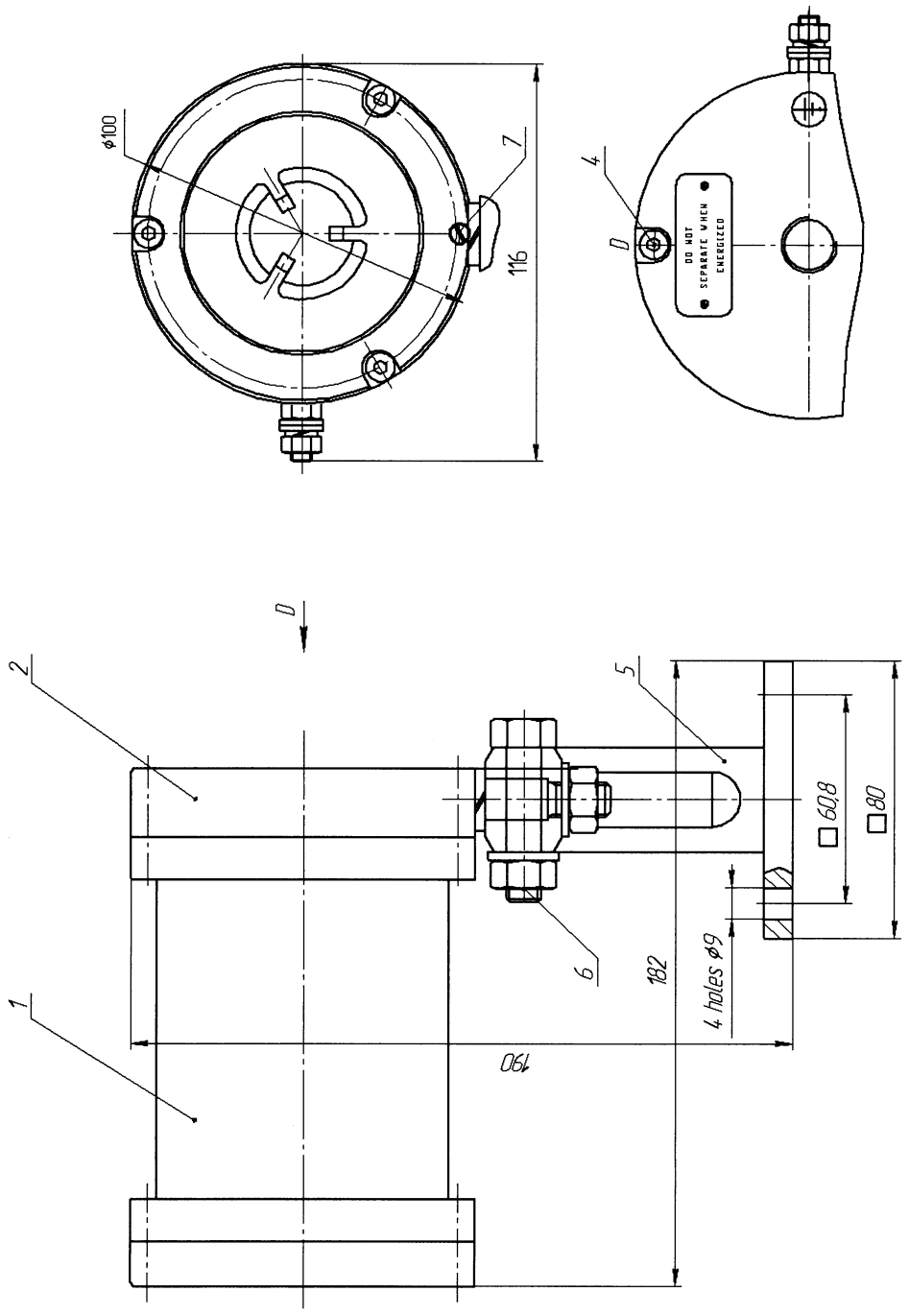
Field of View at Indicated Distance in Feet for **Isopropyl** at **Medium** Sensitivity (1 x 1 foot)



Field of View at Indicated Distance in Meters for **Isopropyl** at **Medium** Sensitivity (1 x 1 foot)



AppedixB1. Drawing of Explosion Protection Means of IPES-IR3.



Appendix B2. Appearance of the IPES.

Appendix C. Protocol of the IPES digital output[4].

IPES-IR3 are designed to transfer alarm signals to RCD of fire-alarm and burglar-fire alarm systems in case fire occurs in the detector's field of vision. Communication with fire alarm systems is performed via analog channels for 4..20 mA, dry relay contacts "Fire" and "Fault", and digital channel containing information on the above-mentioned outputs.

Signals on the absence or presence of fire, as well as operating characteristics, are transmitted to the high-level controller via interface RS-485 under protocol MODBUS. IPES-IR3 can fulfill commands of the following types:

- reading from the device. Instruction code 04;
- recording the word in the device. Instruction code 06.

Address card indicating the device status.

Address 0×01 – the high byte contains the device number (address) (unsigned number).

The low byte defines the rate of exchange via the RS-485 channel:

0×01 - 1200 baud;

0×02 - 2400 baud;

0×04 - 4800 baud;

0×08 - 9600 baud;

0×10 - 19200 baud.

Address 0×02 – a 16-byte register of the detector's status comprising the following data bytes:

The high byte – the preset operating mode of the device in the form of XXXXXD2 D1 D0;

where

D2: 1 – latching ON, 0 – latching OFF;

D1: 1 – high sensitivity, 0 – medium sensitivity;

D0: 1 - fast, 0 - slow.

The low byte presents the current state of the detector in the form of XXXXXD2 D1 D0;

where

D2 1 – dirty window; 0 – normal;

[4] RS-485 protocol option has not been verified by FM Approvals.

D1 1 - fault, 0 - normal ;

D0 1 - fire, 0 - normal.

The register addressed as 0×02 is available only for reading. The detector's parameters (latching, high sensitivity/ medium sensitivity and fast/slow) can be changed by means of hardware (switches in the entry chamber).

In order to change the device address, record the device number ranging from 0×01 to 0×F7 into the register with address 0×01; set the number into the register high byte.

In order to change the device exchange rate via RS-485, record the code adequate to the necessary exchange rate into the 0×01 register; set the code into the register low byte (the device high byte).

0×NN01 - 1200

0×NN02 - 2400

0×NN04 - 4800

0×NN08 - 9600

0×NN10 - 19200

Take into account that when you are trying to change the device number, the exchange rate changes automatically (and vice versa); therefore, while changing the device number, control the content of byte in charge of the exchange rate (and vice versa).

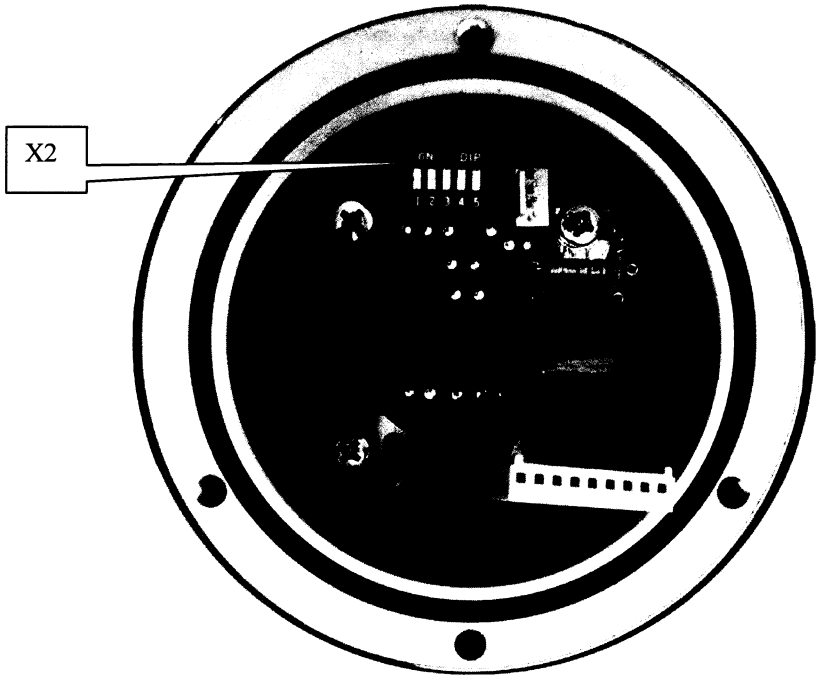
When changing the rate and/or device number, the high-level controller receives the response to the command with the same rate; only after that IPES changes the device exchange rate and number.

While debugging the software, never use command with code 06 cyclically, since the registers intended for recording have a limited number of recording cycles (10000).

While recording data into registers with other addresses, address error signal will be generated.

Appendix D1. Arrangement of switches and jumpers.

(Switching board - View with a taken-off base)



X2

Switches	Working condition	On	Off
S1	Fast/slow	4 s	2 s
S2	High sensitivity/ medium sensitivity	Medium	High
S3	"Alarm" state	No latching of the "alarm" state	Latching of the "alarm" state
S4	Relay state	Connect relay	Disconnect the relay
S5	Relay state	Connect relay	Disconnect the relay

Note: the Manufacturer has made the following presetting:

- **S1 is in the position ON (slow mode).**
- **S2 is in the position OFF (high sensitivity mode).**
- **S3 is in the ON position, which provides no latching of the "alarm" state.**
- **S4 and S5 is in the position ON (relays "Fire" and "Fault" is active).**

Switcher S1 fixes the "fast/slow" mode and determines the time of signal accumulation. Position ON corresponds to the 4-sec accumulation period; position OFF corresponds to the 2-s accumulation period.

Switcher S2 fixes the "high sensitivity/medium sensitivity" mode. Position OFF corresponds to the sensitivity – the "high sensitivity" mode.

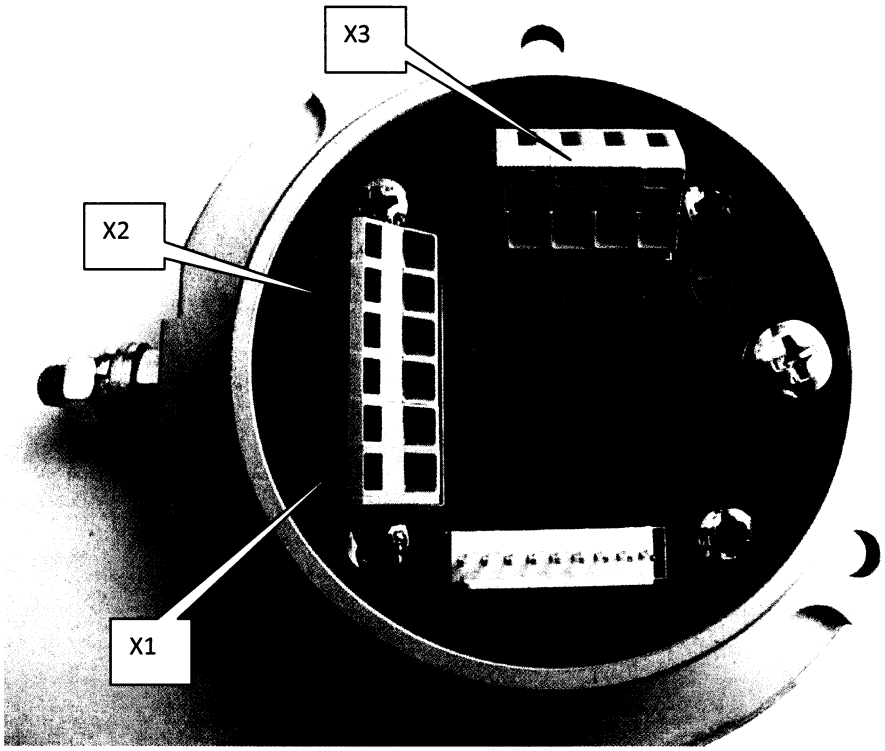
Under mode "very high sensitivity"(VHS) switches S1 and S2 are not active, i.e. its positions don't change VHS parameters.

Switcher S3 being in position ON does not fix the alarm state, i.e., the "alarm" state is cancelled after the signal causing the IPES operation is eliminated. If the switcher is OFF, the "alarm" can be reset only by switching on/off the power supply or by resetting by using the Magnetic C-shape Test Tool or digital channel.

Switchers S4 and S5 are used for activation/deactivation of relays.

Appendix D2. Arrangement and functions of connection terminals.

Interconnecting board.



X1

1 - +24V

2 - –24V

X2

1 – 4-20 mA

2 – 4-20 mA

3 – 485A

4 – 485B

X3

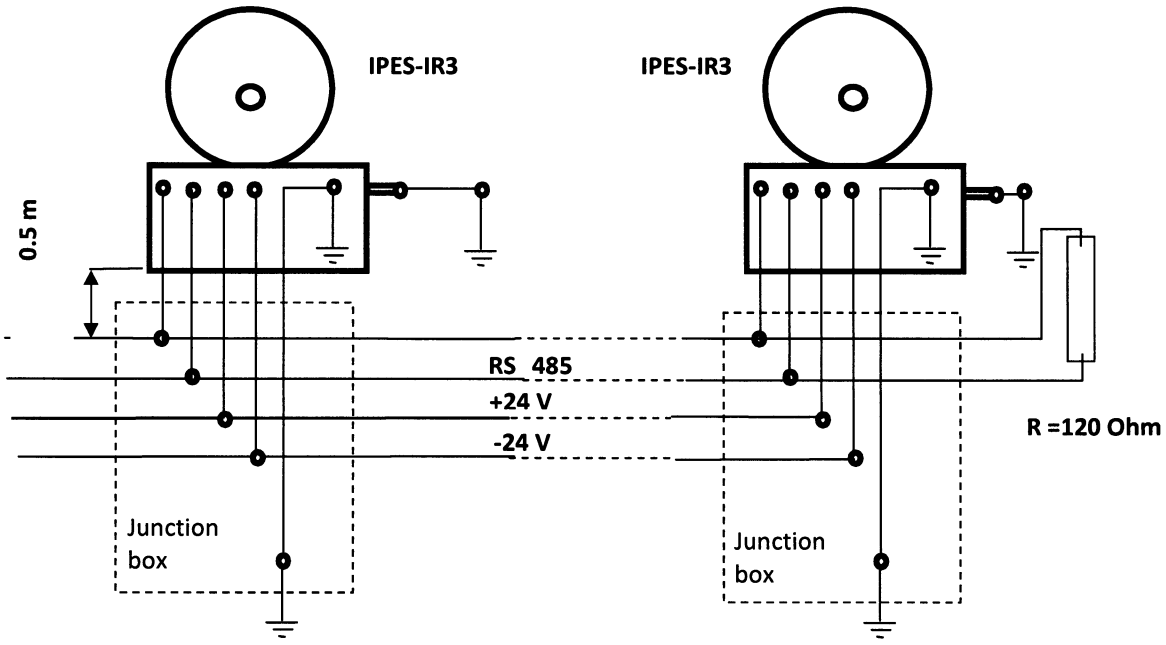
1 – relay contact "Fault"

2 – relay contact "Fault"

3 – relay contact "Fire"

4 – relay contact "Fire"

Appendix D3. IPES-IR3 connection to digital circuit RS 485[5].



[5] RS-485 protocol option has not been verified by FM Approvals.

Specification.

Supply-voltage

Nominal	24 V direct current
Range	from 18 to 32V.

Power consumption

Standby state	2VA
Alarm state	3VA.

Load characteristic relay

The "FIRE" relay- has a two-directional single-pole contact; this allows one to make the contacts at the output normally closed[6] or normally open by changing the position of jumper X1. The relays are designed for commutation of currents of

10 mA to 5 A at DC voltage of 30 V.

The "FAULT" relay- has one-directional single-pole contacts (normally open). The relays are designed for commutation of currents of 10 mA to 5 A at DC voltage of 30 V.

Current output

Analog output 4-20mA

Digital signal RS-485[7] – protocol Modbus RTU, Hart, Ethernet.

Temperature range

Operation from minus 40°C to +85°C.

Storage from minus 40°Cto +50°C

Range humidity

---

[6] This option does not comply with the requirements of NFPA 72 or ULC/ORD-C386-90 and is not approved by FM Approvals.

[7] RS-485 protocol option has not been verified by FM Approvals.

IPES remains serviceability in case moisture condensates on them as the result of a decrease in temperature at relative air humidity not less than 95%.

Response time

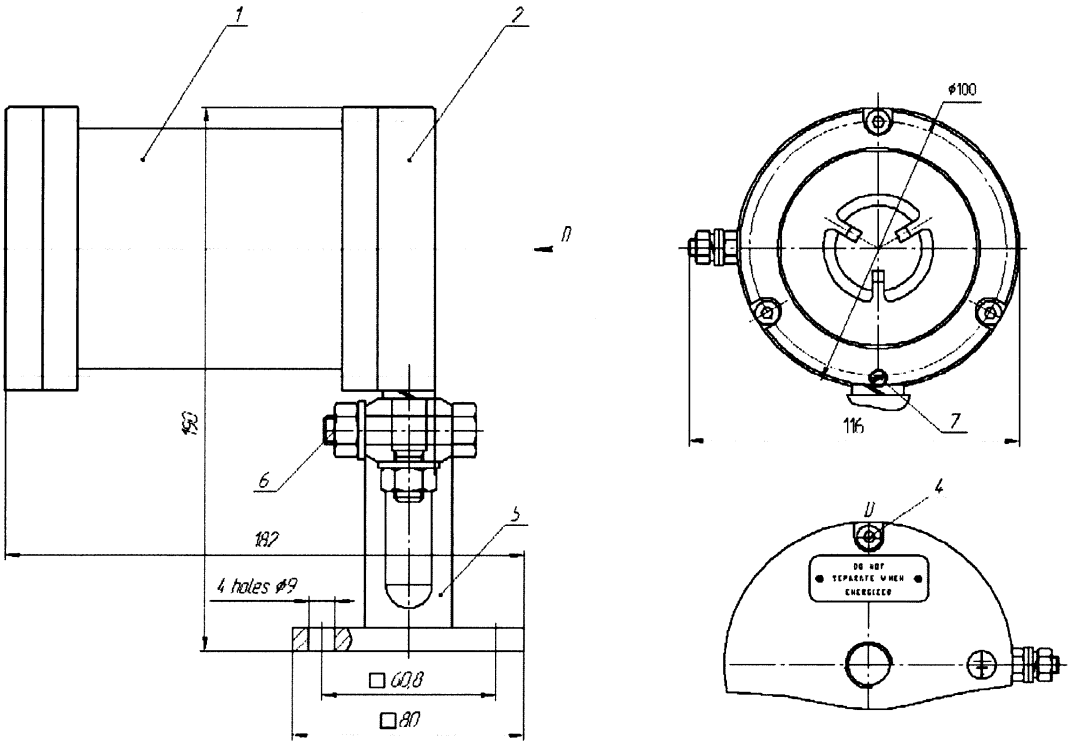
IPES-IR3 responses to the flame of N-heptane, JP4 and isopropyl alcohol (see Apendix A).

Material of case

The case, the cover and the base made from aluminum alloy.

Overall dimensions .

See Picture.



Transporting weight

The IPES-IR3 weight does not exceed kg: 3.5.