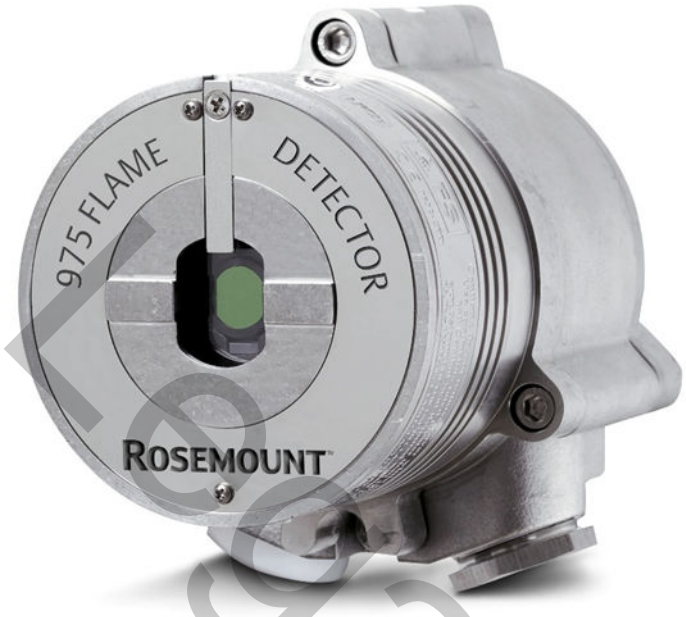
**Reference Manual**
00809-0100-4976, Rev DD
November 2021

# Rosemount™ 975HR

## Multi-Spectrum Infrared Hydrogen Flame Detector






ROSEMOUNT™

EMERSON™

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**⚠ WARNING**

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**⚠ WARNING**

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Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

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**Equipment damage**

This device is not field repairable due to the meticulous alignment and calibration of the sensors and the respective circuits. Modifying or repairing the internal circuits may impair the system's performance and void the Emerson product warranty.

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## Technical support

To get technical support for this product, contact your local Rosemount representative or the Rosemount Technical Support department at +1 866 347 3427 or safety.csc@emerson.com

## Return of material

To expedite the repair and return of this product, proper communication between the customer and the factory is important.

Before returning a product for repair, call +1 866 347 3427 or email safety.csc@emerson.com for a return material authorization (RMA) number.

On the return of equipment, provide the following information:

1. RMA number provided to you by Emerson
2. Company name and contact information
3. Purchase order from your company authorizing repairs of request for quote

Ship all equipment prepaid to:

Emerson Automation Solutions

Measurement Solutions

6021 Innovation Blvd

Shakopee, MN 55379

Mark all packages with "Return for Repair" and include the RMA number.

Pack items to protect them from damage and use anti-static bags or aluminum-backed cardboard as protection from electrostatic damage.

Ship all equipment prepaid. Emerson will not accept collect shipments.

## Abbreviations and acronyms

| Abbreviation or acronym | Definition |
|---|---|
| ATEX | Atmospheric explosives |
| AWG | American wire gauge |
| BIT | Built-in test |
| EMC | Electromagnetic compatibility |
| EOL | End of line |
| FOV | Field of view |
| HART® | Highway addressable remote transducer - communication protocol |
| IAD | Immune at any distance |
| IECEx | International Electrotechnical Commission Explosion |
| IPA | Isopropyl alcohol |

| Abbreviation or acronym | Definition |
|---|---|
| IR | Infrared |
| JP5 | Type of jet fuel |
| Latching | Refers to relays remaining in the ON state even after the ON condition has been removed. |
| LED | Light emitting diode |
| LPG | Liquified petroleum gas |
| mA | Milliamps (0.001 amps) |
| Modbus® | Master-slave messaging structure |
| N.C. | Normally closed |
| N.O. | Normally open |
| N/A | Not applicable |
| NFPA | National Fire Protection Association |
| NPT | National pipe thread |
| RS485 | Communication protocol allowing bi-directional communication |
| PN | Part number |
| SIL | Safety integrity level |
| UNC | Unified coarse thread |
| Vac | Volts alternating current |
| Vdc | Volts direct current |

# Contents

# 1 Introduction

## 1.1 Overview

The Rosemount 975HR Multi-spectrum Infrared Hydrogen Flame Detector is specifically designed for the detection of hydrocarbon and hydrogen flames. It detects hydrocarbon-based fuel and gas fires at long distances with the highest immunity to false alarms. The detector can detect a gasoline pan fire at 215 ft. (65 m) or a hydrogen flame at 100 ft. (30 m) in less than five seconds.

All Rosemount 975 series detectors include a heated optical window for improved performance in icing, snow, and condensation conditions.

The operator can easily adapt detection performance to all environments, applications, and requirements by changing the detector's configuration parameters. Adjusting these parameters, as well as performing other maintenance and monitoring tasks, is possible by means of RS-485 based Modbus® communication or HART® communication (in models with 0-20 mA output).

The detector enclosure is ATEX certified Exd flameproof with an integral, segregated, rear, Exe terminal compartment (avoiding exposure of the sensors and electronics to surrounding environment). Hence the combined approval:

Ex II 2G D

Ex db eb op is IIC T4 G

Ex tb op is IIIC T96 °C Db

(-55 °C ≤ Ta ≤ +75 °C)

or

Ex II 2G D

Ex db eb op is IIC T4 Gb

Ex tb op is IIIC T106 °C Db

(-55 °C ≤ Ta ≤ +85 °C)

The flame detector is designed to operate as a stand-alone unit directly connected to an alarm system or an automatic fire extinguishing system. The detector can also be part of a more complex system where many detectors and other devices are integrated through a common control unit.

# 1.2 Ordering information

The Rosemount 975HR is provided in various configurations depending on:

- Output configurations
- Temperature ranges
- Type of cable entries
- Housing material type
- Required approval


The configuration detail is included in the product part number on the product label and takes the form: Rosemount 975HR-XXXXXXX, where XXXXXXX defines the model according to the above requirements.

To modify the default or pre-ordered configuration and perform maintenance tasks, please refer to the following manuals: Rosemount 975 Flame Detector HART Communication Manual (00809-0200-4975) or WinHost Configuration and Diagnostic Software for Rosemount 975 Flame Detectors (00809-0300-4975).

CONFIGURE > VIEW PRODUCT >

Typical model number: 975HR1A6A1A1

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.



## 1.2.1 Product description

| Code | Description | |
|---|---|---|
| 975 | 975 flame detector | ★ |

## 1.2.2 Technology

| Code | Description | |
|---|---|---|
| MR | Multi-spectrum infrared | ★ |
| HR | Multi-spectrum infrared hydrogen | ★ |
| UF | Ultra fast ultraviolet infrared | ★ |
| UR | Ultraviolet infrared | ★ |

## 1.2.3 Output configuration

| Code | Outputs | Fault relay | Alarm relay | Auxiliary relay | Current type | |
|---|---|---|---|---|---|---|
| 1A | Analog/HART®/ RS-485/relays (fault, alarm) | Normally closed | Normally open | N/A | Sink | ★ |
| 2A | Analog/HART/ RS-485/relays (fault, alarm) | Normally closed | Normally open, normally closed | N/A | Source | ★ |
| 3A | Analog/HART/ RS-485/relays (fault, alarm) | Normally open | Normally open, normally closed | N/A | Source | ★ |
| 1R | RS-485/relays (fault, alarm, auxiliary) | Normally closed | Normally open | Normally open | N/A | ★ |
| 2R | RS-485/relays (fault, alarm, auxiliary) | Normally open | Normally open | Normally open | N/A | ★ |

## 1.2.4 Housing style

| Code | Material | Conduit entry | |
|---|---|---|---|
| 6A(1) | Aluminum | ¾-in. national pipe thread (NPT) | ★ |
| 8A(1) | Aluminum | M25 | ★ |
| 6S | Stainless steel | ¾-in. NPT | ★ |
| 8S | Stainless steel | M25 | ★ |

*(1) Aluminum housing is not available in FM/CSA product certification.*

## 1.2.5 Temperature

| Code | Description | |
|---|---|---|
| 1 | 167 °F (75 °C) | ★ |
| 2 | 185 °F (85 °C) | ★ |

## 1.2.6 Product certifications

| Code | Description | |
|---|---|---|
| A1 | ATEX and IECEx flameproof | ★ |
| A2 | FM and CSA flameproof | ★ |
| E2 | InMetro flameproof | ★ |
| EM | Technical Regulations Customs Union (EAC) flameproof | ★ |

## 1.2.7 Spare parts and accessories

| Part number | Description | |
|---|---|---|
| 00975-9000-0001 | Tilt mount | ★ |
| 00975-9000-0002 | Duct mount | ★ |
| 00975-9000-0003 | Weather cover (plastic) | ★ |
| 00975-9000-0004 | Weather cover (stainless steel) | ★ |
| 00975-9000-0005 | Air shield | ★ |
| 00975-9000-0007 | 2-in. (50.8 mm) pipe mount | ★ |
| 00975-9000-0008 | 3-in. (76.2 mm) pipe mount | ★ |
| 00975-9000-0011 | USB RS-485 harness kit | ★ |
| 00975-9000-0012 | Spare battery pack for use with flame simulator | ★ |
| 00975-9000-0013 | Flame simulator kit (for Rosemount 975HR) | ★ |
| 00975-9000-0014 | 4-in. (101.6 mm) pipe mount | ★ |
| 00975-9000-0015 | Spare battery charger for use with flame simulator | ★ |

## 1.2.8 Output configurations

| Output configuration | Connections provided | | | | | | |
|---|---|---|---|---|---|---|---|
| 1A | Power | Manual built-in test | Fault relay N.C. | Alarm relay N.O. | 0-20 mA sink | RS-485 | HART® |
| 2A | Power | Manual built-in test | Fault relay N.C. | Alarm relay, N.O., N.C. | 0-20 mA source | RS-485 | HART |
| 3A | Power | Manual built-in test | Fault relay N.O. | Alarm relay N.O., N.C. | 0-20 mA source | RS-485 | HART |
| 1R | Power | Manual built-in test | Fault relay N.C. | Alarm relay N.O. | Auxiliary N.O. | RS-485 | N/A |
| 2R | Power | Manual built-in test | Fault relay N.O. | Alarm relay N.O. | Auxiliary N.O. | RS-485 | N/A |

**NOTICE**

Output configuration 1A is default. You can change the mA sink output to source type, with a link between terminals 1 and 8. You cannot change any other output configurations on site.

For example, product number Rosemount 975HR3A8S2A1 has the following options:

- Output configuration: 3A (analog/HART/RS-485/relays, fault N.O., alarm N.O./N.C., source)
- Housing style: 8S (stainless steel - M25 conduit entry)

- Temperature: 2 (185 °F [85 °C])
- Approvals: A1 (ATEX and IECEx flameproof)

**NOTICE**

Check your specific part numbers against the information in Checking the product type.

# 1.3 Features and benefits

The flame detector has the following features and benefits.

- Detects hydrocarbons and hydrogen flames.
- Detection range: Up to 215 ft. (65 m) for a 1 ft.$^2$ (0.1 m$^2$) n-heptane fire.
- Ultra high immunity to false alarms. See Table 1-3.
- Advanced digital processing of the dynamic characteristics of fire: flickering, threshold, correlation, and ratio.
- Multi infrared channels: between two and five microns.
- Field programmable sensitivity: four ranges to avoid zone crossover.
- Built-in-test (BIT): manual and automatic (see Built-in test (BIT)).
- Heated window: prevents effects of icing, snow, and condensation.
- Electrical interface:
  - Dry contact relays
  - Communication network RS-485
  - 0-20 mA output
- HART® protocol: communication protocol (see HART® protocol).
- Exde: integral junction box for easy wiring.
- SIL-2: TÜV approved.
- Hazardous area certification: ATEX, IECEx, FM, and CSA.
- Functionality approval:
  - EN54-10 approved by VdS
  - FM approved per FM3260
- Accessories are approved as part of ATEX and IECEx approval.

# 1.4 Principles of operation

## 1.4.1 Fire detection principle

Emerson designed this flame detector to detect hydrocarbon flames that produce $CO_2$ in their combustion process and non-hydrocarbon flames that produce mainly water vapor

($H_2O$) from inorganic fuels, for example, hydrogen, ammonia, hydrofluoric acid, hydrochloric acid, etc.

The detector's principle of operation is based on the patented spectral analysis technology that identifies the infrared spectral signature of fire products, namely the hot $CO_2$ spectral emissions band at 4.2 to 4.7 microns and the hot water ($H_2O$) spectral emission band at 2.7 to 3.0 microns. The detector also analyzes additional spectral bands (above and below these bands) for background interferences.

The spectral analysis incorporates several detection algorithms, according to several types of fire events, taking into account simultaneous detection of both $CO_2$ and $H_2O$ peaks or only one of them, as well as flickering analysis at frequencies typical to these flames. Only when all the parameters of the spectral analysis and the flickering analysis meet the predetermined values is a fire condition identified and the fire alarm activated.

When exposed to non-fire radiation sources, these parameters do not identify a fire condition, and the detector does not react.

## 1.4.2 Heated optics

The flame detector uses heated optics. The heater increases the temperature of the optical surface by 5 to 8 °F (3 to 5 °C) above the ambient temperature to improve performance in icing, condensation, and snow conditions.

The heated optics can be set to one of the following:

- Off, not operating.
- On continuously.
- Automatic, per temperature change (default): the operator can define the start temperature below which the window is heated. The default is 41 °F (5 °C). The operator can define this temperature between 32 °F (0 °C) and 122 °F (50 °C). The heating stops when the temperature is 27 °F (15 °C) above the start temperature.

For more information, see Configure the detector.

## 1.4.3 HART® protocol

The flame detector uses the HART protocol.

HART communication is a bi-directional industrial field communication protocol used to communicate between intelligent field instruments and host systems. HART is the global standard for smart process instrumentation, and the majority of smart field devices installed in plants worldwide are HART-enabled. HART is available in output configurations 1A, 2A, and 3A (see Output configuration).

HART technology is easy to use and very reliable.

Through the HART connection, you can do the following:

- Detector setup
- Detector troubleshooting
- Detector health and status

For more details, refer to Rosemount 975 HART Communication Manual (00809-0200-4975).

## 1.4.4 RS-485 Modbus®

For more advanced communications, the flame detector has an RS-485 Modbus-compatible output that provides data communication from a network (up to 247 detectors) to a host computer or universal controller for central monitoring. This feature allows for reduced installation costs, easy maintenance, and local or remote diagnostic tools.

## 1.4.5 Product certifications

The flame detector has the following certifications:

- ATEX, IECEx
- FM, CSA
- SIL-2 (TÜV)
- EN54-10
- InMetro (UL)
- TR CU/EAC

### ATEX, IECEx

The flame detector is certified to:

ATEX per SIRA 15ATEX1364X and IECEx per IECEx SIR 15.0138X.

Ex II 2G D

Ex db eb op is IIC T4 Gb

Ex tb op is IIIC T96 °C Db

(-55 °C ≤ Ta ≤ +75 °C)

or

Ex II 2G D

Ex db eb op is IIC T4 Gb

Ex tb op is IIIC T106 °C Db

(-55 °C ≤ Ta ≤ +85 °C)

The accessories: tilt mount (PN 00975-9000-0001), weather cover (PN 00975-9000-0003 [plastic] and PN 00975-9000-0004 [stainless steel]), duct mount (PN 00975-9000-0002), and air shield (PN 00975-9000-0005), are included in the approval.

This product is available to use in hazardous zones 1 and 2 with IIC gas group vapors present and zones 21 and 22 with IIIC dust type present.

## FM, CSA

The flame detector is certified to FM and CSA explosion proof and functionality per FM3260.

- Class I, Division 1, Groups B, C, and D, T5 Ta = 85 °C.
- Dust ignition proof - Class II/III Division 1, Groups E, F, and G.
- Ingress protection - IP67, IP66, NEMA 250 Type 6P
- For more details, see *FM Report Project ID3029553* and CSA Report No. 2451134.

## SIL-2 (TÜV)

The flame detector is certified to SIL-2 requirement per IEC 61508A, Chapter 3.5.12.

The alert condition according to SIL-2 can be implemented by:

- Alert signal via 0-20 mA current loop

or

- Alert signal via alarm relay and fault relay

For more details and guidelines for configuring, installing, operating, and service, see SIL-2 features and TUV Report No. 968/FSP 1223.

## EN54-10

The flame detector is approved per EN54-10 and CPD.

- The detector is listed as Class 1 for sensitivity settings 15, 30, 45, and 60 and Class 2 for sensitivity settings 15, 30, 45, and 60.
- The detector has been tested and approved per EN54-10 Vds.
- This test includes functional test, environmental test, EMI/EMC test, and software check.
- For more details, see Vds Reports Numbers *BMA 12117* and BMA *12118*.

## InMetro (UL)

The flame detector is in compliance with the following standards as of May 18, 2010:

- ABNT NBR IEC 60079-0
- ABNT NBRIEC 60079-1
- ABNT NBR IEC 60079-7
- ABNT NBR IEC 60079-18
- ABNT NBR IEC 60079-31
- INMETRO decree No. 179

For further details, see the Certificate of Compliance No. *UL-BR 16.065XX*.

### TR CU/EAC

The flame detector is in compliance with the standard TR CU 012/2011 per:

1Ex db eb op is IIC T4 Gb X

Ex tb op is IIIC T96 °C Db X

-55 °C ≤ Ta ≤ +75 °C

or

1Ex db eb op is IIC T4 Gb X

Ex tb op is IIIC T106 °C Db X

-55 °C ≤ Ta ≤ +85 °C

For more details, see TR CU certificate No. *TC RU C-US MIO 62.B05535*.

## 1.5 Performance considerations

### 1.5.1 Detection sensitivity

Detection sensitivity is the maximum distance at which the detector reliably detects a specific size of fire and typical type of fuel (standard fire).

#### Standard fire

Defined as 1 ft.$^2$ (0.1 m$^2$) n-heptane pan fire with maximum wind speed of 6.5 ft./sec (2 m/sec).

#### Sensitivity ranges

The detector has four user-selectable sensitivity ranges. For each range, there are two response levels:

- **Warning** (Pre-alarm)
- **Alarm**

The detection distance for the **Warning** level is approximately 10 percent higher than the `Alarm` distance.

Alarm response times for a standard fire at a specified range are shown in Table 1-1.

**Table 1-1: Sensitivity Range Levels**

| Level | Response time (sec) | Sensitivity range - ft. (m) (for 1 ft.$^2$ (0.1 m$^2$) n-heptane pan fire) |
|---|---|---|
| 1 | 3 | 50 (15) |
| 2 default | 5 | 100 (30) |
| 3 | 8 | 150 (45) |

**Table 1-1: Sensitivity Range Levels *(continued)***

| Level | Response time (sec) | Sensitivity range - ft. (m) (for 1 ft.$^2$ (0.1 m$^2$) n-heptane pan fire) |
|---|---|---|
| 4 | 10 | 215 (65) |

For some typical ambient conditions, the Zeta parameter as defined in NFPA 72 for the detector is 0.005 (1/meter).

**Note**
Zeta parameters may vary significantly with changes in temperature, air pressure, humidity, visibility conditions, etc.

## Other fuels

The detector reacts to other types of fire as follows:

- The baseline fire refers to n-heptane 1 ft.$^2$ (0.1 m$^2$) and is defined as 100 percent sensitivity.
- For fuel fire: standard pan fire size: 1 ft.$^2$ (0.1 m$^2$)
- For gas flame: 30 in. (0.75 m) high, 10 in. (0.25 m) wide plume fire
- Maximum response time: 10 sec.

**Table 1-2: Fuel Sensitivity Ranges**

| Type of fuel | Percent of max. distance at each sensitivity range | Max. distance (ft. / m) |
|---|---|---|
| Gasoline | 100% | 215 / 65 |
| n-Heptane | 100% | 215 / 65 |
| JP5 | 70% | 150 / 45 |
| Kerosene | 70% | 150 / 45 |
| Diesel fuel | 70% | 150 / 45 |
| Ethanol 95% | 60% | 135 / 40 |
| IPA | 60% | 135 / 40 |
| Methanol | 55% | 115 / 35 |
| Methane(1) | 70% | 150 / 45 |
| LPG(1) | 70% | 150 / 45 |
| Paper | 38% | 82 / 25 |
| Polypropylene | 55% | 115 / 35 |
| Hydrogen(1) | 50% | 125 / 38 |
| Silane(2) | 3% | 7 / 2 |
| Ammonia(2) | 27% | 60 / 18 |

*(1) 30 in. (0.75 m) high, 10 in. (0.25 m) wide plume fire*

*(2) 20 in. (0.5 m) high, 8 in. (0.2 m) wide plume fire*

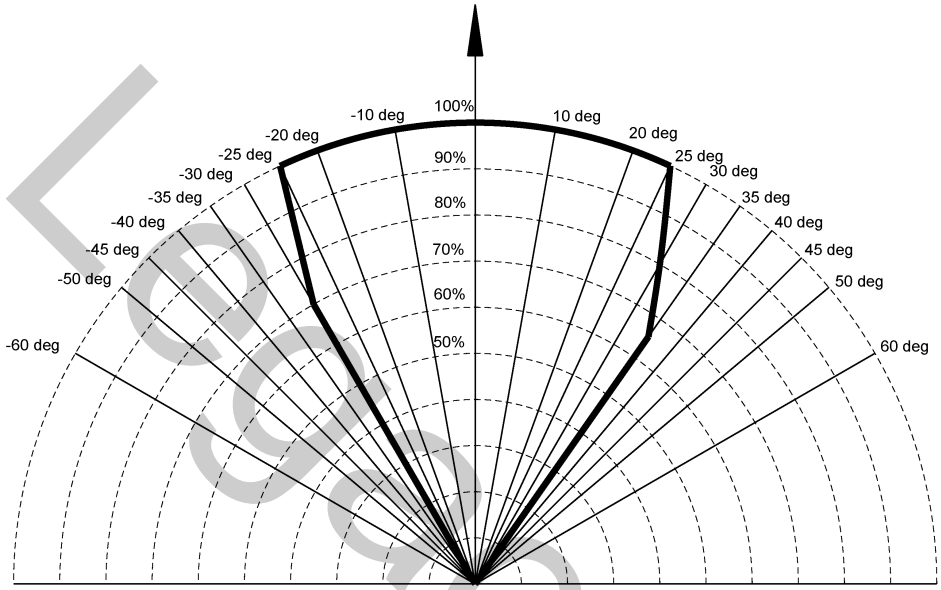
## 1.5.2 Field of view

### Gasoline

For Rosemount 975HR.

- Horizontal: 80 °
- Vertical: 80 °

**Figure 1-1: Vertical and Horizontal Field of View for Gasoline**

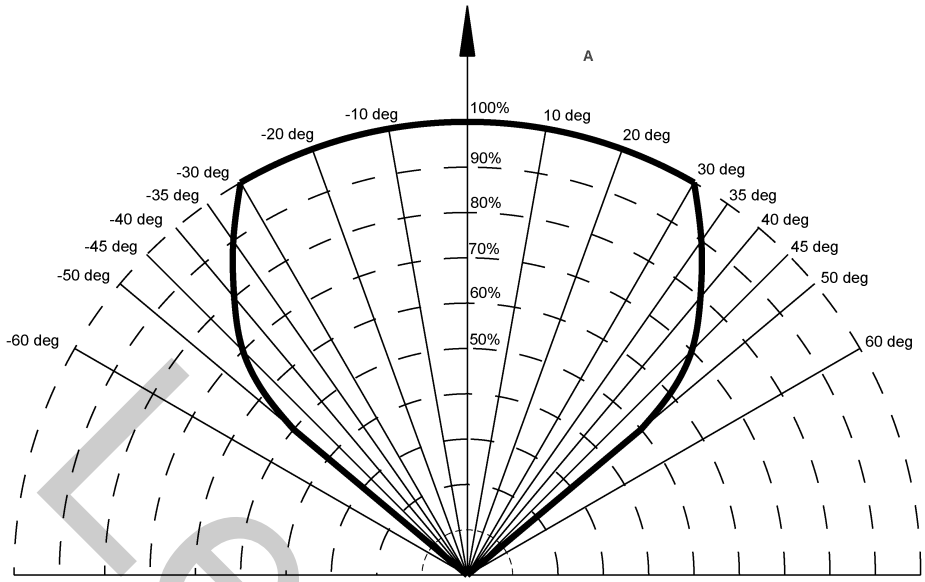



### Hydrogen

For Rosemount 975HR.

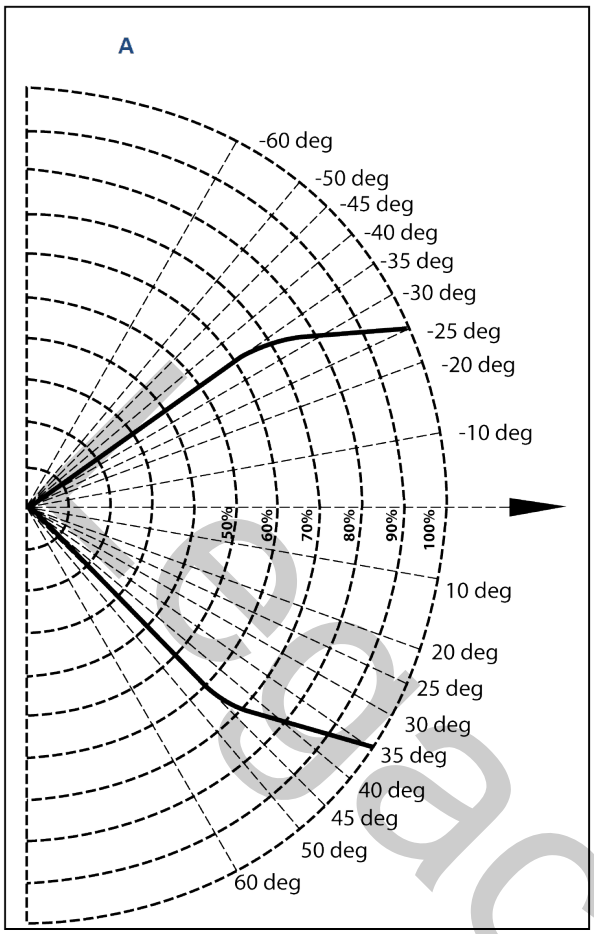
- Horizontal: 70 °
- Vertical: 80 °

**Figure 1-2: Horizontal Field of View for Hydrogen**




*A. Relative range*

**Figure 1-3: Vertical Field of View for Hydrogen**




*A. Relative range*

## 1.5.3 False alarms prevention

To prevent false alarms, the detector will not alarm or react to the radiation sources specified in the table below.

**Table 1-3: Immunity to False Alarm Sources**

| Radiation source | Immunity distance ft. (m) |
|---|---|
| Indirect or reflected sunlight | IAD |
| Vehicle headlights (low beam) conforming to MS53023-1 | IAD |
| Incandescent frosted glass light, 300 W | IAD |
| Fluorescent light with white enamel reflector, standard office or shop, 70 W (or two 35 W) | IAD |

**Table 1-3: Immunity to False Alarm Sources *(continued)***

| Radiation source | Immunity distance ft. (m) |
|---|---|
| Electric arc (15/32 in. [12 mm] gap at 4,000 Vac, 60 Hz) | IAD |
| Arc welding (5/16 in. [6 mm] rod; 210 A) | See Table 1-4 |
| Ambient light extremes (darkness to bright light with snow, water, rain, desert glare, and fog) | IAD |
| Bright colored clothing, including red and safety orange | IAD |
| Electronic flash (180 W-seconds minimum output) | IAD |
| Movie light, 625 W quartz DWY lamp (Sylvania S.G. - 55 or equivalent) | > 6.5 (2) |
| Blue-green dome light conforming to M251073-1 | IAD |
| Flashlight (MX 99 I/U) | IAD |
| Radiation heater, 3,000 W | > 3 (1) |
| Radiation heater, 1,000 W with fan | IAD |
| Quartz lamp (1,000 W) | > 3 (1) |
| Mercury vapor lamp | IAD |
| Grinding metal | IAD |
| Lit cigar | > 1 (0.3) |
| Lit cigarette | > 1 (0.3) |
| Match, wood, stick, including flare up | > 13 (4) |

1. IAD: Immune at any distance.
2. All sources are chopped from 0 to 20 Hz.

**Table 1-4: Welding Immunity Distance**

| Sensitivity setting | Detection range | Immunity distance |
|---|---|---|
| 1 | 50 ft. (15 m) | > 6 ft. (2 m) |
| 2 | 100 ft. (30 m) | > 12 ft. (4 m) |
| 3 | 150 ft. (45 m) | > 17 ft. (6 m) |
| 4 | 215 ft. (65 m) | >25 ft. (7.5 m) |

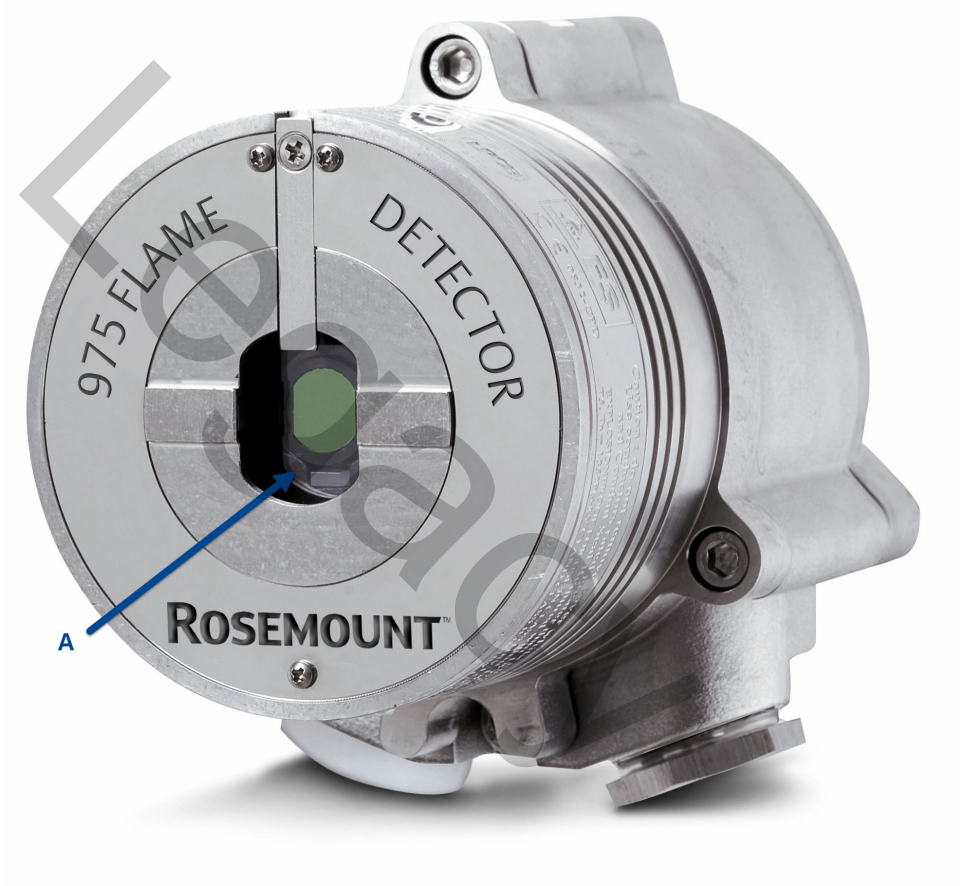
## 1.5.4 Visual indicators

One three-color LED indicator is located inside the detector window, as shown in Figure 1-4. The detector statuses are listed in Table 1-5.

**Table 1-5: LED Indications**

| Detector status | LED color | LED mode |
|---|---|---|
| Fault, BIT Fault | Yellow | 4 Hz - flashing |
| Normal | Green | 1 Hz - flashing |
| Warning | Red | 2 Hz -flashing |
| Alarm | Red | Steady |

**Figure 1-4: Indication LED**




*A. Indicator LED*

## 1.5.5 Output signals

Outputs are available according to the default configuration or the wiring options selected for the detector.

Determine the outputs of your model according to Table 1-6.

The detector incorporates several types of output suitable to different control systems.

- 0-20 mA (stepped) with HART®

- Relays (alarm, fault, auxiliary)
- RS-485 Modbus®

**Table 1-6: Available Output Types**

| Output type | Version | Detector status |
|---|---|---|
| Alarm relay | 975HR- output configurations 1AXXXXX, 1RXXXXX, and 2RXXXXX | The relay is N.O. |
| | 975HR - output configurations 2AXXXXX and 3AXXXXX | The relay is N.O. and N.C. |
| Auxiliary relay | 975HR - output configurations 1AXXXXX, 2AXXXXX, and 1RXXXXX | The relay is N.O. |
| Fault relay | 975HR - output configurations 1AXXXXX, 2AXXXXX, and 1RXXXXX | The relay is N.C. energized. |
| | 975HR - output configurations 3AXXXXX and 2RXXXXX | The relay is N.O. energized. |
| 0-20 mA current output | 975HR - output configuration 1AXXXXX | Sink with the HART protocol (can be changed to Source - see Figure B-3, Figure B-4, and Figure B-5). |
| | 975H - output configurations 2AXXXXX and 3AXXXXXR | Source with the HART protocol |
| RS-485 | All versions | Modbus protocol |

## 1.5.6 Detector status

The possible detector function statuses are listed in the table below. Use HART® or Modbus® to see a more detailed fault analysis.

**Table 1-7: Detector Statuses**

| Status | Description |
|---|---|
| Normal | Normal operation. |
| BIT | Built-in test being performed. |
| Warning | Fire detected - changed to **Warning** (pre-alarm state). |
| Alarm | Fire detected - changed to **Fire Alarm** state. |
| Latched alarm (optional) | The alarm outputs remain latched on following detection of a fire that has already been extinguished. |
| BIT fault | A fault is detected during built-in test sequence or other electric failure. The detector will continue to detect for fire. |
| Fault | A fault is detected when the power supply is too low or due to a software fault or electrical failure. The detector will *not* detect fire in this condition. |

In each state, the detector activates different outputs, as specified in Table 1-8.

**Table 1-8: Output Signals vs. Detector State**

| Detector state | LED indicator | LED mode | Alarm relay | Auxiliary relay | Fault relay | mA output |
|---|---|---|---|---|---|---|
| Normal | Green | 1 Hz | Off | Off | On | 4 mA |
| Warning | Red | 2 Hz | Off | On(1) | On | 16 mA |
| Alarm(2) | Red | Constant | On | On | On | 20 mA |
| Latch(3) | Red | Constant | On | Off | On | 20 mA |
| | | | | On(1) | On | 20 mA |
| BIT Fault(4) | Yellow | 4 Hz | Off | Off | Off | 2 mA |
| Warning at BIT Fault | Red | 2 Hz | Off | On(1) | Off | 16 mA |
| Alarm at BIT Fault | Red | Constant | On | On | Off | 20 mA |
| Fault | Yellow | 4 Hz | Off | Off | Off | 0 mA |

*(1) The auxiliary relay can be activated at the **Warning** level or **Alarm** level, depending on programmed function.*
*(2) The alarm outputs are activated while alarm conditions exist and will stop approximately five seconds after a fire is no longer detected.*
*(3) The **Alarm** state can be optionally latched via programmed function. (Default is non-latching).*
*(4) The detector will remain in **BIT Fault** state until it has passed a successful built-in test.*

**Note**
The outputs depend on the output configurations.

## Optional latching

Alarms are set as non-latching by default. However, the detector includes a latched alarm output capability, which operates according to the programmed function.

If selected, upon detection of a fire, the detection signal is latched until the operator manually resets the detector (disconnecting the power supply or performing a manual built-in test [see Manual built-in test]).

Latching affects the alarm relay, 0-20 mA output, and the alarm LED. The auxiliary relay is latched only when the programmable function *Auxiliary Relay* is set to Yes.

**NOTICE**

The auxiliary relay is available only in models with output configurations - 1RXXXXX and 2RXXXXX.
The 0-20 mA is available only in models with output configurations - 1AXXXXX, 2AXXXXX, and 3AXXXXX.

# 1.6 Internal detector tests

The detector performs two types of self-tests:

- Continuous feature test
- Built-in test (BIT)

## 1.6.1 Continuous feature test

The detector is supplied with default settings, including a continuous feature test.

During normal operation, the detector tests itself continuously and indicates a fault if a failure is found.

The detector continuously tests:

- Input voltage level
- All internal regulator voltage level
- Voltage level status of sensor and sensor circuitry for noise or disconnection in the electronic circuitry
- 0-20 mA level output
- Relays and heater operation
- Processor watch dog
- Software
- Memory
- Oscillator frequency

### Response to a fault indication

If a failure is found, the detector indicates it by:

- Fault relay:
  - Opens in output configurations 1A, 2A, and 1R
  - Closes in output configurations 3A and 2R
- 0-20 mA: indicates fault (0 mA or 2 mA) in output configurations 1A, 2A, and 3A
- LED - yellow flashes (4 Hz)
- Correcting the fault

The fault indications remain until the detector's power is removed. The fault indications return if the fault is still found when power is restored.

## 1.6.2 Built-in test (BIT)

The detector's built-in test (BIT) also checks the following:

- Electronics circuitry
- Sensors

- Window cleanliness

The detector can be set to perform the built-in test in the following modes:

- Automatically and manually
- Manually only

**NOTICE**

In a manual built-in test, the outputs may also be tested; apply control system **inhibit** if this could initiate other systems.

## How the built-in test operates

- The detector's status remains unchanged if the result of a built-in test is the same as the current status (Normal or BIT Fault).
- The detector's status is changed (from Normal to BIT Fault or vice versa) if the built-in test differs from the current status.

**NOTICE**

In BIT Fault status, the detector can continue to detect a fire.

## Automatic built-in test

The detector automatically performs a built-in test every fifteen minutes. A successful built-in test sequence does not activate any indicator.

All outputs of built-in test results function as described in Table 1-9 and Table 1-10, and the built-in test is automatically executed every one minute.

This continues until a successful built-in test occurs, when the detector resumes normal operation.

**Table 1-9: Results of a Successful Built-in Test**

| Output | Result |
|---|---|
| Fault relay | • Output configurations 1A, 2A, and 1R: remain CLOSED<br>• Output configurations 3A and 2R: remain OPEN |
| 0-20 mA output | Output configurations 1A, 2A, and 3A: Normal (4 mA) |
| Power LED | Green, flashing, 1 Hz on (Normal) |

**Table 1-10: Results of an Unsuccessful Built-in Test**

| Output | Result |
|---|---|
| Fault relay | • Output configurations 1A, 2A, and 1R: change to OPEN<br>• Output configurations 3A and 2R: change to CLOSED |
| 0-20 mA output | Output configurations 1A, 2A, and 3A: BIT Fault (2 mA) |
| Power LED | Yellow, flashing, 4 Hz |
| BIT procedure | Performed every one minute |

## Manual built-in test

To intiate the built-in test manually, momentarily connect Terminal 3 to Terminal 2 (or a switch across these terminals in a safe area).

The results of a successful and unsuccessful manual built-in test are listed in Table 1-11 and Table 1-12.

**Table 1-11: Results of a Successful Manual Built-in Test**

| Output | Result |
|---|---|
| Fault relay | • Output configurations 1A, 2A, and 1R: remain CLOSED (Normal).<br>• Output configurations 3A and 2R: remain OPEN (Normal). |
| Alarm relay | Activated for three seconds (only when the function Alarm BIT is set to YES). |
| Auxiliary relay | For output configurations 1R and 2R, is activated for three seconds (only when the function Auxiliary BIT is set to YES). |
| 0-20 mA output | Output configurations 1A, 2A, and 3A:<br>• Initiates 20 mA only when the function Alarm BIT is set to YES.<br>• Initiates 16 mA when the function Auxiliary BIT is set to YES and the function Alarm BIT is set to NO. |
| Power LED | Green, flashing, 1 Hz |

**Table 1-12: Results of an Unsuccessful Manual Built-in Test**

| Output | Result |
|---|---|
| Fault relay | • Output configurations 1A, 2A, and 1R: change to OPEN.<br>• Output configurations 3A and 2R: change to CLOSED. |
| 0-20 mA output | Output configurations 1A, 2A, and 3A: indicates BIT Fault (2 mA) |
| Power LED | Yellow, flashing, 4 Hz |

# 2 Installing the detector

This chapter provides basic guidelines for installing the detector. It does not attempt to cover all of the standard practices and codes of installation. Rather, it emphasizes specific points of consideration and provides some general rules for qualified personnel. Wherever applicable, special safety precautions are stressed.

## 2.1 General guidelines

To ensure optimal performance and an efficient installation, consider the following guidelines:

- Sensitivity: To determine the level of sensitivity, consider the following:
  - Size of fire at the required distance to be detected
  - Type of flammable materials
- Wiring:
  - The wire gauge must be designed according to the distance from the detector to the controller and the number of detectors on the same power line. See Wiring instructions.
  - To fully comply with EMC directive and protect against interference caused by RFI and EMI, the cable to the detector must be shielded, and the detector must be grounded. Ground the shield at the detector end.
- Spacing and location: The number of detectors and their locations in the protected area are determined by:
  - Size of the protected area
  - Sensitivity of the detectors
  - Obstructed lines of sight
  - Cone of view of the detectors
- Environment:
  - Dust, snow, or rain can reduce the detector's sensitivity and require more maintenance activities.
  - The presence of high intensity flickering IR sources may affect sensitivity.
- Aiming the detector:
  - Aim the detector toward the center of the detection zone and make sure the view of the protected area is completely unobstructed.
  - Whenever possible, tilt the detector face down at a 45-degree angle to maximize coverage and prevent accumulation of dust and dirt.
  - Take into account all conceivable considerations regarding detection location before starting an installation.

Installations must comply with National Fire Protection Agency (NFPA) 72E or any other local and international regulations and standards, as applicable to flame detectors and installation of Ex approved products.

# 2.2 Unpack

### Procedure

1. Upon receipt of your detector, verify that you have received the following contents:
   - Delivery form
   - Flame detector
   - Plastic weather cover
   - Quality document
2. Check and record the following:
   a) Verify the appropriate purchase order.
   b) Record the model number and serial number of the detector and the installation date in an appropriate log book.
   c) Verify that all components required for the detector installation are readily available before beginning the installation.

### Postrequisites

If the installation is not completed in a single session, secure and seal the detectors and conduits/cable entries.

## 2.2.1 Checking the product type

Confirm your product has the configuration options you ordered.

Check the detailed model number on the label and compare this information with the descriptions contained in Ordering information.

# 2.3 Required tools

The operator can install the detector using general purpose tools and equipment.

Table 2-1 lists the specific tools required to install the detector.

**Table 2-1: Required Tools**

| Tool | Function | Comments |
|---|---|---|
| Hex key 3/16-in. | Open and close the detector cover (for wiring). | Part of the kit |
| Hex key ¼-in. | Mount the detector on the tilt mount. | Part of the kit |
| Flat screwdriver 6 mm | Connect ground terminal. | Standard tool |
| Flat screwdriver 2.5 mm | Connect wires to the terminal blocks. | Standard tool |
| Hex key 5/16-in. | Scrw detector plug. | Part of the kit |

For wiring, use color-coded conductors or suitable wire markings or labels. You may use 12 to 20 AWG (0.5 $mm^2$ to 3.5 $mm^2$) wires for site wiring. Select wire gauge based on the number of detectors used on the same line and the distance from the control to the ground unit, in compliance with specifications. See General instructions for electrical wiring.).

## 2.4 Certification instructions

**⚠ WARNING**

**Flammable**

Do not open the detector, even when isolated, in a flammable atmosphere.

Use the following certification instructions:

- The cable entry point may exceed 167 °F (75 °C). Take suitable precautions when selecting the cable.
- The equipment may be used with flammable gases and vapors with apparatus groups IIA, IIB, and IIC:
  - T5 in the ambient temperature range: -67 °F (-55 °C) to 167 °F (75 °C)
  - T4 in the ambient temperature range: -67 °F (-55 °C) to 185 °F (85 °C)
- Only suitably trained personnel should install the detector, in accordance with the applicable code of practice, such as EN 60079-14:1997.
- Only suitably trained personnel should inspect and maintain the detector, in accordance with the applicable code of practice, such as EN 60079-17.
- Only suitably trained personnel should repair the detector, in accordance with the applicable code of practice, such as EN 60079-19.
- The certification of this equipment relies upon the following materials used in its construction:
  - Enclosure: 316L stainless steel
  - Window: sapphire glass
- If the equipment is likely to come into contact with aggressive substances, take suitable precautions to prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.
  - Aggressive substances: acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.
  - Suitable precautions: regular checks as part of routine inspections or establishing from the material's data sheets that it is resistant to specific chemicals.
- To maintain the IPx6 and Type 6P ingress protection ratings, NPT plugs shall be torqued to a value of 90 Nm (67 lbft). In addition, a suitable thread sealant, such as PTFE tape, shall be applied to NPT threads for submersion applications.

Refer to Product certifications for more information about product certifications.

## 2.5 Installing cables

When installing cables for the flame detector, consider the following:

- Ensure all cables to the detector are well shielded in order to comply with EMC requirements.
- The end user must use suitable rated blanking plugs for all unused entries.
- Ground the detector to the nearest ground point (not more than 9.8 ft. (3 m) from the flame detector).
- Install the detector with the cable entries and conduit pointed downwards.

### 2.5.1 Installing conduit

The conduit used for the cabling must comply with the following:

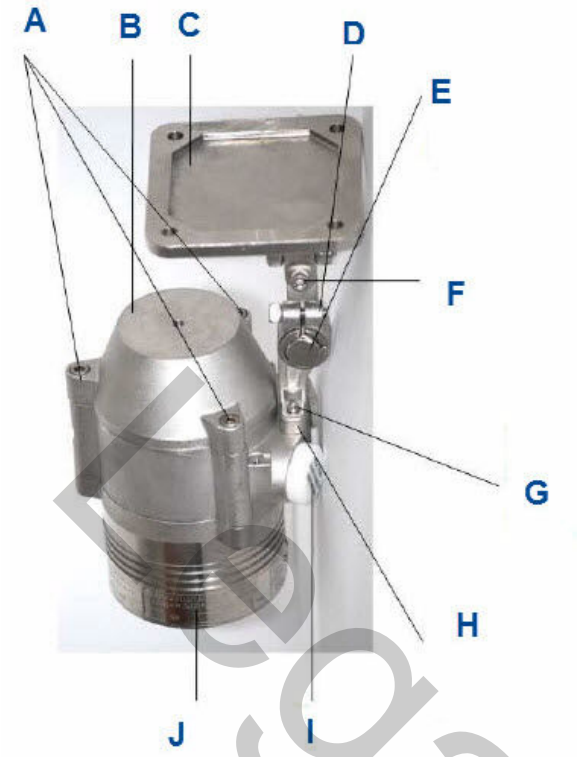
- To avoid water condensation in the detector, install the detector with the conduits that include drain holes pointed downwards.
- When using the optional tilt mount, use flexible conduits for the last portion connecting to the detector.
- For installation in atmospheres as defined in group B of the National Fire Protection Agency (NFPA) 72E, seal the conduit inlets.
- When pulling the cables through the conduits, ensure that they are not tangled or stressed. Extend the cables about 12 in. (30 cm) beyond the detector location to accommodate wiring after installation.
- After pulling the conductor cables through the conduits, perform a continuity test.

## 2.6 Installing the tilt mount (PN 00975-9000-0001)

The tilt mount (PN 00975-9000-0001) enables the detector to rotate up to 60 degrees in all directions.

Figure 2-1 shows the detector mounted on the tilt mount.

**Figure 2-1: Detector with Tilt Mount**



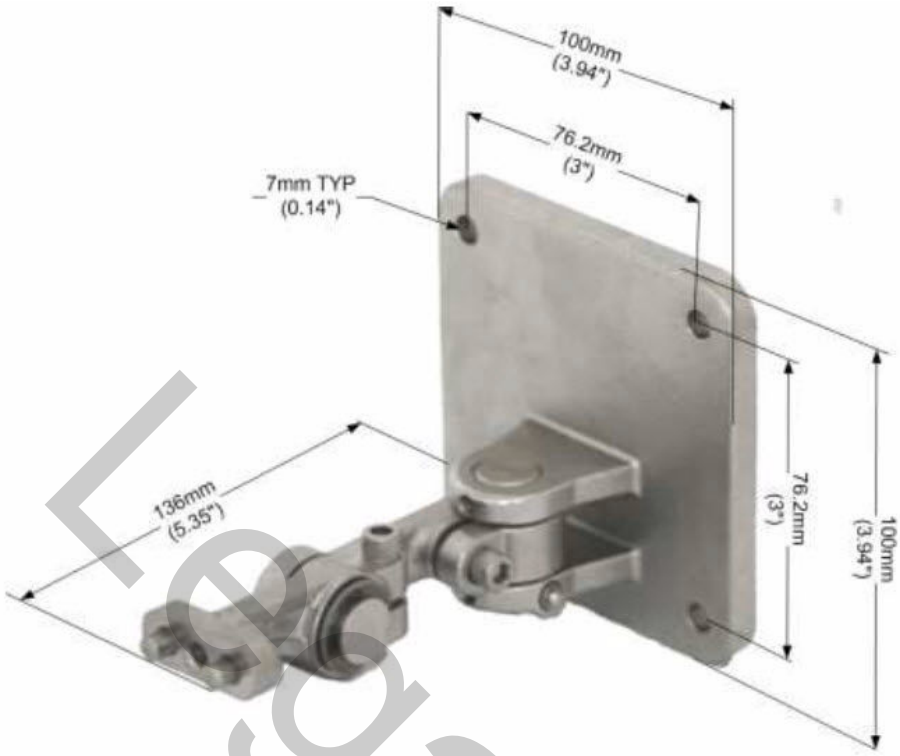

*A. Cover bolts*
*B. Back cover*
*C. Tilt mount plate*
*D. Horizontal locking screw*
*E. Tilt mount*
*F. Vertical locking screw*
*G. Detector holding screw*
*H. Tilt mount holding plate*
*I. Conduit/cable inlet*
*J. Detector assembly*

## 2.6.1 Assemble the tilt mount

**Figure 2-2: Tilt Mount Assembly**


*A. Tilt holding plate*
*B. Tilt mount*
*C. Horizontal locking screw*
*D. Vertical locking screw*
*E. Detector holding plate*

**Figure 2-3: Tilt Mount Assembly Dimensions**






To install the tilt mount:

### Procedure

1. Place the tilt mount in its designated location and secure it with four (4) fasteners through four (4) holes 0.14 in. (7 mm) in diameter. Use the four (4) screws and spring washers according to the kit.

   Refer to Figure 2-3, Table 2-2, and Table 2-3.

   **Note**
   You do not have to remove the tilt mount when removing the detector for maintenance purposes.

2. Unpack the detector.
3. Place the detector with its conduit/cable entries pointing downwards on the holding plate of the tilt mount. Secure the detector with 5/16-in. 18 UNC x 1-in. screw to the tilt mount.
4. Release the horizontal and vertical locking screws using the supplied 3/16-in. hex key, such that the detector can be rotated. Point the detector towards the protected area and ensure the view of the area is unobstructed. Secure the detector in position by tightening the locking screws on the tilt mount.

The detector is now correctly located, aligned, and ready to be connected to the system.

### Postrequisites

Refer to Connect the detector.

## 2.7 Connect the detector

To connect the detector to the electrical cables:

### Procedure

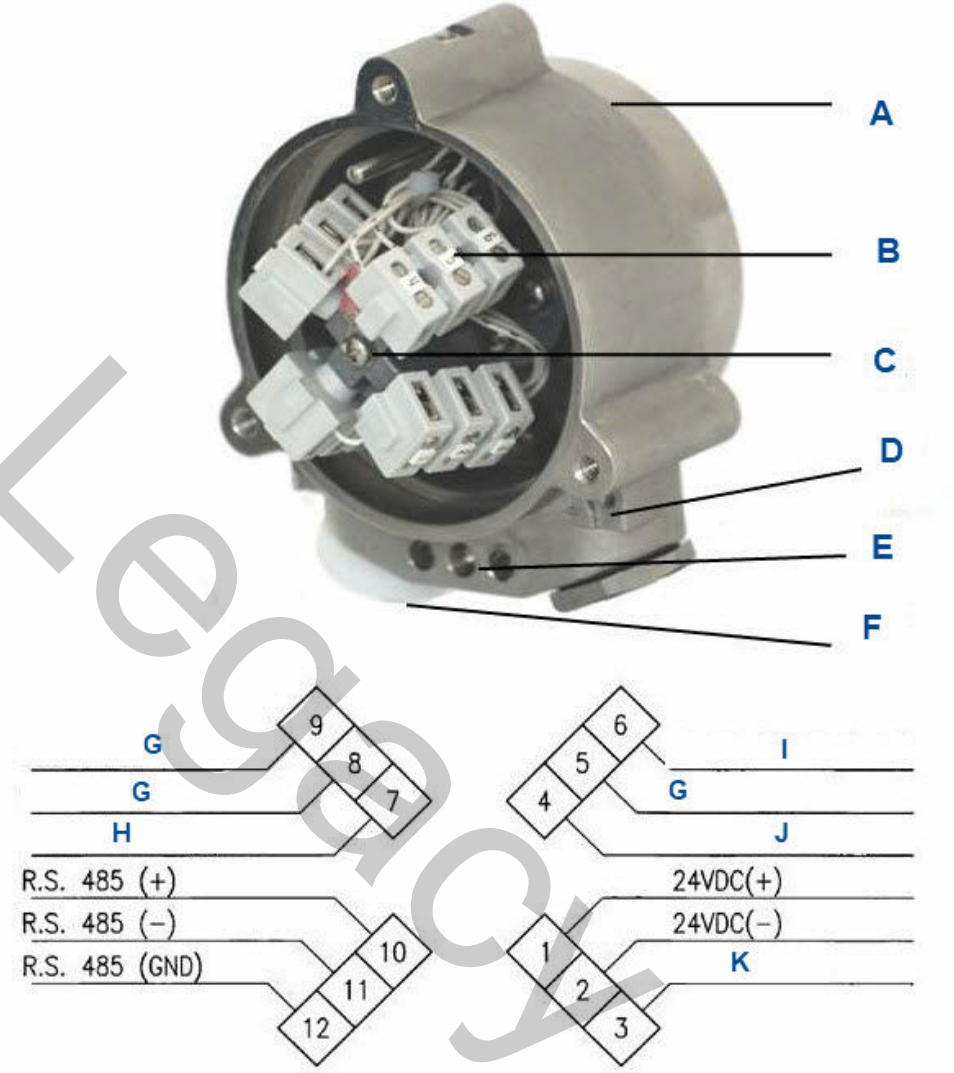
1. Disconnect the power to the electrical cables.
2. Remove the back cover of the detector by removing three socket head screws in the cover bolts.

   Refer to Figure 2-1.

   The terminal chamber is now revealed.
3. Remove the protective plug mounted on the detector conduit/cable entry; pull the wires through the detector inlet.
4. Use a ¾-in. - 14 national pipe thread (NPT) explosion-proof conduit connection or M25 x 1.5 flameproof gland to assemble the cable/conduit to the detector.
5. Connect the wires to the required terminals on the terminal board according to the wiring diagram.

   See Figure 2-4 and Table 2-2.

**Figure 2-4: Detector with Cover Removed**






*A. Terminal chamber*
*B. Terminals*
*C. Internal earth terminal*
*D. Earth terminal*
*E. Detector holding screw*
*F. Conduit/cable entry*
*G. See Table 2-2.*
*H. Alarm relay (C)*
*I. Alarm relay (normally open)*
*J. Fault relay (C)*
*K. Manual built-in test (BIT)*

6. Connect the grounding wire to the ground screw outside the flame detector (earth terminal).

   The detector must be well-grounded to earth ground.

7. Verify the wiring.

**⚠ CAUTION**

**Equipment damage**

Improper wiring may damage the detector.

8. Check the wires for secure mechanical connection and press them neatly against the terminal to prevent them from interfering while closing the back cover.

   Refer to Figure 2-4.

9. Place and secure the detector's back cover by screwing the three (3) socket-head screws in the cover bolts.

   Refer to Figure 2-1.

## 2.7.1 Verify the detector wiring

The flame detector has five output configurations within the Exde integral terminal section of the enclosure. There are twelve terminals labeled 1 - 12.

For more information on the output configurations, see Wiring instructions.

Table 2-2 describes the function of each terminal for all the output configurations.

**Table 2-2: Rosemount 975HR Output Configurations**

| Wire terminal number | 1A (default) | 2A | 3A | 1R | 2R |
|---|---|---|---|---|---|
| 1 | +24 Vdc | +24 Vdc | +24 Vdc | +24 Vdc | +24 Vdc |
| 2 | 0 Vdc | 0 Vdc | 0 Vdc | 0 Vdc | 0 Vdc |
| 3 | Manual built-in test | Manual built-in test | Manual built-in test | Manual built-in test | Manual built-in test |
| 4 | Fault relay normally clsed (N.C.) | Fault relay N.C. | Fault relay normally open (N.O.) | Fault relay N.C. | Fault relay N.O. |
| 5 | | | | | |
| 6 | Alarm relay N.O. | Alarm relay N.O. | Alarm relay N.O. | Alarm relay N.O. | Alarm relay N.O. |
| 7 | Alarm relay C | Alarm relay C | Alarm relay C | Alarm relay C | Alarm relay C |
| 8 | 0-20 mA in | Alarm relay N.C. | Alarm relay N.C. | Auxiliary N.O. | Auxiliary N.O. |
| 9 | 0-20 mA out(1) | 0-20 mA out(1) | 0-20 mA out(1) | Auxiliary C | Auxiliary C |
| 10 | RS-485 + (1) | RS-485 + (1) | RS-485 + (1) | RS-485 + (1) | RS-485 + (1) |
| 11 | RS-485 - (1) | RS-485 - (1) | RS-485 - (1) | RS-485 - (1) | RS-485 - (1) |
| 12 | RS-485 GND | RS-485 GND | RS-485 GND | RS-485 GND | RS-485 GND |

*(1) Available with the HART® protocol.*

### Output configuration notes

- RS-485 is used for network communication, as specified in RS-485 communication network, (terminals 10, 11, and 12) and to connect (in safe areas) to PC/laptop for configuration/diagnostics.
- Alarm relay
  - Normally open (N.O.) in output configuration 1A, 1R, and 2R
  - N.O. and normally closed (N.C.) in output configuration 2A and 3A
- 0-20 mA is Sink in output configuration 1A and Source in output configurations 2A and 3A.
- 0-20 mA output configurations 1A, 2A, and 3A are available with the HART® protocol.
- In output configuration 1A, link terminals 1 and 8 to change the mA output to Source.
- The fault output is N.C. energized SPST relay. The contacts are closed when the detector is in its normal operational condition in output configurations 1A, 2A, and 1R and available as N.O. energized in output configurations 3A and 2R.
- The auxiliary output is N.O. energized (SPST) relay. The auxiliary relay may act in parallel with the alarm relay to activate another external device, or it may provide a warning signal, depending on the function configuration.

## 2.8 Configure the detector

You can reprogram the function setup using the RS-485 connection or using the HART® protocol as follows:

- USB RS-485 harness kit (PN 00975-9000-0011): The USB RS-485 harness kit with RS-485/USB converter, used with the Rosemount host software, enables you to connect to any available PC or laptop to reconfigure settings or perform diagnostics on all Rosemount 975 series flame detectors.
  Refer to the WinHost Configuration and Diagnostic Software for Rosemount 975 Flame Detectors Manual (00809-0300-4975) for programming instructions when using the USB RS-485 harness kit.
- HART protocol: Refer to the Rosemount 975 Flame Detector HART Communication Protocol Manual (00809-0200-4975) for programming instructions.

These functions enable you to set:

- Sensitivity
- Alarm delay
- Address setup
- Mode of operation
- Heated optics operation

The factory default settings listed for each function are:

- Sensitivity: 30
- Alarm delay: A

- Alarm latch: No
- Auxiliary relay: No
- Automatic BIT: Yes
- Alarm BIT: No
- Auxiliary BIT: No
- Heated optics: Auto
- Temperature: 41 °F (5 °C)

## 2.8.1 Sensitivity

The detector offers four sensitivity settings. The settings refer to an n-heptane or gasoline fire of 1 $ft.^2$ (0.1 $m^2$), from the low sensitivity of 50 ft. (15 m) to 215 ft. (65 m).

For other types of fuel sensitivity, refer to Table 1-2.

## 2.8.2 Alarm delay

The flame detector is equipped with an alarm delay option, which provides programmable time delay with settings at:

- Antiflare(1) (default)

Other delay settings are available:

- 0, 3, 5, 10, 15, 20, or 30 seconds

When an alarm (detection) level condition occurs, the flame detector delays the execution of the alarm outputs by the specified period of time. The detector then evaluates the condition for three seconds. If the alarm level is still present, the detector activates the alarm outputs. If this condition no longer exists, the detector returns to its standby state.

The alarm delay option affects the output relays and the 0-20 mA output. The LEDs and outputs indicate warning levels during the delay time only if the fire condition exists.

## 2.8.3 Address setup

The flame detector provides up to 247 addresses that can be changed with the RS-485 communication link or the HART® communication protocol.

## 2.8.4 Function setup

You can select the desired functions as detailed in Table 2-3.

*(1) The Antiflare mode is selected to prevent false alarms in locations where fast flares may be present. The time delay for fire alarms in this mode ranges from 2.5 to 15 seconds (usually less than 10 seconds).*

**Table 2-3: Functions**

| Function | Setting |
|---|---|
| Alarm latch | • Yes: Enable alarm latching.<br>• No: Disable alarm latching (default). |
| Auxiliary relay(1) | • Yes: Activate auxiliary relay at warning level.<br>• No: Activate auxiliary relay at alarm level (default). |
| Automatic BIT | • Yes: Perform automatic and manual built-in test (default).<br>• No: Perform manual built-in test only. |
| Alarm BIT | • Yes: Successful manual built-in test activates the alarm relay for approximately three seconds (default).<br>• No: Successful manual built-in test does not activate the alarm relay. |
| Auxiliary BIT(1) | • Yes: Successful manual built-in test activates the auxiliary relay for approximately three seconds (default).<br>• No: Successful manual built-in test does not activate the auxiliary relay. |

*(1) Only available in output configurations 1R and 2R.*



## 2.8.5 Heated optics

To configure optical window heating, select one of the modes listed below.

- OFF: Optical window surface heating does not operate.
- ON: Optical window surface heating operates continuously.
- AUTO: Optical window surface heating operates according to temperature change. Specify the start temperature below which the optical window surface is heated to improve performance in temperatures where snow, ice, and condensation may occur.

In AUTO mode, the default Heat On setting is 41 °F (5 °C). Heating stops when the temperature is 27 °F (15 °C) above the start temperature.

You can define the start temperature below which the window will be heated. The temperature can be defined between 32 and 122 °F (0 and 50 °C).

# 3 Operating the detector

This chapter describes how to power up and test the detector. It also includes some very important safety checks that you should make before operating the detector.

## 3.1 Power up

Follow these instructions carefully to obtain optimal performance from the detector over its life cycle.

To power up the detector:

### Procedure

1. Turn on the power.
2. Wait approximately 60 seconds for the detector to finish the startup procedure.

   Applying power initiates the following sequence of events:

   - The yellow LED flashes at 4 Hz.
   - Built-in test is executed.

   If successful, the green LED flashes at 1 Hz, and the FAULT relay contacts close; mA output is 4 mA.
3. Enter Normal mode.

   **NOTICE**

   The majority of detectors are used in the default non-latching alarm mode. Only perform a reset when the latching alarm option has been programmed.

   To reset the detector when it is in a Latched Alarm state, do one of the following:

   - Disconnect power (terminal number 1 or terminal number 2).
   - Initiate a manual built-in test.

## 3.2 Safety precautions

After powering up, the detector requires almost no attention in order to function properly, but note the following:

- Follow the instructions in this Reference Manual and refer to the drawings and specifications.
- Do not expose the detector to radiation of any kind unless required for testing purposes.
- Do not open the detector housing while power is applied.
- Do not open the electronic compartment. Keep this part closed at all times. It can only be opened in the factory. Opening the electronic component side invalidates the warranty.

- Only access the wiring compartment to wire or remove the detector or access RS-485 terminals for maintenance.
- Disconnect or disable external devices, such as automatic extinguishing systems, before carrying out any maintenance.

### 3.2.1 Factory default function settings

Table 3-1 lists the default function configurations supplied with the detector.

**Table 3-1: Factory Default Function Settings**

| Function | Value | Notes |
|---|---|---|
| Sensitivity | 30 | |
| Alarm delay | A | Antiflare |
| Alarm latch | No | |
| Auxiliary relay | No | In output configurations 1A, 2A, and 3A, the auxiliary relay is not available. This function is not used. |
| Automatic built-in test (BIT) | Yes | |
| Alarm built-in-test | No | |
| Auxiliary built-in test | No | In output configurations 1A, 2A, and 3A, the auxiliary relay is not available. This function is not used. |
| Heated optics | Auto | |
| Heat on | 41 °F (5 °C) | The detector starts heating the window for any temperature below this value. |



In order to change the default function, use:

- USB RS-485 harness kit PN 00975-9000-001
- HART® protocol. Refer to the Rosemount 975 Flame Detector HART Communication Manual (00809-0200-4975) for instructions.

## 3.3 Testing procedures

This section describes the proof testing procedure for proper operation of the detector. Test the detector using the manual built-in test (BIT) or the flame simulator.

The detector performs the internal test continuously and the automatic built-in test every fifteen minutes; for more details, refer to Built-in test (BIT) .

### 3.3.1 Automatic built-in test

Check that the indicators show normal conditions.

See Power up.

### 3.3.2 Manual built-in test

To perform a manual built-in test:

**NOTICE**

If the function setup Alarm BIT and or Auxiliary BIT are set to YES (default NO), the alarm, auxiliary relay, and 0-20 mA outputs are activated during a manual built-in test. Therefore, you must disconnect automatic extinguishing systems or any external devices that may be activated during the built-in test.

**Procedure**

1. Verify that the detector is in Normal mode.
2. Initiate the manual built-in test.

   The results of successful and unsuccessful manual built-in tests are detailed in Table 1-11 and Table 1-12.

### 3.3.3 Test with flame simulator

Use the flame simulator to simulate exposure of the detector to a real fire condition. The flame simulator exposes the detector to radiation at the required detection level. As a result, the detector generates a fire alarm signal.

See Flame simulator for more information.

**NOTICE**

If the detector is exposed to a flame simulator, the alarm and accessory relays and 0-20 mA are activated during the simulation. Therefore, disconnect automatic extinguishing systems or any external devices that may be activated during this process.

To test the detector with a flame simulator:

**Procedure**

1. Power up the system and wait up to 60 seconds for the detector to turn to a normal state.
   The power LED turns on.
2. Aim the flame simulator at the target point of the detector, in a way that the radiation emitted by it is facing directly towards the detector.

   See Flame simulator.
3. Press **Operation** once.
   After a few seconds, a successful test shows the results shown in Table 3-2.

**Table 3-2: Results of a Successful Flame Simulator Test**

| Component | Action | Notes |
|---|---|---|
| 0-20 mA | Turns to 20 mA | For a few seconds and then returns to 4 mA |
| Alarm relay | Activated | For a few seconds and then returns to Normal |
| Auxiliary relay | Activated | For a few seconds and then returns to Normal |
| Fault relay | Remains active during the test | |
| LED | Red, steady | |

The detector is now ready for operation.

# 4 Maintenance and troubleshooting

This chapter deals with preventative maintenance, describes possible faults in detector operation, and indicates corrective measures.

Ignoring these instructions may cause problems with the detector and may invalidate the warranty. Whenever a unit requires service, please contact Emerson or its authorized distributer for assistance.

## 4.1 Maintenance

This section describes the basic maintenance steps you should take to keep the detector in good working condition.

### 4.1.1 General maintenance procedures

Only suitably qualified personnel who are familiar with local codes and practices should perform maintenance. Maintenance requires ordinary tools.

#### Cleaning

Keep the detector as clean as possible. Clean the viewing window and the reflector of the flame detector periodically.

The frequency of cleaning operations depends upon the local environmental conditions and specific applications. The fire detection system designer will give his or her recommendations.

To clean the detector viewing window and reflector:

**Procedure**

1. Disconnect power to the detector before proceeding with any maintenance, including window/lens cleaning.
2. Use water and detergent and then rinse the viewing window with clean water.
3. Where dust, dirt, or moisture accumulates on the window, first clean only with a soft optical cloth and detergent and then rinse with clean water.

### 4.1.2 Periodic maintenance procedures

In addition to preventive cleaning and maintenance, functionally test the detector every six months or as dictated by local codes and regulations. Also perform these tests if the detector has been opened for any reason.

#### Power-up procedure

Perform the power-up procedure every time power is restored to the system.

Follow the instructions described in Power up.

### Functional test procedure

Perform a functional test of the detector as described in Internal detector tests.

## 4.1.3 Keeping maintenance records

Emerson recommends that you record maintenance operations performed on a detector in a log book. The record should include the following:

- Installation date and contractor
- Serial and tag number
- Entries for every maintenance operation performed, including the description of the operation, date, and personnel ID

If you send a unit to Emerson or a distributer for service, include a copy of the maintenance records.

# 4.2 Troubleshooting

This section is intended to be a guide to correct problems that may happen during normal operation.

## 4.2.1 Fault relay at N.O.

**LEDs off**

0-20 mA at 0 mA

**Potential cause**

No power to the unit.

**Recommended actions**

1. Check that the correct power is sent to the detector.
2. Check power polarity.
3. Check wiring in the detector.
4. Send the detector back for repairs.

## 4.2.2 Fault relay at N.O.

**Yellow/amber LED flashes at 4 Hz.**

0-20 mA at 0 mA

**Potential cause**

Detector fault

- Low voltage
- Faulty detector

#### Recommended actions

1. Check the voltage at the detector; verify at least 24 V at the detector terminal.
2. Send the detector back for repairs.

### 4.2.3 Fault relay at N.O.

#### Yellow/amber LED flashes at 4 Hz.

0-20 mA at 2 mA

#### Potential cause

Built-in test (BIT) fault: faulty detector

#### Recommended actions

1. Clean detector window.
2. Re-power the detector.
3. Replace the detector.

### 4.2.4 Red LED constantly on

#### Potential cause

If no fire exists, the detector alarm may be latched.

#### Recommended action

Reset the detector.

### 4.2.5 Alarm relay at on

0-20 mA at 20 mA

#### Potential cause

Alarm condition

#### Recommended actions

1. Check cause of alarm.
2. If no alarm, re-power the detector.
3. Send the detector back for repairs.

# A Specifications and reference data

## A.1 Technical specifications

**Table A-1: Technical Specifications**

| | | | | |
|---|---|---|---|---|
| Spectral response | Multi IR bands | | | |
| **Detection range (at highest sensitivity setting for 1 ft.$^2$ [0.1 m$^2$] pan fire)** | **Fuel** | **ft. / m** | **Fuel** | **ft. / m** |
| | n-Heptane | 215 / 65 | Kerosene | 150 / 45 |
| | Gasoline | 215 / 65 | Ethanol 95% | 135 / 40 |
| | Diesel fuel | 150 / 45 | Methanol | 115 / 35 |
| | JP5 | 150 / 45 | Isopropyl alcohol (IPA) | 135 / 40 |
| | Methane(1) | 150 / 45 | Polypropylene pellets | 115 / 35 |
| | Liquified petroleum gas (LPG) (1) | 150 / 45 | Ammonia(2) | 60 / 18 |
| | Hydrogen(1) | 125 / 38 | Silane(2) | 7 / 2 |
| | Office paper | 82 / 25 | | |
| Response time | Typically 5 seconds | | | |
| Adjustable time delay | Up to 30 seconds | | | |
| Sensitivity ranges | Two ranges for 1 ft.$^2$ (0.1 m$^2$) n-heptane pan fire from 50 ft. (15 m) to 215 ft. (65 m) | | | |
| Fields of view | Gasoline: horizontal 80 °, vertical 80 °<br>Hydrogen: horizontal 70 °, vertical 80 ° | | | |
| Built-in test (BIT) | Automatic (and manual) | | | |

*(1) 30 in. (0.75 m ) high, 10 in. (0.25 m) wide plume fire*
*(2) 20 in. (0.5 m) high, 8 in. (0.2 m) wide plume fire*



## A.2 Electrical specifications

Operating voltage: 18 - 32 Vdc

Power consumption: Table A-2

**Table A-2: Electrical Specifications**

| Operating voltage | Status | All outputs | Without 0-20 mA |
|---|---|---|---|
| Power consumption (max. 24 Vdc) | Normal | 1.61 W | 1.56 W |
| | Normal when heater on | 2.28 W | 2.16 W |
| | Alarm | 2.64 W | 2.28 W |

**Table A-2: Electrical Specifications *(continued)***

| Operating voltage | Status | All outputs | Without 0-20 mA |
|---|---|---|---|
| | Alarm when heater on | 3.24 W | 2.88 W |
| Maximum current (max. 24 Vdc) | Normal | 70 mA | 65 mA |
| | Normal when heater on | 95 mA | 90 mA |
| | Alarm | 110 mA | 95 mA |
| | Alarm when heater on | 135 mA | 120 mA |
| Power consumption (max. 18-32 Vdc) | Normal | 1.95 W | 1.85 W |
| | Normal when heater on | 2.56 W | 2.45 W |
| | Alarm | 3.04 W | 2.56 W |
| | Alarm when heater on | 3.68 W | 3.2 W |
| Maximum current (18 - 32 Vdc) | Normal | 90 mA | 85 mA |
| | Normal when heater on | 105 mA | 100 mA |
| | Alarm | 130 mA | 115 mA |
| | Alarm when heater on | 160 mA | 145 mA |

Electrical input protection: The input circuit is protected against voltage-reversed polarity, voltage transients, surges, and spikes according to MIL-STD-1275B.



# A.3 Outputs

**Electrical interface**

There are five output configurations. These configurations must be defined at the factory per the customer order and cannot be changed at the customer facility.
See General instructions for electrical wiring for the wiring/terminal diagrams for each option.

Unless otherwise specified, the default is output configuration 1A. The wiring arrangement is identified on the detector by the part number (see Ordering information).

- Output configuration 1A: power, RS-485, 0-20 mA (sink), fault relay (N.C.), alarm relay (N.O.) (see Figure 2-4).
- Output configuration 2A: power, RS-485, 0-20 mA (source) and HART® protocol, fault relay (N.O.), alarm relay (N.O., N.C.)
- Output configuration 3A: power, RS-485, 0-20 mA (source) and HART protocol, fault relay (N.O.), alarm relay (N.O., N.C.)
- Output configuration 1R: power, RS-485, fault relay (N.C.), auxiliary relay (N.O.), alarm relay (N.O.)

- Output configuration 2R: power, RS-485, fault relay (N.O.), auxiliary relay (N.O.), alarm relay (N.O.)

**Electrical outputs**

- Dry contact relays

**Table A-3: Contact Ratings**

| Relay name | Type | Normal position | Maximum ratings |
|---|---|---|---|
| Alarm | SPDT | N.O., N.C. | 2 A at 30 Vdc |
| Auxiliary | SPST | N.O. | 2 A at 30 Vdc |
| Fault (see notes 1 and 2) | SPST | N.C. or N.O. | 2 A at 30 Vdc |

1. The fault relay (in output configurations 1A, 2A, and 1R) is normally energized closed during normal operation of the detector. The relay is de-energized open if a fault condition or low voltage situation occurs.
2. In output configurations 3A and 2R, the relay is normally energized open during normal operation of the detector. The relay is de-energized closed contact if a fault condition or low voltage situation occurs.

- 0-20 mA current output: The 0-20 mA can be Sink or Source according to the output configuration (see General instructions for electrical wiring) . The maximum permitted load resistance is 600 Ω.

**Table A-4: 20 mA Current Output**

| State | Output |
|---|---|
| Fault | 0 + 1 mA |
| Built-in test (BIT) fault | 2 mA ± 10% |
| Normal | 4 mA ± 10% |
| Warning | 16 mA ± 5% |
| Alarm | 20 mA ± 5% |

- HART protocol: The HART protocol is a digital communication signal at a low level on top of the 0-20mA. This is a bi-directional field communication protocol used to communicate between intelligent field instruments and the host system. HART is available in output configurations 1A, 2A, and 3A.
  Through the HART protocol, the detector can:
  - Display setup.
  - Reconfigure the setup.
  - Display detector status and definition.

  - Perform detector diagnostics.
  - Troubleshoot.

  For more details, refer to the Rosemount 975 Flame Detector HART Communication Manual (00809-0200-4975).

- Communication network: The detector is equipped with an RS-485 communication link that can be used in installations with computerized controllers.
  The communication protocol is Modbus® compatible.
  - This protocol is standard and widely used.
  - It enables continuous communication between a standard Modbus controller (master device) and a serial network of up to 247 detectors.

**Heated optics**

The front window can be heated to improve performance in icing, condensation, and snow conditions. The heater increases the temperature of the optical surface by 5 to 8 °F (3 to 5 °C) above the ambient temperature. The heated optics can be configured in three ways:

- OFF: The optics are not heated.
- ON: The optics are heated continuously.
- AUTO: Operated only when the change of temperature requires heating (default).

In AUTO mode, you can define the start heating temperature between 32 and 122 °F (0 and 50 °C). The detector stops heating the window when the temperature is 27 °F (15 °C) above the start temperature.



## A.4 Mechanical specifications

| | |
|---|---|
| **Enclosure** | Stainless steel 316 |
| **Water and dust tight** | • NEMA® 250 type 6p.<br>• IP66 and IP67 per EN 60529 |
| **Electronic modules** | Conformal coated |
| **Electrical connection (two entries)** | • ¾-in. -14 national pipe thread (NPT) conduit or<br>• M25 x 1.5 |
| **Dimensions** | 4 x 4.6 x 6.18 in. (101.6 x 117 x 157 mm) |
| **Weight** | 6.1 lb. (2.8 kg) |

## A.5 Environmental specifications

The Rosemount 975HR is designed to withstand harsh environmental conditions.

**High temperature**

- Designed to meet DNVGL-CG-0339, class D

- Operating temperature: +167 °F (+75 °C)
- Storage temperature: +185 °F (+85 °C)

**Low temperature**

- Designed to meet DNVGL-CG-0339, class D
- Operating temperature: -57 °F (-50 °C)
- Storage temperature: -65 °F (-55 °C)

**Humidity** The Rosemount 975 detector conforms to DNVGL-CG-0339, class B.

**Enclosure** The Rosemount 975 detector conforms to DNVGL-CG-0339, class C.

**Water and dust**

- IP66 per EN60529
- IP68 per EN60529
- Dust: Completely protected against dust.
- Liquids: Protected against immersion between 6 in. (15 cm) and 3 ft. (1 m) in depth. Protected against water jets from all directions.

**Vibration** The Rosemount 975 detector conforms to DNVGL-CG-0339, class B.

### Table A-5: Electromagnetic Compatibility

This product is in conformance with EMC per EN50270.

| | Level per |
|---|---|
| Radiated immunity | EN61000-4-3 |
| Conducted immunity | EN61000-4-6 |
| Electrostatic discharge (ESD) | EN61000-4-2 |
| Magnetic field | EN61000-4-8 |
| Burst | EN61000-4-4 |
| Surge | EN61000-4-5 |
| Radiated emission | EN550022 |
| Conducted emission | EN550022 |

**⚠ CAUTION**

To fully comply with EMC directive 2014/30/EU and protect against interference caused by radio frequency interference and electromagnetic interference, shield the cable to the detector and ground the detector. Ground the shield at the detector end.

# B Wiring instructions

## B.1 General instructions for electrical wiring

Follow the instructions detailed in this section for determining the correct wire gauge to be used for this installation.

1. Use Table B-1 to determine the required wire gauge/size for general wiring, such as relay wiring. Calculate the permitted voltage drop with respect to load current, wire gauge, and length of wires.

**Table B-1: Maximum DC Resistance at 68 °F (20 °C) for Copper Wire**

| AWG # | $mm^2$ | Ohm per 100 ft. | Ohm per 100 m |
|---|---|---|---|
| 20 | 0.52 - 0.61 | 1.07 | 3.50 |
| 18 | 0.81 - 0.96 | 0.67 | 2.20 |
| 16 | 1.22 - 1.43 | 0.43 | 1.40 |
| 14 | 1.94 - 2.28 | 0.27 | 0.88 |

2. Use Table B-2 to select wire gauge for power supply wires. Do not connect any circuit or load to detectors' supply inputs.
   - Select number of detectors connected in one circuit.
   - Select wiring length per installation requirements.
   - Refer to power supply range for voltage extreme applied.

**Table B-2: Wiring Length in Meters (Feet)**

| Number of detectors | Recommended wire diameter (AWG) | | | | | Power supply range (Vdc) |
|---|---|---|---|---|---|---|
| 24 | 18 | 16 | 14 | N/A | N/A | 22-32 |
| 20 | 18 | 16 | 14 | N/A | N/A | 22-32 |
| 16 | 20 | 18 | 16 | 14 | N/A | 22-32 |
| 12 | 20 | 18 | 16 | 14 | N/A | 20-32 |
| 8 | 20 | 18 | 16 | 14 | N/A | 20-32 |
| 4 and less | 20 | 18 | 16 | 16 | 14 | 20-32 |
| m (ft) | 50 (164) | 100 (328) | 150 (492) | 200 (656) | 240 (820) | |
| | **Max. length from power supply to last detector** | | | | | |

## B.1.1 Calculation formula

Use the following formula to calculate minimum wire gauge per wire length between the power supply (controller) and the detector, considering the number of detectors on the same power line, where:

L = Actual wire length between the detector and the power supply.

N = Number of detectors per loop

R = Resistance of wire per 100 m (see Table B-2)

V = Voltage drop on the wire

Calculate the voltage drop on the wire as follows:

$$V = \frac{2\,L \times R}{100} \times N \times 0.2\ A$$

20 + V = Minimum required voltage of the power supply.

0.2 A is the maximum power consumption of the detector.

For example:

If N = 1 (1 detector in loop), L = 1,000 m, wire size = 1.5 $mm^2$ (see Table B-1, the resistance per 100 m for 1.5 $mm^2$ is 1.4 Ω).

You calculate the voltage drop in the wire as follows:

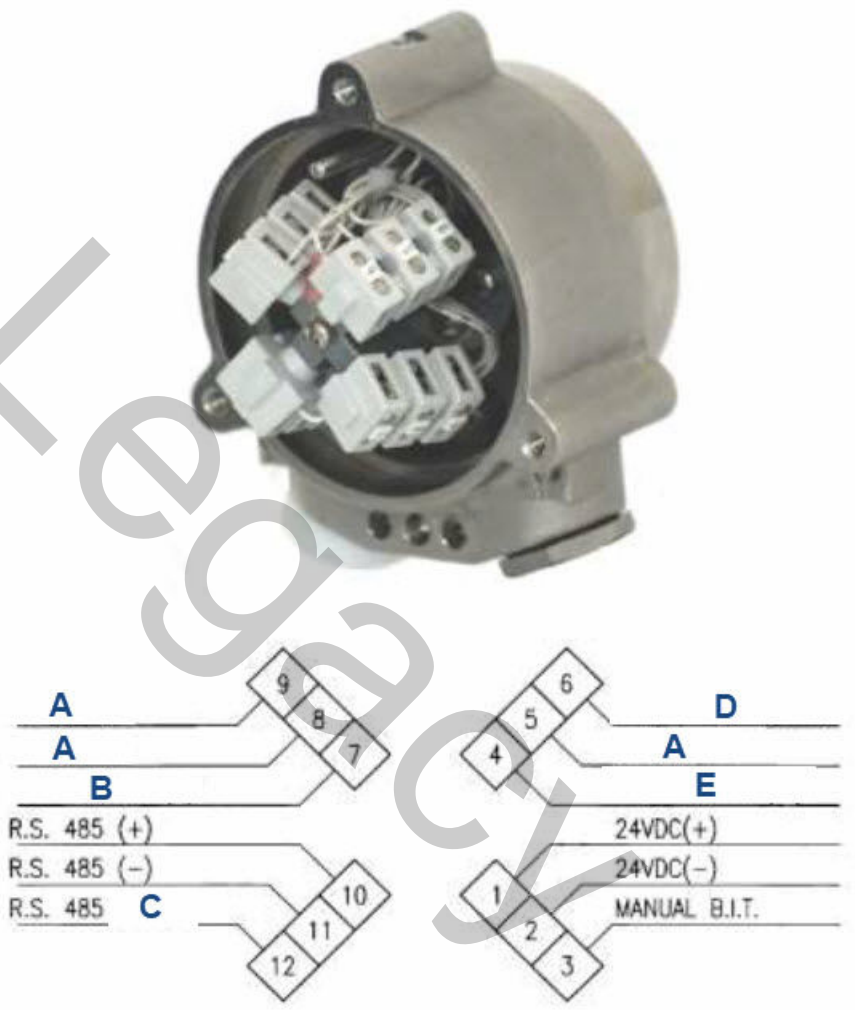
$$\frac{2 \times 1000 \times 1.4\ \Omega}{100} \times 1 \times 0.2\ A = 5.6\ V$$

The minimum voltage of the power supply should be 20 V + 5.6 V = 25.6 V.

# B.2 Typical wiring configurations

This section describes examples of typical wiring configurations.

**Figure B-1: Wiring terminals**

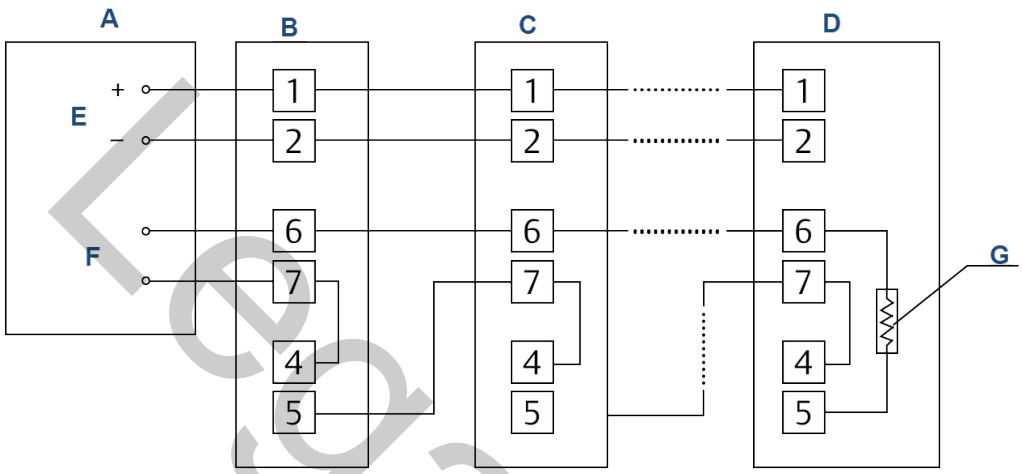



*A. See table.*
*B. Alarm relay (C)*
*C. Ground*
*D. Alarm relay: normally open (N.O.)*
*E. Fault relay (C)*

| Output configuration | Terminals | | |
|---|---|---|---|
| | **5** | **8** | **9** |
| 1A | Fault relay: normally closed (N.C.) | 0-20 mA (sink) | 0-20 mA (sink) |
| 2A | Fault relay (N.C.) | Alarm relay (N.C.) | 0-20 mA (source) |

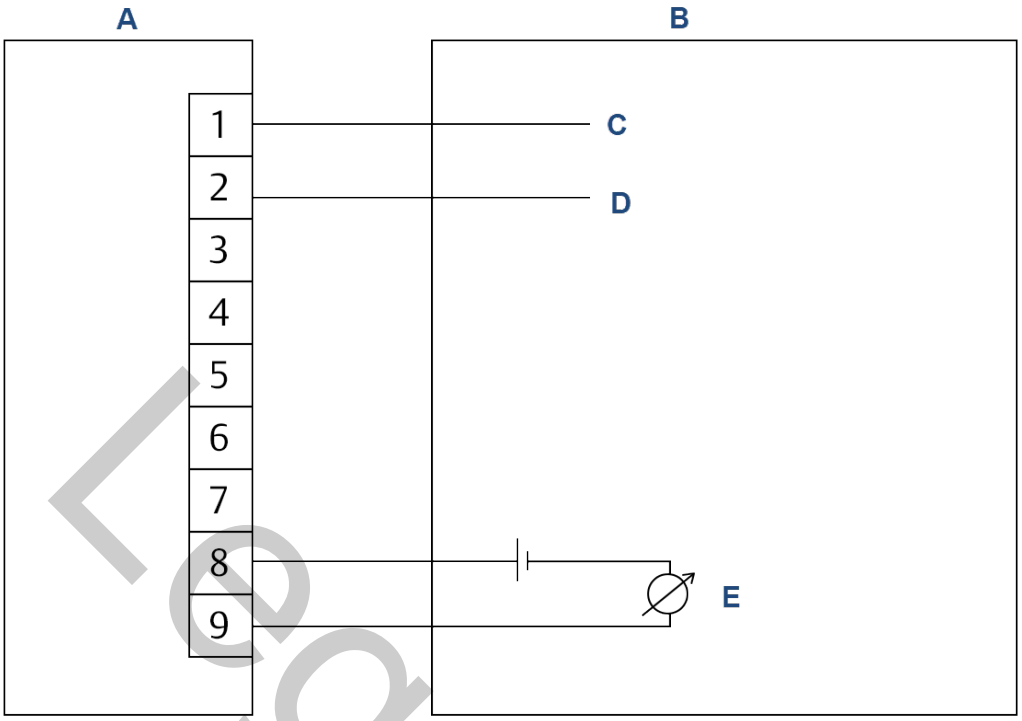
| Output configuration | Terminals | | |
|---|---|---|---|
| 3A | Fault relay: normally open (N.O.) | Alarm relay (N.C.) | 0-20 mA (source) |
| 1R | Fault relay (N.C.) | Auxiliary relay (N.O.) | Auxiliary relay (N.O.) |
| 2R | Fault relay (N.O.) | Auxiliary relay (N.O.) | Auxiliary relay (N.O.) |

**Figure B-2: Typical Wiring for Four-Wire Controllers (Using Output Configuration 1A or 2A)**



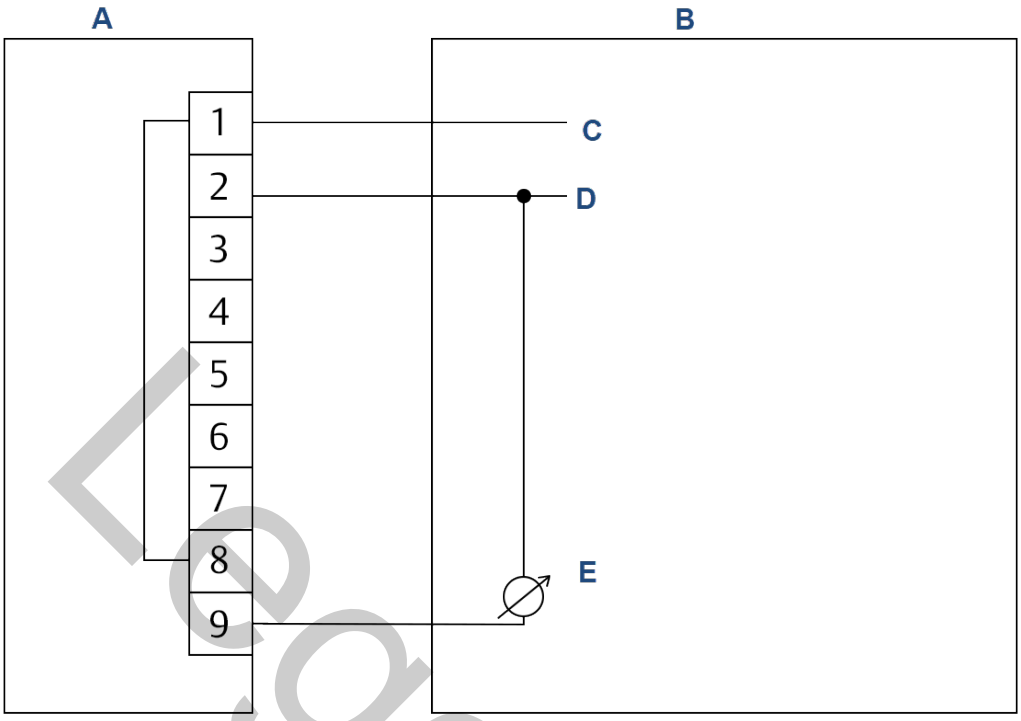

*A. Controller*
*B. First detector*
*C. Second detector*
*D. Last detector*
*E. Power supply*
*F. Alarm loop*
*G. End of line (EOL)*

**Figure B-3: 0-20 mA Output Configuration 1A (Sink 4-Wire) - Default**



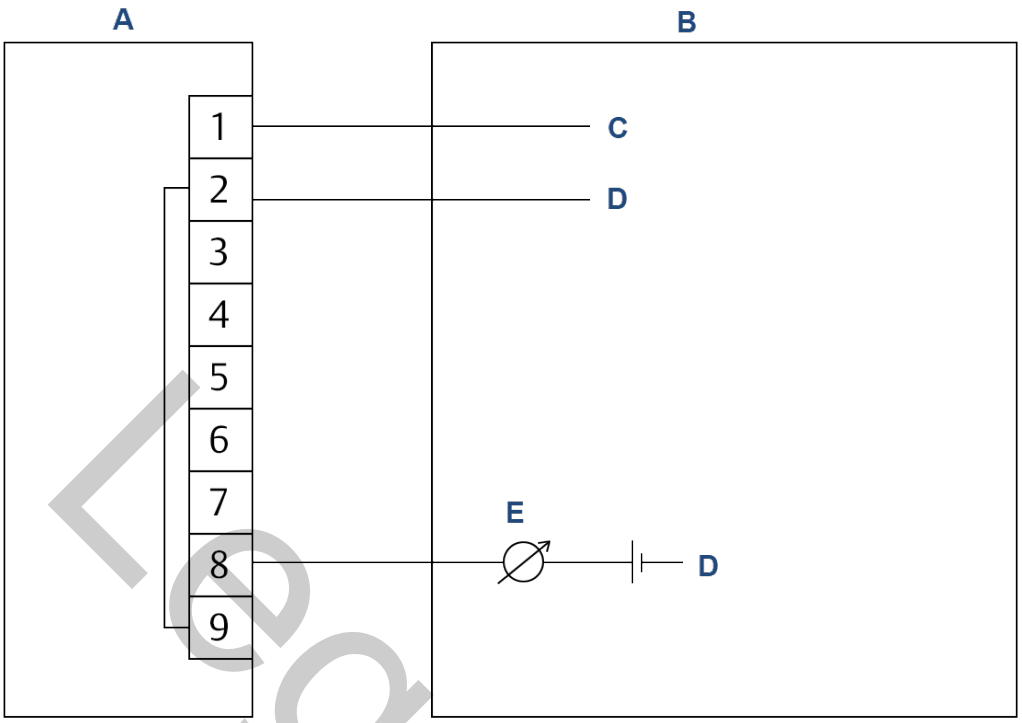

*A. Detector*
*B. Controller*
*C. Input power 18-32 Vdc*
*D. Return*
*E. 0-20 mA meter*

**Figure B-4: 0-20 mA Output Configuration 1A (Converted to Source Three-Wire)**



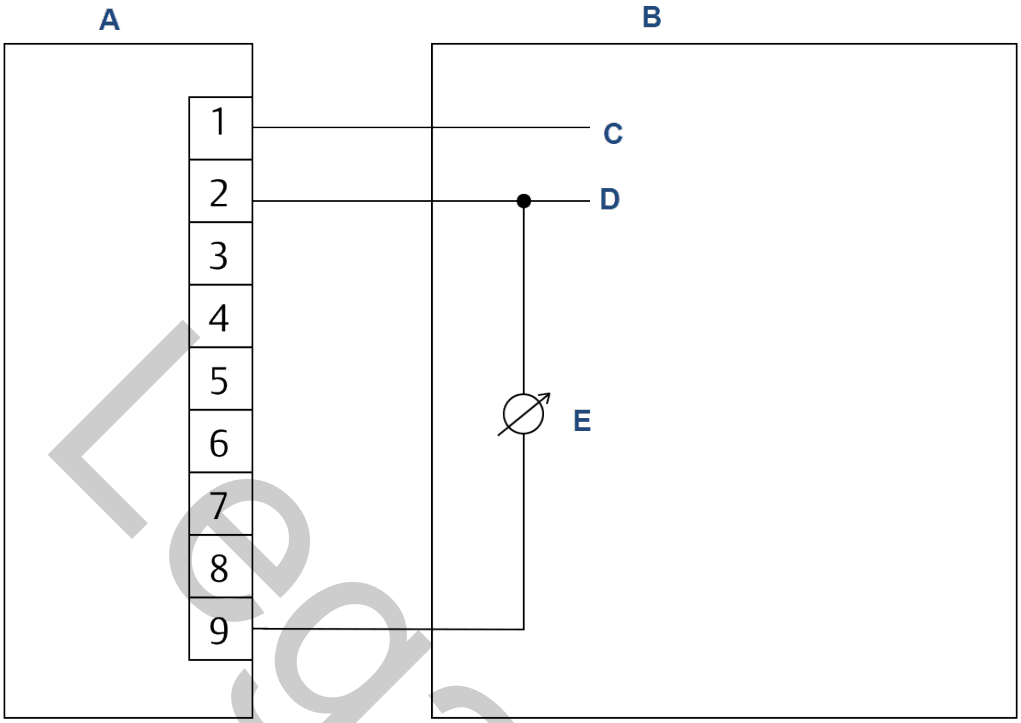

*A. Detector*
*B. Controller*
*C. Input power 18-32 Vdc*
*D. Return*
*E. 0-20 mA meter*

**Figure B-5: 0 - 20 mA Output Configuration 1A (Non-Isolated Sink Three-Wire)**




*A. Detector*
*B. Controller*
*C. Input power 18-32 Vdc*
*D. Return*
*E. 0-20 mA meter*

**Figure B-6: 0-20 mA Output Configurations 2A and 3A (Source Three-Wire Available with HART® Protocol)**




*A. Detector*
*B. Controller*
*C. Input power 18-32 Vdc*
*D. Return*
*E. 0-20 mA meter*

**NOTICE**

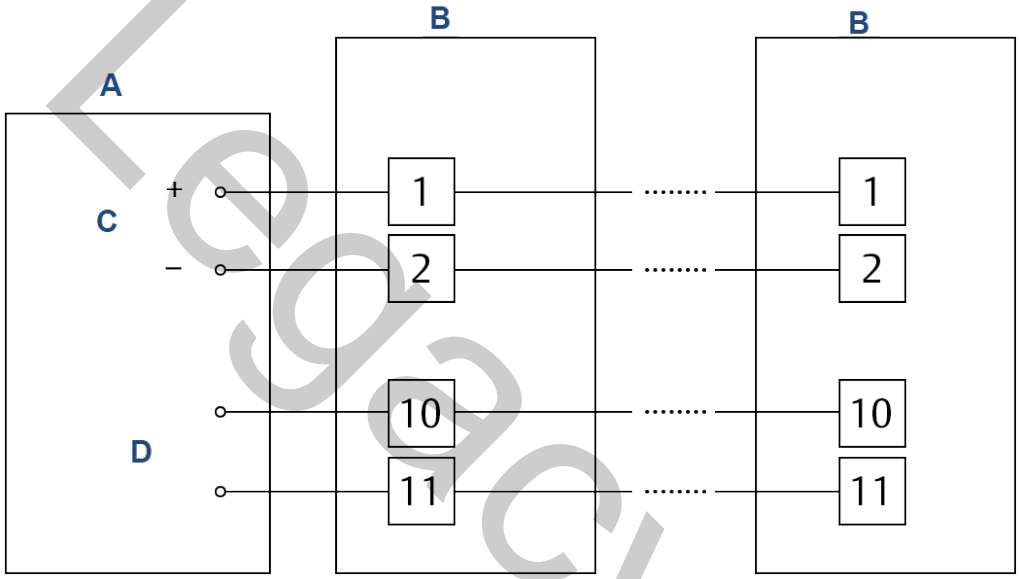
There are no 0-20 mA outputs in output configurations 1R and 2R.

# C RS-485 communication network

By using the RS-485 network capability of the detector and additional software, you can connect up to 32 detectors in an addressable system with four wires only (two for power and two for communication). Using repeaters, the number of detectors can be much larger (32 detectors for each repeater) up to 247 on the same four wires. When using the RS-485 network, you can read each detector status (Fault, Warning, and Alarm) and to initiate a built-in test to each detector individually.

For more details, consult Rosemount.

**Figure C-1: RS-485 Networking**




*A. Controller*
*B. Detector*
*C. Power supply*
*D. RS-485 computer port*

# D Accessories

This appendix describes the accessories that can help you maximize fire detection with the Rosemount 975HR flame detector.

## D.1 Flame simulator

Emerson designed the flame simulators specifically for use with Rosemount flame detectors. The flame simulator emits infrared radiation in a unique sequential pattern corresponding to and recognizable by the detector as fire. This allows the detectors to be tested under simulated fire conditions without the associated risks of an open flame.

**Figure D-1: Flame Simulator**

## D.1.1 Ordering information

The part number of the flame simulator kit is FS-HR-975. The kit is supplied in a carry case that includes:

- Flame simulator
- Charger
- Tool kit
- Reference manual

## D.1.2 Unpacking

Verify that you have received the following contents:

- Delivery form
- Flame simulator with integral battery
- Reference manual
- Factory acceptance test forms
- EC declaration
- Storage case

## D.1.3 Simulate a flame

**⚠ WARNING**

**Hazardous areas**

Do not open the flame simulator to charge the batteries or for any other reason in a hazardous area.

**⚠ CAUTION**

The following test simulates a real fire condition and may activate the extinguishing system of other alarms.

If you don't want this to happen, disconnect/inhibit other alarms before the test and reconnect after the simulation.

**Procedure**

1. Make sure that you are at the correct distance from the detector according to the type of detector and the detector sensitivity.
   When testing, keep a distance of at least 20 in. (50 cm) from the detector.
2. Press the **Operation** button once.
   The flame simulation lasts for fifty seconds. The detector sends an alarm signal (solid red LED).

3. Wait 20 seconds before repeating the test.
4. Verify that the optical window is clean.

## D.1.4 Range

**Table D-1: Sensitivity Ranges**

| Sensitivity | Detection range (ft. / m) | Standard test range (ft. / m) |
|---|---|---|
| 1 (low) | 50 / 15 | 6.6 / 2 |
| 2 | 100 / 30 | 19.6 / 6 |
| 3 | 150 / 45 | 29.5 / 9 |
| 4 (high) | 200 / 60 | 39.3 / 12 |

1. The minimum distance from the detector is 20 in. (50 cm).
2. At extreme temperatures, there is a 15 percent maximum reduction in the range.

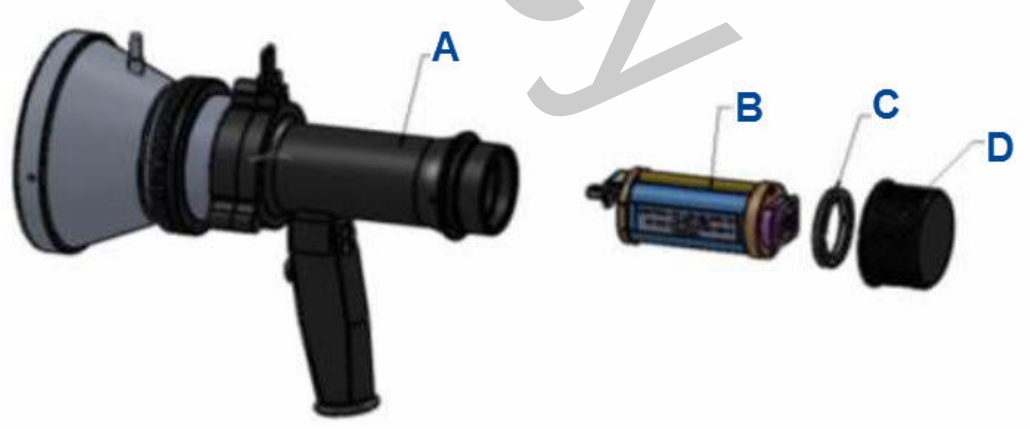
**NOTICE**

Keep the flame simulator in a safe place when not in use.

## D.1.5 Charge the battery

The flame simulator uses lithium ion batteries as a rechargeable power source. When the batteries are fully charged, the simulator operates for at least 1,000 times without having to be recharged. The simulator will not operate when the voltage from the batteries is lower than the required operational level.

**Figure D-2: Flame Simulator Battery Replacement**




*A. Simulator*
*B. Battery pack*
*C. Locking disc*
*D. Back cover*

**NOTICE**

The item letters in this procedure can be found in Figure D-2.

**Procedure**

1. Place the flame simulator in a safe area, not exceeding 104 °F (40 °C).
2. Release the locking screw.
3. Unscrew the battery back cover (D) counter-clockwise.
4. Unscrew the locking disc (C) clockwise.
5. Pull out the battery from the flame simulator.
6. Connect the battery to the charger.
7. Charge for a maximum of two to three hours.
8. Disconnect the charger.
9. Insert the battery in the flame simulator.
10. Screw on the locking disc (C).
11. Screw on the back cover (D).
12. Lock the back cover with the locking screw.

## D.1.6 Replace the battery

**NOTICE**

The item letters shown in this procedure can be found in Figure D-2.

**Procedure**

1. Place the flame simulator on a table in a safe area, not exceeding 104 °F (40 °C).
2. Release the locking screw.
3. Unscrew the battery back cover (D) counter-clockwise.
4. Unscrew the locking disk (C) clockwise.
5. Pull out the battery from the flame simulator.
6. Insert the new battery pack in the simulator housing.
   Use only Rosemount battery pack, PN 00975-9000-0012.
7. Screw on the locking disc (C).
8. Screw on the back cover (D).
9. Lock the back cover with the locking screw.

**NOTICE**

For more information, refer to the Rosemount FS-HR-975 Flame Simulator Manual (00809-0900-4975).

## D.1.7 Technical specifications

### Table D-2: Flame Simulator Technical Specifications

| | |
|---|---|
| General | • Temperature range: -4 to +122 °F (-20 to +50 °C)<br>• Vibration protection: 1 g (10 - 50 Hz) |
| Electrical | • Rechargeable four cell lithium-ion battery:<br>— Power: 14.8 V (4 x 3.7 V), maximum current: 0.2 A<br>— Charging: 16.8 V (4 x 4.2 V), maximum current: 4 A<br>• Battery capacity: 2.6 Ah<br>• Charging time: Two hours at 2 A |
| Physical | • Dimensions: 9 x 7.3 x 5.35 in. (230 x 185 x 136 mm)<br>• Weight: 5.5 lb. (2.5 kg)<br>• Enclosure: aluminum, heavy duty copper free, black zinc coating<br>• Explosion-proof enclosure<br>ATEX and IECEx<br>Ex II 2 G D<br>Ex db ib op is IIB +H2 T4 Gb<br>Ex ib op is tb IIIC T135 °C Db<br>-4 to +122 °F (-20 to +50 °C)<br>• Water and dust tight: IP65 |
| Electromagnetic interference (EMI) compatibility | See Table D-3 and Table D-4. |

### Table D-3: Immunity Tests

| Title | Basic standard | Level to be tested |
|---|---|---|
| Electrostatic discharge (ESD) | IEC 61000-4-2 | 6 kv / 8 kv contact / air |
| Radiated electromagnetic field | IEC 61000-4-3 | 20 V/m (80 MHz to 1 GHz)<br>10 V/m (1.4 GHz to 2 GHz)<br>3 V/m (2.0 GHz to 2.7 GHz) |
| Conducted disturbances | IEC 61000-4-6 | 10 Vrms (150 kHz to 80 MHz) |
| Immunity to mains supply voltage variations | MIL-STD-1275B | N/A |

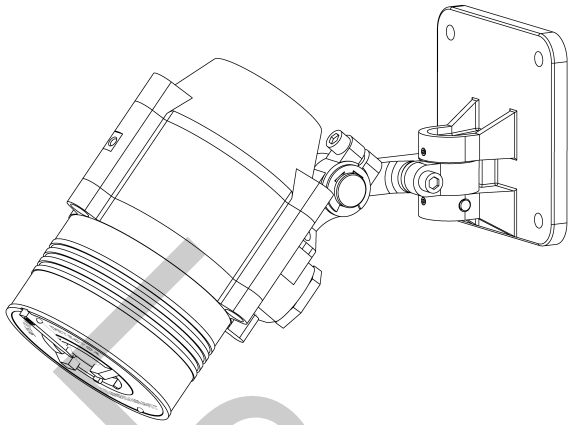
### Table D-4: Emission Tests

| Title | Basic standard | Level to be tested | Class |
|---|---|---|---|
| Radiated emission | IEC 61000-6-3 | 40 dbuv/m (30 MHz to 230 MHz)<br>47 dbuv/m (230 MHz to 1 GHZ) | Like Class B of EN55022 |

## D.2 Tilt mount: PN 00975-9000-0001

The tilt mount provides accurate directional selection for optimum area coverage.

**Figure D-3: Tilt Mount**



## D.3 Duct mount

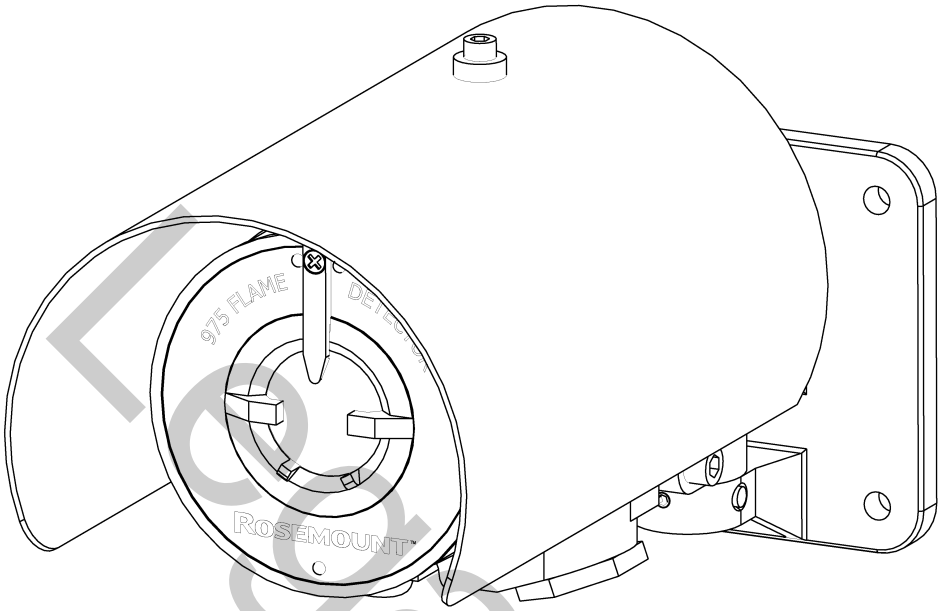
The duct mount limits the cone of vision of the installed detector to 70 degrees horizontal and vertical.

For more instructions, refer to the Duct Mount Manual (00809-0600-4975).

# D.4 Weather cover: PN 00975-9000-0003

The weather cover protects the detector from different weather conditions, such as snow and rain.

**Figure D-4: Weather Cover**



# D.5 Air shield: PN 00975-9000-0005

The air shield is suitable for use with the Rosemount 975 series flame detectors for both the aluminum and stainless steel enclosures.

Optical flame detectors are often used in highly polluted or dirty areas that force maintenance personnel to access the detector frequently to clean its optical window. The special air shield, developed for the Rosemount 975 series optical flame detectors, allows operators to install the flame detectors under tough environmental conditions where they may be exposed to oil vapors, sand, dust, and other particulate matter.

The temperature of the air supply to the air shield should not exceed 140 °F (60 °C) at any time.

Air pressure source: clean, dry, and oil-free air

Inlet pressure: 30-45 psi (2-3 bar), maximum 100 psi (7 bar)

Cubic feet per minute: 1.5-2.8

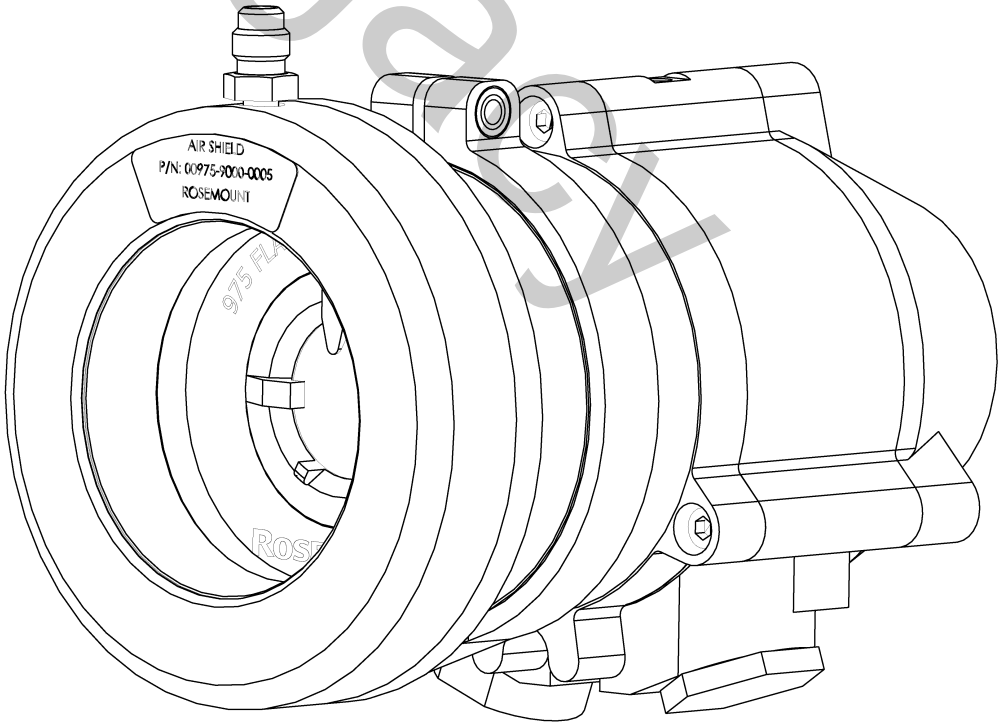
Tube outside diameter: ¼-in. national pipe thread (NPT)/6 mm

Connecting adapter size: 7/16-in. NPT

Operation temperature: -67 to 185 °F (-55 to 85 °C)

For more instructions, refer to the Rosemount 975 Air Shield Manual (00809-0700-4975).

**Figure D-5: Rosemount 975 Air Shield**



# E SIL-2 features

This appendix details the special conditions to comply with the requirements of EN 61508 for SIL 2.

The Rosemount 975HR Flame Detector can only be used in low or high demand mode applications; see IEC 61508.4, Chapter 3.5.12.

## E.1 Safety relevant parameters

Perform the following functional checks of the detector.

- Alternative 1: Functional check of the detector every 180 days:
  - HFT: 0
  - PFD: 3.3 x $10^{-4}$ (≈ 3.3 percent of SIL-2) if only alarm relay is used for alerting.
  - PFD: 3. 6 x $10^{-4}$ (≈ 3.6 percent of SIL-2) if 0-20 mA interface is used as alarm.
  - PFH: 1.6 x $10^{-7}$ 1/h (≈ 16.4 percent of SIL-2) for 0-20 mA application.
  - SFF: 95 percent fulfills the conditions of EN 61508 for SIL-2.
- Alternative 2: Functional check of the detector every 365 days:
  - HFT: 0
  - PFD: 5.1 x $10^{-4}$ (≈ 5.1 percent of SIL-2) if only alarm relay is used for alerting.
  - PFD: 5.6 x $10^{-4}$ (≈ 5.6 percent of SIL-2) if 0-20 mA interface is used as alarm.
  - PFH: 1.6 x $10^{-7}$ 1/h (≈ 16.4 percent of SIL-2) for 0-20 mA application.
  - SFF: 95 percent fulfills the conditions of EN 61508 for SIL-2.

## E.2 Guidelines for configuring, installing, operating, and service

The alert conditions according to SIL-2 can be implemented by an:

- Alert signal via 20 mA current loop

or

- Alert signal via alarm relay and the fault relay

### E.2.1 Conditions for safe operating

1. The flame detector shall consist only of the approved hardware and software modules.
2. The 24 V power supply must fulfill the requirements for PELV/SELV of EN 60950.
3. The automatic built-in test (BIT) must be activated.

4. The setup parameters must be verified (as described in Using the 0-20 mA interface for alerting and Using the alarm relay contact for alerting), and the function of the Rosemount 975 flame detector (flame detection, function of the 0-20 mA interface, relay functions) must be checked completely.
5. The function of the Rosemount 975HR Flame Detector (flame detector, function of the 0-20 mA interface, and relay functions) must be checked completely.

## E.2.2 Using the 0-20 mA interface for alerting

The following parameters shall be set:

- Automatic built-in test: On
- Connected to 0-20 mA terminals

The following allowed output current must be supervised with an accuracy of ±5 percent.

- Normal state: 4 mA
- Warning state: 16 mA
- Alarm state: 20 mA

The output current must be supervised regarding the over-and under run of the 0-20 mA.

The 0-20 mA can be used as low and high demand mode.

## E.2.3 Using the alarm relay contact for alerting

The following parameters shall be set:

- Automatic built-in-test: On
- Connected to normally closed (N.C.) contact of alarm relay terminals
- Connected to fault relay terminals

The relay contacts (alarm and faulty relay) must be protected with a fuse rated at 0.6 of the nominal specified relay contact current.

The maximum contact rating that is allowed per SIL-2 is 30 Vdc.

The contact of the alarm relay opens if there is a fire alarm.

During the forwarding and evaluation of the alarm, the relay contact opens.

The alarm relay can be used as low demand only.

## E.2.4 Other

1. The complete function of the flame detector (flame detection, function of the 0-20 mA interface, and the relays) must be examined at least every six or twelve months (see Safety relevant parameters) when the flame detector must be switched OFF and ON.
2. The window of the sensor must be examined at appropriate time intervals for partial contamination.

3. The HART® and the RS-485 interfaces must not be used for the transmission of the safety-related data.

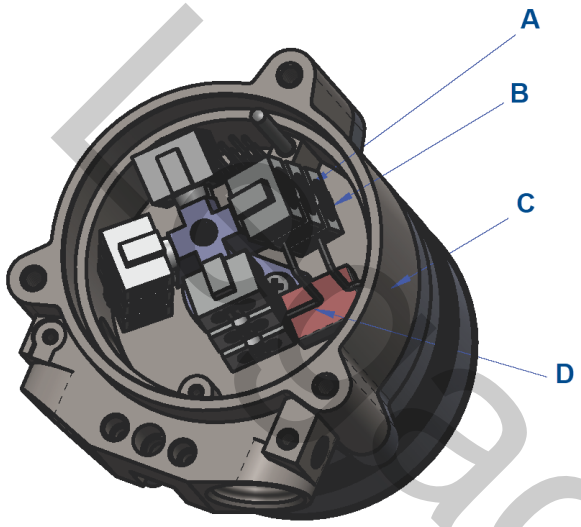
# F End of line resistor

The Rosemount 975 series can be equipped with an EOL resistor inside the flameproof 'd' terminal compartment.

The EOL resistor can be situated in the rear part, which is Ex e or Ex d, depending on the application. When the resistor is assembled, the rear part can be used as Ex d only.

To meet the allowed power consumption, the total resistance should be higher than 1.5 KΩ.

**Figure F-1: Rosemount 975HR Flame Detector**




*A. Terminal number 5*
*B. Terminal number 6*
*C. Rosemount 975HR flame detector*
*D. End of line resistor*

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