

Rosemount™ 975HR

Multi-Spectrum Infrared Hydrogen Flame Detector



Legal Notice

The flame detector described in this document is the property of Rosemount.

No part of the hardware, software, or documentation may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without prior written permission of Rosemount.

While great efforts have been made to ensure the accuracy and clarity of this document, Rosemount assumes no liability resulting from any omissions in this document or from misuse of the information obtained herein. The information in this document has been carefully checked and is believed to be entirely reliable with all of the necessary information included. Rosemount reserves the right to make changes to any products described herein to improve reliability, function, or design and reserves the right to revise this document and make changes from time to time in content hereof with no obligation to notify any persons of revisions or changes. Rosemount does not assume any liability arising out of the application or any use of any product or circuit described herein; neither does it convey license under its patent rights or the rights of others.

WARNING!

All individuals who have or will have responsibility for using, maintaining, or servicing the product should read this manual carefully. The detector is not field repairable due to the meticulous alignment and calibration of the sensors and the respective circuits. Do not attempt to modify or repair the internal circuits or change their settings, as this will impair the system's performance and void the Rosemount product warranty.

Warranty

- Limited Warranty** . Subject to the limitations contained in Section 2 (Limitation of Remedy and Liability) herein, Seller warrants that (a) the licensed firmware embodied in the Goods will execute the programming instructions provided by Seller; (b) that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and care; and (c) Services will be performed by trained personnel using proper equipment and instrumentation for the particular Service provided. The foregoing warranties will apply until the expiration of the applicable warranty period. Sensors and detectors are warranted against defective parts and workmanship for 24 months from the date of purchase and other electronic assemblies for 36 months from the date of purchase. Products purchased by Seller from a third party for resale to Buyer (Resale Products) shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, (i) correct any errors that are found by Seller in the firmware or Services; (ii) repair or replace FOB point of manufacture that portion of the Goods found by Seller to be defective; or (iii) refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance; normal wear and usage; unsuitable power sources or environmental conditions; accident; misuse; improper installation; modification; repair; use of unauthorized replacement parts; storage or handling; or any other cause not the fault of Seller, are not covered by this limited warranty and shall be replaced or repaired at Buyer's sole expense, and Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Seller. All costs of dismantling, reinstallation, freight and the time and expenses of Seller's personnel and representatives for site travel and diagnosis under this limited warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced by Seller during the warranty period shall be in warranty for the remainder of the original warranty period or 90 days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. The limited warranty herein ceases to be effective if Buyer fails to operate and use the Goods sold hereunder in a safe and reasonable manner and in accordance with any written instructions from the manufacturers. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.
- Limitation of Remedy and Liability** SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE REMEDIES OF BUYER SET FORTH IN THE AGREEMENT ARE EXCLUSIVE. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT, OR OTHERWISE), SHALL SELLER'S LIABILITY TO BUYER AND/OR BUYER'S CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED OR SERVICES PROVIDED BY SELLER GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY TO BUYER AND/OR BUYER'S CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL, OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, REVENUE OR USE AND COSTS INCURRED INCLUDING WITHOUT LIMITATION FOR CAPITAL, FUEL AND POWER, AND CLAIMS OF BUYER'S CUSTOMERS.

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
Rosemount
8200 Market Blvd
Chanhassen, MN 55317

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.

All equipment must be shipped prepaid. Collect shipments will not be accepted.

Release history

Rev	Date	Revision History
A	January 2016	First release
B	June 2016	Edited information on flame simulator (changed from FS-IR-975 to FS-HR-975).
C	February 2017	Approvals updates
D	March 2018	Approval and flame simulator information update

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
IR	Infrared
JP5	Jet fuel
Latching	Refers to relays remaining in the ON state even after the ON condition has been removed.
LED	Light emitting diode
LPG	Liquefied 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
PN	Part number
SIL	Safety integrity level
UNC	Unified coarse thread
Vac	Volts alternating current
Vdc	Volts direct current

Contents

Chapter 1	Introduction	1
1.1	Overview	1
1.2	Model and types	1
1.3	Features and benefits	4
1.4	Principles of operation	5
1.4.1	Fire detection principle	5
1.4.2	Heated optics	6
1.4.3	HART protocol	6
1.4.4	RS-485 Modbus	6
1.4.5	Product certifications	6
1.5	Performance considerations	8
1.5.1	Detection sensitivity	8
1.5.2	Cone of vision	10
1.5.3	False alarms prevention	12
1.5.4	Visual indicators	14
1.5.5	Output signals	15
1.5.6	Detector status	15
1.6	Internal detector tests	17
1.6.1	Continuous feature test	17
1.6.2	Built-in test (BIT)	18
Chapter 2	Installing the detector	21
2.1	General guidelines	21
2.2	Unpacking the product	22
2.2.1	Checking the product type	22
2.3	Required tools	22
2.4	Certification instructions	23
2.5	Install cables	24
2.5.1	Conduit installation	24
2.6	Install the tilt mount (PN 00975-9000-0001)	24
2.6.1	Tilt mount assembly	25
2.7	Connecting the detector	28
2.7.1	Verify the detector wiring	30
2.8	Configuring your detector	31
2.8.1	Sensitivity	32
2.8.2	Alarm delay	32
2.8.3	Address setup	32
2.8.4	Function setup	32
2.8.5	Heated optics	33
Chapter 3	Operating the detector	35
3.1	Powering up	35
3.2	Safety precautions	35
3.2.1	Default function settings	36
3.3	Testing procedures	36
3.3.1	Automatic built-in test	37

	3.3.2	Manual built-in test	37
	3.3.3	Testing with flame simulator - FS-HR-975	37
Chapter 4		Maintenance and troubleshooting	39
	4.1	Maintenance	39
	4.1.1	General procedures	39
	4.1.2	Periodic procedures	39
	4.1.3	Keeping maintenance records	40
	4.2	Troubleshooting	41
Appendices and reference			
Appendix A		Specifications	43
	A.1	Technical specifications	43
	A.2	Electrical specifications	43
	A.3	Outputs	44
	A.4	Approvals	46
	A.5	Mechanical specifications	47
	A.6	Environmental specifications	47
Appendix B		Wiring instructions	49
	B.1	General instructions for electrical wiring	49
	B.1.1	Calculation formula	50
	B.2	Typical wiring configurations	51
Appendix C		RS-485 communication network	55
	C.1	RS-485 overview	55
Appendix D		Accessories	57
	D.1	Flame simulator - FS-HR-975	57
	D.1.1	Ordering information	58
	D.1.2	Unpacking	58
	D.1.3	Operating instructions	58
	D.1.4	Range	59
	D.1.5	Charging the battery	59
	D.1.6	Battery replacement	60
	D.1.7	Technical specifications	61
	D.2	Tilt mount - PN 00975-9000-0001	62
	D.3	Duct mount - PN 00975-9000-0002	62
	D.4	Weather cover - PN 00975-9000-0003	64
	D.5	Air shield - PN 00975-9000-0005	65
Appendix E		SIL-2 features	67
	E.1	Rosemount 975HR Multispectrum Infrared Hydrogen Flame Detector	67
	E.1.1	Safety relevant parameters	67
	E.1.2	Guidelines for configuring, installing, operating, and service.	67

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 Rosemount 975HR 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.

Detection performance can be easily adapted 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 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 Rosemount 975 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 Model and types

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: 975HR-XXXXXXX, where XXXXXXXX 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: [HART Protocol 00809-0200-4975](#), the [RS-485 Manual 00809-0300-4975](#), or [00809-0400-4975](#).

The standard offering represents the most common options. The starred options (★) should be selected for best delivery. The expanded offering is subject to additional delivery lead time.

The Rosemount model structure is defined as:

Table 1-1: Rosemount 975 Flame Detector Ordering Information

Product description						
975	975 flame detector					★
Technology						
MR	Multi-spectrum infrared					★
HR	Multi-spectrum infrared hydrogen					★
UF	Ultra fast ultraviolet infrared					★
UR	Ultraviolet infrared					★
Output configuration						
	Outputs	Fault relay	Alarm relay	Auxiliary re- lay	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	★

Table 1-1: Rosemount 975 Flame Detector Ordering Information (continued)

Housing style			
	Material	Conduit entry	
6A ⁽¹⁾	Aluminum	3/4-in. NPT	★
8A ⁽¹⁾	Aluminum	M25	★
6S	Stainless steel	3/4-in. NPT	★
8S	Stainless steel	M25	★
Temperature			
1	167 °F (75 °C)		★
2	185 °F (85 °C)		★
Product certifications			
A1	ATEX and IECEx flameproof		★
A2	FM and CSA flameproof		★
E2	INMETRO flameproof		★
EM	Technical Regulations Customs Union (EAC) flameproof		★
Typical model number: 975HR1A6A1A1			

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

Table 1-2: 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	★
00975-9000-0006	Cone viewer	★
00975-9000-0007	2-in. pipe mount	★
00975-9000-0008	3-in. pipe mount	★
00975-9000-0009	Flame simulator kit (for 975MR)	★
00975-9000-0010	Flame simulator kit (for 975UF and 975UR)	★
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 975HR)	★
00975-9000-0014	4-in. pipe mount	★
00975-9000-0015	Spare battery charger for use with flame simulator	★

NOTICE

Output configuration 1A is default. The mA sink output can be altered to source type, with a link between terminals 1 and 8. No other output configurations can be changed on site.

For example, product number 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 [Section 2.2.1](#).

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 0.1 tt.² (1 m²) n-heptane fire.

- Ultra high immunity to false alarms. See [Table 1-5](#).
- Advanced digital processing of the dynamic characteristics of fire: flickering, threshold, correlation, and ratio.
- Multi IR channels: between 2 and 5 microns.
- Field programmable sensitivity: four ranges to avoid zone crossover.
- Built-in-test (BIT): manual and automatic (see [Section 1.6.2](#)).
- 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 [Section 1.4.3](#)).
- 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

The flame detector is designed to detect hydrocarbon flames that produce CO₂ in their combustion process and non-hydrocarbon flames that produce mainly water vapor (H₂O) 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 IR spectral signature of fire products, namely the hot CO₂ spectral emissions band at 4.2 to 4.7 microns and the hot water (H₂O) spectral emission band at 2.7 to 3.0 microns. Additional spectral bands (above and below these bands) are analyzed for background interferences.

The spectral analysis incorporates several detection algorithms, according to several types of fire events, taking into account simultaneous detection of both CO₂ and H₂O 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 is used.

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 Rosemount 975 flame detectors use 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): you can define the start temperature below which the window is heated. The default is 41 °F (5 °C). This temperature can be defined 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 [Section 2.8](#).

1.4.3 HART protocol

The Rosemount 975 flame detectors use 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 [Table 1-1](#)).

HART technology is easy to use and very reliable.

Through the HART connection, you are able to perform:

- Detector setup
- Detector troubleshooting
- Detector health and status

For more details, refer to [HART 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 detectors have 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

$(-55\text{ °C} \leq T_a \leq +75\text{ °C})$

or

Ex II 2G D
Ex db eb op is IIC T4 Gb
Ex tb op is IIIC T106 °C Db

$(-55\text{ °C} \leq T_a \leq +85\text{ °C})$

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 [Appendix E](#) and [TUV Report No. 968/FSP 1223](#).

EN54-10

The flame detector is certified to EN54-10 and CPD.

- The detector has been tested and approved per EN54-10 by Vds (Germany).
- This test includes functional test, environmental test, EMI/EMC test, and software check.
- For more details, see *Vds reports number BMA 12117 and BMA 12118*.

InMetro (UL)

The flame detector is in compliance with the standards ABNT NBR IEC 60079-0, ABNT NBR IEC 60079-1, ABNT NBR IEC 60079-7, ABNT NBR IEC 60079-18, ABNT NBR IEC 60079-31, and INMETRO decree No. 179 as of May 18th, 2010. Further details may be found on 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

This section describes performance aspects of the flame detector.

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 m²) 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% higher than the `Alarm` distance.

Alarm response times for a standard fire at a specified range are shown in [Table 1-3](#).

Table 1-3: 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)
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).

NOTICE

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 m²) and is defined as 100% sensitivity.
- For fuel fire: standard pan fire size: 1 ft.² (1 m²)
- For gas flame: 30 in. (0.75 m) high, 10 in. (0.25 m) wide plume fire
- Maximum response time: 10 sec.

Table 1-4: 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

Table 1-4: Fuel Sensitivity Ranges (continued)

Type of fuel	Percent of max. distance at each sensitivity range	Max. distance (ft. / m)
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

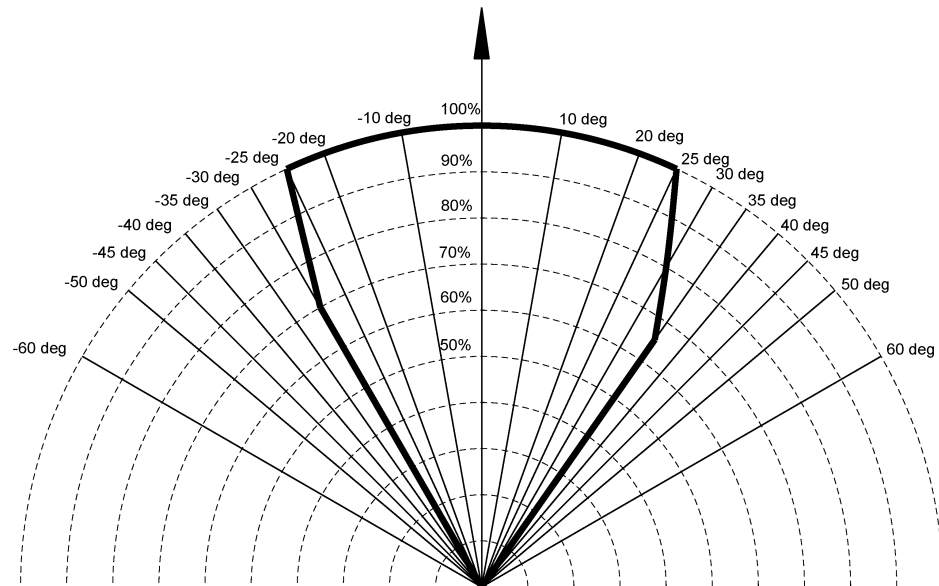
(2) 20 in. (0.5 m) high, 8 in. (0.2 m) wide plume fire

1.5.2 Cone of vision

Gasoline

- Horizontal: 80 °
- Vertical: 80 °

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



Hydrogen

- Horizontal : 70 °
- Vertical: 80 °

Figure 1-2: Horizontal Field of View for Hydrogen

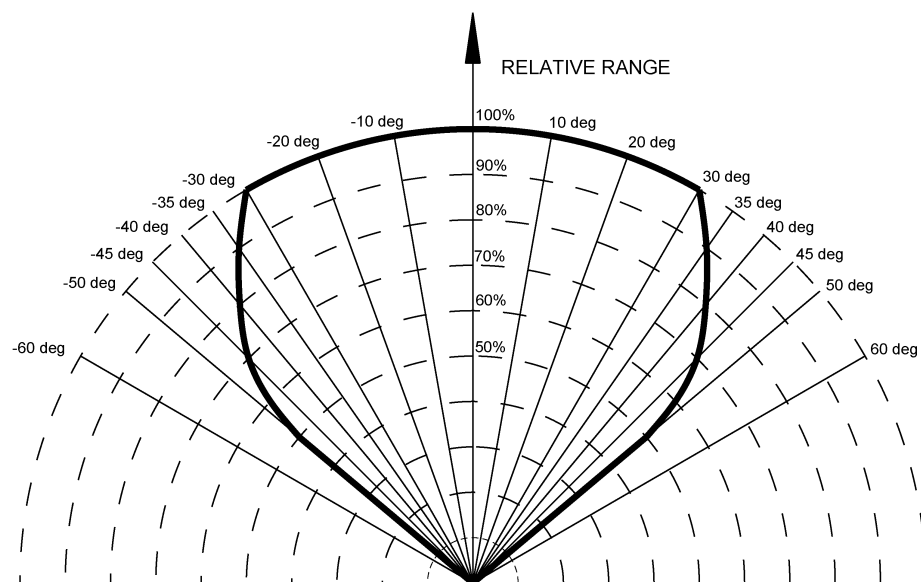
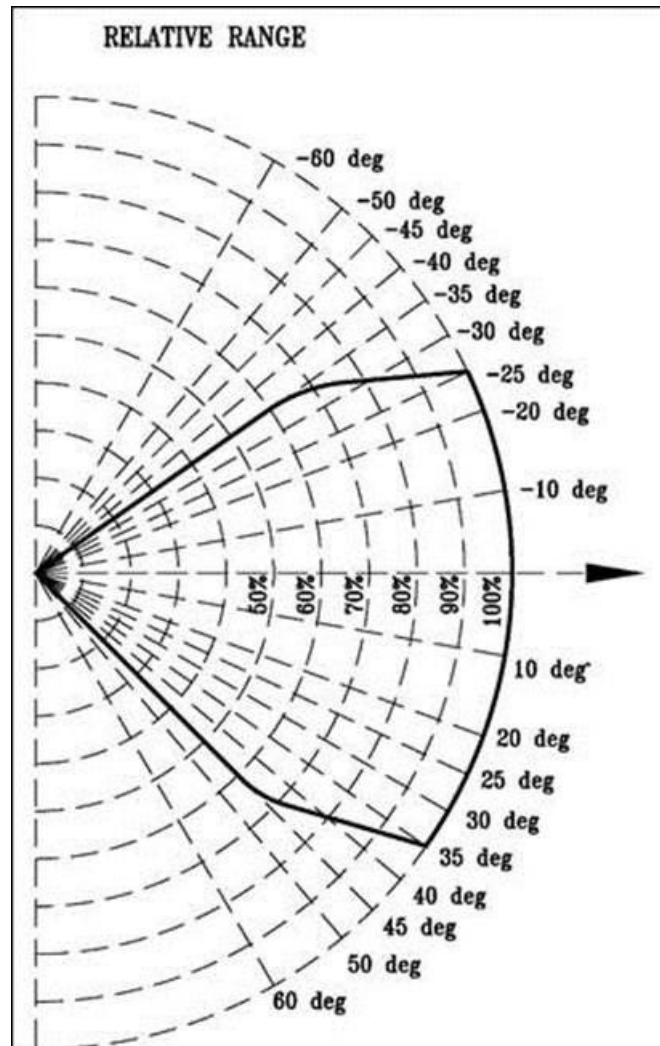


Figure 1-3: Vertical Field of View for Hydrogen



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 1-5: 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

Table 1-5: Immunity to False Alarm Sources (continued)

Radiation source	Immunity distance ft. (m)
Fluorescent light with white enamel reflector, standard office or shop, 70 W (or two 35 W)	IAD
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 1-6
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 1-6: 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)

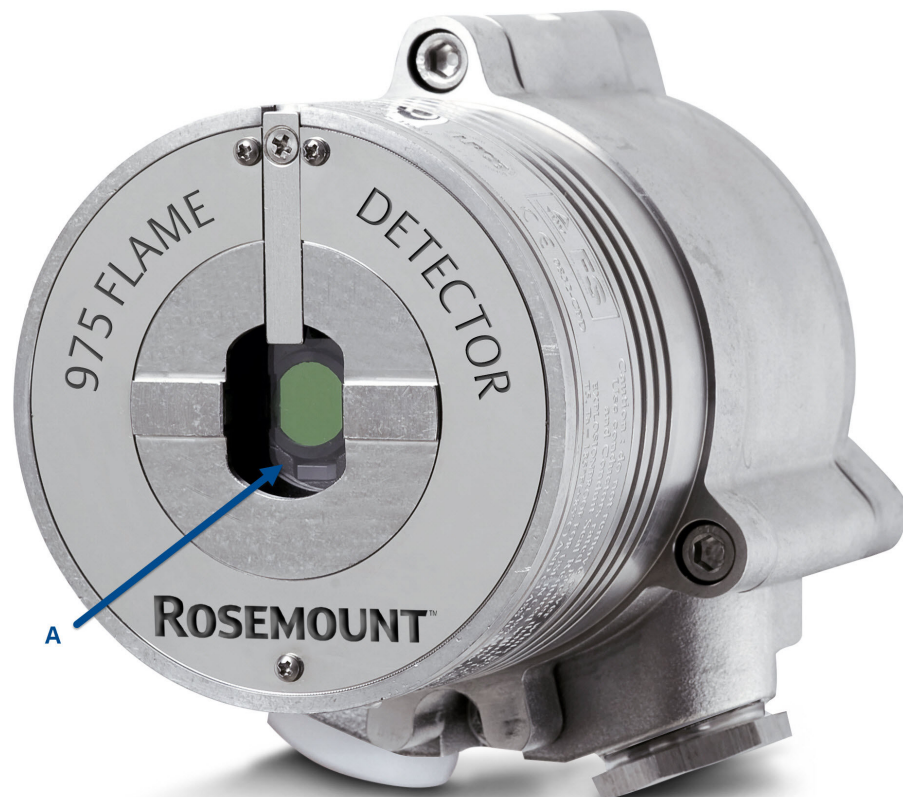
1.5.4 Visual indicators

One three-color LED indicator is located inside the detector window, as shown in [Figure 1-4](#). The detector statuses are listed in [Table 1-7](#).

Table 1-7: 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 1-8](#).

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 1-8: 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. A more detailed fault analysis can be seen via HART or RS-485.

Table 1-9: Detector Statuses

Status	Description
Normal	Normal operation.

Table 1-9: Detector Statuses (continued)

Status	Description
BIT	Built-in test being performed.
Warning	Fire detected - changed to <code>Warning</code> (pre-alarm state).
Alarm	Fire detected - changed to <code>Fire Alarm</code> 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 <i>not</i> detect fire in this condition.

In each state, the detector activates different outputs, as specified in [Table 1-10](#).

Table 1-10: 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 a manual reset is performed (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 ([Section 1.6.1](#))
- Built-in test (BIT) ([Section 1.6.2](#))

1.6.1 Continuous feature test

During normal operation, the detector tests itself continuously and indicates a fault if a failure is found. This type of test complies with SIL-2 requirements.

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, and control system `inhibit` should be applied 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 1-11](#) and [Table 1-12](#), 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 1-11: Results of a Successful Built-in Test

Output	Result
Fault relay	<ul style="list-style-type: none"> Output configurations 1A, 2A, and 1R: remain CLOSED 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 1-12: Results of an Unsuccessful Built-in Test

Output	Result
Fault relay	<ul style="list-style-type: none"> Output configurations 1A, 2A, and 1R: change to OPEN 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

The built-in test is manually initiated by momentarily connecting Terminal 3 with 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 1-13](#) and [Table 1-14](#).

Table 1-13: Results of a Successful Manual Built-in Test

Output	Result
Fault relay	<ul style="list-style-type: none"> Output configurations 1A, 2A, and 1R: remain CLOSED (Normal). Output configurations 3A and 2R: remain OPEN (Normal).
Alarm relay	Activated for three seconds (only when the function <i>Alarm BIT</i> is set to YES).
Auxiliary relay	For output configurations 1R and 2R, is activated for three seconds (only when the function <i>Auxiliary BIT</i> is set to YES).

Table 1-13: Results of a Successful Manual Built-in Test (continued)

Output	Result
0-20 mA output	Output configurations 1A, 2A, and 3A: <ul style="list-style-type: none"> • Initiates 20 mA only when the function <i>Alarm BIT</i> is set to YES. • Initiates 16 mA when the function <i>Auxiliary BIT</i> is set to YES and the function <i>Alarm BIT</i> is set to NO.
Power LED	Green, flashing, 1 Hz

Table 1-14: Results of an Unsuccessful Manual Built-in Test

Output	Result
Fault relay	<ul style="list-style-type: none"> • Output configurations 1A, 2A, and 1R: change to OPEN. • 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

Manual built-in test only selected

The built-in test is initiated manually by momentarily selecting *Terminal Number 3* with *Terminal Number 2* or a switch across these terminals in a safe area.

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 [Appendix B](#).
 - 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. The shield should be grounded 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:
 - The detector should be aimed toward the center of the detection zone and have a completely unobstructed view of the protected area.
 - Whenever possible, the detector face should be tilted down at a 45 ° angle to maximize coverage and prevent accumulation of dust and dirt.
 - Do not start an installation unless all conceivable considerations regarding detection location have been taken into account.

Installations should comply with NFPA 72E or any other local and international regulations and standards, as applicable to flame detectors and installation of Ex approved products.

2.2 Unpacking the product

Unpack the flame detector.

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.

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

Check that your product has the configuration options that you ordered.

Check the detailed model number on the label and compare this information with the descriptions contained in [Section 1.2](#).

2.3 Required tools

The detector can be installed using general-purpose common tools and equipment.

[Table 2-1](#) lists the specific tools required to install the detector.

Table 2-1: Tools

Tool	Function	Comments
Hex key 3/16-in.	Open and close the detector cover (for wiring).	Part of the kit
Hex key 1/4-in.	Mount the detector on the tilt mount.	Part of the kit
Extraction key	Extract the detector cover.	Part of the kit

Table 2-1: Tools (continued)

Tool	Function	Comments
Flat screwdriver 6 mm	Connect ground terminal.	Standard tool
Flat screwdriver 2.5 mm	Connect wires to the terminal blocks.	Standard tool

For wiring, use color-coded conductors or suitable wire markings or labels. 12 to 20 AWG (0.5 mm² to 3.5 mm²) wires may be used 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 [Section B.1](#)).

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.

Refer to [Section 1.4.5](#) for more information about product certifications.

2.5 Install cables

Observe the following guidelines for the cable installation.

- All cables to the detector must be well shielded in order to comply with EMC requirements.
- Ground the detector to the nearest ground point (not more than 9.8 ft. (3 m) from the flame detector location).
- Install the detector with the cable entries pointed downwards.

2.5.1 Conduit installation

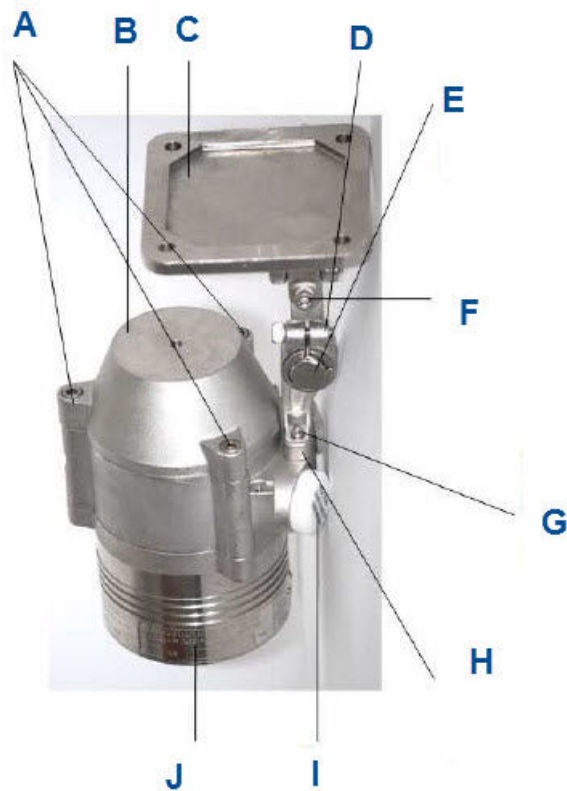
The conduit used for the cabling must comply with the following:

- 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 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 the conductor cables have been pulled through the conduits, perform a continuity test.

2.6 Install the tilt mount (PN 00975-9000-0001)

The tilt mount enables the detector to rotate up to 60 ° in all directions.

[Figure 2-1](#) shows the detector mounted on the tilt mount..

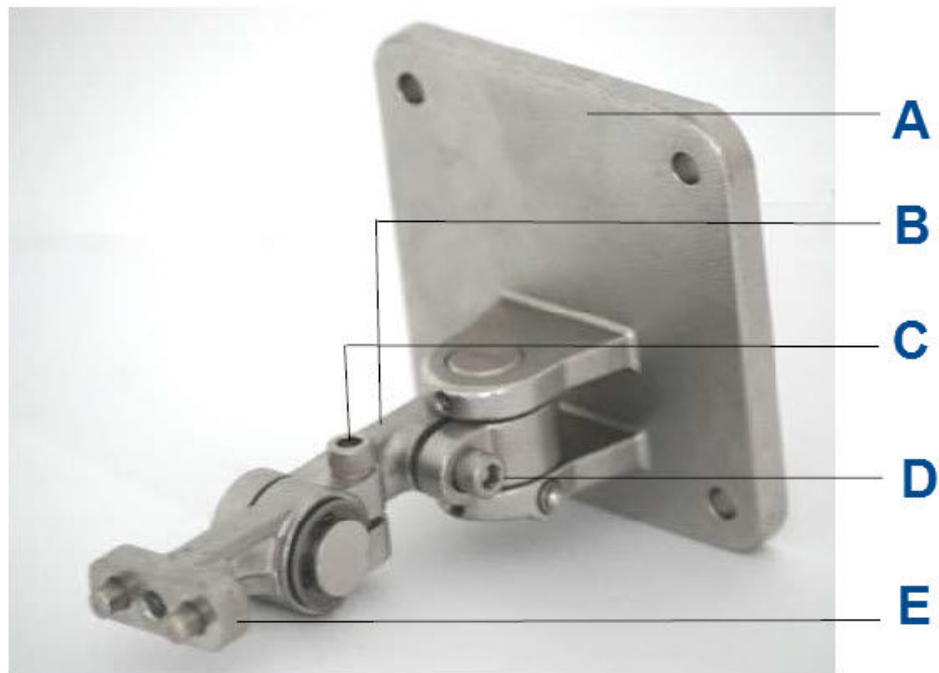
Figure 2-1: Detector with Tilt Mount

- 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 Tilt mount assembly

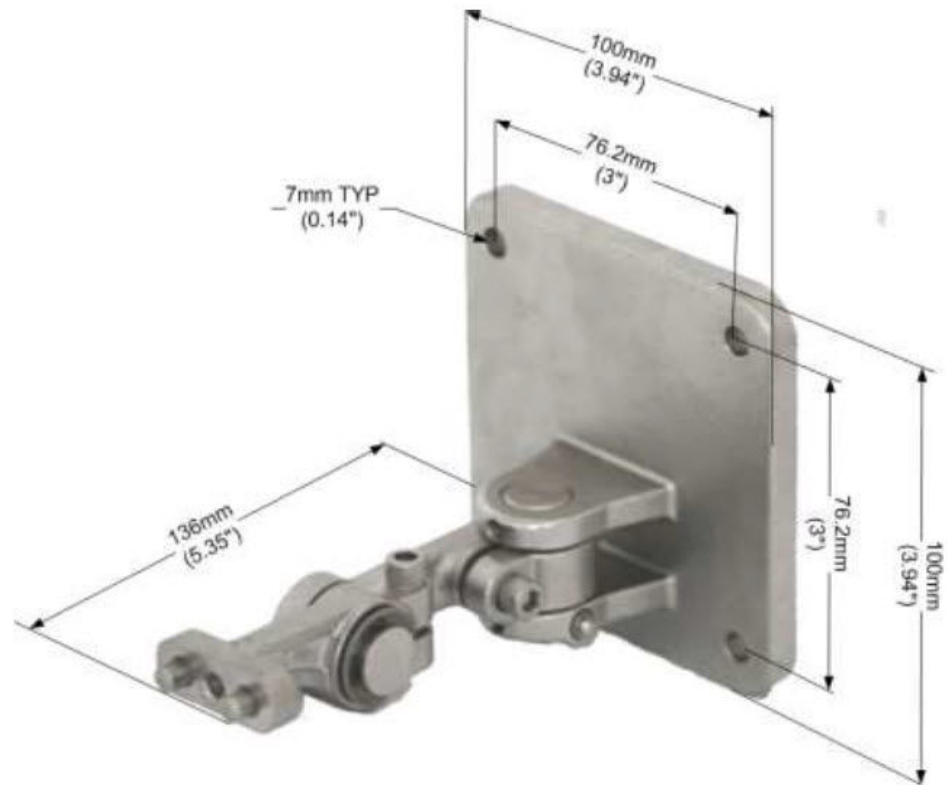
[Figure 2-2](#) shows the tilt mount assembly.

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 in Both Inches and Millimeters)



To install the tilt mount and detector:

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.

NOTICE

Removing the detector for maintenance purposes does not require the tilt mount to be removed.

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 make certain that the view of the area is unobstructed. Secure the detector in that position by tightening the locking screws on the tilt mount. (Make sure the detector is in the correct position).

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

2.7 Connecting the detector

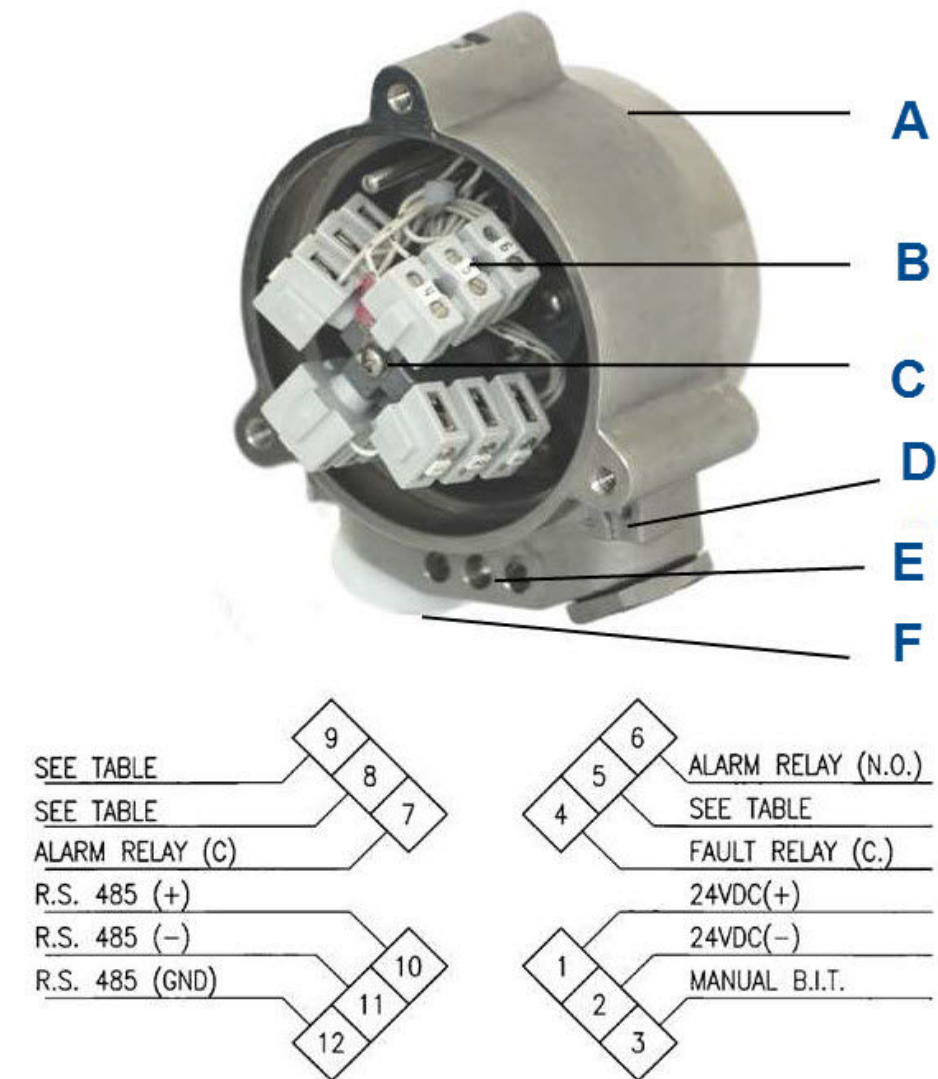
To connect the detector to the electrical cables:

Procedure

1. Disconnect the power.
2. Remove the back cover of the detector by removing three (3) 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 3/4-in. - 14 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 ([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

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

The detector must be well-grounded to earth ground.

7. Verify the wiring.

Improper wiring may damage the flame 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.
9. Place and secure the detector's back cover by screwing the three (3) socket-head screws in the cover bolts ([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 mA output configurations, see [Figure B-2](#), [Figure B-3](#), [Figure B-4](#), and [Figure B-6](#).

[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 N.C.	Fault relay N.C.	Fault relay 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.

Notes

- RS-485 is used for network communication as specified in [Appendix C](#) (terminals 10, 11, and 12) and to connect (in safe area) to PC/laptop for configuration/diagnostics.
- Alarm relay
 - N.O. in output configuration 1A, 1R, and 2R
 - N.O. and 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 Configuring your 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 manual *00809-0300-4975* for programming instructions when using the USB RS-485 harness kit.

- HART protocol: Refer to 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: 5 °C (41 °F)

2.8.1 Sensitivity

The detector offers four (4) sensitivity settings. The settings refer to an n-heptane or gasoline fire of 1 ft.² (0.1 m²), from the low sensitivity of 50 ft. (15 m) to 215 ft. (65 m).

For other types of fuel sensitivity, refer to [Table 1-4](#).

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 alarm outputs are activated. 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. 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 protocol.

2.8.4 Function setup

You can select the desired functions as detailed in [Table 2-3](#).

Table 2-3: Functions

Function	Setting
Alarm latch	<ul style="list-style-type: none"> • Yes: Enable alarm latching. • No: Disable alarm latching (default).
Auxiliary relay ⁽¹⁾	<ul style="list-style-type: none"> • Yes: Activate auxiliary relay at warning level. • No: Activate auxiliary relay at alarm level (default).
Automatic BIT	<ul style="list-style-type: none"> • Yes: Perform automatic and manual built-in test (default). • No: Perform manual built-in test only.

(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 (continued)

Function	Setting
Alarm BIT	<ul style="list-style-type: none"> • Yes: Successful manual built-in test activates the alarm relay for approximately three seconds (default). • No: Successful manual built-in test does not activate the alarm relay.
Auxiliary BIT ⁽¹⁾	<ul style="list-style-type: none"> • Yes: Successful manual built-in test activates the auxiliary relay for approximately three seconds (default). • 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

The heated optics can be defined as one of the following modes:

- OFF: Not operated
- ON: Continuously
- AUTO: Per temperature change

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 Powering up

This section describes how to power up and test the detector. 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 sixty 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 guide 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. This part should be kept closed at all times and only 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 Default function settings

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

Table 3-1: Default Function Values

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.
Heat mode	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 00975-9000-0011. Refer to manual [00809-0300-0975](#) for programming instructions when using the USB RS-485 harness kit.
- HART® protocol. Refer to manual [00809-0200-4975](#) for instructions.

3.3 Testing procedures

This section describes the proof testing procedure for proper operation of the detector. The detector can be tested 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 [Section 1.6.2](#).

3.3.1 Automatic built-in test

Check that the indicators show normal conditions.

See [Section 3.1](#).

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, automatic extinguishing systems or any external devices that may be activated during the built-in test must be disconnected.

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 1-13](#) and [Table 1-14](#).

3.3.3 Testing with flame simulator - FS-HR-975

The flame simulator (FS-HR-975) can be used to simulate exposure of the detector to a real fire condition. The detector is exposed to radiation at the required detection level. As a result, the detector generates a fire alarm signal.

See [Section D.1](#) 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, automatic extinguishing systems or any external devices that may be activated during this process must be disconnected.

To perform a flame simulator test:

Procedure

1. Power up the system and wait up to sixty seconds for the detector to turn to a normal state.

The power LED turns on.

2. Aim the flame simulator model FS-HR-975 at the target point of the detector, in a way that the radiation emitted by it is facing directly towards the detector.

See [Section D.1](#).

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 Rosemount™ or its authorized distributor 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 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 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 [Section 3.1](#).

Functional test procedure

Perform a functional test of the detector as described in [Section 1.6](#).

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 Rosemount or a distributor 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.

Table 4-1: Troubleshooting Table

Problem	Cause	Corrective action
LEDs off Fault relay at N.O. 0-20 mA at 0 mA	No power at the unit	<ul style="list-style-type: none"> • Check that the correct power is sent to the detector. • Check power polarity. • Check wiring in the detector. • Send the detector back for repairs.
Yellow LED flashes at 4 Hz Fault relay at N.O. 0-20 mA at 0 mA	Fault detector <ul style="list-style-type: none"> • Low voltage • Faulty detector 	<ul style="list-style-type: none"> • Check the voltage at the detector; verify at least 24 V at the detector terminal. • Send the detector back for repairs.
Yellow LED flashes at 4 Hz Fault relay at N.O. 0-20 mA at 2 mA	BIT fault <ul style="list-style-type: none"> • Faulty detector 	<ul style="list-style-type: none"> • Clean detector window. • Re-power the detector. • Replace the detector.
Red LED constantly on	If no fire exists, then detector alarm latched	Reset the detector.
Alarm relay at On 0-20 mA at 20 mA	Alarm condition	<ul style="list-style-type: none"> • Check cause for alarm. • If no alarm, re-power the detector. • Send the detector back for repairs.

Appendix A

Specifications

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	IPA (isopropyl alcohol)	135 / 40
	Methane ⁽¹⁾	150 / 45	Polypropylene pellets	115 / 35
	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 0.1 m ² (1 ft ²) n-heptane pan fire from 50 ft. (15 m) to 215 ft. (65 m)			
Fields of view	Gasoline: horizontal 80°, vertical 80° 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
	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 [Section B.1](#) 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 [Section 1.2](#)).

- 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 [Section B.1](#)). The maximum permitted load resistance is 600 Ω .

Table A-4: 20 mA Current Output

State	Output
Fault	0 + 1 mA
BIT fault	2 mA \pm 10%
Normal	4 mA \pm 10%
Warning	16 mA \pm 5%
Alarm	20 mA \pm 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 [HART 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, the start heating temperature can be defined 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 Approvals

Hazardous area approvals

- FM, CSA
Class I Div. 1 Groups, B, C, and D;
Class II/III Div. 1 Groups E, F, and G
- ATEX, IECEx
Ex II 2 G D
Ex db eb op is IIC T4 Gb
Ex tb op is IIIC T 96 °C Db
(-55 °C ≤ Ta ≤ +75 °C)
or
Ex II 2 G D
Ex db eb op is IIC T4 Gb
Ex tb op is IIIC is 106 °C Db
(-55 °C ≤ Ta ≤ +85 °C)
- TR CU / EAC
1EX db eb op is IIC T4 Gb XEx tb op is IIIC T96 °C Db X
-55 °C ≤ Ta ≤ +75 °C

- or
 1Ex db eb op is IIC T4 Gb XEx tb op is IIIC T106 °C Db X
 $-55\text{ °C} \leq T_a \leq +85\text{ °C}$
- Functional approvals**
- EN54-10 approved by VdS
 - FM approved per FM 3260

A.5 Mechanical specifications

Enclosure	Stainless steel 316
Water and dust tight	<ul style="list-style-type: none"> • NEMA® 250 type 6p. • IP 66 and IP 67 per EN 60529
Electronic modules	Conformal coated
Electrical connection (two entries)	<ul style="list-style-type: none"> • 3/4 in. -14 NPT conduit or • 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.6 Environmental specifications

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

High temperature	<ul style="list-style-type: none"> • Designed to meet MIL-STD-810C, method 501.1, procedure II • Operating temperature: 167 °F (75 °C) • Storage temperature: 185 °F (85 °C)
Low temperature	<ul style="list-style-type: none"> • Designed to meet MIL-STD-810C, method 502.1, procedure I • Operating temperature: -57 °F (-50 °C) • Storage temperature: -65 °F (-55 °C)
Humidity	<ul style="list-style-type: none"> • Designed to meet MIL-STD-810C, method 507.1, procedure IV • Relative humidity of up to 95 percent for the operational temperature range
Salt fog	<ul style="list-style-type: none"> • Designed to meet MIL-STD-810C, method 509.1, procedure I • Exposure to a 5 percent salt solution fog for 48 hours
Dust	<ul style="list-style-type: none"> • Designed to meet MIL-STD-810C, method 510.1, procedure I • Exposure to a dust concentration of 0.3 grams/cubic ft at a velocity of 1,750 fprn, for 12 hours

- Vibration**
 - Designed to meet MIL-STD-810C, method 514.2, procedure VIII
 - Vibration at an acceleration of 1.1 g within the frequency range of 5-30 Hz and an acceleration of 3 g within the frequency range 30-500 Hz
- Mechanical shock**
 - Designed to meet MIL-STD-810C, method 516.2, procedure I
 - Mechanical shock of 30 g half-sine wave for 11 msec

Table A-5: Electromagnetic Compatibility (EMC)

	Test standard	Level per
Electrostatic discharge (ESD)	IEC 61000-4-2	IEC 61326-3
Radiated EM field	IEC 61000-4-3	IEC 61326-3
Electrical fast transients	IEC 61000-4-4	IEC 61326-3
Surge	IEC 61000-4-5	IEC 61326-3
Conducted disturbances	IEC 61000-4-6	IEC 61326-3
Power frequency magnetic field	IEC 61000-4-8	IEC 61326-3
Radiated emission	IEC 61000-6-3	EN 55022
Conducted emission	IEC 61000-6-3	EN 55022
Immunity to main supply voltage variations	MIL-STD-1275B	

To fully comply with EMC directive 2014/30/EU and protect against interference caused by RFI and EMI, the cable to the detector must be shielded, and the detector must be grounded. The shield should be grounded at the detector end.

Appendix 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
26	0.12 - 0.15	4.32	14.15
24	0.16 - 0.24	3.42	11.22
22	0.30 - 0.38	1.71	5.60
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
12	3.09 - 3.40	0.17	0.55
10	4.56 - 6.64	0.11	0.35

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 your 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)
	18	16	14	N/A	N/A	
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 1.4Ω).

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



Output configuration	Terminals		
	5	8	9
1A	Fault relay (N.C.)	0-20 mA (sink)	0-20 mA (sink)
2A	Fault relay (N.C.)	Alarm relay (N.C.)	0-20 mA (source)
3A	Fault relay (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 4 Wire Controllers (Using Output Configuration 1A or 2A)

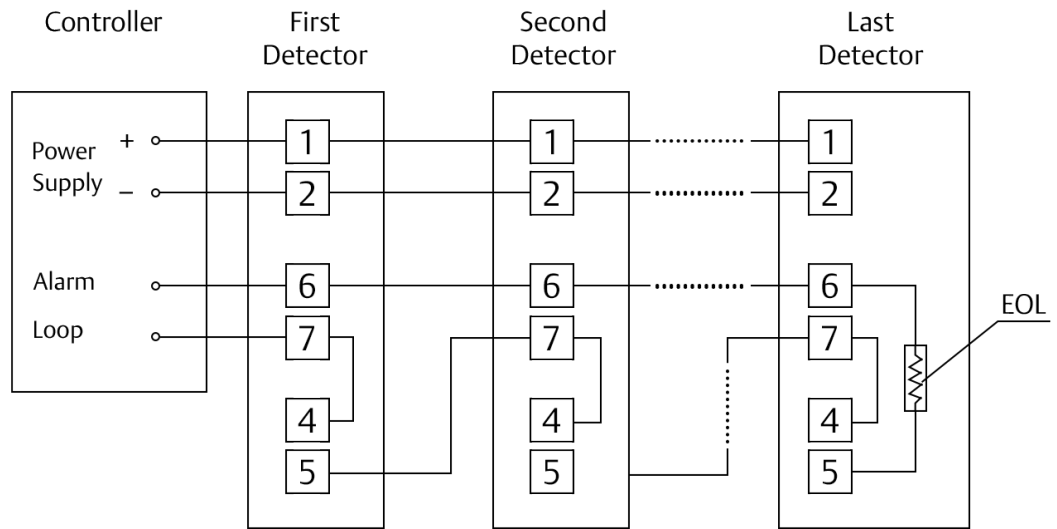


Figure B-3: 0-20 mA Output Configuration 1A (Sink 4 Wire) - Default

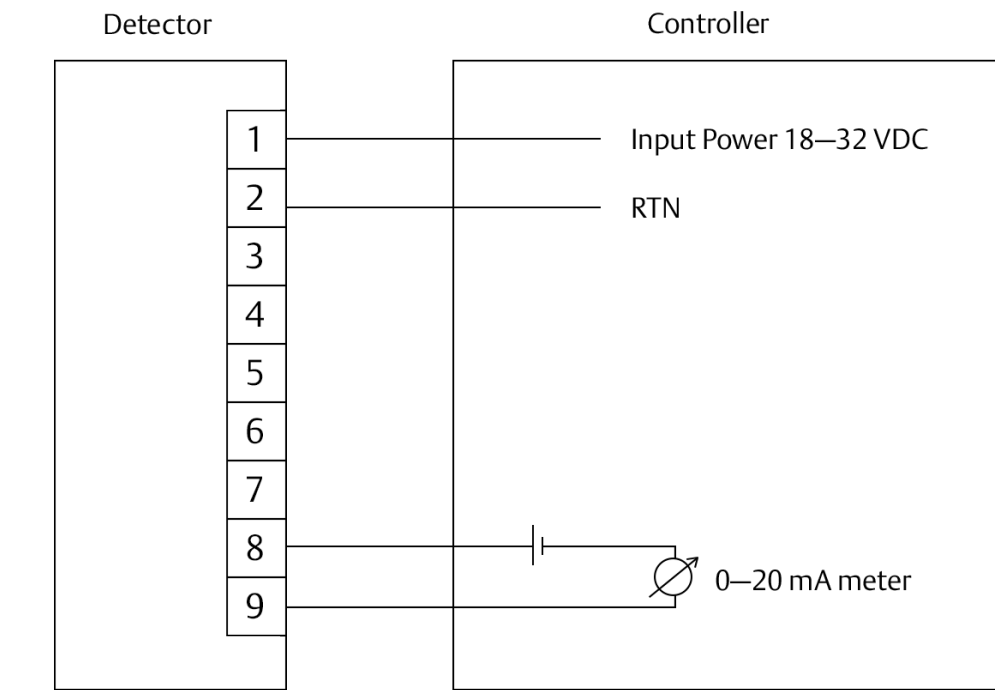


Figure B-4: 0-20 mA Output Configuration 1A (Converted to Source 3-Wire)

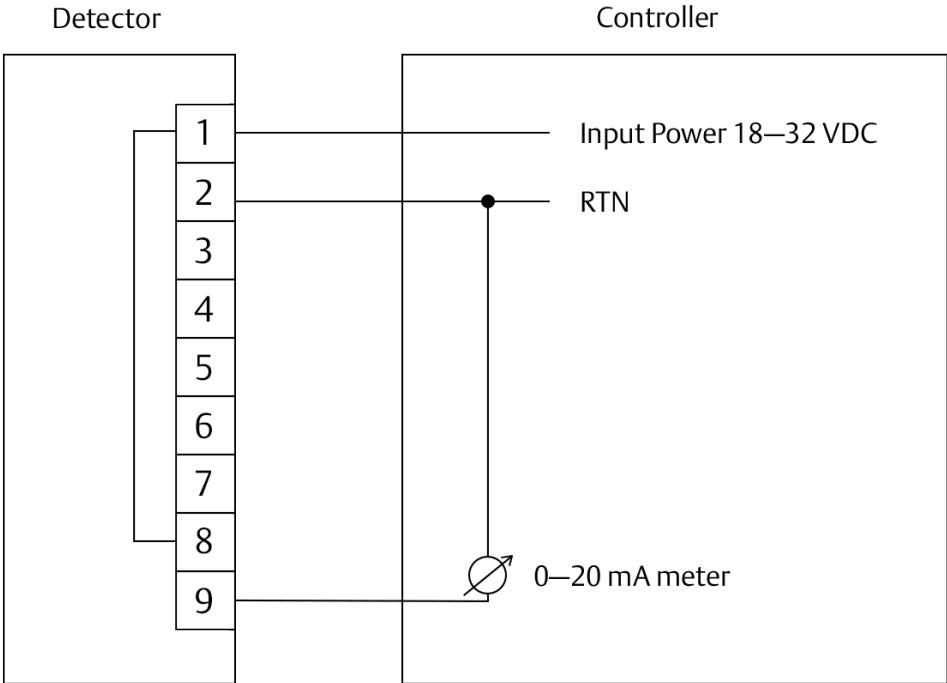


Figure B-5: 0 - 20 mA Output Configuration 1A (Non-Isolated Sink 3-Wire)

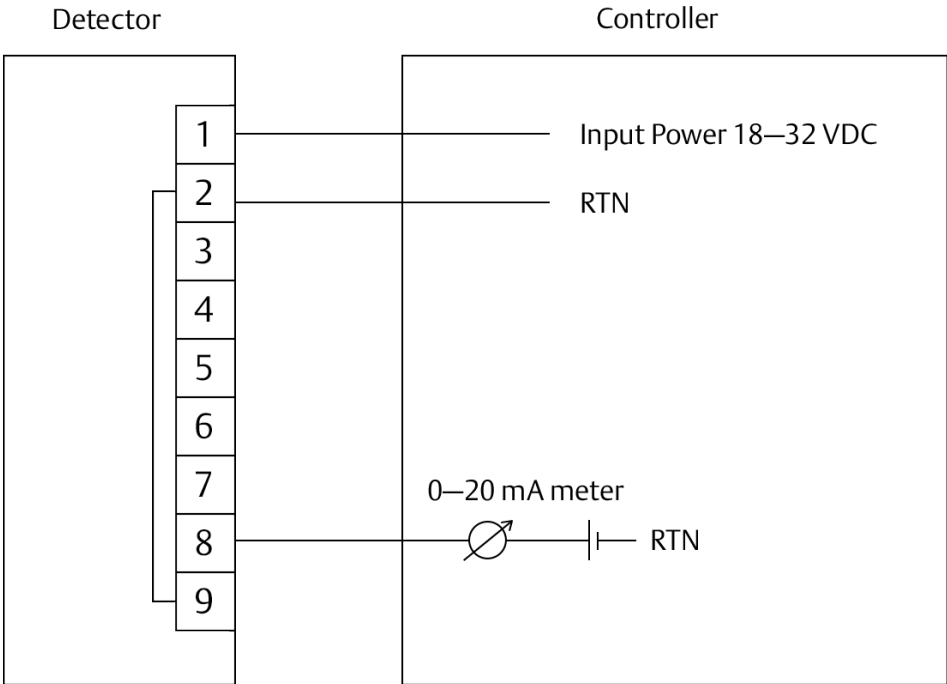
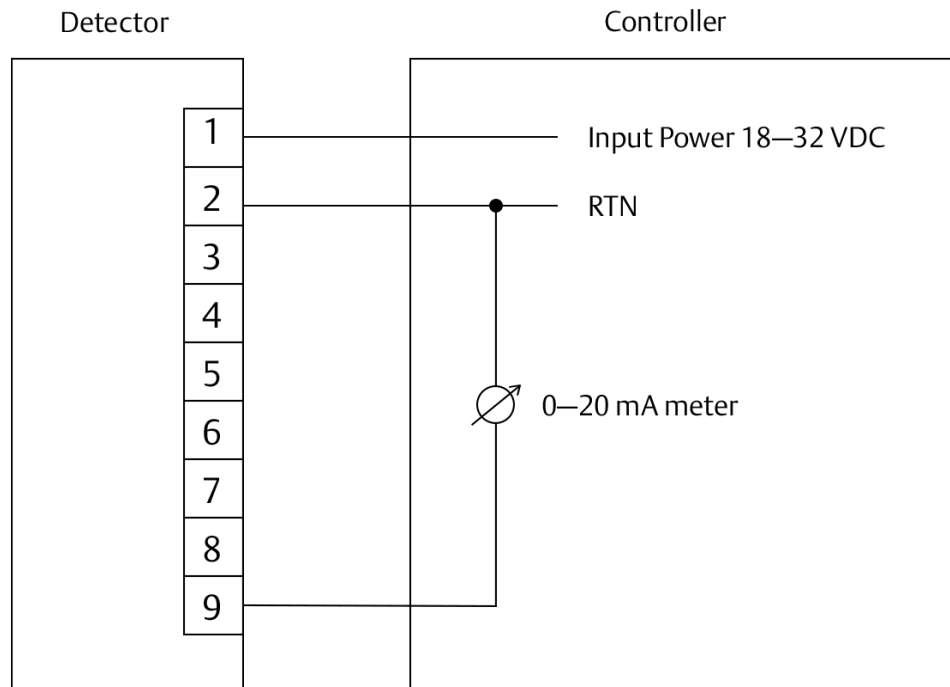


Figure B-6: 0-20 mA Output Configurations 2A and 3A (Source 3-Wire Available with HART® Protocol)



NOTICE

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

Appendix C

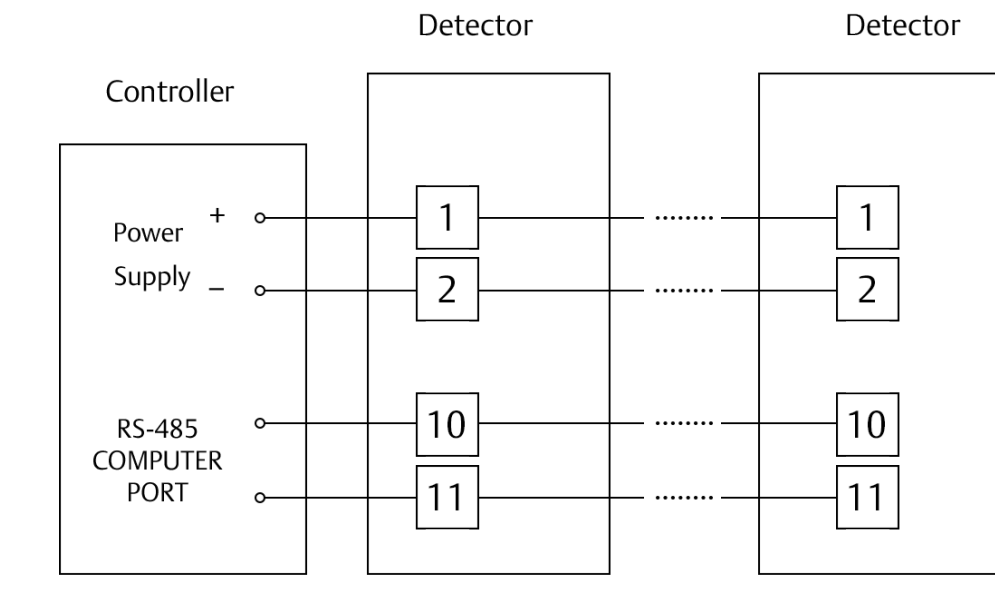
RS-485 communication network

C.1 RS-485 overview

By using the RS-485 network capability of the multi IR detector and additional software, it is possible to connect up to thirty-two detectors in an addressable system with four (4) wires only (two for power and two for communication). Using repeaters, the number of detectors can be much larger (thirty-two detectors for each repeater) up to 247 on the same four (4) wires. When using the RS-485 network, it is possible to 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



Appendix D

Accessories

This appendix describes the accessories that can help you maximize fire detection with the multi-spectrum infrared hydrogen Flame Detector.

D.1 Flame simulator - FS-HR-975

The flame simulator (FS-HR-975) is designed specifically for use with Rosemount™ flame detectors. The flame simulator emits IR 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 - FS-HR-975



D.1.1 Ordering information

The PN of the flame simulator kit is 00975-9000-0013. The kit is supplied in a carry case that includes:

- Flame simulator (FS-HR-975)
- Charger
- Tool kit
- Technical manual

D.1.2 Unpacking

Verify that you have received the following contents:

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

D.1.3 Operating instructions

Complete the following steps to simulate a fire.

⚠ WARNING!

HAZARDOUS AREA

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

⚠ CAUTION!

EQUIPMENT DAMAGE

The following test simulates a real fire condition and may activate the extinguishing system of other alarms. If this is not desired, disconnect/inhibit them 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 50 cm (20 in.) 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 twenty 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

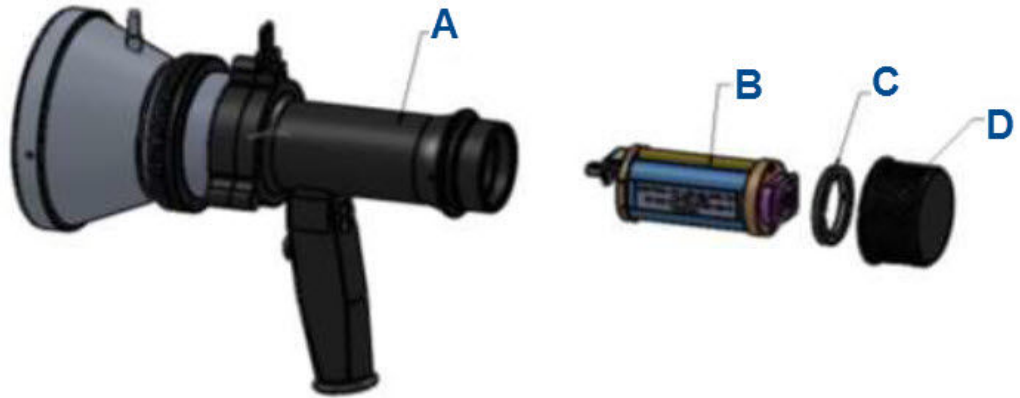
1. The minimum distance from the detector is 20 in. (50 cm)..
2. At extreme temperatures, there is a 15 percent maximum reduction in the range.

NOTICE

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

D.1.5 Charging 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

To charge the battery:

NOTICE

The item letters in this procedure can all 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 Battery replacement

To replace the battery:

NOTICE

The item letters shown in this procedure can all 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 [00809-0900-4975](#).

D.1.7 Technical specifications

Table D-2: Flame Simulator Technical Specifications

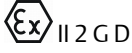
General	<ul style="list-style-type: none"> • Temperature range: -4 to 122 °F (-20 to 50 °C) • Vibration protection: 1 g (10 - 50 Hz)
Electrical	<ul style="list-style-type: none"> • Power: 14.8 V (4 x 3.7 V rechargeable lithium battery) • Max, current: 4 A • Battery capacity: 2.2 AH • Charging time: 2 A at 2 Hr
Physical	<ul style="list-style-type: none"> • Dimensions: 9.1 x 7.3 x 5.4 in. (230 x 185 x 135 mm) • Weight: 2.5 kg (5.5 lb) • Enclosure: aluminum, heavy duty copper free, black zinc coating • Explosion-proof enclosure ATEX and IECEx  Ex d ib op is IIB +H2 T5 Gb Ex ib op is tb IIIC T135 °C Db
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) 10 V/m (1.4 GHz to 2 GHz) 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	

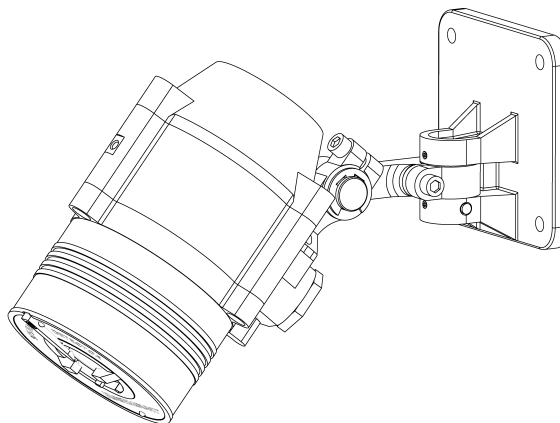
Table D-4: Emission Tests

Title	Basic standard	Level to be tested	Class
Radiated emission	IEC 61000-6-3	40 dbuv/m (30 MHz to 230 MHz), 47 dbuv/m (230 MHz to 1 GHz)	Like Class B of EN 55022

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 - PN 00975-9000-0002

The duct mount is suitable for use with the Rosemount 975 series optical flame detector for both the aluminum and stainless steel enclosures.

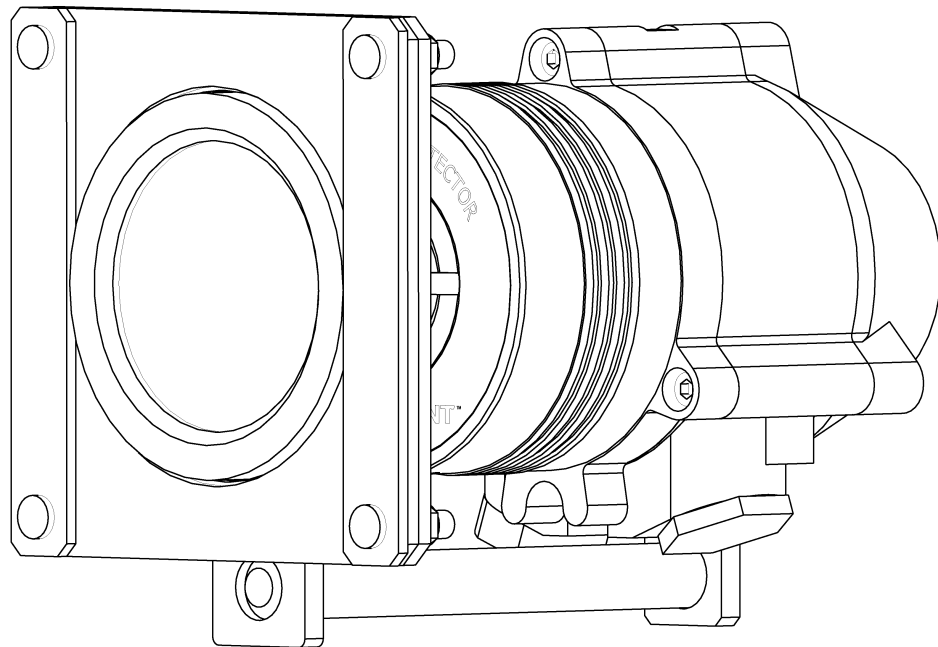
The duct mount allows flame detection in areas where high temperatures exist or in cases where the detector cannot be installed inside the area. It comprises a special duct mount arrangement with specific optical window to allow installation in high temperature duct applications.

The duct mount limits the cone of vision of the installed detector to 65 ° horizontal and 65 ° vertical.

The temperature allowed for the duct mount to be installed is -67 °F to 392 °F (-55 °C to 200 °C).

For more instructions, refer to [00809-0600-4975](tel:00809-0600-4975).

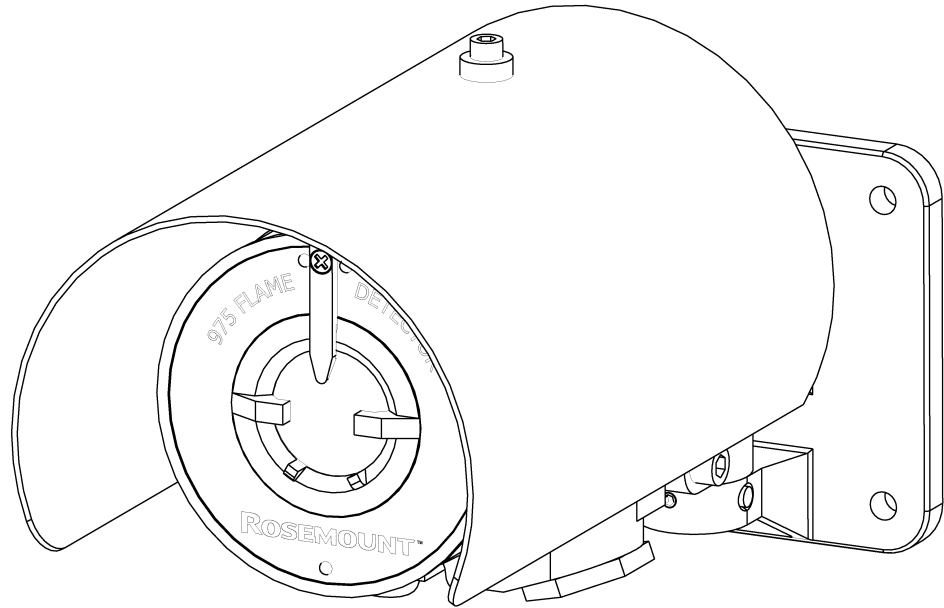
Figure D-4: Duct Mount



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-5: 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 975 series optical flame detectors, allows their installation 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

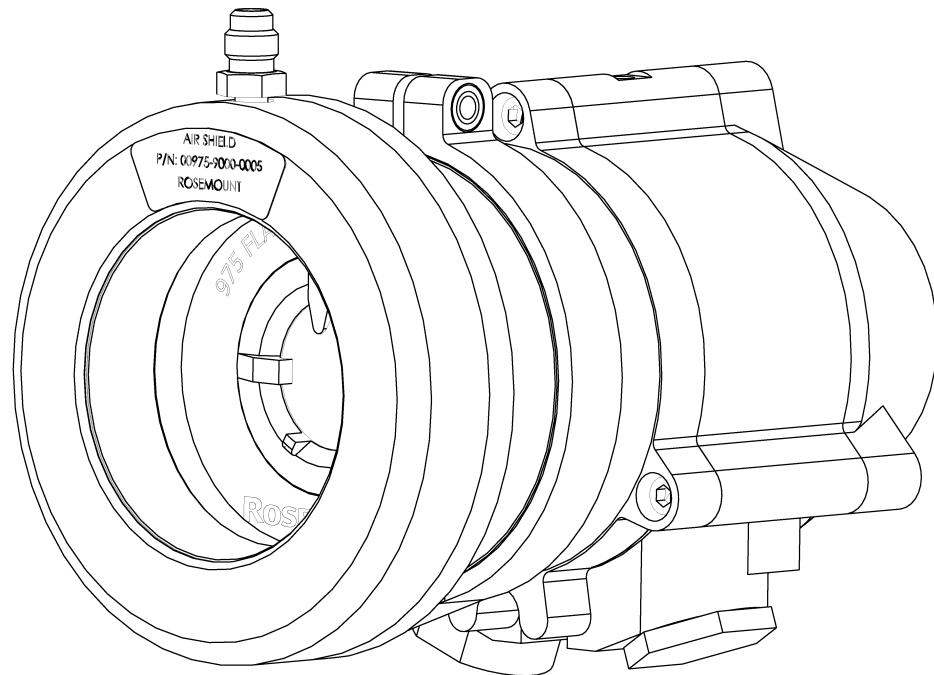
Pressure: 2 - 3 bar (30 - 45 psi)

Fitting: 7/16 in. - 20 UNF - 2 A

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

For more instructions, refer to [00809-0700-4975](#).

Figure D-6: Air Shield



Appendix E

SIL-2 features

E.1 Rosemount 975HR Multispectrum Infrared Hydrogen Flame Detector

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.1.1 Safety relevant parameters

Perform the following functional checks of the detector.

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

E.1.2 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

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 BIT (built-in test) 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 975 flame detector (flame detection, function of the 0-20 mA interface, relay functions) must be checked completely.

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 $\pm 5\%$.

- 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.

Using the alarm relay contact for alerting

The following parameters shall be set:

- Automatic built-in-test = ON
- Connected to 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.

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 [Section E.1.1](#)) 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.

GLOBAL HEADQUARTERS

6021 Innovation Blvd.
Shakopee, MN 55379

+1 866 347 3427

+1 952 949 7001

safety.csc@emerson.com

EUROPE

Emerson Automation Solutions
Neuhofstrasse 19a PO Box 1046
CH-6340 Baar
Switzerland

+41 (0) 41 768 6111

+41 (0) 41 768 6300

safety.csc@emerson.com

MIDDLE EAST AND AFRICA

Emerson Automation Solutions
Emerson FZE
Jebel Ali Free Zone
Dubai, United Arab Emirates, P.O. Box 17033

+971 4 811 8100

+971 4 886 5465

safety.csc@emerson.com

ASIA-PACIFIC


Emerson Automation Solutions
1 Pandan Crescent
Singapore 128461
Republic of Singapore

+65 6 777 8211

+65 6 777 0947

safety.csc@emerson.com

 [Linkedin.com/company/Emerson-Automation-Solutions](https://www.linkedin.com/company/Emerson-Automation-Solutions)

 twitter.com/rosemount_news

 [Facebook.com/Rosemount](https://www.facebook.com/Rosemount)

 [youtube.com/RosemountMeasurement](https://www.youtube.com/RosemountMeasurement)

 [google.com/+RosemountMeasurement](https://plus.google.com/+RosemountMeasurement)

 AnalyticExpert.com

©2018 Emerson. All rights reserved.

The Emerson logo is a trademark and service mark of Emerson Electric Co. Rosemount is a mark of one of the Emerson family of companies. All other marks are the property of their respective owners.