Reference Manual
00809-1400-4975, Rev AA
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Rosemount™ 975

Flame Detectors

ROSEMOUNT™

EMERSON™

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⚠ WARNING

Physical access

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.

⚠ CAUTION

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.

Do not attempt to modify or repair the internal circuits or change their settings.

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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

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	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
PN	Part number
SIL	Safety integrity level

Abbreviation or acronym	Definition
UNC	Unified coarse thread
Vac	Volts alternating current
Vdc	Volts direct current

Contents

1 Introduction

1.1 Product overview

The Rosemount 975 series is based on proven technologies, including triple infrared (IR3) and ultraviolet infrared (UV/IR). The Rosemount 975 series provides the fastest response to fire, longest distance detection, and revolutionary UV/IR technology, coupled with superior immunity to false alarms, functioning in harsh conditions with unparalleled reliability and durability.

The series is suited to meet the challenges of wide range of industrial and commercial applications with long distance and fast response detection, providing superior protection of high value property and personnel to keep an eye on your safety.

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.

1.2 Models

The Rosemount 975 Flame Detectors are electro-optical devices designed to identify fire events, enabling alarm activation. The detectors are intended for indoor or outdoor use and can be used stand alone or connected to an alarm/automatic extinguishing system.

The Rosemount 975 series comprises the following detectors:

Rosemount 975MR

The Rosemount 975MR, an ultra-fast multispectrum triple infrared (IR3) flame detector, provides superior, longest distance detection of hydrocarbon fires at up to 295 ft. (90 m), exceptional ultra-fast detection in under 50 msec, and unparalleled reliability. The Rosemount 975 is based on proven IR3 technology, ensuring highest sensitivity with best immunity to false alarms.

Rosemount 975HR

The Rosemount 975HR is a multispectrum IR flame detector that provides superior, longest distance detection of hydrogen (at up to 165 ft. [50 m]) and hydrocarbon fires (at up to 295 ft. [90 m]), exceptional ultra-fast detection in under 50 msec, and unparalleled reliability. The Rosemount 975HR is designed to deal with the challenges of invisible fires based on proven triple IR (IR3) technology, ensuring highest sensitivity with best immunity to false alarms.

Rosemount 975UF

The Rosemount 975UF is an ultra-fast ultraviolet (UV)/IR flame detector, which is able to detect in under 20 msec and features a unique dual sensor with selectable UV and IR channels that can be used separately or combined. The detector is designed to detect a range of fires, such as hydrocarbon-based fuel and gas, hydroxyl, hydrogen, metal, and inorganic.

Rosemount 975UR

The Rosemount 975UR is an ultra-fast UV/IR flame detector that is able to detect in under 20 msec, and features a unique dual sensor with selectable UV and IR channels that can be used separately or combined. The detector is designed to detect hydrocarbon-based fuel and gas fires.

Table 1-1: Rosemount 975 Series General Technical Specifications

Spectral response	Infrared and ultraviolet bands
Response time	Varies according to model, typically under 5 seconds
Field of view	Varies according to model, up to 100 degrees
Output	4-20 mA, relays, communication
Enclosure	Stainless steel 316 or aluminum polyurethane painted
Operating voltage	18-32 Vdc
Maximum power rating	9.6 W
Relay contacts	2A/30 Vdc
Over voltage category	2
Relative humidity	Non-condensing relative humidity up to 100%

⚠ CAUTION

If the product is used outside of specified limits, this voids the product certification, and our company is not responsible for any incurred warranty expense.

Do not open this product, except for the terminal compartment as listed in this document, under any circumstances.

The detector is not field-repairable. Any attempt to modify or repair the internal circuits or change their settings, as this will impair the system's performance and void the product warranty.

Opening the attachment screws to dismantle the front part of the detector from remaining parts is restricted and voids the product warranty.

2 Installation

2.1 Installation guidelines

Installation 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. To ensure optimal performance and 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
- Proximity to false alarm sources

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 Wire terminals and ground cable).

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 emission 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.

It is recommended to position the detector tilted down at a 45° angle to maximize coverage and prevent accumulation of dust and dirt.

Installation should not begin until all conceivable considerations regarding detection location have been taken into account.

2.2 Preparation for use

The installation sequence may vary according to the physical structure of the site.

Note
Installation steps are also detailed in the Quick Start Guide supplied with the detector.

The following tools are required for installation. These are standard tools and are not supplied with the detector.

Table 2-1: Required Tools

Tool	Function
Hex key 1.5 mm	Fasten back cover security screw
Hex key 6 mm	Adjust the tilt mount
Hex key 10 mm	Affix the detector to the tilt mount
Hex key 3/16-in.	Attach protective cover to detector
Flat screwdriver 6 mm	Connect ground terminal
Flat screwdriver 2.5 mm	Connect wires to the terminal blocks
Hex key 5/16-in.	Stop plug 3/4 national pipe thread (NPT)
Open wrench 28 mm	Stop plug M25 only

2.3 Attach detector to tilt mount

Procedure

1. Unpack the detector.
2. Insert location pins on the tilt mount into the openings on detector housing.

3. Thread the holding screw and tighten it.

   Note
   To change the detector field of view, release the horizontal and vertical locking screws.

4. Point the detector toward the protected area and ensure the view of the area is unobstructed.

5. Secure the detector in that 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.

2.4 Open the back cover

Procedure

1. Loosen the back cover security screw.

A. Back cover security screw
B. Protective plug

2. Unscrew the back cover.

Note
The back cover is attached by a security cable.

3. Remove the protective plug.

2.5 Wire terminals and ground cable

⚠ CAUTION

Improper wiring may damage the detector.

Procedure

1. Connect the terminals according to Table 2-2.
   The terminal details are also on the inside back cover.

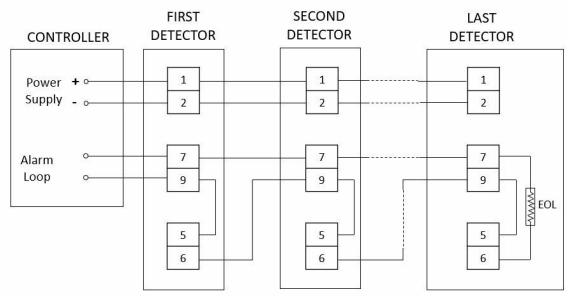
Figure 2-1: Terminal Box

Table 2-2: Terminal Box

Terminal	Function
T1	24 Vdc (+)
T2	24 Vdc (-)
T3	External built-in test (BIT) switch
T4	Fault relay - normally open
T5	Fault relay
T6	Fault relay - normally closed
T7	Alarm relay - normally open
T8	Alarm relay
T9	Alarm relay - normally closed
T10	0-20 mA (+)
T11	0-20 mA (-)
T12	Alarm output
T13	RS485 (+)
T14	RS485 (-)
T15	Accessory relay - normally open
T16	Accessory relay
T17	Accessory relay - normally closed

2. Use Figure 2-2, Figure 2-3, Figure 2-4, and Figure 2-5 for typical wiring configurations.

Figure 2-2: Typical Wiring for Four-Wire Controllers



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

Figure 2-3: Non-Isolated Sink (Three Wires)

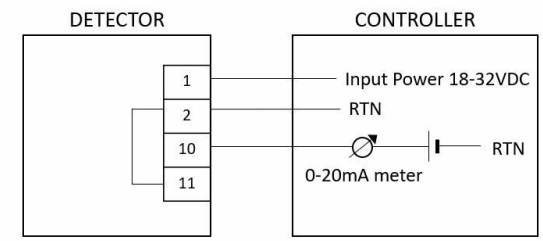


Figure 2-4: Sink Four-Wire

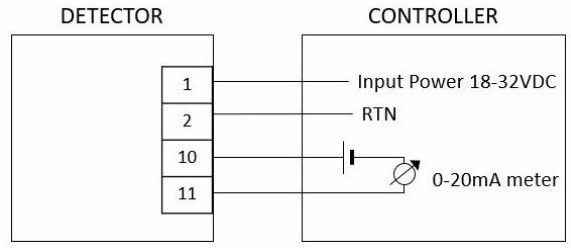
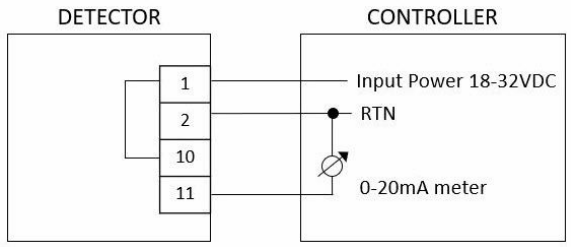


Figure 2-5: Source Three-Wire



Note
For additional configuration options, please refer to the *Modbus® Manager Manual*.

3. Check the wires for secure mechanical connection and press them neatly against the terminal to prevent them from interfering while closing the back cover.
4. Close the terminal compartment by screwing the back cover on to the housing.

5. Tighten the back cover security screw.

Figure 2-6: Closing Security Screw

A. Back cover security screw
B. Ground cable connection point

6. Connect the ground cable.

⚠ WARNING

The terminal temperature may be higher than 185 °F (85 °C).

⚠ CAUTION

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

2.6 Install the protective cover

⚠ CAUTION

The protective cover should always be installed with the detector.

The protective cover is available in ABS plastic or stainless steel.

Table 2-3: Protective Cover

Material	Part number
ABS plastic	00975-9000-0020
Stainless steel	00975-9000-0021

Procedure

1. Place the protective cover on top of the detector.

2. Secure the protective cover by tightening the screw.

Note
When installing the stainless steel protective cover, the same installation instructions apply.

2.7 Aim the detector

See Aiming the detector for guidelines on aiming the detector.

2.8 Changing default detector settings

Main settings that can be modified using the Modbus® Manager or HART communication include:

- Sensitivity
- Response time
- Heated optics functionality
- Alarm delay
- Accessory relay options
- Alarm latch
- Field of view integrity indication

Refer to the Modbus Manager Manual or HART protocol Reference Manual for instructions on changing these settings.

3 Operation

3.1 Power up the detector

This section describes how to turn on the detector.

Procedure

After connecting the detector to power, wait up to 60 seconds for the detector to completed the initial start-up procedure.

Note
Turning on the detector initiates the following sequence of events:

a. The yellow LED flashes at 4Hz.

b. BIT is executed.

c. BIT completes.

d. Detector enters normal mode, indicated by:
   - Flashing green LED at 1Hz
   - Fault relay contacts closing
   - mA output is 4mA (for models featuring analog [voltage] output, this will be 2V)

3.2 Test flame detectors

You can use the Rosemount flame simulators to test the Rosemount 975 flame detectors. You can also use the manual built-in text (BIT) to test the flame detectors.

Table 3-1: Flame Simulator Compatibility

Rosemount flame simulator model	Rosemount 975 flame detector model
FS-HR-975	975HR
FS-IR-975	975MR
FS-UVIR-975	975UF and 975UR

To test a flame detector:

Procedure

1. Power up the system and wait for up to 60 seconds for the detector to return to normal status.
   The **Power** light-emitting diode (LED) turns on.
2. Ensure all indicators show Normal.
   See Power up the detector.

Postrequisites

For full instructions on testing with a flame simulator, see the relevant Reference Manual.

Table 3-2: Flame Simulator Reference Manuals

Rosemount Flame Simulator	Reference Manual
FS-HR-975	00809-0900-4975
FS-IR-975	00809-0500-4975
FS-UVIR-4975	00809-0800-4975

4 Initial setup

4.1 Continuous feature test

The detector is supplied with default settings, containing Continuous Feature Test. To change these settings, refer to Modbus® Manager Manual.

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

4.2 Response to fault indication

If a failure is found, the detector indicates by:

- LED: yellow flashes (4Hz)
- Fault relay opens
- 0-20mA: 1mA default
- Analog voltage output: 0v output

The fault indications remain until the detector is turned off. The fault indications return if the fault is still found when power is restored.

4.3 Built-in-test (BIT)

The detector's BIT checks the following:

- Sensors
- Window cleanliness
- Electronic circuitry

The detector can be set to perform the BIT in the following modes:

- Automatically and manually
- Manually only

BIT operation

The BIT is intended to check optical integrity and electronic circuitry. The detector's status remains unchanged if the result of a BIT is the same as the current status (normal or BIT fault). The detector's status changes if the BIT differs from the current status.

Note
In BIT fault status, the detector can continue to detect a fire in most cases.

Automatic BIT

The detector automatically performs a BIT every 15 minutes. A successful BIT sequence does not activate any indicator. The BIT interval can be modified if required by the customer using the RS485 Modbus® Manager or HART® communicator. In case of a BIT fault, this sequence continues until a successful BIT occurs, when the detector resumes normal operation.

- As result of successful automatic/manual BIT, the fault relay remains *energized*.
- As result of unsuccessful automatic/manual BIT, the fault relay *deenergizes*.

Manual BIT

Manual BIT can be initiated using the Modbus Manager or HART communicator. Connecting terminal 3 to ground also initiates manual BIT. Alarm duration during manual BIT is configurable using the Modbus Manager or HART communicator.

5 Maintenance

5.1 Keeping maintenance records

Maintenance operations performed on a detector should be recorded in accordance with site guidance and requirements.

5.2 Clean the detector

Procedure

1. Disconnect power from the flame detector.
2. Wipe the detector housing with clean water and a damp cloth.

⚠ CAUTION

Do not use a brush or sharp tools.

3. Identify where dust, dirt, or moisture accumulates on the detector window.
   a) Clean with a soft optical cloth.
   b) Rinse with clean water.

6 Troubleshooting

6.1 LED is off, fault relay is open, 0-20mA shows 0mA, analog voltage output is 0V

Cause

No power to the unit.

Recommended actions

1. Check that the operating voltage is correct, according to Electrical specifications.
2. Check power polarity.
3. Check the terminal wiring.

6.2 LED flashes yellow at 4Hz, fault relay is open, 0-20mA shows 1mA

Cause

Low voltage

Faulty detector

Recommended actions

1. Check that the operating voltage is correct, according to Electrical specifications
2. Re-power the detector.

6.3 LED flashes yellow at 4Hz, relay is open, 0-20mA shows 2mA

Cause

BIT fault

Faulty detector

Recommended actions

1. Ensure the detector window and reflector mirror are clean.
2. Re-power the detector.

6.4 LED constantly red, alarm relay energized, 0-20mA indicates alarm

Cause

Existing alarm condition

Alarm latched

Recommended actions

1. Check cause of alarm.
2. Ensure the alarm latch is not enabled in the detector settings.
3. Re-power the detector.

6.5 No HART® communication, 0-20mA shows 0mA

Cause

No HART is available at 0mA level.

Recommended actions

For fault mode, the default indication is 1mA. This can be configured to 0mA.

This is not recommended when using a HART connection in order to preserve the HART communication.

7 Specifications

7.1 Technical specifications

Spectral response

Rosemount 975MR	Four IR bands between 4µm and 5µm
Rosemount 975HR	Four IR bands between 2µm and 5µm
Rosemount 975UF	UV: 0.185 - 0.260 µm IR: 2.5-3.0 µm
Rosemount 975UR	UV: 0.185 - 0.260 µm IR: 4.3 – 4.8µm

Detection range per fuel (ft/m)

Note
The ranges shown are at highest sensitivity setting for 1ft^2 (0.1m^2) pan fire.

Table 7-1: Rosemount 975 Models

Fuel	Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
Gasoline	300/90		93/28	
N-Heptane	300/90		93/28	
Diesel fuel	210/63		70/21	
Kerosene	210/63		70/21	
Alcohol 95%	185/55		57/17	
IPA	185/55		70/21	
Methanol	185/55		57/17	
Methane	207/63		60/18	
LPG	207/63		60/18	
Polypropylene	160/49		60/18	
Paper	112/34		33/10	
Hydrogen	N/A	164/50	70/21	N/A
Magnesium alloy(1)	N/A		33/10	
Gun powder	197/60		66/20	92/28
Fireworks	33/10		10/3	
Cooking oil	207/63		70/21	
Mineral oil: 20w50	207/63		70/21	

Table 7-1: Rosemount 975 Models *(continued)*

Fuel	Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
Wood	112/34		33/10	
Ethylene glycol	164/50		23/7	
Butyl acrylate	246/75		70/21	
Vinyl acetate	246/75		70/21	
Flammable adhesive	207/63		70/21	
Solvents	246/75		70/21	
Oil paint	207/63		70/21	
Jet fuel JP5	210/63		70/21	
Jet fuel A1	207/63		70/21	
Battery(2)	279/85		75/23	

(1) Contact Spectrex representative for guidance on detecting Magnesium alloy.
(2) One battery cell.

Standard response time

Table 7-2: Rosemount 975 Models

Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
Typically <2 sec at 131ft/40m 10 sec at 300ft/90m		Typically 5 sec at 93ft/28m	

Ultra fast response time

Table 7-3: Rosemount 975 Models

Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
Typically <1 sec at 100ft/30m		20msec for flash fire at 10ft (3m)	

High speed response time

Table 7-4: Rosemount 975 Models

Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
50msec for 1ft diameter sphere LPG-air mixture explosion at 66ft/20m		50msec for 1ft diameter sphere LPG-air mixture explosion at 33ft (10m)	

Sensitivity ranges

Note
All distances relate to detection of a 1ft^2 (0.1m^2) n-heptane fire

Table 7-5: Rosemount 975 Models

Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
Six ranges: 10ft (3m), 50ft (15m),, 100ft (30m), 150 (45m), 215 (65m), 300ft (90m)		Three ranges: 10ft (3m), 50ft (15m), 92ft (28m)	

Field of view

Table 7-6: Rosemount 975 Models

Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
H: 100° V: 95°	Hydrogen: H: 90° V: 90°	H: 100° V: 95°	
H: 100° V: 95°	Other fuels: H: 80° V: 80°	H: 100° V: 95°	

Temperature range (operating and storage)

Table 7-7: Rosemount 975 Models

Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
-76 to +185 °F (-60 to +85 °C)			

Humidity

Non-condensing Relative Humidity up to 100%

7.2 Electrical specifications

The electrical specifications apply to all models unless stated otherwise.

Operating voltage	24 VDC nominal (18-32 VDC)
Power consumption	Standby: Max. 3W (8W with heated window) Alarm: Max. 4.2W (9.6W with heated window)
Cable entries	2 x ¾-in. - 14NPT conduits or 2 x M25 x 1.5 mm ISO
Electrical input protection	According to EN 50130
Electromagnetic capability	EMI/RFI protected to EN61000-6-3 and EN 50130
Electrical interface	The detector includes 17 terminals, one wiring option.

Electrical input protection

The input circuit is protected against voltage-reversed polarity, voltage transients, surges, and spikes according to EN54-10.

Outputs

Relays	Alarm, fault, and auxiliary SPST volt-free contacts rated 2A at 30 VDC
Analog	5V at detection, 0v at fault, 2v at normal
0-20mA (stepped)	Fault: 0 +1mA BIT fault: 2mA ± 0.3mA Normal: 4mA ± 0.3mA Warning: 16mA ± 0.3mA Alarm: 20mA ± 0.3mA

Heated optics

The front window can be heated to improve performance in ice, condensation, and snow conditions. The heater increases the temperature of the optical surface by 41–77 °F (5–25 °C) above the ambient temperature(1). The heated optics can be configured in three ways:

Off	Optics are not heated
On	Optics are continuously heated
Auto (default)	Operated only when the change of temperature requires the heating

Note
In auto mode, the starting heat temperature can be defined between 32–95 °F (0–35 °C). The detector stops heating the window when the temperature is 27 °F (15 °C) above the start temperature.

7.3 Mechanical specifications

Enclosure options

Stainless steel 316 with electropolish finish
Heavy duty copper free aluminum (less than 1%), polyurethane painted

Tilt mount

Stainless steel 316 with electropolish finish

Detector dimensions

4 x 4.6 x 6.18 inches (100.6 x 117 x 155 mm)

Weight

Stainless steel detector: 6.3 lb (2.9 kg)
Aluminum detector: 2.8 lb (1.3 kg)
Tilt mount 2.5 lb (1.1 kg)

(1) Rosemount 975 flame detectors also have a low power heater option

Environmental standards

DNV 2-4

Water and dust

IP66 and IP68 per EN60529

A Reference data

A.1 Ordering information, specifications, and dimensional drawings

To view current Rosemount 975 Series ordering information, specifications, and dimensional drawings, follow these steps:

Procedure

1. Go to Emerson.com/en-us/catalog/flame-detectors
2. Select the appropriate product.
3. Scroll down to ***Documents and Drawings***.
4. Select **DATA SHEETS & BULLETINS**
5. Select the appropriate Product Data Sheet.

A.2 Product certifications and installation drawings

To view current Rosemount 975 Series product certifications and installation drawings, follow these steps:

Procedure

1. Go to Emerson.com/en-us/catalog/flame-detectors
2. Select the appropriate product.
3. Scroll down to ***Documents and Drawings***.
4. Select **CERTIFICATES & APPROVALS**
5. Select the appropriate document.

B FM fuel test responses

Results of the FM fuel tests are as follows:

Table B-1:

Fuel	Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
Gasoline[1]	90m		28m	
N-Heptane[1]	90m		28m	
Diesel fuel[1]	63m		21m	
JP5[1]	63m		21m	
Kerosene[1]	63m		21m	
Alcohol 95%[1]	55m		17m	
IPA[1]	55m		21m	
Methanol[1]	55m		17m	
Methane[2]	63m		18m	
LPG[1]	63m		18m	
Polypropylene[1]	49m		18m	
Paper[1]	34m		10m	
Hydrogen[1]	N/A	50m	21m	N/A
Magnesium alloy[3]	N/A		10m	
Gun powder[4]	60m		20m	28m
Fireworks[5]	10m		3m	
Cooking oil[1]	63m		21m	
Mineral oil: 20w50[1]	63m		21m	
Wood[1]	34m		10m	
Ethylene glycol[1]	50m		7m	
Butyl acrylate[1]	75m		21m	
Vinyl acetate[1]	75m		21m	
Flammable adhesive [1]	63m		21m	
Solvents[1]	75m		21m	
Oil paint[1]	63m		21m	
JET A1[1]	63m		21m	

Table B-1: ***(continued)***

Fuel	Rosemount 975MR	Rosemount 975HR	Rosemount 975UF	Rosemount 975UR
Battery(6)	85m		23m	

(1) $1ft^2$
(2) Plume fire: 0.75m high, 0.25m wide
(3) Only for UV detector.
(4) 1.5 $inches^2$
(5) 10 pieces per test.
(6) One battery cell.

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For more information: **www.emerson.com**

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