SAFETY MANUAL

FlameGard® 5 MSIR
Multi-Spectral
Infrared Flame Detectors

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Safety Manual

MSA reserves the right to change published specifications and designs without prior notice.

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Revision **0**

This manual describes the safety related information for the installation, operation, configuration, and maintenance for the FlameGard 5 MSIR Multi-Spectral Infrared Flame Detector.

For complete information regarding performance, installation, operation, maintenance, and specifications of the FlameGard 5 MSIR Flame Detector, please refer to the associated product manual.

MSA's mission is to benefit society by providing safety solutions through industry-leading products, services, and systems that save lives and protect capital resources from the dangers of hazardous flames, gases, and vapors.

The safety product you have purchased should be handled carefully, and installed and maintained in accordance with the associated product instruction manual. Remember, this product is for your safety.

WARNING: TOXIC, COMBUSTIBLE, AND FLAMMABLE GASES AND VAPORS ARE VERY DANGEROUS. USE EXTREME CAUTION WHEN THESE HAZARDS ARE PRESENT.

INTRODUCTION

General Description

The MSA FlameGard 5 MSIR Flame Detector is a microprocessor based Multi-Spectral Infrared (MSIR) flame detector employing state-of-the-art infrared (IR) detectors to detect typical fires such as those produced by alcohol, n-heptane, gasoline, jet fuels, and hydrocarbons. In addition, the detectors can see through dense smoke produced by diesel, rubber, plastics, and lube oil fires, while responding with a 4-20 mA analog output or optional relay output. A sophisticated *artificial neural network* (ANN) based signal processing algorithm is used to produce a system that is highly immune to false alarms caused by lightning, sunlight reflection, arc-welding, hot objects, and other sources of radiation. The FlameGard 5 MSIR Flame Detector is regarded as a Type B field device per IEC 61508.

The safety function of the FlameGard 5 MSIR Flame Detector does not include:

- HART communication
- RS-485 Modbus communication

HART and Modbus communication are typically used for field device setup, diagnostics, and troubleshooting. Carefully observe requirements for interfacing in hazardous locations. HART and Modbus communication are non-interfering functions and do not interrupt the safety critical function of the detector.

INSTALLATION

NOTE: Power should remain disconnected until all other wiring connections are made.

For complete information on the installation of the FlameGard 5 MSIR Flame Detectors refer to the product instruction manual.

CAUTION: For the FlameGard 5 MSIR Flame Detector, do not unscrew the Electronic Module Tube without first removing the front Optical Module Assembly. Unscrewing the Tube from the Junction Module Base, while the Optical Module Assembly is attached, will invariably damage the unit.

Detector Location Considerations

There is no one optimal manner to install a flame detector for all applications. Instead, several variables should be considered when selecting locations to install detectors, including the following:

- Detector Field of View (FOV)
- Optical sensitivity range
- Environmental conditions

In addition, the FlameGard 5 MSIR Flame Detector should be mounted in locations, which will inhibit people or objects from obscuring the detector's FOV. The unit should be mounted free from shock and vibration, and in a location convenient for visual inspection and cleaning. Furthermore, the detector should be tilted downward so that dust or moisture does not accumulate on the sapphire window. Finally, though the FlameGard 5 MSIR Flame Detector is Radio Frequency Interference (RFI) resistant, the detector should not be located near radio transmitters, high magnetic or electrical fields, or in areas with similar interference.

NOTE: Frequent inspection, cleaning, and sensitivity checking is suggested for detectors mounted in dirty environments.

No special or additional detector mounting, wiring, power, or tool requirements exist beyond the standard installation practices documented in the product instruction manual.

WARNING: Under NO circumstances should equipment be connected or disconnected when under power. This is contrary to hazardous area regulations and may also lead to serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.

OPERATION AND MAINTENANCE

For complete operation, configuration, and maintenance information for the FlameGard 5 MSIR Flame Detector refer to the product instruction manual.

Before connecting a unit, check to make sure power is turned off. Before power up check all wiring connections.

The FlameGard 5 MSIR Flame Detector performs internal diagnostics on critical faults every second and a Continuous Optical Path Monitor (COPM) check every 2 minutes. The detector will respond with 0 mA for an internal fault and 2 mA for a COPM fault for non-HART units. A FlameGard 5 MSIR Flame Detector configured with HART communication will respond with a 3.5 mA analog output level for all faults.

Once correctly installed, the unit requires very little maintenance other than regular sensitivity checks and cleaning of the external window. MSA recommends that a maintenance schedule be established and followed.

⚠ **CAUTION:** In case of a power cycle event, confirm that sensitivity settings have not changed. Use the HART or Modbus communication to verify sensitivity – Low, Medium, or High. Observe requirements for interfacing in hazardous locations.

Refer to the Troubleshooting Section in the product instruction manual in the event of a fault condition. Spare parts should be on-hand as described in the Spare Parts Section of the product instruction manual.

SPECIFICATIONS

Table 1 and Table 2 list specifications for the FlameGard 5 MSIR Flame Detector. For a complete list of specifications refer to the product instruction manual.

	FlameGard 5 MSIR Flame Detector Non-HART	FlameGard 5 MSIR Flame Detector with HART
Instruction Manual P/N	MAN5MSIR	MAN5MSIRH
Temp. Range		
Operating:	-40°F to 176°F (-40°C to 80°C)	-40°F to 176°F (-40°C to 80°C)
Storage:	-40°F to 176°F (-40°C to 80°C)	-40°F to 176°F (-40°C to 80°C)
Humidity Range:	0 to 95% RH, non-condensing	0 to 95% RH, non-condensing
Input Power:		
Absolute min:	20 VDC	20 VDC
Nominal:	24 VDC	24 VDC
Absolute max:	36 VDC	36 VDC

Table 1 – Environmental/Electrical Specifications

Mode	FlameGard 5 MSIR Flame Detector non-HART	FlameGard 5 MSIR Flame Detector HART
Fault	0 mA	3.5 mA
Test Mode	1.5 mA	3.5 mA
COPM Fault	2 mA	3.5 mA
Ready	4.3 mA	4.3 mA
WARN Signal	16 mA	16 mA
ALARM Signal	20 mA	20 mA
Over range	20.1 – 22 mA	20.1 – 22 mA

Table 2 – Analog Output Specifications (Max Load: 600 ohms)

CERTIFICATIONS AND FAILURE RATE DATA

The FlameGard 5 MSIR Flame Detector has gone through rigorous reliability and functional safety assessments, which have resulted in the flame detector being certified to IEC 61508 Parts 1, 2, and 3, by FM Approvals. The reliability assessment is a failure rate prediction that assumes an average temperature of 40ºC and an environmental factor equivalent to Ground Fixed. It is assumed that the flame detectors will be installed in a Safety Instrumented System (SIS) operating in a Low Demand environment per IEC 61508. Table 3 lists the Safety Integrity Level (SIL) parameters for both the non-HART and HART versions of the FlameGard 5 MSIR Flame Detector.

Field Device	FlameGard 5 MSIR Flame Detector Analog Output	FlameGard 5 MSIR Flame Detector HART Analog Output
FM Certificate	3041816	3041816
MTBF (Years)	18	18
λ_{DD} (Fails per hour)	2.55E-6	2.54E-6
λ_{DU} (Fails per hour)	6.45E-9	1.28E-8
Safe Failure Fraction (SFF)	>99%	>99%
Safety Integrity Level (SIL)*	3	3
Diagnostic Test Interval	<1 second (critical) 30 seconds (non-critical) 2 minutes (COPM)	
Typical Response Time	<10 seconds	
Average Probability of Failure on Demand PFD_{avg}1oo1**	1.7E-5	2.4E-5

Table 3 – SIL Parameters for FlameGard 5 MSIR Flame Detector

* Hardware Fault Tolerance (HFT) = 0
** PFD_{avg}1oo1 assumes a 4 hour repair time and 90 day proof test interval.

Agency Approvals

The table below lists the agency approvals for the **FlameGard 5 MSIR Flame Detector**.

FlameGard 5 MSIR Flame Detector
ATEX
CSA
FM Approvals
ULC
HART Registered
IEC 61508 per FM Approvals

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