



GENERAL MONITORS

SAFETY MANUAL

FL31xx Flame Detector Series



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Safety Manual

04-09

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Part No.
Revision

MANFL31SAFETY
A/04-09

This manual describes the safety related information for the installation, operation, configuration, and maintenance of the following flame detectors:

- FL3100 – UV/IR Flame Detector
- FL3101 – UV Only Flame Detector
- FL3102 – Digital Frequency Infrared Flame Detector
- FL3110 – UV/IR Flame Detector for European Applications
- FL3111 – UV Only Flame Detector for European Applications
- FL3112 – Digital Frequency Infrared Flame Detector for European Applications

For complete information regarding performance, installation, operation, maintenance and specifications of the above products, please refer to the associated product manual.

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

The safety products you have purchased should be handled carefully and installed, calibrated, and maintained in accordance with the associated product instruction manual. Remember, these products are 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 General Monitors FL3100, FL3101, and FL3102 series flame detectors and FL3110, FL3111, and FL3112 series flame detectors for European applications are ultraviolet and/or infrared flame detectors that detect unwanted fires and respond with a 4-20 mA analog output or optional relay output. All detectors are regarded as Type B field devices per IEC 61508. All flame detectors can interface with the Safety Integrity Level (SIL) suitable TA402A Trip Amplifier module that monitors the presence of fire and provides status indication and alarm outputs.

The safety function of the flame detectors does not include:

- RS-485 Modbus communication

Modbus communication is typically used for field device setup, diagnostics, and troubleshooting. Carefully observe requirements for interfacing in hazardous locations. Modbus communication is a non-interfering function and does not interrupt the safety critical function of the detectors.

INSTALLATION

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

For complete installation information for the FL3100, FL3101, FL3102, FL3110, FL3111, and FL3112, refer to the specific instruction manual for each of these field devices.

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 flame detectors 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 convenient for visual inspection and cleaning. Furthermore, the detector(s) should be tilted downward so that dust or moisture does not accumulate on the window. Finally, though the detectors are Radio Frequency Interference (RFI) resistant, they 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 manuals for each flame detector.



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 and maintenance information for the FL3100, FL3101, FL3102, FL3110, FL3111, and FL3112, refer to the specific instruction manual for each of these field devices.

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

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

The flame detectors perform internal diagnostics on critical faults every second and a Continuous Optical Path Monitor (COPM) check every 1 minute. The detector will respond with 0 mA and fault relay trip for an internal fault and 2 mA and fault relay trip for a COPM fault.

NOTE: The removal of particulate matter and any film buildup on the lenses and light rods is necessary to ensure proper sensitivity of the system. It is recommended that the window and light rods be cleaned at least every 30 days, or more often if the detector is located in a particularly dirty environment.



CAUTION: In case of a power cycle event confirm that sensitivity settings have not changed. Use the Modbus communication to verify sensitivity – Low, Medium, or High. The TL105 test lamp can also be used to check the operation of the FL310x. Observe requirements for interfacing in hazardous locations.

Refer to the Troubleshooting Section in the appropriate product instruction manual in the event of sensitivity check fault or operational fault. 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 FL31xx flame detector series. For a complete list of specifications, refer to the instruction manual of each respective model.

	FL3100	FL3101	FL3102
Instruction Manual P/N	MANFL3100/3101	MANFL3100/3101	MANFL3102
Temp. Range			
Operating:	-40°F to 184°F (-40°C to 85°C)	-40°F to 184°F (-40°C to 85°C)	-40°F to 167°F (-40°C to 75°C)
Storage:	-40°F to 184°F (-40°C to 85°C)	-40°F to 184°F (-40°C to 85°C)	-40°F to 176°F (-40°C to 75°C)
Humidity Range:	0 to 100% RH, non-condensing	0 to 100% RH, non-condensing	0 to 100% RH, non-condensing
Input Power:			
Absolute min:	20 VDC	20 VDC	20 VDC
Nominal:	24 VDC	24 VDC	24 VDC
Absolute max:	36 VDC	36 VDC	36 VDC

Table 1A – FL310x Environmental/Electrical Specifications

	FL3110	FL3111	FL3112
Instruction Manual P/N	MANFL3110/11-EU	MANFL3110/11-EU	MANFL3112-EU
Temp. Range			
Operating:	-40°F to 194°F (-40°C to 90°C)	-40°F to 194°F (-40°C to 90°C)	-40°F to 167°F (-40°C to 75°C)
Storage:	-40°F to 194°F (-40°C to 90°C)	-40°F to 194°F (-40°C to 90°C)	-40°F to 167°F (-40°C to 75°C)
Humidity Range:	0 to 100% RH, non-condensing	0 to 100% RH, non-condensing	0 to 100% RH, non-condensing
Input Power:			
Absolute min:	20 VDC	20 VDC	20 VDC
Nominal:	24 VDC	24 VDC	24 VDC
Absolute max:	36 VDC	36 VDC	36 VDC

Table 1B – FL311x Environmental/Electrical Specifications

Mode	FL310x	FL311x
Fault	0 mA	0 mA
COPM Fault	2 mA	2 mA
Ready	4 mA	4 mA
IR only Signal (FL3100 and FL3110 only)	8 mA	8 mA
UV only Signal (FL3100 and FL3110 only)	12 mA	12 mA
WARN Signal	16 mA	16 mA
ALARM Signal	20 mA	20 mA

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

CERTIFICATIONS AND FAILURE RATE DATA

The FL3100, FL3101, FL3102, FL3110, FL3111, and FL3112 have gone through rigorous reliability and functional safety assessments, which have resulted in these field devices 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 40°C and an environmental factor equivalent to Ground Fixed. It is assumed that the field devices will be installed in a Safety Instrumented System (SIS) operating in a Low Demand environment per IEC 61508. Table 3 lists the SIL parameters for each field device.

Field Device Output Type	FL3100		FL3101		FL3102	
	Relay Output	4-20 mA Output	Relay Output	4-20 mA Output	Relay Output	4-20 mA Output
FM Certificate	3034949-FL3100		3034949-FL3101		3034949-FL3102	
Product Life (Years)	31		34		22	
λ_{DD} (Fails per hour)	1.15E-6	1.28E-6	1.15E-6	0.89E-6	2E-6	1.75E-6
λ_{DU} (Fails per hour)	0.14E-6	1.55E-8	0.14E-6	1.55E-8	2E-7	7E-8
Safe Failure Fraction (SFF)	96%	>99%	96%	>99%	95%	98%
Safety Integrity Level (SIL)*	2	3	2	3	2	2
Diagnostic Test Interval	1 second (Critical Faults) 1 minute (COPM)		1 second (Critical Faults) 1 minute (COPM)		1 second (Critical Faults) 1 minute (COPM)	
Typical Response Time	< 3 seconds		< 3 seconds		< 3 seconds	
Average Probability of Failure on Demand $PFD_{avg}1001^{**}$	1.6E-4	2E-5	1.6E-4	2E-5	3E-4	2.3E-5

Table 3A – SIL Parameters for FL310x

* Hardware Fault Tolerance (HFT) = 0

** $PFD_{avg}1001$ assumes a 4 hour repair time and 90 day proof test interval.

Field Device	FL3110		FL3111		FL3112	
Output Type	Relay Output	4-20 mA Output	Relay Output	4-20 mA Output	Relay Output	4-20 mA Output
FM Certificate	3034949-FL3110		3034949-FL3111		3034949-FL3112	
Product Life (Years)	21		20		20	
λ_{DD} (Fails per hour)	2.5E6	2.5E-6	2.07E-6	2.05E-6	7.85E-7	7.65E-7
λ_{DU} (Fails per hour)	1.2E-7	1.3E-7	2.3E-7	2.3E-7	7.77E-8	8E-8
Safe Failure Fraction (SFF)	98.2%	98%	95.8%	95.7%	96.8%	96.6%
Safety Integrity Level (SIL)*	2	2	2	2	2	2
Diagnostic Test Interval	1 second (Critical Faults) 1 minute (COPM)		1 second (Critical Faults) 1 minute (COPM)		1 second (Critical Faults) 1 minute (COPM)	
Typical Response Time	< 3 seconds		< 3 seconds		< 3 seconds	
Average Probability of Failure on Demand PFD _{avg} 1001**	1.4E-4	1.5E-4	2.6E-4	2.6E-4	8.8E-5	9E-5

Table 3B – SIL Parameters for FL311x

* Hardware Fault Tolerance (HFT) = 0

** PFD_{avg}1001 assumes a 4 hour repair time and 90 day proof test interval.

Agency Approvals

The FL3100, FL3101, FL3102, FL3110, FL3111, and FL3112 have the following approvals:

FL3100	FL3101	FL3102	FL3110	FL3111	FL3112
CSA	CSA	CSA	ATEX	ATEX	ATEX
FM Approvals	FM Approvals	FM Approvals	BV	Approved for Russia	BV
ATEX	ATEX	ATEX	Approved for Russia	IEC 61508 per FM Approvals	Approved for Russia
Approved for Russia	Approved for Russia	IEC 61508 per FM Approvals	IEC 61508 per FM Approvals		Approved for Kazakhstan
Approved for Kazakhstan	Approved for Kazakhstan				IEC 61508 per FM Approvals
IEC 61508 per FM Approvals	IEC 61508 per FM Approvals				

Table 4 – Agency Approvals