



Safety Manual

**AutroFlame X22AF UV, X98AF IR, X52AF UVIR
SIL 2 Certified Flame Detectors**



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SIL 2 Certified Flame Detectors**

SAFETY-CERTIFIED FLAME DETECTORS

This manual addresses the specific requirements and recommendations applicable to the proper installation, operation, and maintenance of all Safety-Certified (SIL-Certified) AutroFlame X22AF UV, X98AF IR, and X52AF UVIR Flame Detectors. The safety function of the X22AF/X98AF/X52AF is to detect a vast variety of fires and to provide present alarm status to its relay and analog outputs. For complete information regarding performance, installation, operation, maintenance and specifications, refer to appropriate instruction manual:

X22AF UV Flame Detector	116-P-X22AF/IGB
X98AF IR Flame Detector	116-P-X98AF/IGB
X52AF UVIR Flame Detector	116-P-X52AF/IGB



QUALITY POLICY STATEMENT

All quality assurance control measures necessary for safety management as specified in IEC 61508 Part 1 have been implemented. The quality management system of Autronica is based on the requirements of EN ISO 9001 and ANSI/ASQC Q9001 through the application of the United Technologies Company Achieving Competitive Excellence (ACE) program. In addition, the Quality Management System complies with the European ATEX Directive requirements per EN 13980, the International Electrotechnical Commission requirements per OD005/V2, and the supervised testing requirements per ISO 17025.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of personnel performing the operations. Information that raises potential safety issues is indicated by the word "Warning". Always read and understand these safety messages.

⚠ WARNING

The AutroFlame X22AF, X98AF and X52AF are intended for use in hazardous environments that may include explosive levels of flammable gases and vapors. These products must be properly installed, operated and maintained. Improper installation or use could result in an explosion or fire resulting in death or serious injury.

- *Do not remove the detector cover in explosive environments when device power is on and circuits are live.*
- *Detector must be properly installed, and wiring compartment cover must be fully engaged to meet hazardous area explosion-proof/non-incendive requirements.*

DESIGN

The X22AF/X98AF/X52AF flame detector is classified as a Type B smart device according to IEC61508. The standard model provides an isolated 4-wire, 0-20 mA output, together with on-board Alarm and Fault relay contacts. These outputs serve to indicate normal operating condition of the detector, fault, or the presence of a flame alarm. The X22AF/X98AF/X52AF contains extensive self-diagnostics and is programmed to send the current output to a specified state (1 mA, 2 mA or 3 mA) upon internal detection of a failure or fault condition.

HART communication is available as an option. The HART option allows the operator to monitor the status of the detector, determine factory settings, adjust field settings, and initiate field tests. For specific information regarding HART communication, refer to the appropriate HART Addendum:

AutroFlame X22AF UV Flame Detector	95-8638
AutroFlame X98AF IR Flame Detector	95-8637
AutroFlame X52AF UVIR Flame Detector	95-8636

NOTE

All configuration changes to the X22AF/X98AF/X52AF must be verified by the user via a proof test, power cycle and re-check of settings, or other appropriate method.

The X22AF/X98AF/X52AF is designed for operation with a supply voltage from 18-30 volts DC. Proper operation outside this range cannot be assumed.

Safety-Certification of the X22AF/X98AF/X52AF includes:

- Analog Output
- Relay Output
- HART Output as non-interfering.

Safety-Certification of the X22AF/X98AF/X52AF does **not** include:

- Pulse Output
- RS-485 Modbus signal.

VALID INPUT RANGE

Fault annunciation is provided on the 0-20 mA signal output loop by signaling to a 1 mA, 2 mA, or 3 mA current output level. The receiving device must be programmed to indicate a fault condition when current levels reach over-current (> 21 mA) or undercurrent (< 2.25 mA).

NOTE

The X22AF/X98AF/X52AF analog signal and relay outputs are not safety-rated during detector warm-up or signal output loop testing (including proof testing). Alternative means should be used at the job site to ensure facility safety during these activities.

DIAGNOSTIC RESPONSE TIME

The X22AF/X98AF/X52AF will perform all critical diagnostic functions within 58 minutes, worst case diagnostic detection time.

CERTIFICATION

The X22AF/X98AF/X52AF Safety-Certified version is certified to IEC61508:2010 for single input use in low demand SIL 2 Safety Instrumented Systems.

SAFETY-CERTIFIED PRODUCT IDENTIFICATION

All Safety Certified X22AF/X98AF/X52AF models are identified on the product label. In addition, the model number printed on the label will include the character suffix "T" in the model number string, indicating SIL 2 approval. Example: Model X3301A4N13T1.

INSTALLATION

NOTE

For complete information regarding performance, installation, operation, maintenance and specifications, refer to the appropriate instruction manual:

X22AF UV Flame Detector	116-P-X22AF/IGB
X98AF IR Flame Detector	116-P-X98AF/IGB
X52AF UVIR Flame Detector	116-P-X52AF/IGB

Tools Required:

- 14 mm hexagonal wrench

No special installation requirements exist above and beyond the standard installation practices documented in the instruction manual. Environmental specification limits are also as published in the general specifications section in the instruction manual.

The operating power distribution system must be designed and installed so the terminal voltage does not drop below 18 Vdc when measured at any specific location. The maximum current limit must be less than 2 amperes. The external system providing power to the X22AF/X98AF/X52AF must have overvoltage protection that ensures supply voltage does not exceed 33 Vdc.

Common Misuse Scenarios

Refer to the General Application Information section of the appropriate instruction manual for detailed information on common misuse scenarios. Application environments to avoid include the following:

UV Detectors Intense UV sources including electric arc welding, high voltage corona, x-rays and gamma radiation should not be present in the detection area.

IR Detectors Intense IR sources should not be present in detection area.

NOTE

The above common misuse scenarios will cause the X22AF/X98AF/X52AF to announce a fault or alarm if the condition is severe enough to compromise the safety function.

UV & IR Detectors Glass and Plexiglas windows attenuate radiation and should not be located between the detector and detection area.

The detector must have a direct line-of-sight to any potential flame source in the detection area; care must be taken to keep physical obstructions out of the line of view of the detector.

NOTE

The black plastic shipping cap must be removed prior to placing the detector into service.

START-UP AND COMMISSIONING

All safety functions of the X22AF/X98AF/X52AF are active within 30 seconds of power-up without any user action required.

Commissioning Personnel

The Safety Certified X22AF/X98AF/X52AF flame detector can be commissioned by any qualified person with knowledge of flame detection instruments and the configuration device being used. Refer to the Start-Up section provided in the instruction manual.

Relay Configuration Requirements

The end user must provide transient and current limiting on the output contacts of the relays. The maximum relay contact output must be limited to 5 amperes at 30 Vdc. The load must be a resistive load. The user must protect against transients by using standard protection methods such as proper grounding of shielded wire and separation of relay load wires from other lines carrying rapidly switched high current (e.g. large motor power supply lines).

Configuration

Digital communication with the X22AF/X98AF/X52AF is necessary to monitor internal status and to modify the factory settings. For specific information regarding HART communication, refer to the appropriate HART Addendum:

AutoFlame X22AF UV Flame Detector	95-8638
AutoFlame X98AF IR Flame Detector	95-8637
AutoFlame X52AF UVIR Flame Detector	95-8636

NOTE

Prior to device configuration (setting alarm thresholds, latch/non-latch function, etc.) all alarm outputs must be bypassed. The device is not safety certified during configuration change activities.

NOTE

All configuration changes to the X22AF/X98AF/X52AF must be verified by the user via a proof test, power cycle and re-check of settings, or other appropriate method. The LED flash rate during power-up should be checked to verify proper setting.

Configuration Protection

When using the 0-20 mA output with HART as a safety output, it is required that Write Protect be set to "on" to ensure that the HART is non-interfering. If HART write protect is temporarily disabled, the user must take specific action to re-enable Write Protect to ensure that HART communication remains non-interfering.

Table 1—Frequency of Proof Tests

Proof Test Name	Commissioning	Frequency
Visual Field Inspection Proof Test	Yes	As needed, depending on level and type of contaminants present
Detector Response Mag oi Proof Test	Yes	Yearly

OPERATION, MAINTENANCE, INSPECTION AND PROOF TESTING

Tools Required:

- 3 mm hexagonal wrench
- Magnetic **oi** test tool (p/n 116-102740-002)
- Window cleaner (p/n 116-001680-001 or isopropanol)
- Lens tissue and cotton swabs
- 4 mm flat blade screwdriver

After normal installation and start-up have been completed as recommended within the instruction manual, Proof Tests must be performed for every Safety-Certified X22AF/X98AF/X52AF detector installed.

Personnel performing Proof Test procedures shall be competent to perform the task. All Proof Test results must be recorded and analyzed. Any corrective actions taken must be documented in the event that an error is found in the safety functionality. The Proof Tests must be performed at a frequency as shown in Table 1.

VISUAL FIELD INSPECTION PROOF TEST

Visual inspection of all Safety-Certified X22AF/X98AF/X52AF flame detectors shall be conducted weekly to confirm that there are no obstructions in the optical field of view. Corrective action will include removal of such impediments should they exist.

Completion of Visual Field Inspection Proof test will be recorded and documented in the SIS logbook.

DETECTOR RESPONSE MAG **oi PROOF TEST**

WARNING

Any external alarm equipment, systems or signaling devices that could be automatically initiated by performing this test must be disabled or bypassed before performing this test!

Tools Required:

- Magnetic **oi** test tool (part number 116-102740-002)

All flame detectors must be performance tested using the Mag **oi** Procedure as described in the Magnetic **oi** / Manual **oi** section of the instruction manual and inspected to ensure that they are capable of providing expected performance and protection. Note that the Mag **oi** Procedure and Manual **oi** Tests are not interference free. During these tests the unit is not performing normal flame detection functions. Model X22AF/X98AF/X52AF provides an onboard status LED, which indicates Green color when internal operational parameters are normal.

To indicate a successful proof test, the LED changes to a Red color, the Alarm and Auxiliary relays change state to indicate an alarm condition, and the current output indicates 20 mA. These results should be verified on the control device.

To indicate an unsuccessful proof test, the LED changes to Yellow, the Fault relay becomes de-energized, and the current output indicates 2 mA. The fault indication can be reset by momentarily applying the magnet or manual **oi** switch.

FAULT/FAILURE ACTION PLAN

In the event of a non-alarm condition result with the Mag **oi** test, the standard Maintenance and Troubleshooting procedures listed in the instruction manual must be followed. In the event that the condition cannot be resolved, the standard Device Repair and Return procedures listed in the instruction manual must be followed.

Any and all failures to successfully complete the alarm test must be recorded and documented in the SIS logbook.

WARNING

Any external alarm equipment, systems or signaling devices that were disabled must be re-activated at the conclusion of proof testing activities.

PRODUCT REPAIR

The X22AF/X98AF/X52AF is not field-repairable and any internal device repairs must be conducted at the factory. No firmware changes are permitted or authorized. All failures indicated by internal diagnostics or Proof Tests that cannot be resolved through the troubleshooting and maintenance procedures described in the manual must be reported to the manufacturer.

OPERATING, ENVIRONMENTAL AND PERFORMANCE SPECIFICATIONS

The operating temperature range for the Safety Certified X22AF/X98AF/X52AF is -40C to +75C. The Safety-Certified X22AF/X98AF/X52AF product versions fully comply with, and must be operated in accordance with the functional and performance specifications provided in the corresponding instruction manual. A 24 hour mean time to repair should be assumed for safety availability calculations.

SPARE PARTS

Refer to the spare parts section of the instruction manual. Safety certification is based on a sufficient number of spares to achieve a 24 hour mean time to repair.

CERTIFICATION AND FAILURE RATE DATA

All Safety-Certified X22AF/X98AF/X52AF models are certified compliant to:

IEC61508: 2010

Type B Device

Systematic Capability: SIL 2 certified

HFT: 0

Low Demand Mode

PFDavg should be calculated for any safety instrumented function using the X22AF/X98AF/X52AF. (Refer to FMEDA report for necessary information, including DU rate).

Safety Accuracy: Not applicable.

Safety Response Time: See appendix A of the corresponding instruction manual for response time details.

Product Life X22AF: 25-53 years, based on manufacturer data.

Product Life X98AF: 21-43 years, based on manufacturer data.

Product Life X52AF: 10-78 years, based on manufacturer data.

All failure rate data for SIL verification is in the FMEDA report, which is available upon request.

PRODUCT CERTIFICATIONS



FM, CSA, ATEX, CE, IECEx, and *exida*.
Refer to the Instruction Manual for details.

FMEDA Report available.

For complete information regarding performance, installation, operation, maintenance and specifications of the X22AF/X98AF/X52AF, refer to the appropriate instruction manual:

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X52AF UVIR Flame Detector	116-P-X52AF/IGB

TERMS AND DEFINITIONS

FMEDA	Failure Mode Effects and Diagnostics Analysis
HART	Highway Addressable Remote Transducer
HFT	Hardware Fault Tolerance
LFL	Lower Flammable Limit
PFD	Probability of Failure on Demand (Probability of Dangerous Failure)
PFDavg	Average Probability of Failure on Demand
SFF	Safe Failure Fraction
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
X22AF	Ultraviolet Flame Detector
X98AF	Infrared Flame Detector
X52AF	Ultraviolet and Infrared Flame Detector

IEC 61508 Failure Rates in FIT*

Failure Category	λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	SFF
X22AF/X98AF/X52AF Flame Detector, Analog Output					
X22AF/X98AF/X52AF Flame Detector, Relay Output					
X22AF/X98AF/X52AF Flame Detector, Analog Output with HART					

*FIT = 1 Failure / 10⁹ Hours

Autronica Fire and Security AS

P.O. box 5620 • NO-7483 Trondheim, NORWAY

Operator: (+47) 73 58 25 00

Fax (+47) 73 58 25 01

www.autronicafire.com • E-mail: info@autronicafire.no

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