The Safety Company

FlameGard® 5 UV/IR-E

Ultraviolet/Infrared Flame Detector

ISO 9001:2000 QUALITY

Instruction Manual **09/09**

Part No. **MAN5UVIRE-EU**
Revision **0**

Warranty Statement

MSA warrants the FlameGard 5 UV/IR-E to be free from defects in workmanship or material under normal use and service within two years from the date of shipment.

MSA will repair or replace without charge any such equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by MSA's personnel.

Defective or damaged equipment must be shipped to MSA plant or representative from which the original shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by MSA. The customer will assume all liability for the misuse of this equipment by its employees or other personnel.

The customer will assume all liability for the misuse of this equipment by its employees or other personnel. All warranties are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without MSA' approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered.

Except for the express warranty stated above, MSA disclaims all warranties with regard to the products sold, including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of MSA for damages including, but not limited to, consequential damages arising out of, or in connection with, the performance of the product.

Warnings

WARNING - Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

EC Declaration of Conformity

The manufacturer or his in the community established authorized representative

MSA AUER GmbH
Thiemannstraße 1
D-12059 Berlin

declares that the product :

MSA AUER FlameGard 5 UV/IR-E

based on the EC-Type Examination Certificates :

SIRA 10 ATEX 1365

complies with the ATEX directive 94/9/EC, Annex III. Quality Assurance Notification complying with Annex IV of the ATEX Directive 94/9/EC has been issued by SIRA Certification Service , Notified Body number: 0518.

The product fulfilled the standard EN 54 -10 :2002

The product is in conformance with the directive 2004 / 108/ EC ,(EMC) :

EN 50130-4 : 2002 EN 61000 - 6 - 4 :2007

MSA AUER GmbH
Dr. Axel Schubert
R & D Instruments

Berlin , March 2011

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1.0 Introduction

1.1 General Description

Fire is a phenomenon of combustion. Combustion is the continuous chemical reaction of a reducing agent (*fuel*) and an oxidizing agent (*oxygen, etc*.) with the evolution of thermal energy (*heat*). Fire is usually manifested in heat (*IR*), smoke, light (*visible*), and flame (*UV*). Flame is the gaseous region of a fire where vigorous combustion chain reactions take place. These reactions emit radiation covering the Infrared, Ultraviolet and the Visible Spectral Regions.

The MSA FlameGard 5 UV/IR-E is an Ultraviolet/Infrared (UV/IR) Flame Detector. It detects the Ultraviolet and Infrared spectral regions of the flame to produce a system which is highly immune to false alarms caused by lightning, arc-welding, hot objects, and other sources of radiation.

The Models FlameGard 5 UV/IR-E features include:

- Compact unitised design.
- Continuous optical path monitoring.
- Wide field of view.
- High false alarm immunity.
- 0-20mA, Relays, Field Loop and Modbus RTU RS-485 serial communications output versions.
- Visual indicators.
- Stainless Steel body with integral mounting bracket.
- Rated for continuous 90°C operation.

1.2 Principle of Operation

UV Detector

The Flame Detector contains an ultraviolet phototube that responds to Ultra-Violet (UV) radiation in the 185 to 260 nanometer region (Figure 2). When radiation from a flame reaches the cathode plate within the UV detector tube, electrons are ejected from the cathode plate. These electrons are accelerated towards the positively charged anode of the tube. They collide with molecules of an ionisable gas, with which the tube is filled. This emits more electrons and produces an avalanche condition. More electrons are released which creates a momentary electron flow from the cathode to the anode. This momentary current (pulse) recurs at a rate proportional to the intensity of the UV radiation.

The Flame Detectors process these UV signals with a microcomputer and, depending on the version, produces the following outputs:

- 0 to 20 milliampere signal.
- Immediate WARN relay contacts.
- Time delayed ALARM relay contacts.
- FAULT relay contacts.
- RS-485 MODBUS RTU serial communications ports.

(See Sections 2 & 3 for more information on detector outputs)

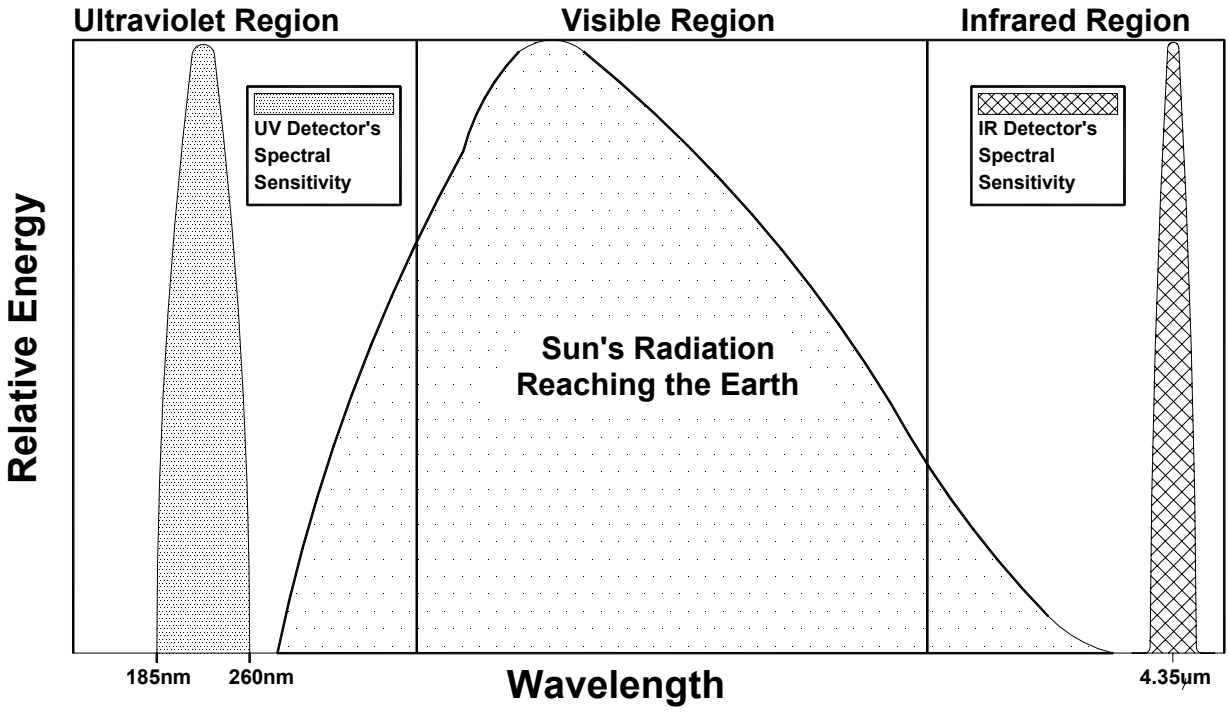

Figure 2 Spectral Response of UV and IR Detectors

UV/IR Flame Detector

The FlameGard 5 UV/IR-E is a discriminating UV/IR Detector, which makes use of an ultraviolet radiation sensitive phototube in addition to an infrared detector (see figure 2). This combination provides a flame detection system, which is highly immune to false alarms.

The UV portion of the detector, as described in UV Detector, is combined with an infrared detector, which reacts to changes in the intensity of infrared radiation. By sensing very specific wavelengths in both the UV and IR spectra and then processing these signals with a microcomputer, a very high degree of discrimination is achieved.

Incorporated in the IR circuitry is a flicker discrimination circuit. This permits the detector to ignore steady IR sources such as hot objects. The inherent flickering of flame provides the necessary modulation to activate the IR circuit.

Since a flame is a copious source of both ultraviolet and infrared radiation, discrimination is provided when both UV and IR emissions are detected. If only UV is detected, as in the case of arc welding, no alarm is given. If only IR is detected, such as a large modulating hot object, no alarm is given. However, if both conditions are met in the correct combination and intensity, as determined by an algorithm in the microcomputer, a fire is identified and the alarm outputs are activated.

COPM Circuitry

A self-testing feature called Continuous Optical Path Monitoring (*COPM*) checks the optical path, the detector(s), and the related electronic circuitry once every minute. If foreign material impairs the optical path of the UV detector tube or infrared detector for two consecutive checks, the unit will indicate FAULT. The optical FAULT outputs are, depending on the version, a 2.0 mA signal or de-energizing of the FAULT relay. The FAULT status is available via the RS-485 serial communications port. (*see Section 3-6 Terminal Connections*). After a COPM FAULT, a COPM check is performed every ten seconds until the obstruction is removed. Then the COPM check will resume checking once per minute check.

WARNING – Dirty or partially blocked windows can significantly reduce the detector's field of view and detection distance.

NOTE: Since the optical path is checked once per minute and it requires two check failures to produce a FAULT, it may take up to two minutes for the unit to detect an obstruction.

Alarm Test

The FlameGard 5 UV/IR-E have a built-in Alarm Test feature. This test may be activated via the serial communications port (*see Section 3-6 Terminal Connections*).

The Flame Detectors will immediately go into WARN and then into time delayed ALARM. After two to ten seconds the Flame Detectors will activate the ALARM. A latching WARN and/or ALARM will remain latched until reset.

Visual Indicators

Two light emitting diodes (*LEDs*) are visible through the IR window. LEDs are provided for a visual indication that corresponds with the detector's outputs. The following blinking sequence indicates the operating condition:

- Timeout (10 seconds when the unit is first powered) – Green and red LEDs blinking alternately.
- Ready – Green LED that flashes off 1 second, every 5 seconds.
- WARNING – Slow blinking red LED.
- ALARM – Fast blinking red LED.
- COPM FAULT – Slow blinking green LED.
- Low Voltage FAULT – Fast blinking green LED.

2.0 Specifications

2.1 System Specifications

Certification:
Ex d e IIC T4/T5 Gb Ex tb IIIC T135°C/T100°C Db IP6X
Tamb = -40°C to +90°C, -40°C to +75°C

IR Detector centre wavelength:
4.35 microns

UV Detector Pass Band:
185 to 260 nanometres

Typical Alarm Activation Response Times*:
< 3 sec. @ 50 ft. (15.2m)

Minimum Detector Response Times:
< 500 ms.

Field of View*: (*Figure 3-A*)
120° maximum conical

Sensitivity:
50 feet (15.2m); Maximum distance for a 1 square foot (*.092m*^{2}) gasoline fire to be reliably detected.

Maximum Cable Parameters:
4-20mA Output Signal
9000 feet (2750 m), maximum 50 Ohms loop, with maximum 250 Ohms input impedance of readout unit.

Remote power supply
3000 feet (930 m), maximum 20 Ohms loop and 24 VDC minimum. (*See Section 3-4 Terminal Connections*)

Approvals:
ATEX & CE Mark, IECEx

Warranty:
Two Years

*** NOTE:**

1. *Response Times and Field of View data have been derived by testing the FlameGard 5 UV/IR-E with a 1 square foot gasoline fire. One cup of unleaded gasoline on top of a one inch layer of water was ignited for each test. These are typical values and different results may occur depending on the variation of each fire.*

2. *To meet the directional dependence requirements of EN 54-10 the horizontal viewing angle must not exceed ±30°.*

2.2 Mechanical Specifications

Enclosure material

Material:	Stainless Steel 316
Colour:	Natural

Dimensions:

Diameter	3.3 in	(8.4 cm)
Length	5.4 in	(13.7 cm)
Weight	5lbs	(2.3 kg)

Cable Entries: 2 x M20

2.3 Electrical Specifications

Supply voltage range:	20 to 36 VDC
Nominal supply voltage:	24VDC
Maximum supply current:	150 mA

Maximum output signal
Load @ 24 VDC: 600 Ohms

Output signal range:	0 to 20mA
FAULT signal:	0 to 0.2mA
COPM fault signal:	2.0mA ± 0.2 mA
Ready signal:	4.0 ± 0.2 mA
WARN signal:	16.0 ± 0.2 mA
ALARM signal:	20.0 ± 0.2 mA

Relay Contact Ratings:
1A MAX @ 30VRMS/42.2 VPK,
Resistive.

RS-485 Serial Communications Port:
Modbus RTU Protocol
128 units MAX. (247 units with repeaters)
Baud Rate: 2400, 4800, 9600 or 19200

RFI/EMI Protection
Complies with EN50270, Type 2
EN55011:1991
EN61000-4-2:1995+A1:1998+A2:2001
EN61000-4-3:1995+A1:1998+A2:200
EN61000-4-4:1995+A1:2001
EN61000-4-5:1995+A1:2001
EN61000-4-6:1996+A1:2001
ENV50204:1995

Status Indicator:
Two LEDs indicate status, fault conditions.

2.4 Environmental Specifications

Operating temperature range:	-40°C to 90°C -40°F to 194°F
Storage temperature range:	-40°C to 90°C -40°F to 194°F
Humidity range:	0 to 100% RH non-condensing

2.5 Modbus RTU Protocol

For detailed information on data format, read commands, write commands, register details, and register locations refer to the Serial Communications section in this manual.

3.0 Installation

WARNING - Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

3.1 Upon Receipt of Your Equipment

All items shipped by MSA are packed in shock absorbing containers which afford a considerable degree of protection against physical damage. When received, the contents should be carefully removed and checked against the enclosed packing slip. All subsequent correspondence with MSA must specify the equipment part number and serial number.

3.2 Choosing Detector Locations

Several variables are involved in selecting the locations in which to install detectors to ensure proper flame detection. There are no hard and fast rules defining the optimum location. There are some general suggestions that should be considered in regard to particular conditions at the site where the unit(s) is being installed:

Detector Field of View
Each FlameGard 5 UV/IR-E Flame Detector has a maximum cone of vision of 120º. This Cone has its vertex at the center of the detector (see figure 3A-1, 3A-2, and 3A-3).

Optical Sensitivity Range
The distance at which the detector will respond to a flame is a function of the intensity of that flame. The maximum distance is 50 feet (15.2m) for a gasoline fire with a surface area of 1 square foot (0.92m^2).

Environmental Factors

1. Mounting should be as free from shock and vibration as possible and convenient for visual inspection and cleaning.

2. Detectors mounted in dirty atmospheric conditions will require more frequent inspection, cleaning, and sensitivity checking.

3. Observe the ambient temperature range for the specific model (see section 2-4 Environmental Specifications). For outdoor installations or other areas exposed to intense, direct solar radiation, the detector may reach temperatures well above specifications. For this condition, a cover for shade may be required to bring the detector temperature within specifications. As with any cover or object nearby, make sure the field-of-view of the detector is not obstructed.

4. Avoid conditions of ice build up on the optical detector windows: complete icing over of the detector windows can result in fault conditions.

5. Mount away from possible sources of electrical noise.

6. A constant UV source detected by the unit will cause the flame detector to go into FAULT after 9-10 minutes of exposure. Source must be removed or detector repositioned. (UV detectors can pick-up arc welding up to 2-3 miles away).

7. Users should be aware that any UV detector may be triggered by other sources of EMI, for instance X-rays, sunlight, reflected sunlight, Gamma rays, lightning, arc welding, industrial lighting, fluorescent lighting, etc., and due regard should be paid to the possible presence of such radiation.

3.3 Detector Installation

The FlameGard 5 UV/IR-E Detector should be mounted tilting downwards so that dust/moisture will not accumulate on the window. (The detector should be mounted in locations which will avoid either people or objects from obscuring the detector's Cone of Vision.)

Cable glands and stopping plugs should be installed with the o-rings supplied with the flame detector. It is recommended to fit boots over cable glands to prevent water ingress at the cable-to-gland junction.

Mounting hardware should be used as shown in figure 3-B. The overall dimensions of the detector and mounting hardware is also shown.

3.4 Interconnecting Cable Guidelines

- The flame detector requires an interconnecting cable with an overall **screen (shield) and armour.** Cables to BS5308 Part 2, Type 2 or equivalent are suitable.
- Interconnecting cables should be segregated from power and other "noisy" cables. Avoid proximity to cables associated with radio transmitters, welders, switched mode power supplies, inverters, battery chargers, ignition systems, generators, switch gear, arc lights and other high frequency or high power switching process equipment. In general, maintain a separation of at least 1m between instrument and other cables. Greater separation is required where long parallel cable runs are unavoidable. Avoid running instrument cable trenches close to lightning conductors earthing pits.
- Complete all cable insulation tests before connecting the cable at either end.
- MSA do not recommend the use of cable shoes or crimps on any junction box or housing wiring terminals. Poor crimping can cause bad connection when unit experiences temperature variations. We therefore recommend that it is good practice to just terminate the cable.

3.5 Installation Instructions

3.5.1 Cable Termination

- The flame detector should be installed in accordance with the certification documents and the relevant regulations of the country concerned.
- Ensure that approved Exe cable glands are used and installed according to the manufacturer's instructions.
- The cable armour must be terminated in the gland to ensure a positive electrical connection.
- The cable screens (drain wires) must not be connected electrically to the electronic circuitry of the flame detector.
- Connect Safety Earth to the chassis grounding screw available on the rear exterior of the base assembly. This Safety Earth wire should have a wire gauge of at least 22 AWG (0.33mm^2) and be no longer than 3 meters in length.

3.5.2 Cable Termination in Safe Area

- The cable armour must be connected to Safety Earth.
- The cable screens (drain wire) and power supply return (OV) must be connected to Instrument Earth.
- The power supply or power distribution system employed should meet the requirements of EN50081- 1/2 and EN60101-1.

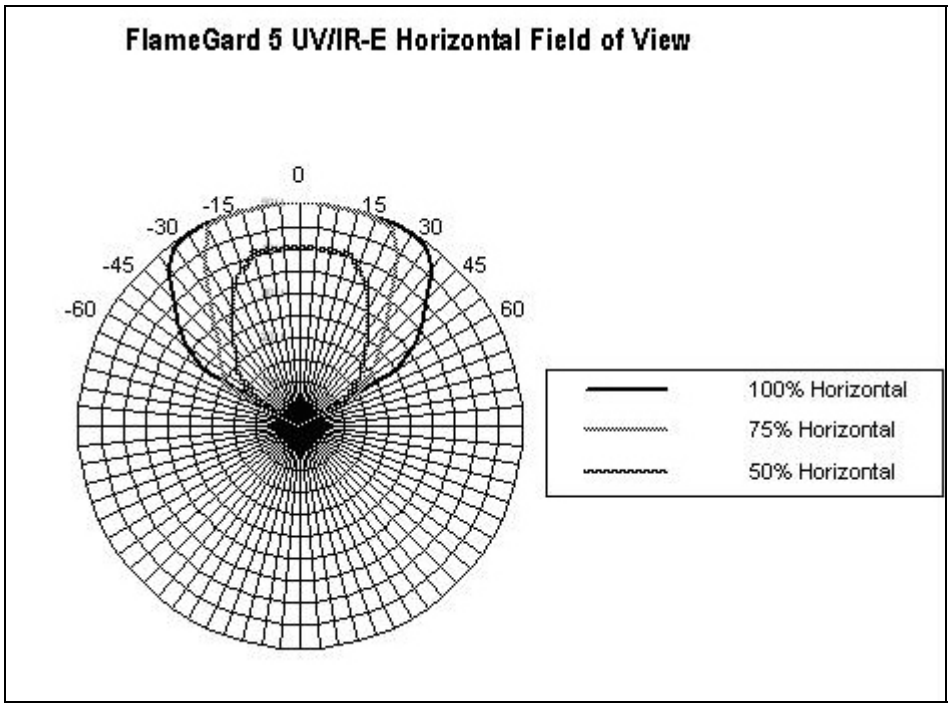

Figure 3A-1 Horizontal Field of View

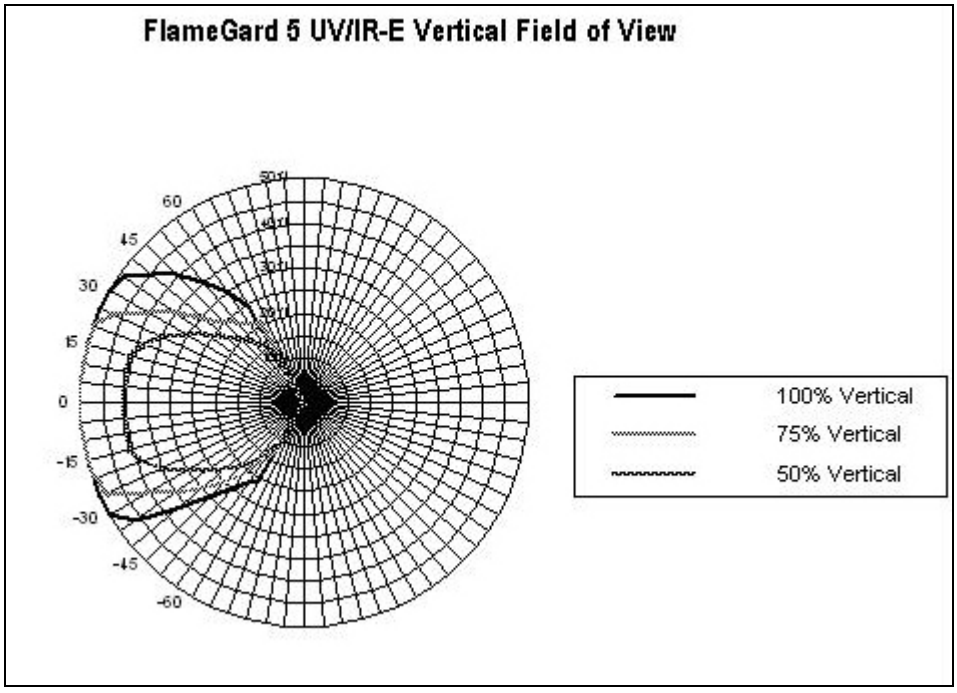

Figure 3A-2 Vertical Field of View

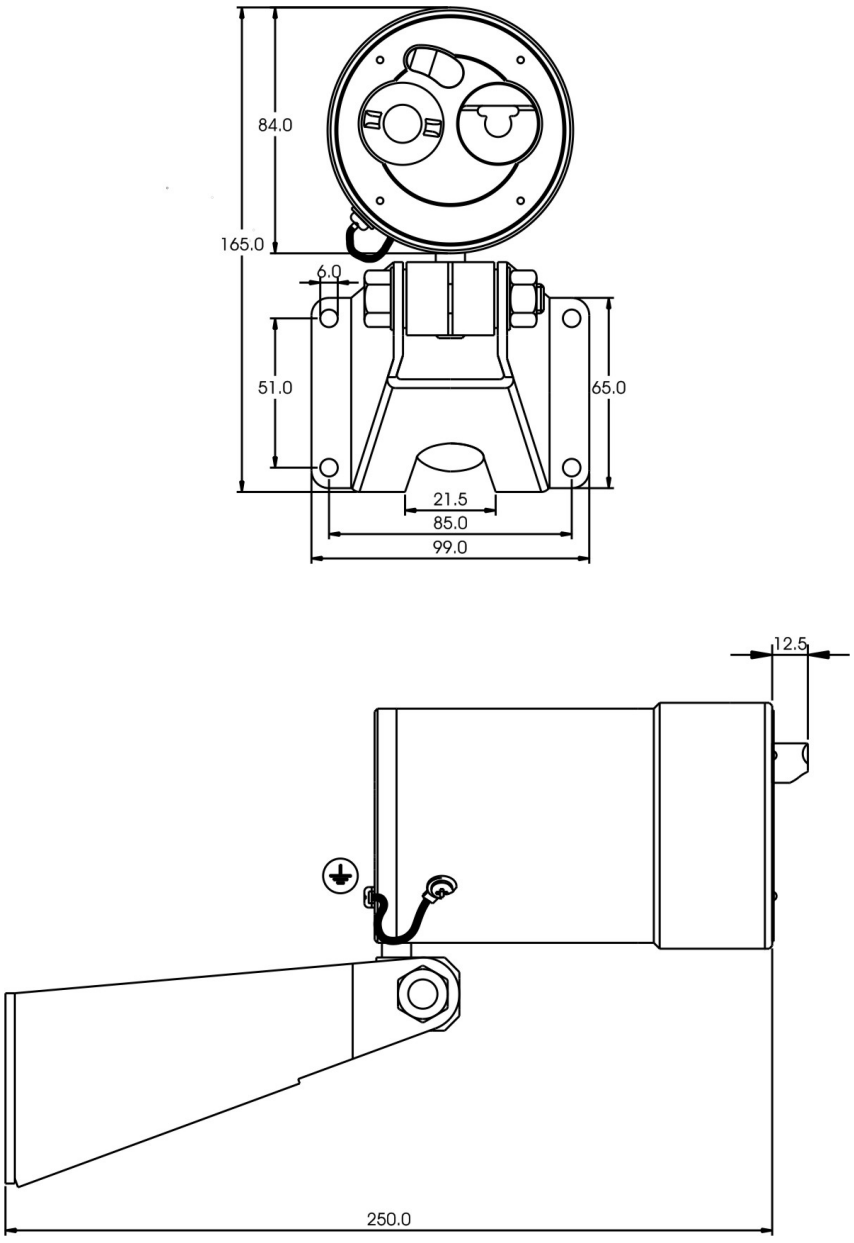

Figure 3-B Outline Drawing

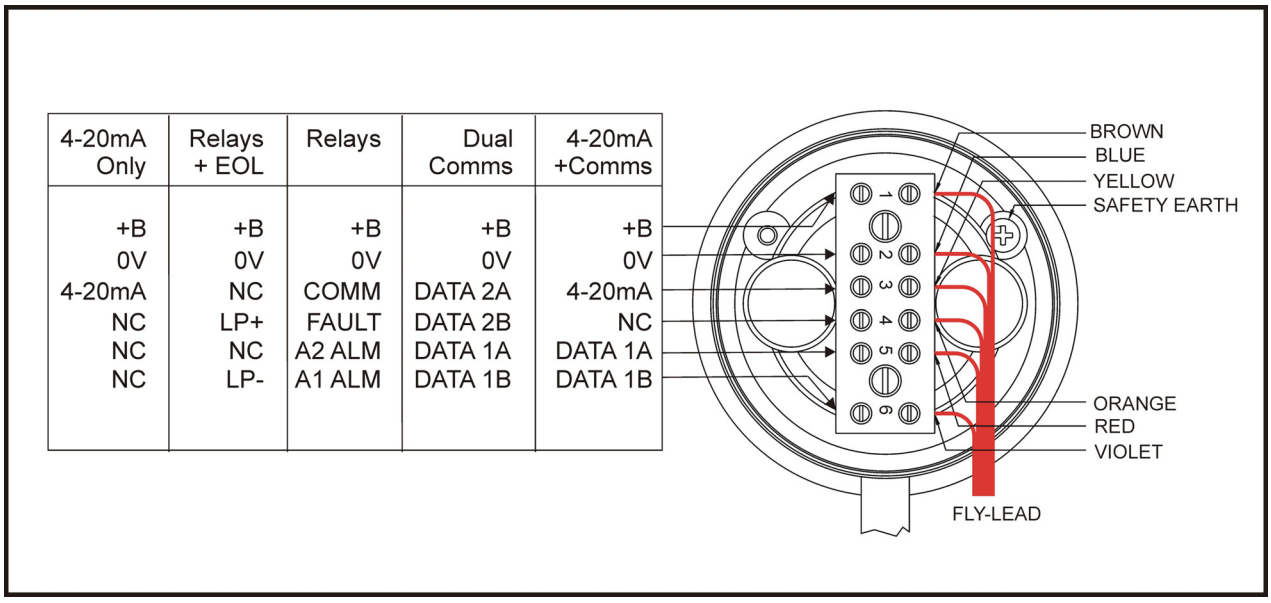

Figure 3-C Base Assembly with Terminal Block

3.6 Terminal Connections

The Terminal Block is located on the Base Assembly (*See figure 3-C*) and accepts 12 AWG (3.31 mm^2) to 22 AWG (0.33 mm^2) stranded or solid core wire. Each wire should be stripped as shown in figure 3-D.

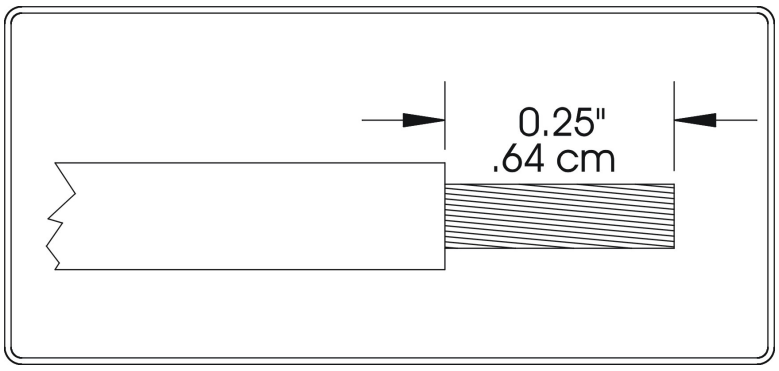

Figure 3-D Strip Length

Four of the six positions on the terminal block have functions which depend on the FlameGard 5 UV/IR-E version selected. The remaining two positions are reserved for the power connections.
Figure 3-C outlines the terminal block connections by version.

On both this and the following pages is a description and specification for each of the signals shown in figure 3-C.

POWER INPUTS
+B and 0V

These are the power connections. The supply voltage range is 20 to 36 VDC at the detector (*low voltage is detected at 18.5 VDC*). The following maximum cable lengths apply for a +24VDC supply (*maximum 20 ohm loop*):

AWG	mm^2	FEET	METRES
14 AWG	2.08	4500	1370
16 AWG	1.31	2340	715
18 AWG	0.82	1540	470
20 AWG	0.52	970	300
22 AWG	0.33	670	205

ANALOGUE OUTPUT
4 – 20mA

The 4 to 20mA output is a current signal that corresponds to the following specification:

FAULT signal:	0 to 0.2mA
COPM Fault signal:	2.0 ± 0.2mA
Ready signal:	4.0 ± 0.2mA
WARN signal:	16.0 ± 0.2mA
ALARM signal:	20.0 ± 0.2mA
Output Load Max.:	600 ohms

For interfacing with 250 ohm input impedance devices, the following maximum cable lengths apply (*maximum 50 ohm loop*):

AWG	mm^2	FEET	METRES
14 AWG	2.08	9000	2750
16 AWG	1.31	5800	1770
18 AWG	0.82	3800	1160
20 AWG	0.52	2400	730
22 AWG	0.33	1700	520

COMMUNICATIONS OUTPUTS
DATA 1A
DATA 1B
DATA 2A
DATA 2B

These are the connections for the RS-485 serial communications ports 1 & 2. The RS-485 connection is used to either query the unit's status or to configure the unit. See Section 7 for detailed information on Modbus RTU protocol.

RELAY OUTPUT (Figure 3-E)

A1 ALM

Description: This connection is the WARN relay contact. The WARN output is immediate and can be normally energised or normally de-energised, latching or non-latching.
WARN relay contact rating is 1A @ 30VRMS/42.2VPK Resistive.

A2 ALM

Description: This connection is the ALARM relay contact. The ALARM output is time delayed for 2, 4, 8 or 10 seconds. The ALARM output can be normally energised or normally de-energised, latching or non-latching.
ALARM relay contact rating is 1A @ 30VRMS/42.2VPK Resistive.

FAULT

Description: This connection is the FAULT relay contact. The FAULT output configuration is normally energised and non-latching. This is the standard output configuration and it cannot be changed. The FAULT circuit will be activated during the time-out function, a low power or loss of power condition, and during a failed COPM check. During these conditions the FAULT relay will de-energise and the analogue output signal will drop to 0 mA (2mA for COPM Faults) for the duration of the FAULT.
FAULT relay contact rating is 1A @ 30VRMS/42.2VPK Resistive.

COMM

Description: This is the common connection of the WARN, ALARM and FAULT relay contacts.

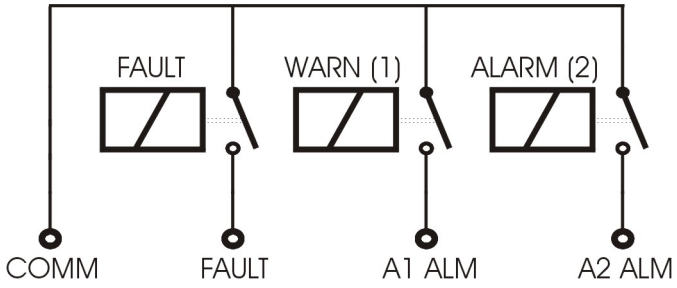

Figure 3-E Relay Outputs

FIELD LOOP OUTPUTS (Figure 3 – F)
LP+ and LP-
Description: These are the field loop connections to a fire card such as MSA' IN042.
The FAULT relay, when energised, inserts a 5600ohms, 2Watt End-Of-Line resistor across these connections.
The ALARM relay, when energised, inserts a 560ohms, 2Watt resistor across the End-Of-Line resistor. The WARN relay has no effect.
For a description of relay functionality refer to the section RELAY OUTPUTS above.

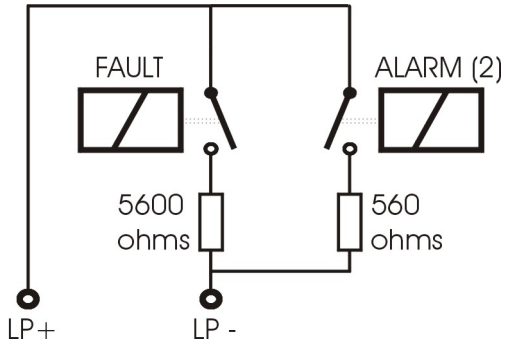

Figure 3-F Field Loop Outputs

RESET
All versions may be reset by interrupting the power supply for a minimum of two seconds. Versions with serial communications can also be reset by using the Remote Reset command. Refer to section 7 for details.

SAFETY EARTH
This connects the flame detector enclosure to Safety Earth. An alternative connection is available on the rear exterior of the base assembly. The Safety Earth wire should have a wire gauge of at least 22 AWG (0.33mm^2) and be no longer than 3 meters in length.

WARNING: Under no condition should the retaining strap screws be used for Safety Earth purposes

3.7 User Selectable Options

All user selectable option settings on the FlameGard 5 UV/IR-Eare held in EEPROM. It is recommended the option settings be specified when ordering.

Versions with serial communications capabilities can be (re)programmed via the communications port(s). Refer to section 7 for details. Other versions can be (re)programmed with the Program Card accessory if necessary.

PROGRAM CARD ACCESSORY
The Program Card is a small module with a DIP switch which can be read by the FlameGard 5 UV/IR-E microprocessor.
DIP switch positions 5 to 8 select the options being programmed, such as Sensitivity and Alarm-time-delay, Relay or Return to Factory Default settings. DIP switch positions 1 to 4 determine the actual parameter settings. Refer to the following tables for details:

SENSITIVITY and ALARM-TIME-DELAY Options

	Sensitivity (%)			Alarm-time-delay (sec)			
DIP	**100**	**75**	**50**	**10**	**2**	**4**	**8**
1				OFF	OFF	ON	ON
2				OFF	ON	OFF	ON
3	OFF	OFF	ON				
4	OFF	ON	OFF				
5	OFF	OFF	OFF	OFF	OFF	OFF	OFF
6	OFF	OFF	OFF	OFF	OFF	OFF	OFF
7	ON	ON	ON	ON	ON	ON	ON
8	ON	ON	ON	ON	ON	ON	ON

WARN and ALARM Relay Options

	WARN (1) Relay				ALARM (2) Relay			
DIP	**LA**	**NL**	**EN**	**DE**	**LA**	**NL**	**EN**	**DE**
1	ON	OFF						
2			ON	OFF				
3					ON	OFF		
4							ON	OFF
5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
6	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
7	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
8	ON	ON	ON	ON	ON	ON	ON	ON

LA = Latching **NL** = Non Latching
EN = Energised **DE** = De-Energised

The above options have been represented pictorially on the label attached to the Program Card

Return to FACTORY DEFAULT settings

DIP	**Default**
5	ON
6	ON
7	OFF
8	ON

DIP switch positions 1 to 4 are not relevant here

WARNING: During the following steps proper anti-static procedures must be observed. Failure to do so may permanently damage the electronic circuits and void the warranty.

To (re)program, remove the detector from the Base Assembly, disconnect the fly-lead and disconnect the retainer strap at the rear of the Base only.

1. Refer to figure 3-G and remove the five screws securing the front cap assembly to the enclosure.

2. Remove the front cap assembly.

3. Disconnect the fly-lead connector from the power supply board.

4. Insert the Program Card with the required DIP switch settings into connector J3 on the microprocessor board.

5. Apply +24VDC to connector J3 pins 1 and 2, as shown in the figure, for a minimum of five seconds. This step allows the microprocessor to read the DIP switch settings on the Program Card.

6. Disconnect the +24VDC power supply.
   If more programming is required, adjust the DIP switch settings and re-apply +24VDC for a minimum of five seconds. Steps 4 to 6 may be repeated as required.
   When programming is completed, remove the +24VDC power supply and the Program Card.

7. Inspect the o-ring on the front cap assembly for damage and the flame path surfaces for contamination. If necessary replace or clean and re-apply a suitable grease to the o-ring and flame path surfaces.

8. Reconnect the fly-lead connector to the power supply board. Insert the front cap assembly into the enclosure, ensuring the o-ring does not snag and secure with the five screws.

Inspect the o-ring on the Base assembly for damage and the corresponding surfaces for contamination. If necessary clean or replace and re-apply a suitable grease to the o-ring and corresponding surfaces.

Reconnect the retainer strap at the rear of the Base assembly and reconnect the fly-leads as shown in figure 3-C. Mount the detector on the Base assembly ensuring the o-ring does not snag.

3.8 Factory Default Settings

Return to Factory Default settings only affects FlameGard 5 UV/IR-E versions with serial communications capabilities. It provides a mechanism to restore the communications parameters, should they be unknown or corrupted. The Factory Default settings are:

Parameter	**Setting**
Address	1 (Decimal)
Baud Rate	19200
Data Format	8-N-1

Refer to section 7 for details

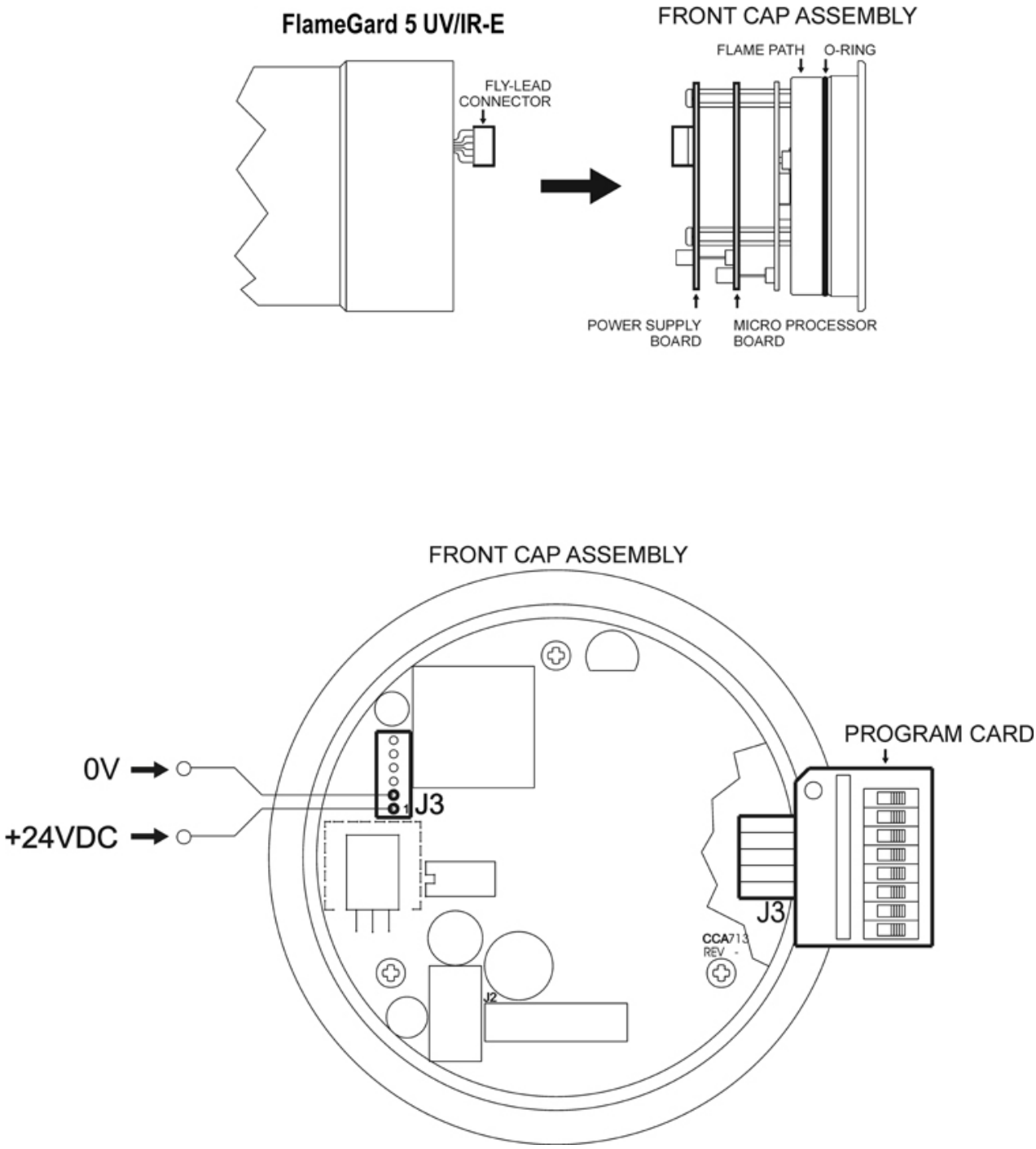

Figure 3-G Front Cap Assembly

4.0 Maintenance

WARNING – Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

4.1 General Maintenance

Once correctly installed, the unit requires very little maintenance other than regular sensitivity checks and cleaning of the lenses, light rod and reflector. MSA recommends that a schedule be established and adhered to.

Warning: Disconnect or inhibit external devices, such as automatic extinguishing or fire suppression systems before performing any maintenance.

4.2 Cleaning the Lenses/Light Rod

A clean, soft, lint-free cloth, tissue or cotton swab should be used to apply the cleaning solution. Do not touch the lenses with fingers.

a) Wet the lenses with the solution.

b) Rub with a dry, unsoiled cloth until clean.

c) Completely dry the lenses.

d) Repeat steps a, b and c for the reflector and light rod.

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

Warning: A dirty or partially blocked lens can significantly reduce the detector's field of view and detection distance

DO NOT USE A COMMERCIAL GLASS CLEANER OTHER THAN "INDUSTRIAL STRENGTH WINDEX® with Ammonia D":
The UV lens material is quartz, the IR lens material is sapphire. The cleaning solution should be Industrial Strength Windex® with Ammonia D.

4.3 Sensitivity Check

To verify that each detector is functioning correctly, an MSA Test Lamp and/or the ALARM TEST function should be used. For the FlameGard 5 UV/IR-E FlameGard 5 Test Lamp is recommended.

Alarm Test
The Flame Detectors have a built-in Alarm Test feature. The user can test the alarm outputs of the Flame Detector by activating the Alarm Test feature via serial communications. The Flame Detector will immediately go into WARN and then into the time delayed ALARM. After two to ten seconds the Flame Detector will reset the non-latching WARN and/or ALARM. A latching WARN and or/ ALARM will remain latched until manually reset. If the Flame Detector does not respond to the sources, it will output a FAULT condition and will retest every ten seconds, as in the COPM FAULT case. See section 6, Spares & Accessories for details on test lamps.

4.4 Storage

These Flame Detectors should be stored in a clean, dry area and within the temperature and humidity ranges quoted in Section 2-4 Environmental Specifications.

5.0 Trouble Shooting

WARNING - Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

5.1 Trouble Shooting Chart

This section is intended to be a guide in correcting problems which may arise in the field. This section is not all-inclusive, and MSA should be contacted for assistance if the corrective actions listed do not eliminate the problem. If equipment or qualified personnel required for various tests are not available it is recommended that the defective unit be returned to MSA for repair.

A complete written description of the problem should be included. Be sure to inhibit or disconnect external alarm wiring before making any checks which might send the unit into alarm, if an alarm condition will create problems.

NOTE: If the equipment is under warranty, any repairs performed by persons other than MSA's authorised personnel may void the warranty. Please read the warranty statement carefully.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
No output signal and green LED in IR window is off.	No DC Power to the Unit	Be sure the +24 VDC is applied with the correct polarity.
No output signal and green LED in IR window is rapidly blinking.	Low voltage FAULT (voltage at unit less than +18VDC).	Be sure that the unit is powered with at least +20VDC under load.
2mA signal and green LED in IR window is slowly blinking.	COPM FAULT, dirty or obscured optical path (UV or IR window)	Clean UV and IR window and source light rod.
Constant 8mA signal with no known radiation to detector.	Background IR radiation at detector.	Cover IR portion of FlameGard 5 UV/IR-E for ten seconds to determine if there is background IR. If there is, remove IR Radiation source or change FlameGard 5 UV/IR-E location. If there is no background IR, replace IR detector in FlameGard 5 UV/IR-E.
Constant 12mA signal with no known radiation to detector.	Background UV radiation at detector.	Cover UV portion of FlameGard 5 UV/IR-E for ten seconds to determine if there is background UV. If there is, remove UV radiation source or change FlameGard 5 UV/IR-E location. If there is no background UV, replace UV detector tube in FlameGard 5 UV/IR-E.

6.0 Spares & Accessories

6.1 Spare Parts

When ordering Spare Parts and/or Accessories please contact your nearest MSA Representative or MSA directly and give the following information.

DESCRIPTION	PART NR
UV Source	70567-3
UV Detector	71521-1A
IR Detector	71391-2
Lamp, IR Source	70596-2
Program Card	71336-1
High Vacuum Grease, 150g Tube	916-078
FlameGard 5 Test Lamp	5TL-12
Window Cleaning Solution	10272-1

6.2 Test Lamps

FlameGard 5 UV/IR Test Lamp

The FlameGard 5 Test Lamp is a battery operated, rechargeable, test source specifically designed to test MSA's UV, UV/IR, and Digital Frequency IR Flame Detection Systems. It consists of a high-energy broad band radiation source which emits sufficient energy in both the Ultraviolet and Infrared spectra to activate UV and/or IR detectors. To simulate a fire, the test lamp automatically flashes at one of three DIP switch selectable rates. The FlameGard 5 Test Lamp, rated explosion-proof, is CSA certified for use in Class I, Division 1, Groups 2 C and D areas. The test lamp operates on internal lead-acid batteries which, when fully charged, will operate continuously for 25 to 30 minutes. An internal circuit will prevent operation when the batteries are low.

FlameGard 5 Test Lamp Operating Instructions

It is always important to start a series of FlameGard 5 Test Lamp checks with a fully charged unit. Stand within 20 feet of the unit to be tested and aim the FlameGard 5 Test Lamp squarely into the detector face. Shaking the lamp from side to side or up and down will increase the simulation of flame flicker, and improve the response of the flame detector to the lamp. If the system is operating normally, the detector will go into a WARNING condition after a few flashes of the Test Lamp. If the lamp remains ON for the time-delayed period of the DIP switch setting, the detector will go into ALARM. To conserve charge, do not operate the Test Lamp longer than is necessary to test each detector. When the battery level drops below the level required maintaining the proper intensity of the lamp, an internal low voltage circuit will shut the lamp off until the batteries have been recharged.

FlameGard 5 Test Lamp Recharging Instructions

Insert the charging plug into the receptacle. Complete recharging takes a minimum of fourteen hours. A schedule should be established and followed.

WARNING: Replace the knurled plug after charging is complete. Charging must be carried out in a non-hazardous area. The charging receptacle is located inside the housing adjacent to the ON button. To gain access, it is necessary to unscrew the gnarled plug from the body of the unit. The plug is secured to the ON button by a safety strap to keep it from being lost. It is recommended that the test lamp be kept on charge when not in use to prevent excessive battery discharge. The batteries may be charged an average of 500 times and the battery pack is replaceable.

7.0 Markings, Certificates and Approvals

7.1 ATEX

Manufacturer	:	MSA AUER, GMBH, Thiemannstrasse 1, D-12059 Berlin
Product	:	**FlameGard 5 UV/IR-E**
Type of protection	:	EN 60079-0:2009 IEC 60079-31:2008 EN 60079-1:2007 IEC 60079-0:2007 Edition 5
Measuring function for explosion protection	:	None
Marking	:	Ex d e IIC T4/T5 Gb Ex tb IIIC T135°C/T100°C Db IP6X Tamb = -40°C to +90°C, -40°C to +75°C
Options:		
EC-Type Examination Certificate	:	Sira 10ATEX1365
Quality Assurance Notification	:	0518
Year of Manufacture	:	see label
Serial No.	:	see label
Special Conditions for safe use		Cable used should be rated to at least 110° C. Cable glands must have the minimum IP rating IP 66.
EMC Conformance (**2004 / 108 / EC**)	:	EN 50130-4 , EN 61000 - 6 - 4

7.2 SIL Parameters

Output Type	Relay Output	4-20 mA Output
FM Certificate	3041816	
MTBF (Years)	21	
λ_{DD} (Fails per hour)	2.5E6	2.5E-6
λ_{DU} (Fails per hour)	1.2E-7	1.3E-7
Safe Failure Fraction (SFF)	98.2%	98%
Safety Integrity Level (SIL)*	2	2
Diagnostic Test Interval	1 second (Critical Faults) 1 minute (COPM)	
Typical Response Time	< 3 seconds	
Average Probability of Failure on Demand PFD_{avg}1oo1**	1.4E-4	1.5E-4

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

8.0 Modbus Serial Communications

See Modbus Specifications for detailed information on Modbus RTU protocol.

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