The MINERVA® S200+ flame detectors are the latest step in over 30 years’ experience of developing and manufacturing infrared, solar blind and multi-channel infrared flame detectors with low power consumption and high false alarm immunity. The MINERVA® S200+ incorporates the patented dual solar blind feature of the S100 and S200 series flame detectors which have over 26,000 installations world-wide.

Features
- IECEx Approval
- ATEX Approval
- Unrivalled blackbody rejection over a wide range of source temperatures
- Triple waveband infrared solar blind flame detection for optimum false alarm immunity
- Discrimination of optical faults (dirty windows) from other faults in the built-in self test
- Range adjustable to 50 metres for a 0.1m² n-heptane pan fire
- Collective versions using 2-wire circuits
- Relay interface, 4-20mA, and Addressable versions

Introduction
The MINERVA® S200+ range of advanced flame detectors is the most comprehensive range available. The devices are available in Intrinsically Safe (EEx ia) and Flameproof (EEx d) versions, both incorporating a variety of electrical interfaces, including one compatible with a range of Vigilant and Simplex fire control panels.

Flameproof Applications
The flameproof models are suffixed by the letter "f" and meet the requirements of EN50020 part 7 and are IECEx & ATEX certified EEx d IIC T5 or T4.

Intrinsically Safe Applications
The intrinsically safe models are suffixed by the letter “i” and meet the requirements of EN50018 and are IECEx & ATEX certified EEx ia IIC T5 or T4.

As part of an intrinsically safe circuit, it is suitable for zones 0, 1 and 2 where group IIC gases or lesser hazards can be continuously present in explosive concentrations.
Performance

The detector is designed to respond after a minimum of 3 seconds, this being the optimum signal processing time constant of the circuitry. Varying sizes of fire will be detected at given distances in the same time and figure 1 shows the typical ranges for the detection of flames, for given areas of liquid fuels. The time taken by the fire to reach equilibrium depends on the initial temperature of the fuel. If kerosene was pre-heated to a temperature above its flash point, then its behaviour would be equivalent to that of petrol at 25°C.

Directional Sensitivity and Range

The polar diagram in figure 2a shows the directional sensitivity in the horizontal plane for a 0.1m² n-heptane fire. Figure 2b shows the same information in the vertical plane. These figures show maximum detector sensitivity to the extremities of its coverage.

Typical Response

The MINERVA® S200+ offers a significantly increased sensitivity to flame with the ability to detect a fully developed 0.1 m² n-heptane pan fire at up to 50 m. This increase is made possible by precisely predicting non-flame energy in the flame detection waveband thus enabling discrimination of the signal from a smaller flame. These detectors include three range settings. Maximum range is 50 m, default range is 25 m and there is a short range of 12.5 m.

Flame Detection Operation

The MINERVA® S200+ flame detector uses the same, well proven, flame detection techniques employed in other MINERVA IR flame detectors. This is based on monitoring for modulated infrared radiation in the 4.3 µm waveband, which corresponds to CO₂ emission. It incorporates our patented techniques:

(a) for improved rejection of solar energy by using a dual 4.3 µm filter combination.
(b) Gaussian noise rejection is achieved by averaging the output signal of two separate sensor elements.

Three separate fire alarm delays of 3s, 6s and 12s are provided in all versions of the MINERVA® S200+.

Triple IR Blackbody Rejection

The MINERVA® S200+ implements a new concept for eliminating nuisance alarms from modulated blackbody sources. The design incorporates a novel optical filter which enables a single infrared sensor to measure the radiated energy present in two separate wavebands placed on either side of the flame detection waveband, at 3.8 µm and 4.8 µm respectively (see figure 3). The signal obtained from this “guard” channel is cross-correlated with the signal from the flame detection channel to provide an accurate prediction of the non-flame energy present in the flame detection waveband. This prediction is independent of the temperature of the radiation source, allowing the MINERVA® S200+ to provide blackbody rejection over a wide range of source temperatures. The use of an optical processing technique as opposed to the use of two separate electronic sensors improves the overall reliability of the detector by reducing the number of components and eliminating the need for complex calibration procedures during manufacture.
Flame Detection in the Presence of Blackbody Radiation

The sensitivity of the MINERVA® S200+ is essentially not affected by the presence of blackbody radiation in the same field of view as the flame. The ability of the detector to accurately determine the amount of non-flame radiation received, allows the detector to set a variable alarm threshold. Refer to figure 4. This threshold is calculated so that the sensitivity of the detector remains largely unchanged in the presence of blackbody sources of differing temperatures and intensity.

Built-in Self Test

The MINERVA® S200+ incorporates a sophisticated self test facility that tests the detector for window contamination and electronic functionality. It incorporates two different coloured LEDs. Different flash rates provide separate indication of alarm, detector (electronic) fault and “dirty” window (optical integrity monitoring). The S241+, S251+ and S27 1+ provide separate analogue output currents, signalling electronic fault and “dirty” window conditions to their respective control equipment.

MINERVA® S200+ Product Range

<table>
<thead>
<tr>
<th>Product designation</th>
<th>3 = Collective</th>
<th>4 = 4 to 20 mA</th>
<th>5 = Analogue Addressable</th>
<th>6 = Relay Interface</th>
<th>7 = MX Digital Addressable</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2XXx+</td>
<td>BASEEFA certified</td>
<td>FM listed Safe</td>
<td>not used f = Flameproof</td>
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S231i+, S231f+, S232f+ Collective 2 wire Interface

These models are suitable for connection to a 20 Vdc current monitored fire alarm panel. This is achieved over a standard two core cable. A wide range of compatible control panels with various land and marine approvals are available. The number of devices permitted on any single detection zone may vary, depending on the control panel to be used.*

S241f+ 4-20mA Current Loop Interface

This model provides a 4-20 mA output (current sink) that can be linked to a PLC type logic controller with the pre-set alarm currents provided for electronic fault, optical fault (dirty window), normal and fire alarm conditions. The interface can be achieved over a 3 core cable.

S25 1i+ and S25 1f+ Analogue Addressable Interface

These detectors may be interfaced with the LPCB approved MINERVA® and UL/FM approved TFX range of analogue addressable fire control equipment. Communication to these devices is achieved over a 2 core cable. Using the S25 1i+ in conjunction with System 602 (Certification for hazardous areas), up to a maximum of 10* detectors may be addressed and identified on a single pair of wires within the hazardous area (zone 0). Up to fifty S25 1f+ detectors can be addressed and identified on a single pair of wires within the hazardous area (zone 1). Use of these two models can significantly reduce cabling costs without loss of system integrity.

S26 1f+ Relay Interface

The S26 1f+ provides a relay interface for alarm and fault condition. The alarm and fault relay can be programmed for either latching or nonlatching operation. Both relays are rated at 2A at 30 Vdc.

*Always consult your supplier with regard to intrinsically safe systems designs

Figure 5. S200 Mounting Bracket

S27 1f+ MX Digital Addressable Interface

This unique detector may be interfaced to the LPCB/VdS Approved MX Digital Addressable and compatible Vigilant fire control panels. Communication is achieved over a 2 core cable thus providing cost effective installation.

System Solutions

The S23Xx+, S25Xx+ and S27 1f+ models operate with a variety of MINERVA®, Vigilant and Simplex fire control panels which provide interfacing to standard industrial fieldbus protocols such as MODBUS. Consult individual fire control panel specifications for detector compatibility and protocols supported.

Bracket

The MINERVA® S200+ can be bulkhead mounted or for greater flexibility a 316 Stainless Steel bracket provides horizontal and vertical adjustment, thus allowing the detector to be positioned to give an accurate cone of vision to the risk area. The bracket provides axial rotation of 50° and an elevation of 67°. Refer to figure 5.

Test Equipment

The MINERVA® S200+ is supported by the T210+ calibrated IR test source for testing detectors in situ. The T210+ test source can be presented to the detectors, using a range of telescopic poles. The T210+ test source is IECEX certified Ex e ib IIC T4.
Benefits of the MINERVA® S200+

• Very low power consumption (0.35mA)
• Models available with Collective or MX Analogue Addressable interface (requires 2 core cable only)
• Models also available with relay or 4-20mA outputs
• Patented dual filter solar blindness for complete solar blindness in outdoor use
• Available in Intrinsically Safe and Flameproof variants. Housing designed for easy installation of cabling
• Flexible mounting and angular adjustment. 2 x 20mm field cable entries. IP66/67 housing designed for external use
• Rugged stainless steel ANC4 LM25 alloy housing and mounting bracket
• Operating temperature range of -40°C to +80°C
• Variable response times and sensitivity settings
• Remote self test and range setting. True window test in detection area (ie. not in the edge of the window)
• Terminals provided for Remote LED connection
• ATEX & IECEX certified with other approvals for selected models. Meets the requirements of EN54 Pt 10. FM approved variants available
• Designed and manufactured in the UK
• Lloyds Register and DNV approved variants available

Specifications

**Mechanical**
- Detector Material: Stainless Steel 316L
- Dimension (WLD): 167 x 167 x 89 mm
- Weight: 4.5kg
- Gland Entry: 3 x 20mm
- Metal Parts: Bright Stainless Steel 316 to (ext & int) BS 1449 Pt 2
- Tag Label: Stainless Steel 316

**Electrical**
- Supply Voltage: 15 to 28 Vdc
- Quiescent Current:
  - S231i+/S23X+ 350 μA max. at 20 Vdc
  - S241i+/S241f+ 350 μA max. at 20 Vdc
  - S251i+/S25X+ 350 μA max. at 20 Vdc
  - S26X+ 17 mA max. at 20 Vdc
  - S271f+ Determined by controller
- Alarm Current:
  - S231i+/S231f+ 33 mA (typical)
  - S241i+/S241f+ Signalled on current loop
  - S251i+/S251f+ Determined by controller
  - S261f+ 30mA (typical)
  - S271f+ (Quiescent Current) 350 μA max. at 20 Vdc
- Connections: One way 2.5mm heavy duty terminal block
- Electrical Interface: See manual for details

**Environmental**
- Operating Temp Range: -40°C to +80°C
- Storage Temperature: -40°C to +80°C
- Relative Humidity: 95% (100% intermittent)
- Ingress Protection: IP66 and IP67

**Performance**
- Range: 0.1m² n-heptane at 50m
  - 0.4m² n-heptane at 60m
- Max Field of View:
  - 90° - Flameproof Versions
  - 100° - Intrinsically safe versions
- Response Time: Field Selectable 3, 6 and 12 seconds
- Sensitivity: 3 range settings - 12.5, 25, 50 metres

**Mounting Bracket**
- Weight: 1.1 kg
- Construction: Bright 316 Stainless Steel to BS1449 Pt2
- Axial Rotation: 50°
- Elevation: 67°
- Fixing Details: M8 bolts (location template provided)

**Part Numbers**
- S231i+:
  - S231i+ Collective I/F - BASEEFA Ex ia
  - S231f+:
  - S231f+ Collective I/F - BASEEFA Ex d
  - 516.037.015
  - S232i+:
  - S232i+ Collective I/F - FM Ex d
  - S241i+:
  - S241i+ 4-20mA I/F - BASEEEFA Ex d
  - 516.039.204
  - S251i+ Analogue Addressable - Contact Tyco Safety Products
  - 516.039.215
  - S251f+ Analogue Addressable - Contact Tyco Safety Products
  - 516.040.216
  - S260.040.002
  - S261f+ Relay I/F - BASEEFA Ex d
  - 516.041.216
  - S271f+ MX Addressable Ex d - Contact Tyco Safety Products
  - 517.001.756
  - S200 Weather Protection Assembly
  - 517.001.756
  - S200 Mounting Bracket
  - 592.001.1016
  - T210+ Test Source (Ex rated)
  - 592.001.1014
  - T210+ Adaptor for S200+

**Approvals**
- The S231f+, S231i+ and S261f+ Flame Detectors are CSIRO ActivFire listed as complying to European Standard prEN54: Part 10: 1997E Fire detection and fire alarm systems. Part 10: Flame detectors - point detectors.
- CSIRO ActivFire Listed: afp-1443
- FPANZ Listed:-
  - S231i+ VF/338
  - S231f+ VF/339
  - S261f+ VF/340
- Flameproof
  - IECEx: BAS 05.0056
  - ATEX: BASEEFA02ATEX0185
- Intrinsically Safe
  - IECEx: BAS 05.0051
  - ATEX: BASEEFA02ATEX0257

Tyco reserves the right to alter specifications without notice in line with its policy of continuous product improvement.