MINI-BEAM® MIAD9 NAMUR Series Sensor

Datasheet

No revision without agency approval.

- Designed for use with approved amplifiers and intrinsically safe barriers in explosive environments
- NAMUR compliant sensors with MINI-BEAM performance and small size
- Output 1 mA or less in the dark condition and 2 mA or more in the light condition
- Models with integral cable or quick-connect

**WARNING: Not To Be Used for Personnel Protection**

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensing Mode</th>
<th>Sensing Beam</th>
<th>Sensing Range</th>
<th>Output Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI9E Emitter</td>
<td>Opposed</td>
<td>Infrared, 880 nm</td>
<td>6 m (20 ft)</td>
<td>Constant Current</td>
</tr>
<tr>
<td>MIAD9R Receiver</td>
<td></td>
<td></td>
<td></td>
<td>≤ 1.2 mA dark</td>
</tr>
<tr>
<td>MIAD9LVAG</td>
<td>Polarized Retroreflective</td>
<td>Visible red, 650 nm</td>
<td>50 mm to 2 m (2 in to 7 ft)</td>
<td>≥ 2.1 mA light</td>
</tr>
<tr>
<td>MIAD9LV</td>
<td>Retroreflective</td>
<td>Visible red, 650 nm</td>
<td>5 m (16.4 ft)</td>
<td></td>
</tr>
<tr>
<td>MIAD9D</td>
<td>Diffuse</td>
<td>Infrared, 880 nm</td>
<td>380 mm (15 in)</td>
<td></td>
</tr>
<tr>
<td>MIAD9W</td>
<td>Divergent Diffuse</td>
<td>Infrared, 880 nm</td>
<td>75 mm (3 in)</td>
<td></td>
</tr>
<tr>
<td>MIAD9CV</td>
<td>Convergent</td>
<td>Visible red, 650 nm</td>
<td>16 mm (0.6 in)</td>
<td></td>
</tr>
<tr>
<td>MIAD9CV2</td>
<td></td>
<td></td>
<td>43 mm (1.7 in)</td>
<td></td>
</tr>
<tr>
<td>MIAD9F</td>
<td>Fiber Optic (Glass)</td>
<td>Infrared, 880 nm</td>
<td>Range varies by sensing mode and fiber optics used</td>
<td></td>
</tr>
</tbody>
</table>

Overview

MIAD9 Series NAMUR Sensors are small, rugged, self-contained two-wire sensors designed for use with certified intrinsically safe switching amplifiers and barriers (Approved Apparatus) with intrinsically safe circuits. MIAD9 Series NAMUR sensors are designed in accordance with DIN 19234 (IEC/EN 60947-5-6) for operation via two-wire connection to an Approved Apparatus that is controlled by the variable internal resistance of the sensor.

These sensors vary the impedance across the sensor output, which passes 1 mA or less in the "dark" condition and 2 mA or more in the "light" condition. A red LED on the rear of the sensor lights whenever the sensor sees the "light" condition. A rugged, clutched, 15-turn slotted brass screw Gain control potentiometer enables precise adjustment of system sensitivity.

Models are available with either a 2 m (6.5 ft) or 10 m (30 ft) long attached PVC-covered cable, or a 4-pin Euro-style quick disconnect (QD) connector. Quick disconnect models (with "Q" in the model number suffix) use MQD9-4.. mating cable (either straight or right angle connector; see Quick-Disconnect (QD) Cables on page 7). Contact Banner Engineering for availability of sensor models with 10 m (30 ft) long attached cable.

Figure 1. Features (rear of sensor, quick-disconnect model shown)

Only standard 2 m (6.5 ft) cable models are listed. For 4-pin Euro-style Integral QD models: add suffix "Q" to the model number (for example, MIAD9RQ); accessory mating cable required.

Original Document 39616 Rev. L 21 March 2017
Installation Instructions

Ex/HazLoc Applications

**WARNING:**
- Explosive Atmospheres/Hazardous Locations
  - The user has the responsibility to ensure that all local, state, and national laws, rules, codes, or regulations relating to the installation and use of this Banner device in any particular application are satisfied. This Banner device must be installed by Qualified Persons, in accordance with this document and applicable regulations.
  - A Qualified Person is a person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

**WARNING:**
- Explosion Hazard
  - Do not disconnect equipment unless the power has been switched off or the area is known to be non-hazardous.

**CAUTION: Electrostatic Discharge (ESD)**

Special Conditions for Safe Use. Parts of the enclosure are non-conducting and may generate an ignition-capable level of ESD. Cleaning of the equipment shall be done only with a damp cloth.

General Notes and Conditions for Safe Use:

- See Specifications and Wiring Diagrams for important information concerning entity parameters, permissible locations, electrical connections and certifications.
- In addition to the warning concerning user responsibility, the installation must comply with the following:
  - All installations must comply with all manufacturer’s instructions.
  - U.S. Installations: The relevant requirements of the National Electrical Code® (ANSI/NFPA-70 (NEC®) and when appropriate ANSI/ISA-RP12.06.01 Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations).
  - Canadian Installations: The relevant requirements of the Canadian Electrical Code (CSA C22.1).
  - ATEX and IECEx Installations: The relevant requirements of EN 60079-14 and applicable National regulations.
  - Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components. Tampering and/or replacement with non-factory components may adversely affect the safe use of the system.
  - Approved Apparatus entity parameters must meet the following requirements:
    - $V_{oc}$ or $V_i \leq V_{max}$
    - $C_d \geq C_i + C_{cable}$
    - $I_{oc}$ or $I_i \leq I_{max}$
    - $L_a \geq L_i + L_{cable}$
  - Sensor Entity Parameters:
    - $V_{max}$ (UI) ≤ 15 V dc
    - $I_{max}$ (II) ≤ 60 mA
    - $P_i \leq 225$ mW
    - $C_i = 0.3$ μF
    - $L_i = 0$ mH
  - Cable Entity Parameters (if unknown):
    - $C_{cable} = 60$ pF/ft
    - $L_{cable} = 0.2$ μH/ft
  - The ambient operating temperature range of the Sensors is −40 °C to +70 °C (−40 °F to +158 °F).
  - For U.S. installations, Class II and III, Division 2 applies only to model numbers ending in a Q suffix.
  - For intrinsically safe installations, sensors must be used with certified intrinsically safe switching amplifiers and barriers (Approved Apparatus) with intrinsically safe circuits that limit supply voltage and current in the event of failures.
  - Associated Apparatus is not required for installation of the devices within a Division 2 hazardous (classified) location when installed per the National Electrical Code. The maximum voltage for Division 2 installation is 15 V dc. In Division 2 installations (without Associated Apparatus), observe Explosion Hazard warning at the beginning of this section.
  - Associated Apparatus is not required for installation of the devices within a Division 2 hazardous (classified) location when installed in or through the wall of a suitable enclosure with provision for connection of rigid metal conduit per the Canadian Electrical Code, as acceptable to the local inspection authority having jurisdiction. The maximum rating for Division 2 installation is 15 V dc, 60 mA. In Division 2 installations (without Associated Apparatus), observe Explosion Hazard warning at the beginning of this section.
  - Maximum non-hazardous area voltage that the Approved Apparatus (intrinsically safe circuit) is connected to must not exceed 250 V.
  - Intrinsic safety ground, if required for the Associated Apparatus, shall be less than 1 ohm.
  - Maximum connector torque: 6 ft-lbs.
Wiring Connections

MIAD9 Series NUMAR sensors are intrinsically safe ONLY when used with certified intrinsically safe switching amplifiers and barriers (Approved Apparatus) with intrinsically safe circuits. Banner does not manufacture such devices; however, our applications engineers can refer you to suppliers of certified devices that will interface with Banner sensors.

The user is responsible for proper installation and maintenance of this equipment, and must conform with the certification requirements relating to barriers and to maximum allowable capacitance and inductance of the field wiring. If in doubt about these requirements, our applications engineers can refer you to the appropriate authority.

Specifications

Supply Voltage and Current
5 to 15 V dc (provided by the amplifier to which the sensor is connected)

Adjustments
15-turn slotted brass screw GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel); located on rear panel and protected by a clear gasketed acrylic cover

Indicators
Red LED Alignment Indicator Device (AID) located on rear panel lights when the sensor sees a “light” condition; pulse rate is proportional to signal strength (the stronger the signal, the faster the pulse rate).

Construction
Reinforced thermoplastic polyester housing, totally encapsulated, o-ring sealing, acrylic lenses, and stainless steel screws

Application Note
Special Conditions for Safe Use: Parts of the enclosure are non-conducting and may generate an ignition-capable level of ESD. Cleaning of the equipment must be done only with a damp cloth.

Output
Constant current output: ≤ 1.2 mA in the “dark” condition and ≥ 2.1 mA in the “light” condition

Output Response Time
Opposed mode: 2 ms ON/400 μs OFF
All other modes: 5 ms ON/OFF (does not include amplifier response)

Environmental Rating
Banner tested to NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12 and 13 IEC IEC IP67

Operating Conditions
Temperature: −40 °C to +70 °C (−40 °F to +158 °F)

Connections
PVC-jacketed 2-conductor 2 m or 9 m cables, or special 4-pin Euro-style quick-disconnect (QD) fitting are available; QD cables are ordered separately.

Certifications

Design Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX (European)</td>
<td>EN 60079-0, EN 60079-11 and EN 60079-26</td>
</tr>
<tr>
<td>United States</td>
<td>FM Class 3600, 3610, and 3810; ANSI/ISA 61010-1 (82.02.01), 60079-0 and 60079-11</td>
</tr>
<tr>
<td>IECEx</td>
<td>IEC 60079-0, IEC 60079-11</td>
</tr>
</tbody>
</table>
### Approvals

<table>
<thead>
<tr>
<th>MIAD9(a)(b), MI9E(b)</th>
<th>a = Sensing mode D, W, F, LV, LVAG, CV, CV2 or R.</th>
<th>b = Connection method Q or blank.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX (European)</td>
<td>II 1 G Ex ia IIC T5 Tα = -40°C to 70°C - 39616;</td>
<td>Entity Parameters: U</td>
</tr>
<tr>
<td>Canadian</td>
<td>IS / I,II,III / 1 / ABCDEFG / T5 Tα = -40°C to 70°C - 39616;</td>
<td>Entity Parameters: V</td>
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<tr>
<td>United States</td>
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</tr>
<tr>
<td>IECEx</td>
<td>Ex ia IIC T5 Tα = -40°C to 70°C - 39616;</td>
<td>Entity Parameters: U</td>
</tr>
</tbody>
</table>

### Performance Curves

#### Model

**MI9E Emitter**

- Diffuse mode performance based on 90% reflectance white card

**MIAD9R Receiver**

- Opposed mode

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**130848D**

FM12ATEX0094X

Ex ia IIC T5 Ga

Ta = -40 °C to +70 °C

IECEx FMG 14.0029X Ex ia IIC T5

INSTALL PER DWG 39616
## Diffuse mode performance based on 90% reflectance white test card

<table>
<thead>
<tr>
<th>Model</th>
<th>Excess Gain</th>
<th>Beam Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIAD9LVAG</td>
<td><img src="image1" alt="MIAD9LVAG Excess Gain" /></td>
<td><img src="image2" alt="MIAD9LVAG Beam Pattern" /></td>
</tr>
<tr>
<td>MIAD9LV</td>
<td><img src="image3" alt="MIAD9LV Excess Gain" /></td>
<td><img src="image4" alt="MIAD9LV Beam Pattern" /></td>
</tr>
<tr>
<td>MIAD9D</td>
<td><img src="image5" alt="MIAD9D Excess Gain" /></td>
<td><img src="image6" alt="MIAD9D Beam Pattern" /></td>
</tr>
<tr>
<td>MIAD9W</td>
<td><img src="image7" alt="MIAD9W Excess Gain" /></td>
<td><img src="image8" alt="MIAD9W Beam Pattern" /></td>
</tr>
</tbody>
</table>

**MIAD9LVAG**
- **Retroreflective Mode**
- **With BRT-3 Reflector**

**MIAD9LV**
- **Retroreflective Mode**
- **With BRT-3 Reflector**

**MIAD9D**
- **Diffuse Mode**

**MIAD9W**
- **Divergent Diffuse Mode**
## MIAD9CV

**Model:** MIAD9CV

**Excess Gain**

Diffuse mode performance based on 90% reflectance white test card

**Beam Pattern**

- **MIAD9CV**

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Excess Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 (0.004&quot;)</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
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</table>

### Convergent Mode

- **MIAD9CV**

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Excess Gain</th>
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</thead>
<tbody>
<tr>
<td>0.1 (0.004&quot;)</td>
<td>100</td>
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<td>1</td>
<td>100</td>
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<tr>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Convergent Mode

- **MIAD9CV2**

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Excess Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 (0.004&quot;)</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Opposed Mode

- **MIAD9F—Opposed Mode**

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Excess Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 (0.004&quot;)</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Diffuse Mode

- **MIAD9F—Diffuse Mode**

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Excess Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 (0.004&quot;)</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Diffuse Mode

- **MIAD9F—Diffuse Mode**

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Excess Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 (0.004&quot;)</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Dimensions

Figure 2. Opposed, Retro, Diffuse, Convergent Models (Suffix E, R, LV, D, and CV)

Figure 3. Diffuse Models (suffix W)

Figure 4. Glass Fiber Models (suffix F)

Accessories

Quick-Disconnect (QD) Cables

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQD9-406</td>
<td>1.83 m</td>
<td>4-pin</td>
<td>1.83 m (6 ft)</td>
<td>M12 x 1 x 15 mm Thread (Mounting Nut Supplied)</td>
</tr>
<tr>
<td>MQD9-415</td>
<td>4.57 m</td>
<td>Straight</td>
<td>4.57 m (15 ft)</td>
<td>ø 3 mm Clearance (2)</td>
</tr>
<tr>
<td>MQD9-430</td>
<td>9.14 m</td>
<td>4-pin</td>
<td>9.14 m (30 ft)</td>
<td>M12 x 1 x 15 mm Thread (Mounting Nut Supplied)</td>
</tr>
</tbody>
</table>
### 4-Pin Threaded M12/Euro-Style Cordsets (for use with NAMUR sensors)

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQD9-406RA</td>
<td>1.83 m (6 ft)</td>
<td>Right-Angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MQD9-415RA</td>
<td>4.57 m (15 ft)</td>
<td>Right-Angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MQD9-430RA</td>
<td>9.14 m (30 ft)</td>
<td>Right-Angle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Brackets

**SMB312S**
- Stainless steel 2-axis, side-mount bracket
- A = 4.3 x 7.5, B = diam. 3, C = 3 x 15.3

**SMB312B**
- Stainless steel 2-axis, bottom-mount bracket
- Includes mounting foot
- A = diam. 6.9, B = 4.3 x 10.5, C = 3.1 x 15.2

**SMB18A**
- Right-angle mounting bracket with a curved slot for versatile orientation
- 12-ga. stainless steel
- 18 mm sensor mounting hole
- Clearance for M4 (#8) hardware
- Hole center spacing: A to B = 24.2
- Hole size: A = ø 4.6, B = 17.0 x 4.6, C = ø 18.5

**SMB18FA**
- Swivel bracket with tilt and pan movement for precision adjustment
- Easy sensor mounting to extruded rail T-slots
- Metric and inch size bolts available
- 18 mm sensor mounting hole
- Hole size: B = ø 18.1

**SMB46U**
- Right-angle
- U bracket for sensor protection
- 14-ga. 316 stainless steel
- Hole center spacing: A = 16.0
- Hole size: A = 16.5 x 18.7, B = 34.0 x 13.0

### Note:
Not for use with plastic fiber optic sensors
SMB46L
- Right-angle
- L bracket
- 14-ga. 316 stainless steel

Hole center spacing: A = 16.0
Hole size: A = 16.5 × 18.7

SMB18Q
- Right-angle flanged bracket
- 18 mm sensor mounting hole
- 12-ga. stainless steel

Hole center spacing: A to B = 24.2
Hole size: A = ø 4.6, B = 17.0 × 4.6, C = ø 19.0

SMB46S
- Right-angle
- S bracket
- 14-ga. 316 stainless steel

Hole center spacing: A = 16.0
Hole size: A = 16.5 × 18.7, B = 34.0 × 10.0

SMB18SF
- 18 mm swivel bracket with M18 × 1 internal thread
- Black thermoplastic polyester
- Stainless steel swivel locking hardware included

Hole center spacing: A = 36.0
Hole size: A = ø 5.3, B = ø 18.0

SMB3018SC
- 18 mm swivel side or barrel-mount bracket
- Black reinforced thermoplastic polyester
- Stainless steel swivel locking hardware included

Hole center spacing: A = 50.8
Hole size: A = ø 7.0, B = ø 18.0

SMB18UR
- 2-piece universal swivel bracket
- 300 series stainless steel
- Stainless steel swivel locking hardware included
- Mounting hole for 18 mm sensor

Hole center spacing: A = 25.4, B = 46.7
Hole size: B = 6.9 × 32.0, C = ø 18.3

SMB30SUS
- Side-mount swivel with extended range of motion
- Black reinforced thermoplastic polyester
- Stainless steel swivel locking hardware included

Hole center spacing: A = 50.8, B = 24.1
Hole size: A = ø 7, B = ø 7.6

SMBAMS18P
- Flat SMBAMS series bracket with 18 mm hole
- Articulation slots for 90° rotation
- 12-ga. (2.6 mm) cold-rolled steel

Hole center spacing: A = 26.0, A to B = 13.0
Hole size: A = 26.8 × 7.0, B = ø 6.5, C = ø 19.0
SMB30SK
- Flat-mount swivel bracket with extended range of motion
- Black reinforced thermoplastic polyester and 316 stainless steel
- Stainless steel swivel locking hardware included

Hole center spacing: A = 50.8
Hole size: A = ø 7, B = ø 18

SMBAMS18RA
- Right-angle SMBAMS series bracket with 18 mm hole
- Articulation slots for 90° rotation
- 12-ga. (2.6 mm) cold-rolled steel

Hole center spacing: A = 26.0, A to B = 13.0
Hole size: A = 26.8 × 7.0, B = ø 6.5, C = ø 19.0

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Obtain assistance with product repairs by contacting your local Banner Engineering Corp distributor or by calling Banner directly at (763) 544-3164. Access literature translated into your native language on the Banner website at www.bannerengineering.com or contact Banner directly at (763) 544-3164.

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