

Q45AD9 NAMUR Series Sensor



Datasheet

No revision without agency approval.



- Designed for use with approved amplifiers and intrinsically safe barriers in explosive environments
- NAMUR compliant sensor with the rugged design and exceptional optical performance of Q45 series sensors
- Output passes ≤ 1.2 mA in the "dark" condition and ≥ 2.1 mA in the "light" condition
- Internal multi-turn SENSITIVITY (Gain) control accessible beneath hinged, o-ring sealed top cover
- Models are available with an integral cable or a quick-disconnect connector
- Supply voltage: 5 to 15 V dc



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

Standard 2 m (6.5 ft) cable models are listed. To order the 9 m (30 ft) cable model, add suffix "W/30" to the cabled model number (Q459E W/30). Models with a QD connector require a mating cable (see Accessories list).

Opposed Models - Emitter (E) and Receiver (R)

Models	Cable	Performance	Output Type
Q459E	2 m (6.5 ft)	880 nm, infrared Range: 6meters (20 feet)	Constant current ≤ 1.2 mA dark ≥ 2.1 mA light
Q459EQ	4-Pin Euro QD		
Q45AD9R	2 m (6.5 ft)		
Q45AD9RQ	4-Pin Euro QD		

Retroreflective Models

Retroreflective range is specified using one model BRT-3 P retroreflector (3-inch diameter). Actual sensing range may be more or less than specified, depending upon the efficiency and reflective area of the retroreflector(s) in use.

Non-Polarized Models	Cable	Performance	Output Type
Q45AD9LV	2 m (6.5 ft)	680 nm, visible red Range: 9 m (30 ft)	Constant Current ≤ 1.2 mA dark ≥ 2.1 mA light
Q45AD9LVQ	4-pin Euro QD		

Polarized Models	Cable	Performance	Output Type
Q45AD9LP	2 m (6.5 ft)	680 nm, visible red Range: 6 m (20 ft)	Constant Current ≤ 1.2 mA dark ≥ 2.1 mA light
Q45AD9LPQ	4-pin Euro QD		

Diffuse Models

Performance curves are based on a 90% reflectance white test card.



Short Range Models	Cable	Performance	Output Type
Q45AD9D	2 m (6.5 ft)	880 nm, infrared	Constant Current
Q45AD9DQ	4-pin Euro QD	Range: 300 mm (12 in)	≤ 1.2 mA dark ≥ 2.1 mA light

Long Range Models	Cable	Performance	Output Type
Q45AD9DL	2 m (6.5 ft)	880 nm, infrared	Constant Current
Q45AD9DLQ	4-pin Euro QD	Range: 1 m (40 in)	≤ 1.2 mA dark ≥ 2.1 mA light

Convergent Models

Convergent mode models operate at 680 nm, visible red. Performance curves are based on a 90% reflectance white test card.

Models	Cable	Focus	Output Type
Q45AD9CV	2 m (6.5 ft)	38 mm (1.5 in)	Constant Current
Q45AD9CVQ	4-pin Euro QD	Spot size at focus: 1.3 mm (0.05 in)	≤ 1.2 mA dark ≥ 2.1 mA light
Q45AD9CV4	2 m (6.5 ft)	100 mm (4 in)	Constant Current
Q45AD9CV4Q	4-pin Euro QD	Spot size at focus: 1.5 mm (0.06 in)	≤ 1.2 mA dark ≥ 2.1 mA light

Plastic Fiber Optic Models

Performance curves are based on a 90% reflectance white test card.

Models	Cable	Performance	Output Type
Q45AD9FP	2 m (6.5 ft)	660 nm, visible red	Constant Current
Q45AD9FPQ	4-pin Euro QD	Range: varies by sensing mode and fiber optics used	≤ 1.2 mA dark ≥ 2.1 mA light

Glass Fiber Optic Models

Performance curves are based on a 90% reflectance white test card.

Models	Cable	Performance	Output Type
Q45AD9F	2 m (6.5 ft)	880 nm, infrared	Constant Current
Q45AD9FQ	4-pin Euro QD	Range: varies by sensing mode and fiber optics used	≤ 1.2 mA dark ≥ 2.1 mA light

Models	Cable	Performance	Output Type
Q45AD9FV	2 m (6.5 ft)	650 nm, visible red	Constant Current
Q45AD9FVQ	4-pin Euro QD	Range: varies by sensing mode and fiber optics used	≤ 1.2 mA dark ≥ 2.1 mA light

Overview

The Q45AD9 Series NAMUR Sensor is a rugged, self-contained two-wire sensor designed for use with certified intrinsically safe switching amplifiers and barriers (Approved Apparatus) with intrinsically safe circuits.

The Q45AD9 Series NAMUR sensor is designed in accordance with DIN 19234 (IEC/EN 60947-5-6) for operation via two-wire connection to an Approved Apparatus controlled by the variable internal resistance of the sensor.

The sensor varies 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 highly visible red LED indicator is located beneath a raised transparent dome on top of the sensor.

- SIGNAL—LED lights red when the sensor sees its modulated light source
- POWER (Emitters only)—LED lights red when 5 to 15 V dc power is applied

Multi-turn sensitivity control on top of sensor, beneath a transparent cover, allows precise sensitivity setting (turn clockwise to increase gain).

Models are available with either a 2 m (6.5 ft) or 9 m (30 ft) long attached PVC-covered cable, or a 4-pin M12/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 [Accessories](#) on page 9). Contact Banner Engineering for the availability of sensor models with 9 m (30 ft) long attached cable.

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:

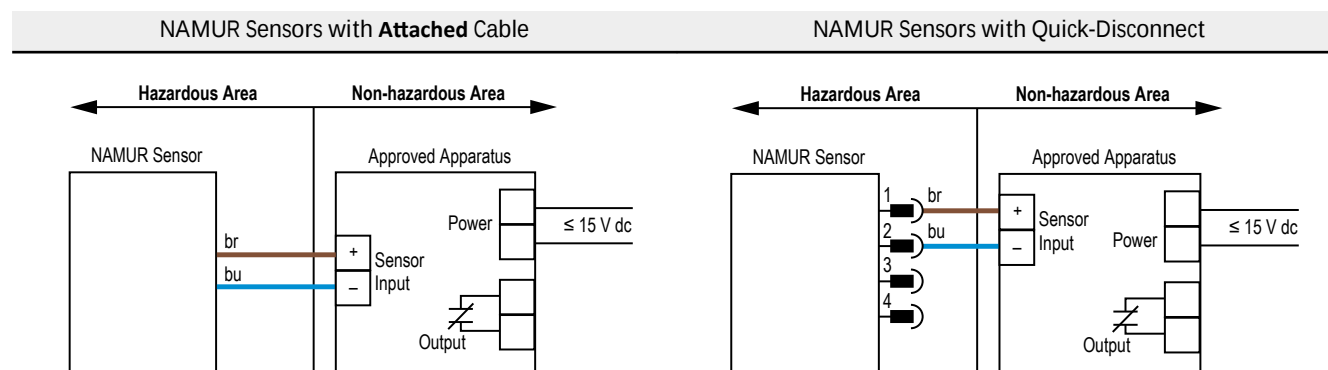
- See Specifications and Wiring Diagrams for important information concerning entity parameters, permissible locations, electrical connections and certifications.
- In addition to the warning above concerning user responsibility, the installation must comply with the following:
 - All installations must 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:
 - $V_{oc} \text{ or } V_t \leq V_{max}$
 - $C_a \geq C_i + C_{cable}$
 - $I_{sc} \text{ or } I_t \leq I_{max}$
 - $L_a \geq L_i + L_{cable}$
- Sensor Entity Parameters:
 - $V_{max}(U_i) \leq 15 \text{ V dc}$
 - $I_{max}(I_i) \leq 60 \text{ mA}$
 - $P_i \leq 225 \text{ mW}$
 - $C_i = 0.3 \mu\text{F}$
 - $L_i = 0 \text{ mH}$
- Cable Entity Parameters (if unknown):
 - $C_{cable} = 60 \text{ pF/ft}$
 - $L_{cable} = 0.2 \mu\text{H/ft}$
- The ambient operating temperature range of the Sensors is -40°C to $+70^\circ\text{C}$ (-40°F to $+158^\circ\text{F}$).
- 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 15V 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 15V 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 250V.

- Intrinsic safety ground, if required for the Associated Apparatus, shall be less than 1 ohm.
- Maximum connector torque: 6 ft-lbs.

Wiring Connections

Q45AD9 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 for Q45 NAMUR Sensors

Supply Voltage and Current

5 to 15 V dc. Supply voltage is provided by the amplifier to which the sensor is connected.

Adjustments

Multi-turn sensitivity control on top of sensor, beneath a transparent o-ring sealed cover, allows precise sensitivity setting (turn clockwise to increase gain).

Output

Constant current output: ≤ 1.2 mA in the "dark" condition and ≥ 2.1 mA in the "light" condition

Output Response Time

Opposed mode receiver: 2 milliseconds on/0.4 milliseconds off. All others 5 milliseconds on/off (does not include amplifier response)

Construction

Molded thermoplastic polyester housing, o-ring sealed transparent Lexan® top cover, molded acrylic lenses, and stainless steel hardware. Q45s are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2-inch NPS integral internal conduit thread.

Environmental Rating

Banner tested to NEMA 6P, IEC IP67

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.

Indicators

Indicator LEDs are highly visible, located beneath a raised transparent dome on top of the sensor.
POWER (red) LED (emitters only) lights whenever 5 to 15 V dc power is applied
SIGNAL (red) LED lights whenever the sensor sees its modulated light source

Connections

PVC-jacketed 2 m (6.5 ft) or 9 m (30 ft) cables, or 4-pin Euro-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See *Accessories*.

Operating Conditions

Temperature: -40 °C to $+70$ °C (-40 °F to $+158$ °F)
Maximum relative humidity: 90% at 50 °C (non-condensing)

Certifications

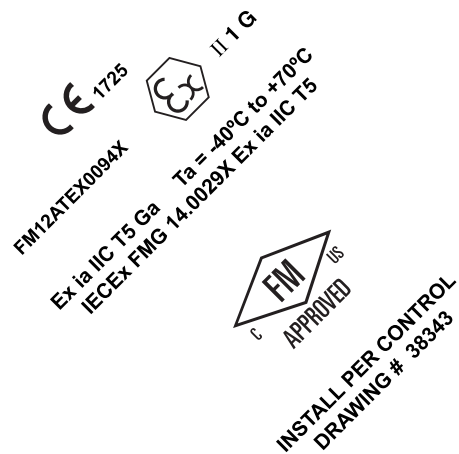


IEC IECEx FMG 14.0029X
ATEX FM12ATEX0094X
FM CoC 0003046293 (US)
FM CoC 0003046293C (CAN)

Design Standards	
ATEX (European)	EN 60079-0, EN 60079-11 and EN 60079-26
Canada	CAN/CSA C22.2: No.0-M91, No.142-M1987, No.157-92, No.213-M1987, No.1010.1, E60079-0 and E60079-11
United States	FM Class 3600, 3610, and 3810; ANSI/ISA 61010-1 (82.02.01), 60079-0 and 60079-11
IECEX	IEC 60079-0, IEC 60079-11

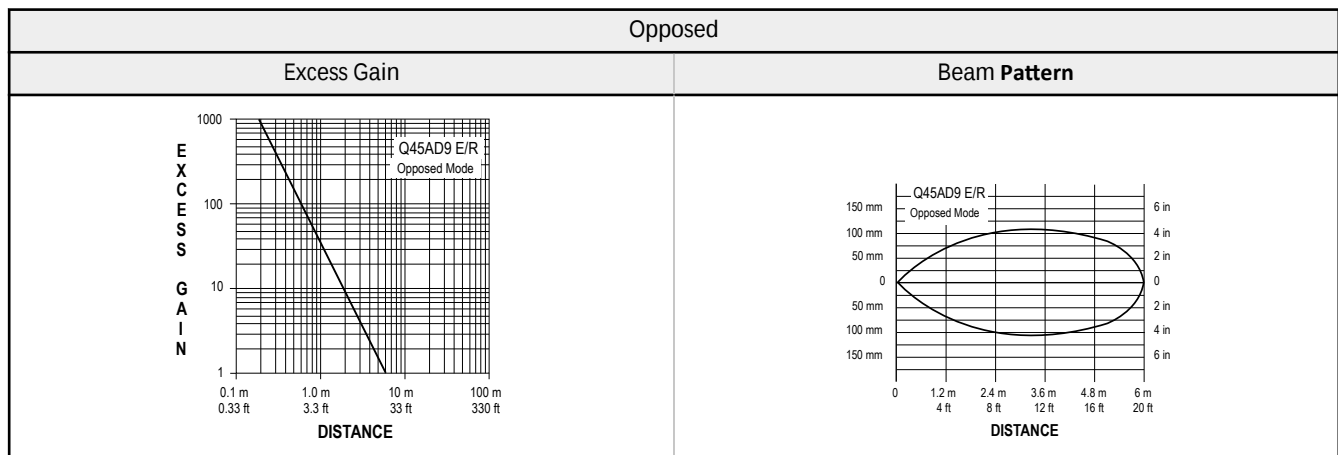
¹ Lexan® is a registered trademark of General Electric Co.

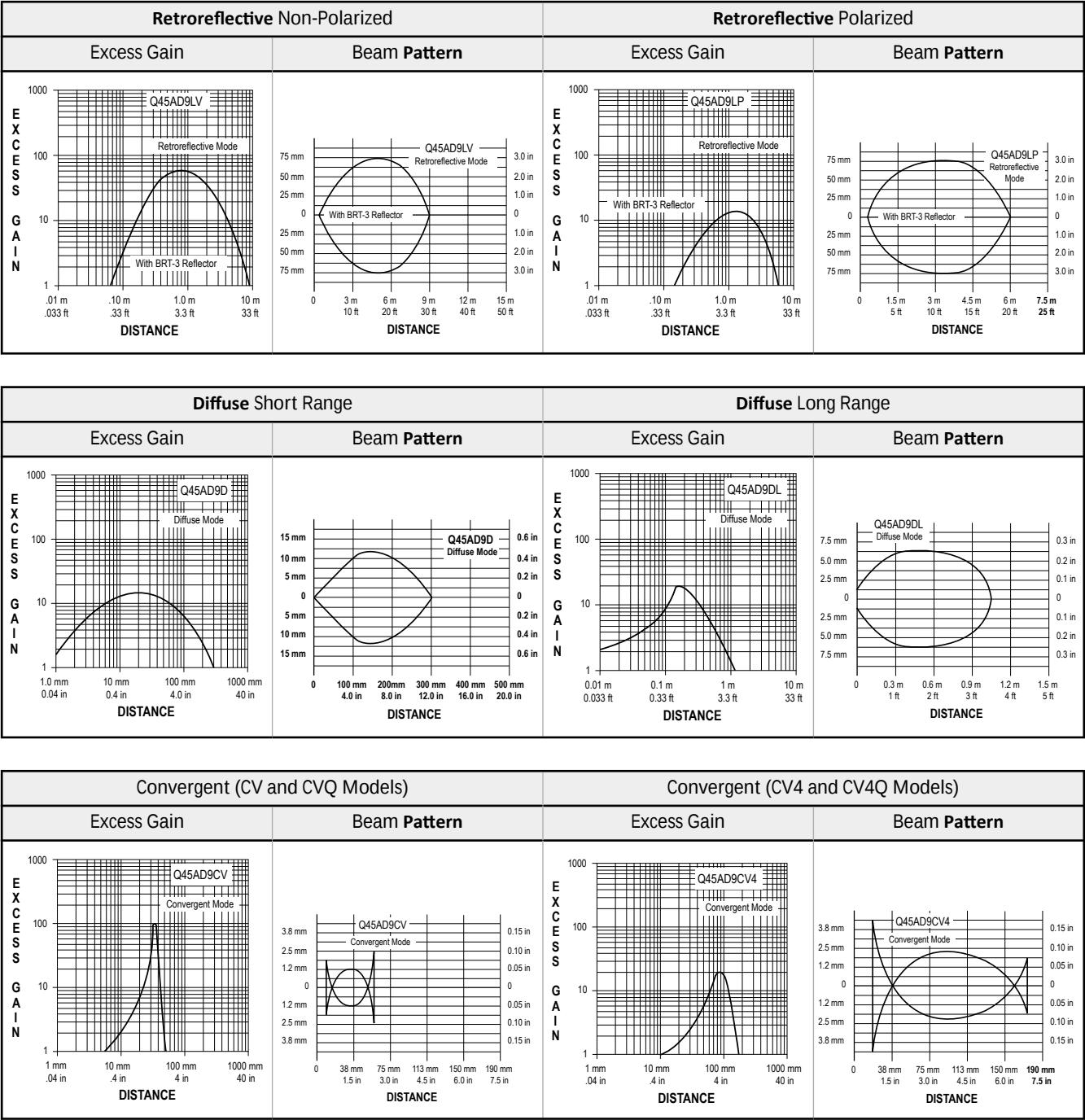
Approvals	
Q45AD9(a)(b), Q459E(b)	a = Sensing mode D, DL, F, FP, FV, LV, LP, CV, CV4 or R. b = Connection method Q or blank
ATEX (European)	II 1 G Ex ia IIC T5 Ta = -40°C to 70°C - 38343; Entity Entity Parameters: U _i = 15 V dc, I _i = 60 mA, P _i = 225 mW, C _i = 0.3 µF, L _i = 0 mH.
Canadian	IS / I,II,III / 1 / ABCDEFG / T5 Ta = -40°C to 70°C - 38343; Entity I / 0 / Ex ia / IIC / T5 Ta = -40°C to 70°C - 38343; Entity (Non-incendive) NI / I / 2 / ABCD / T5 Ta = -40°C to 70°C Entity Parameters: V _{Max} = 15 V dc, I _{Max} = 60 mA, P _i = 225 mW, C _i = 0.3 µF, L _i = 0 mH
United States	IS / I,II,III / 1 / ABCDEFG / T5 Ta = -40°C to 70°C - 38343; Entity I / 0 / AEx ia / IIC / T5 Ta = -40°C to 70°C - 38343; Entity (Non-incendive) NI / I / 2 / ABCD / T5 Ta = -40°C to 70°C S / II,III / 2 / FG* / T5 Ta = -40°C to 70°C *Class II and III, Division 2 applies only to model numbers ending in a Q suffix. Entity Parameters: V _{Max} = 15 V dc, I _{Max} = 60 mA, P _i = 225 mW, C _i = 0.3 µF, L _i = 0 mH
IECEx	Ex ia IIC T5 Ta= -40 °C to +70 °C - 35331; Entity Entity Parameters: U _i = 15 V dc, I _i = 60 mA, C _i = 0.3 µF, L _i = 0 mH.

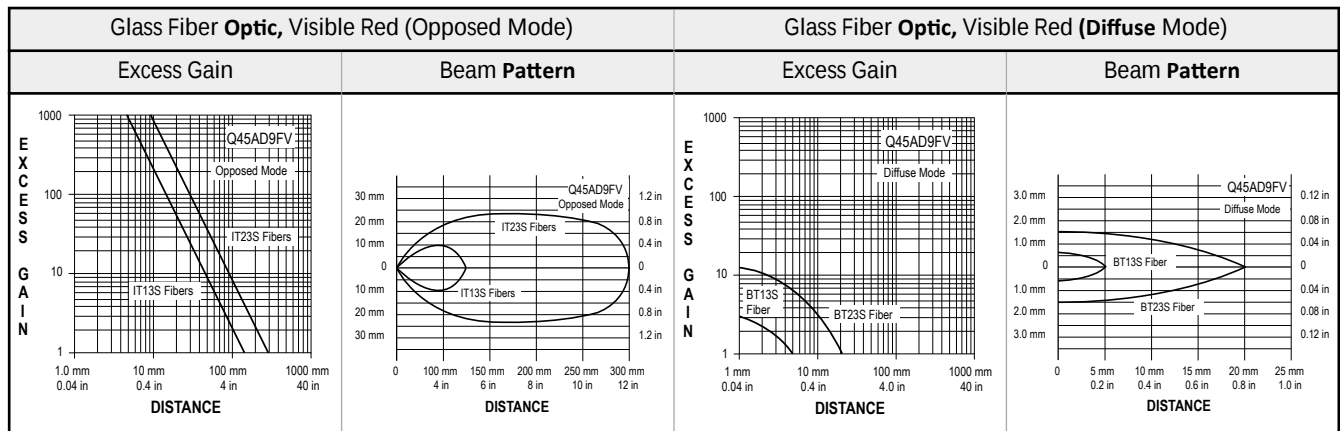
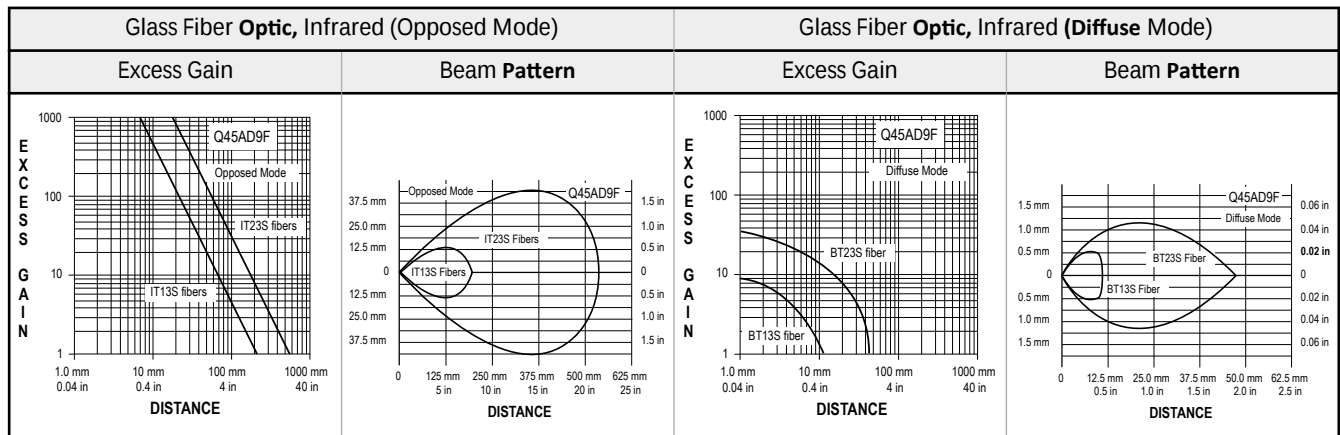
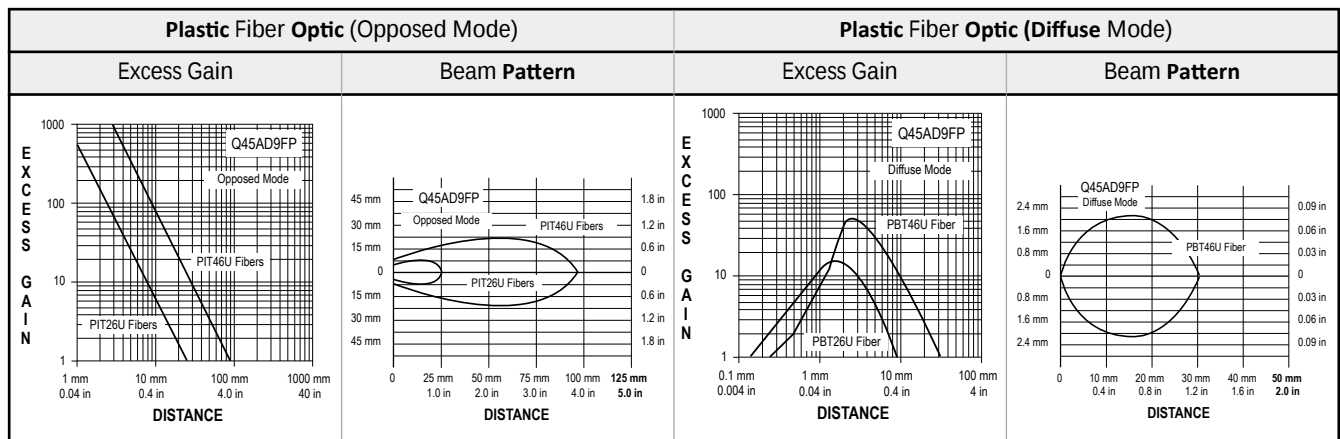


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Performance Curves

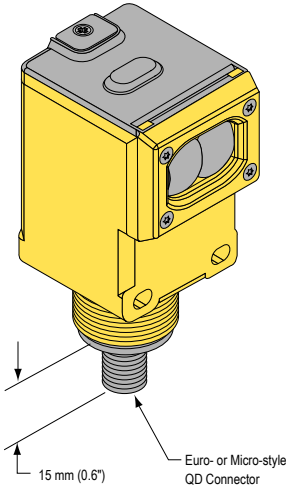
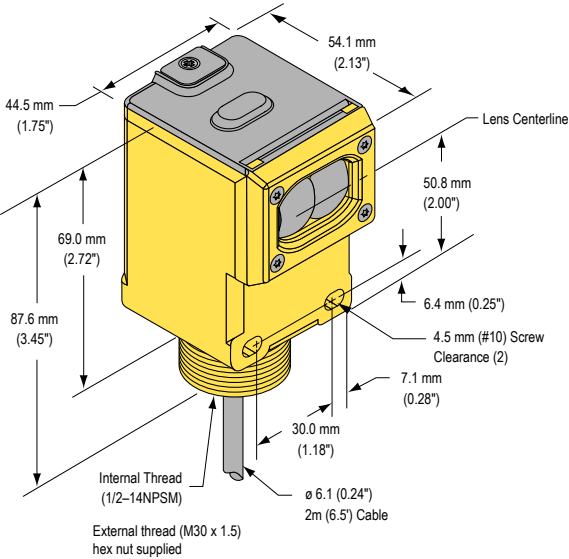




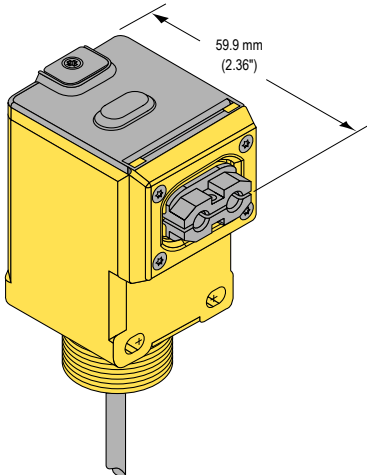
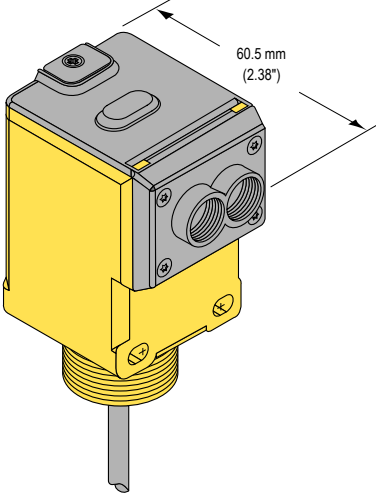
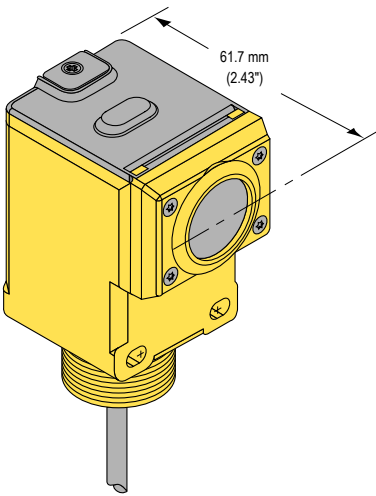


Dimensions

NAMUR Series Opposed, Retro, and Diffuse Sensing Modes (Model Suffix E, R, D, DL, LP, and LV)	
Cabled Models	Quick-Disconnect 4-pin Euro-style Models

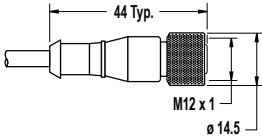
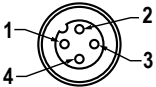
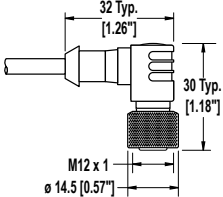


Convergent Sensor Models (CV and CV4)	Glass Fiber Optic Models (F and FV)	Plastic Fiber Optic Models (FP)
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Accessories

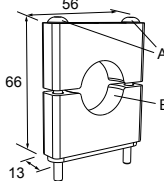
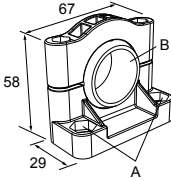
Quick-Disconnect (QD) Cables

4-Pin Threaded M12/Euro-Style Cordsets (for use with NAMUR sensors)				
Model	Length	Style	Dimensions	Pinout (Female)
MQD9-406	1.83 m (6 ft)	Straight		 1 = Brown 2 = Blue
MQD9-415	4.57 m (15 ft)			
MQD9-430	9.14 m (30 ft)			
MQD9-406RA	1.83 m (6 ft)	Right-Angle		
MQD9-415RA	4.57 m (15 ft)			
MQD9-430RA	9.14 m (30 ft)			

Replacement Lenses

Replacement Lens Assemblies	
Models	Description
UC-45L	Replacement lens for E, R, DL and LV models
UC-45LP	Replacement lens for LP
UC-45D	Replacement lens for D
UC-45F	Replacement lens for F and FV
UC-45FP	Replacement lens for FP
UC-45C	Replacement lens for CV
UC-45C4	Replacement lens for CV4
Q45 Series lens assemblies are field-replaceable.	

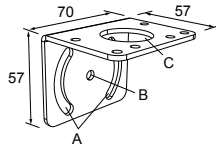
Brackets

Mounting Brackets	
SMB30C 30 mm split clamp, black PBT bracket - Stainless steel mounting hardware included - Mounting hole for 30 mm sensor  Hole center spacing: A=45 Hole size: B=27.2	SMB30SC - Swivel bracket with 30 mm mounting hole for sensor - Black reinforced thermoplastic polyester - Stainless steel mounting and swivel locking hardware included  Hole center spacing: A=50.8 Hole size: A=7.0, B=30.0

Mounting Brackets

SMB30MM

- 12-ga. stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor



Hole center spacing: A = 51, A to B = 25.4
Hole size: A = 42.6 x 7, B = $\varnothing$ 6.4, C = $\varnothing$ 30.1

SMB30UR

- 2-piece universal swivel bracket for limit-switch style sensors
- 300 series stainless steel
- Stainless steel swivel locking hardware included

Hole center spacing: A to B=31.8, B to C=19.0, A to C=50.8, D=50.8
Hole size: C=6.9x32, D=73.0x6.9

Repairs and Translations

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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