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Q20 Series Sensor

Original Instructions
p/n: 127816 Rev. P
28-Apr-26
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Chapter Contents

Models 3

Chapter 1 Features



- Photoelectric sensors in a compact, rugged, sealed, overmolded plastic housing
- Standard 3 mm threaded mounting holes on 25.4 mm (1 in) spacing
- Advanced electronic design for excellent noise immunity and cross-talk avoidance
- Threaded metal M8 connector on certain quick-disconnect models
- 10 V DC to 30 V DC operation with complementary solid-state outputs (1 normally open, 1 normally closed); PNP or NPN, depending on model
- Complete offering of mounting brackets and apertures available
- Crosstalk prevention filters are available for visible red opposed mode pairs
- Exceptional optical performance with easy-to-align visible red emitters
- Background suppression models provide reliable detection up to 150 mm while ignoring objects in the background
- Background suppression models provide stable detection in the presence of fluorescent lights

WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Models

Opposed mode sensors

Model	Sensing Mode	Range	Output
Q20E	Opposed, 624 nm Visible Red Effective Beam: 10 mm (0.4 in)	12 m (39.4 ft)	N/A
Q20PR			PNP
Q20NR			NPN
Q20EL	Opposed, 850 nm Infrared Effective Beam: 10 mm (0.4 in)	20 m (65.6 ft)	N/A
Q20PRL			PNP
Q20NRL			NPN

Retroreflective sensors

Model	Sensing Mode	Range	Output
Q20PLP	Polarized Retroreflective, 645 nm Visible Red	4 m (13 ft) (specified using reflector BRT-84)	PNP
Q20NLP			NPN
Q20PLV	Retroreflective, 645 nm Visible Red	6 m (20 ft) (specified using reflector BRT-84)	PNP
Q20NLV			NPN

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Diffuse sensors

Model	Sensing Mode	Range	Output
Q20PDL	Long-Range Diffuse, 624 nm Visible Red	800 mm (32 in)	PNP
Q20NDL			NPN
Q20PDXL	Long Range Diffuse, 850 nm Infrared	1500 mm (59 in)	PNP
Q20NDXL			NPN
Q20PD	Short Range Diffuse, 624 nm Visible Red	250 mm (10 in)	PNP
Q20ND			NPN
Q20PDVS	Small Spot Diffuse, 660 nm Visible Red	250 mm (10 in)	PNP
Q20NDVS			NPN

Fixed-field sensors

Model	Sensing Mode	Range	Output
Q20PFF50	Fixed Field, 655 nm Visible Red	50 mm (2 in) cutoff	PNP
Q20NFF50			NPN
Q20PFF100		100 mm (4 in) cutoff	PNP
Q20NFF100			NPN
Q20PFF150		150 mm (6 in) cutoff	PNP
Q20NFF150			NPN

Diffuse-mode and fixed-field performances are based on the use of a 90% reflectance white test card.

Integral 2 m (6.5 ft) unterminated cable models are listed.

- To order the 9 m (30 ft) PVC cable model, add the suffix "W/30" to the cabled model number. For example, Q20E W/30.
- To order the 4-pin M8 integral quick disconnect model, add the suffix "Q7" to the model number. For example, Q20EQ7.
- To order the 150 mm (6 in) PVC cable model with a 4-pin M8 quick disconnect, add the suffix "Q" to the model number. For example, Q20EQ.
- To order the 150 mm (6 in) PVC cable model with a 4-pin M12 quick disconnect, add the suffix "Q5" to the model number. For example, Q20EQ5.
- To order the 150 mm (6 in) PUR cable model with a 4-pin M12 quick disconnect, add the suffix "QPMA" to the model number. For example, Q20EQPMA.
- Models with a quick disconnect require a mating cordset.

Models are available with Health or Alarm Mode output; contact Banner Engineering for details.

Some connector options are no longer available for order, but are still covered by the information in this document.

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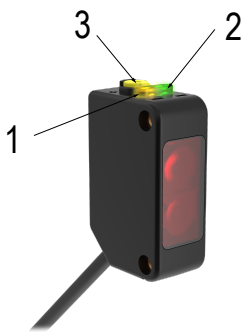
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Chapter 2 Overview

Banner's Q20 family of sensors offers a full complement of sensing modes, with the excellent performance expected of much larger sensors. Their compact plastic housings feature overmolded construction for superior robustness and sealing. Their popular rectangular design is easy to mount into tight spaces; integral threaded mounting holes eliminate the need for separate mounting nuts.

The single-turn Gain potentiometer on most models and bright LEDs (positioned on top of the housing for 360° visibility) provide easy alignment and configuration for reliable sensing.

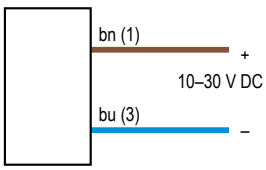


1. Output LED
2. Power LED
3. Single-Turn Gain Potentiometer (Retro and Diffuse models only)

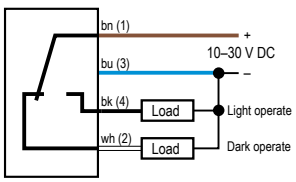
Wiring Diagrams

Cabled wiring diagrams are shown. Quick disconnect wiring diagrams are functionally identical.

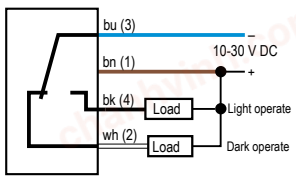
Emitter



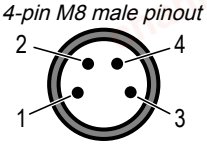
PNP output



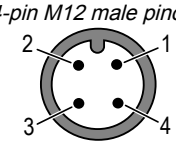
NPN output



4-pin M8 male pinout



4-pin M12 male pinout



1. Brown
2. White
3. Blue
4. Black

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Chapter 3 Specifications

Supply Voltage

Fixed-Field: 10 V DC to 30 V DC (10% maximum ripple within specified limits) at less than 25 mA, exclusive of load

All others: 10 V DC to 30 V DC (10% maximum ripple within specified limits) at less than 18 mA, exclusive of load

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Repeatability

Opposed mode: 140 microseconds

All other models: 90 microseconds

Construction

ABS housing; PMMA lenses; PBT Gain Adjuster (Retro and Diffuse models only)

Output Configuration for Receiver

100 mA with short circuit protection

OFF-state leakage current:

NPN: < 200 µA sinking (see Application Note 2);
PNP: < 10 µA sourcing

ON-state saturation voltage

NPN: < 1.6 V at 100 mA
PNP: < 3.0 V at 100 mA

Output Configuration for all Other Models

Maximum Current ≤ 100 mA

PNP Output Voltage:

High ≥ Vsupply – Vsaturation
Low ≤ 1 V (≤ 1M Ω)

NPN Output Voltage:

High ≥ Vsupply – 1 V (≤ 1M Ω)
Low ≤ Vsaturation

Vsaturation ≤ 3 V

Output Response Time

Opposed mode: 1 millisecond ON/600 microseconds OFF

All other models: 850 microseconds ON/OFF

100 millisecond delay on power-up; outputs do not conduct during this time

Connections

2 m (6.5 ft) or 9 m (30 ft) 4-wire PVC cable, 150 mm (6 in) cable with 4-pin threaded M8 (Q) or M12 (Q5) connector, or 4-pin integral threaded M8 connector (Q7), depending on the model ordered

Indicators

Two LED Indicators: Power (green) and Output (amber)

Fixed-Field models:

Green on: Power ON
Amber on: Black (LO) wire conducting

All other models:

Green on: Power ON
Amber on: Black (LO) wire conducting
Amber flashing: Marginal excess gain (1 to 1.5×)
Black (LO) wire conducting

Adjustments

Diffuse, Retroreflective, and Polarized Retroreflective models (only): Single-turn Sensitivity (Gain) adjustment potentiometer

Operating Conditions

–20 °C to +60 °C (–4 °F to +140 °F)

95% at +50 °C maximum relative humidity (non-condensing)

Environmental Rating

IP67; NEMA 6

Vibration and Mechanical Shock

All models meet MIL-STD-202F, Method 201A (Vibration: 10 Hz to 60 Hz maximum, 0.06 inch (1.52 mm) double amplitude, 10G maximum acceleration) requirements. Also meets IEC 60947-5-2 (Shock: 30G 11 ms duration, half sine wave) requirements.

Applications Notes

1. Opposed mode sensor spacing can be reduced by alternating emitters and receivers or by applying cross talk filters (visible red models only)
2. For receiver only: NPN off-state leakage current is <200 µA for load resistances > 3kΩ or optically isolated loads. For load currents of 100 mA, leakage is <1% of load current.

Certifications

CE
Banner Engineering BV
Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

UKCA
Turck Banner LTD Blenheim House
Blenheim Court
Wickford, Essex SS11 8YT
GREAT BRITAIN

cULus (Class 2 power supply required)

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Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.

Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.

Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

FCC Part 15 Class B for Unintentional Radiators

(Part 15.105(b)) This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada ICES-003(B)

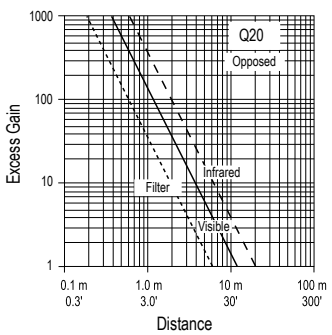
This device complies with CAN ICES-3 (B)/NMB-3(B). Operation is subject to the following two conditions: 1) This device may not cause harmful interference; and 2) This device must accept any interference received, including interference that may cause undesired operation.

Cet appareil est conforme à la norme NMB-3(B). Le fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne peut pas occasionner d'interférences, et (2) il doit tolérer toute interférence, y compris celles susceptibles de provoquer un fonctionnement non souhaité du dispositif.

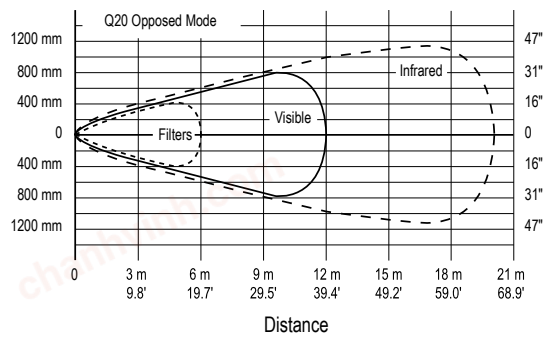
Performance Curves

Opposed Mode Models

Excess Gain



Beam Pattern

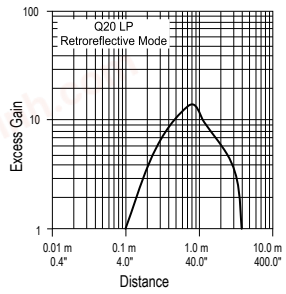


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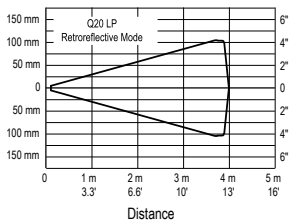
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Retroreflective Mode Models (based on retroreflector BRT-84)

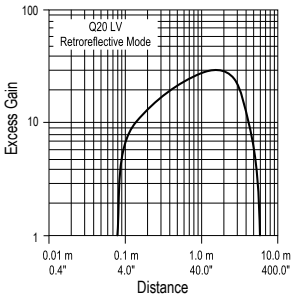
Excess Gain



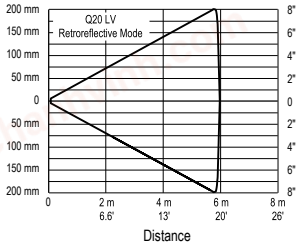
Beam Pattern



Excess Gain

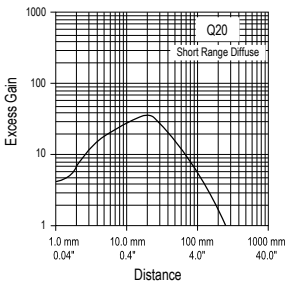


Beam Pattern

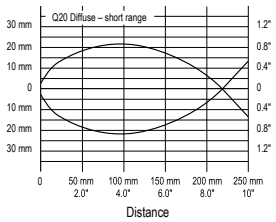


Diffuse Mode Models (based on 90% reflectance white test card)

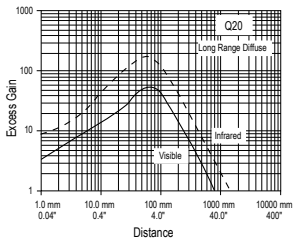
Excess Gain



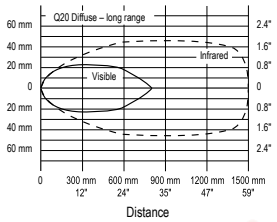
Beam Pattern



Excess Gain

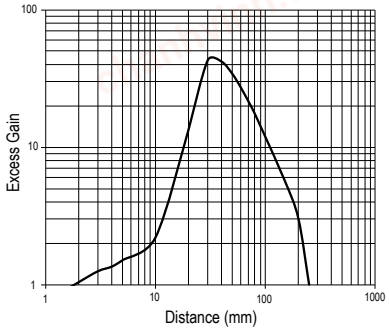


Beam Pattern

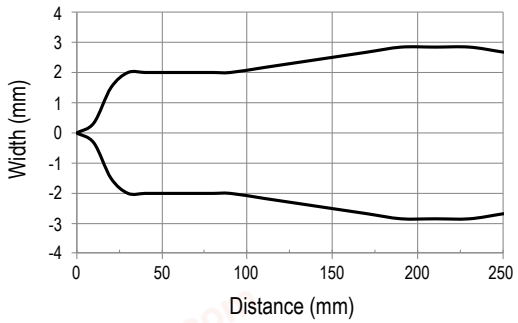


Q20DVS Models

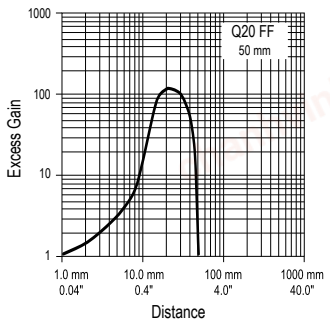
Excess Gain

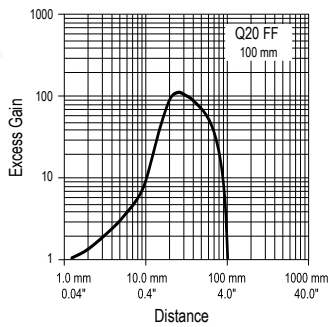


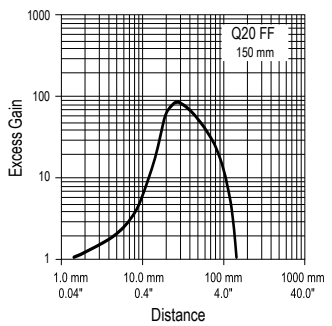
Beam Pattern



Fixed-Field Excess Gain (based on 90% reflectance white test card)







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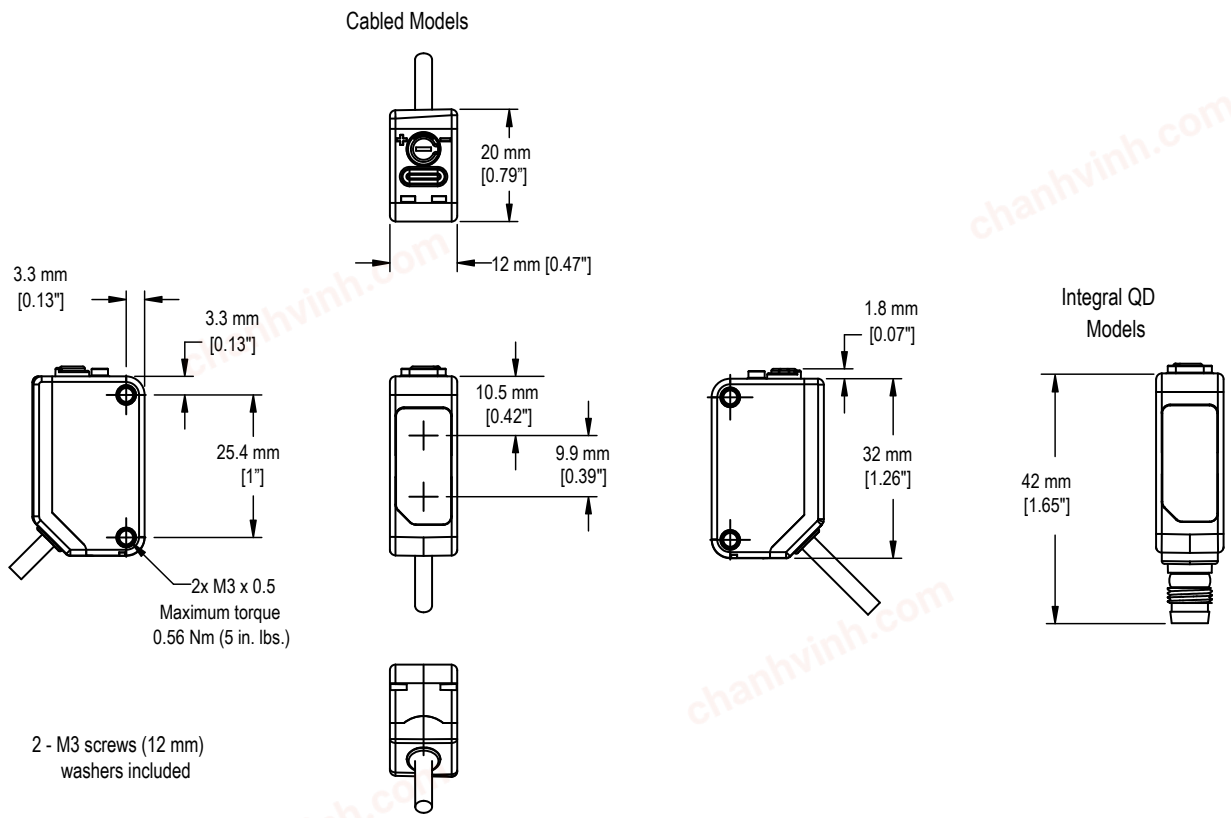
Fixed-Field Excess Gain (based on 90% reflectance white test card)		
Ø 6 mm spot size at 25 mm	Ø 6 mm spot size at 50 mm	Ø 6 mm spot size at 75 mm
Ø 6 mm spot size at 50 mm cutoff	Ø 6 mm spot size at 100 mm cutoff	Ø 9 mm spot size at 150 mm cutoff
Using 18% gray test card: cutoff distance will be 95% of value shown	**Using 18% gray test card:** cutoff distance will be 90% of value shown	**Using 18% gray test card:** cutoff distance will be 80% of value shown
Using 6% black test card: cutoff distance will be 90% of value shown	**Using 6% black test card:** cutoff distance will be 85% of value shown	**Using 6% black test card:** cutoff distance will be 70% of value shown

See "Accessories" on page 10 or www.bannerengineering.com for complete information.

NOTE: Polarized sensors require corner cube type retroreflective targets only.

Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise. The measurements provided are subject to change.



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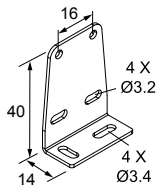
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Cross Talk Prevention Filters 10
Quick-Disconnect (QD) Cordsets 11
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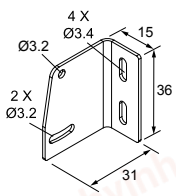
Chapter 4 Accessories

Mounting Brackets

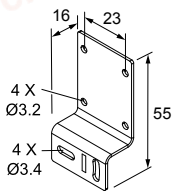
SMBQ20L
- Sensor vertical base mount
- ±5° tip, ±7° swivel
- Stainless steel
- CAD Files: DXF, PDF, IGS, STP



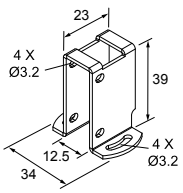
SMBQ20LV
- Sensor vertical back mount
- ±10° tip
- Stainless steel
- CAD Files: DXF, PDF, IGS, STP



SMBQ20H
- Sensor horizontal flange mount
- ±10° swivel
- Stainless steel
- CAD Files: DXF, PDF, IGS, STP



SMBQ20U
- Sensor vertical base mount with protection
- ±22.5° swivel
- Stainless steel
- CAD Files: DXF, PDF, IGS, STP



Cross Talk Prevention Filters

Model		Description		Reduced Sensor Range E/R (two apertures used)
PFQ20-H		Stainless steel (natural color)	7.5 mm (0.3 in) dia.	6.0 m (19.7 ft)
PFQ20-V		Stainless steel (colorized black)		

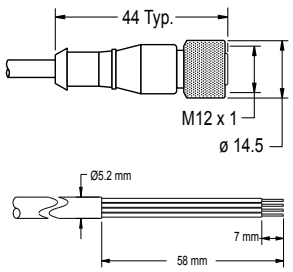
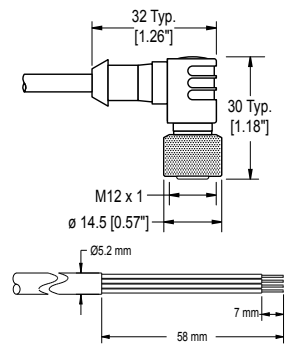
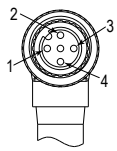
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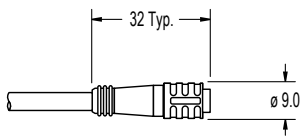
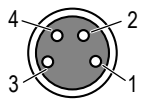
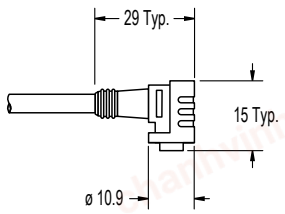
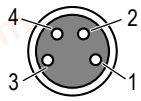
For visible red models only. The "H" and "V" in the model numbers refer to the polarization of the filter material. Since they are visually identical, the "H" models have been left the natural stainless steel and the "V" models have been colored black.

Quick-Disconnect (QD) Cordsets

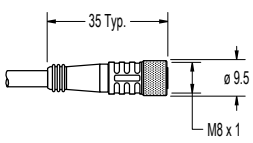
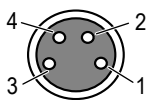
4-Pin Single-Ended M12 Female Cordsets

Model	Length	Style	Dimensions	Pinout (Female)	
MQDC-406	2 m (6.56 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Not used c UL us
MQDC-415	5 m (16.4 ft)				
MQDC-430	9 m (29.5 ft)				
MQDC-450	15 m (49.2 ft)				
MQDC-406RA	2 m (6.56 ft)	Right-Angle			
MQDC-415RA	5 m (16.4 ft)				
MQDC-430RA	9 m (29.5 ft)				
MQDC-450RA	15 m (49.2 ft)				

4-Pin Single-Ended Snap-on M8 Female Cordsets

Model	Length	Style	Dimensions	Pinout (Female)	
PKG4-2	2.03 m (6.66 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black
PKW4Z-2	2 m (6.56 ft)	Right-Angle			

4-Pin Single-Ended M8 Female Cordsets

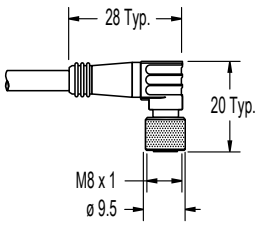
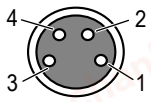
Model	Length	Style	Dimensions	Pinout (Female)	
PKG4M-2	2 m (6.56 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black
PKG4M-5	5 m (16.4 ft)				
PKG4M-9	9 m (29.52 ft)				

Continued on page 12

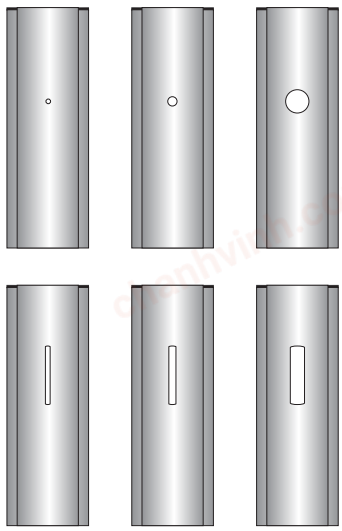
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4-Pin Single-Ended M8 Female Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**	
PKW4M-2	2 m (6.56 ft)	Right Angle			
PKW4M-5	5 m (16.4 ft)				
PKW4M-9	9 m (29.5 ft)				

Q20 Apertures

Model		Reduced Sensor Range E/R (two apertures used)	Reduced Sensor Range EL/RL (two apertures used)	Description
Circular				
APQ20-0.5	0.5 mm (0.02") dia.	0.10 m (0.33 ft)	0.18 m (0.6 ft)	
APQ20-1	1 mm (0.04") dia.	0.35 m (1.14 ft)	0.66 m (2.1 ft)	
APQ20-2	2 mm (0.08") dia.	1.5 m (4.9 ft)	2.9 m (9.5 ft)	
Vertical Slot				
APQ20-0.5V	0.5 mm (0.02") dia.	1.4 m (4.6 ft)	2.3 m (7.5 ft)	
APQ20-1V	1 mm (0.04") dia.	2.8 m (9.2 ft)	4.8 m (15.7 ft)	
APQ20-2V	2 mm (0.08") dia.	5.8 m (19.0 ft)	8.6 m (28.2 ft)	
APK-Q20	Includes two of each type			

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Chapter 5 Product Support and Maintenance

Clean Sensor with Compressed Air Then Isopropyl Alcohol

Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. create stray light that may degrade the peak performance of the sensor.

Blow dust from the sensor using filtered, compressed air. If the sensor is still dirty, gently wipe the sensor with a dry optical cloth. If the dry optical cloth does not remove all residue, use 70% isopropyl alcohol on a clean optical cloth, then dry with a clean dry optical cloth and blow with filtered, compressed air. Do not use any other chemicals for cleaning.

Repairs

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

> **IMPORTANT:** If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

Contact Us

Banner Engineering Corp. | 9714 Tenth Avenue North | Plymouth, MN 55441, USA | Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit www.bannerengineering.com.

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