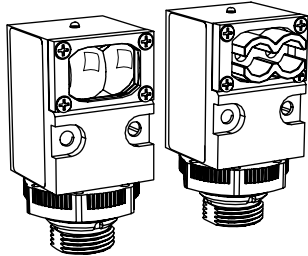


Datasheet

AC- and DC-powered sensors with solid-state outputs

To view or download the latest technical information about this product, including specifications, dimensions, accessories, and wiring, go to www.bannerengineering.com.



- Choose models for 10 to 30 V DC or 24 to 250 V AC operation
- DC models have bipolar solid-state outputs: one NPN (sinking) and one PNP (sourcing)
- AC models have an SPST solid-state output rated for up to 3/4 amp with simple 2-wire connection
- All models have a rear panel sensitivity adjustment and light/dark operate switch
- DC models include Banner's Alignment Indicating Device (AID™) system
- Choose models with integral 2 m (6.5 ft) cable or Mini-style QD (quick-disconnect) connector; 9 m (30 ft) cables are also available



WARNING:

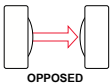
- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction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

Models

To order the 9 m (30 ft) PVC cable model, add the suffix "W/30" to the cabled model number. For example, SMA91E W/30. A model with a QD connector requires a mating cable; see [Quick-Disconnect Cables](#) on page 9.

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

Infrared, 880 nm

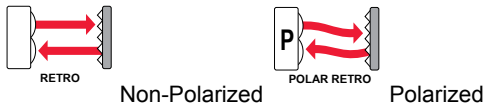


| Models | Range | Connection | Supply Voltage | Output Type |
|-------------|---------------|-------------------------------------|-------------------|-----------------------------|
| SMA91E | 60 m (200 ft) | 2 m (6.5 ft) cable | 10 to 250 V AC/DC | - |
| SMA91EQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |
| SM91R | | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM91RQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A91R | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-wire |
| SM2A91RQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |
| SMA91ESR | 3 m (10 ft) | 2 m (6.5 ft) cable | 10 to 250 V AC/DC | - |
| SMA91ESRQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |
| SM91RSR | | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM91RSRQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A91RSR | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-wire |
| SM2A91RSRQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |



Retroreflective Mode Models

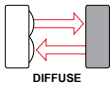
Visible red, 650 nm



| Models | Range ¹ | Connection | Supply Voltage | Output Type |
|-------------------------------|------------------------------|-------------------------------------|----------------|-----------------------------|
| Non-Polarized | | | | |
| SM912LV | 0.15 to 9 m (6 in to 30 ft) | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM912LVQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A912LV | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A912LVQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |
| Polarized ² | | | | |
| SM912LVAG | 0.3 to 4.5 m (1 ft to 15 ft) | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM912LVAGQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A912LVAG | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A912LVAGQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |

Diffuse Mode Models

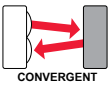
Infrared, 880 nm



| Models | Range | Connection | Supply Voltage | Output Type |
|--------------|----------------|-------------------------------------|----------------|-----------------------------|
| SM912D | 760 mm (30 in) | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM912DQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A912D | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A912DQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |
| SM912DSR | 380 mm (15 in) | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM912DSRQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A912DSR | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A912DSRQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |

Convergent Mode Models

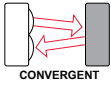
Visible red or infrared



| Models (Visible Red, 650 nm) | Range | Cable* | Supply Voltage | Output Type |
|------------------------------|--|-------------------------------------|----------------|-----------------------------|
| SM912CV | 38 mm (1.5 in) Spot Size at Focus: 1.5 mm (0.06 in) | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM912CVQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A912CV | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A912CVQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |

¹ Retroreflective range is specified using one model BRT-3 retroreflector (3-inch diameter). Actual sensing range may be more or less than specified, depending upon the efficiency and reflective area of the retroreflector used.

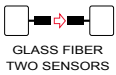
² Use polarized models when shiny objects will be sensed.



| Models (Infrared, 880 nm) | Range | Cable* | Supply Voltage | Output Type |
|---------------------------|----------------|-------------------------------------|----------------|-----------------------------|
| SM912C | 38 mm (1.5 in) | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM912CQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A912C | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A912CQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |

Glass Fiber Optic Individual Emitter or Receiver Models

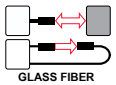
Infrared, 880 nm . Use where the separation between emitting and receiving fibers is more than a few feet, or where it is inconvenient to run both fibers from a single sensor. Watertight o-ring-sealed sensor/fiber interface.



| Models | Range | Connection | Supply Voltage | Output Type |
|-------------------|------------------------------|-------------------------------------|-------------------|-----------------------------|
| SMA91EF | Range varies with fiber used | 2 m (6.5 ft) cable | 10 to 250 V AC/DC | - |
| SMA91EFQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |
| SM91RF | | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM91RFQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A91RF | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A91RFQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |

Glass Fiber Optic Models

Infrared, 880 nm . Watertight o-ring-sealed sensor/fiber interface.



| Models | Range | Connection | Supply Voltage | Output Type |
|-------------------|--|-------------------------------------|----------------|-----------------------------|
| SM912F | Range varies with sensing mode and fiber optics used | 2 m (6.5 ft) cable | 10 to 30 V DC | Bipolar NPN/PNP |
| SM912FQD | | 4-pin 7/8 in-16UNF Quick Disconnect | | |
| SM2A912F | | 2 m (6.5 ft) cable | 24 to 250 V AC | SPST SCR Solid-state 2-Wire |
| SM2A912FQD | | 3-pin 7/8 in-16UNF Quick Disconnect | | |

DC Wiring Diagrams

Figure 1. Emitters - Cabled

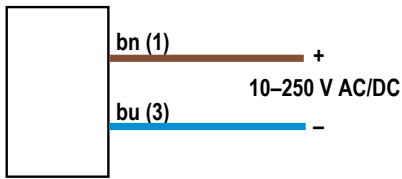


Figure 2. Emitters - QD (3-Pin 7/8 in-16UNF)

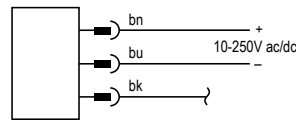
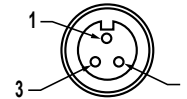


Figure 3. 3-Pin 7/8 in-16UNF Pinout



1 = Black
2 = Brown
3 = Blue

Figure 4. Other DC Models - Cabled

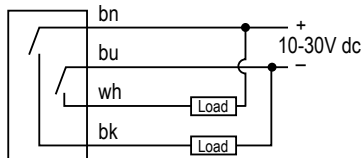


Figure 5. Other DC Models - QD (4-Pin 7/8 in-16UNF)

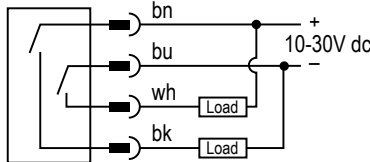
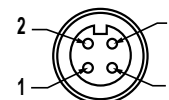


Figure 6. 4-Pin 7/8 in-16UNF Pinout



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

AC Wiring Diagrams

Figure 7. Emitters - Cabled

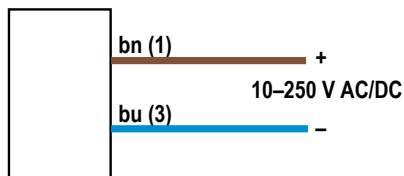


Figure 8. Emitters - QD (3-Pin 7/8 in-16UNF)

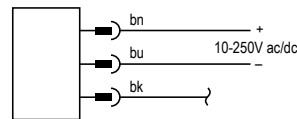


Figure 9. 3-Pin 7/8 in-16UNF Pinout

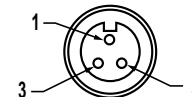


Figure 10. Other AC Models - Cabled

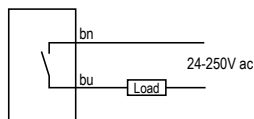
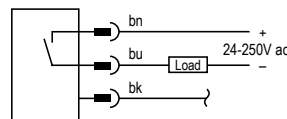


Figure 11. Other AC Models - QD (3-Pin 7/8 in-16UNF)



1 = Black
2 = Brown
3 = Blue

Specifications

Specifications - DC Models

Supply Voltage and Current

10 to 30 V dc at 20 mA maximum, exclusive of load; except for SMA91E, ESR and EF emitters, which operate from 10 to 250 V ac or dc, 10 mA max.

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Output Configuration

Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor

Construction

Reinforced thermoplastic polyester housing, totally encapsulated, molded acrylic lenses and stainless steel hardware

Output Response Time

Receivers only: 8 milliseconds ON and 4 milliseconds OFF, independent of signal strength.

All other models: 4 milliseconds ON/OFF



Note: 100 millisecond delay on power-up; outputs do not conduct during this delay.

Repeatability

Opposed and Glass Fiber Optic Emitter-Receiver pairs: 1.0 millisecond
Retro, Diffuse, Convergent and Glass Fiber Optic Models: 1.3 milliseconds

Adjustments

Light/Dark Operate select switch and Sensitivity control potentiometer, both located at rear of sensor

Output Rating

250 mA continuous, each output
Off-state leakage current: less than 10 microamps
Output saturation voltage: (PNP output) less than 1 volt at 10 mA and less than 2 volts at 250 mA
Output saturation voltage: (NPN output) less than 200 millivolts at 10 mA and less than 1 volt at 250 mA

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 (Amps) |
|---------------------|--|
| 20 | 5.0 |
| 22 | 3.0 |
| 24 | 2.0 |
| 26 | 1.0 |
| 28 | 0.8 |
| 30 | 0.5 |

Indicators

Alignment Indicating Device (AID™) lights a top-mounted red LED indicator whenever the sensor sees a "light" condition; its pulse rate is proportional to the light signal strength (the stronger the signal, the faster the pulse rate).
Model SMA91E and SM91ESR emitters: visible-red "tracer beam" indicates "Power ON" and enables line-of-sight alignment.

Environmental Rating

Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 12 and 13
 IP66

Connections

PVC-jacketed 2 m (6.5 ft) or 9 m (30 ft) cables or 4-pin Mini-style quick-disconnect (QD) fitting available.



Note: Opposed-mode emitters use 3-pin Mini-style QD fitting. See [Quick-Disconnect Cables](#) on page 9.

Operating Conditions

Temperature: -20 °C to +70 °C (-4 °F to +158 °F)
 90% at +50 °C maximum relative humidity (non-condensing)

Certifications



Specifications - AC Models

Supply Voltage and Current

24 to 250 V ac (50/60 Hz);
 except for SMA91E, ESR and EF emitters, which operate from 10 to 250 V ac or dc

Supply Protection Circuitry

Protected against transient voltages

Output Configuration

SPST SCR solid-state relay with either normally closed or normally open contact (light/dark operate selectable); 2-wire hookup

Construction

Reinforced thermoplastic polyester housing, totally encapsulated, molded acrylic lenses and stainless steel hardware

Output Rating

Minimum load current 10 mA, max. steady-state load capability 750 mA to 50 °C ambient (122 °F), 500 mA to 70 °C ambient (158 °F)
Inrush capability: 4 amps for 1 second (non-repetitive)
Off-state leakage: current less than 1.7 mA rms
On-state voltage drop: ≤ 5 volts rms at 750 mA load, ≤ 10 volts rms at 15 mA load

Output Protection Circuitry

Protected against false pulse on power-up

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 (Amps) |
|---------------------|--|
| 20 | 5.0 |
| 22 | 3.0 |
| 24 | 2.0 |
| 26 | 1.0 |
| 28 | 0.8 |
| 30 | 0.5 |

Output Response Time

Receivers only: 8 milliseconds ON and 4 milliseconds OFF, independent of signal strength.

All other models: 4 milliseconds ON/OFF

OFF time does not include load response of up to 1/2 ac cycle (8.3 milliseconds).

Response time specification of the load should be considered when total response time is important.



Note: 300 millisecond delay on power-up; outputs do not conduct during this delay.

Repeatability

Opposed and Glass Fiber Optic Emitter-Receiver pairs: 1.0 millisecond
Retro, Diffuse, Convergent and Glass Fiber Optic Models: 2.6 milliseconds

Adjustments

Light/Dark Operate select switch and Sensitivity control potentiometer, both located at rear of sensor

Indicators

Top-mounted red LED indicator lights when output is conducting.

Model SMA91E and SM91ESR emitters: visible-red "tracer beam" indicates "Power ON" and enables line-of-sight alignment.

Environmental Rating

Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 12 and 13
 IP66

Connections

PVC-jacketed 2 m (6.5 ft) or 9 m (30 ft) cables or 3-pin Mini-style (QD) fitting available. See [Quick-Disconnect Cables](#) on page 9.

Operating Conditions

Temperature: -20 °C to +70 °C (-4 °F to +158 °F)
 90% at +50 °C maximum relative humidity (non-condensing)

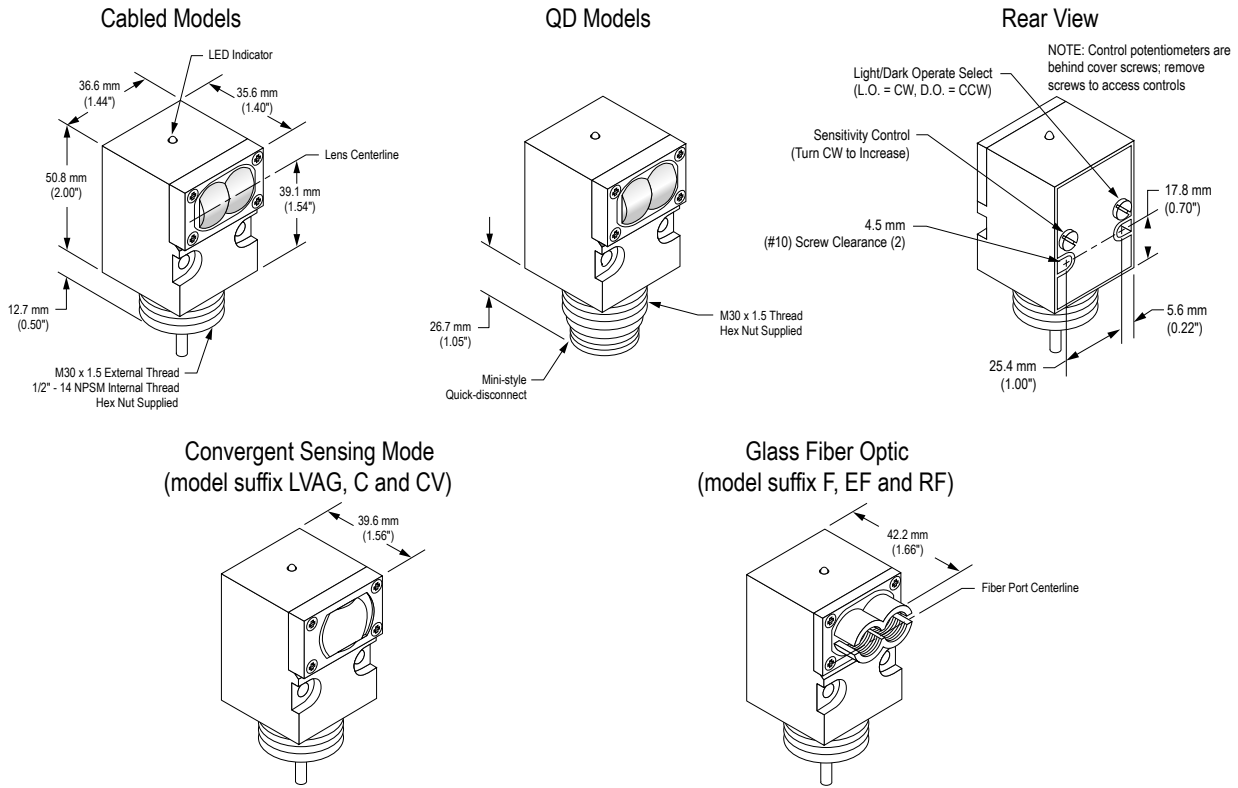
Application Notes

- 912 Series ac sensors can be destroyed from overload conditions.
- Use on low voltage requires careful analysis of the load to determine if the leakage current or on-state voltage of the sensor will interfere with proper operation of the load.
- The false-pulse protection feature may cause momentary drop-out of the load when the sensor is wired in series or parallel with mechanical switch contacts.

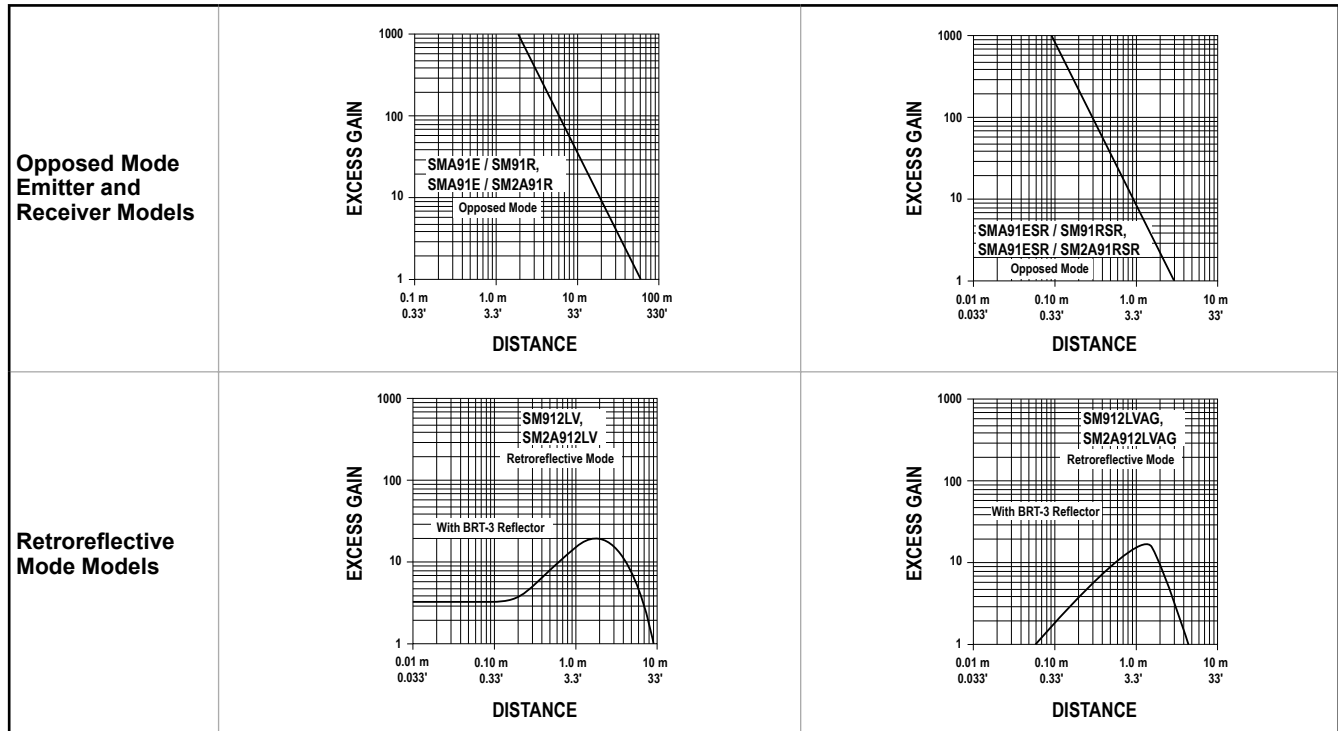
Certifications



Dimensions

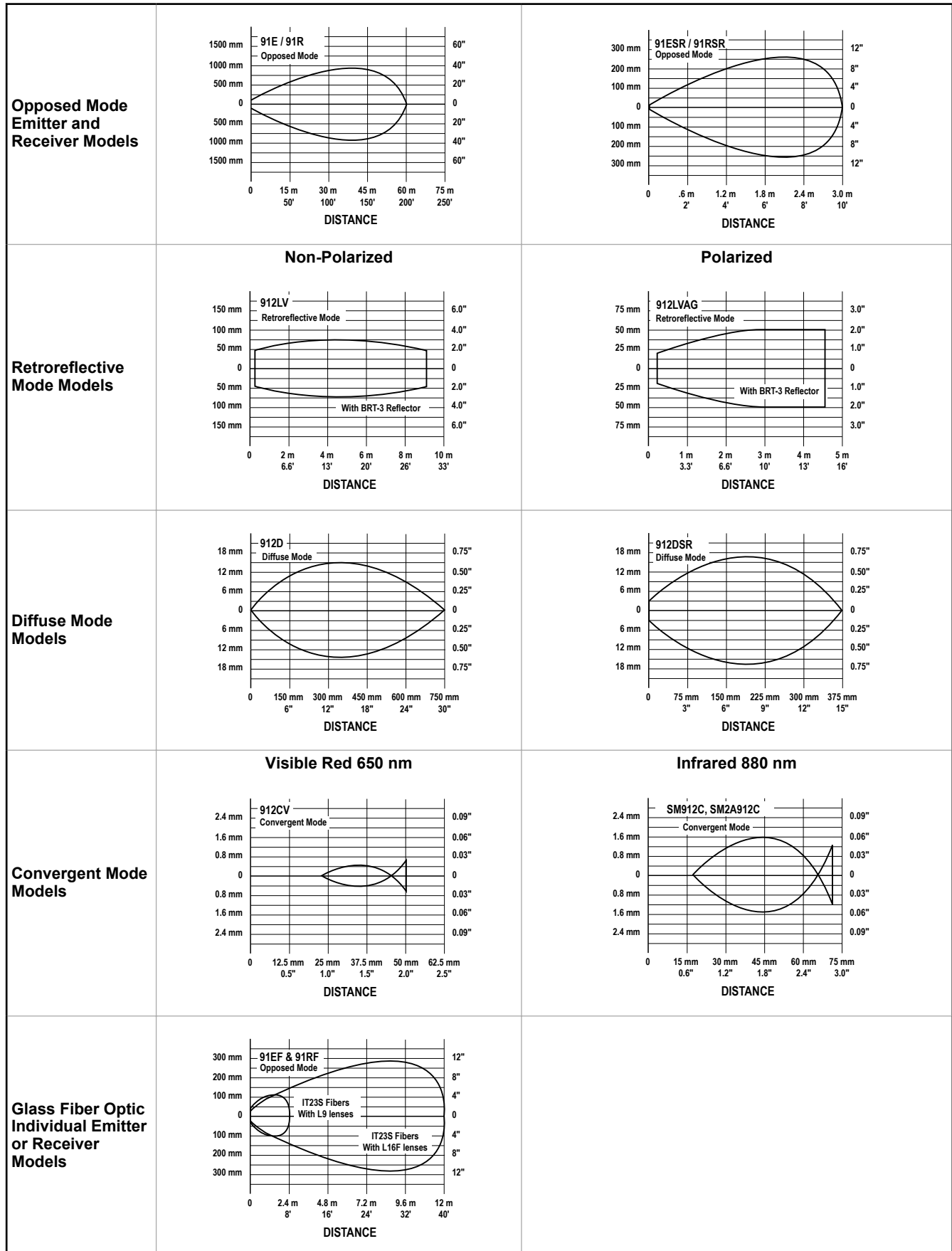


Excess Gain

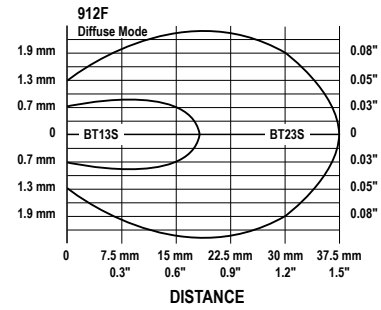
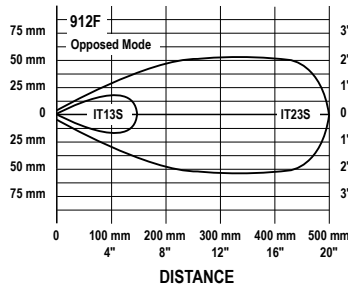


| | | |
|---|---|--|
| <p>Diffuse Mode Models</p> | <p>SM912D, SM2A912D Diffuse Mode</p> <p>EXCESS GAIN</p> <p>DISTANCE</p> | <p>SM912DSR, SM2A912DSR Diffuse Mode</p> <p>EXCESS GAIN</p> <p>DISTANCE</p> |
| <p>Convergent Mode Models</p> | <p>Visible Red 650 nm</p> <p>SM912CV, SM2A912CV Convergent Mode</p> <p>EXCESS GAIN</p> <p>DISTANCE</p> | <p>Infrared 880 nm</p> <p>SM912C, SM2A912C Convergent Mode</p> <p>EXCESS GAIN</p> <p>DISTANCE</p> |
| <p>Glass Fiber Optic Individual Emitter or Receiver Models</p> | <p>SMA912F & SM912F, SMA912F & SM2A912F Opposed Mode</p> <p>IT23S Fibers W/L9 Lenses</p> <p>EXCESS GAIN</p> <p>DISTANCE</p> | |
| <p>Glass Fiber Optic Models</p> | <p>SM912F, SM2A912F Opposed Mode</p> <p>IT23S Fibers</p> <p>EXCESS GAIN</p> <p>DISTANCE</p> | <p>SM912F, SM2A912F Diffuse Mode</p> <p>BT23S Fiber BT13S Fiber</p> <p>EXCESS GAIN</p> <p>DISTANCE</p> |

Beam Patterns



Glass Fiber Optic Models



Accessories

Quick-Disconnect Cables

| 3-pin 7/8-in Cordsets—Single Ended | | | | |
|------------------------------------|----------------|----------|------------|---|
| Model | Length | Style | Dimensions | Pinout (Female) |
| MBCC-306 | 1.83 m (6 ft) | Straight | | <p>1 = Brown 3 = Blue 4 = Black</p> |
| MBCC-312 | 3.66 m (12 ft) | | | |
| MBCC-330 | 9.14 m (30 ft) | | | |

| 4-Pin 7/8-in Cordsets—Single Ended | | | | |
|------------------------------------|----------------|----------|------------|---|
| Model | Length | Style | Dimensions | Pinout (Female) |
| MBCC-406 | 1.83 m (6 ft) | Straight | | <p>1 = Brown 2 = White 3 = Blue 4 = Black</p> |
| MBCC-412 | 3.66 m (12 ft) | | | |
| MBCC-430 | 9.14 m (30 ft) | | | |

Cabling Accessories

| Model | Description | |
|----------|---|----------------------------|
| AC-6 | 2 m (6.5 ft) armored cable jacket | I.D. 5/16-in; O.D. 7/16-in |
| PVC-6 | 2 m (6.5 ft) flexible PVC tubing (not for QD models) | I.D. 1/4-in; O.D. 3/8-in |
| RF1-2NPS | Compression fitting for attaching armored cable or PVC tubing | — |
| HF1-2NPS | <ul style="list-style-type: none"> Flexible black nylon cable protector Includes a neoprene gland that compresses around the VALU-BEAM cable to provide an additional seal against moisture Resistant to gasoline, alcohol, oil, grease, solvents and weak acids Working temperature range of -30 °C to +100 °C (-22 °F to +212 °F) | |

Extension Cables (without connectors)

The following cables are available for extending the length of existing sensor cable. These are 30 m (100 ft) lengths of VALU-BEAM cable. This cable may be spliced to existing cable. Connectors, if used, must be customer-supplied.

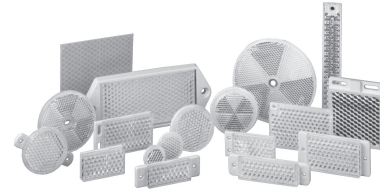
| Model | Type | Used With: |
|------------|-------------|--|
| EC312-100 | 4-conductor | SM912 Series dc sensors |
| EC312A-100 | 2-conductor | For all emitters and SM2A912 Series ac sensors |

Retroreflective Targets

Banner offers a wide selection of high-quality retroreflective targets. See www.bannerengineering.com for complete information.



Note: Polarized sensors require corner cube type retroreflective targets. Non-polarized sensors may use any retroreflective target.



Replacement Lens Assemblies

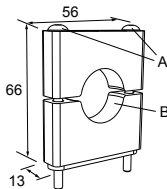
VALU-BEAM lens assemblies are field-replaceable. In addition, some lenses may be used to convert from one sensing mode to another, or to change the sensing range of a particular sensor. The possible conversions are listed in the table below.

| Models | Description | Possible Sensing Mode or Range Changes |
|-----------|--|---|
| UC-900AG | Replacement lens for LVAG | Change LV to LVAG |
| UC-900C | Replacement lens for C and CV | Change LV to CV |
| UC-900DSR | Replacement lens for DSR, ESR, and RSR | Change D or F to DSR, EF to ESR, and RF to RSR |
| UC-900F | Replacement lens for F | Change D to F and DSR to F |
| UC-900FP | Replacement lens for FP | – |
| UC-900L | Replacement lens for E, R, LV, and D | Change LVAG to LV, CV to LV, DSR to D, and F to D |
| UC-900J | Attach to E, R, ESR, RSR, LV, and D models | Flat polycarbonate dust cover |

Mounting Brackets

SMB30C

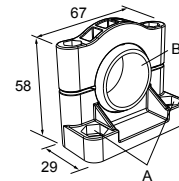
- 30 mm split clamp, black PBT bracket
- Stainless steel mounting hardware included
- Mounting hole for 30 mm sensor



Hole center spacing: A=ø 45
Hole size: B=ø 27.2

SMB30SC

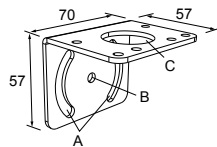
- Swivel bracket with 30 mm mounting hole for sensor
- Black reinforced thermoplastic polyester
- Stainless steel mounting and swivel locking hardware included



Hole center spacing: A=ø 50.8
Hole size: A=ø 7.0, B=ø 30.0

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 = ø 6.4, C = ø 30.1