



Fiber Optic Systems

Fiber System Overview page 164

- Fiber Systems Explained
- When to Use Fiber Systems
- Selection information for sensors and fibers
- Choosing Plastic or Glass Fibers



D10 page 166

- Advanced amplifier for use with plastic fibers
- High-performance, low-contrast sensing
- Easy-to-set TEACH programming
- Manual adjustment capability for fine tuning
- 4-digit display of signal strength and operating status
- Visible red or visible green sensing beam



FI22 page 180

- Low-profile design to mount directly on equipment
- 8-segment LED status bar for signal strength, sensing contrast, programming status and diagnostic warnings
- Completely sealed, IP67 point-of-use or inline fiber optic amplifier



D12 page 172

- Glass and plastic fiber optic models
- Models for standard applications, high-speed response and increased power
- AC-coupled for high-sensitivity applications



Plastic Fibers page 182

- Inexpensive and easily cut to length during installation
- Very bendable, for a precise fit
- Available coiled, for applications requiring articulated or reciprocating motion
- Diameters of 0.25, 0.5, 1.0 or 1.5 mm



R55F page 177

- Green, blue, white, red or infrared LED colors
- For mounting flat or to a 35 mm DIN rail
- Models for glass and plastic fiber optics



Glass Fibers page 198

- For hostile environments: high temperatures, corrosive materials, extreme moisture and high levels of shock and vibration
- Inherent immunity to extreme electrical noise
- Quickly custom designed and built for your unique applications

The broadest selection of fiber sensors in the world.

| Sensor Model | Models for Plastic Fibers | Page Number | Models for Glass Fibers | Page Number |
|--------------|---|--------------------------|---|-------------|
| WORLD-BEAM® |  | page 70 |  | page 70 |
| MINI-BEAM® |  | page 77 |  | page 77 |
| Q23/QH23 |  | page 90 | | |
| QM42 |  | page 136 | | |
| Q45 |  | page 142 |  | page 142 |
| OMNI-BEAM® |  | page 155 |  | page 155 |
| D10 |  | page 166 | | |
| D12 |  | page 172 |  | page 172 |
| R55F |  | page 177 | | page 177 |
| FI22 |  | page 180 |  | |
| D11 |  | page 32 | | |
| ECONO-BEAM® |  | page 32 |  | page 32 |
| MAXI-BEAM® |  | page 33 |  | page 33 |
| MULTI-BEAM® | | |  | page 33 |
| PC44 |  | See data sheet p/n 32910 | | |
| VALU-BEAM® |  | page 32 |  | page 32 |
| SM512 | | |  | page 33 |

Fiber Systems

Two-part fiber systems include the sensor and the separately purchased application-specific fiber.

1. Sensors

The sensor contains all the electronics, the amplifier and the mechanical interface to the fiber. Some models are sealed and rated IP67 to mount directly on a machine; other are designed to be DIN-rail mounted in a centralized control enclosure.

2. Fibers

Sensing fibers are non-electronic, light-transmitting, optical-quality glass or plastic strands encased in cladding that reflects light to the core. Fibers transmit and/or receive light from the LED of a sensor. Glass fibers are arranged in bundles, and plastic fibers are typically packaged as monofilaments with a protective jacket of polyethylene, PVC, stainless-steel braid or other material. Fiber sensing tips have a wide variety of shapes and configurations.

When to Use Fiber Systems

- **Confined areas.** The small size and flexibility of fibers allows precise positioning where space is limited.
- **High temperatures.** Fiber optic assemblies can tolerate elevated temperatures—in some cases as high as 480° C.
- **High vibration and shock.** The low mass of fibers enables them to withstand extreme vibration and mechanical shock.
- **Corrosive and wet environments.** Special purpose fibers withstand corrosive materials, moisture and even repeated washdown.
- **Explosive environments.** Fibers are passive and can safely pipe light to and from hazardous areas.
- **Noisy environments.** Fibers are non-electronic mechanical components and are completely immune to electrical noise.
- **Unique target shapes and requirements.** Fiber optic sensing heads can be custom designed and optimally shaped to the physical and optical requirements of a specific application.

Typical Applications

- Punch presses
- Vibratory feeders
- Conveyors
- Web control
- Tablet counting
- Ovens
- Semiconductor processing equipment
- Liquid level

Compare & select fiber optic sensors online: www.bannerengineering.com/iselect



The screenshot shows the Banner iSelect website interface. It features a navigation bar with 'SELECT BY PRODUCT...', 'OR SELECT BY ATTRIBUTE...', 'COMPARE MULTIPLE MODELS...', and 'NARROW ALL POSSIBILITIES TO AN EXACT MATCH.' The interface includes a search bar, a list of sensor models, and a comparison table with columns for 'Model', 'Fiber Type', 'Fiber Length', 'Fiber Diameter', 'Fiber Material', and 'Fiber Color'. The 'COMPARE MULTIPLE MODELS...' section shows a table with columns for 'Model', 'Fiber Type', 'Fiber Length', 'Fiber Diameter', 'Fiber Material', and 'Fiber Color'. The 'NARROW ALL POSSIBILITIES TO AN EXACT MATCH.' section shows a list of sensor models with a 'Select' button next to each.

Choosing Plastic or Glass Fibers

Plastic fibers are for general purpose use. They tolerate severe flexing, can be cut to length in the field and cost less than glass fibers. Glass fibers are the best choice for challenging environments such as high temperatures, corrosive materials and moisture.



Plastic fibers page 182

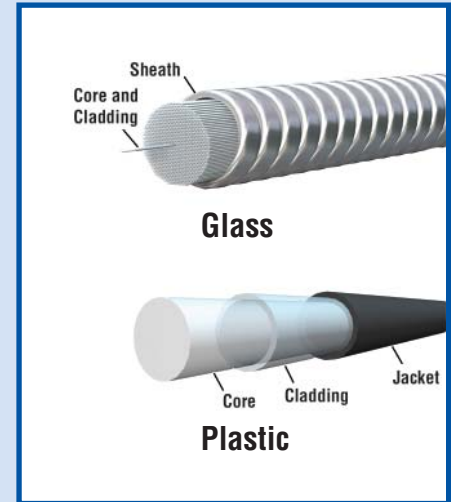
- Inexpensive and easily cut to length during installation
- Bend for a precise fit
- Available in high-flex models to withstand flexing
- Offered with special jackets that withstand corrosion, impact and abrasion
- Available in coiled versions for applications requiring articulated or reciprocating motion
- Available in diameters of 0.25, 0.5, 1.0 or 1.5 mm
- Can be quickly custom designed and built for your unique applications



Glass fibers page 198

- Solve numerous challenging sensing requirements
- Ideal for hostile environments such as high temperatures to 480° C, corrosive materials and extreme moisture
- Withstand high levels of shock and vibration
- Inherently immune to extreme electrical noise
- Available with choice of sheathings: standard stainless-steel flexible conduit, PVC or other flexible tubing.
- Can be quickly custom designed

Fiber Construction



Core—Thin glass or plastic center of the fiber through which light travels.

Cladding—Outer optical material surrounding the core that reflects light back into the core.

Jacket—Protective layer to protect plastic fiber from damage and moisture.



Specialty fibers for specific sensing applications.



DURA-BEND™ for extremely tight radius bends



Fluoropolymer encapsulated fibers



Focused beam fibers



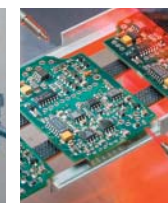
Convergent beam fibers



Linear array fibers



Liquid level detection fibers



High temperature fibers

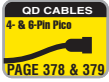
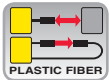


STEELSKIN™ for impact, abrasion

D10 Series

Redefining High-Performance Fiber Optic Sensing

- Features advanced fiber optic amplifier for use with plastic fibers
- Available with visible red or green beam
- Delivers high-performance, low-contrast sensing with automatic TEACH options or manual adjustment
- Available in bipolar, dual-discrete, and analog/discrete output models



Expert Models:

- 4-digit TEACH and signal strength display or bargraph readout
- Operating status indicators
- Easy-to-set static, dynamic and single-point programming
- Manual fine tuning
- Remote configuration, using TEACH wire

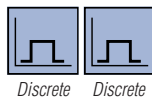


Expert Advanced LED Display

- Configuration and performance indicator
- Quick and easy setup
- Constant status monitoring in RUN mode

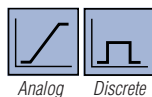
Expert Dual-Discrete Outputs

- Two configurable individual setpoints
- Current sourcing (PNP) or current sinking (NPN)



Expert Analog & Discrete Outputs

- Two configurable individual setpoints: one for analog and one for discrete output
- Current sourcing (PNP) or current sinking (NPN)
- One 4-20 mA current analog output or 0-10V dc voltage analog output



D10 Expert with Numeric Display Page 167
D10 Expert with Bargraph Display 168
D10 Discrete Output 168

D10 Expert with Numeric Display

- Numeric display of signal strength and operating status
- Two output options: two discrete outputs in the same sensor; or discrete output and either a 4-20 mA current or a 0-10V dc voltage analog output in the same sensor

D10 Expert with Bargraph Display

- Easy-to-read 8-segment light bar display indicator for TEACH and signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)

D10 Discrete Output

- 15-turn manual sensitivity adjustment
- Pulse rate LED indicator for signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)



D10 Sensors

- Static and dynamic programming push buttons or manual gain potentiometer
- Informative signal-strength readout with LED display, bargraph display or mechanical indicator
- Output indicators
- 2 m or 9 m integral cable, or Pico-style quick disconnect



D10 Expert™ with Numeric Display—Dual Discrete, 12-24V dc



| Models | Sensing Mode/LED* | Range | Cable** | Outputs | Data Sheet |
|-----------------------|-------------------|--|----------------------|----------|------------|
| D10DNFP D10DNFPQ | PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet part number 64154 for range information. | 2 m 6-pin Pico QD | Dual NPN | 64154 |
| D10DPFP D10DPFPQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | Dual PNP | |
| D10DNFPG D10DNFPGQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | Dual NPN | |
| D10DPFPG D10DPFPGQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | Dual PNP | |

D10 Expert™ with Numeric Display—Analog/Discrete, 12-24V dc



| Models | Sensing Mode/LED* | Range | Cable** | Discrete Output | Analog Output | Data Sheet |
|-----------------------|-------------------|--|----------------------|-----------------|---------------|------------|
| D10INFP D10INFPQ | PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet part number 65448 for range information. | 2 m 6-pin Pico QD | NPN | 4-20 mA | 65448 |
| D10IPFP D10IPFPQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | PNP | | |
| D10INFPG D10INFPGQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | NPN | 4-20 mA | |
| D10IPFPG D10IPFPGQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | PNP | | |

* Visible Red LED Visible Green LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D10DNFP W/30**). A model with a QD requires a mating cable (see page 379).

D10 Series

Fiber Systems

D10 Expert™ with Numeric Display—Analog/Discrete, 15-24V dc



| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Analog Output | Data Sheet |
|-----------------------|-------------------|--|----------------------|-------------|---------------|------------|
| D10UNFP D10UNFPQ | PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 182 or reference data sheet part number 65448 for range information. | 2 m 6-pin Pico QD | NPN | 0-10V | 65448 |
| D10UPFP D10UPFPQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | PNP | | |
| D10UNFPG D10UNFPGQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | NPN | 0-10V | |
| D10UPFPG D10UPFPGQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | PNP | | |

D10 Expert™ with Bargraph Display—Discrete, 10-30V dc



| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Excess Gain | Beam Pattern | Data Sheet |
|---------------------|-------------------|---|----------------------|--------------------|-----------------------------------|---------------------------------|------------|
| D10BFP D10BFPQ | PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 182 or reference data sheet part number 117830 for range information. | 2 m 6-pin Pico QD | Bipolar NPN/PNP | EGCP-28 to EGCP-31 (p. 448) | BPP-28 to BPP-31 (p. 466) | 117830 |
| D10BFPG D10BFPGQ | PLASTIC FIBER | | 2 m 6-pin Pico QD | | | | |

D10—Discrete, 10-30V dc




| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Data Sheet |
|-----------------------|-------------------|---|----------------------|--------------------|------------|
| D10AFP D10AFPQ | PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 182 or reference data sheet part number 118431 for range information. | 2 m 4-pin Pico QD | Bipolar NPN/PNP | 118431 |
| D10AFPG D10AFPGQ | PLASTIC FIBER | | 2 m 4-pin Pico QD | | |
| D10AFPY D10AFPYQ | PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 182 or reference data sheet part number 118431 for range information. | 2 m 4-pin Pico QD | | |
| D10AFPGY D10AFPGYQ | PLASTIC FIBER | | 2 m 4-pin Pico QD | | |

* Visible Red LED Visible Green LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D10DUNFP W/30**). A model with a QD requires a mating cable (see pages 378 and 379).


D10 Expert™ with Numeric Display—Dual-Discrete Specifications

| | | | |
|------------------------------------|--|-----------------------------------|---------------------------|
| Required Fiber Optic Cable | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 182) | | |
| Supply Voltage and Current | 12 to 24V dc (10% max. ripple) at less than 65 mA, exclusive of load | | |
| Supply Protection Circuitry | Protected against reverse polarity and transient voltage. | | |
| Output Configuration | Two independently configured current sourcing (PNP) or current sinking (NPN) solid-state transistors. | | |
| Output Rating | 150 mA max. load OFF-state leakage current: less than 10 μ A at 24V dc ON-state saturation voltage: NPN less than 1.5V at 150 mA load PNP less than 2.5V at 150 mA load | | |
| Output Protection Circuitry | Protected against false pulse on power-up and continuous short-circuit | | |
| Output Response Time | Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds NOTE: < 1 second delay on power-up; outputs do not conduct during this time. | | |
| Adjustments | Two push buttons or remote programming of (TEACH) switching threshold response time, OFF-delay, light/dark operate, and display | | |
| Indicators | Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light/dark operate selection; two yellow LEDs serve as output indicators and active channel indicator. | | |
| Construction | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. | | |
| Environmental Rating | NEMA 1; IEC IP50 | | |
| Connections | PVC-jacketed 2 m or 9 m 6-wire integral cable or integral 6-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 379. | | |
| Operating Conditions | Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C | | |
| | Number of Devices Stacked | Ambient Temperature Rating | Load Specification |
| | 3 | 55° C | 150 mA |
| | 7 | 50° C | 50 mA |
| 10 | 45° C | 50 mA | |
| Installation | 35 mm DIN rail or included mounting bracket | | |
| Certifications |  | | |
| Hookup Diagrams | NPN Models: DC21 (p. 481) PNP Models: DC22 (p. 481) | | |


D10 Expert™ with Numeric Display—Analog/Discrete Specifications

| | | | |
|------------------------------------|---|---|--|
| Required Fiber Optic Cable | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 182) | | |
| Supply Voltage and Current | 4-20 mA Analog Models: 12-24V dc (10% max. ripple) at less than 65 mA exclusive of load 0-10V dc Analog Models: 15-24V dc (10% max. ripple) at less than 70 mA exclusive of load | | |
| Supply Protection Circuitry | Protected against reverse polarity and transient voltage. | | |
| Output Configuration | 2 independently configurable outputs, depending on model: NPN w/analog (4-20 mA or 0-10V) or PNP w/analog (4-20 mA or 0-10V) | | |
| Output Rating | Discrete Output: 150 mA, max. load OFF-state leakage current: < 10 μ A at 24V dc ON-state saturation voltage: NPN < 1.5V @ 150 mA PNP < 2.5V @ 150 mA | Analog Output: 4-20 mA or 0-10V dc Load: 4-20 mA Models: 100 Ω max. impedance 0-10V dc Models: 1 M Ω min. impedance | |
| Output Protection Circuitry | Protected against false pulse on power-up and continuous short-circuit | | |
| Output Response Time | Discrete Output: Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds Analog Output: 1 millisecond NOTE: < 1 second delay on power-up; outputs do not conduct during this time. | | |
| Adjustments | Push-button or remote programming of (TEACH) switching threshold response time, OFF-delay, light/dark operate, and display | | |
| Indicators | Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light/dark operate selection; two yellow output indicators. | | |

D10 Expert™ with Numeric Display—Analog/Discrete (cont'd)

| | | | |
|-----------------------------|--|-----------------------------------|---------------------------|
| Construction | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. | | |
| Environmental Rating | NEMA 1; IEC IP50 | | |
| Connections | PVC-jacketed 2 m or 9 m 6-wire integral cable or integral 6-pin Pico-style quick-disconnect, QD cables are ordered separately. See page 379. | | |
| Operating Conditions | Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C | | |
| | Number of Devices Stacked | Ambient Temperature Rating | Load Specification |
| | 3 | 55° C | 150 mA |
| | 7 | 50° C | 50 mA |
| | 10 | 45° C | 50 mA |
| Installation | 35 mm DIN rail or included mounting bracket | | |
| Certifications |  | | |
| Hookup Diagrams | D10INFP(Q) Current & NPN Models: DC23 (p. 481) D10UNFP(Q) Current & PNP Models: DC25 (p. 482) D10IPFP(Q) Voltage & NPN Models: DC24 (p. 481) D10UPFP(Q) Voltage & PNP Models: DC26 (p. 482) | | |

D10 Expert™ with Bargraph Display—Discrete Specifications

| | |
|------------------------------------|---|
| Required Fiber Optic Cable | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 182) |
| Supply Voltage and Current | 10 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load |
| Supply Protection Circuitry | Protected against reverse polarity, over voltage and transient voltage. |
| Delay at Power Up | 200 milliseconds max.; outputs do not conduct during this time |
| Output Configuration | Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN) |
| Output Rating | 150 mA max. load OFF-state leakage current: less than 5 μ A at 30V dc ON-state saturation voltage: NPN less than 200 mV at 10 mA and 1V at 150 mA load PNP less than 1V at 10 mA and 1.5V at 150 mA load |
| Output Protection Circuitry | Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power-up |
| Output Response Time | 500 microseconds (normal mode) or 200 microseconds (high-speed mode) |
| Repeatability | 100 microseconds (normal mode) or 66 microseconds (high-speed mode) |
| Adjustments | Two push buttons and remote wire <ul style="list-style-type: none"> • <i>Expert</i> TEACH programming (two-point static, dynamic and single-point static) • Manually Adjust (+/-) sensitivity (from buttons only – not available on remote wire) • LO/DO, OFF Delay, and response speed configurable (from buttons or remote wire) • Push-button lockout (from remote wire only) Factory Default Settings: Light Operate, Normal Speed, No Delay |
| Indicators | 8-segment red bargraph: Light-to-dark signal difference relative to taught condition (single-point TEACH) Sensing contrast (two-point TEACH) Green Status Indicators: LO, DO, High Speed (HS) and OFF Delay Green LED: Power ON Yellow LED: Output conducting |
| Construction | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. |
| Environmental Rating | NEMA 1; IEC IP50 |
| Connections | PVC-jacketed 2 m or 9 m 6-wire integral cable or integral 6-pin Pico-style quick-disconnect. QD cables are ordered separately. See page 379. |
| Operating Conditions | Temperature: -10° to +55° C Storage Temperature: -20° to +85° C Relative humidity: 90% @ 50° C |
| Installation | 35 mm DIN rail or included mounting bracket |
| Certifications |  |
| Hookup Diagrams | DC11 (p. 478) |

D10—Discrete Specifications

| | |
|------------------------------------|--|
| Required Fiber Optic Cable | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 182) |
| Supply Voltage | 10 to 30V dc (10% max. ripple) @ less than 25 mA, exclusive of load |
| Supply Protection Circuitry | Protected against reverse polarity and transient voltage |
| Output Configuration | Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN) |
| Output Rating | 100 mA per output with short circuit protection OFF-state leakage current: < 10 μ A sourcing; 200 μ A sinking ON-state saturation voltage: NPN: 1.6V @ 100 mA PNP: 2.0V @ 100 mA |
| Output Protection Circuitry | Protected against output short-circuit and false pulse on power up (max. 100 milliseconds delay on power up; outputs do not conduct during this time). |
| Output Response Time | Standard models (with cross-talk avoidance circuitry): 500 microseconds High-speed models: 200 microseconds |
| Repeatability | Standard models: 95 microseconds High-speed models: 50 microseconds |
| Adjustments | 12-turn Sensitivity potentiometer with relative position indicator; LO/DO Selection switch; 0 or 40 milliseconds OFF-delay switch NOTE: Use proper ESD techniques while making adjustments under cover. |
| Indicators | Two LEDs: Green and Yellow Green ON steady: Power ON Yellow flashing: Light Sensed Signal strength indicator (Banner's AID Alignment Indicator Device - the faster the flash, the more light is received). |
| Construction | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. |
| Environmental Rating | IEC IP50; NEMA 1 |
| Connections | PVC-jacketed 2 m or 9 m attached cable or 4-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 378. |
| Operating Conditions | Temperature: -10° to +55° C Storage: -20° to +85° C Relative humidity: 90% @ 55° C (non-condensing) |
| Certifications | Approvals in process. |
| Hookup Diagrams | DC06 (p. 477) |

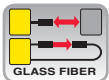
D12 Series

Fiber Systems

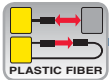
D12

Complete Family of Plastic and Glass Fiber Optic Sensors

- Features LED bargraph that indicates signal strength, sensing contrast, programming status and diagnostic warnings, when not in high-speed mode
- Available in glass and plastic fiber optic models
- Includes marginal gain indicator with alarm output
- Solves routine applications with economical standard models
- Features high-speed sensing response and higher sensing power in some models
- Excels in low-contrast applications with ac-coupled models
- Features easy push-button TEACH-mode setup on D12E *Expert™* models



D12 *Expert™* Models Page 173
 D12 Standard Models 173
 D12 AC-Coupled Models 174

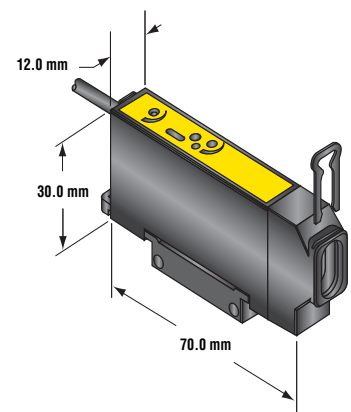


D12 Sensors

- 7-LED bargraph signal strength indicators
- Dual-LED multi-function status indicators
- Sensitivity adjustment
- 2 m or 9 m attached cable, or Pico-style quick disconnect
- 35 mm DIN-rail mountable



**Plastic Fiber Models
Suffix FP and FPY**



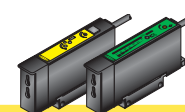
**Glass Fiber Models
Suffix FV and FVY**

D12 Expert™, 10-30V dc



| Models | Sensing Mode/LED* | Maximum Range | Switching Threshold Setting | Cable** | Output Type | Data Sheet | |
|------------------------|-------------------|--|--|---------|-------------|------------|--|
| D12EN6FV D12EP6FV | | Range varies by sensing mode and fiber optics used. See data sheet part number 41974 for maximum range specifications. | Just above the "dark" condition | 2 m | NPN | 41974 | |
| D12E2N6FV D12E2P6FV | | | Midway between "dark" and "light" conditions | | NPN | | |
| D12EN6FP D12EP6FP | | | Just above the "dark" condition | | NPN | | |
| D12E2N6FP D12E2P6FP | | | Midway between "dark" and "light" conditions | | NPN | | |
| | | | | | PNP | | |

D12 and D12 High-Speed, 10-30V dc



| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Output Response | Excess Gain | Data Sheet | | |
|-----------------------------|-------------------|--|------------------------------|-------------|-------------------------------------|----------------------------|------------|--------|----------------------------|
| D12SN6FV D12SN6FVQ | | Range varies by sensing mode and fiber optics used | 2 m 4-Pin Pico Pigtail QD | NPN | 500 μs | EGCG-40 & EGCG-41 (p. 446) | 32822 | | |
| D12SP6FV D12SP6FVQ | | | 2 m 4-Pin Pico Pigtail QD | PNP | | | | | |
| D12SN6FVY D12SN6FVYQ | | | 2 m 4-Pin Pico Pigtail QD | NPN | Selectable 50 μs or 500 μs*** | EGCG-42 & EGCG-43 (p. 446) | | | |
| D12SN6FVY1† D12SN6FVY1Q† | | | 2 m 4-Pin Pico Pigtail QD | | | | | | |
| D12SP6FVY D12SP6FVYQ | | | 2 m 4-Pin Pico Pigtail QD | PNP | | | | | |
| D12SP6FVY1† D12SP6FVY1Q† | | | 2 m 4-Pin Pico Pigtail QD | | | | | | |
| D12SN6FP D12SN6FPQ | | | 2 m 4-Pin Pico Pigtail QD | NPN | | | | 500 μs | EGCP-36 & EGCP-37 (p. 449) |
| D12SP6FP D12SP6FPQ | | | 2 m 4-Pin Pico Pigtail QD | PNP | | | | | |
| D12SN6FPY D12SN6FPYQ | | | 2 m 4-Pin Pico Pigtail QD | NPN | Selectable 50 μs or 500 μs*** | EGCP-38 & EGCP-39 (p. 449) | | | |
| D12SN6FPY1† D12SN6FPY1Q† | | | 2 m 4-Pin Pico Pigtail QD | | | | | | |
| D12SP6FPY D12SP6FPYQ | | | 2 m 4-Pin Pico Pigtail QD | PNP | | | | | |
| D12SP6FPY1† D12SP6FPY1Q† | | | 2 m 4-Pin Pico Pigtail QD | | | | | | |

† Y1 models have 20 milliseconds output pulse stretcher.

* Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D12EN6FV W/30**). A model with a QD requires a mating cable (see page 378).

*** When 50 microseconds is selected, bargraph is disabled.

D12 Series

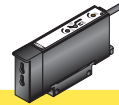
Fiber Systems

D12 High-Power, 10-30V dc



| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Output Response | Excess Gain | Data Sheet |
|-------------------------|-------------------|--|------------------------------|-------------|-----------------|-----------------------------|------------|
| D12SN6FPH D12SN6FPHQ | | Range varies by sensing mode and fiber optics used | 2 m 4-Pin Pico Pigtail QD | NPN | 500 μs | EGCP- 40 & EGCP-41 (p. 449) | 34970 |
| D12SP6FPH D12SP6FPHQ | | | 2 m 4-Pin Pico Pigtail QD | PNP | | | |

D12 AC-Coupled, 10-30V dc



| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Output Response | Data Sheet |
|-------------------------|-------------------|--|------------------------------|-----------------|-----------------|------------|
| D12DAB6FV D12DAB6FVQ | | Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet part number 38384 for range information. | 2 m 4-Pin Pico Pigtail QD | Bipolar NPN/PNP | 50 μs | 38384 |
| D12DAB6FP D12DAB6FPQ | | | 2 m 4-Pin Pico Pigtail QD | | 50 μs | |


* Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D12SN6FPH W/30**). A model with a QD requires a mating cable (see page 378).


D12 Expert™ Specifications

| | |
|------------------------------------|---|
| Supply Voltage and Current | 10 to 30V dc at 45 mA max. (exclusive of load); 10% max. ripple |
| Supply Protection Circuitry | Protected against reverse polarity and transient voltages |
| Output Configuration | NPN open collector (both outputs) or PNP open collector (both outputs), depending on model Load output: NO and programmable Light or Dark-Operate; Alarm output: NO |
| Output Rating | 150 mA max. each output Off-state leakage current: less than 10 μA at 30V dc On-state saturation voltage: less than 1 volt at 10 mA dc and less than 1.5 volts at 150 mA dc. The total load may not exceed 150 mA |
| Output Protection Circuitry | Protected against false pulse on power-up and short circuit of outputs (trips at 175 mA) |
| Output Response Time | 200 microseconds ON/OFF (40 milliseconds OFF when OFF-delay selected) (NOTE: False pulse protection circuit causes a 0.1 second delay on power-up) |
| Output Operation Mode | Light operate or dark operate: selected by push button |
| Output Timing Functions | ON/OFF (no delay) or fixed 40 millisecond OFF-delay; selected by push button |
| Repeatability | 66 microseconds |
| Adjustments | Push-button teach mode sensitivity setting; Remote teaching input is provided |
| Indicators | Green LED lights for DC power ON and flashes when ready for teach mode; 1 Hz when ready to learn first condition; 2 Hz for second condition Yellow LED lights for load output ON (conducting) 7-segment moving dot red LED display indicates relative received light signal strength, output program settings, relative contrast level and alarm |
| Mounting Bracket | D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware |

D12 Expert™ Specifications (cont'd)

| | |
|--------------------------------------|--|
| Construction | Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is Acetal |
| Environmental Rating | Rated NEMA 4; IEC IP66 |
| Connections | PVC-jacketed 2 m or 9 m cables or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cables are ordered separately. See page 378. |
| Operating Conditions | Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing) |
| Certifications (except D10E2) |  |
| Hookup Diagrams | NPN Models: DC27 (p. 482) PNP Models: DC28 (p. 482) |

D12 Standard, High-Speed and High-Power Specifications

| | |
|------------------------------------|--|
| Supply Voltage and Current | 10 to 30V dc at 45 mA max. (exclusive of load) |
| Supply Protection Circuitry | Protected against reverse polarity and transient voltages |
| Output Configuration | Outputs are NPN (sinking) or PNP (sourcing), depending on model Complementary: one normally open (NO) and the other normally closed (NC); NC output may be wired as diagnostic alarm output by reversing power supply connections except high speed "Y" and "Y1" suffix models (see hookups) |
| Output Rating | 150 mA max. each output Off-state leakage current: less than 10 mA at 30V dc On-state saturation voltage: less than 1 volt at 10 mA dc and less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA |
| Output Protection Circuitry | Protected against false pulse on power-up and short circuit of outputs |
| Output Response Time | Standard and High-Power Models: 500 microseconds on/off; High-Speed Models: selectable 50 or 500 microseconds on/off (NOTE: False pulse protection circuit causes a 0.1 second delay on power-up) |
| Output Timing Functions | "Y1" models have fixed 20 milliseconds pulse stretcher (off-delay) when 50 microseconds mode is used |
| Repeatability | 130 microseconds; "Y" and "Y1" models have selectable 50 microseconds/500 microseconds response; repeatability in 50 microseconds mode is 15 microseconds |
| Adjustments | All models have a SENSITIVITY control on top of sensor (15-turn slotted brass screw, clutched at both ends of adjustment); "Y" and "Y1" (high speed models) also have a top-mounted response mode selector switch |
| Indicators | Two top-mounted LED indicators, one yellow and one green, and one 7-segment red LED moving dot bargraph; Note that the 7-segment bargraph and marginal excess gain indication (bargraph segment #7) are inoperative in the 50 µs response mode of "Y" and "Y1" models Green LED lights for DC Power On Yellow LED lights for NORMALLY OPEN OUTPUT CONDUCTING On all models in 500 microseconds response mode, the 7-segment moving dot red LED bargraph lights to indicate relative received light signal strength; On all models in 50 and 500 microseconds response mode, segment #1 flashes to indicate OUTPUT OVERLOAD; On all models in the 500 microseconds response mode, segment #7 flashes to indicate MARGINAL EXCESS GAIN; On standard and high power models, a flashing LED corresponds to the "on" state of the alarm output; (Alarm output not available on Y & Y1 models) |
| Mounting Bracket | D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware |
| Construction | Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is Acetal |
| Environmental Rating | Rated NEMA 4; IEC IP66 |
| Connections | PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cables are ordered separately. See page 378. |
| Operating Conditions | Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing) |
| Certifications |  |
| Hookup Diagrams | NPN Models: DC07 (p. 477) PNP Models: DC08 (p. 477) |

D12 AC-Coupled Specifications

| | |
|------------------------------------|---|
| Supply Voltage and Current | 10 to 30V dc at 60 mA max. (exclusive of load) |
| Supply Protection Circuitry | Protected against reverse polarity and transient voltages |
| Output Configuration | Bipolar: one NPN (current sinking) and one PNP (current sourcing) open-collector transistor |
| Output Rating | 150 mA max. each output Off-state leakage current: less than 10 mA at 30V dc On-state saturation voltage: less than 1 volt at 10 mA dc and less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA |
| Output Protection Circuitry | Protected against false pulse on power-up and short circuit of outputs |
| Output Response Time | 50 microseconds ON/OFF (NOTE: False pulse protection circuit causes a 0.1 second delay on power-up) |
| Output Operation Mode | Light operate or dark operate: selected by switch |
| Output Timing Functions | Pulse output; adjustable from 1 to 70 milliseconds |
| Repeatability | 15 microseconds ON |
| Adjustments | Three top-panel controls: SENSITIVITY control (15-turn slotted brass screw, clutched at both ends of adjustment), a light- or dark-operate select switch, and an OUTPUT PULSE adjustment (3/4-turn potentiometer) |
| Indicators | Three top-mounted LED indicators: Green LED lights to indicate dc Power ON Yellow LED lights for Output Conducting Red LED lights whenever AGC system is locked onto the signal |
| Mounting Bracket | D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware |
| Construction | Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is Acetal |
| Environmental Rating | Rated NEMA 4; IEC IP66 |
| Connections | PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cables are ordered separately. See page 378. |
| Operating Conditions | Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing) |
| Application Note | D12 AC-coupled sensors should not be used in areas of known electrical "noise" or RF fields. |
| Hookup Diagrams | DC06 (p. 477) |



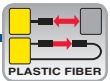
R55F

Glass or Plastic Fiber Optic Sensors

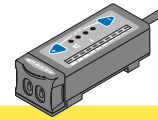
- Delivers outstanding color contrast sensitivity
- Features innovative TEACH function for two options for setting the sensing threshold
- Reliably detects 16 levels of grayscale at up to 10,000 actuations per second
- Available in two fiber types: economical plastic for repeated flexing and glass for harsh conditions
- Easily mounts in confined areas, either flat or to 35 mm DIN rail
- Provides bipolar (NPN/PNP) outputs with delay settings of 0, 20 and 40 milliseconds.

R55 Fiber Optic Sensors

- 10-element signal strength indicator bargraph
- 2 m or 9 m attached cable, or Euro-style quick disconnect
- Simple push-button programming and status indicators
- Models for use with glass or plastic fiber optics
 - Glass fiber models function well in harsh environments typically associated with printing processes.
 - Plastic fiber models function well in applications that require repeated flexing of the fibers.
- Quick fiber installation without tools



R55 Fiber Optic, 10-30V dc



| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Data Sheet |
|---------|-------------------|---|---------------|-----------------|------------|
| R55F | | Range varies by sensing mode and fiber optics used. | 2 m | Bipolar NPN/PNP | 57945 |
| R55FQ | GLASS FIBER | | 5-pin Euro QD | | |
| R55FV | | | 2 m | | |
| R55FVQ | GLASS FIBER | | 5-pin Euro QD | | |
| R55FVG | | | 2 m | | |
| R55FVGQ | GLASS FIBER | | 5-pin Euro QD | | |
| R55FVB | | | 2 m | | |
| R55FVBQ | PLASTIC FIBER | | 5-pin Euro QD | | |
| R55FVW | | | 2 m | | |
| R55FVWQ | GLASS FIBER | | 5-pin Euro QD | | |
| R55FP | | | 2 m | | |
| R55FPQ | PLASTIC FIBER | | 5-pin Euro QD | | |
| R55FPG | | | 2 m | | |
| R55FPGQ | PLASTIC FIBER | | 5-pin Euro QD | | |
| R55FPB | | | 2 m | | |
| R55FPBQ | PLASTIC FIBER | | 5-pin Euro QD | | |
| R55FPW | | | 2 m | | |
| R55FPWQ | PLASTIC FIBER | | 5-pin Euro QD | | |

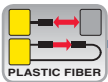
* Infrared LED Visible Red LED Visible Green LED Visible Blue LED Visible White LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **R55F W/30**). A model with a QD requires a mating cable (see page 382).

FI22 Expert™

Low-Profile Inline Fiber Optic Sensors

- Features a low profile for inconspicuous surface mounting
- Includes 8-segment LED light bar that indicates relative received signal strength, sensing contrast, programming status and diagnostic warnings
- Offers TEACH-mode programming for static, dynamic and single-point configuration, and manual adjustment for fine tuning
- Features easy-to-read TEACH and signal strength readout, as well as a continuous readout of operating status
- Can be programmed for either light- or dark-operate output



FI22 Expert™ Sensors

- Push-button TEACH-mode programming
- 2 m or 9 m integral cable, or 6-pin Pico-style quick disconnect
- Easy-to-read 8-segment bargraph status indicator
- Custom bracket for quick snap-in mounting



Plastic Fiber Models
Suffix FP



FI22 Expert™, 10-30V dc

| Models | Sensing Mode/LED* | Range | Cable** | Output Type | Excess Gain | Beam Pattern | Data Sheet |
|---------|-------------------|--|---------------|------------------------|---|--|------------|
| FI22FP | | Range varies by sensing mode and fiber optics used. See data sheet part number 108899 for maximum range specifications. | 2 m | Bipolar NPN/PNP | Opposed mode: EGCP-42, EGCP-43 & EGCP-44 (p. 449) | Opposed mode: BPP-36, BPP-37 & BPP-38 (p. 467) | 108899 |
| FI22FPQ | | | 6-pin Pico QD | | Diffuse mode: EGCP-45, EGCP-46 & EGCP-47 (p. 449) | Diffuse mode: BPP-39, BPP-40 & BPP-41 (p. 467) | |

* Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **FI22FP W/30**). A model with a QD requires a mating cable (see page 379).

FI22 Expert™ Specifications

| | |
|------------------------------------|---|
| Supply Voltage | 10 to 30V dc (10% max. ripple) @ less than 32 mA exclusive of load |
| Supply Protection Circuitry | Protected against reverse polarity, over voltage, and transient voltages |
| Delay at Power Up | 250 milliseconds max.; outputs do not conduct during this time |
| Output Configuration | Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN) |
| Output Rating | 100 mA max. load @25° C (derate 1 mA per ° C increase) OFF-state leakage current: less than 50 µA at 30V dc ON-state saturation voltage: NPN: less than 200 mV @ 10 mA and 1V @ 100 mA load PNP: less than 1.5V @ 10 mA and 2.0V @ 100 mA load |
| Output Protection | Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power up |
| Output Response Time | 500 microseconds |
| Repeatability | 100 microseconds |
| Adjustments | 2 push buttons and remote wire <ul style="list-style-type: none"> • Expert TEACH programming (two-point static, dynamic and single-point static) • Manually adjust (+/-) thresholds (from buttons only – not available from remote wire) • LO/DO and OFF Delay configurable (from buttons or remote wire) • Push-button lockout (from remote wire only) |
| Indicators | 8-segment red bargraph: Light-to-dark signal difference relative to taught condition (single-point TEACH) Sensing contrast (two-point TEACH) Green LED: Power ON Yellow LED: Output conducting |
| Construction | PC/ABS blend plastic housing; polycarbonate cover |
| Environmental Rating | IP67; NEMA 6 |
| Connections | 5-conductor 2 m PVC cable, 9 m PVC cable, or 6-pin integral Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 379. |
| Operating Conditions | Temperature: -10° to +55° C Relative humidity: 90% @ 50° C (non-condensing) |
| Certifications | |
| Hookup Diagrams | DC11 (p. 478) |

Plastic Fiber Optics

- Provide an economical alternative to glass fiber optics for piping photoelectric sensing light to and from confined areas with suitable environments
- Ideal for detecting small objects
- Withstand repeated flexing and bending
- Available in individual or bifurcated styles*
- Available with optional DURA-BEND™ fibers for improved flexibility for difficult-to-access locations, without the decreased performance to which excessively bent standard plastic fibers optics are prone
- Available with core diameters of 0.25, 0.50, 0.75, 1.0 and 1.5 mm



Plastic Fiber Optic Model Key



PLASTIC FIBER FAMILY designator

Same for all plastic fibers

ASSEMBLY STYLE designator

- B** = Bifurcated fiber
- I** = Individual fiber*
- DI** = Dual Individual fiber*

SENSING END designator

- A** = 90° Angle
- AT** = 90° Angle/Thread
- CF** = Coaxial Ferrule
- CT** = Coaxial Thread
- E** = Encapsulated
- EFP** = Extended Ferrule Probe
- F** = Ferrule
- FM** = Ferrule Miniature
- FMP** = Ferrule Miniature Probe
- L** = Lensed
- P** = Probe
- PF** = Probe Ferrule
- PMSB** = Probe Miniature Side-view Bendable
- PS** = Probe Side-view
- PSB** = Probe Side-view Bendable
- PSM** = Probe Side-view Miniature
- R** = Rectangular
- RS** = Rectangular Side-view
- T** = Thread
- TA** = Thread/90° Angle
- TP** = Thread/Probe

MODIFICATIONS designator

"MXX" = Sensing end tip modification

CONTROL END designator

- T5** = Terminated
- TMB5** = STEELSKIN™ braiding over monocoil reinforcement
- U** = Unterminated straight cable**
- UC** = Unterminated Coiled cable
- UHF** = Unterminated DURA-BEND™ multi-core cable

FIBER LENGTH designator

- 3** = 1 m (1000 mm)
- 6** = 2 m (2000 mm)
- 100** = 30 m (30480 mm)

FIBER CORE DIAMETER designator

- 1** = 0.25 mm
- 2** = 0.50 mm
- 3** = 0.75 mm
- 4** = 1.00 mm
- 6** = 1.50 mm
- 1X4** = 4 x 0.25 mm
- 1X16** = 16 x 0.265 mm
- 1X32** = 32 x 0.265 mm

* All individual plastic fiber optics are sold and used in pairs. Bifurcated fibers are two-way fibers with a single sensing end that both emits and receives light and with dual-control sensor ends that attach separately to the sensor's LED and photodetector.
 ** Plastic fibers with "U" in the suffix of the model numbers have unterminated control ends; cut them to the required length. Use supplied cutter.

Plastic Fiber Optics Specifications

| | |
|--------------------------------------|---|
| Construction | <p>Optical Fiber: acrylic (PMMA) monofilament, except as noted.</p> <p>Protective Jacket: black polyethylene, except as noted</p> <p>Threaded End Tips and Hardware: nickel-plated brass, except as noted.</p> <p>Probe End Tips: annealed (bendable) 304 stainless steel</p> <p>Angled End tips: hardened 304 stainless steel</p> <p>Ferrule End Tips: 303 stainless steel</p> |
| Sensing Range | Refer to the specific fiber optic/sensor combination |
| Implied Dimensional Tolerance | <p>All dimensions are in millimeters: x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified.</p> <p>“L” = ±40 mm per meter</p> |
| Minimum Bend Radius | <p>8 mm for 0.25 mm diameter fibers</p> <p>12 mm for 0.5 mm diameter fibers (except DURA-BEND™)</p> <p>25 mm for 1.0 mm diameter fibers (except DURA-BEND™)</p> <p>38 mm for 1.5 mm diameter fibers</p> |
| Repeat Bending/Flexing | Life expectancy of plastic fiber optic cable is in excess of one million cycles at bend radii of no less than the minimum and a bend of 90° or less. Avoid stress at the point where the cable enters the sensor (“control end”) and at the sensing end tip. Coiled plastic fiber optic assemblies are recommended for any application requiring reciprocating fiber motion. |
| Chemical Resistance | The acrylic core of the monofilament optical fiber will be damaged by contact with acids, strong bases (alkalis) and solvents. The polyethylene jacket will protect the fiber from most chemical environments. However, materials may migrate through the jacket with long term exposure. Samples of fiber optic material are available from Banner for testing and evaluation. |
| Temperature Extremes | Temperatures below -30° C will cause embrittlement of the plastic materials but will not cause transmission loss. Temperatures above +70° C will cause both transmission loss and fiber shrinkage. |
| Operating Temperature | -30° to +70° C, unless otherwise specified |

⚠ APPLICATION NOTES AND WARNINGS ⚠

- 1** Plastic fiber assemblies with “U” in the suffix of the model numbers have unterminated control ends (the end that is coupled to the photoelectric sensor). The customer can cut these fiber optic assemblies to the required length using the supplied cutter. Use only the supplied cutter to ensure optimal light coupling efficiency.
- 2** Terminated plastic fiber assemblies are optically ground and polished and cannot be shortened, spliced or otherwise modified.
- 3** Do not subject the plastic fibers to sharp bends, pinching, high tensile loads or high levels of radiation.
- 4** When ordering fiber lengths in excess of 2 m, take into account light signal attenuation due to the additional length.
- 5** Due to their light transmission properties, plastic fiber optics are recommended for use only with visible light fiber optic sensors.
- 6** Use caution when applying fiber optics in hazardous locations. Although fiber optic assemblies are, by themselves, intrinsically safe, the sensor and associated electronics must be LOCATED IN A SAFE ENVIRONMENT. Alternatively, fiber optics may be used with NAMUR sensor model Q45AD9FP (page 152). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.

Plastic Fiber Optics

Fiber Systems

PHOTOELECTRICS



| MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|---|----------------------|----------------|-----------------------|---------------------------------------|--------------------|
| PBF16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Smooth ferrule | NA |
| PBF26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Smooth ferrule | NA |
| PBF46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Smooth ferrule | NA |
| PBF46UM3MJ1.3 <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Smooth ferrule; thin jacket (ø 1.3) | NA |
| PBF66U <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • Smooth ferrule; long range | NA |
| PBFM16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Non-bendable miniature tip | NA |
| PBFM46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Smooth ferrule | NA |
| PBT16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Thread | NA |
| PBT26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Thread | NA |
| PBT46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Thread | NA |
| PBT66U <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • Thread; long range | NA |

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.
NA: WORLD-BEAM QS18 not recommended.

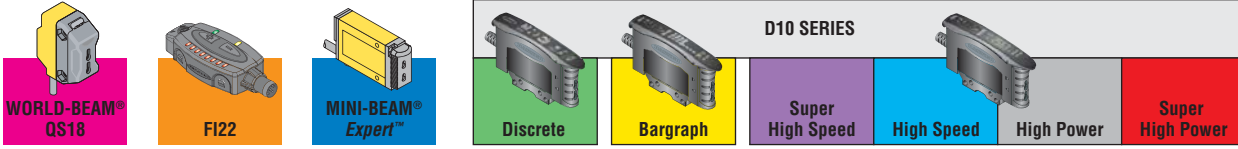


| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|-----------|--|----------------------|----------------|-----------------------|-------------------------------------|--------------------|
| | | | | | | |
| PROBE | PBEFP26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Smooth ferrule; non-bendable tip | NA |
| | PBFMP16UMP.2 <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Smooth ferrule; non-bendable tip | NA |
| | PBP16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Thread; bendable tip | NA |
| | PBP26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Thread; bendable tip | NA |
| | PBP46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Thread; bendable tip | NA |
| | PBPF26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Thread; bendable tip | NA |
| | PBPF26UMB <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Flat mounting block; bendable tip | NA |
| | PBPMSB36U <i>Detailed Dimensions Online</i> | | 0.75 | 20 | • Smooth ferrule; bendable tip | NA |
| | PBPS26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Smooth ferrule; non-bendable tip | NA |
| | PBPS46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Smooth ferrule; non-bendable tip | NA |
| SIDE-VIEW | PBPS46UMT <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Thread; non-bendable tip | NA |
| | PBPS66U <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • Smooth ferrule; non-bendable tip | NA |

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.
 NA: WORLD-BEAM QS18 not recommended.

Plastic Fiber Optics

Fiber Systems



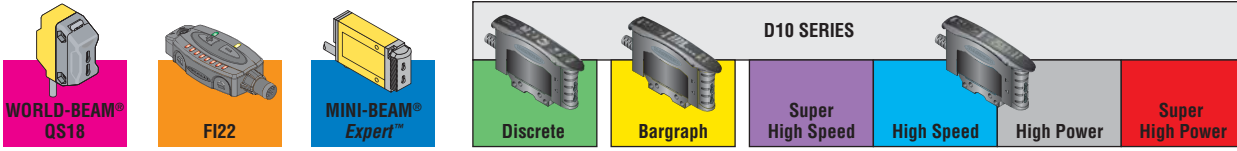
| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|----------------------|---|----------------------|------------------|-----------------------|---|---------------------------------------|
| COAXIAL | PBCF21X46U <i>Detailed Dimensions Online</i> | | 0.5 4X 0.25 | 12 | • Miniature probe tip | NA 20 40 60 80 100 120 |
| | PBCF46U <i>Detailed Dimensions Online</i> | | 1.0 16X 0.265 | 25 | • Smooth ferrule | 50 100 150 200 250 300 350 |
| | PBCT21X46U <i>Detailed Dimensions Online</i> | | 0.5 4X 0.25 | 12 | • Miniature thread | NA 20 40 60 80 100 120 |
| | PBCT26U <i>Detailed Dimensions Online</i> | | 0.5 9X 0.25 | 12 | • Thread | NA 20 40 60 80 100 120 140 160 180 |
| | PBCT26UM3 <i>Detailed Dimensions Online</i> | | 0.5 9X 0.25 | 12 | • Miniature thread | NA 20 40 60 80 100 120 140 160 180 |
| | PBCT26UM4M2.5 <i>Detailed Dimensions Online</i> | | 0.5 9X 0.25 | 12 | • Thread | NA 20 40 60 80 100 120 140 160 180 |
| | PBCT46U <i>Detailed Dimensions Online</i> | | 1.0 16X 0.265 | 25 | • Thread | 50 100 150 200 250 300 350 |
| HIGH-FLEX | PBFM1X43T5 <i>Detailed Dimensions Online</i> | | 4X 0.25 | 8 | • Best for repetitive flexing (1,000s of cycles) | NA 10 20 30 40 50 |
| | PBP46UC <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • For applications involving reciprocating motion | 20 40 60 80 100 120 |
| | PBT46UC <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • For applications involving reciprocating motion | 20 40 60 80 100 120 |
| CONVERGENT BEAM SPOT | PLI-A10 <i>Detailed Dimensions Online</i> | | 0.5 9X 0.25 | 12 | • Anodized AL tip; ø 0.5 - 3.2 mm beam spot • Glass lens | |

NA: WORLD-BEAM QS18 not recommended.

NA: MINI-BEAM Expert™ not recommended.

Indicates lens available for model. See page 189 for details.

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.



| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|-----------------------|---|----------------------|----------------|-----------------------|--|--------------------|
| DURA-BEND | PBF46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Smooth ferrule | |
| | PBFM46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Smooth ferrule | |
| | PBP46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Thread; bendable tip | |
| | PBPS46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Smooth ferrule; non-bendable tip | |
| | PBT26UHF <i>Detailed Dimensions Online</i> | | 0.5 | 1 | • Thread | |
| | PBT46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Thread | |
| AREA SENSING (ARRAY) | PBR1X326U <i>Detailed Dimensions Online</i> | | 32X 0.265 | 25 | • Rectangular tip | |
| | PBR5X326U <i>Detailed Dimensions Online</i> | | 32X 0.265 | 25 | • Rectangular tip; side sensing | |
| MECHANICAL CONVERGENT | P22-C1 <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Straight exit with lenses; 3 mm range; DURA-BEND fiber | |
| | P12-C1 <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Side exit with lenses; 3 mm range; DURA-BEND fiber | |
| | P32-C2 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Flat mount; 2 mm range; DURA-BEND fiber | |

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.
NA: WORLD-BEAM QS18 not recommended.

Plastic Fiber Optics

Fiber Systems

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| MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|--|----------------------|----------------|-----------------------|--------------------------------------|--------------------|
| PBAT43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • 90° Angle/Thread | |
| PBCT23TMB5 <i>Detailed Dimensions Online</i> | | 0.5 9X 0.25 | 12 | • Miniature thread | |
| PBCT23TMB5M4 <i>Detailed Dimensions Online</i> | | 0.5 9X 0.25 | 12 | • Thread | |
| PBF43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Smooth ferrule | |
| PBPS43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Smooth ferrule; non-bendable tip | |
| PBT43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Thread | |
| PBTA43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Thread/90° Angle | |
| PBTP43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Thread; bendable tip | |
| PBT26UHT1 <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Thread; withstands 125° C (257° F) | |
| PBT46UHT1 <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Thread; withstands 125° C (257° F) | |

NA: WORLD-BEAM QS18 not recommended.

DIFFUSE STEELSKIN

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| MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|--|----------------------|----------------|-----------------------|---|---------------------------------------|
| PIA16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • 90° Angle | NA 5 10 15 20 25 30 35 40 |
| PIA26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • 90° Angle | NA 20 40 60 80 100 120 140 160 180 |
| PIAT16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • 90° Angle/Thread | NA 20 40 60 80 100 |
| PIAT26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • 90° Angle/Thread | NA 50 100 150 200 250 300 |
| PIAT46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • 90° Angle/Thread | NA 200 400 600 800 1000 |
| PIAT46UM.4X.4MT <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • 90° Angle/Thread | NA 200 400 600 800 1000 |
| PIAT66U <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • 90° Angle/Thread; long range | NA 500 1000 1500 2000 |
| PIF16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Smooth ferrule | NA 10 20 30 40 50 60 70 80 90 |
| PIF26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Smooth ferrule | NA 50 100 150 200 250 300 350 400 |
| PIF26UMLS <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Smooth ferrule; thick jacket (ø 2.2 mm) | NA 50 100 150 200 250 300 350 400 |

NA: WORLD-BEAM QS18 not recommended.

190 More information online at bannerengineering.com

Indicates lens available for model. See page 195 for details.

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.



| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) | |
|---|--|---|----------------|-----------------------|--|------------------------------------|--|
| | | | | | | | |
| STANDARD | PIF46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Smooth ferrule | | |
| | PIF66U <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • Smooth ferrule; long range | | |
| | PIFM46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Smooth ferrule; miniature tip | | |
| | PIL46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Plastic lens; ultra-long range • Lens available separately, see page 195. | | |
| | PIT16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Thread | | |
| | PIT26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Thread | | |
| | PIT46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Thread | | |
| | PIT66U <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • Thread; long range | | |
| | PROBE | PIP16U <i>Detailed Dimensions Online</i> | | 0.25 | 8 | • Smooth ferrule; non-bendable tip | |
| | | PIP26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Thread; bendable tip | |
| PIP46U <i>Detailed Dimensions Online</i> | | | 1.0 | 25 | • Thread; bendable tip | | |



Indicates lens available for model. See page 195 for details.



Indicates fiber can be Free Cut using Fiber Cutter. See page 197.

NA: WORLD-BEAM QS18 not recommended.

Plastic Fiber Optics

Fiber Systems

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| MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|---|----------------------|--------------------------|--------------------------|--|--------------------|
| PLIS-1 <i>Detailed Dimensions Online</i> | | 0.5 | 12 | <ul style="list-style-type: none"> Low beam divergence angle of 2° Ideal for wafer mapping | |
| PIPS26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | <ul style="list-style-type: none"> Smooth ferrule; non-bendable tip | |
| PIPS46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | <ul style="list-style-type: none"> Smooth ferrule; non-bendable tip | |
| PIPS66U <i>Detailed Dimensions Online</i> | | 1.5 | 38 | <ul style="list-style-type: none"> Smooth ferrule; non-bendable tip | |
| PIPSB46U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | <ul style="list-style-type: none"> Smooth ferrule; bendable tip | |
| PIPSM26U <i>Detailed Dimensions Online</i> | | 0.5 | 12 | <ul style="list-style-type: none"> Miniature smooth ferrule; non-bendable tip | |
| L2RA <i>Detailed Dimensions Online</i> | | <i>ref. model PIT46U</i> | <i>ref. model PIT46U</i> | <ul style="list-style-type: none"> Compact glass prism M2.5 thread | |
| PIFM1X46U <i>Detailed Dimensions Online</i> | | 4X 0.25 | 8 | <ul style="list-style-type: none"> Best for repetitive flexing (1,000s of cycles) | |
| PIT1X46U <i>Detailed Dimensions Online</i> | | 4X 0.25 | 8 | <ul style="list-style-type: none"> Best for repetitive flexing (1,000s of cycles) | |
| PIP46UC <i>Detailed Dimensions Online</i> | | 1.0 | 25 | <ul style="list-style-type: none"> For applications involving reciprocating motion | |
| PIT46UC <i>Detailed Dimensions Online</i> | | 1.0 | 25 | <ul style="list-style-type: none"> For applications involving reciprocating motion | |

Indicates lens available for model. See page 195 for details.

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.

NA: WORLD-BEAM QS18 not recommended.



| MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|--|----------------------|----------------|-----------------------|--|--------------------|
| PIAT46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • 90° Angle/Thread | |
| PIF46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Smooth ferrule | |
| PIFM46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Smooth ferrule; miniature tip | |
| PIP46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Thread; bendable tip | |
| PIPS46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Smooth ferrule; non-bendable tip | |
| PIPSB46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Smooth ferrule; bendable tip | |
| PIT26UHF <i>Detailed Dimensions Online</i> | | 0.5 | 1 | • Thread | |
| PIT46UHF <i>Detailed Dimensions Online</i> | | 1.0 | 1 | • Thread | |
| PIE46UT <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Fluoropolymer encapsulated; lens | |
| PIE66UTMNL <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • Fluoropolymer encapsulated; large effective beam | |
| PIES46UT <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • Fluoropolymer encapsulated; side-view prism | |

Indicates lens available for model. See page 195 for details.

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.

NA: WORLD-BEAM QS18 not recommended.

Plastic Fiber Optics

Fiber Systems

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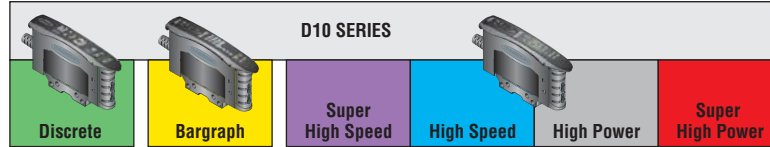


| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|---|--|--|---|---|--|--------------------------------------|
| OPPOSED | AREA SENSING (ARRAY) | <p>PIR1X166U <i>Detailed Dimensions Online</i></p> | 16X 0.265 | 25 | • Ultra-compact head; straight exit; 5.25 mm width | NA |
| | | <p>PIRS1X166U <i>Detailed Dimensions Online</i></p> | 16X 0.265 | 25 | • Ultra-compact head; side exit; 5.25 mm width | NA |
| | | <p>PIRS1X166UM.4 <i>Detailed Dimensions Online</i></p> | 16X 0.265 | 25 | • Compact head; side exit; 10 mm width | NA |
| | | <p>PIRS1X166UMPM.75 <i>Detailed Dimensions Online</i></p> | 16X 0.265 | 25 | • Side exit; 19 mm width | NA |
| | | <p>PIRS1X166UMPMAL <i>Detailed Dimensions Online</i></p> | 16X 0.265 | 25 | • Side exit; 34 mm width | NA |
| | | HIGH TEMP | <p>PIT26UHT1 <i>Detailed Dimensions Online</i></p> | 0.5 | 12 | • Thread; withstands 125° C (257° F) |
| <p>PIT46UHT1 <i>Detailed Dimensions Online</i></p> | 1.0 | | 25 | • Thread; withstands 125° C (257° F) | NA | |
| SLOT | <p>PDIS46UM12 <i>Detailed Dimensions Online</i></p> | 1.0 | 25 | • Easy mount "fork" head; DURA-BEND fiber | | |
| | <p>PDISM46UM5MA <i>Detailed Dimensions Online</i></p> | 1.0 | 25 | • 90° Angle; compact "fork" head; DURA-BEND fiber | | |

NA: WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 195 for details.

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.



| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|---------------------|--|----------------------|-------------------|-----------------------|---|------------------------------------|
| OPPOSED STEELSKIN | PIA43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • 90° Angle/Thread | |
| | PIF43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Smooth ferrule | |
| | PIPS43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Smooth ferrule; non-bendable tip | |
| | PIT43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Thread | |
| | PITA43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Thread/90° Angle | |
| | PITP43TMB5 <i>Detailed Dimensions Online</i> | | 1.0 | 12 | • Thread; bendable tip | |
| DUAL INDIVIDUAL | PDIT26T5 <i>Detailed Dimensions Online</i> | | 0.5 | 12 | • Accomplish 2 inspections using only one sensor | NA |
| | PDIT4100U <i>Detailed Dimensions Online</i> | | 1.0 | 25 | • 30 m duplex fiber cable | Contact factory for sensing range. |
| VACUUM | PIF66UM.52M.19D <i>Detailed Dimensions Online</i> | | 1.5 | 38 | • For use with VFT-M8MVS (ambient side) See page 203. | Contact factory for sensing range. |
| EXTENDED RANGE LENS | L2 <i>Detailed Dimensions Online</i> | | ref. model PIT46U | ref. model PIT46U | • Range-extending lens • M2.5 thread | |
| | LO8FP <i>Detailed Dimensions Online</i> | | ref. model PIL46U | ref. model PIL46U | • Ultra-long range-extending lens; use with raw plastic fiber | |

Indicates lens available for model. See this page for details.

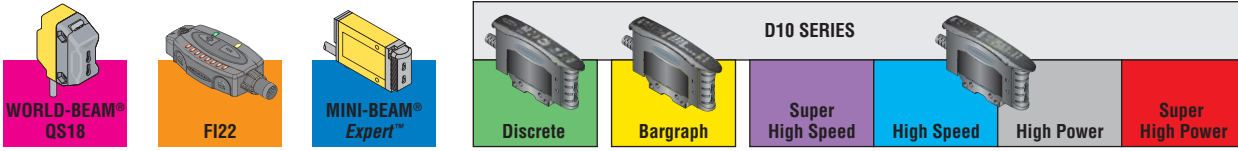
NA: WORLD-BEAM QS18 not recommended.

Indicates fiber can be Free Cut using Fiber Cutter. See page 197.

NA: MINI-BEAM Expert™ not recommended.


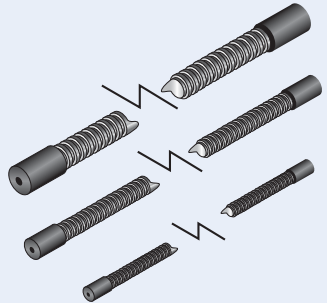
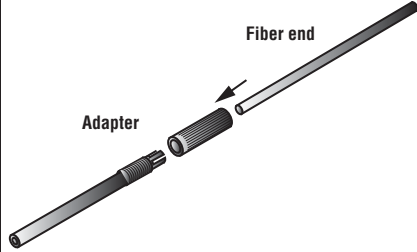
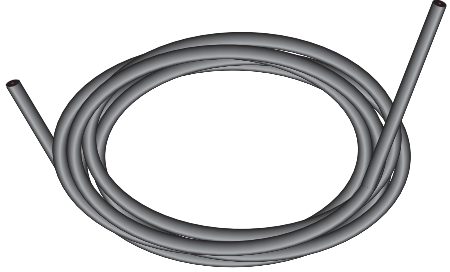
Plastic Fiber Optics

Fiber Systems



| | | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|---------|-----------|---|----------------------|----------------|-----------------------|---|--------------------|
| OPPOSED | HIGH-TEMP | BMT16.6S-HT <i>Detailed Dimensions Online</i> | | 1.57 | 19 | <ul style="list-style-type: none"> High performance glass fiber optics for use with Banner D10 plastic fiber sensors Miniature thread; end tip withstands 315° C (600° F) | |
| | | IMT.756.6S-HT* <i>Detailed Dimensions Online</i> | | 1.27 | 19 | <ul style="list-style-type: none"> High performance glass fiber optics for use with Banner D10 plastic fiber sensors Miniature thread; end tip withstands 315° C (600° F) | |

Indicates lenses available for model. See page 195 for details.
 NA: WORLD-BEAM QS18 not recommended.
 NA: MINI-BEAM Expert™ not recommended.
 * Fibers are sold separately, must order two fibers to form a pair.

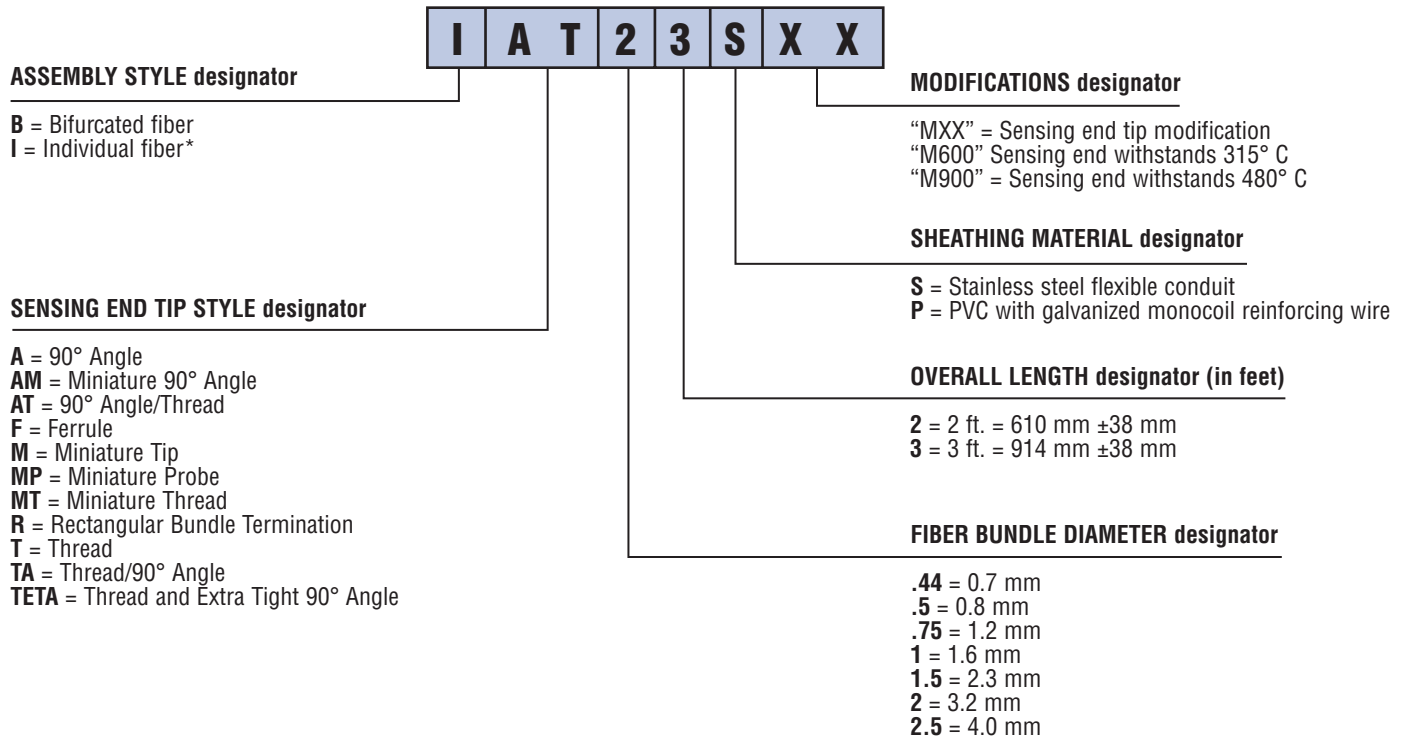
| | | MODEL NUMBER | MODEL SPECIFIC FEATURES | GENERAL FEATURES | DRAWING | |
|---|--|-------------------|---|---|---|---|
| FIBER CUTTERS | | PFK20 | <ul style="list-style-type: none"> For use with 0.25 mm and 0.5 mm diameter cables. | <ul style="list-style-type: none"> These kits are used with unterminated plastic fiber cables. Each kit contains 40 bushings and 10 cutter assemblies (cutters can be purchased separately in packages of 25 - reference model PFC-2-25) |  <p>NOTE: Bushings used with Q45, OMNI-BEAM, ECONO-BEAM, MAXI-BEAM and VALU-BEAM sensors only.</p> | |
| | | PFK40 | <ul style="list-style-type: none"> For use with 1 mm and 1.5 mm diameter cables. | | | |
| | | MODEL NUMBER | MODEL SPECIFIC FEATURES | GENERAL FEATURES | DRAWING | |
| PLASTIC FIBER FIELD-INSTALLABLE SHEATHING | | PFS69S6T | <ul style="list-style-type: none"> May be used with bifurcated fiber assemblies having M6 x 0.75 threaded end tips (e.g., PBCT46U, PBP46U, PBT46UHT1, and PBT66U). | <ul style="list-style-type: none"> Stainless-steel sheathing with stainless-steel end fittings (one end internally threaded to capture fiber end tips, other end non-threaded) is used in applications where protection is required for plastic fiber optic cables. All models listed are 1.8 m in length. Other lengths are available by contacting Banner Applications Department. |  | |
| | | PFS53S6T | <ul style="list-style-type: none"> May be used with individual or bifurcated fiber assemblies having M4 x 0.7 threaded end tips (e.g., PBCT26U, PBP26U, PIP46U, PIT46U, and PIT66U). | | | |
| | | PFS44S6T | <ul style="list-style-type: none"> May be used with individual fiber assemblies having M3 x 0.5 threaded end tips (e.g., PIP26U, PIT26U and PIT1X46U). | | | |
| PLASTIC FIBER ADAPTERS | | UPFA-1-100 | <ul style="list-style-type: none"> Use to adapt plastic fiber optic cables with outside jacket diameter of 1.0 mm, such as PIT26U and PBP16U. | <ul style="list-style-type: none"> Compression fitting adapters are used with small-diameter unterminated plastic fiber cables. Use when interfacing small-diameter plastic fibers to D10, D11, D12, PC44, QM42, Q23, QS18, R55F, FI22, and MINI-BEAM plastic fiber sensor families. Each kit contains 100 pairs of adapters. One pair will interface either one bifurcated fiber optic cable or a pair of individual cables to a fiber optic amplifier. |  | |
| | | UPFA-2-100 | <ul style="list-style-type: none"> Use to adapt plastic fiber optic cables with outside jacket diameter of 1.25 mm or 1.3 mm, such as PBCT26U and PBF46UM3MJ1.3. | | | |
| | | MODEL NUMBER | CORE | LENGTH | TYPE | DRAWING |
| UNTERMINATED INDIVIDUAL AND BIFURCATED PLASTIC FIBERS | | PIU230U | 0.5 mm | 9 m | Single |  |
| | | PIU260U | | 18 m | | |
| | | PIU430U | 1.0 mm | 9 m | Single | |
| | | PIU460U | | 18 m | | |
| | | PIU630U | 1.5 mm | 9 m | Single | |
| | | PIU660U | | 18 m | | |
| | | PBU430U | 1.0 mm | 9 m | Duplex | |
| | | PBU460U | | 18 m | | |

Glass Fiber Optics

- Solve numerous challenging sensing applications in the most hostile environments, including temperatures up to 480° C, corrosive materials and extreme moisture
- Withstand severe shock and vibration
- Ignore extreme electrical noise
- Constructed of a combination of optical glass fiber, stainless steel, PVC, brass, molded thermoplastics and optical-grade epoxy



Glass Fiber Optic Model Key



* Individual glass fibers are packaged separately.

Glass Fiber Optics Specifications

| | |
|---------------------------------------|--|
| Construction | Combination of optical glass fiber, stainless steel or PVC, brass, molded thermoplastics, and optical-grade epoxy. Optical fiber is F2 core, EN1 clad, approx. 50 µm diameter per strand. Flexible steel interlock sheathing is 302 stainless. |
| Sensing Range | Refer to the specific fiber optic to be used. |
| Bend Radius | Inside bend radius must be 12 mm or greater for PVC covered fiber optic assemblies, and 25 mm or greater for stainless steel armored cable covered fibers. |
| Length | Standard length for assemblies is 915 mm; see dimension diagrams. Most models are available from the factory with shorter or longer cable lengths, up to 18 m max. |
| Length Dimension Tolerance | Overall assembly length: ±12 mm per 300 mm of length Shrink junction dimensions: ±12 mm |
| Implied Dimensional Tolerances | All dimensions are in millimeters: x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified. |
| Operating Conditions | Fiber assemblies with stainless-steel (SS) sheathing and metal end tips: -140° to +249° C Fiber assemblies with PVC sheathing and/or plastic end tips: -40° to +105° C Special order assemblies with SS sheathing and metal end tips and model suffix "M600": -140° to +315° C* Special order assemblies with SS sheathing and metal end tips and model suffix "M900": -140° to +480° C*; note dimensional changes from STD models * sensing end tip only |

⚠ APPLICATION NOTES AND WARNINGS ⚠

- 1** The ends of glass fiber optic assemblies are optically ground and polished. Care taken in this manufacturing process accounts for the light coupling efficiency of the fiber optic assembly. As a result, glass fiber assemblies cannot be shortened, spliced, or otherwise modified.
- 2** Use caution when applying fiber optics in hazardous locations. Although fiber optic assemblies are, by themselves, intrinsically safe, the sensor and associated electronics must be LOCATED IN A SAFE ENVIRONMENT. Alternatively, fiber optics may be used with sensor model SMI912FQD (page 32). This sensor is approved for use inside hazardous areas when used with an appropriate intrinsic barrier. Also, see NAMUR sensor models Q45AD9F (page 152) and MIAD9F (page 86). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.
- 3** In applications where glass fibers to insulate the control from high voltage, specify silicone rubber, Teflon®, or high-density polyethylene sheathing with no reinforcing wire in the cable. It is the responsibility of the user to test each fiber optic assembly for insulation capacity.
- 4** Do not subject the fibers to sharp bends, pinching, repeated flexing or high levels of radiation.
- 5** When ordering fiber lengths in excess of 1 m, take into account light signal reduction of 5 percent per 300 mm of additional length.

Glass Fiber Optics

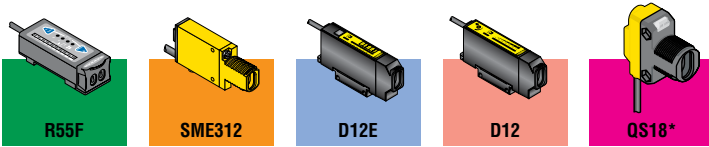
Fiber Systems



* Range data for QS18F not available at printing.

M600 Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23SM600).
M900 Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23SM900).

| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|----------------------|---|----------------------|----------------|-----------------------|---|--------------------|
| STANDARD | BA23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • 90° Angle M600 M900 | |
| | BAT23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • 90° Angle/Thread M600 M900 | |
| | BF23P <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Smooth ferrule M600 M900 | |
| | BMT.442P <i>Detailed Dimensions Online</i> | | 0.69 | 9.5 | • Miniature thread | |
| | BT23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Thread M600 M900 | |
| | BTA23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Thread/90° Angle M600 M900 | |
| MINIATURE PROBE | BAM.752S <i>Detailed Dimensions Online</i> | | 1.17 | 19 | • ø 1.5 mm non-bendable probe; 90° angle M600 | |
| | BM.752S <i>Detailed Dimensions Online</i> | | 1.17 | 19 | • ø 1.5 mm non-bendable probe M600 | |
| | BMP.753P <i>Detailed Dimensions Online</i> | | 1.17 | 9.5 | • ø 1.5 mm non-bendable probe | |
| AREA SENSING (ARRAY) | BR2.53S <i>Detailed Dimensions Online</i> | | 3.96 | 19 | • Straight exit; 38 mm width M600 | |
| | BR23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Straight exit; 10 mm width M600 | |



* Range data for QS18F not available at printing.



M600 Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23SM600).

M900 Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23SM900).

| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|------------------------------------|---|----------------------|---|---|---|---|
| D I F F U S E S I D E - V I E W | BA1.53SMETA <i>Detailed Dimensions Online</i> | | 2.29 | 19 | • Ultra-compact head M600 | |
| | BA1.53SMTA <i>Detailed Dimensions Online</i> | | 2.29 | 19 | • Compact head M600 | |
| | BTETA1.53S <i>Detailed Dimensions Online</i> | | 2.29 | 19 | • Ultra-compact head; thread M600 | |
| D I F F U S E V A C U U M | BMT13SMVF <i>Detailed Dimensions Online</i> | | 1.57 | 19 | • Miniature thread; entire cable withstands 480° C (900° F) | <i>Contact factory representative for range information</i> |
| | L10 <i>Detailed Dimensions Online</i> | | <i>ref. glass fiber key or call factory</i> | <i>ref. glass fiber key or call factory</i> | • Glass lens; withstands 315° C (600° F) • Focuses light to .80 mm with ø 1.6 mm fiber | |



Glass Fiber Optics—Additional Models Available

In addition to the configurations shown, Banner offers thousands of readily available alternative fiber models:

- Substitute PVC over monocoil sheathing for stainless steel.
- Reduce or increase glass fiber optic bundle diameters.
Example: Change ø 3.18 mm bundle to ø 1.57 mm.
- Substitute a rectangular-shaped fiber bundle (0.5 mm x 2.5 mm) for a circular bundle.
- Change endtip material from brass to stainless steel.
- Modify straight or angled probe tip dimensions.
- Modify overall fiber length in intervals of 305 mm (standard lengths are 914 mm and 610 mm).

Glass Fiber Optics

Fiber Systems



* Range data for QS18F not available at printing.



M600 Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23SM600).
M900 Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23SM900).

| | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|------------------------|---|----------------------|----------------|-----------------------|---|--------------------|
| STANDARD | IA23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • 90° Angle M600 M900 | |
| | IAT23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • 90° Angle/Thread M600 M900 | |
| | IF23P <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Smooth ferrule M600 M900 | |
| | IMT.442P <i>Detailed Dimensions Online</i> | | 0.69 | 9.5 | • Miniature thread M600 M900 | |
| | IT23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Thread M600 M900 | |
| | ITA23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Thread/90° Angle M600 M900 | |
| MINIATURE PROBE | IAM.752S <i>Detailed Dimensions Online</i> | | 1.17 | 19 | • ø 1.5 mm non-bendable probe; 90° angle M600 | |
| | IM.752S <i>Detailed Dimensions Online</i> | | 1.17 | 19 | • ø 1.5 mm non-bendable probe M600 | |
| | IMP.753P <i>Detailed Dimensions Online</i> | | 1.17 | 9.5 | • ø 1.5 mm non-bendable probe M600 | |
| AREA DETECTION (ARRAY) | IR2.53S <i>Detailed Dimensions Online</i> | | 3.96 | 19 | • Straight exit; 38 mm width M600 | |
| | IR23S <i>Detailed Dimensions Online</i> | | 3.18 | 19 | • Straight exit; 10 mm width M600 | |

Indicates lenses available for model. See page 203 for details.

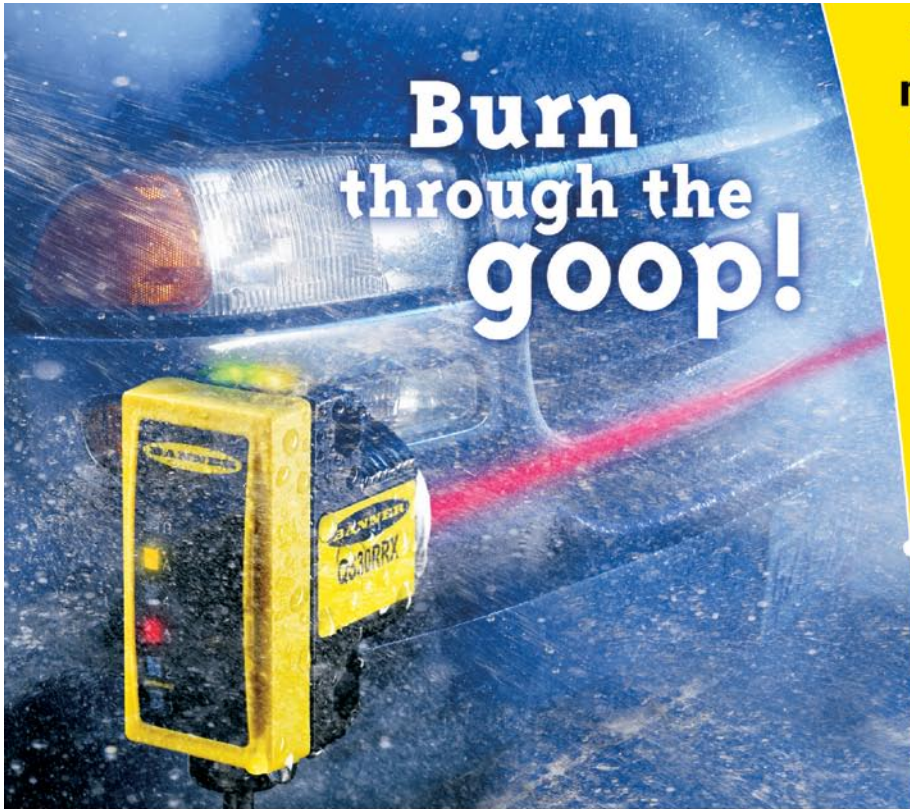


* Range data for QS18F not available at printing.



M600 Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23SM600).
M900 Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23SM900).

| | | MODEL NUMBER | DRAWING & DIMENSIONS | CORE DIA. (mm) | MIN. BEND RADIUS (mm) | FEATURES | TYPICAL RANGE (mm) |
|---------------------|---------------------|--------------|----------------------|------------------|-----------------------|---|--|
| OPPOSED | SIDE-VIEW | IA1.53SMETA | | 2.29 | 19 | • Ultra-compact head M600 | |
| | | IA1.53SMTA | | 2.29 | 19 | • Compact head M600 | |
| | | ITETA1.53S | | 2.29 | 19 | • Ultra-compact head; thread M600 | |
| EXTENDED RANGE LENS | VACUUM | IMT.753SMVF | | 1.27 | 19 | • Miniature thread; entire cable withstands 480° C (900° F) | Contact factory representative for range information |
| | | L9 | | ref. model IT23S | ref. model IT23S | • Glass lens; withstands 315° C (600° F) | |
| | | L16F | | ref. model IT23S | ref. model IT23S | • Plastic housing; withstands 105° C (220° F) | |
| | | L16FAL | | ref. model IT23S | ref. model IT23S | • Aluminum housing; withstands 315° C (600° F) | |
| ACCESSORIES | VACUUM FEED THROUGH | VFT-M8MVS | | 3.56 | - | • Seals to 1 x 10 ⁻⁹ torr; withstands 120° C (248° F) | |
| | | TGR | | 3.18 | - | • Use with BT23S • Sensor switches when tip of glass rod is immersed in liquid | |



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