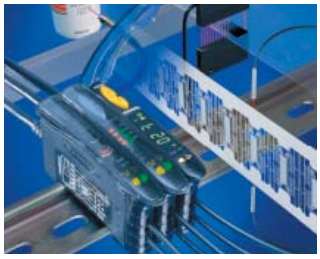
Fiber Optic Systems



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

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.

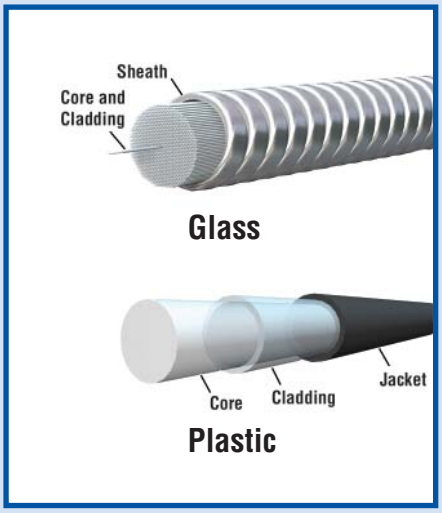
Plastic fibers ..... **page 182**

- 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

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

PLASTIC FIBER

BRACKETS
PAGE 350

QD CABLES
4- & 6-Pin Pico
PAGE 378 & 379

PLASTIC FIBERS
PAGE 182

Expert Models:

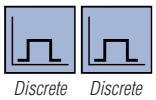
- 4-digit TEACH and signal strength display or bargraph readout
- Operating status indicators
- Easy-to-set static, dynamic and single-point programming
- Manual fine tuning
- Remote configuration, using TEACH wire

Expert Advanced LED Display

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

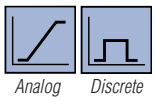
Expert Dual-Discrete Outputs

- 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

- 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)

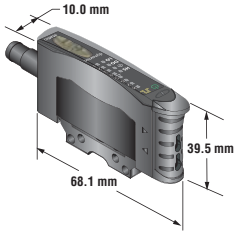
D10 Sensors

- *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* Models with Numeric Display

D10—Discrete Models

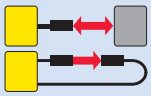
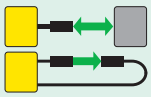
MORE INFO ONLINE Detailed Dimensions



D10 *Expert* Models with Bargraph Display

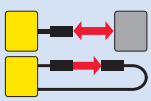
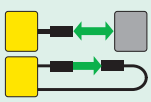
D10 *Expert*™ with Numeric Display—Dual Discrete, 12-24V dc

MORE INFO ONLINE Download PDF

Models	Sensing Mode/LED*	Range	Cable**	Outputs	Data Sheet
D10DNFP D10DNFPQ		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			2 m 6-pin Pico QD	Dual PNP	
D10DNFPG D10DNFPGQ			2 m 6-pin Pico QD	Dual NPN	
D10DPFPG D10DPFPGQ			2 m 6-pin Pico QD	Dual PNP	

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

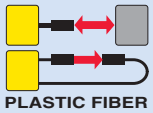
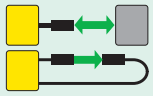
MORE INFO ONLINE Download PDF

Models	Sensing Mode/LED*	Range	Cable**	Discrete Output	Analog Output	Data Sheet
D10INFP D10INFPQ		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			2 m 6-pin Pico QD	PNP		
D10INFPG D10INFPGQ			2 m 6-pin Pico QD	NPN	4-20 mA	
D10IPFPG D10IPFPGQ			2 m 6-pin Pico QD	PNP		

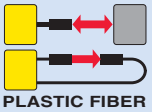
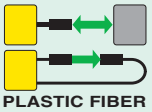
* Visible Red LED Visible Green LED

** 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).

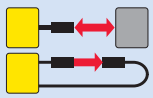
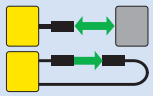
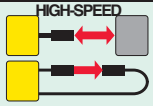
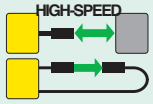
D10 *Expert*™ with Numeric Display—Analog/Discrete, 15-24V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Analog Output	Data Sheet
D10UNFP D10UNFPQ		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			2 m 6-pin Pico QD	PNP		
D10UNFPG D10UNFPGQ			2 m 6-pin Pico QD	NPN	0-10V	
D10UPFPG D10UPFPGQ			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		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			2 m 6-pin Pico QD		EGCP-32 to EGCP-35 (pp. 448-449)	BPP-32 to BPP-35 (pp. 466-467)	

D10—Discrete, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Data Sheet
D10AFP D10AFPQ		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			2 m 4-pin Pico QD		
D10AFPY D10AFPYQ		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			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 µA 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	CE c UL us
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 µA 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:** 100Ω max. impedance **0-10V dc Models:** 1 MΩ 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	CE cULus
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 µA 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 • *Expert* 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	CE
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 µA sourcing; 200 µA 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

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

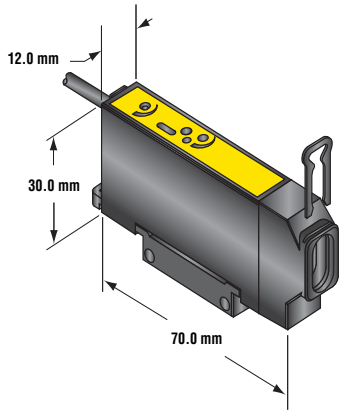
GLASS FIBER
PLASTIC FIBER
BRACKETS PAGE 350
QD CABLES 4-Pin Pico PAGE 378
PLASTIC FIBERS PAGE 182
GLASS FIBERS PAGE 198

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*

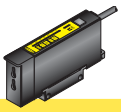
Plastic Fiber Models
Suffix FP and FPY

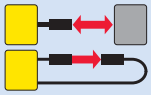
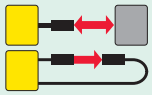
MORE INFO ONLINE Detailed Dimensions



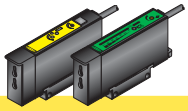
Glass Fiber Models
Suffix FV and FVY

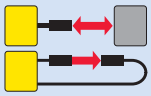
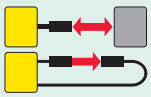
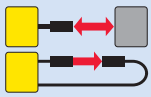
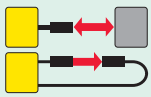
D12 *Expert*™, 10-30V dc



Models	Sensing Mode/LED*	Maximum Range	Switching Threshold Setting	Cable**	Output Type	Data Sheet
D12EN6FV	 GLASS FIBER	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
D12EP6FV					PNP	
D12E2N6FV			Midway between "dark" and "light" conditions		NPN	
D12E2P6FV					PNP	
D12EN6FP	 PLASTIC FIBER		Just above the "dark" condition		NPN	
D12EP6FP					PNP	
D12E2N6FP			Midway between "dark" and "light" conditions		NPN	
D12E2P6FP					PNP	

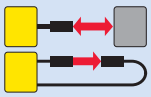
D12 and D12 High-Speed, 10-30V dc



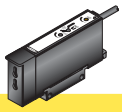
Models	Sensing Mode/LED*	Range	Cable**	Output Type	Output Response	Excess Gain	Data Sheet
D12SN6FV	 GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m 4-Pin Pico Pigtail QD	NPN	500 µs	EGCG-40 & EGCG-41 (p. 446)	32822
D12SN6FVQ							
D12SP6FV			2 m 4-Pin Pico Pigtail QD	PNP			
D12SP6FVQ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

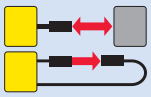
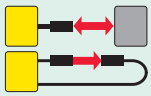
† Y1 models have 20 milliseconds output pulse stretcher.
* ➡ Visible Red LED
** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D12EN6FV W/30**). A model with a QD requires a mating cable (see page 378).
*** When 50 microseconds is selected, bargraph is disabled.

D12 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)	CE c UL us
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	CE c UL us
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.

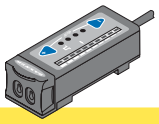
GLASS FIBER
PLASTIC FIBER
BRACKETS PAGE 350
QD CABLES 5-Pin Euro PAGE 382
PLASTIC FIBERS PAGE 182
GLASS FIBERS PAGE 198

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*

MORE INFO ONLINE Detailed Dimensions

R55 Fiber Optic, 10-30V dc



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

R55 Fiber Optic Specifications

Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 70 mA, exclusive of load
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
Output Rating	150 mA max each output @ 25° C (derate ≈ 1 mA per ° C increase) **OFF-state leakage current:** less than 5 µA @ 30V dc **ON-state saturation voltage:** PNP Output less than 1V @ 10 mA and 1.5V @ 150 mA NPN Output less than 200 mV @ 10 mA and 1V @ 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Output Response Time	50 microseconds NOTE: 100 millisecond delay on power-up; outputs do not conduct during this time.
Adjustments	**Using push buttons ("+" Dynamic and "-" Static):** Manually adjust Switch Point using "+" or "-" buttons Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Static Single-Point TEACH Light operate/Dark operate OFF Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds **Using Remote TEACH input (gray wire):** Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Static Single-Point TEACH Light operate/Dark operate OFF Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds Push button lockout for security
Indicators	10-segment (green) light bar indicates signal strength Light Operate (green) Dark Operate (green) Outputs Conducting (yellow) OFF Delay (green): **SETUP Mode:** OFF — no delay Flashing — 20 milliseconds delay ON — 40 milliseconds delay **RUN Mode:** OFF — no delay ON — 20 or 40 milliseconds Delay
Construction	Black ABS/polycarbonate blend; nylon fiber clip mounts to standard 35 mm DIN rail 1 stainless steel right angle bracket and 1 PBT polyester bracket for mounting to flat surfaces also included with sensor
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m PVC-jacketed 5-conductor cable or 5-pin Euro-style quick-disconnect (QD) fitting. QD cables are ordered separately. See page 382. **Fibers:** Fiber clip (no tool required)
Operating Conditions	**Temperature:** -10° to +55° C **Relative humidity:** 90% at 50° C (non-condensing)
Application Notes	• Do not mount the fiber tip directly perpendicular to shiny surfaces; position it at approximately a 15° angle in relation to the sensing target. • Minimize web or product "flutter" whenever possible to maximize sensing reliability.
Certifications	CE
Hookup Diagrams	DC11 (p. 478)

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

PLASTIC FIBER

QD CABLES 6-Pin Pico PAGE 379

PLASTIC FIBERS PAGE 182

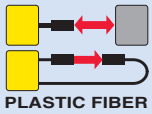
FI22 *Expert*™ Sensors

- *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

MORE INFO ONLINE Detailed Dimensions

FI22 *Expert*™, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
FI22FP	 PLASTIC FIBER	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) Diffuse mode: EGCP-45, EGCP-46 & EGCP-47 (p. 449)	Opposed mode: BPP-36, BPP-37 & BPP-38 (p. 467) Diffuse mode: BPP-39, BPP-40 & BPP-41 (p. 467)	108899
FI22FPQ			6-pin Pico QD				

* 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 • *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	CE c UL us
Hookup Diagrams	DC11 (p. 478)

Fiber Systems

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

P	B	P	4	6	U	C	X

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

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

FIBER LENGTH designator

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

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

MODIFICATIONS designator

"MXX" = Sensing end tip modification

* 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	**Optical Fiber:** acrylic (PMMA) monofilament, except as noted. **Protective Jacket:** black polyethylene, except as noted **Threaded End Tips and Hardware:** nickel-plated brass, except as noted. **Probe End Tips:** annealed (bendable) 304 stainless steel **Angled End tips:** hardened 304 stainless steel **Ferrule End Tips:** 303 stainless steel
Sensing Range	Refer to the specific fiber optic/sensor combination
Implied Dimensional Tolerance	**All dimensions are in millimeters:** x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified. "L" = ±40 mm per meter
Minimum Bend Radius	8 mm for 0.25 mm diameter fibers 12 mm for 0.5 mm diameter fibers (except DURA-BEND™) 25 mm for 1.0 mm diameter fibers (except DURA-BEND™) 38 mm for 1.5 mm diameter fibers
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

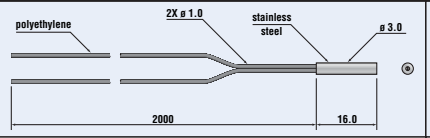
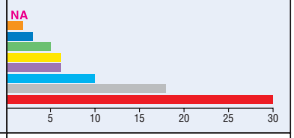
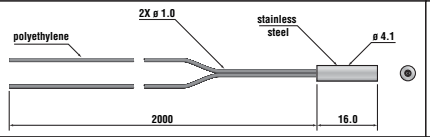
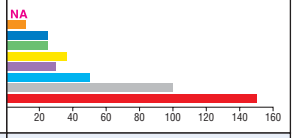
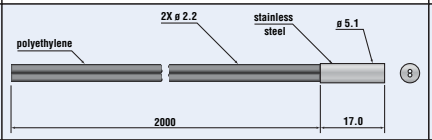
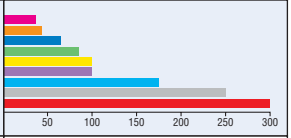
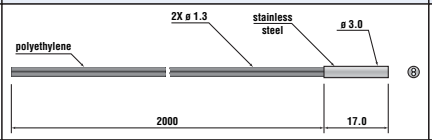
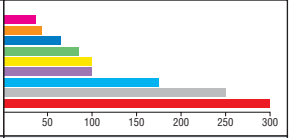
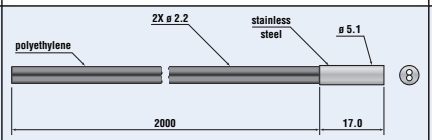
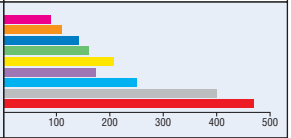
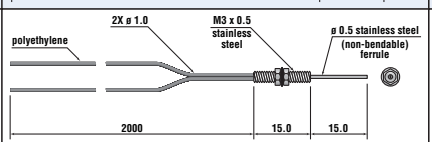
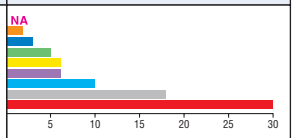
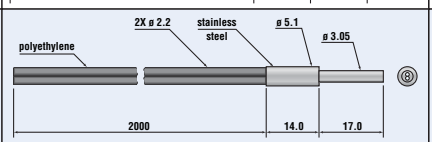
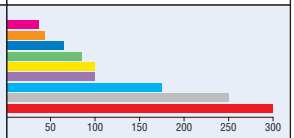
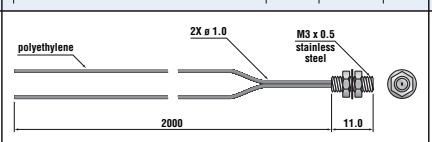
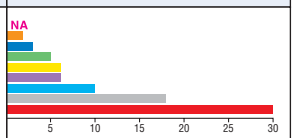
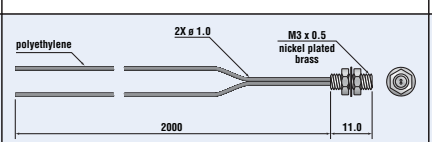
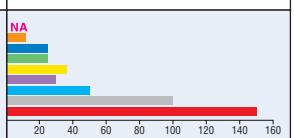
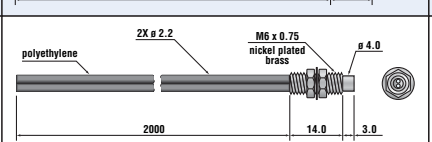
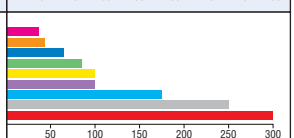
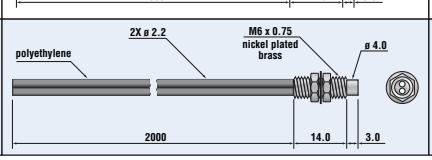
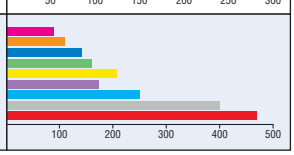
⚠ Application Notes and Warnings ⚠

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

DIFFUSE — STANDARD

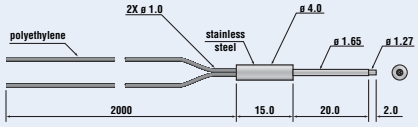
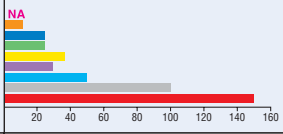
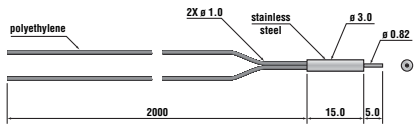
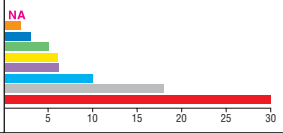
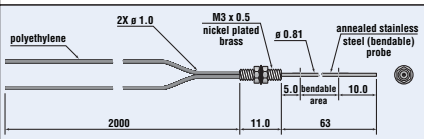
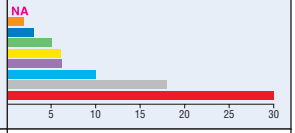
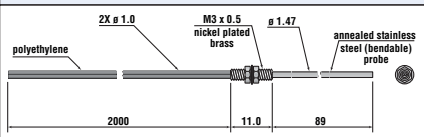
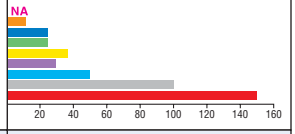
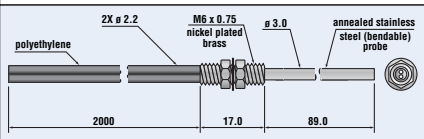
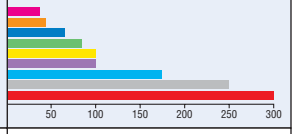
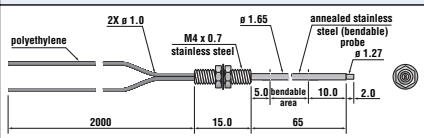
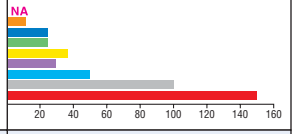
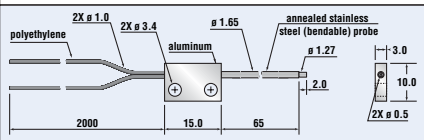
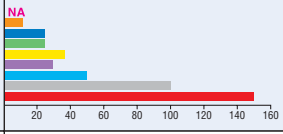
MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
PBF16U *Detailed Dimensions Online*		0.25	8	• Smooth ferrule	
PBF26U *Detailed Dimensions Online*		0.5	12	• Smooth ferrule	
PBF46U *Detailed Dimensions Online*		1.0	25	• Smooth ferrule	
PBF46UM3MJ1.3 *Detailed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

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

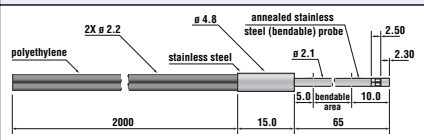
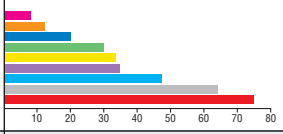
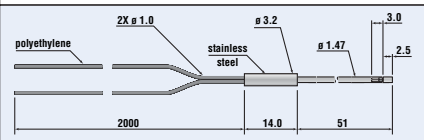
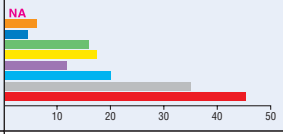
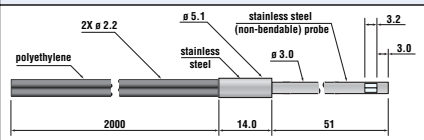
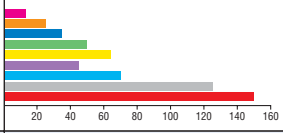
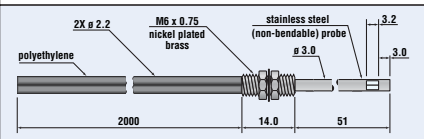
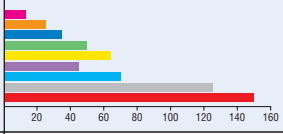
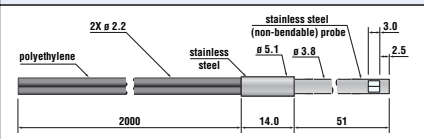
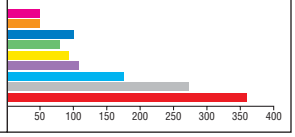
MORE INFO ONLINE

DIFFUSE

PROBE

MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
PBEFP26U *Detailed Dimensions Online*		0.5	12	• Smooth ferrule; non-bendable tip	
PBFMP16UMP.2 *Detailed Dimensions Online*		0.25	8	• Smooth ferrule; non-bendable tip	
PBP16U *Detailed Dimensions Online*		0.25	8	• Thread; bendable tip	
PBP26U *Detailed Dimensions Online*		0.5	12	• Thread; bendable tip	
PBP46U *Detailed Dimensions Online*		1.0	25	• Thread; bendable tip	
PBPF26U *Detailed Dimensions Online*		0.5	12	• Thread; bendable tip	
PBPF26UMB *Detailed Dimensions Online*		0.5	12	• Flat mounting block; bendable tip	

SIDE-VIEW

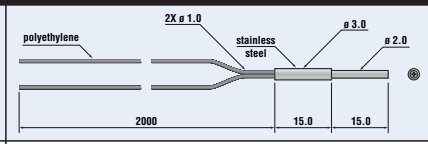
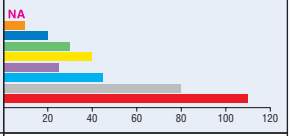
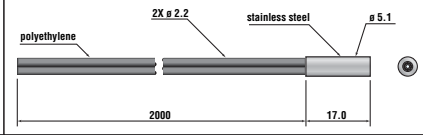
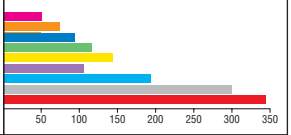
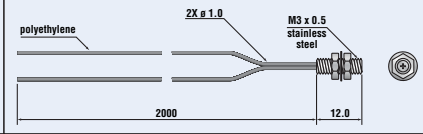
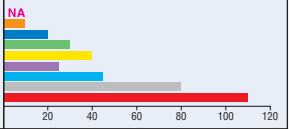
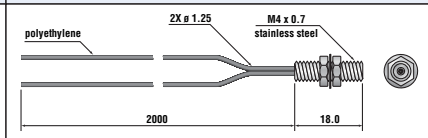
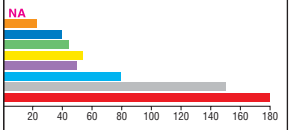
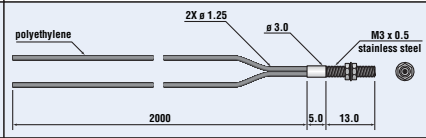
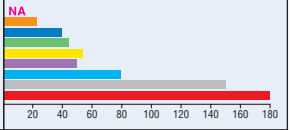
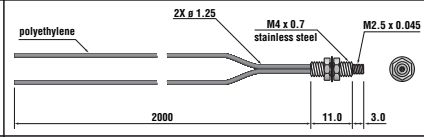
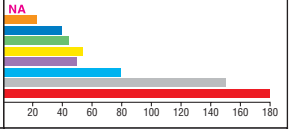
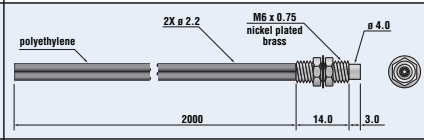
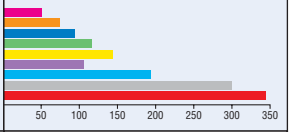
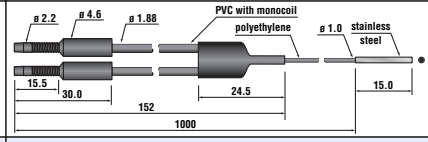
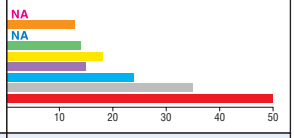
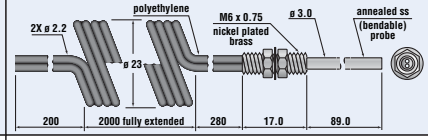
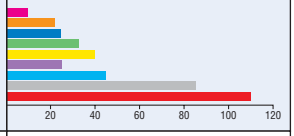
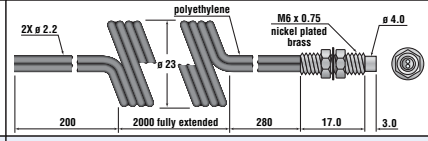
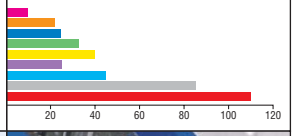
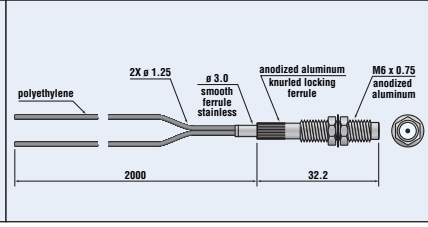
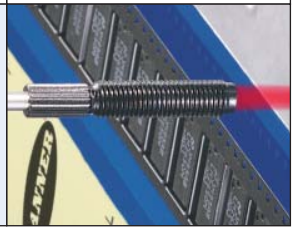
MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
PBPMSB36U *Detailed Dimensions Online*		0.75	20	• Smooth ferrule; bendable tip	
PBPS26U *Detailed Dimensions Online*		0.5	12	• Smooth ferrule; non-bendable tip	
PBPS46U *Detailed Dimensions Online*		1.0	25	• Smooth ferrule; non-bendable tip	
PBPS46UMT *Detailed Dimensions Online*		1.0	25	• Thread; non-bendable tip	
PBPS66U *Detailed Dimensions Online*		1.5	38	• Smooth ferrule; non-bendable tip	

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

Plastic Fiber Optics

Fiber Systems

MORE INFO ONLINE

		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	COAXIAL	**PBCF21X46U** *Detailed Dimensions Online*		0.5 4X 0.25	12	• Miniature probe tip	
		PBCF46U *Detailed Dimensions Online*		1.0 16X 0.265	25	• Smooth ferrule	
		PBCT21X46U *Detailed Dimensions Online*		0.5 4X 0.25	12	• Miniature thread	
		PBCT26U *Detailed Dimensions Online*		0.5 9X 0.25	12	• Thread	
		PBCT26UM3 *Detailed Dimensions Online*		0.5 9X 0.25	12	• Miniature thread	
		PBCT26UM4M2.5 *Detailed Dimensions Online*		0.5 9X 0.25	12	• Thread	
		PBCT46U *Detailed Dimensions Online*		1.0 16X 0.265	25	• Thread	
	HIGH-FLEX	**PBFM1X43T5** *Detailed Dimensions Online*		4X 0.25	8	• Best for repetitive flexing (1,000s of cycles)	
		PBP46UC *Detailed Dimensions Online*		1.0	25	• For applications involving reciprocating motion	
		PBT46UC *Detailed Dimensions Online*		1.0	25	• For applications involving reciprocating motion	
	CONVERGENT BEAM SPOT	**PLI-A10** *Detailed Dimensions Online*		0.5 9X 0.25	12	• Anodized AL tip; ø 0.5 - 3.2 mm beam spot • Glass lens	

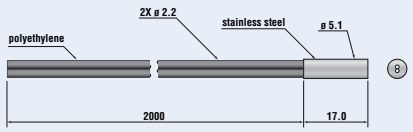
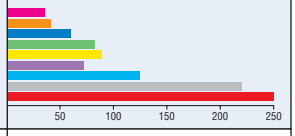
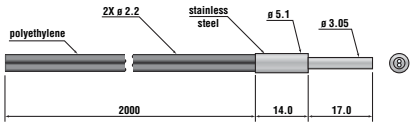
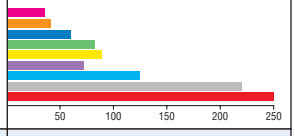
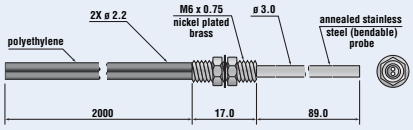
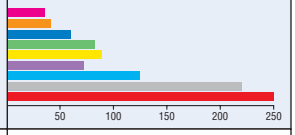
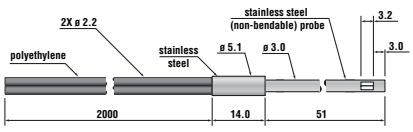
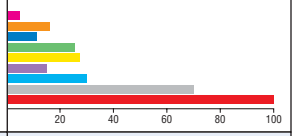
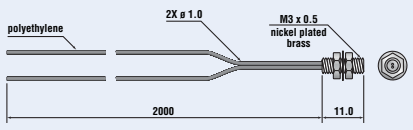
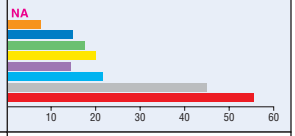
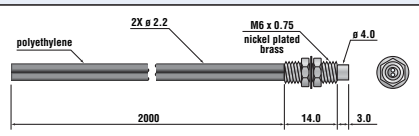
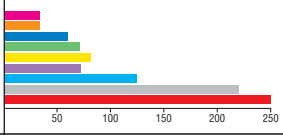
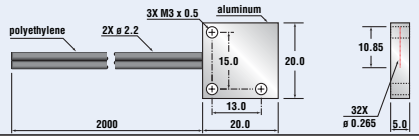
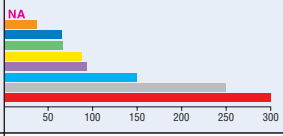
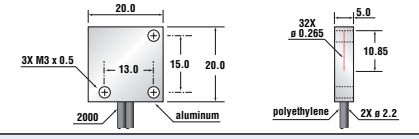
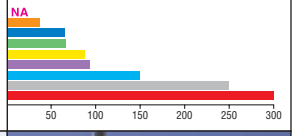
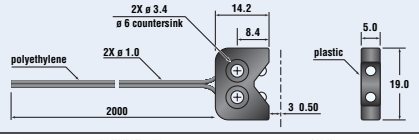
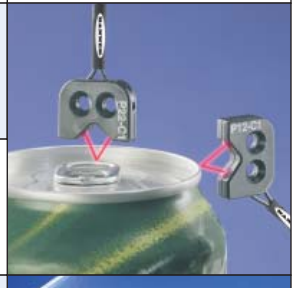
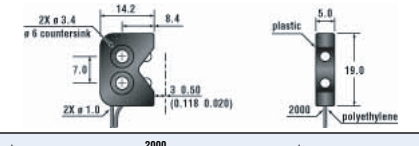
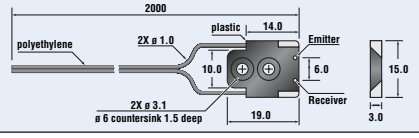
NA: WORLD-BEAM QS18 not recommended.

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.

MORE INFO ONLINE

		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	DURA-BEND	**PBF46UHF** *Detailed Dimensions Online*		1.0	1	• Smooth ferrule	
		PBFM46UHF *Detailed Dimensions Online*		1.0	1	• Smooth ferrule	
		PBP46UHF *Detailed Dimensions Online*		1.0	1	• Thread; bendable tip	
		PBPS46UHF *Detailed Dimensions Online*		1.0	1	• Smooth ferrule; non-bendable tip	
		PBT26UHF *Detailed Dimensions Online*		0.5	1	• Thread	
		PBT46UHF *Detailed Dimensions Online*		1.0	1	• Thread	
	AREA SENSING (ARRAY)	**PBR1X326U** *Detailed Dimensions Online*		32X 0.265	25	• Rectangular tip	
		PBRS1X326U *Detailed Dimensions Online*		32X 0.265	25	• Rectangular tip; side sensing	
	MECHANICAL CONVERGENT	**P22-C1** *Detailed Dimensions Online*		0.5	12	• Straight exit with lenses; 3 mm range; DURA-BEND fiber	
		P12-C1 *Detailed Dimensions Online*		0.5	12	• Side exit with lenses; 3 mm range; DURA-BEND fiber	
		P32-C2 *Detailed Dimensions Online*		1.0	12	• Flat mount; 2 mm range; DURA-BEND fiber	

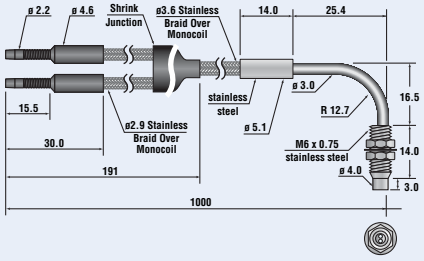
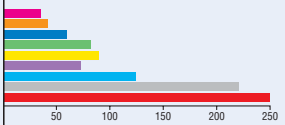
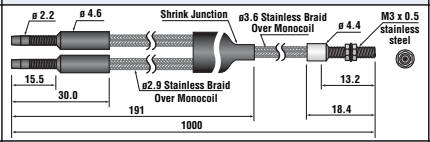
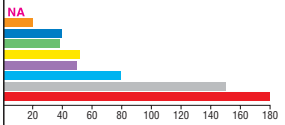
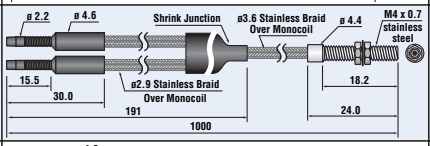
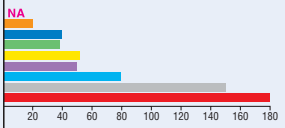
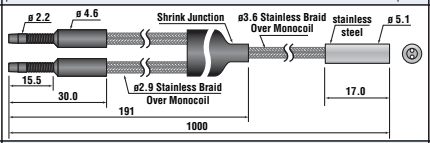
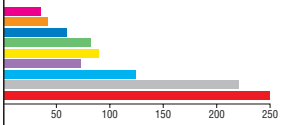
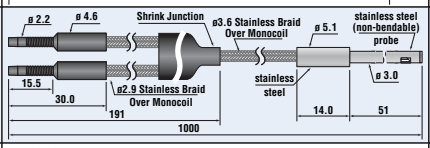
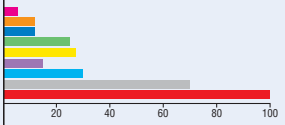
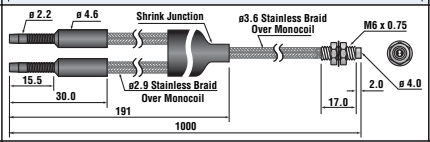
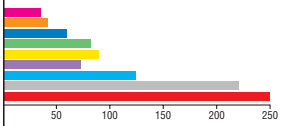
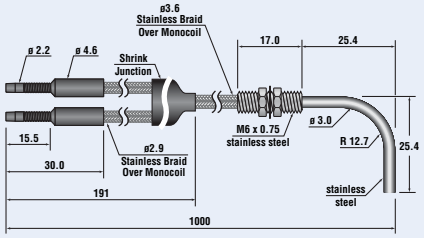
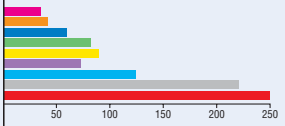
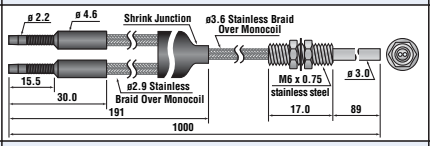
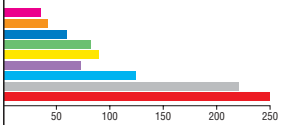
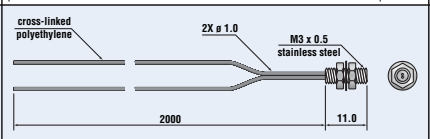
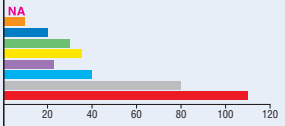
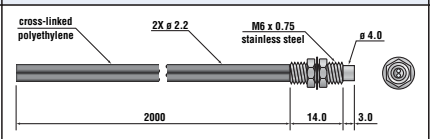
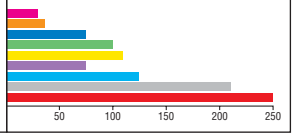
Indicates fiber can be Free Cut using Fiber Cutter. See page 197.
NA: *WORLD-BEAM QS18 not recommended.*

Plastic Fiber Optics

Fiber Systems

DIFFUSE

STEELSKIN

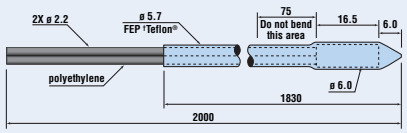
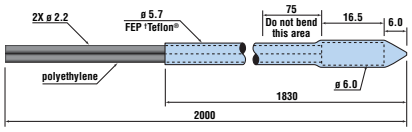
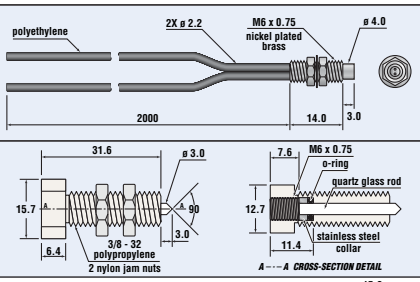
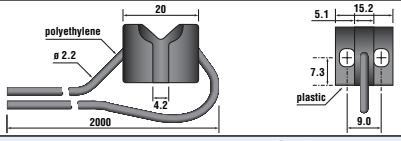
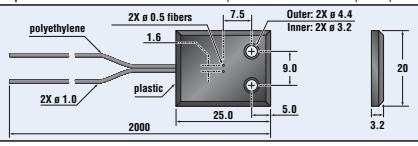
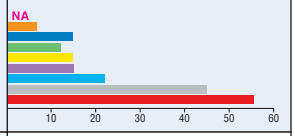
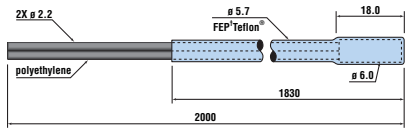
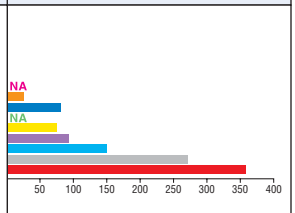
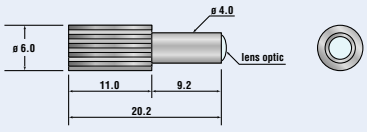
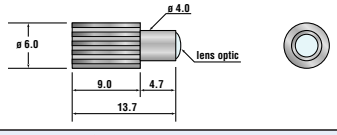
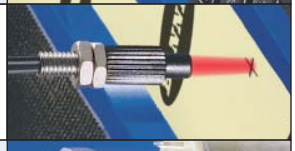
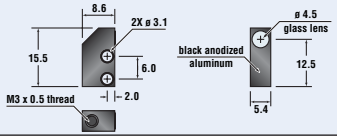
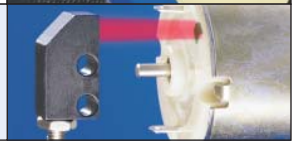
MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
PBAT43TMB5 *Detailed Dimensions Online*		1.0	12	• 90° Angle/Thread	
PBCT23TMB5 *Detailed Dimensions Online*		0.5 9X 0.25	12	• Miniature thread	
PBCT23TMB5M4 *Detailed Dimensions Online*		0.5 9X 0.25	12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

NA: WORLD-BEAM QS18 not recommended.

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

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

DIFFUSE

	MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
LIQUID LEVEL	**PBE46UTMLLP** *Detailed Dimensions Online*		1.0	25	• Fluoropolymer encapsulated • Sensor switches when tip of fiber is immersed in liquid	
LIQUID LEVEL	**PBE46UTMLLPHT1** *Detailed Dimensions Online*		1.0	25	• Fluoropolymer encapsulated; withstands 125° C (257° F) • Sensor switches when tip of fiber is immersed in liquid	
LIQUID LEVEL	**PBT26UM6M.1** **and** **TGR3/8MPFMQ** *Detailed Dimensions Online*		0.5	12	• Quartz probe; polypropylene housing • Sensor switches when tip of quartz is immersed in liquid	
LIQUID LEVEL	**PDI46U-LLD** *Detailed Dimensions Online*		1.0	1	• Clear tube mount; DURA-BEND fiber • Sensor switches when liquid meniscus reaches optical axis	
FLAT PACK	**PBRS26U** *Detailed Dimensions Online*		0.5	12	• 3.2 mm thickness; DURA-BEND fiber	
CHEMICAL RESISTANT	**PBE46UTMNL** *Detailed Dimensions Online*		1.0	25	• Fluoropolymer encapsulated tip	
CONVERGENT SPOT LENS	**L4C6** *Detailed Dimensions Online*		*ref. model PBCT26U*	*ref. model PBCT26U*	• Anodized AL housing; ø 0.25 mm beam spot @ 6 mm • Fixed focus	
CONVERGENT SPOT LENS	**L4C20** *Detailed Dimensions Online*		*ref. model PBCT26U*	*ref. model PBCT26U*	• Anodized AL housing; ø 4 mm beam spot @ 20 mm • Fixed focus	
CONVERGENT SPOT LENS	**LZ3C8** *Detailed Dimensions Online*		*ref. model PBCT26-UM3*	*ref. model PBCT26-UM3*	• Anodized AL housing; ø 0.5 - 3.2 mm adj. beam spot • Adjustable focus	

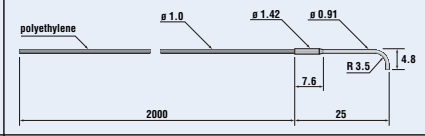
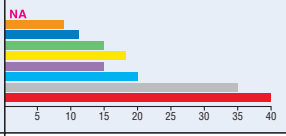
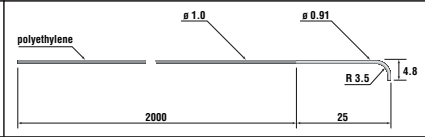
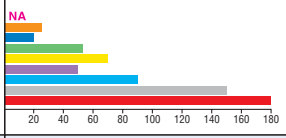
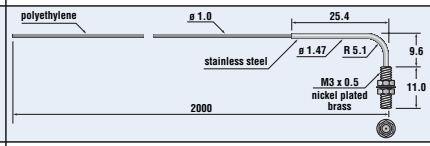
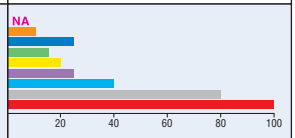
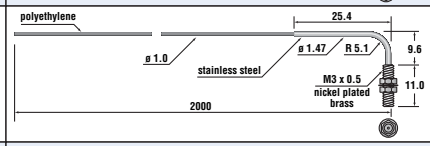
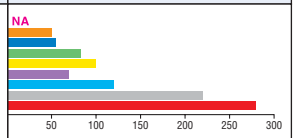
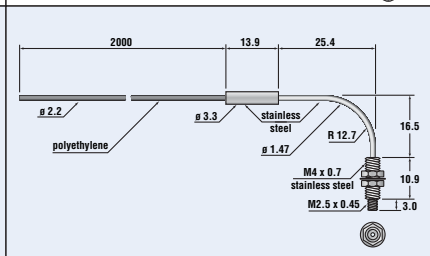
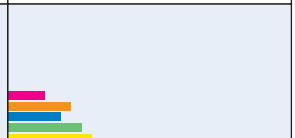
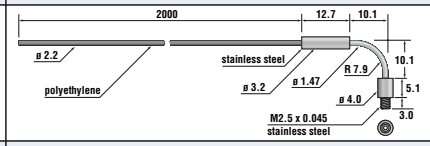
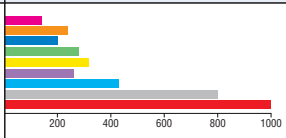
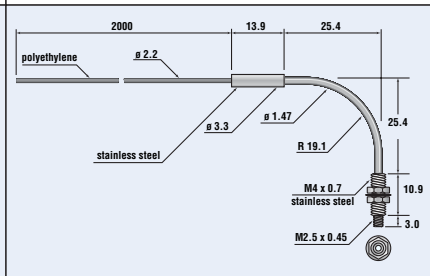
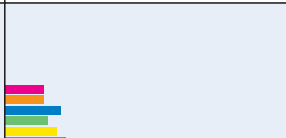
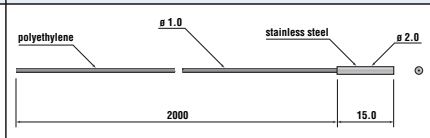
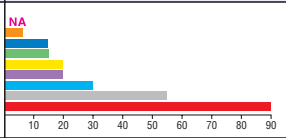
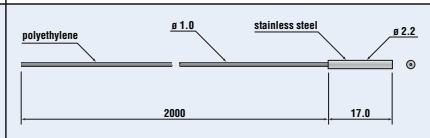
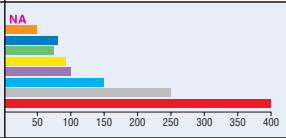
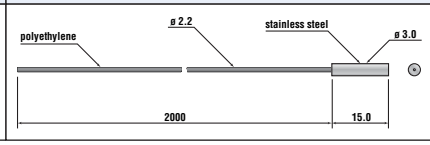
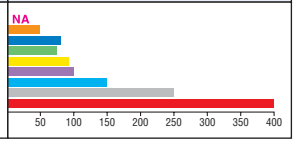
Indicates fiber can be Free Cut using Fiber Cutter. See page 197.
NA: *WORLD-BEAM QS18 not recommended.*
NA: *D10—Discrete not recommended.*

Plastic Fiber Optics

Fiber Systems

MORE INFO ONLINE

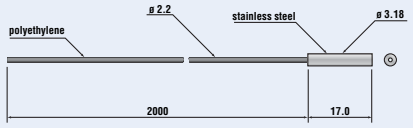
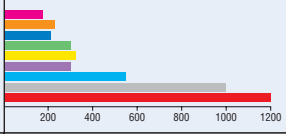
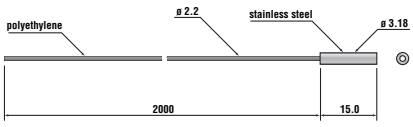
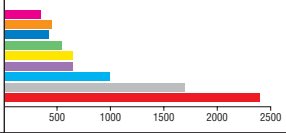
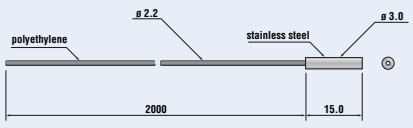
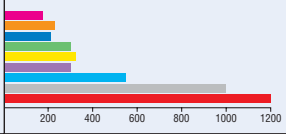
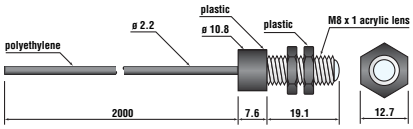
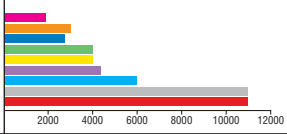
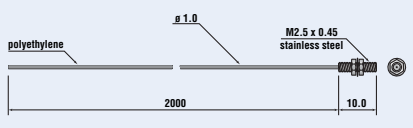
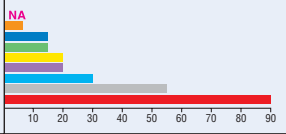
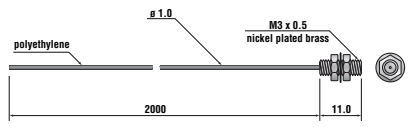
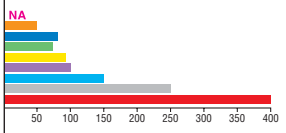
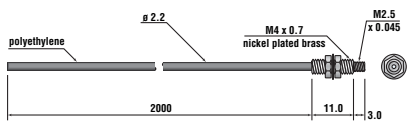
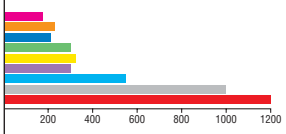
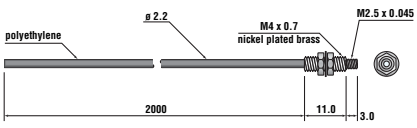
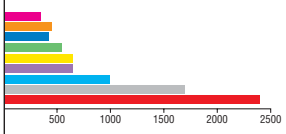
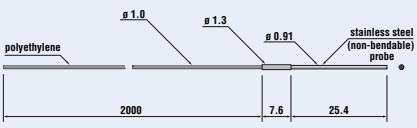
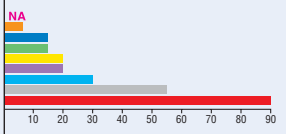
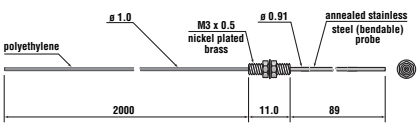
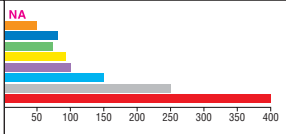
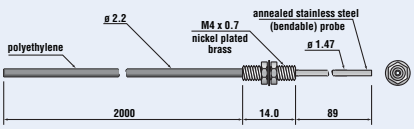
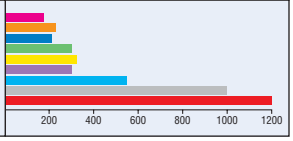
OPPOSED — STANDARD

MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
PIA16U *Detailed Dimensions Online*		0.25	8	• 90° Angle	
PIA26U *Detailed Dimensions Online*		0.5	12	• 90° Angle	
PIAT16U *Detailed Dimensions Online*		0.25	8	• 90° Angle/Thread	
PIAT26U *Detailed Dimensions Online*		0.5	12	• 90° Angle/Thread	
PIAT46U *Detailed Dimensions Online*		1.0	25	• 90° Angle/Thread	
PIAT46UM.4X.4MT *Detailed Dimensions Online*		1.0	25	• 90° Angle/Thread	
PIAT66U *Detailed Dimensions Online*		1.5	38	• 90° Angle/Thread; long range	
PIF16U *Detailed Dimensions Online*		0.25	8	• Smooth ferrule	
PIF26U *Detailed Dimensions Online*		0.5	12	• Smooth ferrule	
PIF26UMLS *Detailed Dimensions Online*		0.5	12	• Smooth ferrule; thick jacket (ø 2.2 mm)	

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	STANDARD	**PIF46U** *Detailed Dimensions Online*		1.0	25	• Smooth ferrule	
		PIF66U *Detailed Dimensions Online*		1.5	38	• Smooth ferrule; long range	
		PIFM46U *Detailed Dimensions Online*		1.0	25	• Smooth ferrule; miniature tip	
		PIL46U *Detailed Dimensions Online*		1.0	25	• Plastic lens; ultra-long range • Lens available separately, see page 195.	
		PIT16U *Detailed Dimensions Online*		0.25	8	• Thread	
		PIT26U *Detailed Dimensions Online*		0.5	12	• Thread	
		PIT46U *Detailed Dimensions Online*		1.0	25	• Thread	
		PIT66U *Detailed Dimensions Online*		1.5	38	• Thread; long range	
	PROBE	**PIP16U** *Detailed Dimensions Online*		0.25	8	• Smooth ferrule; non-bendable tip	
		PIP26U *Detailed Dimensions Online*		0.5	12	• Thread; bendable tip	
		PIP46U *Detailed Dimensions Online*		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.

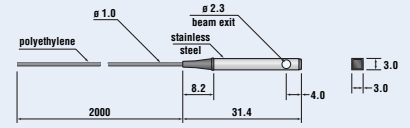
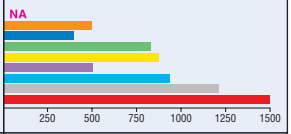
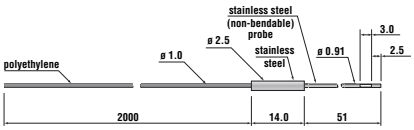
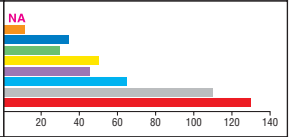
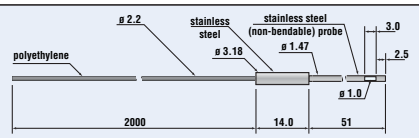
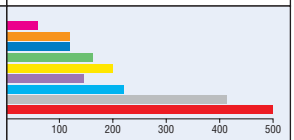
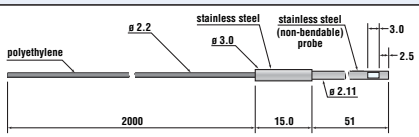
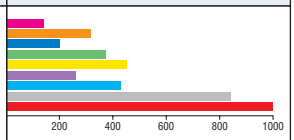
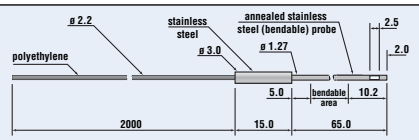
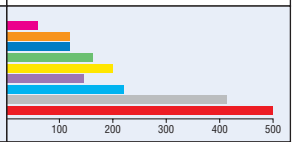
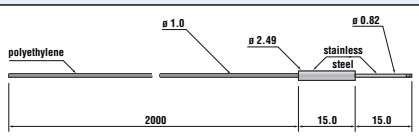
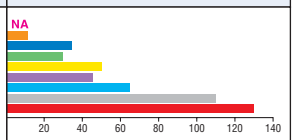
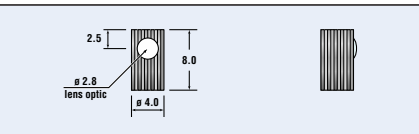
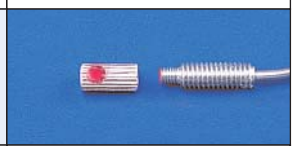
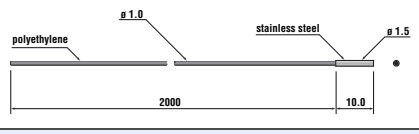
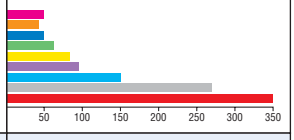
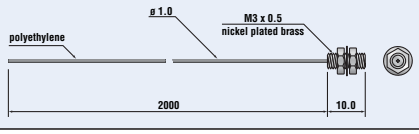
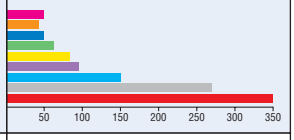
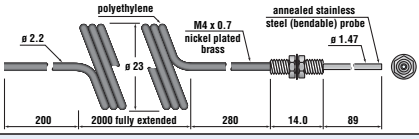
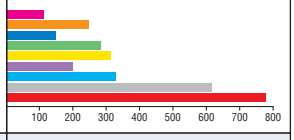
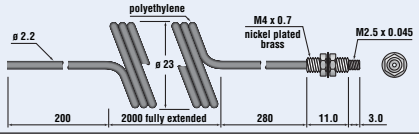
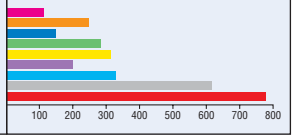
NA: *WORLD-BEAM QS18 not recommended.*

Plastic Fiber Optics

Fiber Systems

MORE INFO ONLINE

OPPOSED

	MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
SIDE-VIEW	**PLIS-1** *Detailed Dimensions Online*		0.5	12	• Low beam divergence angle of 2° • Ideal for wafer mapping	
SIDE-VIEW	**PIPS26U** *Detailed Dimensions Online*		0.5	12	• Smooth ferrule; non-bendable tip	
SIDE-VIEW	**PIPS46U** *Detailed Dimensions Online*		1.0	25	• Smooth ferrule; non-bendable tip	
SIDE-VIEW	**PIPS66U** *Detailed Dimensions Online*		1.5	38	• Smooth ferrule; non-bendable tip	
SIDE-VIEW	**PIPSB46U** *Detailed Dimensions Online*		1.0	25	• Smooth ferrule; bendable tip	
SIDE-VIEW	**PIPSM26U** *Detailed Dimensions Online*		0.5	12	• Miniature smooth ferrule; non-bendable tip	
SIDE-VIEW	**L2RA** *Detailed Dimensions Online*		*ref. model PIT46U*	*ref. model PIT46U*	• Compact glass prism • M2.5 thread	
HIGH-FLEX	**PIFM1X46U** *Detailed Dimensions Online*		4X 0.25	8	• Best for repetitive flexing (1,000s of cycles)	
HIGH-FLEX	**PIT1X46U** *Detailed Dimensions Online*		4X 0.25	8	• Best for repetitive flexing (1,000s of cycles)	
HIGH-FLEX	**PIP46UC** *Detailed Dimensions Online*		1.0	25	• For applications involving reciprocating motion	
HIGH-FLEX	**PIT46UC** *Detailed Dimensions Online*		1.0	25	• For applications involving reciprocating motion	

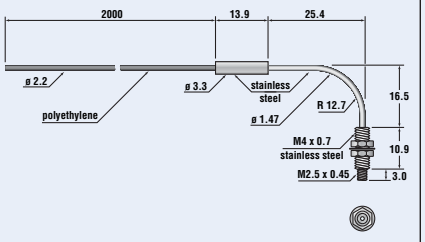
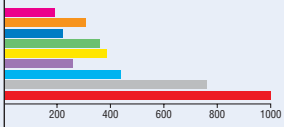
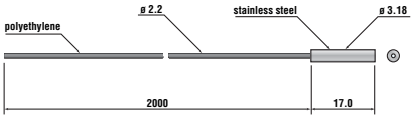
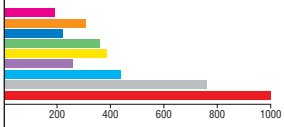
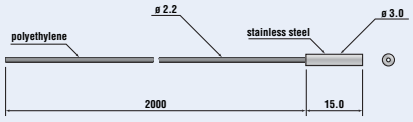
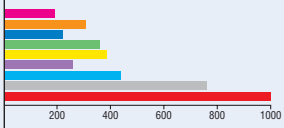
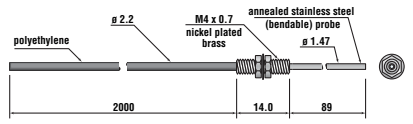
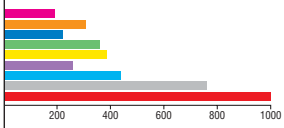
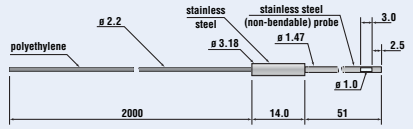
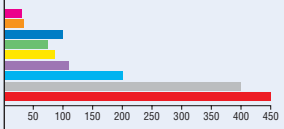
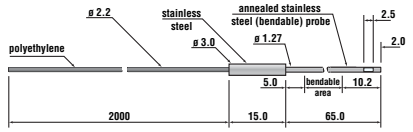
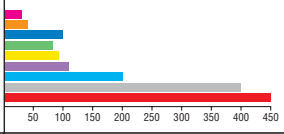
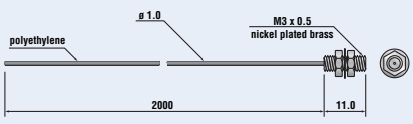
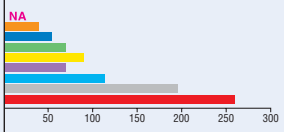
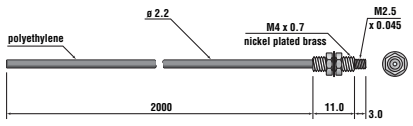
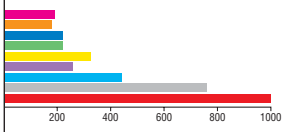
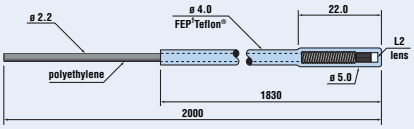
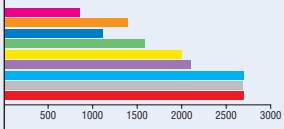
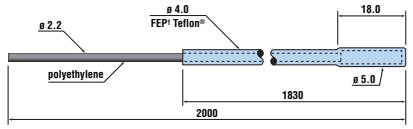
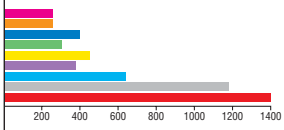
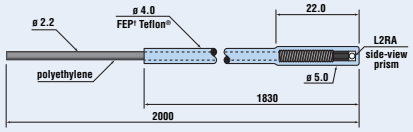
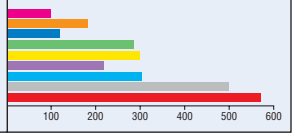
Indicates lens available for model. See page 195 for details.

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

NA: *WORLD-BEAM QS18 not recommended.*

OPPOSED

DURA-BEND

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

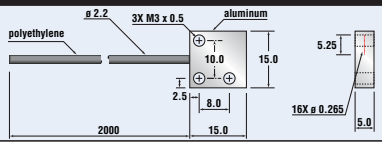
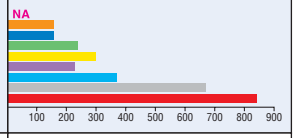
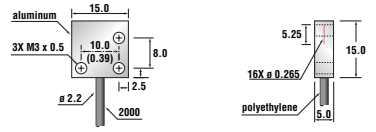
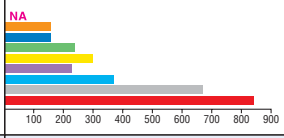
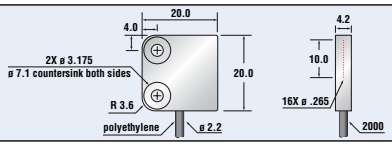
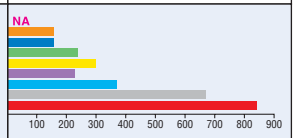
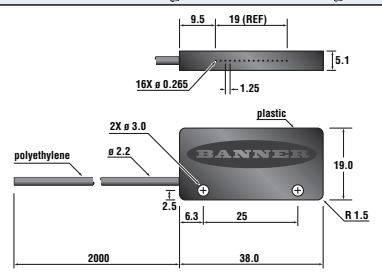
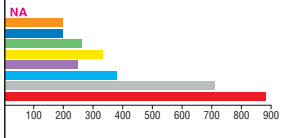
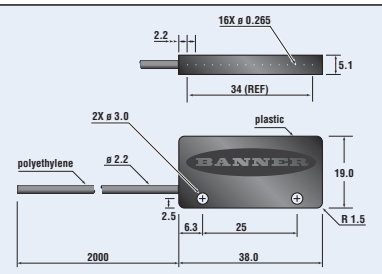
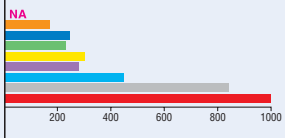
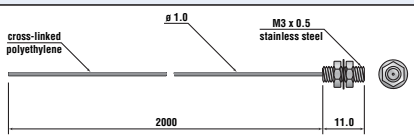
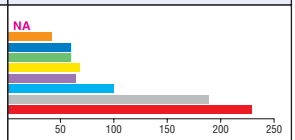
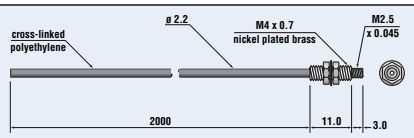
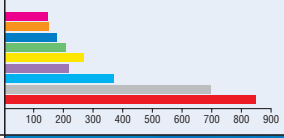
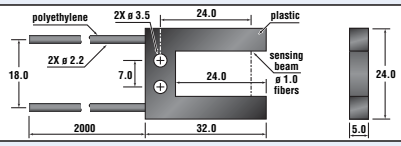
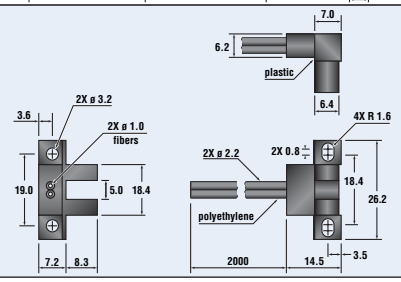
CHEMICAL RESISTANT

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

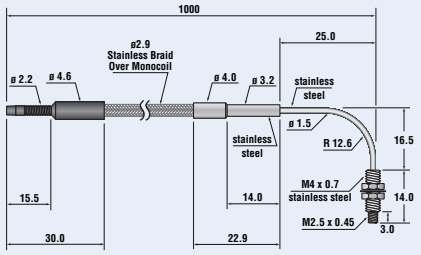
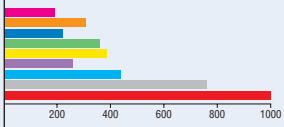
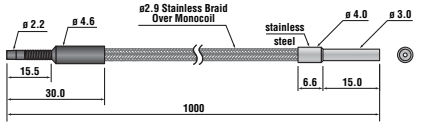
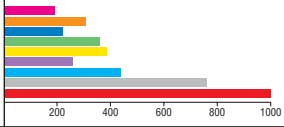
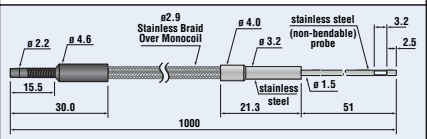
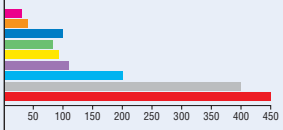
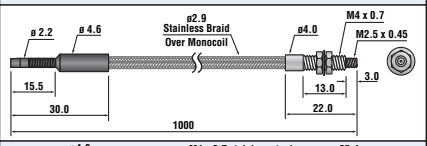
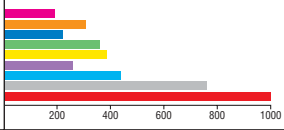
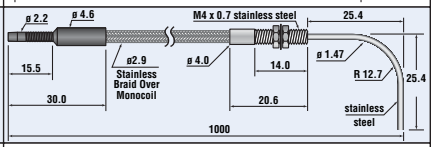
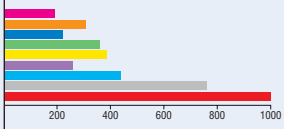
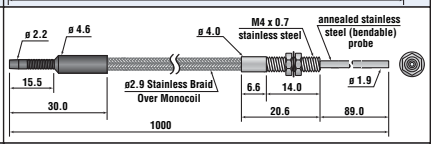
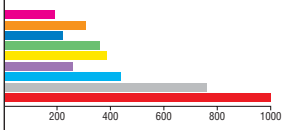
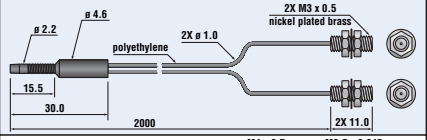
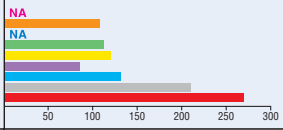
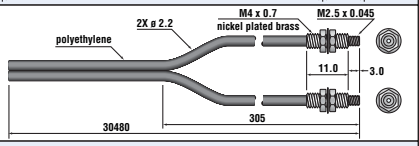
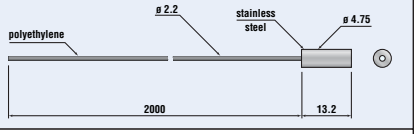
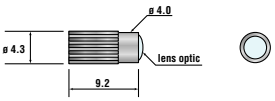
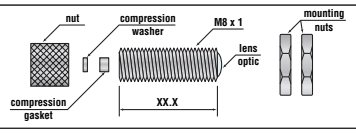
Fiber Systems

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

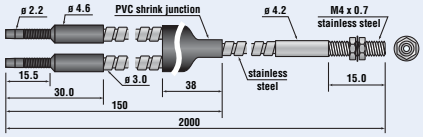
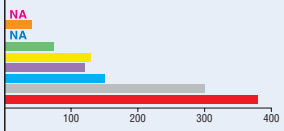
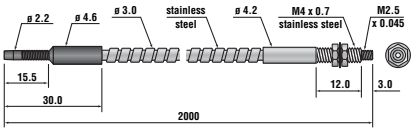
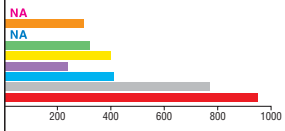
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
OPPOSED	STEELSKIN	**PIAT43TMB5** *Detailed Dimensions Online*		1.0	12	• 90° Angle/Thread	
		PIF43TMB5 *Detailed Dimensions Online*		1.0	12	• Smooth ferrule	
		PIPS43TMB5 *Detailed Dimensions Online*		1.0	12	• Smooth ferrule; non-bendable tip	
		PIT43TMB5 *Detailed Dimensions Online*		1.0	12	• Thread	
		PITA43TMB5 *Detailed Dimensions Online*		1.0	12	• Thread/90° Angle	
		PITP43TMB5 *Detailed Dimensions Online*		1.0	12	• Thread; bendable tip	
	DUAL INDIVIDUAL	**PDIT26T5** *Detailed Dimensions Online*		0.5	12	• Accomplish 2 inspections using only one sensor	
		PDIT4100U *Detailed Dimensions Online*		1.0	25	• 30 m duplex fiber cable	Contact factory for sensing range.
	VACUUM	**PIF66UM.52M.19D** *Detailed Dimensions Online*		1.5	38	• For use with VFT-M8MVS (ambient side) See page 203.	Contact factory for sensing range.
	EXTENDED RANGE LENS	**L2** *Detailed Dimensions Online*		*ref. model PIT46U*	*ref. model PIT46U*	• Range-extending lens • M2.5 thread	
		LO8FP *Detailed Dimensions Online*		*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.
Indicates fiber can be Free Cut using Fiber Cutter. See page 197.

NA: *WORLD-BEAM QS18 not recommended.*
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)
DIFFUSE	HIGH-TEMP	**BMT16.6S-HT** *Detailed Dimensions Online*		1.57	19	• High performance glass fiber optics for use with Banner D10 plastic fiber sensors • Miniature thread; end tip withstands 315° C (600° F)	
OPPOSED	HIGH-TEMP	**IMT.756.6S-HT*** *Detailed Dimensions Online*		1.27	19	• 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.*

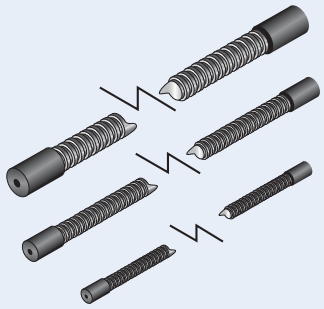
** Fibers are sold separately, must order two fibers to form a pair.*

FIBER OPTIC ACCESSORIES

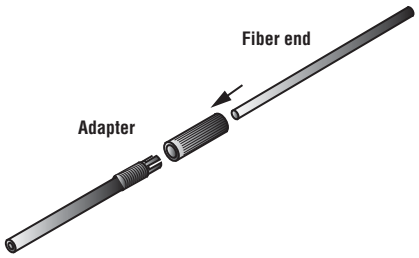
FIBER CUTTERS

MODEL NUMBER	MODEL SPECIFIC FEATURES	GENERAL FEATURES	DRAWING
PFK20	• For use with 0.25 mm and 0.5 mm diameter cables.	• 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**)	 NOTE: Bushings used with Q45, OMNI-BEAM, ECONO-BEAM, MAXI-BEAM and VALU-BEAM sensors only.
PFK40	• For use with 1 mm and 1.5 mm diameter cables.		

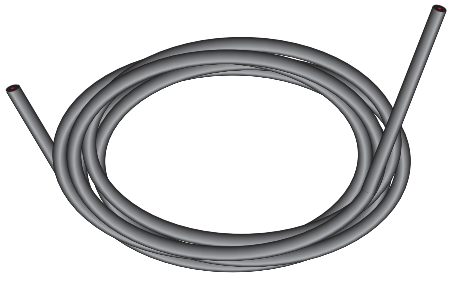
PLASTIC FIBER FIELD-INSTALLABLE SHEATHING

MODEL NUMBER	MODEL SPECIFIC FEATURES	GENERAL FEATURES	DRAWING
PFS69S6T	• May be used with bifurcated fiber assemblies having M6 x 0.75 threaded end tips (e.g., PBCT46U, PBP46U, PBT46UHT1, and PBT66U).	• 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	• May be used with individual or bifurcated fiber assemblies having M4 x 0.7 threaded end tips (e.g., PBCT26U, PBPF26U, PIP46U, PIT46U, and PIT66U).		
PFS44S6T	• May be used with individual fiber assemblies having M3 x 0.5 threaded end tips (e.g., PIP26U, PIT26U and PIT1X46U).		

PLASTIC FIBER ADAPTERS

MODEL NUMBER	MODEL SPECIFIC FEATURES	GENERAL FEATURES	DRAWING
UPFA-1-100	• Use to adapt plastic fiber optic cables with outside jacket diameter of 1.0 mm, such as PIT26U and PBP16U.	• 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	• 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.		

UNTERMINATED INDIVIDUAL AND BIFURCATED PLASTIC FIBERS

MODEL NUMBER	CORE	LENGTH	TYPE	DRAWING
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

I	A	T	2	3	S	X	X

ASSEMBLY STYLE designator

B = Bifurcated fiber
I = Individual fiber*

SENSING END TIP STYLE designator

A = 90° Angle
AM = Miniature 90° Angle
AT = 90° Angle/Thread
F = Ferrule
M = Miniature Tip
MP = Miniature Probe
MT = Miniature Thread
R = Rectangular Bundle Termination
T = Thread
TA = Thread/90° Angle
TETA = Thread and Extra Tight 90° Angle

MODIFICATIONS designator

"MXX" = Sensing end tip modification
"M600" Sensing end withstands 315° C
"M900" = Sensing end withstands 480° C

SHEATHING MATERIAL designator

S = Stainless steel flexible conduit
P = PVC with galvanized monocoil reinforcing wire

OVERALL LENGTH designator (in feet)

2 = 2 ft. = 610 mm ±38 mm
3 = 3 ft. = 914 mm ±38 mm

FIBER BUNDLE DIAMETER designator

.44 = 0.7 mm
.5 = 0.8 mm
.75 = 1.2 mm
1 = 1.6 mm
1.5 = 2.3 mm
2 = 3.2 mm
2.5 = 4.0 mm

* Individual glass fibers are packaged separately.

Glass Fiber Optics Specifications

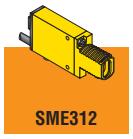
Construction	Combination of optical glass fiber, stainless steel or PVC, brass, molded thermoplastics, and optical-grade epoxy. Optical fiber is F2 core, EN1 clad, approx. 50 µm diameter per strand. Flexible steel interlock sheathing is 302 stainless.
Sensing Range	Refer to the specific fiber optic to be used.
Bend Radius	Inside bend radius must b 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

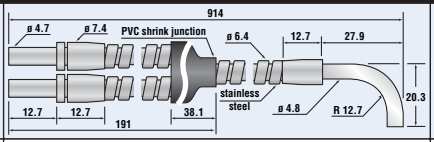
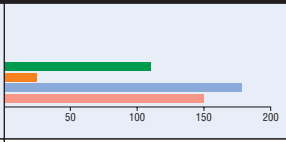
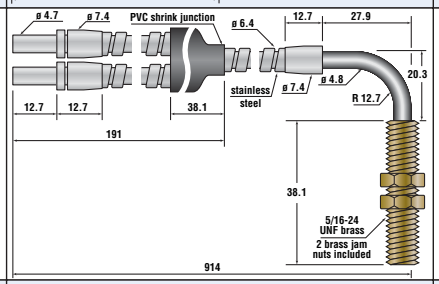
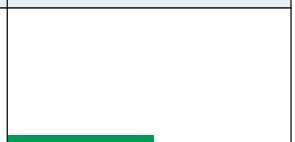
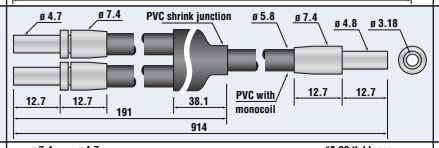
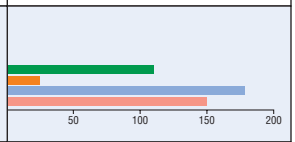
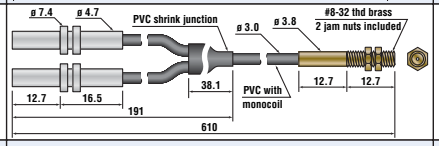
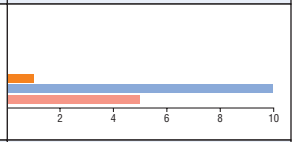
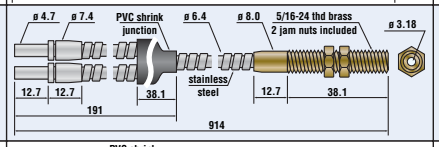
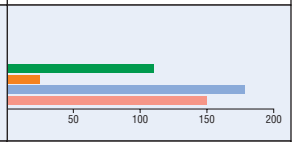
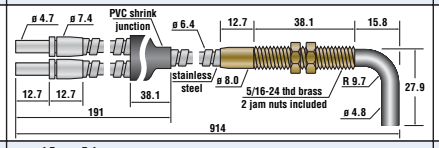
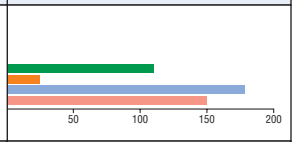
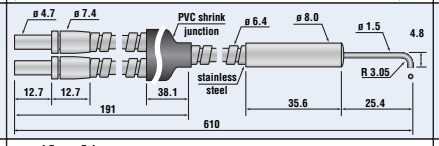
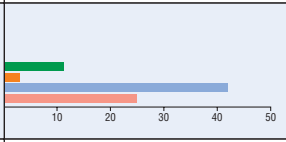
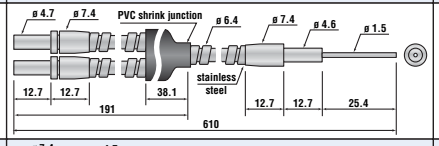
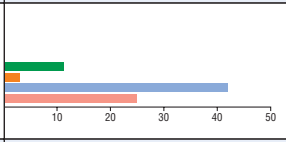
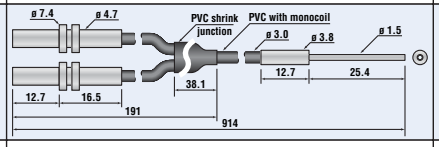
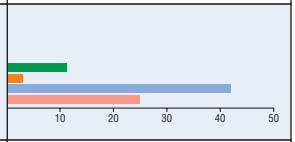
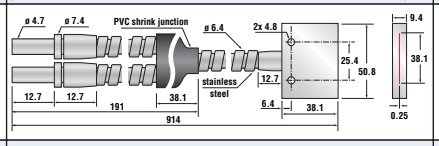
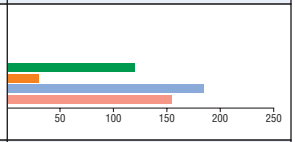
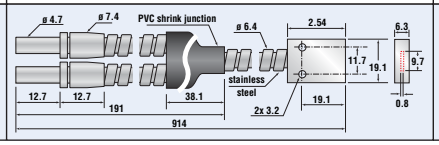
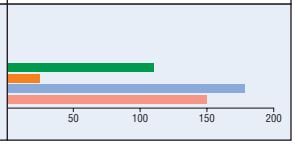


* *Range data for QS18F not available at printing.*

MORE INFO ONLINE

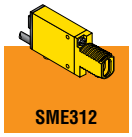
M600 *Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23S**M600**).*

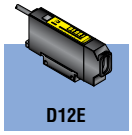
M900 *Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23S**M900**).*

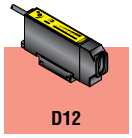
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	STANDARD	**BA23S** *Detailed Dimensions Online*		3.18	19	• 90° Angle M600 M900	
		BAT23S *Detailed Dimensions Online*		3.18	19	• 90° Angle/Thread M600 M900	
		BF23P *Detailed Dimensions Online*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

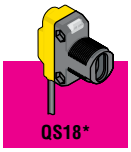
Indicates lenses available for model. See page 201 for details.


R55F


SME312


D12E


D12

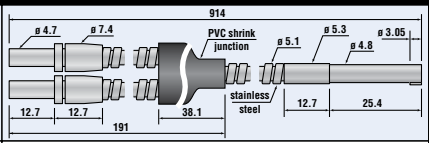
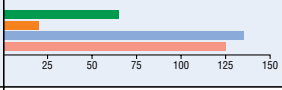
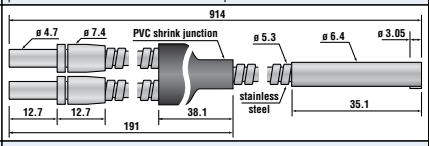
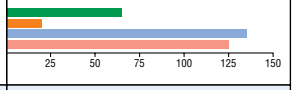
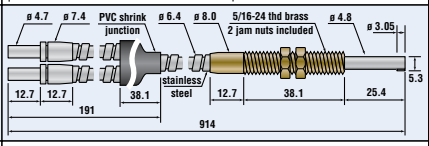
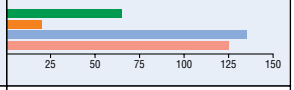
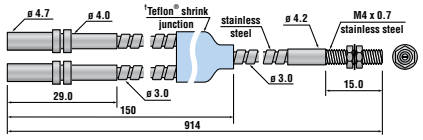
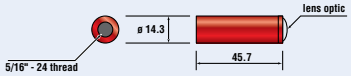

QS18*

* *Range data for QS18F not available at printing.*

MORE INFO ONLINE

M600 *Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23S**M600**).*

M900 *Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23S**M900**).*

		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	SIDE-VIEW	**BA1.53SMETA** *Detailed Dimensions Online*		2.29	19	• Ultra-compact head **M600**	
		BA1.53SMTA *Detailed Dimensions Online*		2.29	19	• Compact head **M600**	
		BTETA1.53S *Detailed Dimensions Online*		2.29	19	• Ultra-compact head; thread **M600**	
	VACUUM	**BMT13SMVF** *Detailed Dimensions Online*		1.57	19	• Miniature thread; entire cable withstands 480° C (900° F)	*Contact factory representative for range information*
	CONVERGENT BEAM SPOT	**L10** *Detailed Dimensions Online*		*ref. glass fiber key or call factory*	*ref. glass fiber key or call factory*	• Glass lens; withstands 315° C (600° F) • Focuses light to .80 mm with ø 1.6 mm fiber	

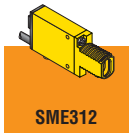
Glass Fiber Optics—Additional Models Available

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

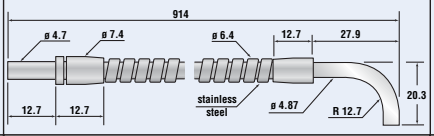
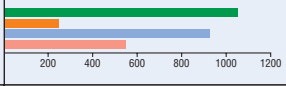
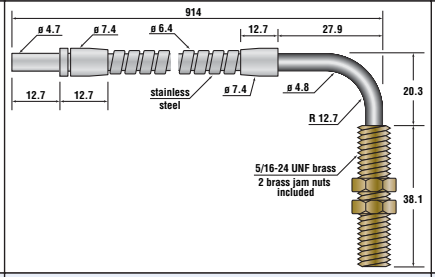
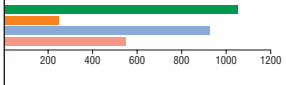
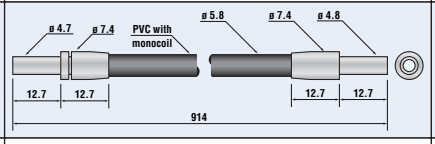
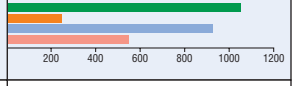
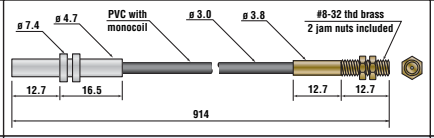
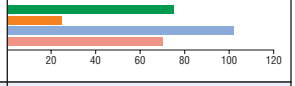
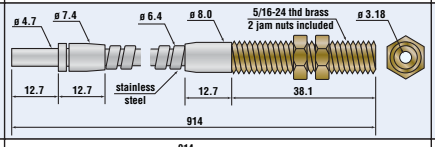
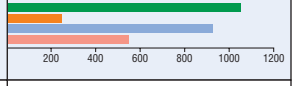
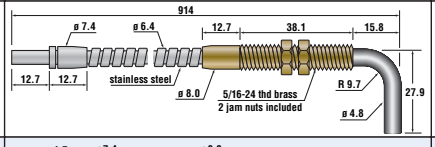
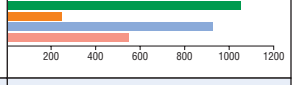
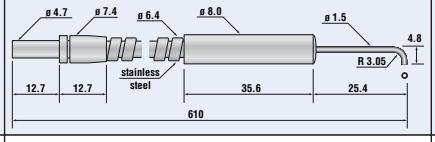
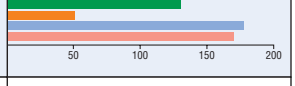
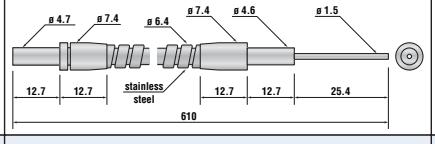
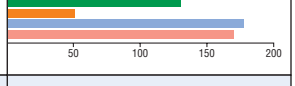
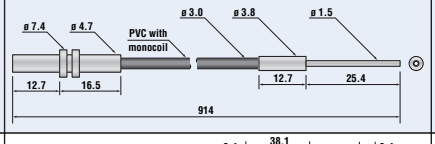
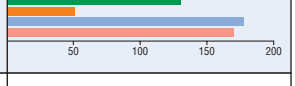
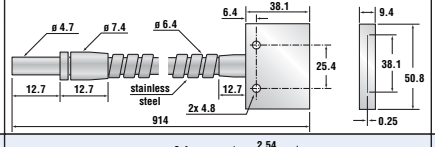
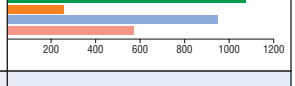
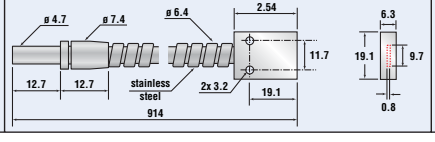
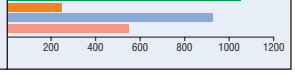


* *Range data for QS18F not available at printing.*

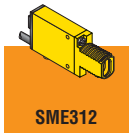
*M600 Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23S**M600**).*

*M900 Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23S**M900**).*

OPPOSED

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

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

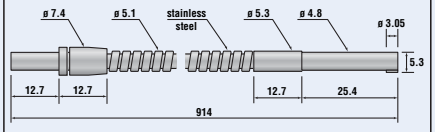
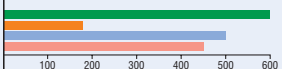
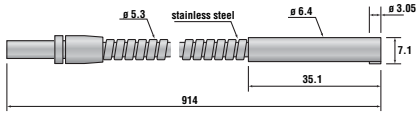
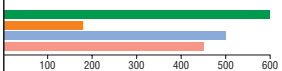
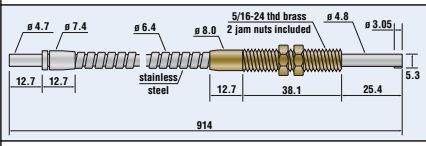
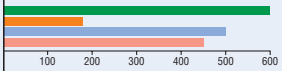
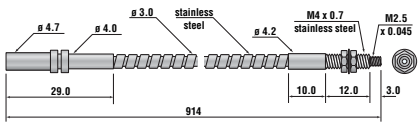
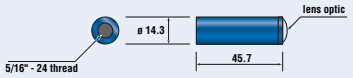
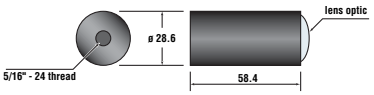
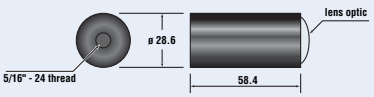
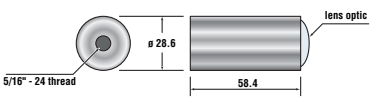
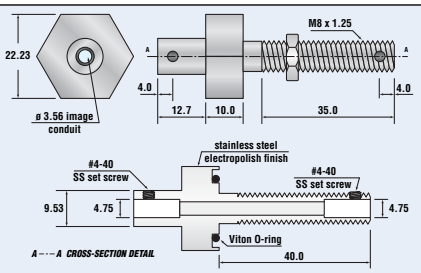
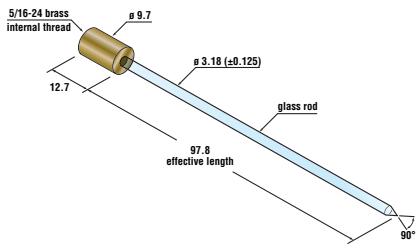


* *Range data for QS18F not available at printing.*

MORE INFO ONLINE

M600 *Available 315° C (600°F) models. Add M600 to end of model number (ex: BA23S**M600**).*

M900 *Available 480° C (900°F) models. Add M900 to end of model number (ex: BA23S**M900**).*

		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
OPPOSED	SIDE-VIEW	**IA1.53SMETA** *Detailed Dimensions Online*		2.29	19	• Ultra-compact head **M600**	
		IA1.53SMTA *Detailed Dimensions Online*		2.29	19	• Compact head **M600**	
		ITETA1.53S *Detailed Dimensions Online*		2.29	19	• Ultra-compact head; thread **M600**	
	VACUUM	**IMT.753SMVF** *Detailed Dimensions Online*		1.27	19	• Miniature thread; entire cable withstands 480° C (900° F)	*Contact factory representative for range information*
	EXTENDED RANGE LENS	**L9** *Detailed Dimensions Online*		*ref. model IT23S*	*ref. model IT23S*	• Glass lens; withstands 315° C (600° F)	
		L16F *Detailed Dimensions Online*		*ref. model IT23S*	*ref. model IT23S*	• Plastic housing; withstands 105° C (220° F)	
		L16FAL *Detailed Dimensions Online*		*ref. model IT23S*	*ref. model IT23S*	• Aluminum housing; withstands 315° C (600° F)	
		L16FSS *Detailed Dimensions Online*		*ref. model IT23S*	*ref. model IT23S*	• Stainless steel housing; withstands 480° C (900° F)	
ACCESSORIES	VACUUM FEED THROUGH	**VFT-M8MVS** *Detailed Dimensions Online*		3.56	-	• Seals to 1 x 10^{-9} torr; withstands 120° C (248° F)	
	LIQUID LEVEL	**TGR** *Detailed Dimensions Online*		3.18	-	• Use with BT23S • Sensor switches when tip of glass rod is immersed in liquid