

Fiber Optic Systems

Fiber System Overview page 170

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



D10 page 172

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



FI22 page 186

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



D12 page 178

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



Plastic Fibers page 188

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



R55F page 183

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



Glass Fibers page 204

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

The broadest selection of fiber sensors in the world.

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; others 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.

Sensor Model	Models for Plastic Fibers	Page Number	Models for Glass Fibers	Page Number
WORLD-BEAM®		page 70		page 70
MINI-BEAM®		page 79		page 79
QM42		page 140		
Q45		page 146		page 146
OMNI-BEAM™		page 159		page 159
D10		page 172		
D12		page 178		page 178
R55F		page 183		page 183
FI22		page 186		
D11		page 34		
ECONO-BEAM®		page 34		page 34
MAXI-BEAM®		page 35		page 35
MULTI-BEAM®				page 35
PC44		See data sheet p/n 32910		
VALU-BEAM®		page 34		page 34
SM512				page 35

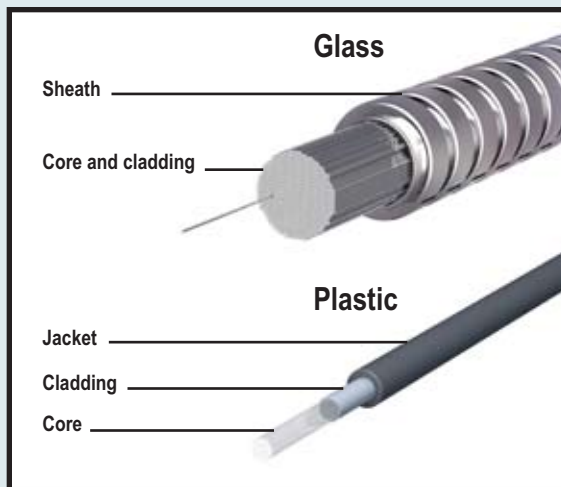
Typical Applications

- 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



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/Sheath** Protective layer to protect fiber from damage and moisture.

Specialty fibers for specific sensing applications.

Choosing Plastic or Glass

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 188**

- 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 204**

- 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



DURA-BEND™
for extremely tight
radius bends



**Fluoropolymer
encapsulated
fibers**



**Focused beam
fibers**



**Convergent beam
fibers**



**Linear array
fibers**



**Liquid level
detection fibers**



**High temperature
fibers**



STEELSKIN™ for
impact, abrasion

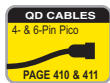
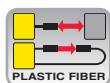
D10 Series

Redefining High-Performance Fiber Optic Sensing

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

Expert™ Models:

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



Expert™ Advanced LED Display

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

Expert™ Dual-Discrete Outputs

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



Expert™ Analog & Discrete Outputs

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



D10 Expert™ with Numeric Display	page 173
D10 Expert™ with Bargraph Display	174
D10 Discrete Output	174

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 Expert™ with Bussable Power

- Connect up to 16 devices side-to-side
- Reduce wiring cost; connect power to one sensor and bus to the next
- Save making up to 30 power connections



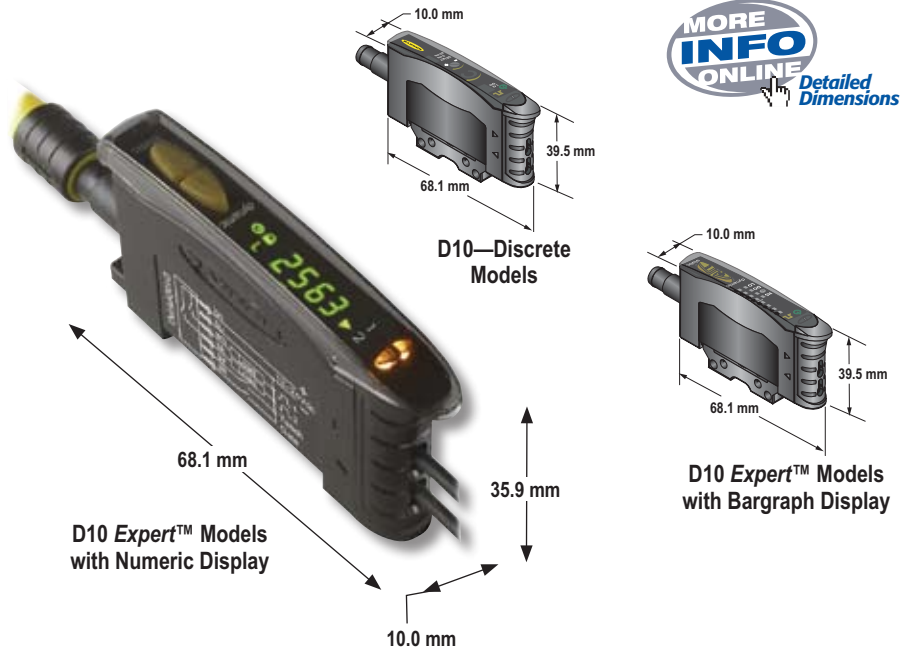
D10 Discrete Output

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





D10 Sensors



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



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

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

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



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

* Visible Red LED Visible Green LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **D10DNFP W30**). A model with a QD requires a mating cable (see page 411).





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

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Analog Output	Data Sheet
D10UNFP	 PLASTIC FIBER	Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 65448 for range information.	2 m	NPN	0-10V	65448
D10UNFPQ			6-pin Pico QD			
D10UPFP			2 m	PNP		
D10UPFPQ			6-pin Pico QD			
D10UNFPG	 PLASTIC FIBER		2 m	NPN	0-10V	
D10UNFPGQ			6-pin Pico QD			
D10UPFPG			2 m	PNP		
D10UPFPGQ			6-pin Pico QD			



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

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
D10BFP	 PLASTIC FIBER	Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 117830 for range information.	2 m	Bipolar NPN/PNP	EGCP-26 to EGCP-29 (p. 489)	BPP-26 to BPP-29 (p. 508)	117830
D10BFPQ	6-pin Pico QD						
D10BFPG	 PLASTIC FIBER		2 m		EGCP-30 to EGCP-33 (pp. 489-490)	BPP-30 to BPP-33 (pp. 508-509)	
D10BFPGQ	6-pin Pico QD						





D10—Discrete, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Data Sheet
D10AFP	 PLASTIC FIBER	Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 118431 for range information.	2 m	Bipolar NPN/PNP	118431
D10AFPQ			4-pin Pico QD		
D10AFPG			2 m		
D10AFPGQ			4-pin Pico QD		
D10AFPY	 PLASTIC FIBER	Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 118431 for range information.	2 m		
D10AFPYQ			4-pin Pico QD		
D10AFPGY			2 m		
D10AFPGYQ			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, **D10UNFP W/30**). A model with a QD requires a mating cable (see pages 410 and 411).

D10 Expert™ with Numeric Display—Dual-Discrete Specifications



Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)
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, depending on model.
Output Rating	150 mA max. load OFF-state leakage current: less than 10 μ A at 24V dc ON-state saturation voltage: NPN: less than 1.5V at 150 mA load PNP: less than 2.5V at 150 mA load
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit
Output Response Time	Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds NOTE: less than 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	IEC IP50; NEMA 1
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 411.
Operating Conditions	Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C
	Number of Devices Stacked Ambient Temperature Rating Load Specification
	3 55° C 150 mA
	7 50° C 50 mA
	10 45° C 50 mA
Installation	35 mm DIN rail or included mounting bracket
Certifications	 
Hookup Diagrams	DC14: (p. 523)

D10 Expert™ with Numeric Display—Analog/Discrete Specifications


Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)
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	Two 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: less than 10 μ A at 24V dc ON-state saturation voltage: NPN: < 1.5V @ 150 mA PNP: < 2.5V @ 150 mA Analog Output: 4-20 mA or 0-10V dc Load: 4-20 mA Models: 100 Ω max. impedance 0-10V dc Models: 1 M Ω min. impedance
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit
Output Response Time	Discrete Output: Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds Analog Output: 1 millisecond NOTE: less than 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.

More on
next page

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

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 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect. QD cables are ordered separately. See page 411.		
Operating Conditions	Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C		
	Number of Devices Stacked	Ambient Temperature Rating	Load Specification
	3	55° C	150 mA
	7	50° C	50 mA
	10	45° C	50 mA
Installation	35 mm DIN rail or included mounting bracket		
Certifications	 		
Hookup Diagrams	NPN Models: DC15 (p. 523) PNP Models: DC16 (p. 523)		

D10 Expert™ with Bargraph Display—Discrete Specifications

Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)
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 @ 25° C (derate 1 mA per ° C increase)
	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
	<ul style="list-style-type: none"> • Expert-style configuration (Static and Dynamic TEACH, and Windows SET) • Manually Adjust (+/-) sensitivity (from buttons only) • LO/DO, OFF-Delay, and response speed configurable (from buttons or remote wire) • Push-button lockout (from remote wire only)
Indicators	Factory Default Settings: Light Operate, Normal Speed, No Delay
	8-segment red bargraph: Light-to-dark signal difference relative to taught condition (window SET) Sensing contrast (Static or Dynamic 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	IEC IP50, NEMA 1
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 411.
Operating Conditions	Temperature: -10° to +55° C Storage Temperature: -20° to +85° C Relative humidity: 90% @ 55° C
Installation	35 mm DIN rail or included mounting bracket
Certifications	
Hookup Diagrams	DC08 (p. 521)

D10—Discrete Specifications

Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)
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: less than 10 μ A sourcing; 200 μ A sinking ON-state saturation voltage: NPN: 1.6V @ 100 mA PNP: 2.0V @ 100 mA
Output Protection Circuitry	Protected against output short-circuit and false pulse on power up (max. 100 milliseconds delay on power up; outputs do not conduct during this time).
Output Response Time	Standard models (with crosstalk 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 410.
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	DC04 (p. 520)

D12

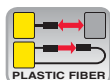
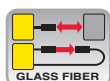
Complete Family of Plastic and Glass Fiber Optic Sensors

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

D12 *Expert*™ Models page 179

D12 Standard Models 179

D12 AC-Coupled Models 180

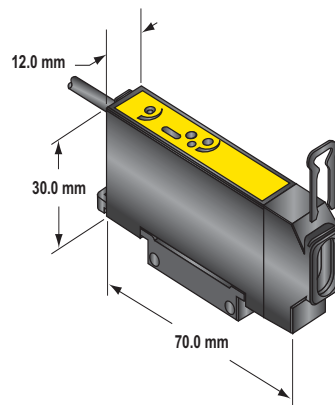


D12 Sensors

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

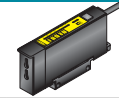



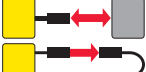
Plastic Fiber Models
Suffix FP and FPY



Glass Fiber Models
Suffix FV and FVY

D12 Expert™, 10-30V dc



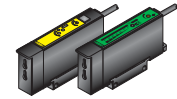
Models	Sensing Mode/LED*	Maximum Range	Switching Threshold Setting	Cable**	Output Type	Data Sheet
D12EN6FV	 GLASS FIBER	Range varies by sensing mode and fiber optics used. See data sheet part number 41974 for maximum range specifications.	Just above the “dark” condition	2 m	NPN	41974
D12EP6FV					PNP	
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	





SENSORS

PLASTIC FIBERS

GLASS FIBERS

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	NPN	500 μ s	EGCG-40 & EGCG-41 (p. 487)	32822
D12SN6FVQ			4-Pin Pico Pigtail QD				
D12SP6FV			2 m	PNP			
D12SP6FVQ			4-Pin Pico Pigtail QD				
D12SN6FVY	 HIGH-SPEED GLASS FIBER		2 m	NPN	Selectable 50 μ s or 500 μ s***	EGCG-42 & EGCG-43 (p. 487)	
D12SN6FVYQ			4-Pin Pico Pigtail QD				
D12SN6FVY1†			2 m				
D12SN6FVY1Q†			4-Pin Pico Pigtail QD				
D12SP6FVY			2 m	PNP			
D12SP6FVYQ			4-Pin Pico Pigtail QD				
D12SP6FVY1†			2 m				
D12SP6FVY1Q†			4-Pin Pico Pigtail QD				
D12SN6FP	 PLASTIC FIBER	2 m	NPN	500 μ s	EGCP- 34 & EGCP-35 (p. 490)		
D12SN6FPQ		4-Pin Pico Pigtail QD					
D12SP6FP		2 m	PNP				
D12SP6FPQ		4-Pin Pico Pigtail QD					
D12SN6FPY	 HIGH-SPEED PLASTIC FIBER	2 m	NPN	Selectable 50 μ s or 500 μ s***	EGCP-36 & EGCP-37 (p. 490)		
D12SN6FPYQ		4-Pin Pico Pigtail QD					
D12SN6FPY1†		2 m					
D12SN6FPY1Q†		4-Pin Pico Pigtail QD					
D12SP6FPY		2 m	PNP				
D12SP6FPYQ		4-Pin Pico Pigtail QD					
D12SP6FPY1†		2 m					
D12SP6FPY1Q†		4-Pin Pico Pigtail QD					

† Y1 models have 20 milliseconds output pulse stretcher.


* Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, D12EN6FV W/30). A model with a QD requires a mating cable (see page 410).

*** 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	 PLASTIC FIBER	Range varies by sensing mode and fiber optics used	2 m	NPN	500 μ s	EGCP- 38 & EGCP-39 (p. 490)	34970
D12SN6FPHQ			4-Pin Pico Pigtail QD				
D12SP6FPH			2 m	PNP			
D12SP6FPHQ			4-Pin Pico Pigtail QD				

D12 AC-Coupled, 10-30V dc



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

* 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 410).

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 μ A at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; 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	IEC IP11; NEMA 2
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 410.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications (except D10E2)	 
Hookup Diagrams	DC17 (p. 524)

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 μ A at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; 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 μ s 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	IEC IP11; NEMA 2
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 410.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	 
Hookup Diagrams	NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)

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 μ A at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; 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	IEC IP11; NEMA 2
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 410.
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	DC04 (p. 520)



R55F

Glass or Plastic Fiber Optic Sensors

- Delivers outstanding color contrast sensitivity
- Features innovative TEACH function with two options for setting the sensing threshold
- Reliably detects 16 levels of gray scale 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.

SENSORS

PLASTIC FIBERS

GLASS FIBERS



R55 Fiber Optic Sensors

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





R55 Fiber Optic, 10-30V dc

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

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

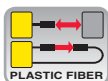
** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **R55F W/30**). A model with a QD requires a mating cable (see page 414).

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com

FI22 Expert™

Low-Profile Inline Fiber Optic Sensors

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



FI22 Expert™ Sensors

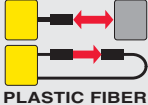
- *Push-button TEACH-mode programming*
- *2 m or 9 m integral cable, or 6-pin Pico-style quick-disconnect*
- *Easy-to-read 8-segment bargraph status indicator*
- *Custom bracket for quick snap-in mounting*



Plastic Fiber Models
Suffix FP

FI22 Expert™, 10-30V dc





Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
FI22FP	 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-40, EGCP-41 & EGCP-42 (p. 490)	Opposed mode: BPP-34, BPP-35 & BPP-36 (p. 509)	108899
FI22FPQ			6-pin Pico QD		Diffuse mode: EGCP-43, EGCP-44 & EGCP-45 (p. 490)	Diffuse mode: BPP-37, BPP-38 & BPP-39 (p. 509)	

*  Visible Red LED

** For 9 m cable, add suffix W30 to the 2 m model number (example, FI22FP W30). A model with a QD requires a mating cable (see page 411).

FI22 Expert™ Specifications

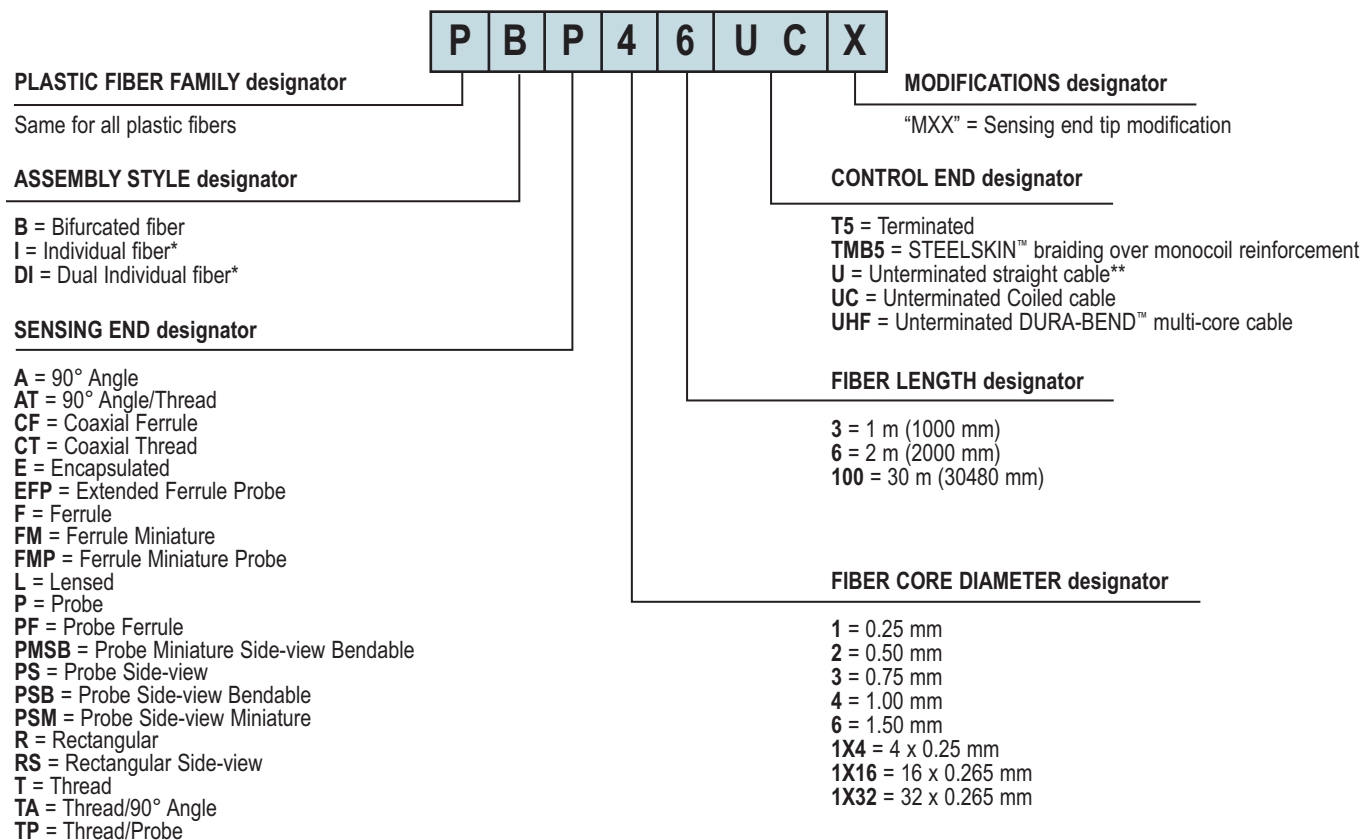
Supply Voltage	10 to 30V dc (10% max. ripple) @ less than 32 mA exclusive of load
Supply Protection Circuitry	Protected against reverse polarity, over voltage, and transient voltages
Delay at Power Up	250 milliseconds max.; outputs do not conduct during this time
Output Configuration	Bipolar: 1 current 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) or 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 411.
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 90% @ 50° C (non-condensing)
Certifications	 
Hookup Diagrams	DC08 (p. 521)

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



* 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.

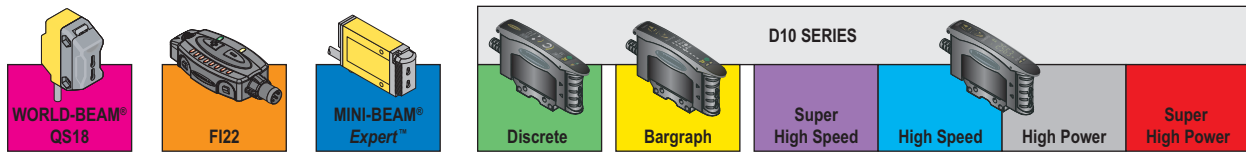
** Plastic fibers with "U" in the suffix of the model numbers have unterminated control ends; cut them to the required length. Use supplied cutter.

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: $x = \pm 2.5$ mm, $x.x = \pm 0.25$ mm and $x.xx = \pm 0.12$ 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 157). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.



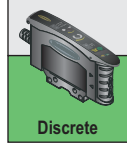
Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
PBF16U		0.25	8	• Smooth ferrule	✓	 Details Online
PBF26U		0.5	12	• Smooth ferrule	✓	 Details Online
PBF46U		1.0	25	• Smooth ferrule	✓	 Details Online
PBF46UM3MJ1.3		1.0	25	• Smooth ferrule; thin jacket (ø 1.3)	✓	 Details Online
PBF66U		1.5	38	• Smooth ferrule; long range	✓	 Details Online
PBFM16U		0.25	8	• Non-bendable miniature tip	✓	 Details Online
PBFM46U		1.0	25	• Smooth ferrule	✓	 Details Online
PBT16U		0.25	8	• Thread	✓	 Details Online
PBT26U		0.5	12	• Thread	✓	 Details Online
PBT46U		1.0	25	• Thread	✓	 Details Online
PBT66U		1.5	38	• Thread; long range	✓	 Details Online

NA: WORLD-BEAM QS18 not recommended.

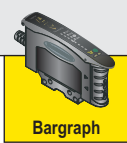
* Fibers can be free cut using fiber cutter (see page 203).

WORLD-BEAM®
QS18

F122

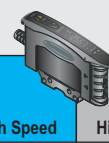
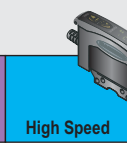
MINI-BEAM®
Expert™

Discrete



Bargraph

D10 SERIES

Super
High Speed

High Speed



High Power

Super
High Power

SENSORS

PLASTIC
FIBERSGLASS
FIBERS

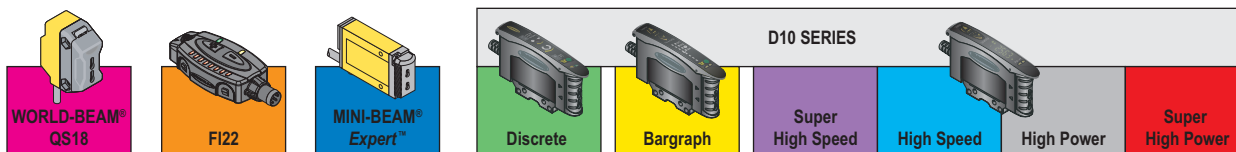
Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)		
Diffuse	Probe	PBEFP26U		0.5	12	• Smooth ferrule; non-bendable tip	✓	
		PBFMP16UMP2		0.25	8	• Smooth ferrule; non-bendable tip	✓	
		PBP16U		0.25	8	• Thread; bendable tip	✓	
		PBP26U		0.5	12	• Thread; bendable tip	✓	
		PBP46U		1.0	25	• Thread; bendable tip	✓	
		PBPF26U		0.5	12	• Thread; bendable tip	✓	
		PBPF26UMB		0.5	12	• Flat mounting block; bendable tip	✓	
Side-view		PBPMSB36U		0.75	20	• Smooth ferrule; bendable tip	✓	
		PBPS26U		0.5	12	• Smooth ferrule; bendable tip	✓	
		PBPS46U		1.0	25	• Smooth ferrule; bendable tip	✓	
		PBPS46UMT		1.0	25	• Thread; non-bendable tip	✓	
		PBPS66U		1.5	38	• Smooth ferrule; non-bendable tip	✓	

NA: WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 203).

More information online at bannerengineering.com

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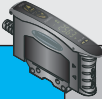












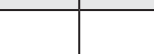




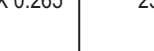

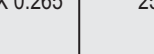








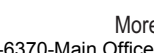

Model Number		Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)	
Diffuse	Coaxial	PBCF21X46U		0.5 4X 0.25	12	• Miniature probe tip	✓	 Details Online
		PBCF46U		1.0 16X 0.265	25	• Smooth ferrule	✓	 Details Online
		PBCT21X46U		0.5 4X 0.25	12	• Miniature thread	✓	 Details Online
		PBCT26U		0.5 9X 0.25	12	• Thread	✓	 Details Online
		PBCT26UM3		0.5 9X 0.25	12	• Miniature thread	✓	 Details Online
		PBCT26UM4M2.5		0.5 9X 0.25	12	• Thread	✓	 Details Online
	High-Flex	PBCT46U		1.0 16X 0.265	25	• Thread	✓	 Details Online
		PBFM1X43T5		4X 0.25	8	• Best for repetitive flexing (1,000s of cycles)		 Details Online
		PBP46UC		1.0	25	• For applications involving reciprocating motion	✓	 Details Online
	Convergent Beam Spot	PBT46UC		1.0	25	• For applications involving reciprocating motion	✓	 Details Online
PLI-A10			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.

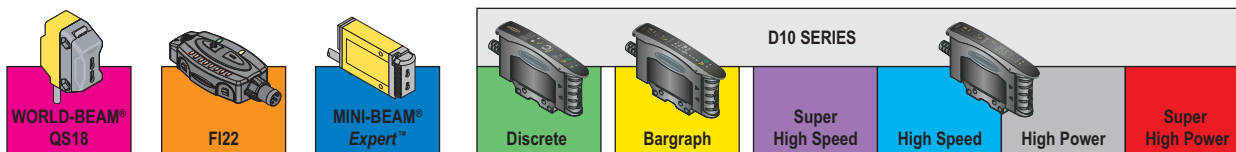
Indicates lens available for model. See page 195 for details.

* Fibers can be free cut using fiber cutter (see page 203).

							D10 SERIES						
		WORLD-BEAM® QS18	FI22	MINI-BEAM® Expert™	Discrete	Bargraph	Super High Speed	High Speed	High Power	Super High Power			
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													
													

NA: WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 203).




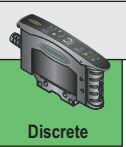


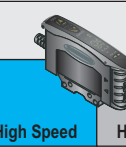
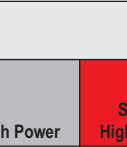
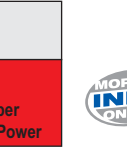




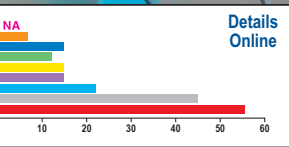
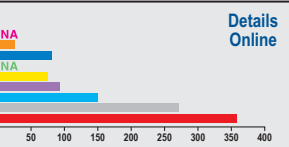
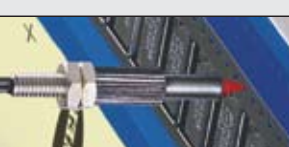
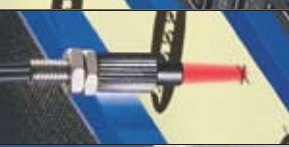



Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
Diffuse STEELSKIN		1.0	12	• 90° Angle/Thread		Details Online
		0.5 9X 0.25	12	• Miniature thread		Details Online
		0.5 9X 0.25	12	• Thread		Details Online
		1.0	12	• Smooth ferrule		Details Online
		1.0	12	• Smooth ferrule; non-bendable tip		Details Online
		1.0	12	• Thread		Details Online
		1.0	12	• Thread/90° Angle		Details Online
		1.0	12	• Thread; bendable tip		Details Online
High Temp		1.0	25	• Thread; withstands 105° C		Details Online

NA: WORLD-BEAM QS18 not recommended.

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

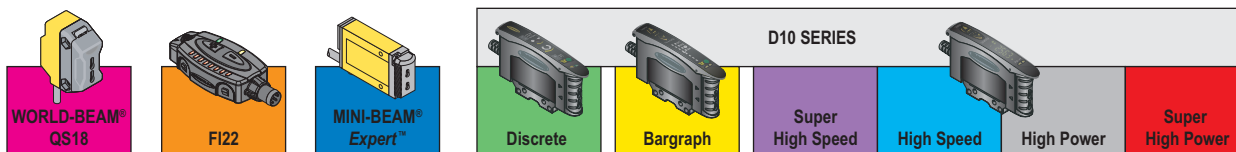
* Fibers can be free cut using fiber cutter (see page 203).

<div>    <div>   <div> D10 SERIES     </div> </div>  </div>						
Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
Diffuse	Liquid Level	1.0	25	<ul style="list-style-type: none"> Fluoropolymer encapsulated Sensor switches when tip of fiber is immersed in liquid 	✓	
				<ul style="list-style-type: none"> Fluoropolymer encapsulated; with-stands 105° C Sensor switches when tip of fiber is immersed in liquid 	✓	
		0.5	12	<ul style="list-style-type: none"> Quartz probe; polypropylene housing Sensor switches when tip of quartz is immersed in liquid 	✓	
		1.0	1	<ul style="list-style-type: none"> Clear tube mount; DURA-BEND fiber Sensor switches when liquid meniscus reaches optical axis 	✓	
Chemical Resistant	Flat Pack	0.5	12	<ul style="list-style-type: none"> 3.2 mm thickness; DURA-BEND fiber 	✓	 Details Online
		1.0	25	<ul style="list-style-type: none"> Fluoropolymer encapsulated tip 	✓	 Details Online
Convergent Spot Lens	L4C6	ref. model PBCT26U	ref. model PBCT26U	<ul style="list-style-type: none"> Anodized AL housing; ø 0.25 mm beam spot @ 6 mm Fixed focus 		
	L4C20	ref. model PBCT26U	ref. model PBCT26U	<ul style="list-style-type: none"> Anodized AL housing; ø 4 mm beam spot @ 20 mm Fixed focus 		
	LZ3C8	ref. model PBCT26UM3	ref. model PBCT26UM3	<ul style="list-style-type: none"> Anodized AL housing; ø 0.5 - 3.2 mm adj. beam spot Adjustable focus 		

NA: WORLD-BEAM QS18 not recommended.

NA: D10-Discrete not recommended.

* Fibers can be free cut using fiber cutter (see page 203).




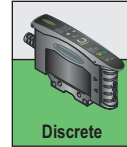

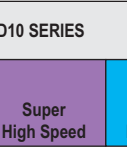
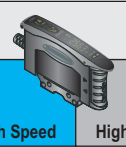
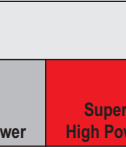


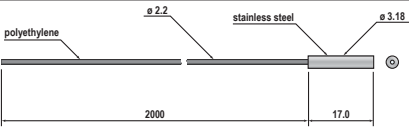
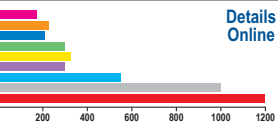
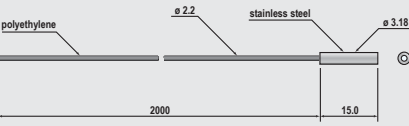
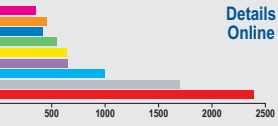
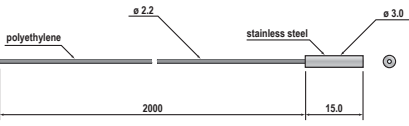
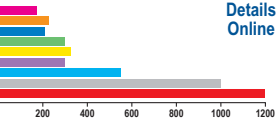
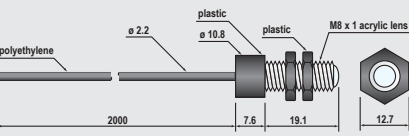
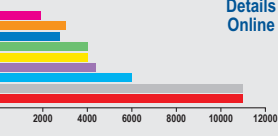
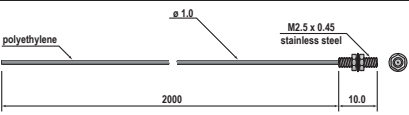
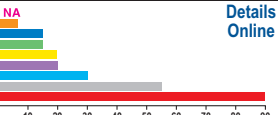
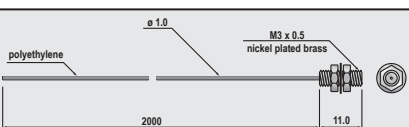
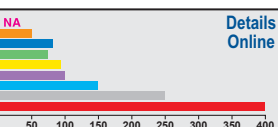
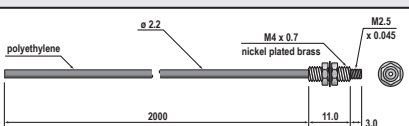
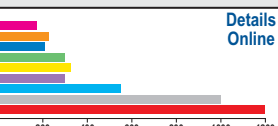
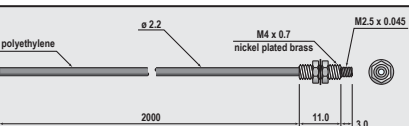
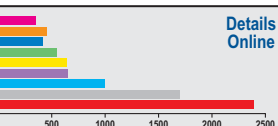
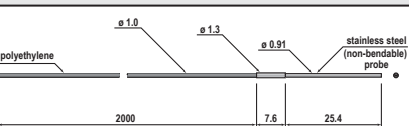
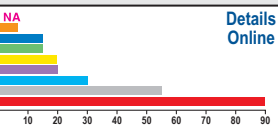
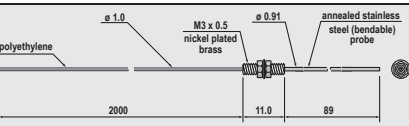
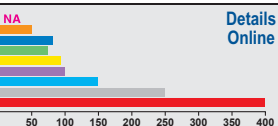
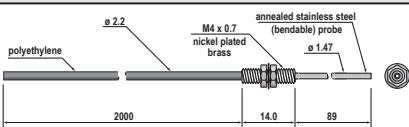
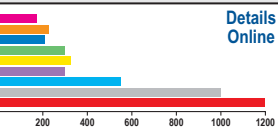


Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
PIA16U		0.25	8	• 90° Angle	✓	Details Online
PIA26U		0.5	12	• 90° Angle	✓	Details Online
PIAT16U		0.25	8	• 90° Angle/Thread	✓	Details Online
PIAT26U		0.5	12	• 90° Angle/Thread	✓	Details Online
PIAT46U		1.0	25	• 90° Angle/Thread	✓	Details Online
PIAT46UM 4X.4MT		10.	25	• 90° Angle/Thread	✓	Details Online
PIAT66U		1.5	38	• 90° Angle/Thread; long range	✓	Details Online
PIF16U		0.25	8	• Smooth ferrule	✓	Details Online
PIF26U		0.5	12	• Smooth ferrule	✓	Details Online
PIF26UMLS		0.5	12	• Smooth ferrule; thick jacket (ø 2.2 mm)	✓	Details Online

NA: WORLD-BEAM QS18 not recommended.

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

* Fibers can be free cut using fiber cutter (see page 203).

<div>    <div>   <div> D10 SERIES     </div> </div>  </div>						
Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
Standard		1.0	25	• Smooth ferrule	✓	 Details Online
		1.5	38	• Smooth ferrule; long range	✓	 Details Online
		1.0	25	• Smooth ferrule; miniature tip	✓	 Details Online
		1.0	25	• Plastic lens; ultra-long range • Lens available separately, see page 201.	✓	 Details Online
		0.25	8	• Thread	✓	 Details Online
		0.5	12	• Thread	✓	 Details Online
		1.0	25	• Thread	✓	 Details Online
		1.5	38	• Thread; long range	✓	 Details Online
Probe		0.25	8	• Smooth ferrule; non-bendable tip	✓	 Details Online
		0.5	12	• Thread; bendable tip	✓	 Details Online
		1.0	25	• Thread; bendable tip	✓	 Details Online

NA: WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 203).

		D10 SERIES						MORE INFO ONLINE			
		WORLD-BEAM® QS18	FI22	MINI-BEAM® Expert™	Discrete	Bargraph	Super High Speed	High Speed	High Power	Super High Power	


NA: WORLD-BEAM QS18 not recommended.

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

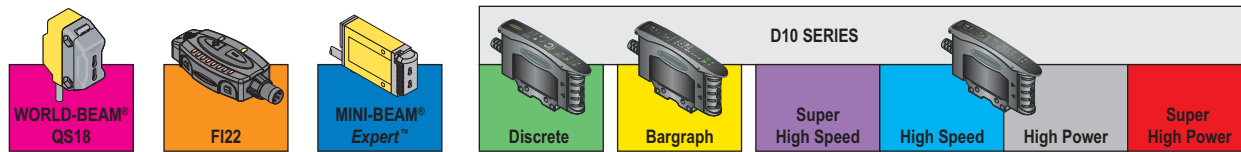
* Fibers can be free cut using fiber cutter (see page 203).

<div><div><div></div><div>WORLD-BEAM® QS18</div></div><div><div></div><div>FI22</div></div><div><div></div><div>MINI-BEAM® Expert™</div></div><div><div></div><div>Discrete</div></div><div><div></div><div>Bargraph</div></div><div><div></div><div>Super High Speed</div></div><div><div></div><div>High Speed</div></div><div><div></div><div>High Power</div></div><div><div></div><div>Super High Power</div></div></div> <div>D10 SERIES</div> <div><div></div><div>MORE INFO ONLINE</div></div>									
Model Number		Drawing & Dimensions		Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)	
Opposed	DURA-BEND	PIA46UHF		1.0	1	• 90° Angle/Thread	✓		Details Online
		PIF46UHF		1.0	1	• Smooth ferrule	✓		Details Online
		PIFM46UHF		1.0	1	• Smooth ferrule; miniature tip	✓		Details Online
		PIP46UHF		1.0	1	• Thread; bendable tip	✓		Details Online
		PIPS46UHF		1.0	1	• Smooth ferrule; non-bendable tip	✓		Details Online
		PIPSB46UHF		1.0	1	• Smooth ferrule; bendable tip	✓		Details Online
		PIT26UHF		0.5	1	• Thread	✓		Details Online
		PIT46UHF		1.0	1	• Thread	✓		Details Online
Chemical Resistant	PIE46UT		1.0	25	• Fluoropolymer encapsulated; lens	✓		Details Online	
	PIE66UTMNL		1.5	38	• Fluoropolymer encapsulated; lens	✓		Details Online	
	PIES46UT		1.0	25	• Fluoropolymer encapsulated; side-view prism	✓		Details Online	

NA: WORLD-BEAM QS18 not recommended.

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

* Fibers can be free cut using fiber cutter (see page 203).



Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
Opposed	PIR1X166U	16X 0.265	25	• Ultra-compact head; straight exit; 5.25 mm width	✓	Details Online
	PIRS1X166U	16X 0.265	25	• Ultra-compact head; side exit; 5.25 mm width	✓	Details Online
	PIRS1X166UM4	16X 0.265	25	• Compact head; side exit; 10 mm width	✓	Details Online
	PIRS1X166UMPM.75	16X 0.265	25	• Side exit; 19 mm width	✓	Details Online
	PIRS1X166UMPMAL	16X 0.265	25	• Side exit; 34 mm width	✓	Details Online
High Temp	PIT46UHT1	1.0	25	• Thread; withstands 105° C	✓	Details Online
Slot	PDIS46UM12	1.0	25	• Easy mount "fork" head; DURA-BEND fiber	✓	
	PDISM46UM5MA	1.0	25	• 90° Angle; ompact "fork" head; DURA-BEND fiber	✓	

NA: WORLD-BEAM QS18 not recommended.

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

* Fibers can be free cut using fiber cutter (see page 203).




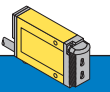


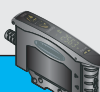



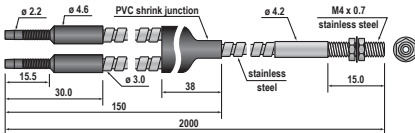
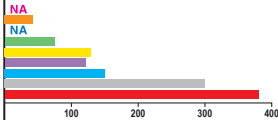
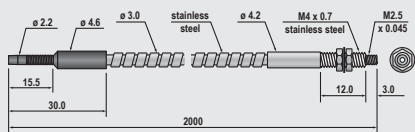

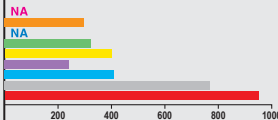
		D10 SERIES						MORE INFO ONLINE		
		WORLD-BEAM® QS18	FI22	MINI-BEAM® Expert™	Discrete	Bargraph	Super High Speed	High Speed	High Power	Super High Power

NA: WORLD-BEAM QS18 not recommended.

NA: MINI-BEAM Expert not recommended.

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

* Fibers can be free cut using fiber cutter (see page 203).

D10 SERIES									
 WORLD-BEAM® QS18	 FI22	 MINI-BEAM® Expert™	 Discrete	 Bargraph	 Super High Speed	 High Speed	 High Power	 Super High Power	
Model Number	Drawing & Dimensions			Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)	
Diffuse	High-Temp	BMT16.6S-HT		1.57	19	<ul style="list-style-type: none">High performance glass fiber optics for use with Banner D10 plastic fiber sensorsMiniature thread; end tip withstands 315° C		 Details Online	
	High-Temp	IMT.756.6S-HT†		1.27	19	<ul style="list-style-type: none">High performance glass fiber optics for use with Banner D10 plastic fiber sensorsMiniature thread; end tip withstands 315° C 		 Details Online	

NA: WORLD-BEAM QS18 not recommended.


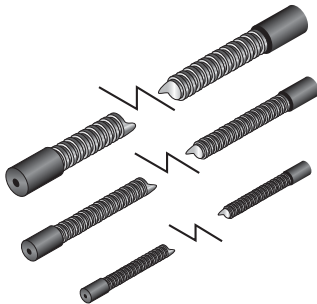
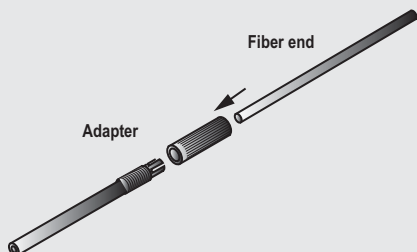
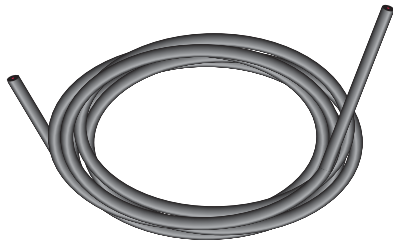
NA: MINI-BEAM Expert not recommended.

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

* Fibers can be free cut using fiber cutter (see page 203).

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

Fiber Optic Accessories

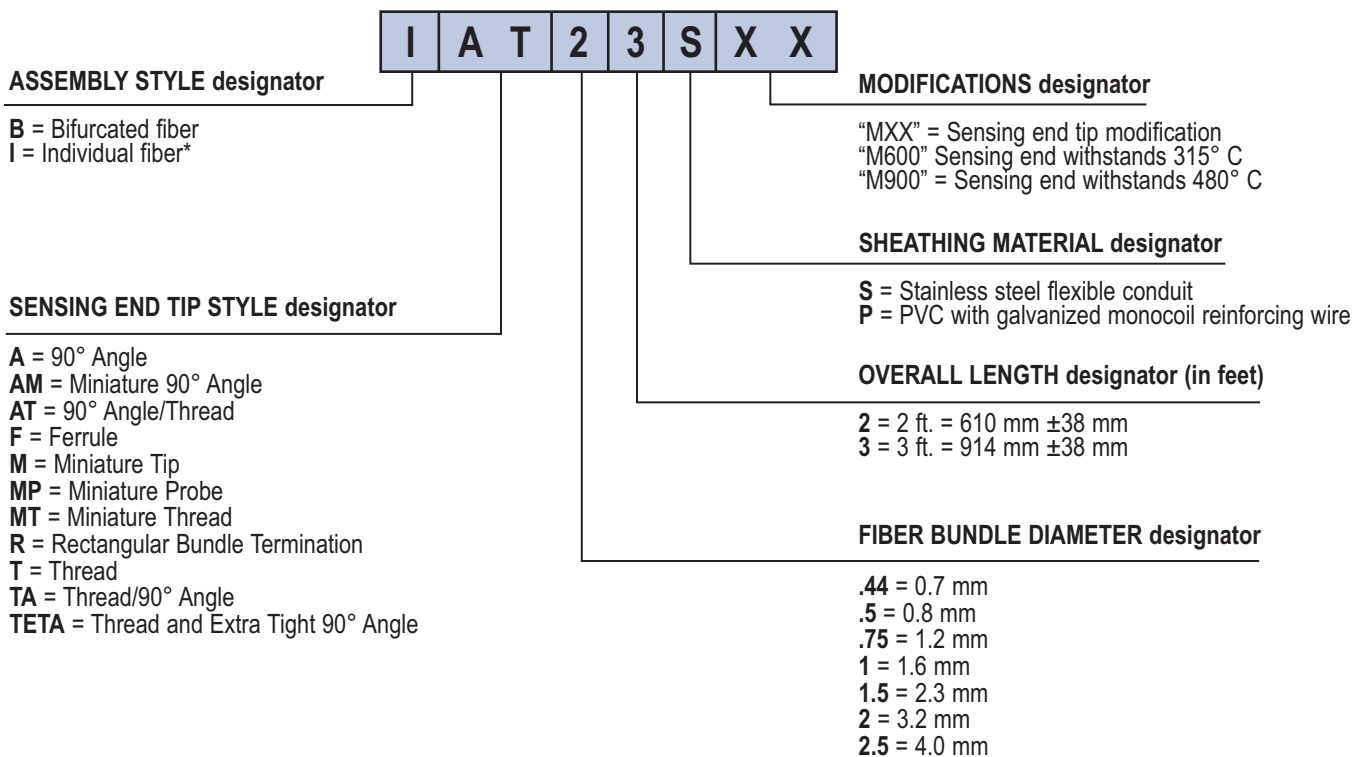
Model Number		Model Specific Features	General Features		Drawings
Fiber Cutters	PFK20	• For use with 0.25 mm and 0.5 mm diameter cables.	• These kits are used with unterminated plastic fiber cables. • Each kit contains 40 bushings and 10 cutter assemblies (cutters can be purchased separately in packages 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	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, PBP46U, 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	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, 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.			
Model Number		Core	Length	Type	Drawing
Unterminated Individual and Bifurcated Plastic Fibers	PIU230U	0.5 mm	9 m	Single	
	PIU260U		18 m		
	PIU430U	1.0 mm	9 m	Single	
	PIU460U		18 m		
	PIU630U	1.5 mm	9 m	Single	
	PIU660U		18 m		
	PBU430U	1.0 mm	9 m	Duplex	
	PBU460U		18 m		

Glass Fiber Optics

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



Glass Fiber Optic Model Key



* Individual glass fibers are packaged separately.

Glass Fiber Optics Specifications

Construction	Combination of optical glass fiber, stainless steel or PVC, brass, molded thermoplastics, and optical-grade epoxy. Optical fiber is F2 core, EN1 clad, approx. 50 μ m diameter per strand. Flexible steel interlock sheathing is 302 stainless.
Sensing Range	Refer to the specific fiber optic to be used.
Bend Radius	Inside bend radius must be 12 mm or greater for PVC covered fiber optic assemblies, and 25 mm or greater for stainless steel armored cable covered fibers.
Length	Standard length for assemblies is 915 mm; see dimension diagrams. Most models are available from the factory with shorter or longer cable lengths, up to 18 m max.
Length Dimension Tolerance	Overall assembly length: ± 12 mm per 300 mm of length Shrink junction dimensions: ± 12 mm
Implied Dimensional Tolerances	All dimensions are in millimeters: $x = \pm 2.5$ mm, $x.x = \pm 0.25$ mm and $x.xx = \pm 0.12$ mm, unless specified.
Operating Conditions	Fiber assemblies with stainless-steel (SS) sheathing and metal end tips: -140° to $+249^{\circ}$ C Fiber assemblies with PVC sheathing and/or plastic end tips: -40° to $+105^{\circ}$ C Special order assemblies with SS sheathing and metal end tips and model suffix "M600": -140° to $+315^{\circ}$ C* Special order assemblies with SS sheathing and metal end tips and model suffix "M900": -140° to $+480^{\circ}$ 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 34). This sensor is approved for use inside hazardous areas when used with an appropriate intrinsic barrier. Also, see NAMUR sensor models Q45AD9F (page 156) and MIAD9F (page 90). 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.

* Teflon® is a registered trademark of Dupont™.



Indicates lenses available for model. See page 207 for details.

Available 315° C models. Add **M600** to end of model number (example, BA23SM600).

Available 480° C models. Add **M900** to end of model number (example, BA23SM900).

Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Typical Range (mm)
Diffuse	Standard	3.18	19	• 90° Angle M600 M900	Details Online
				• 90° Angle/Thread M600 M900	Details Online
				• Smooth ferrule M600 M900	Details Online
				• Miniature thread M600 M900	Details Online
				• Thread M600 M900	Details Online
				• Thread/90° Angle M600 M900	Details Online
Miniature Probe	Miniature Probe	1.17	19	• ø 1.5 mm non-bendable probe; 90° angle M600	Details Online
				• ø 1.5 mm non-bendable probe M600	Details Online
				• ø 1.5 mm non-bendable probe	Details Online
Area Sensing (Array)	Area Sensing (Array)	3.96	19	• Straight exit; 38 mm width M600	Details Online
				• Straight exit; 10 mm width M600	Details Online



M600 Available 315° C models. Add **M600** to end of model number (example, **BA23SM600**).

M900 Available 480° C models. Add **M900** to end of model number (example, **BA23SM900**).

Model Number		Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Typical Range (mm)	
Diffuse	Side-view	BA1.53SMETA		2.29	19	<ul style="list-style-type: none">• Ultra-compact head	Details Online
		BA1.53SMTA		2.29	19	<ul style="list-style-type: none">• Compact head	Details Online
		BTETA1.53S		2.29	19	<ul style="list-style-type: none">• Ultra-compact head; thread	Details Online
Vacuum	BMT13SMVF		1.57	19	<ul style="list-style-type: none">• Miniature thread; entire cable withstands 480° C	Details Online Contact factory representative for range information	
	L10		ref. glass fiber key or call factory	ref. glass fiber key or call factory	<ul style="list-style-type: none">• Glass lens; withstands 315° C• Focuses light to .80 mm with ø 1.6 mm fiber		

SENSORS

PLASTIC FIBERS

GLASS FIBERS

More Models Available!

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 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 and 610 mm).



M600

Available 315° C models. Add **M600** to end of model number (example, **BA23SM600**).

M900

Available 480° C models. Add **M900** to end of model number (example, **BA23SM900**).

Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Typical Range (mm)
Side-view	IA1.53SMETA 	2.29	19	• Ultra-compact head M600	 Details Online
	IA1.53SMTA 	2.29	19	• Compact head M600	 Details Online
	ITEA1.53S 	2.29	19	• Ultra-compact head; thread M600	 Details Online
Vacuum	IMT753SMVF 	1.27	19	• Miniature thread; entire cable withstands 480° C	Contact factory representative for range information
Diffuse	L9 Detailed Dimensions Online 	ref. model IT23S	ref. model IT23S	• Glass lens; withstands 315° C	
	L16F Detailed Dimensions Online 	ref. model IT23S	ref. model IT23S	• Plastic housing; withstands 105° C	
	L16FAL Detailed Dimensions Online 	ref. model IT23S	ref. model IT23S	• Aluminum housing; withstands 315° C	
	L16FSS Detailed Dimensions Online 	ref. model IT23S	19	• Stainless steel housing withstands 480° C	
Vacuum Feed Through	VFT-M8MVS Detailed Dimensions Online 	3.56	—	• Seals to 1 x 10 ⁻⁹ torr; withstands 120° C	
Liquid Level	TGR Detailed Dimensions Online 	3.18	—	• Use with BT23S • Sensor switches when tip of glass rod is immersed in liquid	

SENSORS

PLASTIC FIBERS

GLASS FIBERS