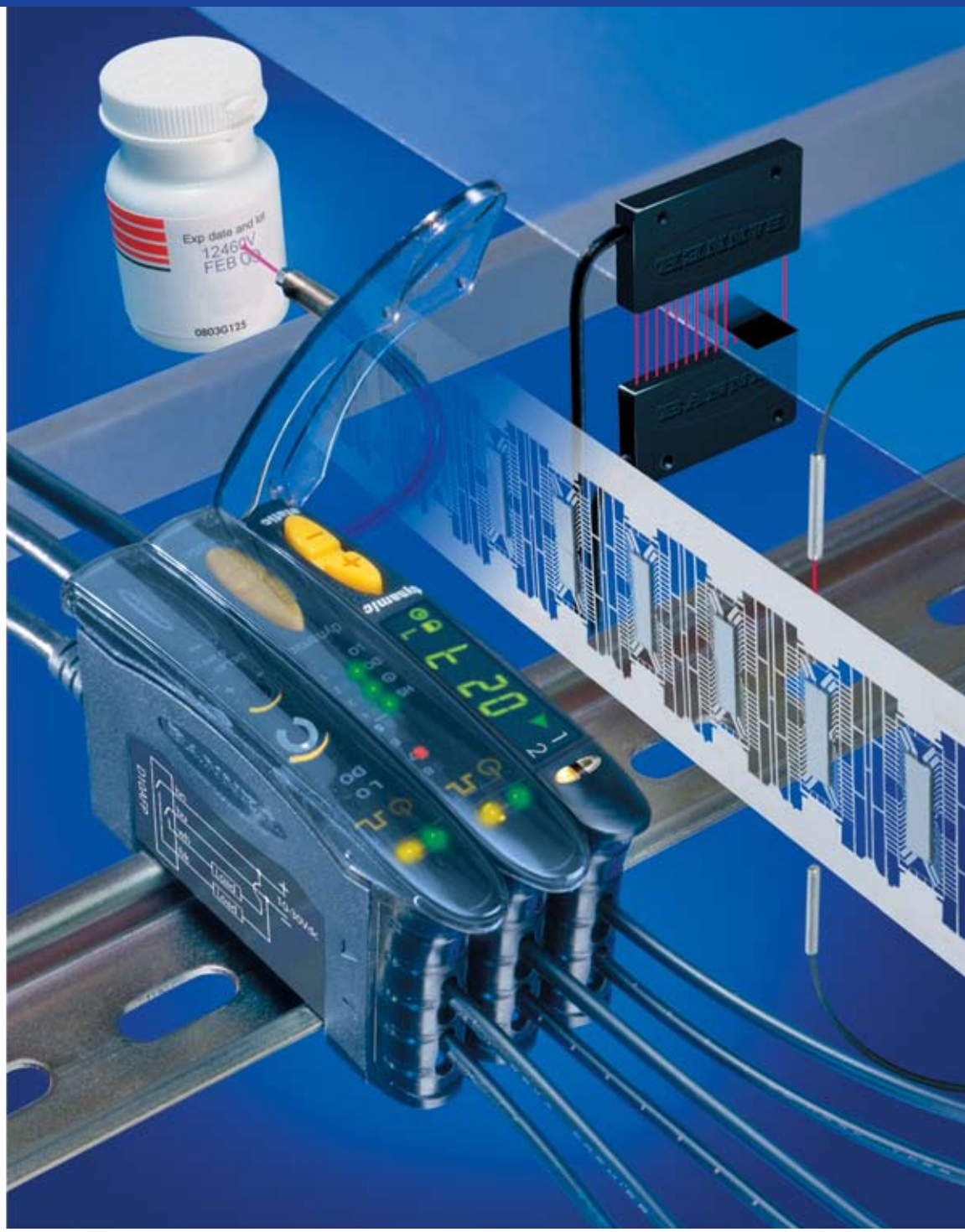
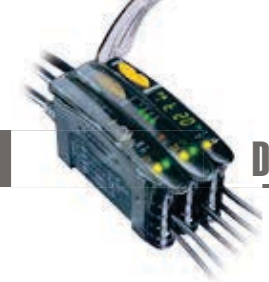


BANNER®

High-Performance Fiber Optic Sensor



D10 Series: High-performance fiber optic sensors

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

D10 *Expert*™ with Numeric Display, page 4

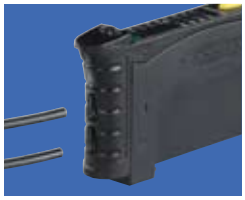
- Numeric display of signal strength and operating status
- Two output options: two discrete outputs in the same sensor; or discrete output and either a 4-20 mA current or a 0-10V dc voltage analog output in the same sensor

D10 *Expert*™ with Bargraph Display, page 6

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

D10 Discrete Output, page 7

- 14-turn manual sensitivity adjustment
- Pulse rate LED for signal strength indication
- Bipolar discrete ouputs: one current sourcing (PNP) and one current sinking (NPN)



Unique slide-lock fiber connections: no tools required

Fiber connection is a cinch with the D10's unique sliding fiber lock. Simply slide the locking mechanism up to open the emitter and receiver ports, insert the fibers, and then slide it back down to create a secure connection. All in just seconds.

Understanding fiber optic 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. Models are designed to be DIN-rail mounted in a centralized control enclosure.

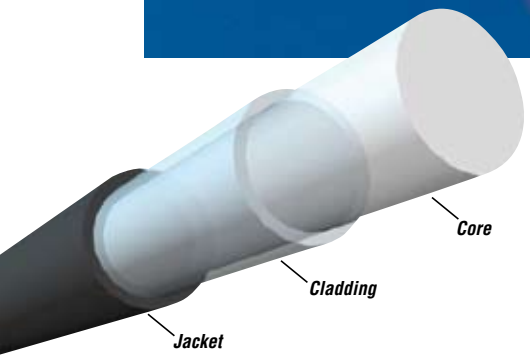
2 Fibers
Sensing fibers are non-electronic, light-transmitting, optical quality plastic strands with cladding. Fibers transmit light to and from the LED of a sensor. Plastic fibers are typically packaged as monofilaments with a protective jacket of polyethylene, PVC, stainless-steel braid or other materials. 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 tolerate elevated temperatures in some cases as high as 315° 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 into and out of hazardous areas.
- **Noisy environments.** Fibers are non-electronic mechanical components that 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
- Conveyors
- Ovens
- Tablet counting
- Web control
- Vibratory feeders
- Liquid level
- Semiconductor processing equipment



Plastic fiber construction

Plastic Fibers for use with D10s, page 14-26

- Fibers are inexpensive and easily cut to length during installation.
- Fibers bend easily to fit precisely where you want them.
- High-flex models withstand flexing.
- Special jackets withstand corrosion, impact and abrasion.
- Coiled versions are available for applications requiring articulated or reciprocating motion.
- Diameters include 0.25, 0.5, 1.0 and 1.5 mm.
- Custom-designed fibers are quickly built for your unique applications.

Specialty fibers for specific sensing applications

DURA-BEND™ for extremely tight radius bends

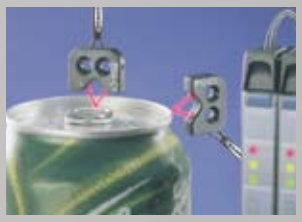
Linear array fibers

Fluoropolymer encapsulated fibers

Liquid level detection fibers

Focused beam fibers

SteelSkin™ withstands impact, abrasion and flexing



Convergent beam fibers

High temperature fibers

D10 *Expert*™ with Numeric Display: Redefining high-performance fiber optic sensing

Ultimate power and performance in low-contrast applications

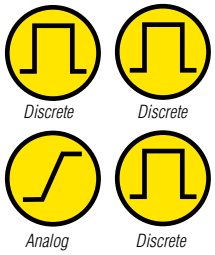
With its advanced 16-bit microprocessor and 12-bit A/D resolution, the D10 *Expert* fiber optic sensor can solve the most difficult sensing applications, even when contrast is as low as 1 percent or less. Using its advanced "teachable" microprocessor, the sensor learns the light and dark sensing conditions, computes the most accurate setting for recognizing the difference in received light signals and self-programs that setting.

Two independently configurable outputs in each sensor

For the ultimate in versatility, the D10 *Expert* is available with two independent output channels, each with its own individually configurable setpoint. This configurability allows you to solve complex applications with a single sensor.

Two discrete outputs both can be either NPN (sinking) or PNP (sourcing), depending on model.

Analog and discrete output models have either an NPN (sinking) or PNP (sourcing) discrete output, and a 4-20 mA current analog output or a 0-10V dc voltage analog output, depending on the model (see model selection, page 8).



Indicates push buttons are locked.

Indicates channel selected, 1 or 2.

Indicates timing function chosen.

Indicates light or dark operate chosen.

Numerical display of signal strength (excess gain).

Display instantly tells you if your application setup is PASS or FAIL.

Advanced LED digital display

Take advantage of the most advanced diagnostics with Banner's all-new digital display of sensor configuration and performance. The display continuously shows whether the sensor is in setup or run mode, how it is configured and the strength of the sensing signal. This display saves significant setup and diagnostics time.

D10 *Expert*™ with Numeric Display: The most advanced setup & programming available

Three easy microprocessor-based programming options

1 Dynamic TEACH programs the sensor "on-the-fly."
Dynamic TEACH enables the D10 to sample the sensing events, "learn" a series of conditions "on-the-fly" and compute the optimum threshold between light and dark sensing conditions. It then self-programs the setting and periodically updates it to compensate for any changes in sensing conditions during operation.

2 Static TEACH computes each sensing condition individually.
In Static TEACH mode, you simply present the output ON condition and push one button to "teach" or program that condition. Simply repeat the procedure for the OFF condition and the sensor computes the optimal setting.

3 Single-Point Static TEACH sets a single ON condition.
Single-point Static TEACH programs the sensor to accept only a single ON condition. Discrete outputs do not conduct when any other condition is sensed; analog outputs are scaled so that the condition taught falls at the mid-point of the output range.

Manual adjustment allows fine-tuning to the exact desired threshold

To fine-tune your application settings, you can manually override any pre-selected settings simply by pushing the plus or minus buttons. This ability to customize your settings gives you even greater flexibility and precision.

Analog output is uniquely scalable

Unlike conventional analog sensors, D10 *Expert* analog outputs are automatically scaled between your desired sensing setpoints, speeding setup.

Select light-operate, dark-operate, channel display and timing functions

When in setup mode, the D10 *Expert* is easily programmed for outputs to operate in the light or dark sensing condition. You can select which of two channels to view on the digital display and select timing functions.

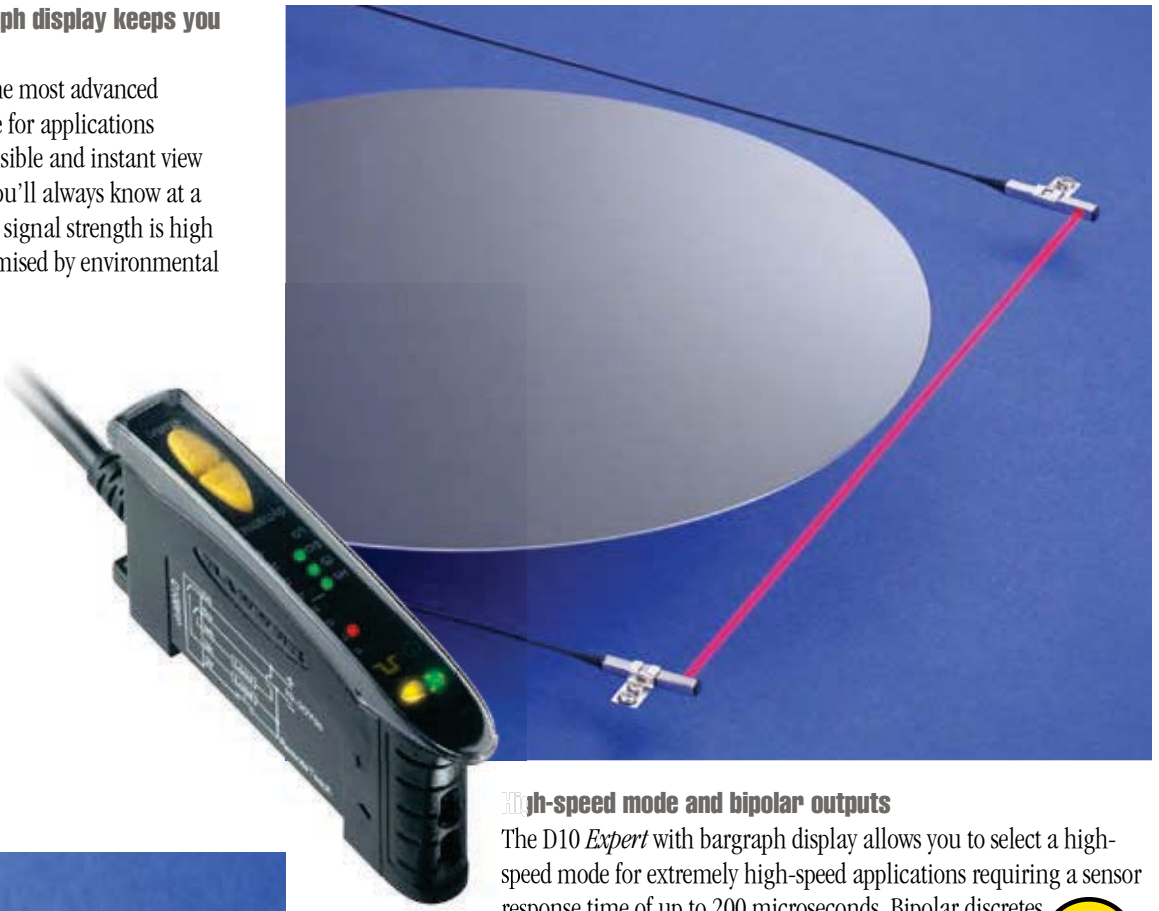
Remote programming

For maximum convenience and easier access when programming hard-to-reach sensors, you can program from a remote location using an external switch, a computer or a PLC. You can lock the push buttons remotely, providing added security by preventing tampering with the sensor adjustments.

D10 *Expert*™ with Bargraph Display: Advanced sensor with visible light bar indication

8-segment bargraph display keeps you better informed

Now you can have the most advanced diagnostics available for applications requiring a highly visible and instant view of signal strength. You'll always know at a glance whether your signal strength is high or has been compromised by environmental conditions.



High-speed mode and bipolar outputs

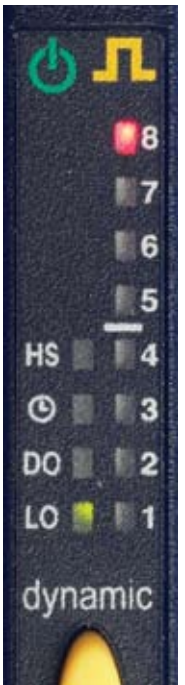
The D10 *Expert* with bargraph display allows you to select a high-speed mode for extremely high-speed applications requiring a sensor response time of up to 200 microseconds. Bipolar discretes outputs allow you to select either one current sourcing (PNP) or one current sinking (NPN) in the same sensor.

Discrete

Bargraph for advanced TEACH programming

Banner's push-button TEACH function allows static, dynamic and single-point programming. The bargraph display works in conjunction with TEACH programming, immediately indicating the reliability of the application setup. The display indicates the light-to-dark signal difference for the taught condition for Single-Point TEACH or the actual sensing contrast in Two-Point TEACH.

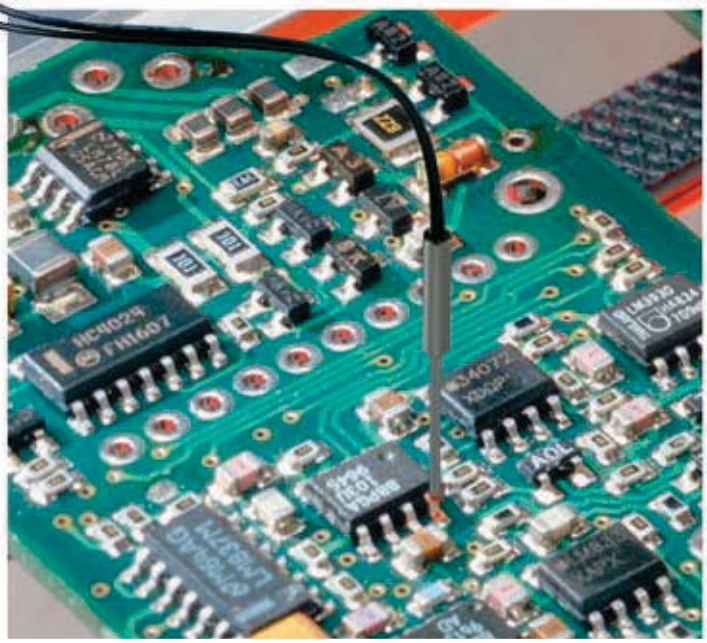
Weak Signal



Strong Signal

D10 Discrete Output: A low-cost fiber optic solution

Single discrete output
This economical model provides high-performance sensing for applications not requiring the numeric or bargraph display. It is also available in a high-speed model with a 200 microsecond response time.



Advanced LED diagnostics

Excellent diagnostics in the D10 Discrete include LEDs that indicate Power ON and Output ON. The LED of Banner's Alignment Indicating Device (AID) flashes in direct proportion to the signal strength. An LED also flashes to warn of problems including an overloaded output and marginal excess gain. The D10 Discrete also has a light-operate/dark-operate selection switch and a 0 or 40 ms OFF-delay switch.

14-turn sensitivity adjustment
The D10's potentiometer for manual adjustments of sensitivity has a relative position indicator for setting and fine-tuning the sensor's signal strength.

D10 Series: Fiber Optic Sensor Model Selection

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

Models	Sensing Mode/LED*	Range	Cable**	Outputs	Data Sheet
D10DNFP D10DNFPQ	PLASTIC FIBER	Range varies by power level/speed selection used and with fiber optics used. See fiber section on page 14 or reference 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	PLASTIC FIBER		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

Models	Sensing Mode/LED*	Range	Cable**	Discrete Output	Analog Output	Data Sheet
D10INFP D10INFPQ	PLASTIC FIBER	Range varies by power level/speed selection used and with fiber optics used. See fiber section on page 14 or reference 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	PLASTIC FIBER		2 m 6-pin Pico QD	NPN	4-20 mA	
D10IPFPG D10IPFPGQ			2 m 6-pin Pico QD	PNP		

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

Models	Sensing Mode/LED*	Range	Cable**	Discrete Output	Analog Output	Data Sheet
D10UNFP D10UNFPQ	PLASTIC FIBER	Range varies by power level/speed selection used and with fiber optics used. See fiber section on page 14 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	PLASTIC FIBER		2 m 6-pin Pico QD	NPN	0-10V	
D10UPFPG D10UPFPGQ			2 m 6-pin Pico QD	PNP		

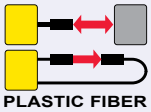
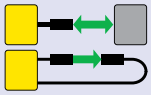
* Visible Red LED Visible Green LED

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 27).

D10 Series: Fiber Optic Sensor Model Selection & Dimensions

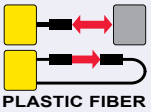
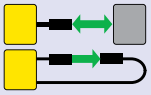
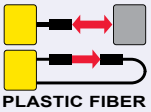
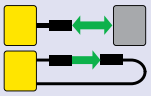
D10 *Expert* with Bargraph Display – Discrete, 10-30V dc

MORE INFO ONLINE Download PDF

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Data Sheet
D10BFP D10BFPQ	 PLASTIC FIBER	Range varies by power level/speed selection used and with fiber optics used. See fiber section on page 14 or reference data sheet part number 117830 for range information.	2 m 6-pin Pico QD	Bipolar NPN/PNP	117830
D10BFPG D10BFPGQ	 PLASTIC FIBER		2 m 6-pin Pico QD		

D10 – Discrete, 10-30V dc

MORE INFO ONLINE Download PDF

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Data Sheet
D10AFP D10AFPQ	 PLASTIC FIBER	Range varies by power level/speed selection used and with fiber optics used. See fiber section on page 14 or reference data sheet part number 118431 for range information.	2 m 4-pin Pico QD	Bipolar NPN/PNP	118431
D10AFPG D10AFPGQ	 PLASTIC FIBER		2 m 4-pin Pico QD		
D10AFPY D10AFPYQ	 PLASTIC FIBER	Range varies by power level/speed selection used and with fiber optics used. See fiber section on page 14 or reference data sheet part number 118431 for range information.	2 m 4-pin Pico QD		
D10AFPGY D10AFPGYQ	 PLASTIC FIBER		2 m 4-pin Pico QD		

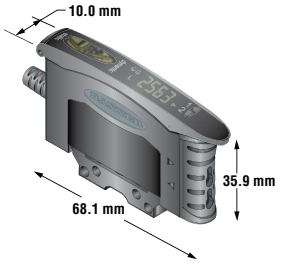
* Visible Red LED Visible Green LED

For 9 m cable, add suffix **W/30 to the 2 m model number (example, **D10DBFP W/30**). A model with a QD requires a mating cable (see page 27).

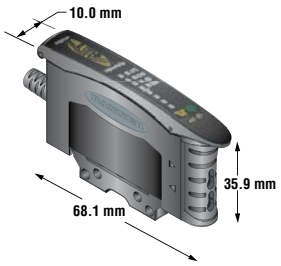
Sensor Dimensions

MORE INFO ONLINE Detailed Dimensions

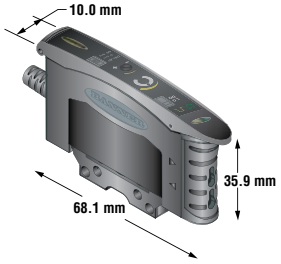
D10 *Expert* Models with Numeric Display



D10 *Expert* Models with Bargraph Display



D10 Models



D10 Series – ALL MODELS

Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 14)
Sensing Beam	Visible red, 680 nm, or 64 nm or visible green, 525 nm, depending on model
Supply Protection Circuitry	Protected against reverse polarity and transient voltage
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover
Environmental Rating	NEMA 1; IEC IP50
Installation	35 mm DIN rail or included mounting bracket

D10 *Expert* with Numeric Display – Dual-Discrete

Supply Voltage and Current	12 to 24V dc (10% maximum ripple) @ less than 65 mA, exclusive of load		
Output Configuration	Two independently configured current sourcing (PNP) or current sinking (NPN) solid-state transistors		
Output Rating	150 mA maximum load **OFF-state leakage current:** less than 10 µA @ 24V dc **ON-state saturation voltage: NPN:** less than 1.5V @ 150 mA load, **PNP:** less than 2.5V @ 150 mA load		
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	2 push buttons or remote programming (TEACH) of switching threshold response time, OFF-delay, light operate (LO)/dark operate (DO), and display		
Indicators	4-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light operate (LO)/dark operate (DO) selection; two yellow LEDs serve as output indicators and active channel indicator		
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		
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
Certifications	CE c UL us		

D10 *Expert* with Numeric Display – Analog/Discrete

Supply Voltage and Current	**4-20 mA analog models:** 12-24V dc (10% maximum ripple) @ less than 65 mA exclusive of load **0-10V dc analog models:** 15-24V dc (10% maximum ripple) @ less than 70 mA exclusive of load	
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:** less than 10 µA @ 24V dc **ON-state saturation voltage: NPN:** less than 1.5V @ 150 mA **PNP:** less than 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 max. impedance
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	2 push buttons or remote programming (TEACH) of switching threshold response time, OFF-delay, light operate (LO)/dark operate (DO), and display	
Indicators	4-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light operate (LO)/dark operate (DO) selection; two yellow output indicators	
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	

D10 *Expert* with Numeric Display – Analog/Discrete (Cont'd)

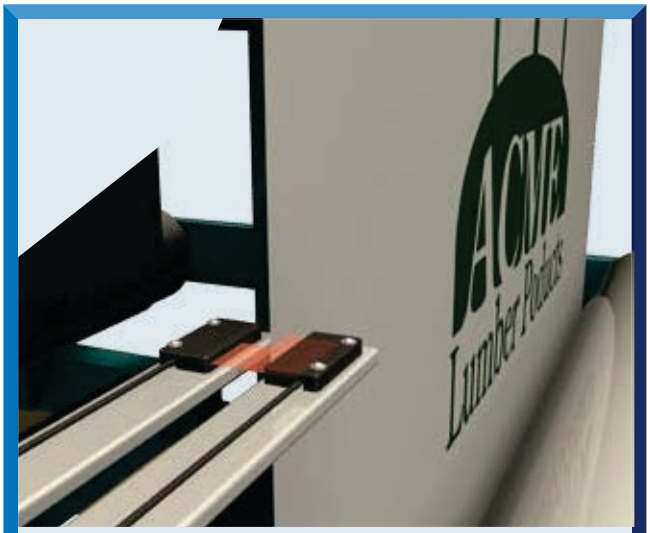
Operating Conditions	**Temperature:** -20° to +55° C **Storage temperature:** -20° to +80° C **Relative humidity:** 90% @ 50° C		
	Number of Devices Stacked	**Ambient Temperature Rating**	**Load Specification**
	3	55° C	150 mA
	7	50° C	50 mA
	10	45° C	50 mA
Certifications	CE c UL us		

D10 *Expert* with Bargraph Display – Discrete

Supply Voltage and Current	10 to 30V dc (10% maximum ripple) @ less than 45 mA, exclusive of load
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 maximum load **OFF-state leakage current:** less than 5 µA @ 30V dc **ON-state saturation voltage: NPN:** less than 200 mV @ 10 mA and 1V @ 150 mA load **PNP:** less than 1V @ 10 mA and 1.5V @ 150 mA load
Output Response Time	500 milliseconds (normal mode) or 200 milliseconds (high-speed mode)
Repeatability	100 milliseconds (normal mode) or 66 milliseconds (high-speed mode)
Adjustments	2 push buttons and remote wire • *Expert* TEACH programming (two-point static, dynamic and single-point static) • Manually adjust (+/–) sensitivity (using buttons only – not available on remote wire) • LO/DO, OFF-delay, and response speed configurable (using buttons or remote wire) • Push-button lockout (using 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
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.
Operating Conditions	**Temperature:** -10° to +55° C **Storage temperature:** -20° to +85° C **Relative humidity:** 90% @ 50° C
Certifications	CE

D10 – Discrete

Supply Voltage	10 to 30V dc (10% maximum ripple) @ less than 25 mA, exclusive of load.
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 µA sourcing; 200 µA sinking **ON-state saturation voltage: NPN:** 1.6V @ 100 mA **PNP:** 2.0V @ 100 mA
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	14-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 LED indicators:** **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).
Connections	PVC-jacketed 2 m or 9 m integral cable, or integral 4-pin Pico-style quick-disconnect fitting. QD cables are ordered separately.
Operating Conditions	**Temperature:** -10° to +55° C **Storage:** -20° to +85° C **Relative humidity:** 90% @ 55° C (non-condensing)
Certifications	Approvals in process.

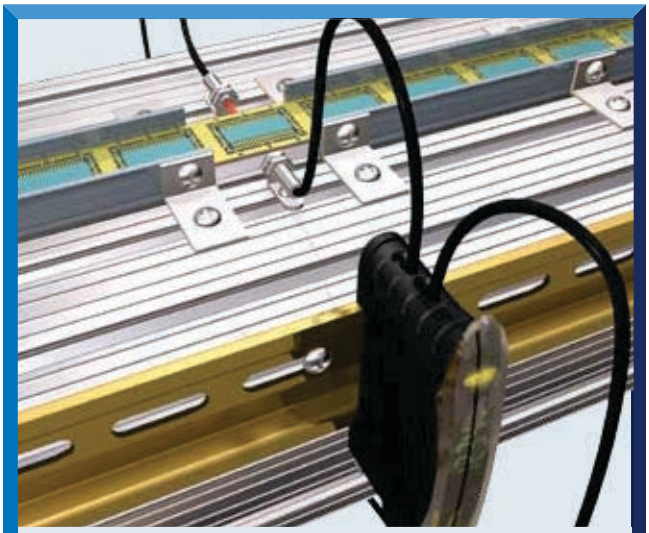


Analog/Discrete EDGE GUIDING

Objective: To guide the edge of a roll of plastic.

Sensors: D10INFP
PIRS1X166UMPMAL opposed-mode plastic fiber arrays

Operation: As a roll of plastic wrapping passes through a series of rollers, a sensor guides the edge of the roll.

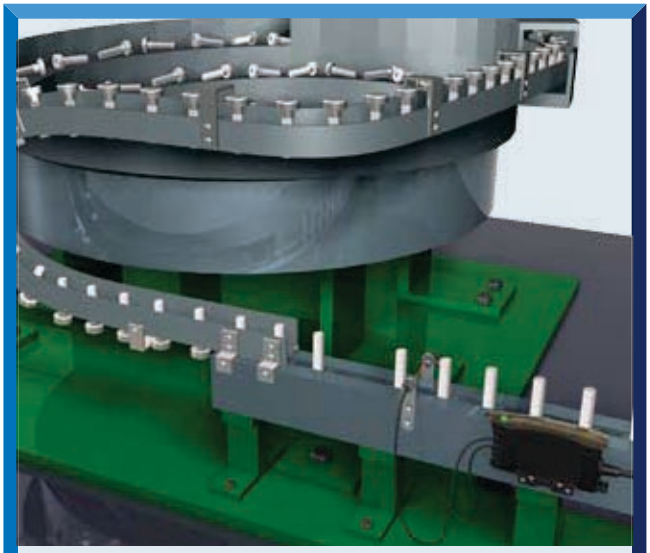


Analog/Discrete LEAD FRAME PRESENCE DETECTION

Objective: To detect the presence of an IC lead frame.

Sensors: D10UNFP
PIF26UMLS individual plastic fiber optics in opposed mode

Operation: The lead frame of an integrated circuit moves toward the cassette that holds multiple frames. The sensors detect the leading and trailing edge, to signal to the cassette that the lead frame is approaching.



Discrete COUNTING

Objective: To count bolts dispensed from a feeder bowl.

Sensors: D10AFP
PIT26U individual plastic fiber optics in opposed mode

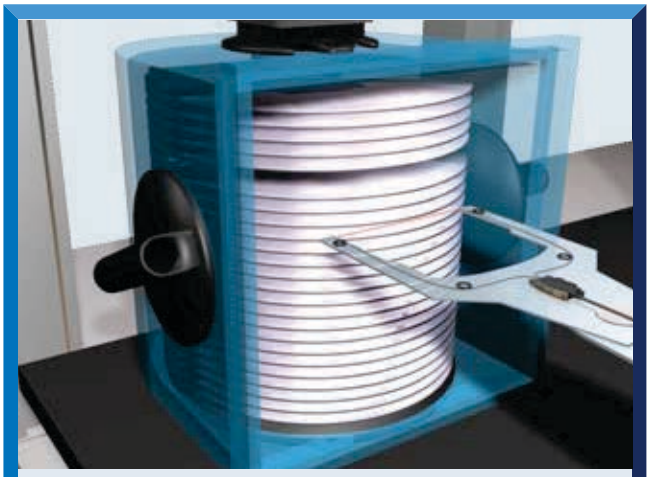
Operation: As bolts drop from a vibrating feeder bowl and pass the sensor, the sensor counts the bolts.

Discrete TRIGGER

Objective: To trigger a vision sensor.

Sensors: D10AFP
PIT46U individual plastic fiber optics in opposed mode

Operation: As bolts pass on a conveyor, the D10 sensor detects their presence and triggers a vision sensor, which inspects the bolts.

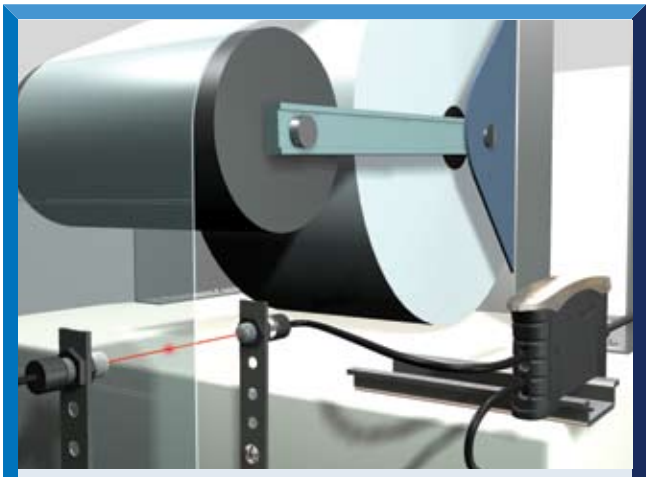


Bargraph WAFER MAPPING

Objective: To map the presence of wafers in a cassette.

Sensors: D10BFP
PLIS-1 individual plastic fiber optics in opposed mode

Operation: The sensor's fibers moved up and down the wafer in the cassette, mapping which slots are occupied and empty. The bargraph displays the sensor's status.

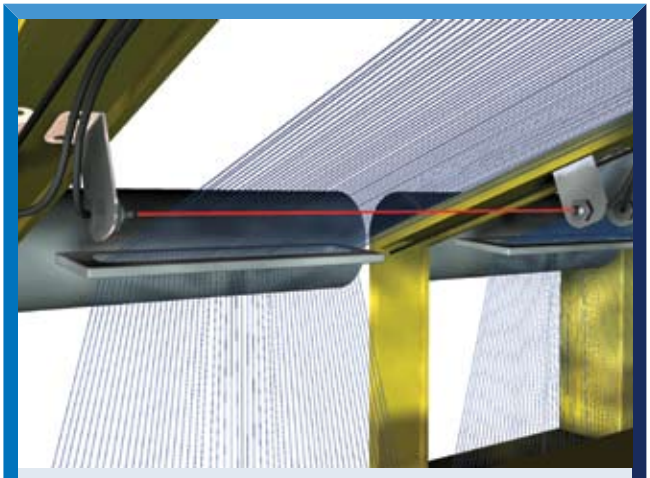


Bargraph POLYBAG SEAL DETECTION

Objective: To locate the perforations between bags on a web.

Sensors: D10BFP
PIL46U individual plastic fiber optics in opposed mode

Operation: Plastic bags on a continuous web have a seal and perforation between bags. The sensor signals the location of the perforation to the separation mechanism, based on the location of the seal; in effect, the seal acts as a registration mark. The low contrast capability of the D10 *Expert* sensor, combined with the light-averaging ability of the PIL46U fibers, reliably sense the bag seal.

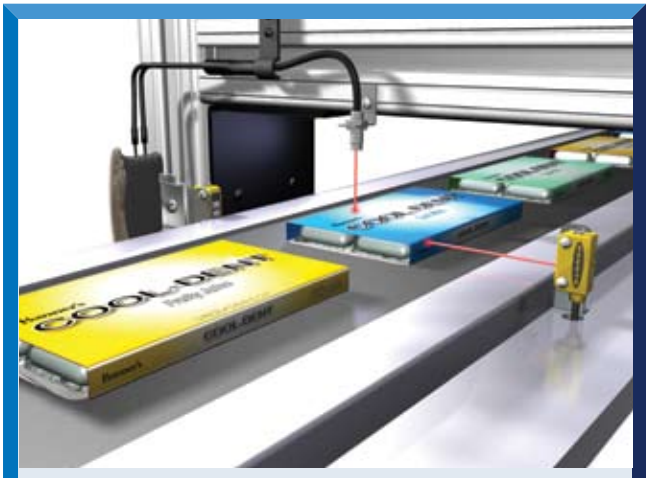


Dual-Discrete THREAD BREAK DETECTION

Objective: To detect broken threads on a loom.

Sensors: D10DNFP
PIT46U individual plastic fiber optics in opposed mode

Operation: On a loom, any thread that breaks falls through the beam of the dual-discrete sensor. The sensor signals the line to stop, to prevent production of a defective fabric.



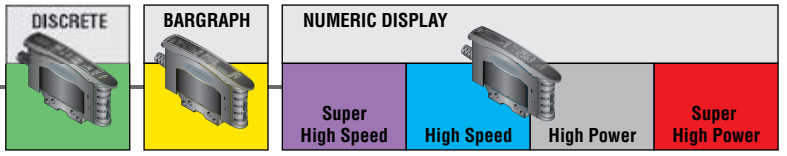
Dual-Discrete COLOR SORTING

Objective: To sort gum packets by label color.

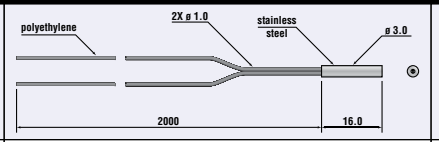
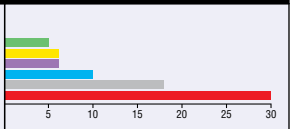
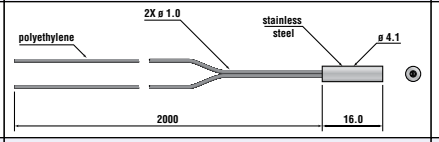
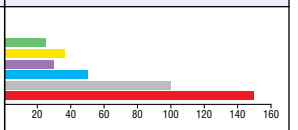
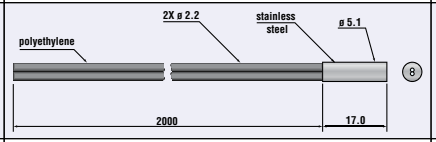
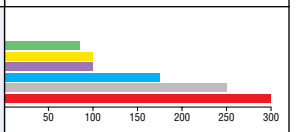
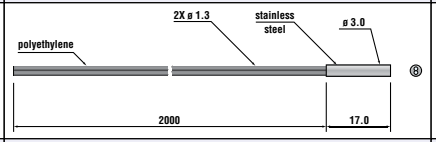
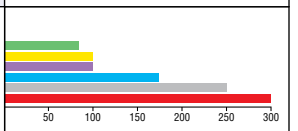
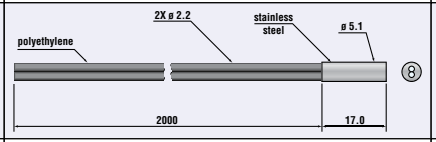
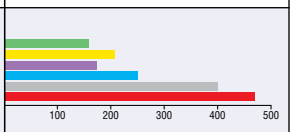
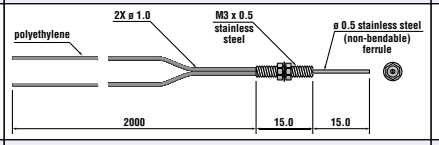
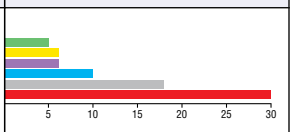
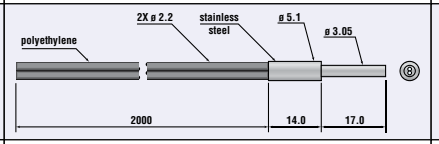
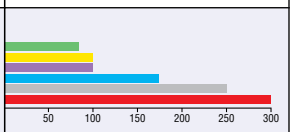
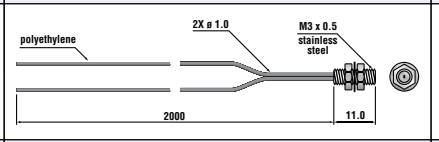
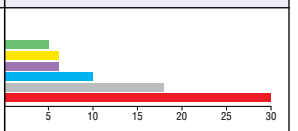
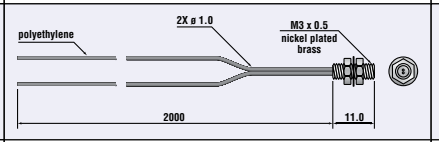
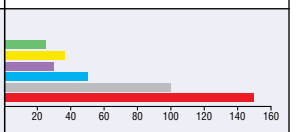
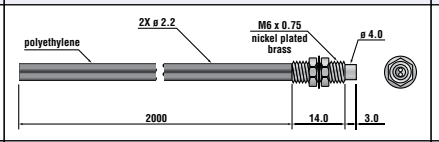
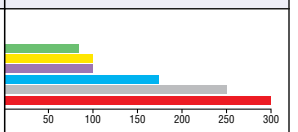
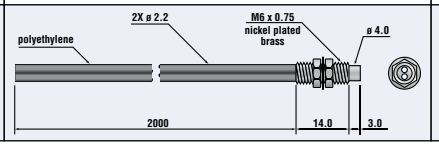
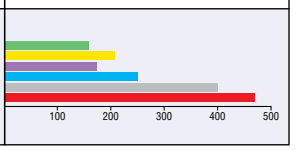
Sensors: D10DNFP
PBCT46U bifurcated plastic fiber optic
Packet presence detection Q12AB6FF30

Operation: Using the dual-discrete outputs, the D10 *Expert* identifies packets of gum based on label color so they can be sorted. The output wire of a Q12 sensor connects to the inhibit wire of the D10 *Expert* sensor, to shut off the D10 when no packet is present.

D10 Series: Fiber Optic Systems

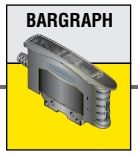


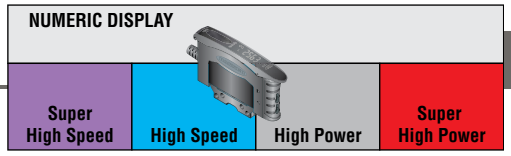
MORE INFO ONLINE *Fiber Optics*

		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	STANDARD	**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	

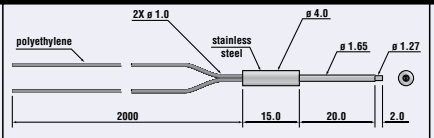
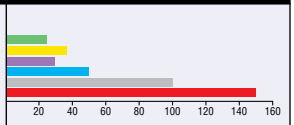
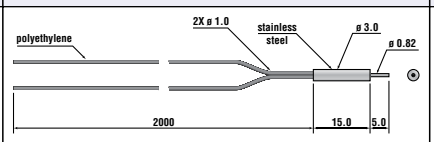
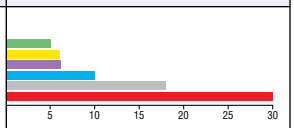
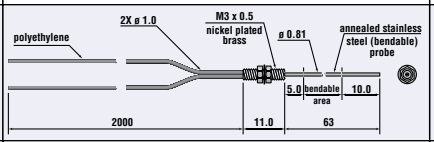
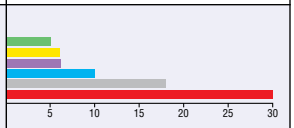
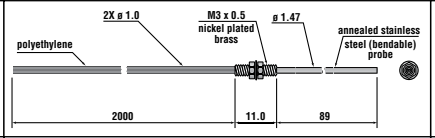
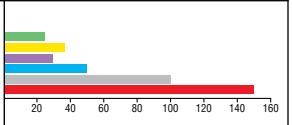
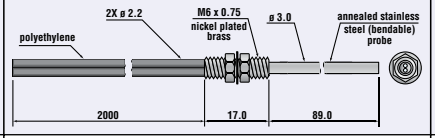
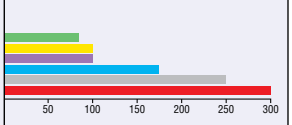
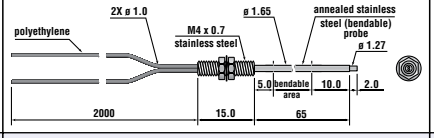
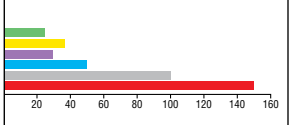
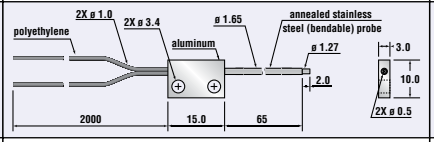
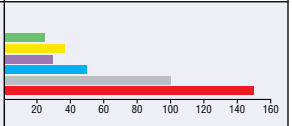
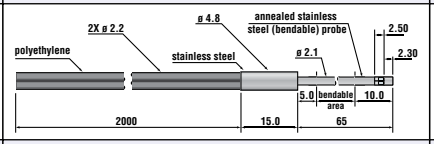
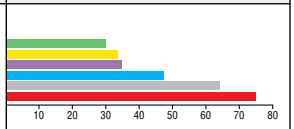
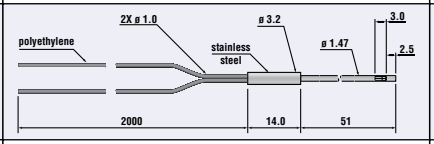
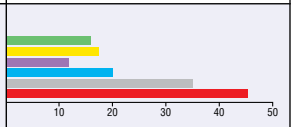
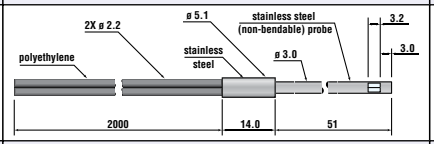
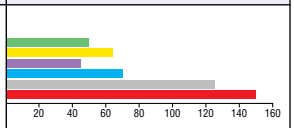
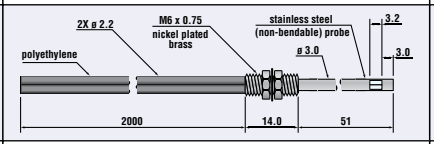
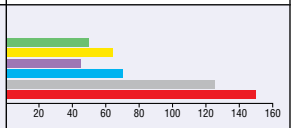
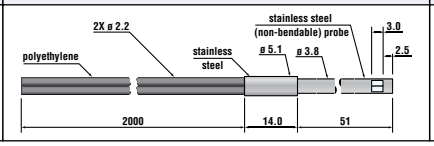
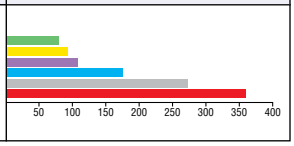
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems



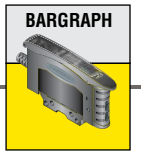


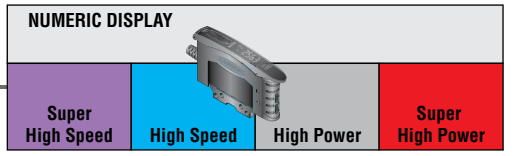
MORE INFO ONLINE *Fiber Optics*

		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	PROBE	**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	**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	

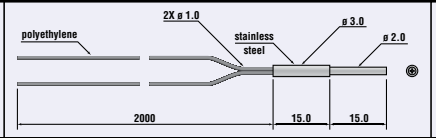
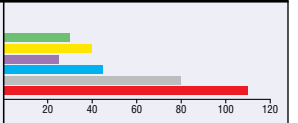
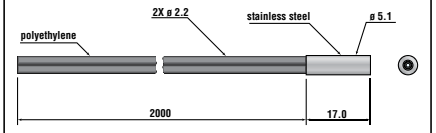
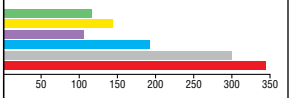
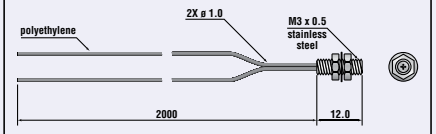
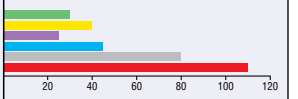
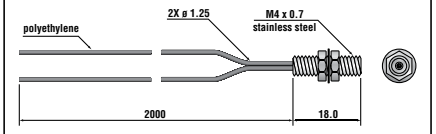
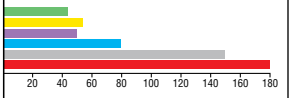
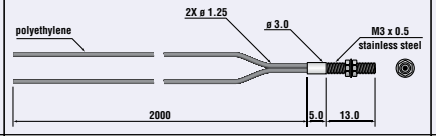
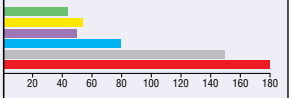
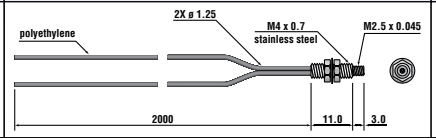
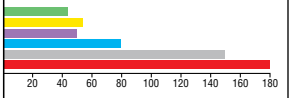
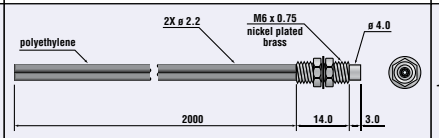
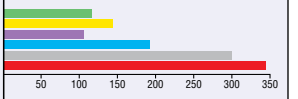
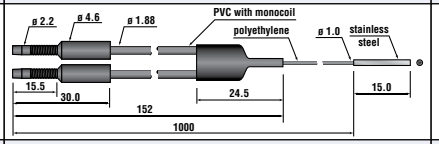
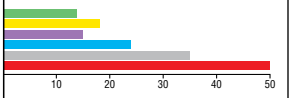
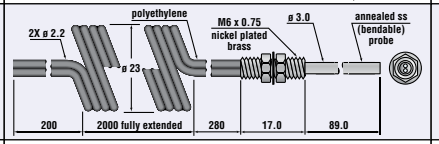
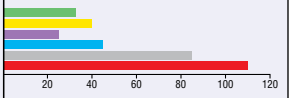
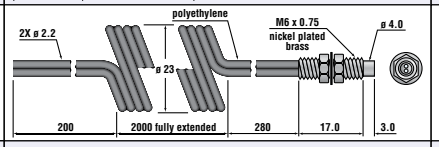
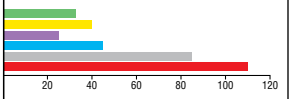
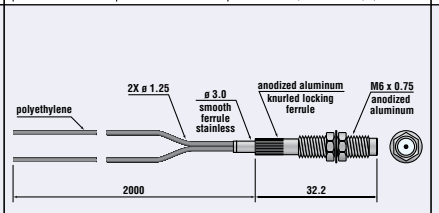
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems





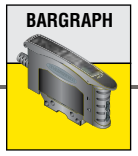
MORE INFO ONLINE *Fiber Optics*

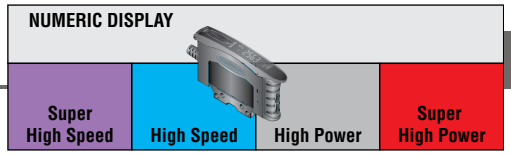
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	COAXIAL	**PBCF21X46U** *Detailed Dimensions Online*		0.5 4X 0.25	12	• Miniature probe tip	
		PBCF46U *Detailed Dimensions Online*		1.0 16X 0.265	25	• Smooth ferrule	
		PBCT21X46U *Detailed Dimensions 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	

Indicates lens available for model. See page 19 for details.

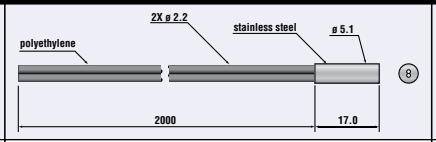
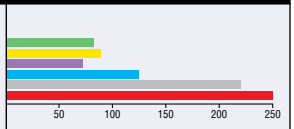
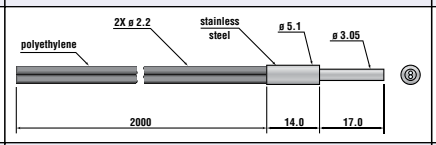
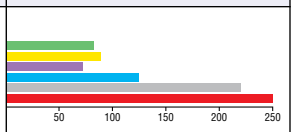
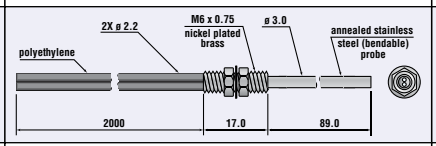
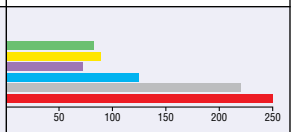
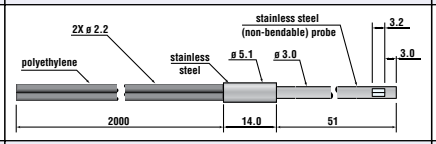
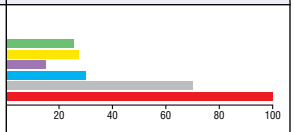
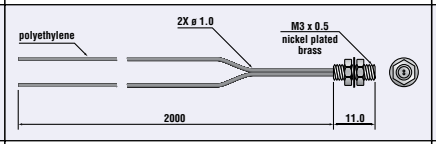
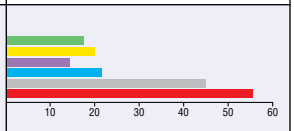
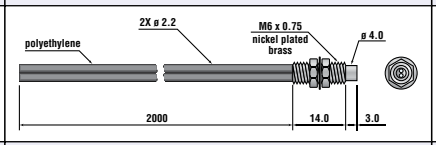
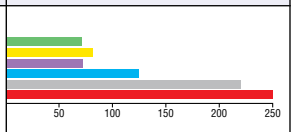
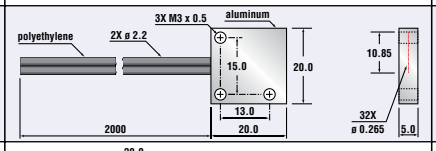
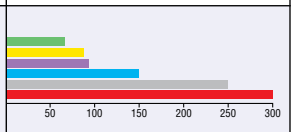
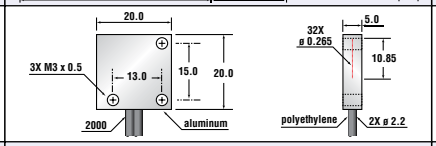
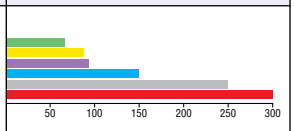
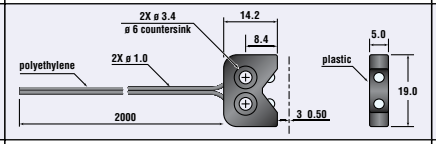
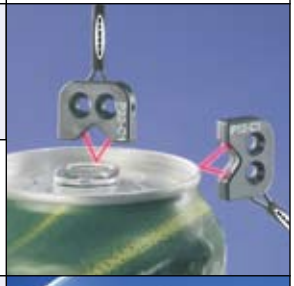
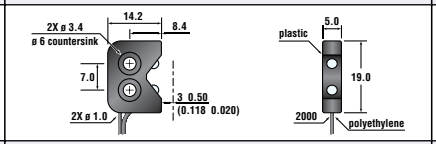
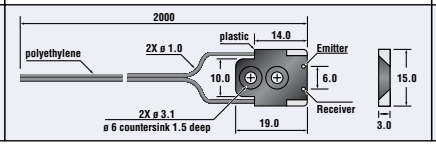
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems



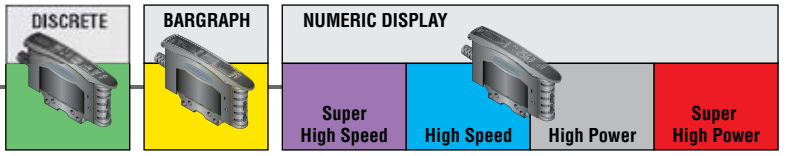


MORE INFO ONLINE *Fiber Optics*

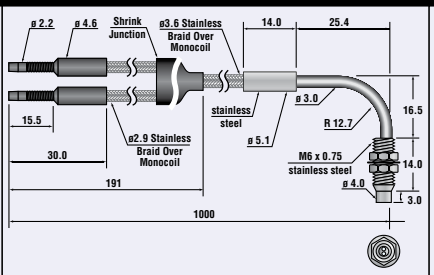
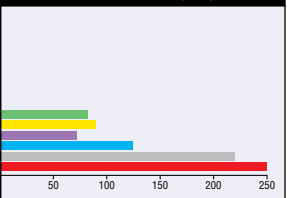
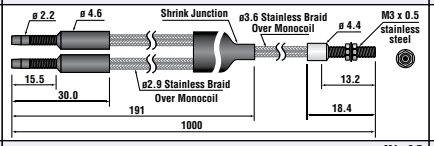
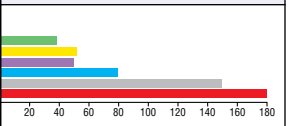
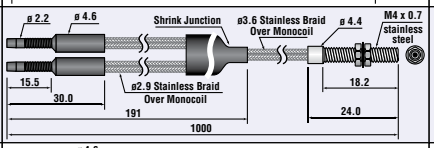
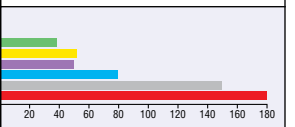
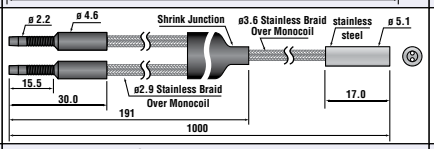
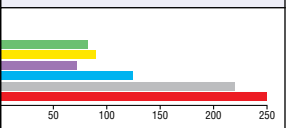
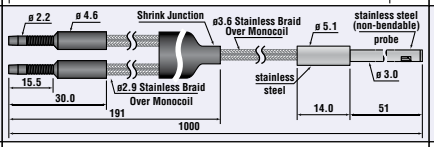
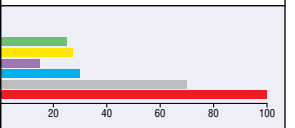
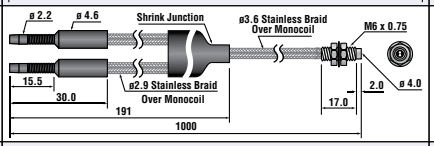
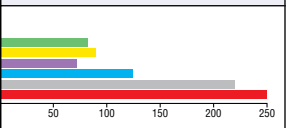
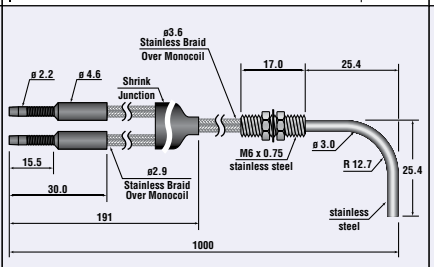
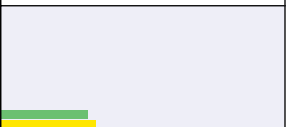
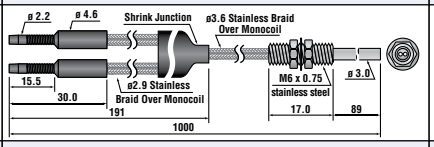
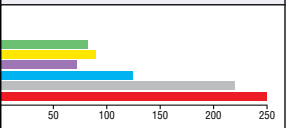
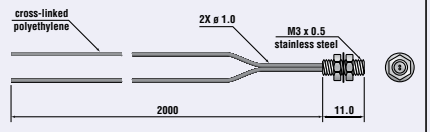
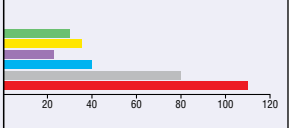
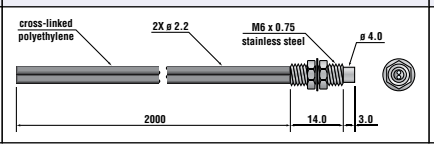
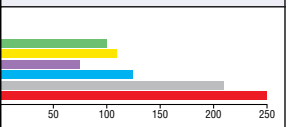
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	DURA-BEND	**PBF46UHF** *Detailed Dimensions Online*		1.0	1	• Smooth ferrule	
		PBFM46UHF *Detailed Dimensions Online*		1.0	1	• Smooth ferrule	
		PBP46UHF *Detailed Dimensions Online*		1.0	1	• Thread; 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 27.

D10 Series: Fiber Optic Systems



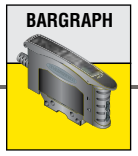
MORE INFO ONLINE *Fiber Optics*

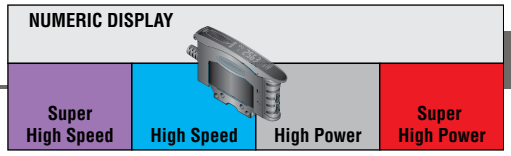
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	STEELSKIN	**PBAT43TMB5** *Detailed Dimensions Online*		1.0	12	• 90° Angle/Thread	
		PBCT23TMB5 *Detailed Dimensions Online*		0.5 9X 0.25	12	• Miniature thread	
		PBCT23TMB5M4 *Detailed Dimensions 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	
		PBT46UHT1 *Detailed Dimensions Online*		1.0	25	• Thread; withstands 125° C	

Indicates lens available for model. See page 19 for details.

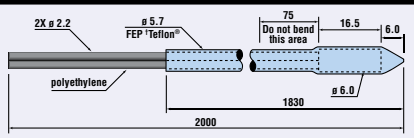
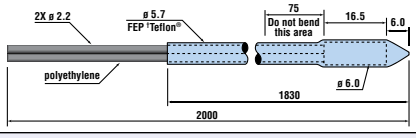
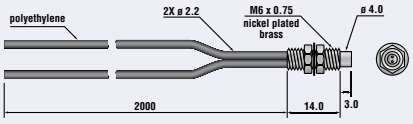
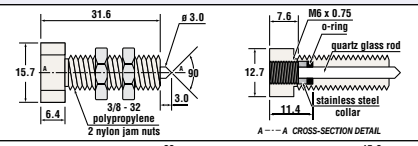
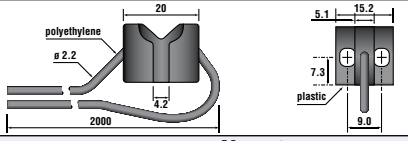
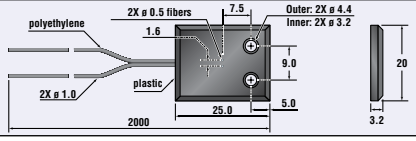
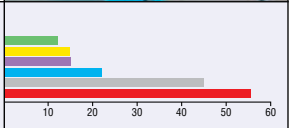
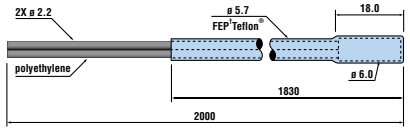
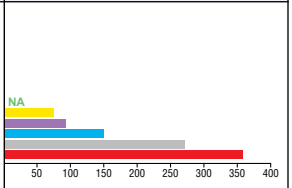
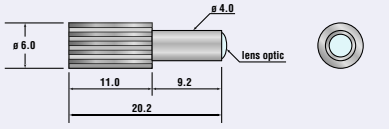
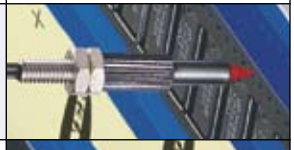
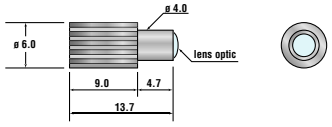
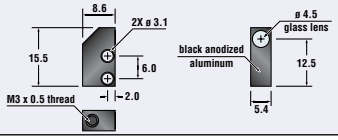
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems





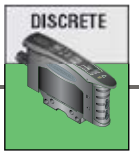
MORE INFO ONLINE *Fiber Optics*

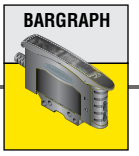
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
DIFFUSE	LIQUID LEVEL	**PBE46UTMLLP** *Detailed Dimensions Online*		1.0	25	• Fluoropolymer encapsulated • Sensor switches when tip of fiber is immersed in liquid	
		PBE46UTMLLPHT1 *Detailed Dimensions Online*		1.0	25	• Fluoropolymer encapsulated; withstands 125° C • Sensor switches when tip of fiber is immersed in liquid	
		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	
		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	
		L4C20 *Detailed Dimensions Online*		*ref. model PBCT26U*	*ref. model PBCT26U*	• Anodized AL housing; ø 4 mm beam spot @ 20 mm • Fixed focus	
		LZ3C8 *Detailed Dimensions Online*		*ref. model PBCT26-UM3*	*ref. model PBCT26-UM3*	• Anodized AL housing; ø 0.5 - 3.2 mm adj. beam spot • Fixed focus	

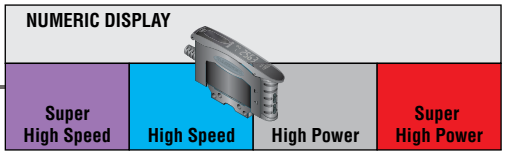
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

NA: *D10—Discrete not recommended.*

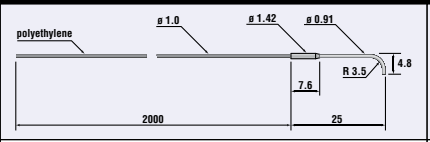
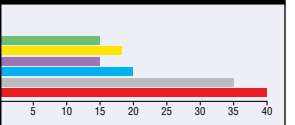
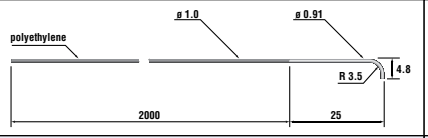
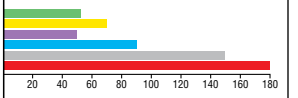
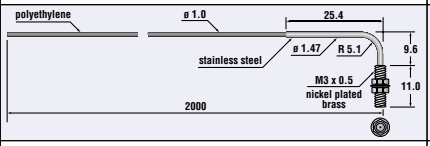
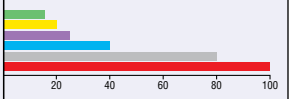
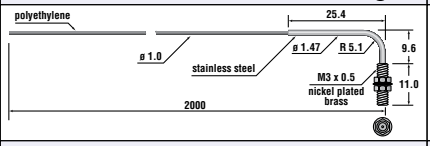
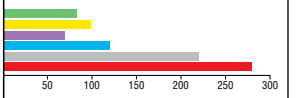
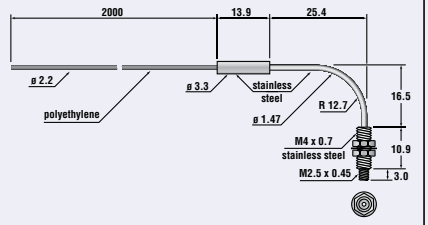
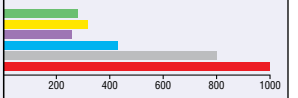
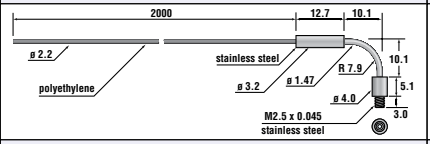
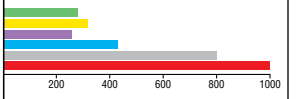
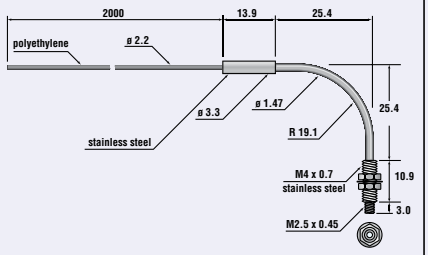
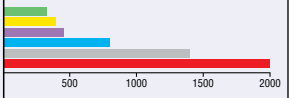
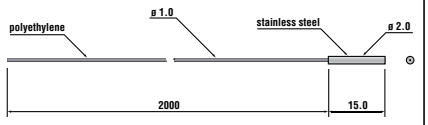
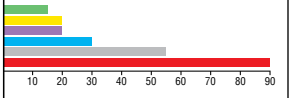
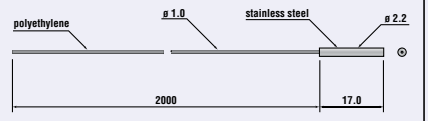
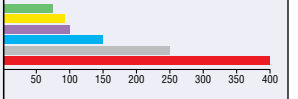
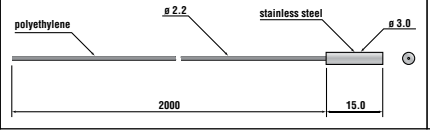
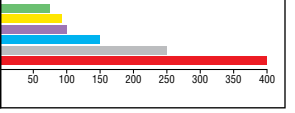
D10 Series: Fiber Optic Systems







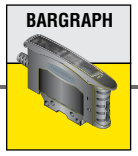
MORE INFO ONLINE *Fiber Optics*

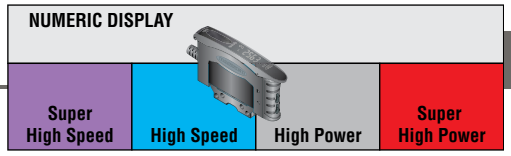
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
OPPOSED	STANDARD	**PIA16U** *Detailed Dimensions Online*		0.25	8	• 90° Angle	
		PIA26U *Detailed Dimensions Online*		0.5	12	• 90° Angle	
		PIAT16U *Detailed Dimensions Online*		0.25	8	• 90° Angle/Thread	
		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)	

Indicates lens available for model. See page 25 for details.

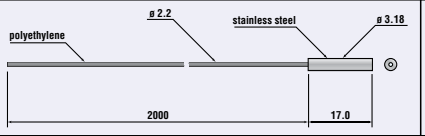
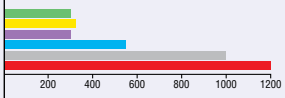
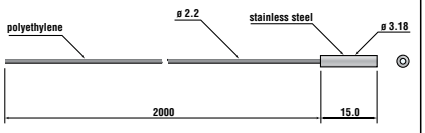
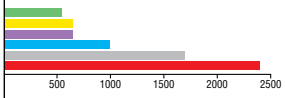
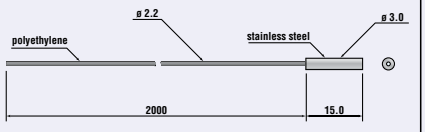
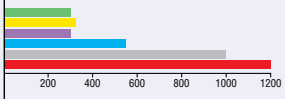
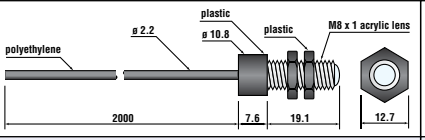
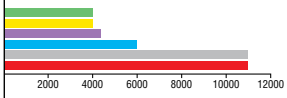
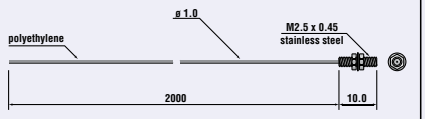
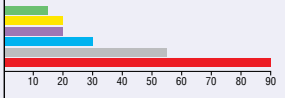
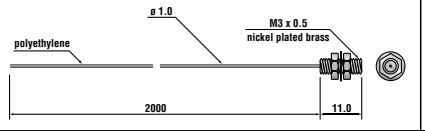
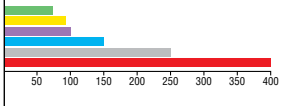
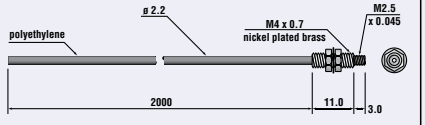
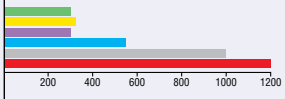
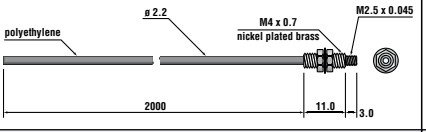
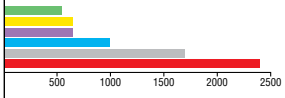
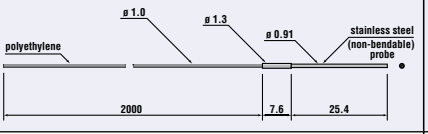
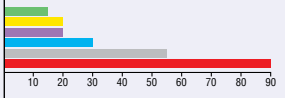
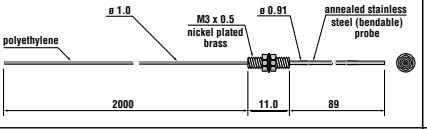
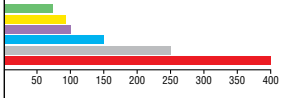
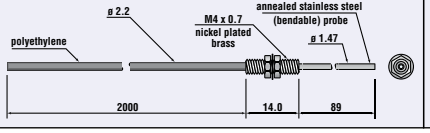
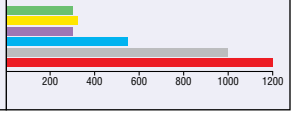
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems





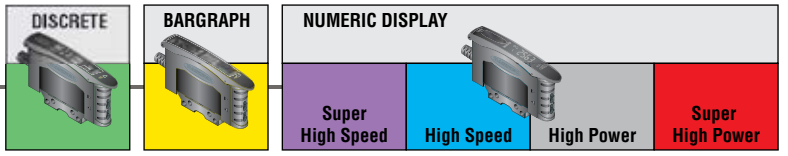
MORE INFO ONLINE *Fiber Optics*

		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 25	
		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	

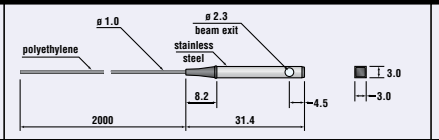
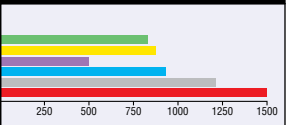
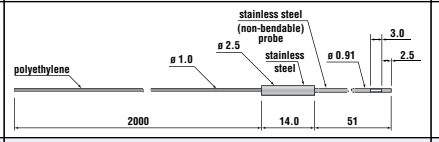
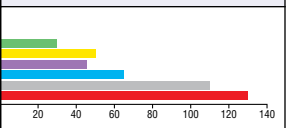
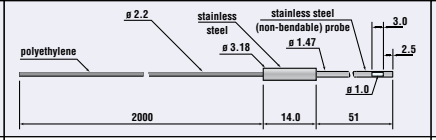
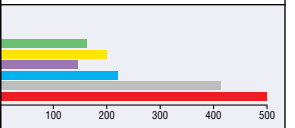
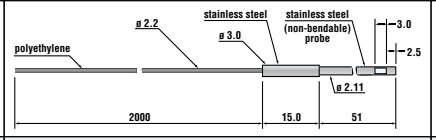
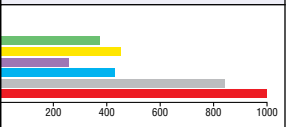
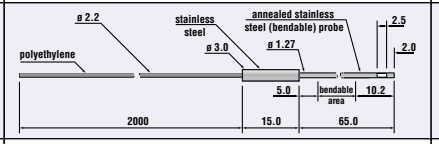
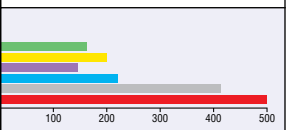
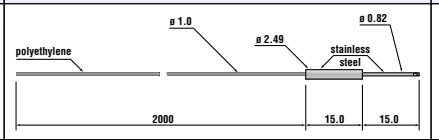
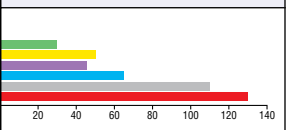
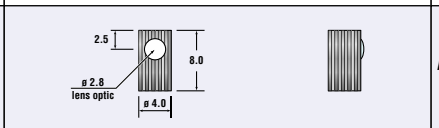
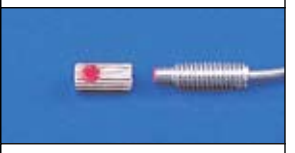
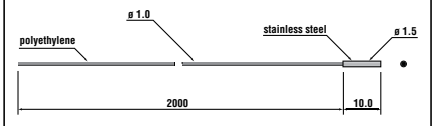
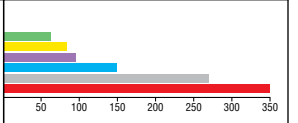
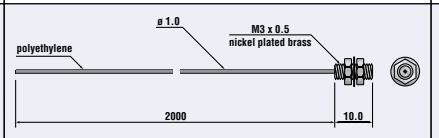
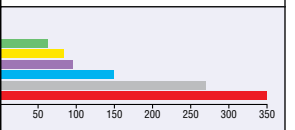
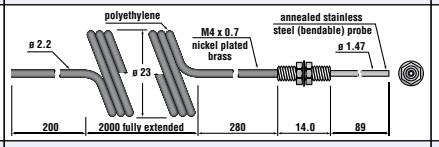
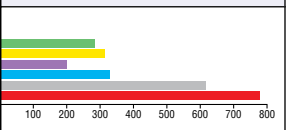
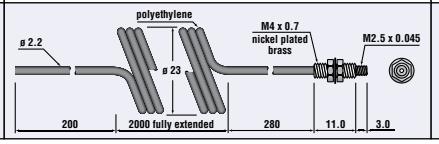
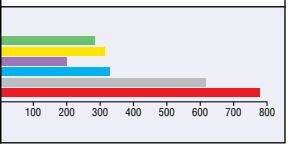
Indicates lens available for model. See page 25 for details.

Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems



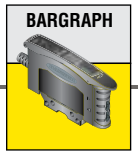
MORE INFO ONLINE *Fiber Optics*

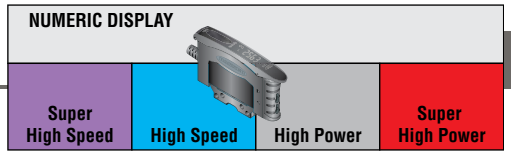
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
OPPOSED	SIDE-VIEW	**PLIS-1** *Detailed Dimensions Online*		0.5	12	• Low beam divergence angle of 2° • Ideal for wafer mapping	
		PIPS26U *Detailed Dimensions Online*		0.5	12	• Smooth ferrule; non-bendable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

Indicates lens available for model. See page 25 for details.

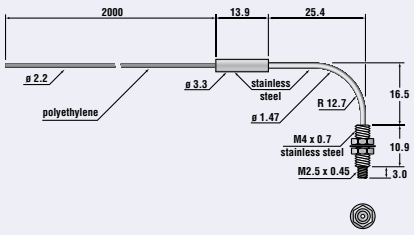
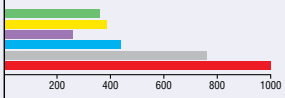
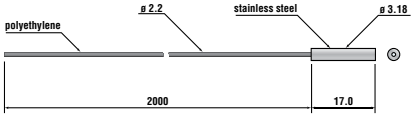
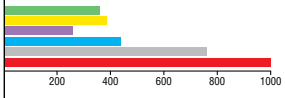
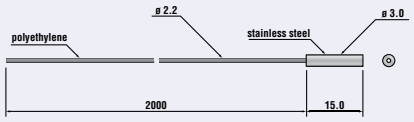
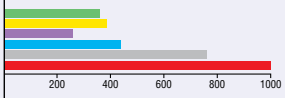
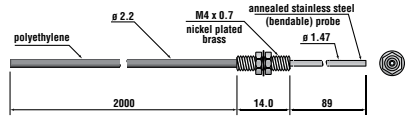
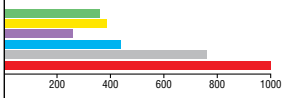
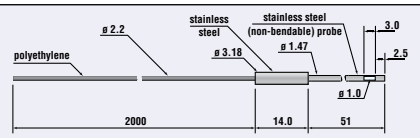
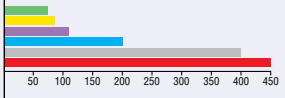
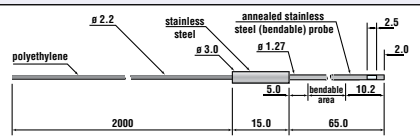
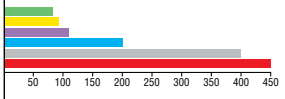
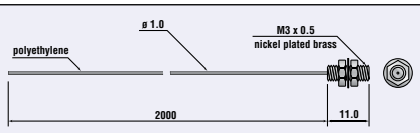
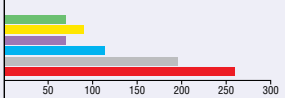
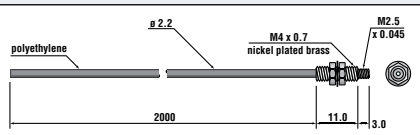
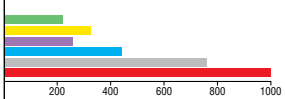
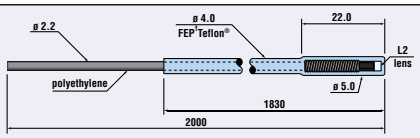
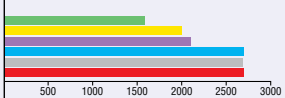
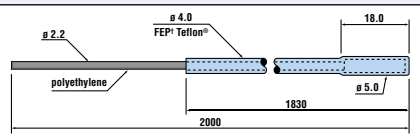
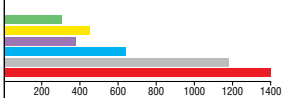
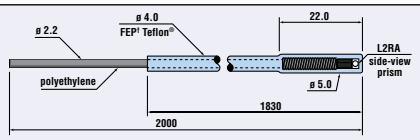
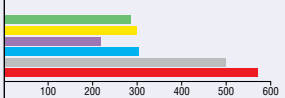
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems





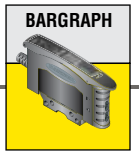
MORE INFO ONLINE *Fiber Optics*

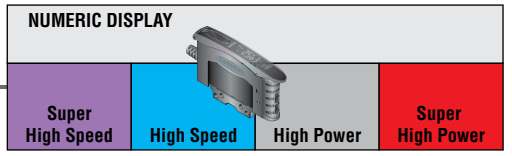
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
OPPOSED	DURA-BEND	**PIAT46UHF** *Detailed Dimensions Online*		1.0	1	• 90° Angle/Thread	
		PIF46UHF *Detailed Dimensions Online*		1.0	1	• Smooth ferrule	
		PIFM46UHF *Detailed Dimensions Online*		1.0	1	• 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	
	CHEMICAL RESISTANT	**PIE46UT** *Detailed Dimensions Online*		1.0	25	• Fluoropolymer encapsulated; lense	
		PIE66UTMNL *Detailed Dimensions Online*		1.5	38	• Fluoropolymer encapsulated; large effective beam	
		PIES46UT *Detailed Dimensions Online*		1.0	25	• Fluoropolymer encapsulated; side-view prism	

Indicates lens available for model. See page 25 for details.

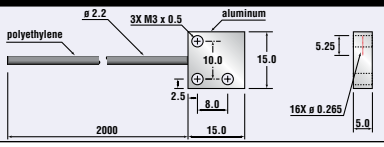
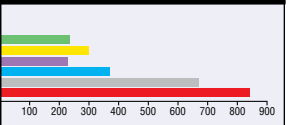
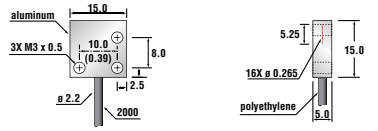
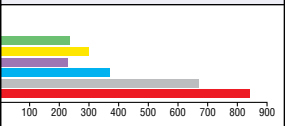
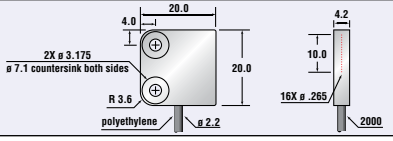
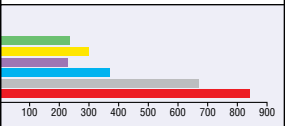
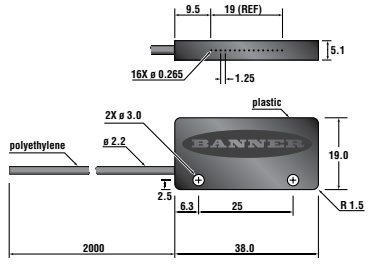
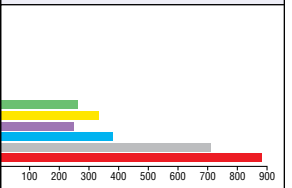
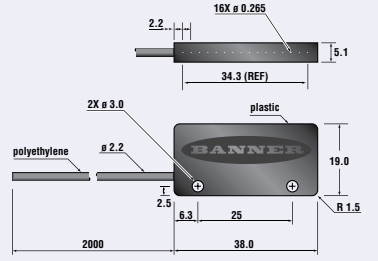
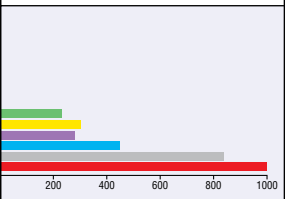
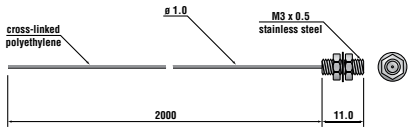
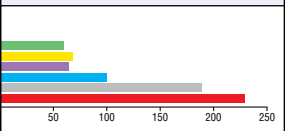
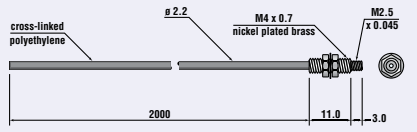
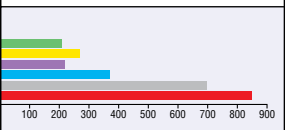
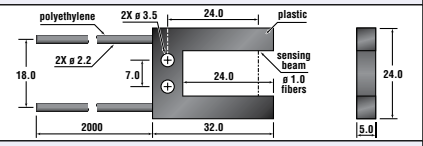
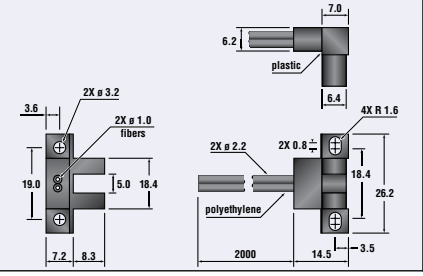
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems





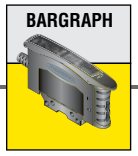
MORE INFO ONLINE *Fiber Optics*

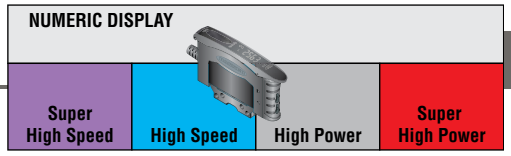
		MODEL NUMBER	DRAWING & DIMENSIONS	CORE DIA. (mm)	MIN. BEND RADIUS (mm)	FEATURES	TYPICAL RANGE (mm)
OPPOSED	AREA SENSING (ARRAY)	**PIR1X166U** *Detailed Dimensions Online*		16X 0.265	25	• Ultra-compact head; straight exit; 5.25 mm width	
OPPOSED	AREA SENSING (ARRAY)	**PIRS1X166U** *Detailed Dimensions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

Indicates lens available for model. See page 25 for details.

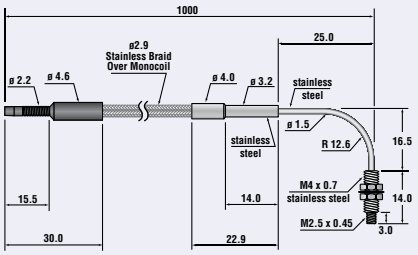
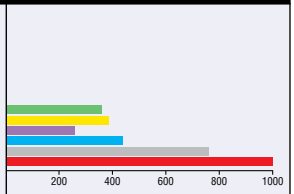
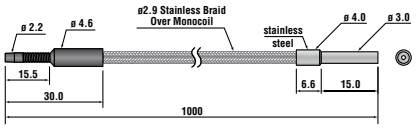
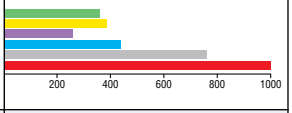
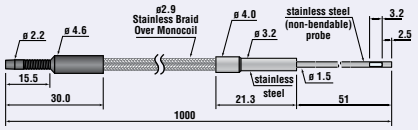
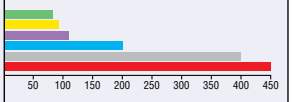
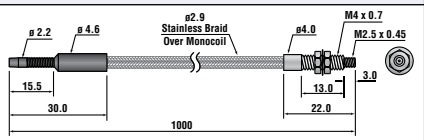
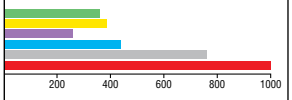
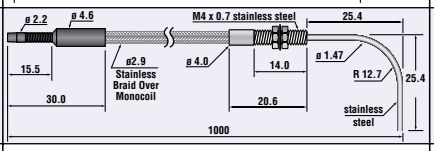
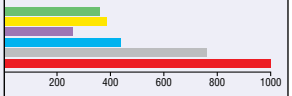
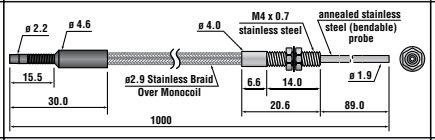
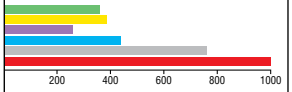
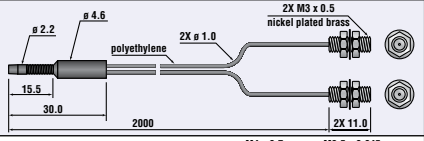
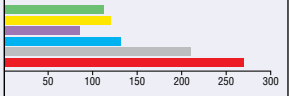
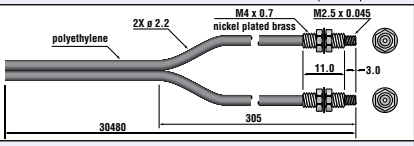
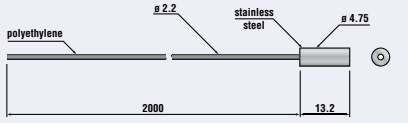
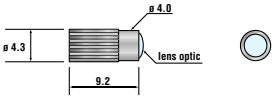
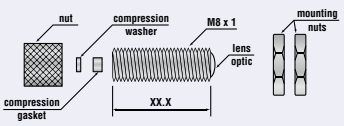
Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems





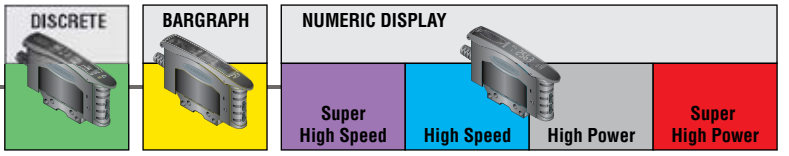
MORE INFO ONLINE *Fiber Optics*

		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	
OPPOSED	STEELSKIN	**PIF43TMB5** *Detailed Dimensions Online*		1.0	12	• Smooth ferrule	
OPPOSED	STEELSKIN	**PIPS43TMB5** *Detailed Dimensions Online*		1.0	12	• Smooth ferrule; non-bendable tip	
OPPOSED	STEELSKIN	**PIT43TMB5** *Detailed Dimensions Online*		1.0	12	• Thread	
OPPOSED	STEELSKIN	**PITA43TMB5** *Detailed Dimensions Online*		1.0	12	• Thread/90° Angle	
OPPOSED	STEELSKIN	**PITP43TMB5** *Detailed Dimensions Online*		1.0	12	• Thread; bendable tip	
OPPOSED	DUAL INDIVIDUAL	**PDIT26T5** *Detailed Dimensions Online*		0.5	12	• Accomplish 2 inspections using only one sensor	
OPPOSED	DUAL INDIVIDUAL	**PDIT4100U** *Detailed Dimensions Online*		1.0	25	• 30 m duplex fiber cable	Contact factory for sensing range.
OPPOSED	VACUUM	**PIF66UM.52M.19D** *Detailed Dimensions Online*		1.5	38	• For use with VFT-M8MVS (ambient side) Call factory	Contact factory for sensing range.
OPPOSED	EXTENDED RANGE LENS	**L2** *Detailed Dimensions Online*		*ref. model PIT46U*	*ref. model PIT46U*	• Range-extending lens • M2.5 thread	
OPPOSED	EXTENDED RANGE LENS	**LO8FP** *Detailed Dimensions Online*		*ref. model PIL46U*	*ref. model PIL46U*	• Ultra-long range-extending lens; use with raw plastic fiber	

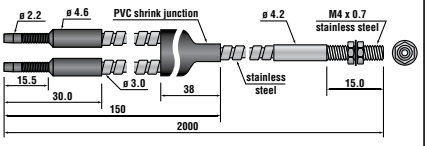
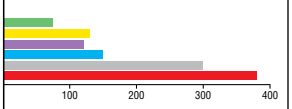
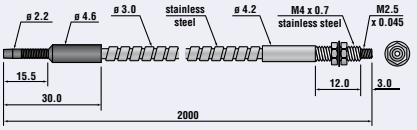
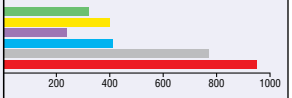
Indicates lens available for model.

Indicates fiber can be Free Cut using Fiber Cutter. See page 27.

D10 Series: Fiber Optic Systems



MORE INFO ONLINE *Fiber Optics*

		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	
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	

Indicates lens available for model. See page 25 for details.
** Fibers are sold separately, two must be ordered to form a pair.*

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

* *Individual plastic fibers are sold in pairs.*

** *Plastic fibers having the letter "U" in the suffix of their model numbers have unterminated control ends and may be cut by the customer to the required length. Use supplied cutter.*

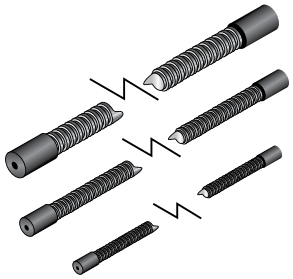
Plastic Fiber Optic Accessories

Fiber Cutters

Model Number	Model Specific Features	General Features
PFK20	• Use with 0.25 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**)
PFK40	• Use with 1 and 1.5 mm diameter cables.	

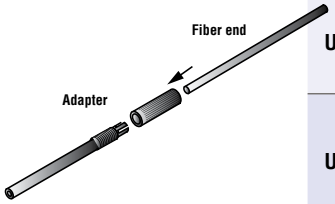
NOTE: Bushings not used with D10 Sensors.

Plastic Fiber Field-Installable Sheathing

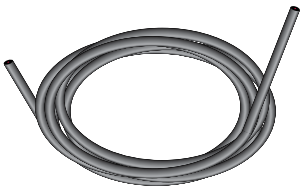


Model Number	Model Specific Features	General Features
PFS69S6T	• May be used with bifurcated fiber assemblies having M6 x 0.75 threaded end tips (example, PBCT46U, PBP46U, PBT46UHT and PBT66U).	• Stainless-steel sheathing with stainless-steel end fittings (one end internally threaded to capture fiber end tips, other end non-threaded) is used in applications requiring protection 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 (example, PBCT26U, PBPF26U, PIP46U, PIT46U, and PIT66U).	
PFS44S6T	• May be used with individual fiber assemblies having M3 x 0.5 threaded end tips (example, PIP26U, PIT26U and PIT1X46U).	

Plastic Fiber Adapters



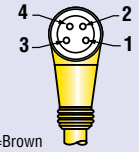
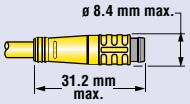
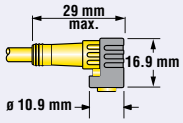
Model Number	Model Specific Features	General Features
UPFA-1-100	• Use to adapt plastic fiber optic cables with outside jacket diameter of 1.0 mm, such as PIT26U and PBP16U.	• Use compression fitting adapters with small-diameter unterminated plastic fiber cables. • Use when interfacing small-diameter plastic fibers to D10 plastic fiber sensor families. • Each kit contains 100 pairs of adapters. One pair interfaces 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 or 1.3 mm, such as PBCT26U and PBF46UM3MJ1.3.	



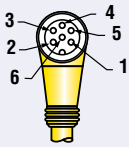
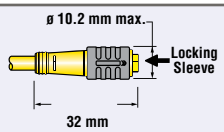
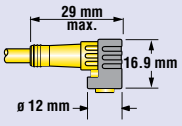
Unterminated Individual & Bifurcated Plastic Fibers

Model Number	Core	Length	Type
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	
PBU43OU	1.0 mm	9 m	Duplex
PBU460U		18 m	

4-Pin Snap-On Pico-Style Cables

Female Pinout	Model	Style	Length	Dimensions	Used With
 1=Brown 2=White 3=Blue 4=Black	**PKG4-2**	Straight	2 m		• D10 Discrete
	PKW4Z-2	Right-Angle	2 m		

6-Pin Snap-On Pico-Style Cables

Female Pinout	Model	Style	Length	Dimensions	Used With
 1 = Brown 4 = Black 2 = White 5 = Gray 3 = Blue 6 = Pink	**PKG6Z-2** **PKG6Z-9**	Straight Straight	2 m 9 m		• D10 *Expert*
	PKW6Z-2 **PKW6Z-9**	Right-Angle Right-Angle	2 m 9 m		

Cable: PVC jacket, PUR connector body, POM snap-lock coupling nut
Temperature: +105° C **Voltage Rating:** 125V ac/dc, 2.0A