

D11 Expert Series, Visible Green, Blue or White LED Light Source



Low-cost TEACH-mode sensors for use with plastic fiber optics

Features

- Visible green, blue or white LED light source for use in color mark sensing and other low-contrast sensing applications
- Low-cost, 10 to 30V dc self-contained TEACH mode sensors for use with all Banner plastic fiber optics
- Compact 11 mm-wide housing designed for DIN rail mounting; can also be mounted to any surface using the supplied mounting bracket
- Easy push-button TEACH mode programming automatically adjusts sensitivity to optimal setting
- Designed for high performance, even in low-contrast sensing applications
- Fast, 200 microsecond (0.2 millisecond) output response; a 40 millisecond output pulse stretcher may be programmed, when needed
- · Choose models with NPN (sinking) or PNP (sourcing) output
- · Output may be programmed for either light or dark operate
- Separate input for remote programming by external switch, process controller, etc.
- LED status indicators for power ON, output state, received signal strength, and sensing contrast
- Choose models with integral 2 m (6.5') cable or Pico-style quick-disconnect (QD) connector; 9 m (30') cables are also available

† U.S. Patent #5087838

See Sensing Beam Information Below



D11 Expert Series Models

		Supply		Maximum Range Specifications	
Models	Cable*	Voltage	Output Type	Diffuse mode performance based on 90% reflectance white test card	
Visible Green 525 nm					
D11EN6FPG D11EN6FPGQ	2 m (6.5') 4-pin Pico QD	10-30V de	NPN (sinking)		
D11EP6FPG D11EP6FPGQ	2 m (6.5') 4-pin Pico QD	10-30V ut	PNP (sourcing)	Range varies by sensing mode and fiber optics used:	
Visible Blue 470 nm			PIT46U fibers, opposed mode: 50 mm (2.0") [†]		
D11EN6FPB D11EN6FPBQ	2 m (6.5') 4-pin Pico QD	10.20V do	NPN (sinking)	PBT46U fiber, diffuse mode: 17 mm (0.7")	
D11EP6FPB D11EP6FPBQ	2 m (6.5') 4-pin Pico QD	10-30V ut	PNP (sourcing)	PBT66U fiber, diffuse mode: 25 mm (1.0")	
Visible White 450 - 650 nm			(see Banner Products Catalog for available lenses).		
D11EN6FPW D11EN6FPWQ	2 m (6.5') 4-pin Pico QD	10-30V do	NPN (sinking)		
D11EP6FPW D11EP6FPWQ	2 m (6.5') 4-pin Pico QD	10-30V ut	PNP (sourcing)		

*NOTE: 9 m (30') cables are available by adding suffix **"W/30"** to the model number of any cabled sensor (e.g., **D11EN6FPG W/30**). A model with a QD connector requires an optional mating cable (see page 6).

RUN Mode

Normal operation of the D11 Expert is called RUN mode. The LED indicators operate in RUN mode, as follows:

Indicator	LED Color	Function
Power "ON"	Green	 On steadily whenever power is applied Flashes at approximately 4Hz to indicate that the output is overloaded
Output Indicator	Yellow	Follows the action of the output: On when the output is energized Off when the output is de-energized
Signal Strength	Red	Lights whenever the sensor "sees" its modulated light source and pulses at a rate which is proportional to the received light signal strength

Signal Strength Indicator Output Indicator Power ON Indicator Programming Push Button

The Signal Strength indicator is Banner's exclusive AID[™] (Alignment Indicating Device, U.S. Patent #4356393). This feature makes alignment during the TEACH mode easy and accurate and provides a means of signaling when maintenance is needed when the sensor is in RUN mode. Whenever the pulse rate is slow, the fiber sensing ends should be cleaned and/or the alignment checked.

Figure 1. D11E Expert Features

TEACH Mode

Sensitivity is automatically set (and optimized) by "teaching" the sensor the light and dark conditions. This is accomplished in TEACH mode. TEACH mode simply requires that each of the two sensing conditions be presented to the fiber optics. When the push button is clicked, the sensor samples the sensing condition and registers it into memory. After the second sensing condition is registered, the D11E automatically sets the sensitivity to the optimum value for the application, and then returns to RUN mode.

NOTE: There is a period of a few seconds at the end of TEACH mode before RUN mode begins.

Light or Dark Operate Selection

The two sensing conditions may be presented in either order: the light condition first, and then the dark condition, or vice versa. The condition presented first is the condition for which the output will energize. In other words, the output will be light operated if the light condition is TEACH condition #1, or the output will be dark operated if the dark condition is TEACH condition #1.

Number of Flashes at end of TEACH mode	Relative Contrast
1	Unacceptable
2	Low
3	Moderate
4	High

Contrast Indication

When the push button is clicked to teach the second sensing condition, the three LED indicators flash simultaneously to indicate relative sensing contrast. Contrast is the difference in light level between the two sensing conditions. Higher contrast allows higher sensitivity level, and resulting higher excess gain. A high contrast level is directly related to sensing reliability, and forgivingness to subtle changes in sensing conditions. The display of contrast at the end of the TEACH mode is as follows:

NOTE: If the relative contrast level is unacceptable (1 flash), the program will return to TEACH Condition #1.

TEACH Mode Programming



[†]NOTE: The sensor will return to RUN mode if the first TEACH condition is not registered within 20 seconds. TEACH mode may be cancelled before either condition #1 or #2 by holding the push button depressed for 2 seconds.

Maximum Sensitivity Setting

D11E sensors are factory-programmed for maximum sensitivity. This default setting may be easily recalled by holding the push button for two or more seconds to enter TEACH mode, and then clicking the push button four times in a row.

NOTE: The default program includes light operate output and pulse stretcher OFF.

Output Pulse Stretcher

A 40 millisecond pulse stretcher (OFF-delay) may be enabled for applications where a very short sensing event might be missed due to the response of the load or input connected to the sensor output. The pulse stretcher is turned ON or OFF using the following procedure:

Output Pulse Stretcher Programming

Push	Resulting Indicator Status		
Push and hold for ≥ 2 seconds	Push and Hold ≥ 2 Seconds	Green: Flashes at 1Hz Yellow: OFF Red: Pulses to indicat strength	e relative received signal
Pulse Stretcher Double-click to display status Single-click to toggle pulse stretcher ON or OFF	Double-Click Single-Click	pulse stretcher ON: Green: OFF Yellow: OFF Red: ON steadily	pulse stretcher OFF: Green: OFF Yellow: OFF Red: Double-Flash
Double-click to save configuration and return to RUN mode	Double-Click	See page 2	

D11E Expert Series Specifications

Required Fiber Optic Cable	equired Fiber Optic Cable PI or PB Series plastic fibers		
Sensing Beam	Visible green, 525 nm; visible blue, 470 nm; visible white, 450-650 nm		
Supply Voltage and Current	10 to 30V dc (10% maximum ripple) at less than 45 mA, exclusive of load		
Supply Protection Circuitry	Protected against reverse polarity and transient voltages		
Output Configuration	Juration One (SPST) NPN (sinking) or PNP (sourcing) open-collector transistor, depending on model; Programmable for light or dark operate		
Output Rating	150 mA maximum; OFF-state leakage current: < 5 microamps at 30V dc; ON-state saturation voltage: < 1V at 10 mA dc; < 1.5V at 150 mA dc		
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit		
Output Response Time	200 microseconds (0.2 milliseconds) ON and OFF (40 milliseconds OFF when pulse stretcher is programmed). NOTE: 100 millisecond delay on power-up; output does not conduct during this time		
Output Timing Functions	ON/OFF (no delay) or fixed 40 millisecond OFF-Delay pulse stretcher; selected by push button		
Repeatability	65 microseconds		
Adjustments	Push-button TEACH-mode sensitivity setting (see TEACH Mode information); remote TEACH-mode input is provided		
Indicators	Three LEDs: Green, Yellow and Red Green LED lights for dc power ON and flashes when ready to register sensing condition during TEACH mode: 1 Hz when waiting to learn first sensing condition, 2 Hz when waiting to learn second sensing condition, 4 Hz when output is overloaded		
	Yellow LED lights for output ON (conducting)		
	Red LED is Banner's patented Alignment Indicating Device (AID [™] , U.S. patent #4356393) which lights whenever the sensor "sees" a light condition and superimposes a pulse rate which is proportional to the strength of the received light signal (the stronger the signal, the faster the pulse rate)		
Construction	Black ABS (Cycolac® KJB) flame-retardant housing with acrylic cover; Stainless steel M3 x 0.5 hardware for use with ABS (Cycolac® KJB) mounting bracket (supplied)		
Environmental Rating	onmental Rating IEC IP54; NEMA 2		
Connections	2 m (6.5') or 9 m (30') attached cable, or 4-pin Pico-style quick-disconnect fitting; cables for QD models are purchased separately		
Operating Conditions	Temperature: -10° to +55°C (-14° to +131°F) Maximum relative humidity: 90% at 50°C (non-condensing)		
Certifications			

Cycolac® is a registered trademark of General Electric Company.



WARNING . . . Not To Be Used for Personnel Protection

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products catalog for safety products which meet OSHA, ANSI and IEC standards for personnel protection.

D11E Series Hookups

Sensors with NPN (Sinking) Outputs

Cabled Hookup



Quick-Disconnect Hookup



Sensors with PNP (Sourcing) Outputs

Cabled Hookup



Quick-Disconnect Hookup



Quick-Disconnect (QD) Cables

The following cables are available for D11E QD models					
Style	Model	Length	For use with	Dimensions	Pinout
4-pin Pico-style straight	PKG4-2	2 m (6.5')	All D11 sensors with quick-disconnect fitting	Ø 10 mm max (0.4")	Black Wire Blue Wire Blue Wire
4-pin Pico-style right-angle	PKW4-2	2 m (6.5')		25 mm max. (1.0") 20 mm (0.8") <u>\$\$12 mm max.</u> (0.5")	



Dimensions

Plastic Fiber Installation:

- Cut fiber ends per instructions 1. included with the fibers. Slide the fiber gripper up (open). For 0.25 mm or 0.5 mm diameter fibers, insert the adapter (shown below) into the ports as far as it will go.
- 2. All fibers: Insert the prepared plastic fiber sensor ends gently into the ports as far as they will go.
- 3. Slide the fiber gripper back down to lock.

Fiber Adaptor



Adaptor (included) is for use with 0.25 mm (0.01") or 0.5 mm (0.02") diameter fibers

DIN Rail Mounting



Remote Programming

The white wire of the D11E may be connected to a remote switch for the following sensor programming functions:

- 1) Disable or enable the push button
- 2) TEACH mode programming of sensitivity
- 3) Enable or disable the 40-millisecond pulse stretcher.

A remote programming switch is connected between the white wire and dc common (see hookup diagrams on page 6). The switch may be either a normally-open contact, or an opencollector NPN transistor which has its emitter connected to dc common.

Programming is accomplished using a specified sequence of input pulses. The duration of each pulse ("T") is defined: 0.04 seconds < T < 0.8 seconds.

The required spacing between adjacent pulses in a sequence (e.g. a "double-pulse") also "T". The timing diagrams, (right) illustrate the input requirements.



Disable or Enable the Push Button:

When remote programming is used, exclusively, it may be beneficial to disable the push button on the D11E to increase the security of the settings.

- To disable the push button: Pulse the remote input four times (see timing diagram, above).
- 2) To enable the push button at a later date: Pulse the input four times (again).

Set Sensitivity via the TEACH mode:

- 1) Present the first (output ON) sensing condition to the sensor and pulse the remote input once.
- Present the second (output OFF) sensing condition to the sensor and pulse the remote input once. The three LED indicators will flash simultaneously one to four times to indicate relative sensing contrast (see page 3), and the sensor will return to RUN mode.

Enable or Disable the 40-millisecond Pulse Stretcher:

- Pulse the remote input two times (see timing diagram). The status of the pulse stretcher is indicated by the red LED: The red LED will be lit, steadily, if the pulse stretcher is ON; the red LED will double-flash if the pulse stretcher is OFF.
- 2) Pulse the remote input once to toggle the the pulse stretcher ON or OFF.
- Pulse the remote input two times to save the setting and return to the RUN mode.



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