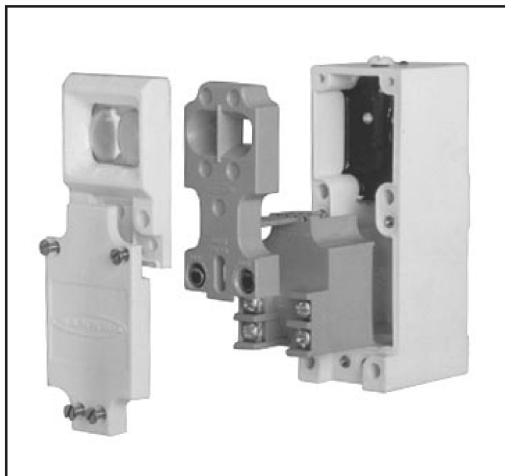
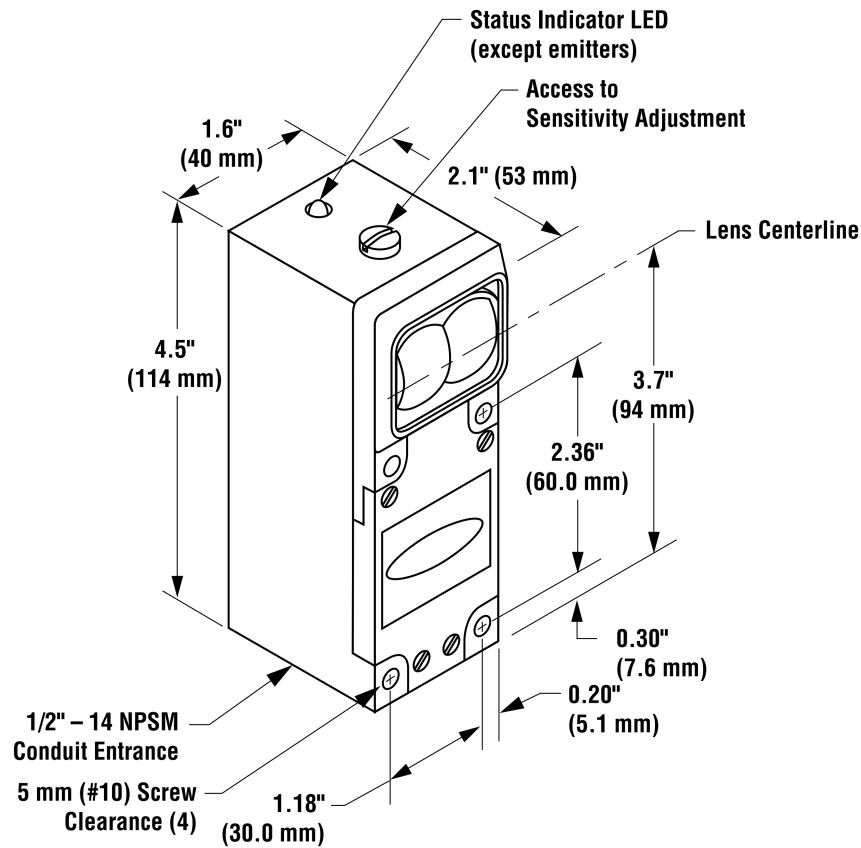




MULTI-BEAM[®] Sensors

Compact modular self-contained photoelectric sensing controls



- Modular design with interchangeable components (scanner blocks, power blocks, and logic timing modules); over 5,000 sensor configurations possible
- *Scanner blocks* for opposed, retro, diffuse, convergent, and fiber optic sensing modes (including high-gain models)
- *Power blocks* for ac or dc operation, including 2-wire ac operation
- *Logic modules* to support a wide variety of delay, pulse, limit, and rate sensing logic functions
- Most scanner blocks include Banner's exclusive, patented AID™ (Alignment Indicating Device) system, which lights a top-mounted indicator LED whenever the sensor sees its own modulated light source, and pulses the LED at a rate proportional to the strength of the received light signal.

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WARNING MULTI-BEAM® photoelectric presence sensors described in this catalog do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in *either* an energized or a de-energized sensor output condition.


Never use these products as sensing devices for personnel protection. Their use as a safety device may create an unsafe condition which could lead to serious injury or death.

Only MACHINE-GUARD and PERIMETER-GUARD Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection.


WARRANTY: Banner Engineering Corporation warrants its products to be free from defects for one year. Banner Engineering Corporation will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.

3- and 4-wire Systems (pages 6 through 23)

Power Blocks	Model	Input Voltage	Output Configuration	Agency Approvals	Page
	PBT	10 to 30V dc	SPST NPN (sink), 250mA maximum	UL & CSA	p. 15
	PBT2	10 to 30V dc	SPDT NPN (sink), 250mA each output		p. 15
	PBP	10 to 30V dc	SPST PNP (source), 250mA maximum	UL & CSA	p. 15
	PBT-1	10 to 30V dc	No output: for powering emitters	UL & CSA	p. 16
	PBT48	44 to 52V dc	SPST NPN (sink), 250mA maximum		p. 15
	PBP48	44 to 52V dc	SPST PNP (source), 250mA maximum		p. 15
	PBT48-1	44 to 52V dc	No output: for powering emitters		p. 16
	PBD-2	11 to 13V ac (50/60Hz)	SPST SCR, 3/4 amp maximum		p. 17
	PBD	22 to 28V ac (50/60Hz)	SPST SCR, 3/4 amp maximum	UL & CSA	p. 17
	PBD-1	22 to 28V ac (50/60Hz)	No output: for powering emitters		p. 19
	PBA	105 to 130V ac (50/60Hz)	SPST SCR, 3/4 amp maximum	UL & CSA	p. 17
	PBAQ	105 to 130V ac (50/60Hz)	SPST SCR, normally closed, 3/4 amp max.	UL & CSA	p. 19
	PBAT	105 to 130V ac (50/60Hz)	SPST isolated transistor, 100mA max. (ac or dc)	UL & CSA	p. 18
	PBO	105 to 130V ac (50/60Hz)	SPST isolated transistor, 50mA max. (dc only)	UL & CSA	p. 18
	PBAM	105 to 130V ac (50/60Hz)	Voltage source: 8V dc at 8ma max.	UL & CSA	p. 18
	PBA-1	105 to 130V ac (50/60Hz)	No output: for powering emitters	UL & CSA	p. 19
	PBB	210 to 250V ac (50/60Hz)	SPST SCR, 3/4 amp maximum	UL & CSA	p. 17
	PBBT	210 to 250V ac (50/60Hz)	SPST isolated transistor, 100mA max. (ac or dc)	UL & CSA	p. 18
PBOB	210 to 250V ac (50/60Hz)	SPST isolated transistor, 50mA max. (dc only)	UL & CSA	p. 18	
PBB-1	210 to 250V ac (50/60Hz)	No output: for powering emitters	UL & CSA	p. 19	

Logic Modules	Model	Timing Logic Function	Time Range(s)	Page
	LM1	ON/OFF (no timing function), light operate only	<i>NOTE for items below:</i> other time ranges available (p. 23)	p. 21
	LM3	ON/OFF (no timing function), light or dark operate		p. 21
	LM5	ON-delay	.15 to 15 seconds	p. 22
	LM5R	OFF-delay	.15 to 15 seconds	p. 22
	LM5-14	ON & OFF delay	.15 to 15 seconds (both delays)	p. 22
	LM5T	Limit timer (time-limited ON/OFF)	.15 to 15 seconds	p. 22
	LM4-2	One-shot, retriggerable	.01 to 1 second	p. 21
	LM4-2NR	One-shot, non-retriggerable	.01 to 1 second	p. 22
	LM8-1	Delayed one-shot	.15 to 15 seconds (both times)	p. 23
	LM8A	ON-delay one-shot	.15 to 15 seconds (both times)	p. 23
	LM6-1	Rate sensor	60 to 1200 pulses per minute	p. 22
	LM8	Repeat cycle timer	.15 to 15 seconds (both times)	p. 23
	LM2	Alternate action, divide by 2		p. 21
	LM10	Alternate action, divide by 10		p. 23
	LMT	Test module		p. 23

2-wire Systems (pages 24 through 29)

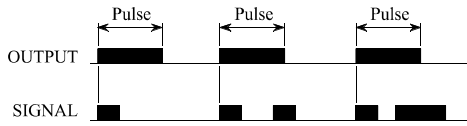
Scanner Blocks	Model	Sensing Mode	Range	Response	Page
	SBE & 2SBR	Opposed	150 feet	10 milliseconds	p. 25
	2SBL1	Retroreflective	30 feet	10 milliseconds	p. 25
	2SBD1	Diffuse (proximity): short range	12 inches	10 milliseconds	p. 26
	2SBDX1	Diffuse (proximity): long range	30 inches	10 milliseconds	p. 26
	2SBC1	Convergent beam	1.5-inch focus	10 milliseconds	p. 25
	2SBC1-4	Convergent beam	4-inch focus	10 milliseconds	p. 25
	2SBF1	Fiberoptic	see specs	10 milliseconds	p. 26

MULTI-BEAM 3- & 4-wire Logic Modules

Model and Function

Description of Logic

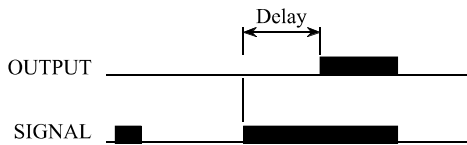
LM4-2NR one-shot (non-retriggerable)



Setable time range: .1 to 1 second.

The **LM4-2NR** provides a one-shot ("single shot") output pulse each time there is a transition from LIGHT to DARK (jumper installed) or from DARK to LIGHT (jumper removed). The output pulse time range is adjustable from 0.1 to 1 second. The duration of the pulse is independent of the duration of the input signal. The output pulse of the LM4-2NR must complete before it recognizes another input transition. This is called a "non-retriggerable" one shot, which sometimes offers an advantage in indexing or registration control applications where multiple input signals are possible during advance of the product.

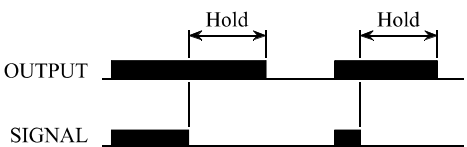
LM5 on-delay



Setable time range: 1.5 to 15 seconds.

The **LM5** is a true "on-delay" type logic module. The input signal must be present for a predetermined length of time before the output is energized. The output then remains energized until the input signal is removed. If the input signal is not present for the predetermined time period, no output occurs. If the input signal is removed momentarily and then reestablished, the timing function starts over again from the beginning. A LIGHT/DARK operation selection jumper is included. The standard time range is adjustable from 1.5 to 15 seconds (field adjustable), and other ranges are available. The LM5 is often used to detect jams on a conveyor line, where a beam broken for longer than a preset period of time implies a product jammed in the light beam.

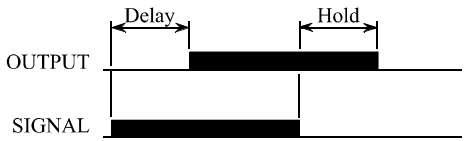
LM5R off-delay



Setable time range: 1.5 to 15 seconds.

The **LM5R** is an "off-delay" logic module, similar to the LM5, except that timing begins on the trailing edge of the input signal. When the input occurs, the output is immediately energized; if the input is then removed, the output remains energized for the adjustable pre-determined time period, then de-energizes. If the input is removed but then re-established while the timing holds the output energized, a new output cycle is begun. The LM5R might typically be used to tell when no products have broken a beam for a predetermined length of time, therefore indicating a jam or an empty reservoir upstream. The LIGHT/ DARK operate jumper wire is included. Timing range is adjustable from 1.5 to 15 seconds, and optional ranges are available.

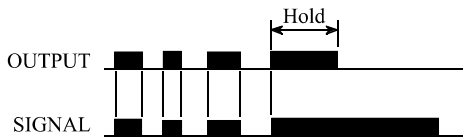
LM5-14 on- & off-delay



Setable time range: 1.5 to 15 seconds.

The **LM5-14** combines the function of an "on-delay" and an "off-delay" into one logic module. When the signal is present for more than the on-delay time, the output energizes. The off-delay circuit is now active, and holds the output on even if the input signal disappears for short periods of time. If the input signal is gone for longer than the off-delay time, the output finally drops out. The most common use for the LM5-14 is to control fill level, for example in a bin: when the bin is full, a beam is broken, and a predetermined time later, the flow is stopped. After the level has fallen below the beam for a time, the flow is restarted. The time delays control the high and low levels. Each delay is independently adjustable for 1.5 to 15 seconds.

LM5T limit timer



Setable time range: 1.5 to 15 seconds.

The **LM5T** "limit" timer combines the function of on-off logic and on-delay logic. As long as the signal is present for only short periods of time, the output "follows the action" of the input signal. If the input signal is present for longer than the predetermined time, the output deenergizes. The output only reenergizes when the input signal is removed and then reestablished. Interval timers are used to operate loads which must not run continuously for long periods of time, such as intermittent duty solenoids and conveyor motors. The LM5T may be used to run a supermarket checkout conveyor, always bringing the product up to the sensor beam and then stopping the motor. When the last item is removed, the motor times out and stops. Timing range is .15 to 15 seconds.

LM6-1 rate sensor



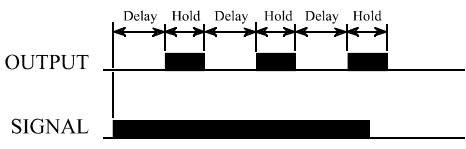
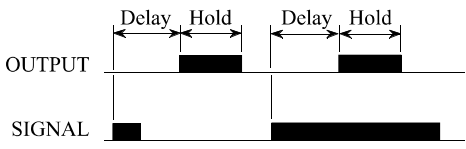
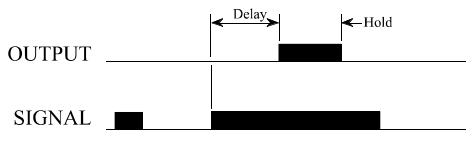
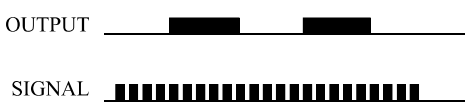

Setable rate: 60 to 1200 pulses per minute.

The **LM6-1** is a true overspeed or underspeed sensing logic module that monitors signals from a scanner block and continuously calculates the time between input signals, and compares that time with the reference set by the "HOLD" potentiometer. A jumper allows the mode to be changed from *overspeed* (jumper installed) to *underspeed* (jumper removed). In the overspeed mode, the output will drop if the preset rate is exceeded. In the underspeed mode, the output remains energized until the input rate drops below the preset. The output will not "pulse" at low speeds as retriggerable one-shots do. A "DELAY" adjustment allows the LM6-1 to ignore data for the first several seconds after power is applied, to permit the rate to accelerate to operating speed without false underspeed outputs. The sensing rate may be adjusted from 60 to 1200 pulses per minute (.05 to 1.0 second per pulse), and the power-up inhibit from 1 to 15 seconds.

MULTI-BEAM 3- & 4-wire Logic Modules

Model and Function

Description of Logic

<p>LM8 repeat cycler</p>  <p>Setable time range: 1.5 to 15 seconds.</p>	<p>The LM8 is a repeat cycle timing module with independently adjustable delay and hold times. When an input signal is received from the scanner block, a delay period begins during which there is no output. If the signal remains, the delay period is followed by a hold period, during which the output is energized. If the signal still remains, the hold period times out, releasing the output and starting a new delay period. This sequence continues indefinitely until the input signal is removed. The LM8 is used in edgeguide and other registration control schemes where it is desired to "pulse" the correction motor to avoid overcorrection that might occur with a continuous output. Both time ranges are independently adjustable from 1.5 to 15 seconds. NOTE: use of the LIGHT/DARK operate jumper is reversed: remove for DARK, leave in place for LIGHT.</p>
<p>LM8-1 delayed one-shot</p>  <p>Setable time range: 1.5 to 15 seconds.</p>	<p>The LM8-1 is a delayed one-shot that functions very much like two individual one-shots, with the end of the first initiating the second. When an input signal occurs, a delay period is initiated, during which time the output is not energized. After the delay, the output is energized for the hold period, then deenergized. No further action takes place unless the signal is removed and then reestablished. This sequence is independent of the duration of the input signal. The LM8-1 is frequently used to sense a product, and then act on that product a short time later when it is clear of the inspection station. An example might be to inspect cartons for open flaps, and to eject the faulty cartons when they have completely passed the inspection point. Both time ranges are adjustable from 1.5 to 15 seconds.</p>
<p>LM8A on-delay one-shot</p>  <p>Setable time range: 1.5 to 15 seconds.</p>	<p>The LM8A differs slightly from the LM8-1. It too incorporates both a delay and a hold time, except that the delay is a true on-delay. If the input signal does not last for the total duration of the delay time, no output action ever occurs (with the LM8-1, even a momentary signal generates one complete cycle of timing). If the delay time passes, the one-shot output occurs, regardless of what happens to the input signal. Removing the input signal and reapplying it begins a new cycle. The LM8A is used to eject a part that has remained in the sensor beam longer than the delay time (for instance, a jammed part). Both time ranges are independently adjustable from 1.5 to 15 seconds. NOTE: use of the LIGHT/DARK operate jumper is reversed: remove for DARK, leave in place for LIGHT.</p>
<p>LM10 ÷10 counter</p> 	<p>The LM10 is a fixed-count divide-by-ten logic module, with neither timing nor LIGHT/DARK operate functions. When power is first applied, the output is OFF; with each dark-to-light transition, the LM10 enters one count in its memory. After five counts, the output is energized, and it remains energized until the tenth count. It then deenergizes, and the sequence continues. The LM10 is intended for product counting applications using programmable logic controllers or computers, where the scan time of the input section of the controller is too slow to permit "catching" high speed count rates. It may also be used with electromechanical totalizers, which suffer from this same slow response. In operation, of course, the registered count must be multiplied by ten to get the true count (ambiguity of five).</p>
<p>LMT test logic</p> 	<p>LMT is a plug-in test logic module for use when troubleshooting MULTI-BEAM sensors. It contains LED indicator lights in place of the timing potentiometers and a miniature switch in place of the LIGHT/DARK operate jumper. The indicator lights display the operation of the scanner block and power block to verify proper functioning, and the switch permits manual operation of the load to verify the output switching circuit. The step-by-step testing procedure included with the LMT will allow a MULTI-BEAM to be completely tested without removing it from the installation, and, if there is a faulty scanner block, power block, or logic module, the LMT will identify it. <i>The LMT may also be used with all 2-wire MULTI-BEAMs (see pages 24 to 29).</i></p>

Logic Module Modifications

The time ranges of any MULTI-BEAM 3- & 4-wire logic module may be factory modified. Time range modification is often necessary to improve the setability of the timing function. Some time range modifications are carried in stock. The current Banner products price list is the best source of this information. Other time range modifications may be quoted. When ordering modified logic modules, add the letter "M" after the model number, followed by the maximum time desired (in seconds). The table below lists possible modifications.

Model Number Suffix	Setable Time Range
M.01	.001 to .01 seconds
M.1	.01 to .1 seconds
M.5	.05 to .5 seconds
M1	.1 to 1 second
M5	.5 to 5 seconds
M15	1.5 to 15 seconds

- For logic modules with a single timing function, specify the maximum desired time in seconds (e.g., LM5M5 indicates an LM5 on-delay with the delay time adjustable up to 5 seconds).

- For logic modules with dual timing functions, specify the maximum desired delay and hold time in seconds (e.g., LM5-14M1M5 indicates an LM5-14 on-off delay with an on-delay adjustable up to 1 second and an off-delay adjustable up to 5 seconds). Always specify both timing ranges, even if only one is to be modified.

- For fixed timing, the letter "F" should always be followed by the desired time, in seconds (e.g., LM5MF1 would be an LM5 on-delay with a fixed 1 second delay time). For fractions of seconds, use decimal equivalents, such as LM5MF.5, or LM5MF.01, etc.