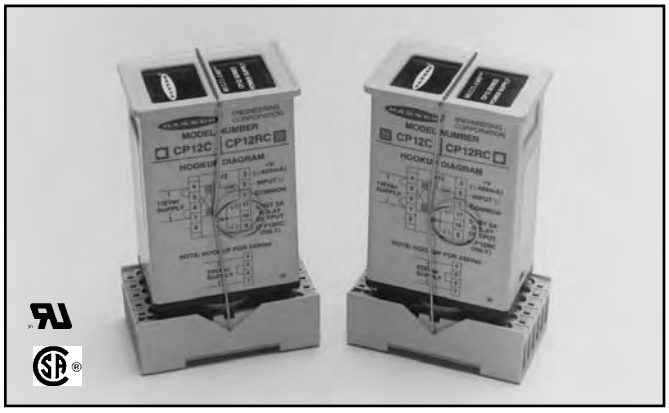
MAXI-AMP™ System
CP Series Power Supply Modules

the photoelectric specialist



MODEL	INPUT VOLTAGE	OUTPUT POWER	OUTPUT DEVICE
CP12C	105 to 130V ac (15 VA) or 210 to 250V ac (15 VA) 50/60Hz	400 milliamps maximum for 10-30V dc sensing devices	None
CP12RC			SPDT 5-amp electro-mechanical

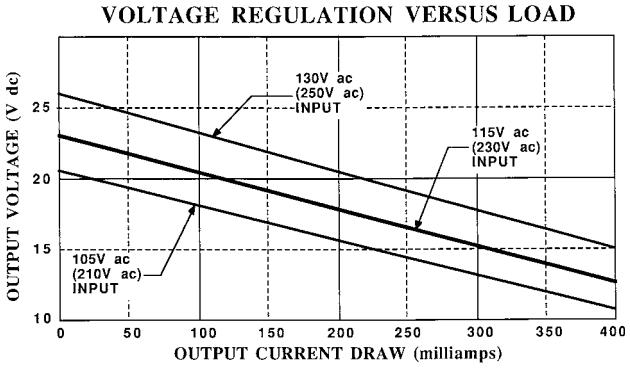
MAXI-AMP CP Series power supply modules provide a convenient source of power for 10 to 30V dc sensing devices such as Banner self-contained dc sensors and/or any of the Banner logic modules and remote amplifiers. It is an excellent way to supply power to a system using multiple MAXI-AMP modules and associated sensors.

These supplies are designed for either 120 or 220/240V ac input voltage (see hookup diagrams). They offer 400 milliamps for powering 10 to 30V dc devices.

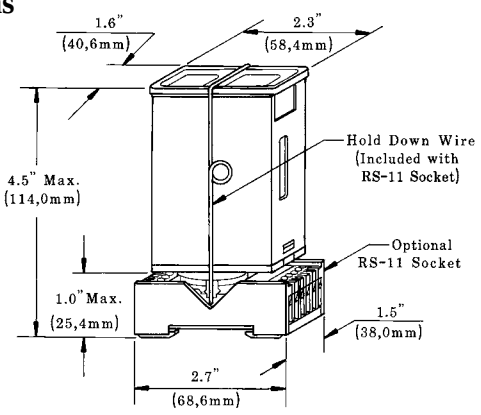
Model CP12RC includes a relay which may be switched by a current sinking device (pin #2) or a current sourcing device (pin #8). The relay is a single-pole double-throw (SPDT) 5 amp electromechanical type.

CP series power supplies are built into the rugged MAXI-AMP housing. They connect via a standard 11-pole round-pin relay socket (Banner RS-11). The RS-11 socket allows DIN rail mounting of the power supply. Operating temperature for CP series power supply modules is 0 to 50 degrees C (32 to 122 degrees F).

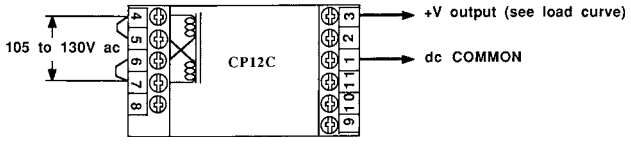
Load Curve



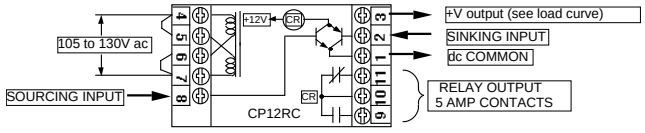
Dimensions



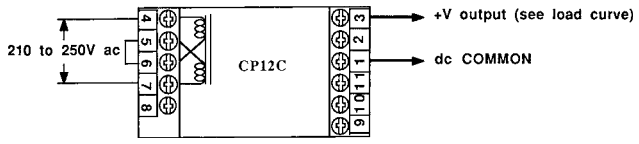
120V ac Hookup Diagram, CP12C



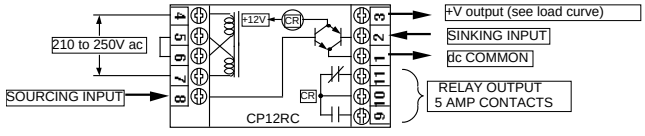
120V ac Hookup Diagram, CP12RC



220/240V ac Hookup Diagram, CP12C



220/240V ac Hookup Diagram, CP12RC



Printed in USA

P/N 03460C3B

OC-12

SYSTEMS INTERFACE DEVICE: Optical Coupler Module

more sensors, more solutions

The Banner model OC-12 is an optical coupler module used to interface the outputs of amplifiers and amplified scanners to other logic systems such as computers, programmable logic controllers (PLCs), solid-state totalizers, preset counters, speed controls, and any other devices which must be *isolated from ground.* The OC-12 allows interfacing between systems operating at different DC voltage levels (e.g. - a 24V dc sensor to a 5V dc logic circuit).

The OC-12's output is a phototransistor capable of sinking up to 50mA dc at applied voltages of up to 30V dc. ***The OC-12 may NOT be used to switch AC.*** Response time is less than 100 microseconds, and life is infinite. On-state saturation voltage is less than 1V dc, and off-state leakage current is less than 10 microamps.

The OC-12's input is compatible with the NPN or PNP transistor outputs of all Banner amplified DC photoelectric sensors, including the MULTI-BEAM, MAXI-BEAM, VALU-BEAM, MINI-BEAM, and ECONO-BEAM families. It may also be connected to the logic level outputs of Banner MAXI-AMP CL3, CM3, and CR3 Series modules and to the outputs of Banner "M" and "B" series amplifiers and MICRO-AMP family amplifiers and logic modules.

The OC-12 has a standard octal plug base, and is wired using a standard octal relay socket (Banner model OS-8). The OC-12 may also be used in place of the electromechanical relay on the model MRB control chassis.

Specifications

INPUT: 10-30V dc. Connects directly to the PNP or NPN transistor output of all Banner self-contained (amplified) DC photoelectric sensors (MULTI-BEAM, MAXI-BEAM, VALU-BEAM, MINI-BEAM, and ECONO-BEAM families); CM3, CL3, CR3, "M", and "B" series amplifiers; and MICRO-AMP amplifiers and logic modules.

OUTPUT: ground-isolated optically-coupled NPN current sinking phototransistor, 50mA maximum at 30V dc maximum.

RESPONSE TIME: less than 100 microseconds (0.1 milliseconds).

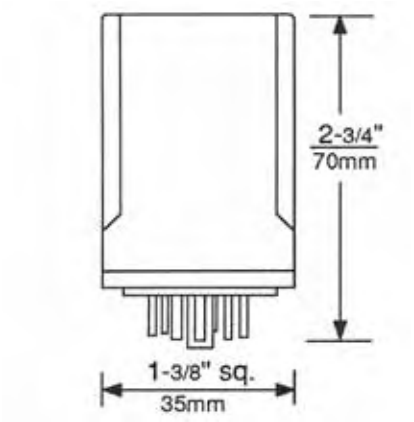
ON-STATE SATURATION VOLTAGE: less than 1V dc. Photodarlington output.

OFF-STATE LEAKAGE CURRENT: less than 10 microamps.

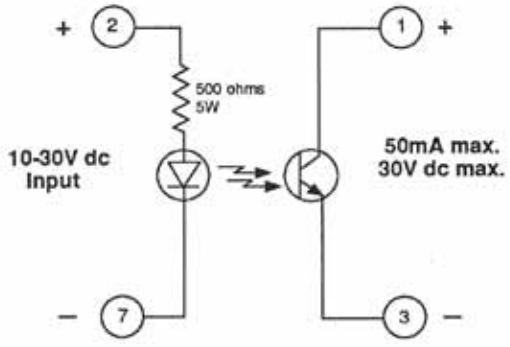
OPERATING TEMPERATURE: 0 to 50 degrees C (32 to 122 degrees F).

CONSTRUCTION: standard black plastic octal-plug relay housing.

DIMENSION DRAWING



FUNCTIONAL SCHEMATIC

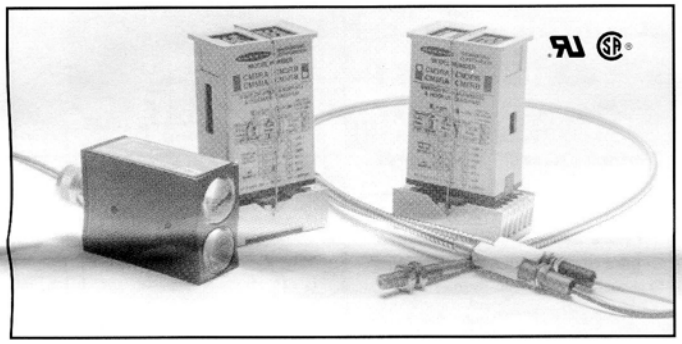


Printed in USA

P/N 03444H8A

MAXI-AMP™ CM Series
Modulated Amplifier Modules

BANNER
the photoelectric specialist



MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CM3RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay, plus NPN transistor solid-state DC switch	ON/OFF
CM3RB	210 to 250V ac, or 12 to 28V dc		
CM5RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay (5 amp contact rating)	12 timing functions
CM5RB	210 to 250V ac, or 12 to 28V dc		

CM Series MAXI-AMPs combine power supply, modulated photoelectric amplifier, timing logic (in CM5 models) and output relay in a single compact, cost-saving module. CM Series modules work together with the popular family of Banner high-performance modulated remote sensors (pages 3-4). These sensors offer small size and excellent optical performance, and are built to operate in highly demanding sensing environments. MAXI-AMP modules themselves are also ruggedly built for dependable industrial duty.

CM Series MAXI-AMP modules contain the state-of-the-art Banner custom-designed CMOS modulator/demodulator/amplifier circuit, offering high immunity to both ambient light and electrical interference plus reliable sensor performance. All models have Banner's *exclusive,* patented Alignment Indicating Device ("AID™") system*, which lights an LED indicator whenever the sensor sees a "light" condition, and pulses the LED at a rate proportional to the received light signal strength.

All CM Series modules are programmable for LIGHT or DARK operate and either high or low hysteresis. Input response time may be set at 0.3, 2, or 10 milliseconds. The 10-millisecond response mode offers enhanced immunity to electrical interference ("noise"), and also minimizes optical "crosstalk" between adjacent sensors. Unlike other amplifier designs, input response time settings of the CM Series modules do *not* affect sensor range.

CM5 models include a versatile multi-function timing logic circuit which is programmable for 12 of the most popular and useful delay, one-shot, and latch functions (see page 7). Each timing function has a choice of three time ranges. Timing and sensitivity adjustments are accomplished via rugged 15-turn potentiometers for very accurate settings. CM Series circuitry is designed to prevent false outputs on system power-up.

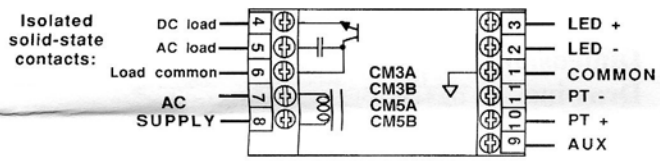
An auxiliary input is available on CM5 models for interrogation or reset of the selected logic function (see example, page 5). Page 7 describes the function of the auxiliary input for each logic mode. A dc power supply is included for powering an additional self-contained dc sensor.

The output circuit for *all* CM Series modules is an SPDT 5-amp electromechanical relay. *Additionally, CM3 models have an NPN transistor solid-state switch.* The output may be programmed for either normally open or normally closed operation. A solid-state relay is offered as an option to the electromechanical relay (see below).

*US patent number 4356393

Solid-state Output Option

CM Series modules are available with a solid-state relay which replaces the electromechanical relay. This is actually two SPST solid-state contacts. One contact will switch ac loads. The contact is rated at 250V ac maximum and 3/4 amps maximum at 25 degrees C (derated to 1/2 amp at 50 degrees C). The other solid-state contact will switch dc loads of up to 30V dc and up to 50 milliamps. Both contacts are isolated from the MAXI-AMP power supply.



MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CM3A	105 to 130V ac, or 12 to 28V dc	SPST solid-state contact for switching AC loads up to 250 V ac and up to 3/4 amp, plus solid-state contact for switching DC loads up to 30V dc and up to 50mA.	ON/OFF
CM3B	210 to 250V ac, or 12 to 28V dc		
CM5A	105 to 130V ac, or 12 to 28V dc		12 timing functions
CM5B	210 to 250V ac, or 12 to 28V dc		

WARNING These photoelectric sensing devices 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 output condition.

Never use these products as sensing devices for personnel protection. Their use as safety devices 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.

Printed in USA

P/N 03448C4D

MAXI-AMP CM Series Specifications

SUPPLY VOLTAGE: Models CM3(R)A, CM5(R)A: 105 to 130V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA.
Models CM3(R)B, CM5(R)B: 210 to 250V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA.
NOTE: do not connect ac power if using external dc power.

OUTPUT CONFIGURATION:
Models CM3A, CM3B, CM5A, CM5B have an SPST solid-state relay for switching ac or dc (see page 1).

Models CM3RA, CM3RB, CM5RA, CM5RB have an SPDT electromechanical (e/m) relay with the following ratings:

CONTACT RATING: 250V ac max, 24V dc max, 5 amps max. (resistive load), 1/10 H.P. at 240V ac. Install transient suppressor (MOV) across contacts which switch inductive loads.
CONTACT RESPONSE: 10 milliseconds max. open/close; 20 operations/second max.
MECHANICAL LIFE: 20,000,000 operations
CM3 models also have a logic level current sinking NPN transistor switch at pin #9. See schematic (right) and hookup info.

AMPLIFIER:
RESPONSE SPEED: programmable for 10, 2, or 0.3 milliseconds. NOTE: use 10 millisecond setting whenever possible for enhanced noise rejection.
HYSTERESIS: if programmed "HIGH", approximately 20%; if programmed "LOW", approximately 5%. NOTE: see cautions for "LOW" setting, page 6.
MODULATION FREQUENCY: approximately 10kHz.

SENSOR LEAD LENGTH: 50 feet (15 m) maximum. Use *separate* shielded cable for emitter and receiver, or order sensors with extended cable length. NOTE: see splicing precautions, page 5.

MULTIPLE SENSOR HOOKUP: Up to three sensors may be wired together to one CM Series amplifier for "OR" operation (in LIGHT operate) or "NAND" operation (in DARK operate). Emitters are connected in *series,* and receivers are connected in *parallel.* When wiring two sensors to one MAXI-AMP, multiply excess gain data for each sensor by 1/2 (obtain data from applicable excess gain curve). When wiring three sensors to one MAXI-AMP, multiply excess gain by 1/3.

TIMERS (CM5 models only):
TIMING RANGES: LOW range - 10 to 150 milliseconds
MIDDLE range - 0.1 to 1.5 seconds
HIGH range - 1 to 15 seconds
REPEATABILITY: +/-2% of set time over all extremes of supply voltage and temperature

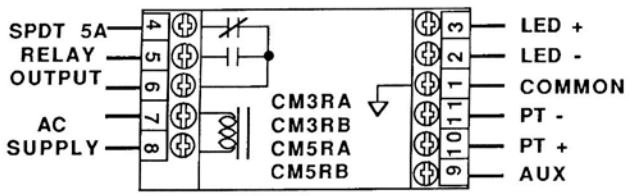
ADJUSTMENTS: Miniature switches for programming of LIGHT/ DARK operate, amplifier response time, amplifier hysteresis, normally open or normally closed output, and timing function (CM5 models). 15-turn clutched potentiometer for gain and time setting(s) (CM5 models).

OPERATING TEMPERATURE: 0 to 50°C (32 to 122°F).

INDICATOR LEDs: Red indicator LED is "ON" when the module output is energized. Exclusive Banner Alignment Indicating Device (AID™) system lights a red LED indicator whenever the receiver "sees" its own modulated light source, and pulses it at a rate which is proportional to the strength of the received light signal.

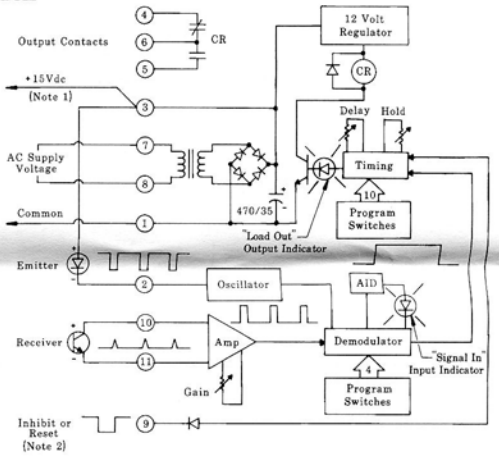
CONSTRUCTION: Rugged NORYL® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole plug base.

Generalized Hookup:
models with electromechanical relay output



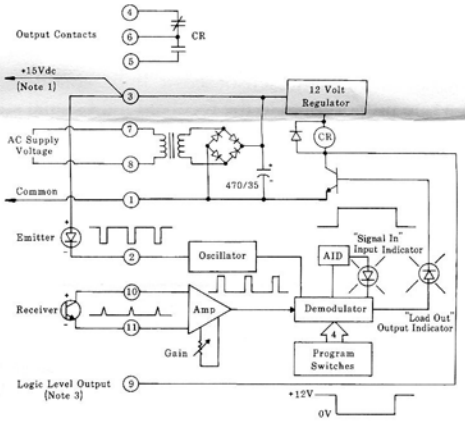
NOTE: If MAXI-AMP is powered by a dc power supply, connect +12 to 28V dc @ ≥70mA to terminal #3 and dc common to terminal #1.
Make no connections to terminal #7 or #8.

Functional Schematics
CM5 Models



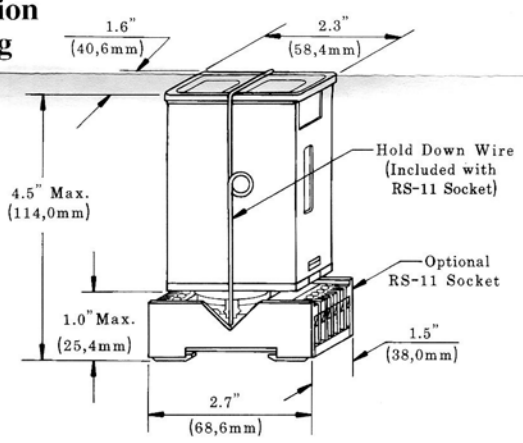
NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example, page 17). Current available is 40 mA at 120V ac (240V ac) line level; 30mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). *Do not connect ac voltage if using external dc power.*
NOTE #2: pulling pin #9 low (to common) will inhibit the timing, or reset the latch of CM5 models (see "Description of Logic Functions", page 7).

CM3 Models



NOTE #3: pin #9 of CM3 models may be connected directly to the AUXILIARY input of a MAXI-AMP module. It may also serve as the input to Banner CL Series MAXI-AMPs or to Banner Plug Logic modules (see hookup example, page 5).

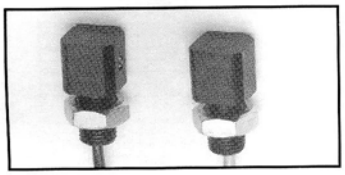
Dimension Drawing

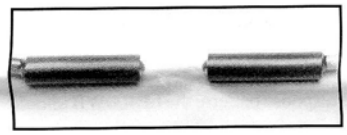


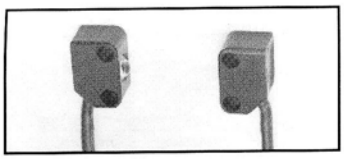
Sensors for use with CM Series Modulated Amplifiers

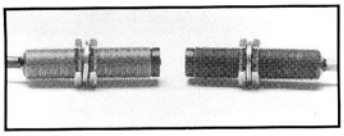
Models/Dimensions *Excess Gain* *Beam Pattern*

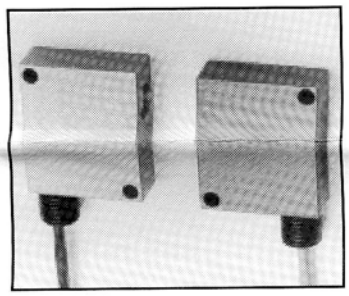
OPPOSED Mode











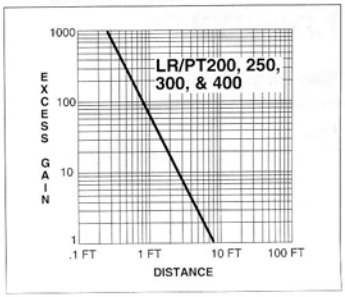
ALL MODELS:
Range: 8 feet (2,4m)
Beam: infrared, 880nm
Effective Beam: .14 in. (3,6mm) dia.

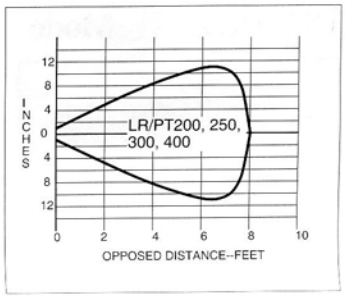
LR200 & PT200
Size: .63 in. (16,0 mm) square, right-angle design
Temp. range: -40 to +100 degrees C

LR250 & PT250
Size: .25 in. (6,4 mm) diameter; smooth barrel 1 in. (25 mm) long
Temp. range: -40 to +100 degrees C

LR300 & PT300
Size: .30 in. (7,6 mm) wide x .54 in. (13,7 mm) deep; right-angle design
Temp. range: -40 to +80 degrees C

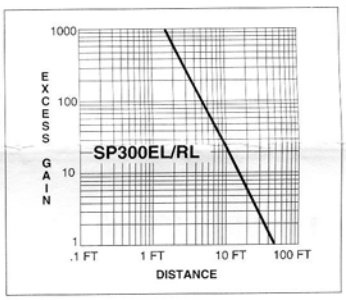
LR400 & PT400
Size: .38 (9,7 mm) diameter, threaded barrel 1.6 in. (41 mm) long
Temp. range: -40 to +100 degrees C

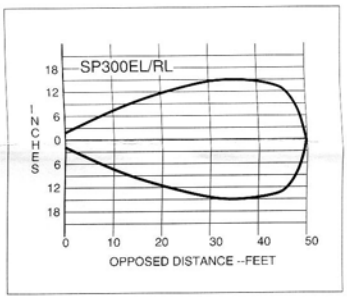




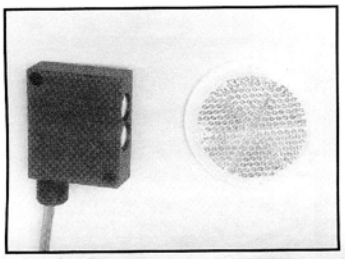
LR/PT200, 250, 300, and 400 opposed mode remote sensors are identical electronically and optically, and differ only in their physical packages. All are encapsulated and use hermetically sealed glass lenses to eleiminate condensation inside the optical chamber. Models 200 and 300 are right-angle designs, and are most commonly used on small conveyors where it is desireable to run the cables directly down to a wireway. Models 250 and 400 are in-line tubular designs. The 250 is a smooth barrel, typically held in place in a 1/4-inch diameter hole with a small setscrew. The 3/8-32 threaded barrel of the 400s allows for a number of mounting methods. The 400s accept models L4 and L16 lens assemblies for extended range and AP-400 apertures aseemblies for small-object detection or precise position sensing. The LR400 emitter is available in visible LED variations. Models SP300EL and RL are very rugged and totally encapsulated in aluminum housings. They should be used for their long range or high excess gain, or in multiple-receiver arrays where a narrow beam angle is required.

SP300EL & SP300RL
Size: .50in. (13 mm) wide x 1.9 in. (48 mm) high x 1.25 in. (32 mm) deep; right-angle design
Range: 50 feet (15m)
Effective Beam: .5 inch (13mm) dia.
Temp. range: -40 to +100 degrees C

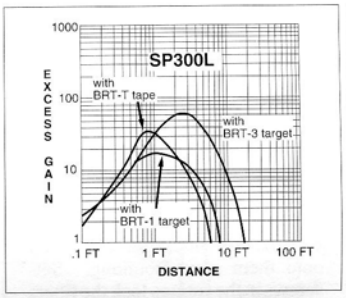


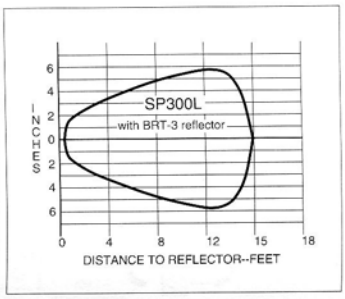


RETROREFLECTIVE Mode

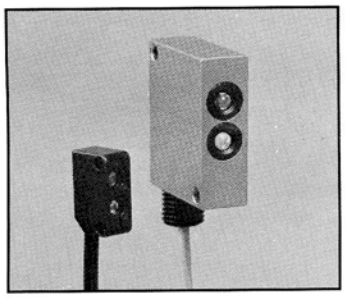


SP300L
Size: .50in. (13 mm) wide x 1.9 in. (48 mm) high x 1.25 in. (32 mm) deep; right-angle design
Range: 15 feet (4,5m) with BRT-3 retroreflector
Temp. range: -40 to +80 degrees C



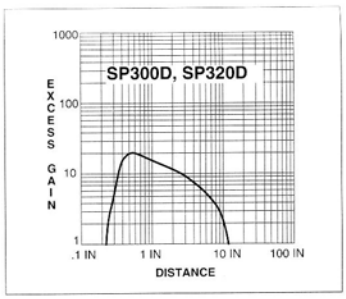


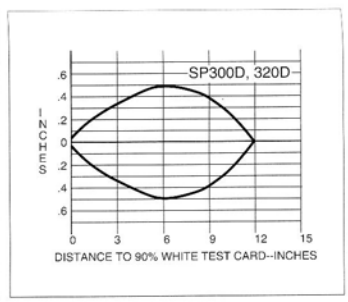
DIFFUSE Mode



SP300D
Size: .50in. (13 mm) wide x 1.9 in. (48 mm) high x 1.25 in. (32 mm) deep; right-angle design
Range: 12 inches (30 cm) retroreflector
Temp. range: -40 to +80 degrees C

SP320D
Size: .32 in. (8,1 mm) wide x .80 in. (20,3 mm) high x .49 in. (12,4 mm) deep; right-angle design
Range: 12 inches (30 cm)
Temp. range: -40 to +80 degrees C





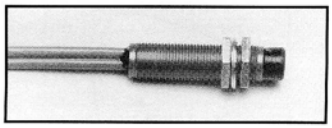
The SP300D and SP320D are identical except for housings. The 320 has a miniature plastic housing; the 300 has the same rugged housing as the SP300L. Both are ideal for presence sensing and are highly resistant to washdown, steam, vibration, and shock.

Sensors for use with CM Series Modulated Amplifiers

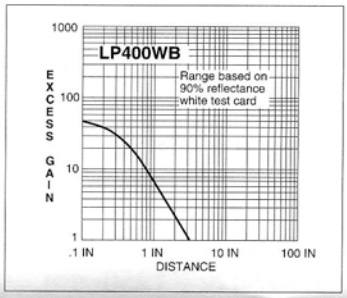
Models/Dimensions *Excess Gain* *Beam Pattern*

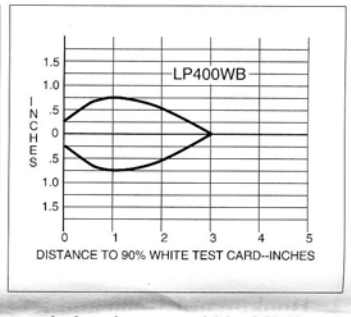
DIVERGENT Mode

LP400WB



Size: .38 in. (9,7 mm) diameter, threaded barrel; 1.5 in. (38 mm) long
Range: 3 inches (76mm)
Temp. range:
-40 to +80 degrees C
Housing material: blue anodized aluminum

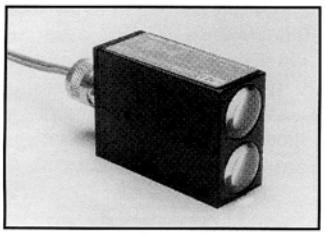




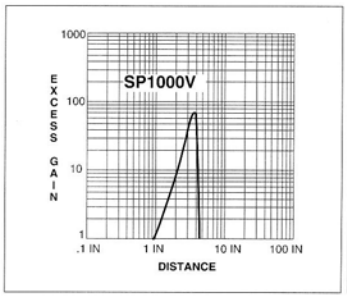
The LP400WB (**W**ide **B**eam) is an infrared divergent mode (wide angle diffuse mode) sensor which is particularly forgiving for reflectively sensing transparent or translucent materials or for sensing objects with irregular surfaces (e.g.- webs with "flutter"). The optics are such that even small threads or wires .005" (0,1mm) or greater in diameter may be detected when they pass within .25" (6mm) of the sensor's plastic lens. Due to its wide response pattern, the LP400WB should not be used for precise positioning control, nor should it be mounted with its lens recessed into a hole.

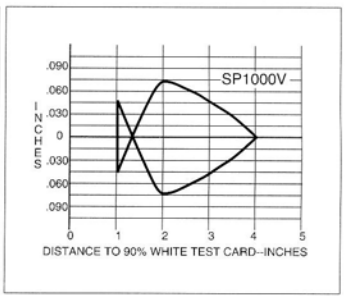
CONVERGENT Mode

SP1000V



Size: 1.25 in. (31,8 mm) wide x 2.25 in. (57,2 mm) high x 4.2 in. (107 mm) long
Range: focus at 3.8 inches (96mm)
Temp. range: -40 to +80 degrees C
Housing material: black anodized aluminum

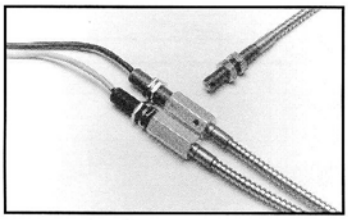




The SP1000V is a convergent mode sensor that produces a very small 0.1 inch (2,5mm) diameter sensing image at a point exactly 3.8 inches (96mm) from its glass lenses. As the excess gain curve illustrates, the SP1000V has a very sharp drop-off of gain beyond the focus point. This feature makes it an excellent choice for detecting a small part which is only a fraction of an inch in front of another surface, such as parts on a conveyor (viewed from above). It is also ideal for fill level detection and for precise positioning control, in lieu of opposed sensing.

FIBER OPTIC Mode

LR400 & PT400
with FOF-400 fittings and fiber optics



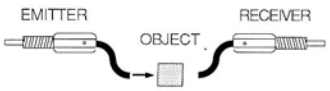
Range: see excess gain curves
Temp. range: -40 to +100 degrees C

The threaded barrel design of the LR400 and PT400 permit the connection of any Banner glass fiber optic assembly by using two model FOF-400 fittings. The sensors are typically mounted through 3/8 inch (10mm) diameter clearance holes, with the FOF-400 fittings threaded onto them after mounting. Setscrews in the fittings lock the fibers in place, but allow rapid replacement without disturbing any electrical wiring.

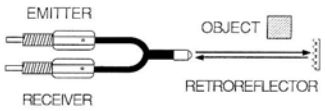
The Banner product catalog details the wide selection of standard and custom glass fiber optic assemblies.

Banner *plastic* fiber optics may be used with the MAXI-AMP by substituting emitter model LR400VH, which employs a high-intensity *visible red* LED light source suitable for efficient transmission through plastic fiber optic cable.

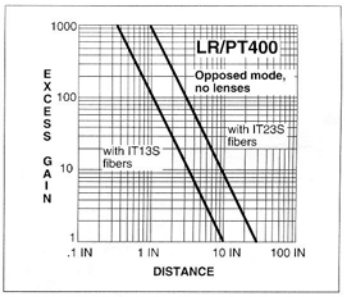
OPPOSED MODE

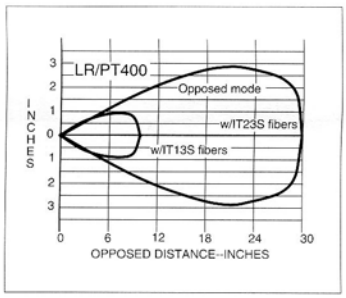


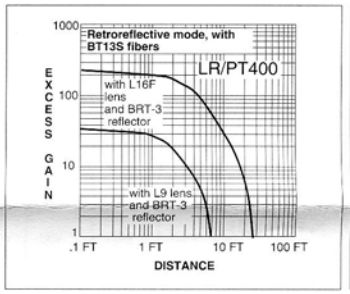
RETROREFLECTIVE MODE

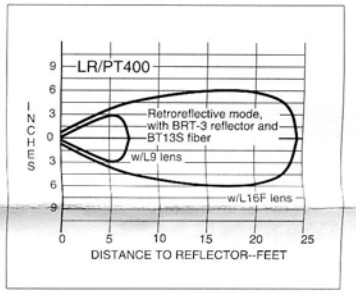


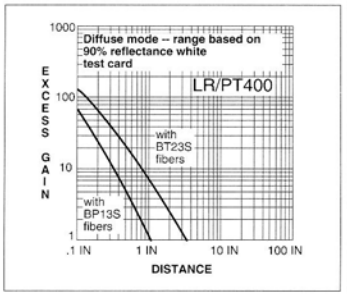
DIFFUSE MODE

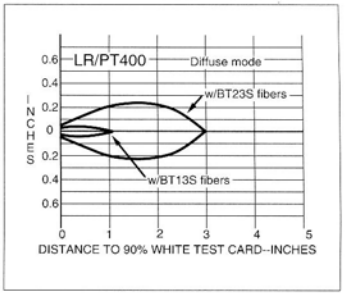












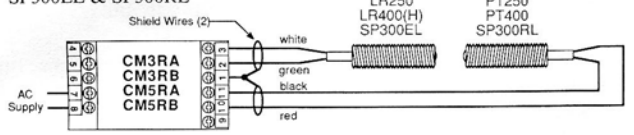
Sensor Hookup Diagrams for CM Series MAXI-AMP Modules

Hookup of LR/PT200, 250, 300, and 400

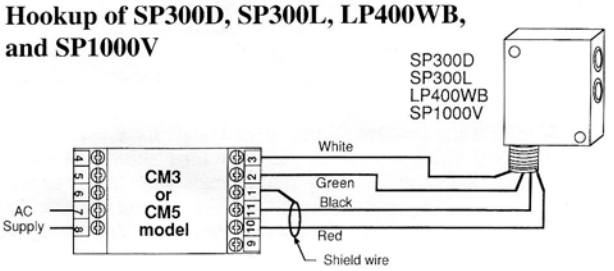
TO SENSOR PAIR MODELS:

LR200 & PT200
LR250 & PT250
LR400 & PT400
SP300EL & SP300RL

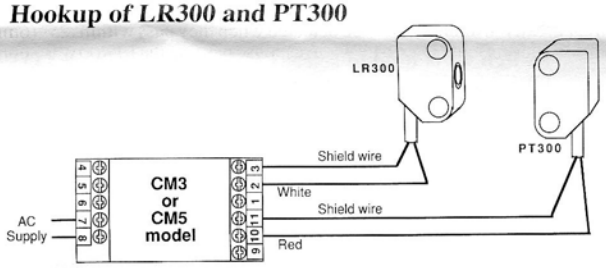
NOTE: both shield wires must be connected to COMMON (terminal #1) to avoid cable crosstalk.



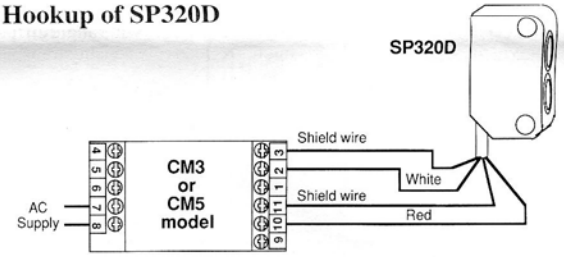
Hookup of SP300D, SP300L, LP400WB, and SP1000V



Hookup of LR300 and PT300



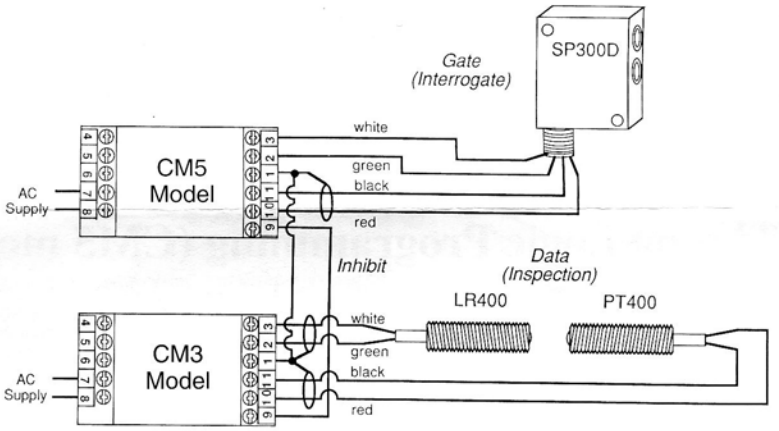
Hookup of SP320D



Logic Level NPN Output (CM3 models)

The AUXILIARY terminal (#9) of CM3 models offers a logic-level NPN (current sinking) output which may be used as a fast-response solid-state inhibit signal to the AUXILIARY input of MAXI-AMP CM5 modules. This output may also serve as an input to any Plug Logic, MAXI-AMP CL Series, or MICRO-AMP logic module. In addition, this output may interface to other dc devices or circuits like counters, rate meters, or programmable logic controllers. Switching capacity is 20mA at 12V dc.

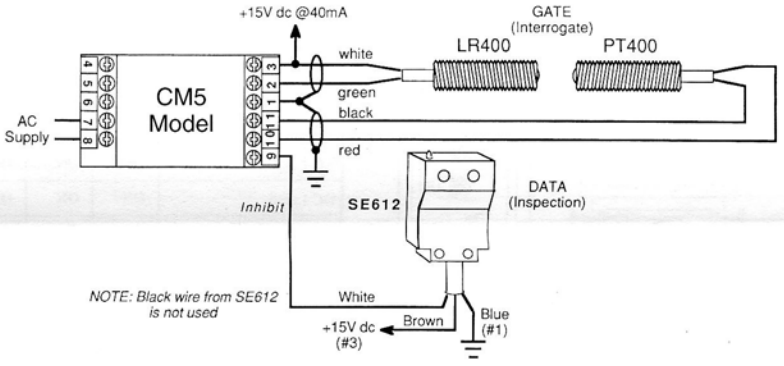
The example here shows the use of LR & PT400 sensors and a CM3 module to provide inspection information, with the SP300D functioning as a product sensor. Typically, the CM5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the LR & PT400 "sees" an acceptable condition when the SP300D senses the leading (or trailing) edge of a product, the CM3 will inhibit a reject pulse from occuring.



Power for External Devices

External 10 to 30V dc devices such as self-contained sensors may be connected between terminals #3 (+) and #1 (-) of any CM Series MAXI-AMP module. Terminal #3 offers 40mA maximum. This is sufficient to power most Banner self-contained dc sensors.

As the example at the right illustrates, the *current sinking* output of a self-contained sensor powered by the MAXI-AMP may be used as the input to the AUXILIARY terminal of a CM5 module.



NOTE REGARDING CABLE SPLICING:

When splicing additional cable length to modulated remote sensors, it is important to use a separate shielded cable for emitter and receiver wires. Combining emitter and receiver wires together in the same cable (even if the cable is shielded) will result in direct coupling of the emitter signal to the receiver leads. This is called "cable crosstalk", and will not allow full amplifier sensitivity setting without an amplifier "lock on" situation, which appears as a continuous LIGHT condition. Banner offers extension cable for remote sensors which, if used for cable splicing, will minimize the chances for cable crosstalk.

MAXI-AMP CM Series

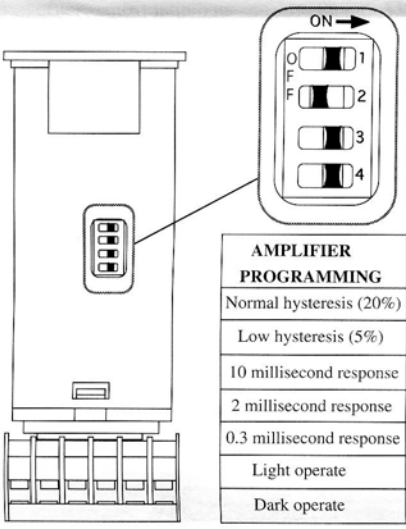
Amplifier Programming (all models)

Amplifier response conditions may be programmed via the group of four switches located on one of the narrow sides of the MAXI-AMP module.

Switch #1 selects the amount of amplifier hysteresis. Hysteresis is the amount of signal change beyond the switching threshold which is required to cause the amplifier output to change state, and is expressed as a percent of amplifier gain. The NORMAL setting of 20% should *always* be used, except for low contrast situations such as many color registration applications.

NOTE: the LOW hysteresis setting should be used only when all sensing conditions remain stable. "Buzzing" of the output (in ON/OFF and LIMIT operation) or false outputs (in DELAY, ONE-SHOT, or LATCH operation) may occur if sensing variables (e.g.-web flutter) result in optical contrast approaching unity.

Switches #2 and #3 are used to program the amplifier response time. The 10 millisecond setting should be used whenever possible for the greatest immunity to electrical interference ("noise"). The 2 millisecond setting has more interference rejection than the 0.3 millisecond mode. Sensor performance (excess gain) is identical in all three response settings.



Factory settings shown at left. "Underlined" settings in table below are factory settings.

AMPLIFIER PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4
Normal hysteresis (20%)	ON	—	—	—
Low hysteresis (5%)	OFF	—	—	—
10 millisecond response	—	OFF	ON	—
2 millisecond response	—	ON	ON	—
0.3 millisecond response	—	ON	OFF	—
Light operate	—	—	—	ON
Dark operate	—	—	—	OFF

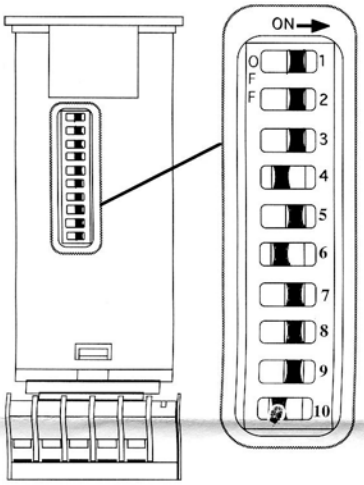
Switch #4 is used to select LIGHT OPERATE or DARK OPERATE. In the LIGHT OPERATE mode, the output will energize (in ON/OFF or LATCH operation) or the timing function will initiate (in DELAY, ONE-SHOT, or LIMIT operation) when the receiver "sees" sufficient light (excess gain greater than 1X). In DARK OPERATE, the output will energize or timing will begin when the receiver is sufficiently dark (excess gain less than 1X).

The diagram at the left shows the location of switches 1-4, and the table summarizes the settings required for each response condition.

NOTE: an adhesive-backed mylar label is supplied, which may be marked to indicate switch programming and then applied to the MAXI-AMP housing as a switch cover.

Timing Logic Programming (CM5 models)

Settings illustrated below are factory settings. Factory settings are "underlined" in the table.



TIMING LOGIC PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4	SWITCH #5	SWITCH #6	SWITCH #7	SWITCH #8	SWITCH #9	SWITCH #10
On/Off	ON	ON	ON	OFF	ON	OFF	ON	—	—	—
On Delay	ON	ON	OFF	OFF	ON	OFF	ON	—	—	—
Off Delay	ON	OFF	ON	OFF	ON	OFF	ON	—	—	—
On and Off Delay	ON	OFF	OFF	OFF	ON	OFF	ON	—	—	—
One-shot	OFF	OFF	ON	OFF	ON	OFF	ON	—	—	—
Delayed One-shot	OFF	OFF	OFF	OFF	ON	OFF	OFF	—	—	—
Limit	ON	ON	OFF	OFF	OFF	OFF	ON	—	—	—
Repeat Cycle	ON	OFF	OFF	ON	ON	OFF	ON	—	—	—
AC Latch	OFF	ON	ON	OFF	ON	ON	ON	—	—	—
DC Latch	ON	ON	ON	OFF	ON	ON	ON	—	—	—
Delay and Latch	ON	ON	OFF	OFF	ON	ON	ON	—	—	—
Limit and Latch	ON	ON	OFF	OFF	OFF	ON	ON	—	—	—

N/C Output	OFF	—	—
N/O Output	ON	—	—
.15 Sec. Max. Time	—	OFF	OFF
1.5 Sec. Max. Time	—	ON	OFF
15 Sec. Max. Time	—	OFF	ON

A group of ten switches, located on the side of the module opposite the amplifier program switches, is used to select the timing logic for the CM5 models.

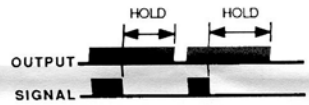
Switches #1 through #7 are used to select the logic function. Switch #8 programs the output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for *both* functions of a dual timing mode (ON & OFF DELAY, DELAYED ONE-SHOT, and REPEAT CYCLE). However, DELAY and HOLD times are independently adjustable within the selected range.

The diagram shows switch locations, and the table summarizes the program switch positions.

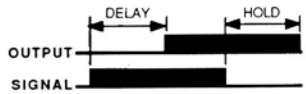
Description of Logic Functions, CM5 models

ON/OFF: ON/OFF operation does not involve timing. The output simply follows the action of the input signal. Grounding pin #9 (AUXILIARY) turns the output "off", regardless of the state of the input signal. This may be accomplished by closing a switch or relay contact between pins #9 and #1 (common), or by connecting an open collector NPN (current sinking) output of any external dc device directly to pin #9. NOTE: connect the COMMON of any external dc device to pin #1 of the MAXI-AMP to establish a voltage reference between the dc supply for the external device and the internal dc supply of the MAXI-AMP.

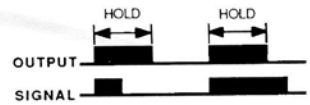
ON DELAY: The ON DELAY timer keeps the output "off" until the selected LIGHT or DARK signal has been present for the preset "DELAY" time. If the input signal is interrupted, the timing is reset and starts over with the next signal. Grounding pin #9 immediately cancels an output in progress and resets the delay timer. The delay timer is restarted when the inhibit signal is removed, if an input signal is present.



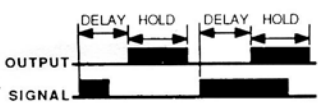
OFF DELAY: The output energizes immediately when the input signal occurs, but does not de-energize until the signal has been removed for the preset OFF-DELAY ("HOLD") time. Grounding pin #9 prevents an output from occuring. If an inhibit input occurs during an output, the output remains "on" for the remainder of the OFF-DELAY time.



ON & OFF DELAY: ON and OFF DELAY logic combines both timing functions into a single mode. The ON-DELAY ("DELAY") time and the OFF-DELAY ("HOLD") time are independently adjustable within the selected time range. Momentary grounding of pin #9 during the ON-DELAY period resets the DELAY timer. An inhibit signal which occurs during an output will allow the output to stay energized for the remainder of the OFF-DELAY time. ON and OFF DELAY logic is often used in jam and void control, high/low level control, and edge-guiding applications.

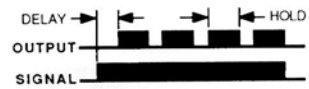


ONE-SHOT: The output of a ONE-SHOT function is a pulse of adjustable "HOLD" duration which is independent of the duration of the input signal. With the MAXI-AMP programmed for LIGHT operate, the pulse occurs when the input signal changes from dark to light. In DARK operate, the pulse occurs with a light to dark input transition. Grounding pin #9 prevents the one-shot from triggering, but does not affect a pulse already under way.

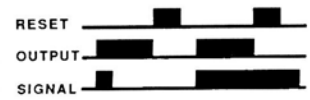


DELAYED ONE-SHOT: A DELAYED ONE-SHOT is initiated by either a momentary or maintained input signal. This input starts the adjustable "DELAY" period, after which the output pulses for an adjustable pulse ("HOLD") time. No further action occurs unless the input is removed and reapplied, beginning a new sequence. Grounding pin #9 during the delay period will cancel the sequence, and no output occurs. This feature is often used for inspection/rejection control logic. An inhibit signal will not affect a pulse under way.

LIMIT: The output of the LIMIT function follows the action of the input, as it does with the ON/OFF function. However, an input signal which is longer than the adjustable LIMIT ("HOLD") time will turn the output "off". Removing the input signal resets the timer. This function is sometimes called "TIME LIMITED ON/OFF", and is useful for energy conservation. Grounding pin #9 cancels the output. Lifting the inhibit restarts the LIMIT timer, if an input signal is present.



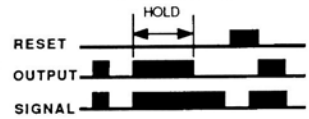
REPEAT CYCLE: The REPEAT CYCLE function provides an oscillating output when an input signal is present. Presence of an input signal triggers an adjustable "DELAY" timer. After the delay, the output energizes for an adjustable "HOLD" period. If the input remains, the output continues to cycle "on" and "off" at this rate indefinitely. When the signal is removed, any output in progress completes and then remains "off" until the next signal and DELAY period. Grounding pin #9 cancels the sequence, but will allow the completion of a "HOLD" period in progress. Lifting the inhibit signal begins the DELAY period, if an input signal is present.



AC LATCH: An AC LATCH is the combination of a ONE-SHOT and a LATCH. A momentary or sustained input will latch the output "on". Grounding pin #9 will reset the latch, even if the input signal remains. The output will not re-latch until the input signal is removed and then reapplied.

DC LATCH: The output will latch "on" whenever the selected LIGHT or DARK input condition occurs. Grounding pin #9 of a dc latch will turn the output "off" regardless of the state of the input signal. If the signal is present when the reset is removed, the output will immediately latch "on" again.

DELAY AND LATCH: The DELAY + LATCH is a combination of the ON-DELAY and DC LATCH functions. An input must be present for at least the adjustable "DELAY" time for the output to latch "on". If the input signal is removed during the timing cycle, the timing is reset. Momentary grounding of pin #9 resets the latch and/or the DELAY timing cycle. Sustained grounding of pin #9 inhibits any output.



LIMIT AND LATCH: The LIMIT + LATCH operates exactly like the LIMIT function, except that the LIMIT ("HOLD") timer can be reset *only* by the auxiliary input. An output remains latched "off" until reset by momentarily grounding pin #9. In addition to resetting the timer, grounding pin #9 will hold the output "off", regardless of the state of the input signal.

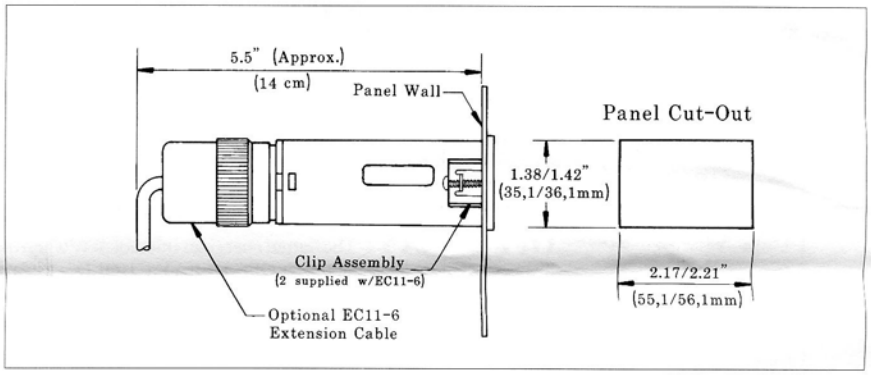
MAXI-AMP System

Mounting and Accessories

Panel Wall Mounting of MAXI-AMP Module

After the panel cutout has been completed and deburred, slide the MAXI-AMP through the cutout and place one clip assembly into the rectangular depression on each of the two narrow sides of the housing. Orient clips as shown, and alternately tighten the screws for equal pressure against the inside of the panel wall. Do not overtighten the screws. Attach the optional EC11-6 extension cable (described below) to the MAXI-AMP and route the opposite end of the cable to the RS-11 (or equivalent) socket.

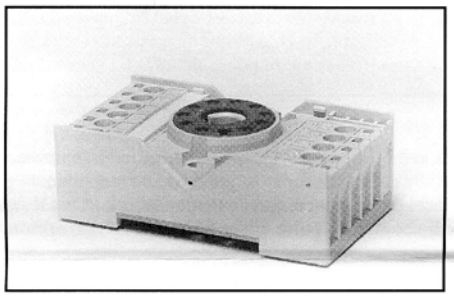
Model EC11-6 extension cable is 6 feet (2m) long. Clips for panel wall mounting of the MAXI-AMP are included with the cable.



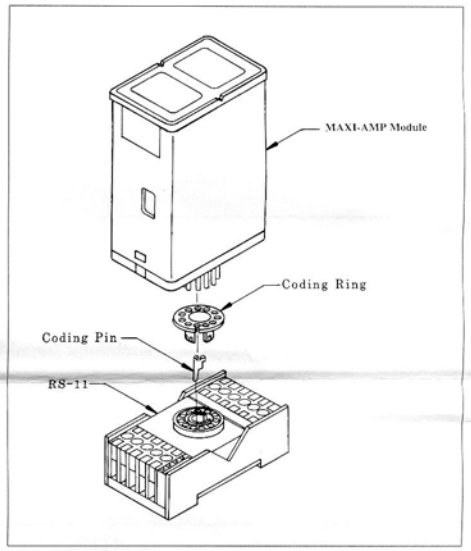
Accessories for MAXI-AMP Modules

Model RS-11 Socket

Model RS-11 is an eleven-pole round-pin screw terminal relay socket which is used to make electrical connections to any MAXI-AMP module. The socket provides in-line wire clamp screw terminals which will accept from one #24 AWG up to two #14 wires at each pin. The RS-11 is UL recognized (file #E92191) and CSA approved (file #LR38486). It may be mounted directly to a panel plate or via standard 35mm DIN-rail track (see below). A hold-down wire is supplied with each RS-11 socket (see dimension diagram on page 2).

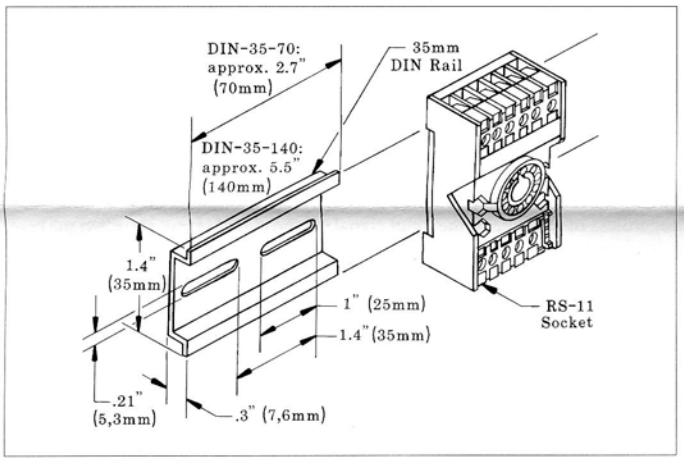


The RS-11 is supplied with a coding ring and pin (see diagram at right). This allows a MAXI-AMP to be keyed to fit only its own 11-pin socket. The pin is installed in one of the eleven slots in the RS-11, and the notch in the ring is aligned to slip over the pin. When the MAXI-AMP is removed from the RS-11, the coding ring stays with the MAXI-AMP base, while the coding pin remains in the socket.



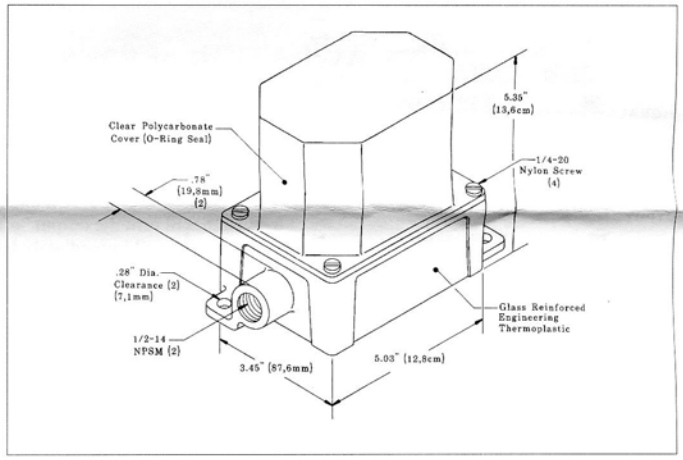
35mm DIN Rail Track

Track model DIN-35-70 accomodates one RS-11 socket. Model DIN-35-105 holds two sockets. Model DIN-35-140 holds up to three sockets. The RS-11 socket is designed to snap (or slide) directly into the 35mm DIN track.



Model BENC-4 Enclosure

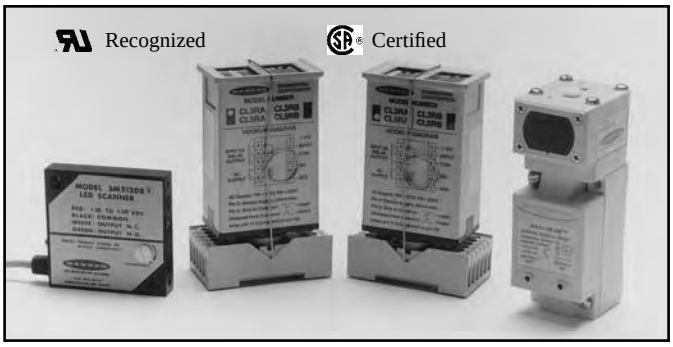
Model BENC-4 is a NEMA-4 rated corrosion-resistant enclosure for a MAXI-AMP module or other control device. It is supplied with a DIN-35-70 track for easy mounting of one RS-11 socket. For mounting two sockets, use DIN-35-105.



Printed in USA Banner Engineering Corp. 9714 10th Ave. No. Minneapolis, MN 55441 Tel. (763) 544-3164 FAX (763) 544-3573

MAXI-AMP™ CL Series
Logic-level Input Modules

the photoelectric specialist



MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CL3RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay, plus NPN transistor solid-state switch	ON/OFF
CL3RB	210 to 250V ac, or 12 to 28V dc		
CL5RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay (5 amp contact rating)	12 timing functions
CL5RB	210 to 250V ac, or 12 to 28V dc		

Banner CL Series MAXI-AMP™ modules are the perfect solution for many sensing/control applications where economy, versatility, dependability, and ruggedness are important. CL Series MAXI-AMPs combine power supply, timing logic (in CL5 models) and output relay in a single compact, cost-saving module. The integrated, *stand-alone* design saves both the expense of a separate control chassis and a substantial amount of panel space. Several models are available, for either 120V ac or 240V ac operation, and either with or without timing logic (models are listed in table at above right). Alternatively, any model may be powered by 12 to 28V dc.

The well-defined electrical characteristics of CL Series MAXI-AMP modules provide a wealth of application possibilities. The input circuit accepts signals from any Banner dc sensor with an NPN (current sinking) output; as well as from MAXI-AMP, MICRO-AMP, and Plug Logic modules. The input is compatible with almost any sensor or circuit which has an NPN transistor (current sinking) output. Additionally, inputs may be generated by limit switches, contact closures, and optical couplers. A 50mA power supply is included for powering 10 to 30V dc devices.

CL5 models offer a versatile multi-function timing logic circuit which is programmable for twelve of the most popular and useful delay, one-shot, and latch functions (see page 5). The MAXI-AMP offers the choice of either single or dual timing functions in the same module. Logic and timing may be easily reprogrammed as control requirements change.

In order to allow accurate timing adjustments, each CL5 model has three time ranges to choose from. Timing adjustments are made via rugged 15-turn potentiometers. Circuitry is included to prevent any possibility of false output on power-up.

An auxiliary input is available on CL5 models for interrogation or reset of the selected logic function by using an additional sensor or input signal (see example, page 3). Page 5 describes the function of the auxiliary input for each logic mode.

The output circuit for all CL Series modules is an SPDT 5-amp electro-mechanical relay. A solid-state relay is offered as an option to the electromechanical relay (see information below).

Additionally, CL3 models have an NPN transistor solid-state switch. This solid-state output may be used to take advantage of the amplifier's fast 1-millisecond response. This output may be connected directly to the primary or auxiliary input of other Banner logic modules, including CL5 modules, MICRO-AMP logic modules, and Plug Logic modules. In addition, this output can interface to other dc devices or circuits such as counters, rate meters, or programmable controllers. Switching capacity is 20mA at 12V dc. The output may be programmed for either normally open or normally closed operation.

Like all MAXI-AMPs, the CL Series modules are designed both electrically and mechanically for solid dependability in industrial environments.

Solid-state Output Option

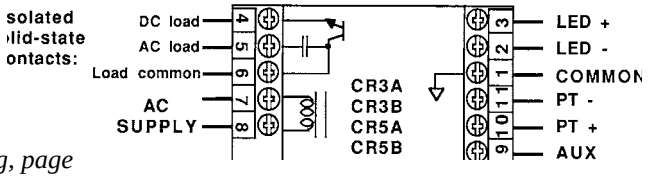
CL Series modules are available with a solid-state relay which replaces the electromechanical relay. This is actually two SPST solid-state contacts. One contact will switch ac loads, and is rated at 250V ac maximum and 3/4 amps maximum at 25 degrees C (derated to 1/2 amp at 50 degrees C). A solid-state contact is particularly helpful when switching inductive ac loads which can cause electrical "noise" and contact damage when switched with a "hard" relay contact.

The other solid-state contact will switch dc loads of up to 30V dc and up to 50 milliamps. Both solid-state outputs are electrically isolated from the MAXI-AMP power supply. Both outputs switch within the 1 millisecond response time of the CL module circuitry. NOTE: ac loads may take up to 1/2 cycle (8.3 milliseconds) to turn "off".

Both outputs are normally open, but may be programmed for normally closed operation.

Except for the output configuration, the specifications for the models listed in the table at the right are exactly the same as for the standard CL Series models.

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CL3A	105 to 130V ac, or 12 to 28V dc	SPST solid-state contact for switching AC loads up to 250V ac and up to 3/4 amp, plus solid-state contact for switching dc loads up to 30V dc and up to 50mA.	ON/OFF
CL3B	210 to 250V ac, or 12 to 28V dc		
CL5A	105 to 130V ac, or 12 to 28V dc		12 timing functions
CL5B	210 to 250V ac, or 12 to 28V dc		



Please read Personnel Safety Warning, page 3.

MAXI-AMP CL Series Specifications

SUPPLY VOLTAGE: Models CL3RA, CL5RA: 105 to 130V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 60mA. Models CL3RB, CL5RB: 210 to 250V ac, 50/60Hz (4 VA), or 12 to 28V dc at 60mA. ***Do not connect ac voltage if using external dc power.**

OUTPUT CONFIGURATION: all models have SPDT electromechanical relay:
CONTACT RATING: 250V ac max, 24V dc max, 5 amps max. (resistive load), 1/10 H.P. at 240V ac. Install transient suppressor (MOV) across contacts which switch inductive loads.
CLOSURE TIME: 10 milliseconds max.
RELEASE TIME: 10 milliseconds max.
MAXIMUM SWITCHING SPEED: 20 operations/second
MECHANICAL LIFE: 20,000,000 operations
CL3 models also have a logic level current sinking NPN transistor switch at pin #9. See schematic below and hookup info.

AMPLIFIER:
RESPONSE SPEED: 1 millisecond
INPUT CHARACTERISTICS: input is switched when the voltage at pin #2 is pulled below 1V dc or when less than 1K ohms is connected between pins #2 and #1. When an inverting jumper is connected between pins #10 and #11, input is switched when the voltage at pin #2 rises above 4.5V dc or when the impedance between pins #2 and #1 exceeds 15K ohms.
HYSTERESIS: greater than .35 volts, less than 2 volts.

MULTIPLE SENSOR HOOKUP: any number of switched output devices may be connected in parallel to the input (see hookup example).

TIMERS (CL5 models only):
TIME RANGES: LOW range - 10 to 150 milliseconds
MIDDLE range - 0.1 to 1.5 seconds
HIGH range - 1 to 15 seconds
REPEATABILITY: +/-2% of set time over all extremes of supply voltage and temperature

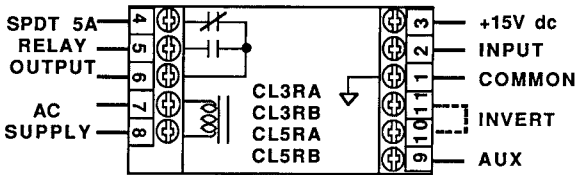
ADJUSTMENTS: Miniature switches for setting of timing function, timing range, and output polarity (CL5 models). 15-turn clutched potentiometer for time setting (CL5 models).

INDICATOR LEDs: Red indicator LEDs for input and output status.

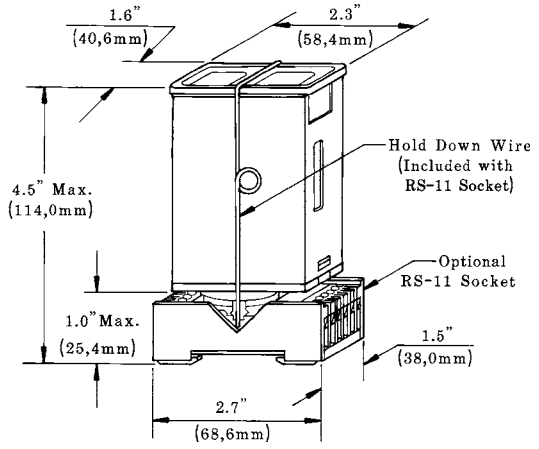
CONSTRUCTION: Rugged NORYL® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole plug base.

OPERATING TEMPERATURE: 0 to 50 degrees C (32 to 122 degrees F).

Generalized Hookup:
models with electromechanical relay output

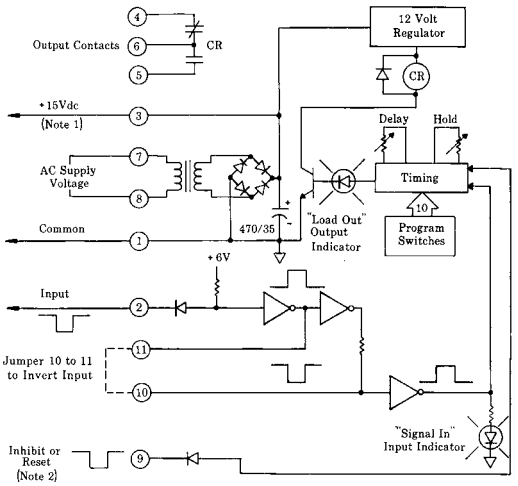


Dimension Drawing

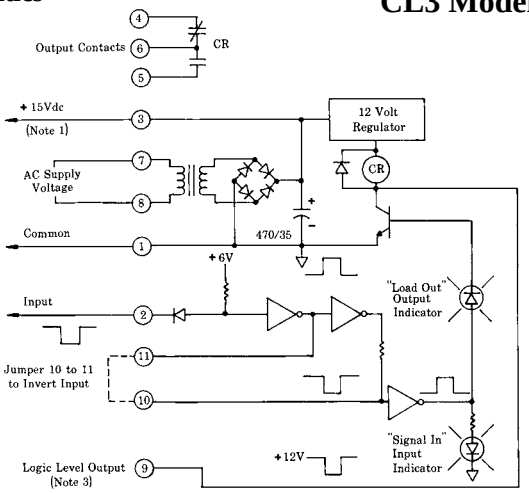


Functional Schematics

CL5 Models



CL3 Models



NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example). Current available is 50mA at 120V ac (240V ac) line level; 40mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). **Do not connect ac voltage if using external dc power.**

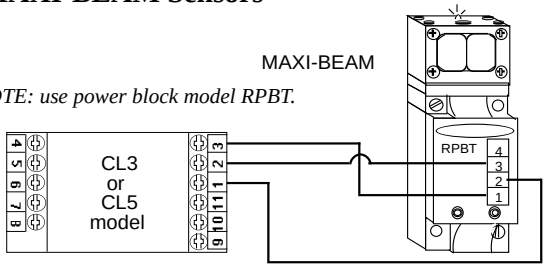
NOTE #2: pulling pin #9 low (to Common) will inhibit the timing, or reset the latch of CL5 models. (See "Description of Logic Functions", page 5)
NOTE #3: pin #9 of model CL3RA and CL3RB may be connected directly to the primary or auxiliary input of MAXI-AMP model CL5 or to Banner Plug Logic modules.

Sensor Hookup Diagrams, CL Series MAXI-AMP Modules

To MAXI-BEAM Sensors

MAXI-BEAM

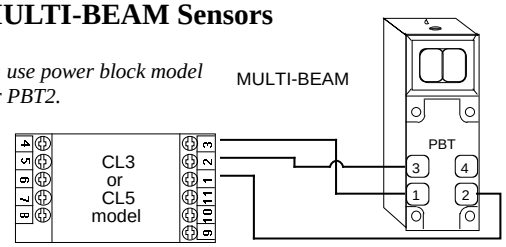
NOTE: use power block model RPBT.



To MULTI-BEAM Sensors

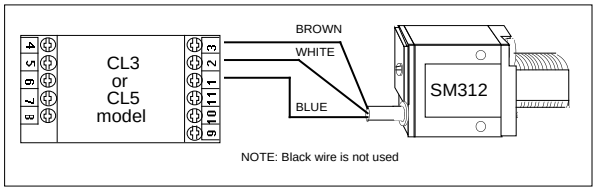
NOTE: use power block model PBT or PBT2.

MULTI-BEAM



NOTE: the MAXI-AMP cannot power a MULTI-BEAM emitter and receiver pair. Use a separate power source for the emitter (e.g.- power block PBA-1, etc.)

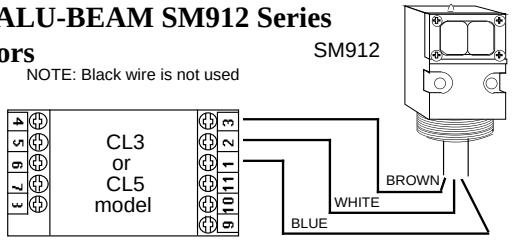
To MINI-BEAM SM312 Series Sensors



To VALU-BEAM SM912 Series Sensors

SM912

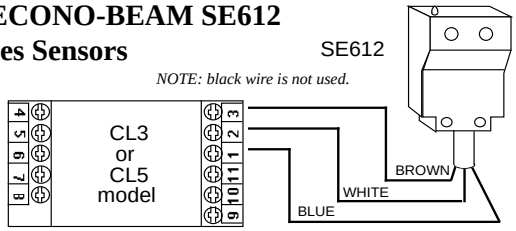
NOTE: Black wire is not used



To ECONO-BEAM SE612 Series Sensors

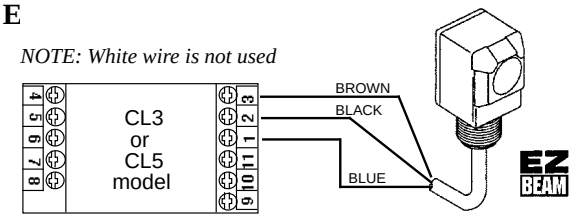
SE612

NOTE: black wire is not used.



To E

NOTE: White wire is not used

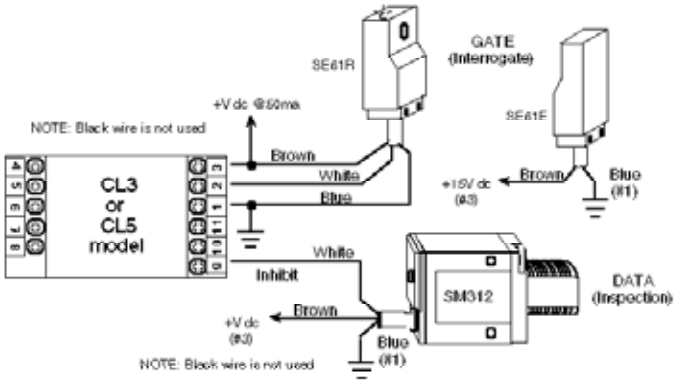


This hookup is for DC NPN (current sinking) models of S18 Series, Q25 Series, and other DC sensors bearing the EZ-BEAM logo.

Use of Auxiliary Input (CL5 models)

CL5 model MAXI-AMPs have an auxiliary input at terminal #9 which may be used for the interrogation or reset of the selected logic function. This is accomplished by a switch closure between pins #9 and #1 (Common). The auxiliary input may also be switched by a DC device with an NPN transistor (current sinking) output. The effect of the auxiliary input is described for each logic function on page 5.

This example shows a typical inspection/rejection scheme which uses a Banner MINI-BEAM as the inspection sensor. Typically, the CL5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the SM312 "sees" an acceptable condition when the SE612 senses the leading (or trailing) edge of the product, the SM312 will inhibit a reject pulse from occuring. Reject products will be ejected by the output pulse.



NOTE: the MAXI-AMP can supply 50mA for external 10 to 30V dc devices. Carefully check the current draw of the devices to be powered by the MAXI-AMP.

WARNING The MAXI-AMP modules described in this data sheet do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A failure or malfunction can result in *either* an energized or a de-energized output condition.

Never use these products for personnel protection. Their use as safety devices 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.

MAXI-AMP CL Series

Hookup of Multiple Self-contained Sensors

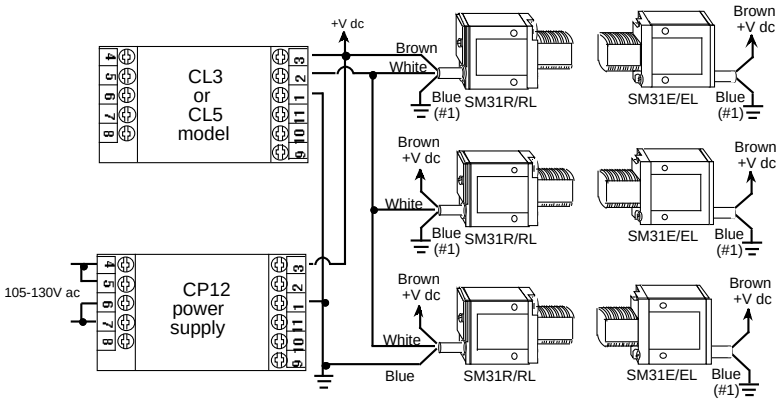
Any number of self-contained dc sensors may be wired together in parallel to a single CL Series MAXI-AMP module to create almost any multiple-sensor logic configuration. Power for the sensors may be obtained from MAXI-AMP 400mA power supply CP12 (shown below) or from 1-amp model PS120-15. The table at the right describes how the four most frequently used multiple-sensor logic configurations may be created.

MINI-BEAM SM312 Series and VALU-BEAM SM912 Series sensors have a switch on the back of their housings which is used to program the sensors for LIGHT or DARK operate. MAXI-BEAM sensors are set for LIGHT or DARK operate using the programming ring. MULTI-BEAM sensors are programmed for LIGHT or DARK operate with the logic module jumper wire. OMNI-BEAMs are programmed by a switch in the sensor block.

For ON/OFF sensor operation, *light operate* is equated to *normally open* output, and *dark operate* is defined as *normally closed*. EZ-BEAM sensors have both a normally open and a normally closed output. Selection of either output determines the LIGHT/DARK operate mode. ECONO-BEAM sensors are not programmable and must be ordered for LIGHT OPERATE (standard models) or DARK OPERATE (model suffix "NC").

The addition of a jumper wire between MAXI-AMP terminals #10 and #11 changes the input response from a low-going to a high-going signal. This feature, combined with the selection of LIGHT or DARK operate at the sensor, allows "AND" logic with parallel sensor connections.

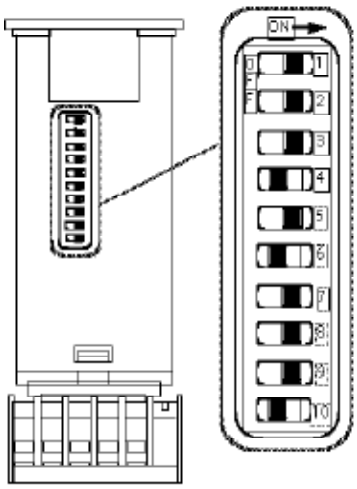
SENSOR PROGRAM: Light or Dark Operate	INVERTING JUMPER Installed Between Module Terminals #10 and #11	OUTPUT OCCURS (AFTER DELAY, IF ANY)	LOGIC DESCRIPTION
LIGHT OPERATE	NO	If any receiver "sees" light	LIGHT "OR"
LIGHT OPERATE	YES	When all receivers "see" dark	DARK "AND"
DARK OPERATE	NO	If any receiver "sees" dark	DARK "OR"
DARK OPERATE	YES	When all receivers "see" light	LIGHT "AND"



Timing Logic Programming (CL5 models)

Settings illustrated below are factory settings. Factory settings are "underlined" in the table.

(NOTE: see page 5 for description of logic functions)



TIMING LOGIC PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4	SWITCH #5	SWITCH #6	SWITCH #7	SWITCH #8	SWITCH #9	SWITCH #10
On/Off	ON	ON	ON	OFF	ON	OFF	ON	—	—	—
On Delay	ON	ON	OFF	OFF	ON	OFF	ON	—	—	—
Off Delay	ON	OFF	ON	OFF	ON	OFF	ON	—	—	—
On and Off Delay	ON	OFF	OFF	OFF	ON	OFF	ON	—	—	—
One-shot	OFF	OFF	ON	OFF	ON	OFF	ON	—	—	—
Delayed One-shot	OFF	OFF	OFF	OFF	ON	OFF	OFF	—	—	—
Limit	ON	ON	OFF	OFF	OFF	OFF	ON	—	—	—
Repeat Cycle	ON	OFF	OFF	ON	ON	OFF	ON	—	—	—
AC Latch	OFF	ON	ON	OFF	ON	ON	ON	—	—	—
DC Latch	ON	ON	ON	OFF	ON	ON	ON	—	—	—
Delay and Latch	ON	ON	OFF	OFF	ON	ON	ON	—	—	—
Limit and Latch	ON	ON	OFF	OFF	OFF	ON	ON	—	—	—

N/C Output	OFF	—	—
N/O Output	ON	—	—
15 Sec. Max. Time	—	OFF	OFF
1.5 Sec. Max. Time	—	ON	OFF
15 Sec. Max. Time	—	OFF	ON

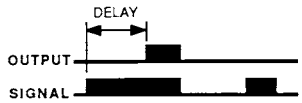
A group of ten switches located on one side of the module is used to select the timing logic for CL5 models.

Switches #1 through #7 are used to select the logic function. Switch #8 programs the output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for *both* functions of a dual timing mode (ON & OFF DELAY, DELAYED ONE-SHOT, and REPEAT CYCLE). However, DELAY and HOLD times are independently adjustable within the selected range.

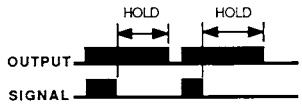
The diagram shows switch locations, and the table summarizes the program switch positions.

Description of Logic Functions, CL5 models

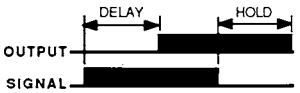
ON/OFF: ON/OFF operation does not involve timing. The output simply follows the action of the input signal. Grounding pin #9 (AUXILIARY) turns the output "off", regardless of the state of the input signal. This may be accomplished by closing a switch or relay contact between pins #9 and #1 (common), or by connecting an open collector NPN (current sinking) output of any external dc device directly to pin #9. NOTE: connect the COMMON of any external dc device to pin #1 of the MAXI-AMP to establish a voltage reference between the dc supply for the external device and the internal dc supply of the MAXI-AMP.



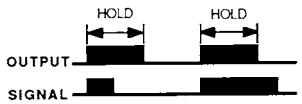
ON DELAY: The ON DELAY timer keeps the output "off" until the selected LIGHT or DARK signal has been present for the preset "DELAY" time. If the input signal is interrupted, the timing is reset and starts over with the next signal. Grounding pin #9 immediately cancels an output in progress and resets the delay timer. The delay timer is restarted when the inhibit signal is removed, if an input signal is present.



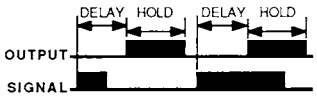
OFF DELAY: The output energizes immediately when the input signal occurs, but does not de-energize until the signal has been removed for the preset OFF-DELAY ("HOLD") time. Grounding pin #9 prevents an output from occuring. If an inhibit input occurs during an output, the output remains "on" for the remainder of the OFF-DELAY time.



ON & OFF DELAY: ON and OFF DELAY logic combines both timing functions into a single mode. The ON-DELAY ("DELAY") time and the OFF-DELAY ("HOLD") time are independently adjustable within the selected time range. Momentary grounding of pin #9 during the ON-DELAY period resets the DELAY timer. An inhibit signal which occurs during an output will allow the output to stay energized for the remainder of the OFF-DELAY time. ON and OFF DELAY logic is often used in jam and void control, high/low level control, and edge-guiding applications.

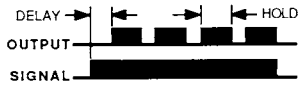


ONE-SHOT: The output of a ONE-SHOT function is a pulse of adjustable "HOLD" duration which is independent of the duration of the input signal. With the MAXI-AMP programmed for LIGHT operate, the pulse occurs when the input signal changes from dark to light. In DARK operate, the pulse occurs with a light to dark input transition. Grounding pin #9 prevents the one-shot from triggering, but does not affect a pulse already under way.

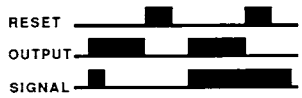


DELAYED ONE-SHOT: A DELAYED ONE-SHOT is initiated by either a momentary or maintained input signal. This input starts the adjustable "DELAY" period, after which the output pulses for an adjustable pulse ("HOLD") time. No further action occurs unless the input is removed and reapplied, beginning a new sequence. Grounding pin #9 during the delay period will cancel the sequence, and no output occurs. This feature is often used for inspection/rejection control logic. An inhibit signal will not affect a pulse under way.

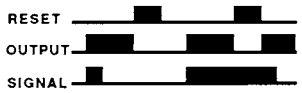
LIMIT: The output of the LIMIT function follows the action of the input, as it does with the ON/OFF function. However, an input signal which is longer than the adjustable LIMIT ("HOLD") time will turn the output "off". Removing the input signal resets the timer. This function is sometimes called "TIME LIMITED ON/OFF", and is useful for energy conservation. Grounding pin #9 cancels the output. Lifting the inhibit restarts the LIMIT timer, if an input signal is present.



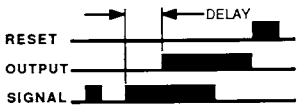
REPEAT CYCLE: The REPEAT CYCLE function provides an oscillating output when an input signal is present. Presence of an input signal triggers an adjustable "DELAY" timer. After the delay, the output energizes for an adjustable "HOLD" period. If the input remains, the output continues to cycle "on" and "off" at this rate indefinitely. When the signal is removed, any output in progress completes and then remains "off" until the next signal and DELAY period. Grounding pin #9 cancels the sequence, but will allow the completion of a "HOLD" period in progress. Lifting the inhibit signal begins the DELAY period, if an input signal is present.



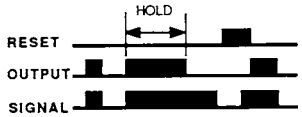
AC LATCH: An AC LATCH is the combination of a ONE-SHOT and a LATCH. A momentary or sustained input will latch the output "on". Grounding pin #9 will reset the latch, even if the input signal remains. The output will not re-latch until the input signal is removed and then reapplied.



DC LATCH: The output will latch "on" whenever the selected LIGHT or DARK input condition occurs. Grounding pin #9 of a dc latch will turn the output "off" regardless of the state of the input signal. If the signal is present when the reset is removed, the output will immediately latch "on" again.



DELAY AND LATCH: The DELAY + LATCH is a combination of the ON-DELAY and DC LATCH functions. An input must be present for at least the adjustable "DELAY" time for the output to latch "on". If the input signal is removed during the timing cycle, the timing is reset. Momentary grounding of pin #9 resets the latch and/or the DELAY timing cycle. Sustained grounding of pin #9 inhibits any output.



LIMIT AND LATCH: The LIMIT + LATCH operates exactly like the LIMIT function, except that the LIMIT ("HOLD") timer can be reset *only* by the auxiliary input. An output remains latched "off" until reset by momentarily grounding pin #9. In addition to resetting the timer, grounding pin #9 will hold the output "off", regardless of the state of the input signal.

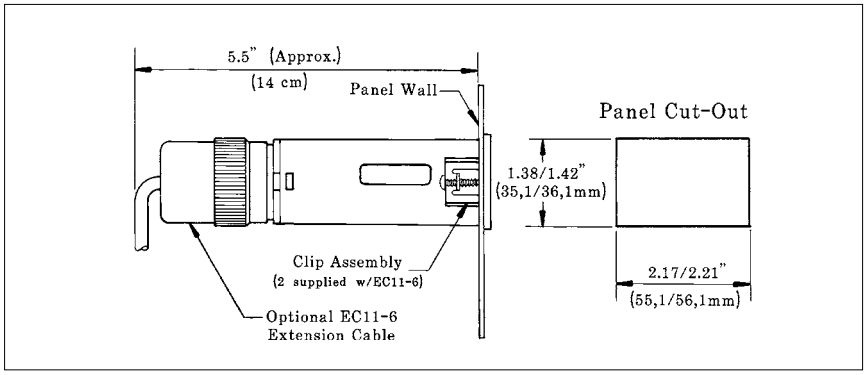
MAXI-AMP System

Mounting and Accessories

Panel Wall Mounting of MAXI-AMP Module

After the panel cutout has been completed and de-burred, slide the MAXI-AMP through the cutout and place one clip assembly into the rectangular depression on each of the two narrow sides of the housing. Orient clips as shown, and alternately tighten the screws for equal pressure against the inside of the panel wall. Do not overtighten the screws. Attach the optional EC11-6 extension cable (described below) to the MAXI-AMP and route the opposite end of the cable to the RS-11 (or equivalent) socket.

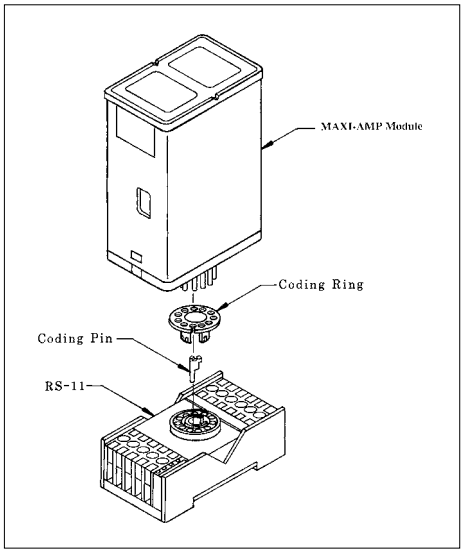
Model EC11-6 extension cable is 6 feet (2m) long. Clips for panel wall mounting of the MAXI-AMP are included with the cable.



Accessories for MAXI-AMP Modules

Model RS-11 Socket

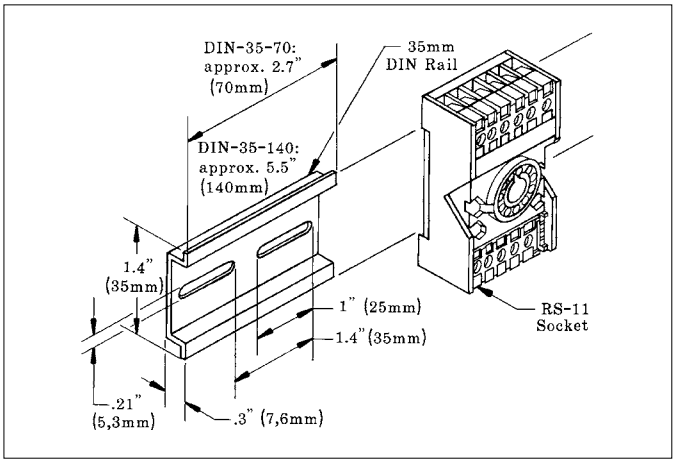
Model RS-11 is an eleven-pole round-pin screw terminal relay socket which is used to make electrical connections to any MAXI-AMP module. The socket provides in-line wire clamp screw terminals which will accept from one #24 AWG up to two #14 wires at each pin. The RS-11 is UL recognized (file #E92191) and CSA approved (file #LR38486). It may be mounted directly to a panel plate or via standard 35mm DIN-rail track (see below). A hold-down wire is supplied with each RS-11 socket (see dimension diagram on page 2).



The RS-11 is supplied with a coding ring and pin (see diagram at right). This allows a MAXI-AMP to be keyed to fit only its own 11-pin socket. The pin is installed in one of the eleven slots in the RS-11, and the notch in the ring is aligned to slip over the pin. When the MAXI-AMP is removed from the RS-11, the coding ring stays with the MAXI-AMP base, while the coding pin remains in the socket.

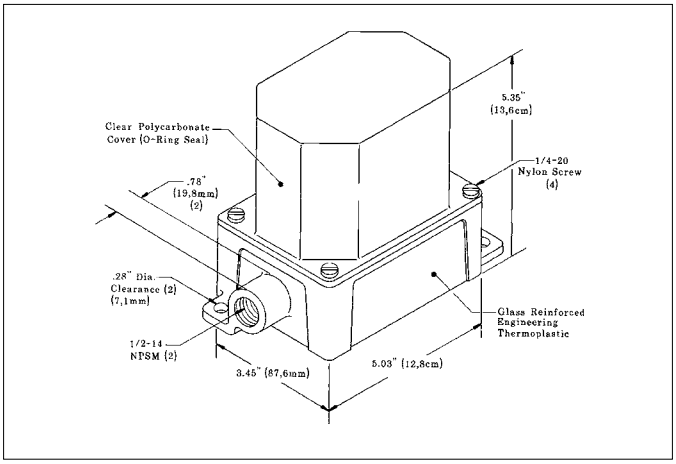
35mm DIN Rail Track

Track model DIN-35-70 accomodates one RS-11 socket. Model DIN-35-105 holds two sockets. Model DIN-35-140 holds up to three sockets. The RS-11 socket is designed to snap (or slide) directly into the 35mm DIN track.



Model BENC-4 Enclosure

Model BENC-4 is a NEMA-4 rated corrosion-resistant enclosure for a MAXI-AMP module or other control device. It is supplied with a DIN-35-70 track for easy mounting of one RS-11 socket. For mounting two sockets, use DIN-35-105.

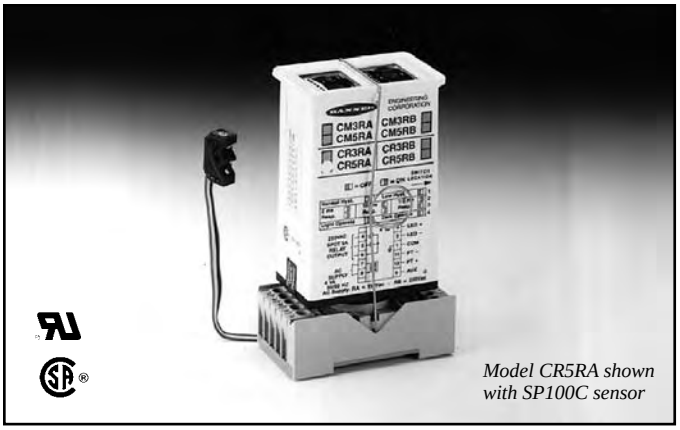


MAXI-AMP™ CR Series

Modulated Amplifier Modules for "100 Series" Sensors

the photoelectric specialist

- **Modulated photoelectric amplifier, power supply, output relay, and versatile timing logic (CR5 models) in one compact, stand-alone package**
- **120 or 240V ac or 12 to 28V dc operation; requires only the addition of Banner "100 Series" modulated remote sensor(s) to create a complete sensing system**
- **CR5 models are easily programmed for any of 12 delay, one-shot, and latch functions (single or dual timing); interrogation schemes are possible using the module's auxiliary input**



Model CR5RA shown with SP100C sensor

CR Series MAXI-AMPs combine power supply, modulated photoelectric amplifier, timing logic (in CR5 models) and output relay in a single compact, cost-saving module. The integrated stand-alone design saves both the expense of a separate control chassis and a substantial amount of panel space. Several models are available, for either 120V or 240V ac operation, and either with or without timing logic. Alternatively, any model may be powered by 12 to 28V dc.

CR Series modules are specifically designed for use with the popular "100 Series" of Banner miniature sensors (page 3). Their rugged encapsulated design, slim ribbon-style connecting cables, and small size make these sensors ideal for use in many situations previously considered impractical or impossible. MAXI-AMP modules themselves are also ruggedly built for dependable industrial duty.

CR Series MAXI-AMP modules contain the state-of-the-art Banner custom-designed CMOS modulator/demodulator/amplifier circuit, offering high immunity to both ambient light and electrical interference plus reliable sensor performance. All models have Banner's exclusive, patented Alignment Indicating Device (AID™) system, which lights an LED indicator whenever the sensor sees a "light" condition, and pulses the LED at a rate proportional to the received light signal strength.

All CR Series modules are programmable for LIGHT or DARK operate and either high or low hysteresis. Input response time may be set at 0.3, 2, or 10 milliseconds. The 10-millisecond response mode offers enhanced immunity to electrical interference ("noise"), and also minimizes optical "crosstalk" between adjacent sensors.

CR5 models include a versatile multi-function timing logic circuit which is programmable for 12 of the most popular and useful delay, one-shot, and latch functions. Each timing function has a choice of three time ranges. Timing and sensitivity adjustments are accomplished via rugged 15-turn potentiometers for very accurate settings. CR Series circuitry is designed to prevent false outputs on system power-up.

The output circuit for all CR Series modules is an SPDT 5-amp electromechanical relay. Additionally, CR3 models have an NPN transistor solid-state switch. The output may be programmed for either normally open or normally closed operation. A solid-state relay is offered as an option to the electromechanical relay (see below).

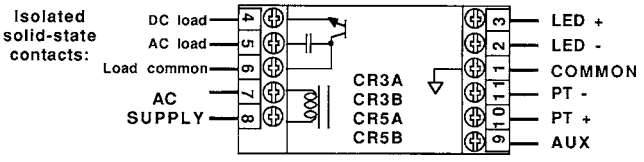
An auxiliary input is available on CR5 models for interrogation or reset of the selected logic function (see example, page 4). Page 6 describes the function of the auxiliary input for each logic mode. A dc power supply is included for powering an additional self-contained dc sensor.

Read Personnel Safety Use WARNING, page 7.

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CR3RA	105 to 130V ac, or 12 to 28V dc	SPDT electromechanical relay, plus NPN transistor solid-state DC switch	ON/OFF
CR3RB	210 to 250V ac, or 12 to 28V dc		
CR5RA	105 to 130V ac, or 12 to 28V dc	SPDT electromechanical relay (5 amp contact rating)	12 timing functions
CR5RB	210 to 250V ac, or 12 to 28V dc		

Solid-state Output Option

CR Series modules are available with a solid-state relay which replaces the electromechanical relay. This is actually two SPST solid-state contacts. One contact will switch ac loads, and is rated at 250V ac maximum and 3/4 amps maximum at 25 degrees C (derated to 1/2 amp at 50 degrees C). The other solid-state contact will switch dc loads of up to 30V dc and up to 50 milliamps. Both contacts are isolated from the MAXI-AMP power supply.



MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CR3A	105 to 130V ac, or 12 to 28V dc	SPST solid-state contact for switching AC loads up to 250 V ac and up to 3/4 amp, plus solid-state contact for switching DC loads up to 30V dc and up to 50mA.	ON/OFF
CR3B	210 to 250V ac, or 12 to 28V dc		
CR5A	105 to 130V ac, or 12 to 28V dc		12 timing functions
CR5B	210 to 250V ac, or 12 to 28V dc		

MAXI-AMP CR Series Specifications

SUPPLY VOLTAGE: Models CR3(R)A, and CR5(R)A: 105 to 130V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA.
Models CR3(R)B, and CR5(R)B: 210 to 250V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA.
***NOTE: do not connect ac power if using external dc power.**

OUTPUT CONFIGURATION:
Models CR3A, CR3B, CR5A, CR5B have an SPST solid-state relay for switching ac or dc (see page 1).

Models CR3RA, CR3RB, CR5RA, CR5RB have an SPDT electromechanical (e/m) relay with the following ratings:

CONTACT RATING: 250V ac max, 24V dc max, 5 amps max. (resistive load), 1/10 H.P. at 240V ac. Install transient suppressor (MOV) across contacts which switch inductive loads.
CONTACT RESPONSE: 10 milliseconds max. open/close; 20 operations/second max.
MECHANICAL LIFE: 20,000,000 operations
CR3 models also have a logic level current sinking NPN transistor switch at pin #9. See schematic (right) and hookup info.

AMPLIFIER:
RESPONSE SPEED: programmable for 10, 2, or 0.3 milliseconds. NOTE: use 10 millisecond setting whenever possible for enhanced noise rejection.
HYSTERESIS: if programmed "HIGH", approximately 20%; if programmed "LOW", approximately 5%. NOTE: see cautions for "LOW" setting (see page 5).
MODULATION FREQUENCY: approximately 10kHz.

SENSOR LEAD LENGTH: 50 feet (15 m) maximum. Use separate shielded cable for emitter and receiver, or order sensors with extended cable length. NOTE: see splicing precautions.

MULTIPLE SENSOR HOOKUP: Up to three sensors may be wired together to one CR Series amplifier for "OR" operation (in LIGHT operate) or "NAND" operation (in DARK operate). Emitters are connected in series, and receivers are connected in parallel. When wiring two sensors to one MAXI-AMP, multiply excess gain data for each sensor by 1/2 (obtain data from applicable excess gain curve). When wiring three sensors to one MAXI-AMP, multiply excess gain by 1/3.

TIMERS (CR5 models only):
TIMING RANGES: LOW range - 10 to 150 milliseconds
MIDDLE range - 0.1 to 1.5 seconds
HIGH range - 1 to 15 seconds
REPEATABILITY: +/-2% of set time over all extremes of supply voltage and temperature

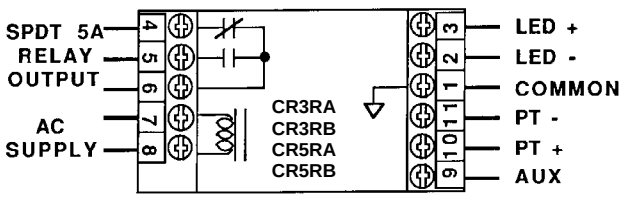
ADJUSTMENTS: Miniature switches for programming of LIGHT/ DARK operate, amplifier response time, amplifier hysteresis, normally open or normally closed output, and timing function (CR5 models). 15-turn clutched potentiometer for gain and time setting(s) (CR5 models).

OPERATING TEMPERATURE: 0 to 50°C (32 to 122°F).

INDICATOR LEDs: Red indicator LED is "ON" when the module output is energized. Exclusive Banner Alignment Indicating Device (AID™) system lights a red LED indicator whenever the receiver "sees" its own modulated light source, and pulses it at a rate which is proportional to the strength of the received light signal.

CONSTRUCTION: Rugged NORYL® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole plug base.

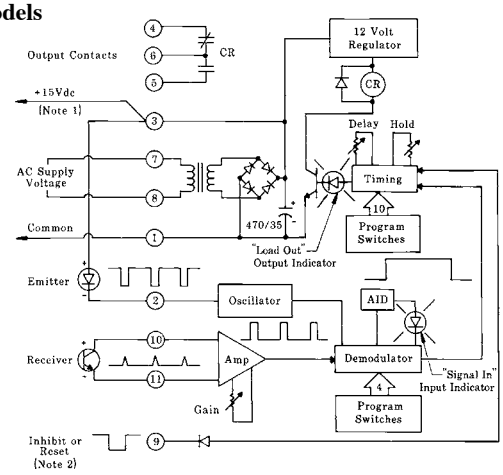
Generalized Hookup



NOTE: If MAXI-AMP is powered by a dc power supply, connect +12 to 28V dc @ ≥70mA to terminal #3 and dc common to terminal #1.
Make no connections to terminal #7 or #8.

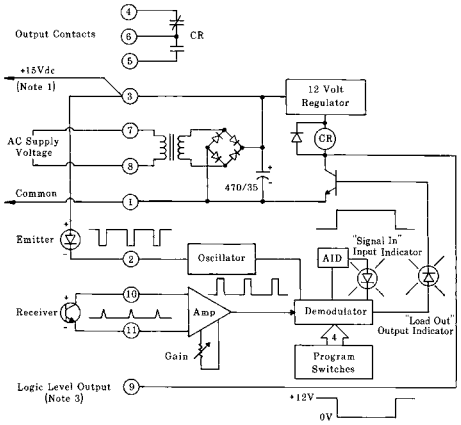
Functional Schematics

CR5 Models



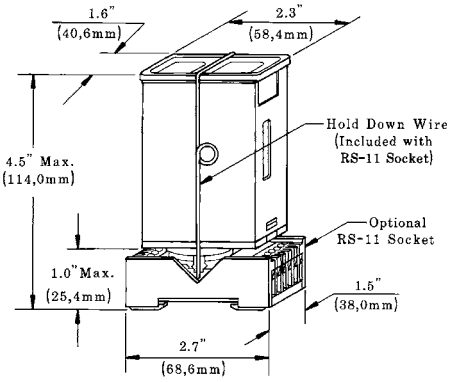
NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example, page 4). Current available is 40 mA at 120V ac (240V ac) line level; 30mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). Do not connect ac voltage if using external dc power.
NOTE #2: pulling pin #9 low (to common) will inhibit the timing, or reset the latch of CR5 model (see "Description of Logic Functions", page 6).

CR3 Models



NOTE #3: pin #9 of CR3 model may be connected directly to the AUXILIARY input of a MAXI-AMP or Banner M Series module. It may also serve as the input to Banner CL series MAXI-AMPs or to Banner Plug Logic modules.

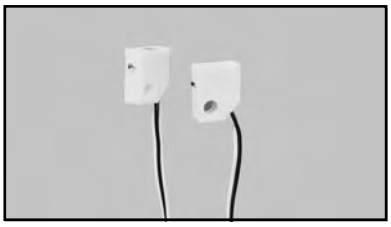
Dimension Drawing



Sensors for use with CR Series Modulated Amplifier Modules

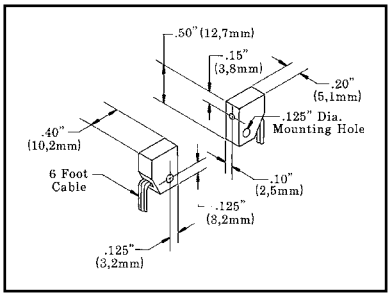
Temperature range for all miniature modulated remote sensors is 0 to 70 degrees C (+32 to 158 degrees F).
Sensors are epoxy-encapsulated and optics are hermetically sealed.

Models/Dimensions **Excess Gain** ***Beam Pattern***



SP100E & SP100R

Range: 8 inches (20cm)
Beam: infrared, 880nm
Effective beam: .05 inch (1,3mm diameter)



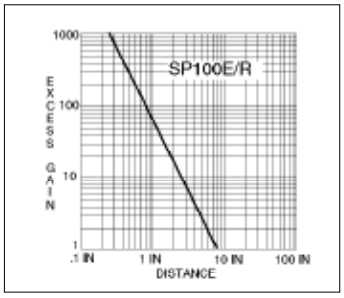
Cable (all 6-foot lengths): SP100E: 2-wire ribbon cable (white, green).

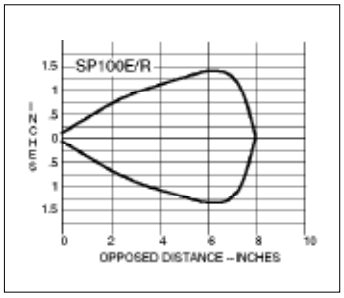
SP100R: 3-wire ribbon cable (red, black, yellow).

SP100D, DB, C, CCF: 5-wire ribbon cable (white, green, red, black, yellow). See hookup drawing, page 4.

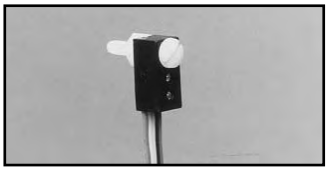
OPPOSED Mode Sensors

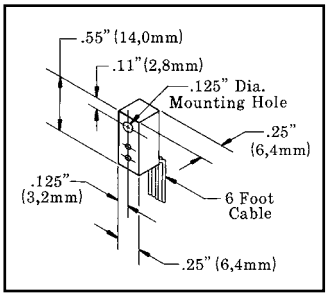
SP100E and SP100R miniature opposed sensors have a slim right-angle design which allows them to be mounted in very tight locations. The thin, flexible ribbon cable which exits from one corner may be run in any direction away from the sensing point. The SP100E and R have a wide beam angle for forgiving line-of-sight alignment. Alignment is easily made exact (and monitored) using the AID™ LED on the CR module.



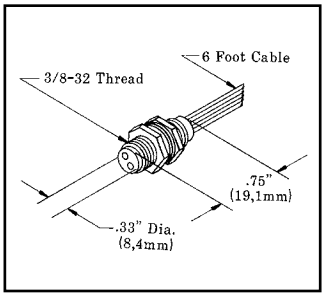


SP100D



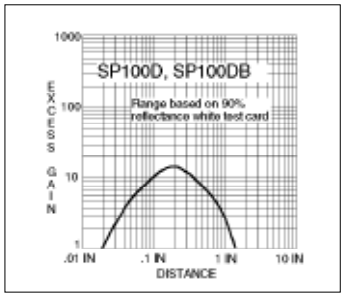


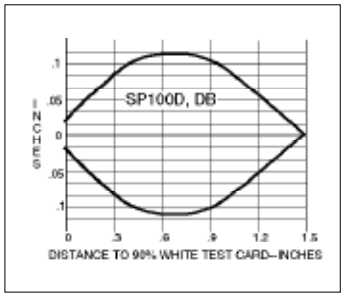
SP100DB



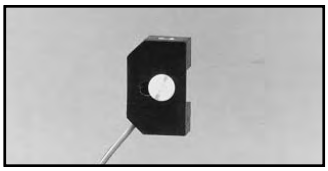
DIFFUSE Mode Sensors

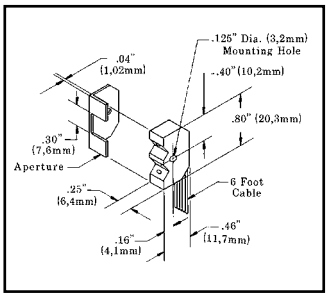
Models SP100D and SP100DB are general-purpose miniature diffuse sensors which detect the reflection of their own light from the surface of an object. The SP100D is a right-angle design which is generally held in place using a #4 (3mm) screw. The SP100DB ("B" = Barrel) is an in-line threaded barrel which typically mounts through a 3/8" (10mm) diameter hole using the lock nuts which are supplied. The optical response of these two sensors is the same.



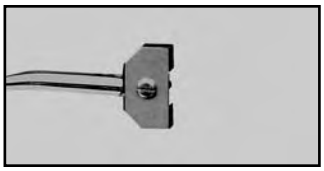


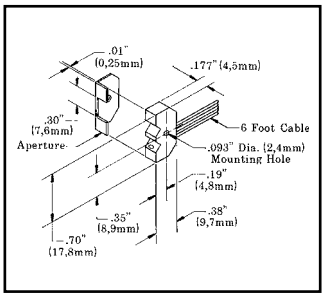
SP100C





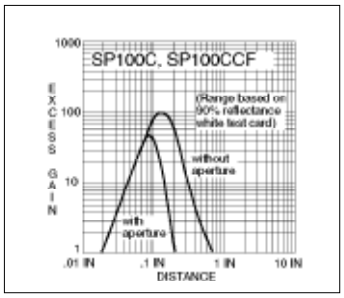
SP100CCF

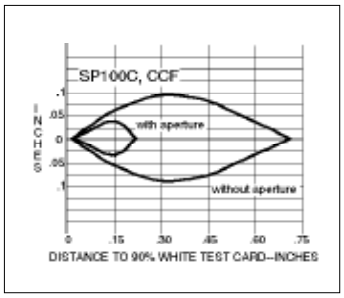




CONVERGENT Mode Sensors

Models SP100C and CCF are ideally suited to applications where depth of field is critical. The emitter and receiver are both directed at a point 0.1 inch (2,5mm) ahead of the front surface. An aperture is included which, when attached, narrows the depth of field (see curves, below). This is particularly useful when it is necessary to detect an object while ignoring another object or a surface just a fraction of an inch farther away. The high excess gain at the focus allows detection of objects of low reflectivity. The SP100C and CCF differ only in housing style. Model SP100C is for general application. Model SP100CCF is used where a narrow profile is important for mounting.

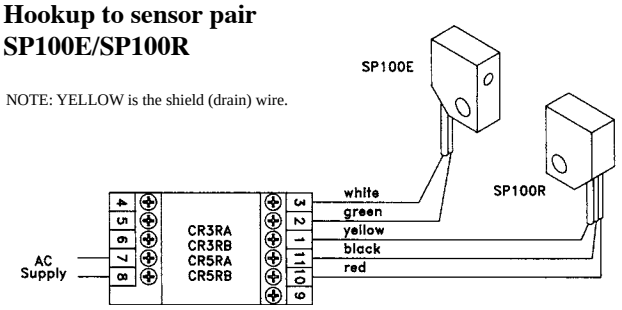




Sensor Hookup Diagrams for CR Series MAXI-AMP Modules

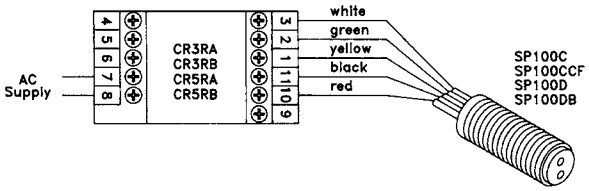
Hookup to sensor pair SP100E/SP100R

NOTE: YELLOW is the shield (drain) wire.



Hookup to sensor models SP100C, SP100CCF, SP100D, SP100DB

NOTE: YELLOW is the shield (drain) wire.

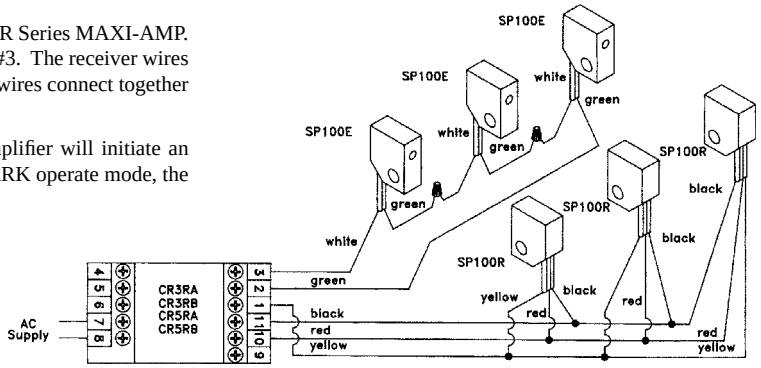


Hookup to multiple sensors

Up to three miniature remote sensors may be connected to any CR Series MAXI-AMP. The emitter wires connect together in series to terminals #2 and #3. The receiver wires connect in parallel to terminals #10 and #11. The yellow shield wires connect together at terminal #1.

If the MAXI-AMP is programmed for LIGHT operate, the amplifier will initiate an output or the timing logic if any receiver "sees" light. In the DARK operate mode, the amplifier will output when all receivers "see" dark coincidently.

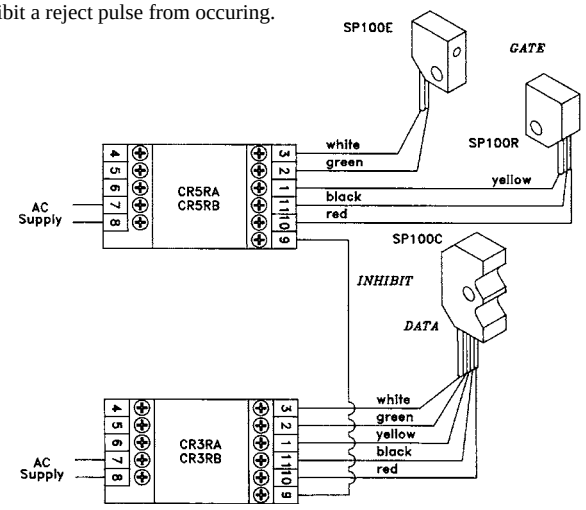
When multiple remote sensors share a common amplifier, the range of each sensor decreases. When wiring two sensors to one MAXI-AMP, multiply excess gain data for each sensor by 1/2 (obtain the data from the applicable excess gain curve). When wiring three sensors to one MAXI-AMP, multiply excess gain by 1/3.



Logic level NPN output, CR3 models

The AUXILIARY terminal (#9) of models CR3(R)A and CR3(R)B offers a logic-level NPN (current sinking) output which may be used as a fast-response solid-state inhibit signal to the AUXILIARY input of MAXI-AMP CR5 Series modules. This output may also serve as an input to any B Series or Plug Logic module. In addition, this output may interface to other dc devices or circuits like counters, rate meters, or programmable logic controllers. Switching capacity is 20mA at 12V dc.

The example here shows the use of an SP100C sensor and a CR3 module to provide inspection information, with the SP100E/R pair functioning as a product sensor. Typically, the CR5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the SP100C "sees" an acceptable condition when the SP100E/R pair senses the leading (or trailing) edge of a product, the CR3 will inhibit a reject pulse from occuring.

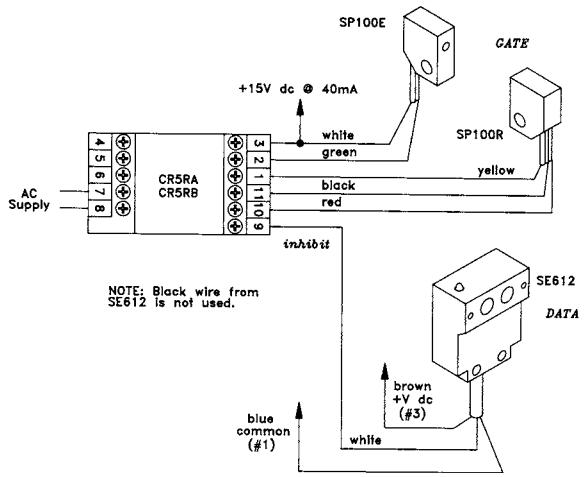


Power for external devices

External 10 to 30V dc devices such as self-contained sensors may be connected between terminals #3 (+) and #1 (-) of any CR Series MAXI-AMP module. Terminal #3 offers 40mA maximum. This is sufficient to power most Banner self-contained dc sensors.

In the example below, the current sinking output of a self-contained sensor powered by the MAXI-AMP may be used as the input to the AUXILIARY terminal of a CR5 module.

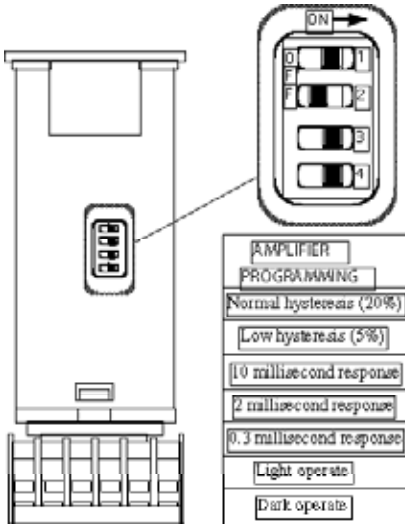
The example shows the use of an SE612 ECONO-BEAM sensor to provide inspection information, with the SP100E/R pair functioning as a product sensor. Typically, the CR5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the SE612 "sees" an acceptable condition when the SP100E/R pair senses the leading (or trailing) edge of a product, it will inhibit a reject pulse from occuring.



Amplifier Programming (all models)

Amplifier response conditions may be programmed via the group of four switches located on one of the narrow sides of the MAXI-AMP module.

Switch #1 selects the amount of amplifier hysteresis. Hysteresis is the amount of signal change beyond the switching threshold which is required to cause the amplifier output to change state, and is expressed as a percent of amplifier gain. The NORMAL setting of 20% should always be used, except for low contrast situations such as many color registration applications.



Factory settings shown at left. "Underlined" settings in table below are factory settings.

AMPLIFIER PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4
Normal hysteresis (20%)	ON	—	—	—
Low hysteresis (5%)	OFF	—	—	—
10 millisecond response	—	OFF	ON	—
2 millisecond response	—	ON	ON	—
0.3 millisecond response	—	ON	OFF	—
Light operate	—	—	—	ON
Dark operate	—	—	—	OFF

NOTE: the LOW hysteresis setting should be used only when all sensing conditions remain stable. "Buzzing" of the output (in ON/OFF and LIMIT operation) or false outputs (in DELAY, ONE-SHOT, or LATCH operation) may occur if sensing variables (e.g.- web flutter) result in optical contrast approaching unity.

Switches #2 and #3 are used to program the amplifier response time. The 10 millisecond setting should be used whenever possible for the greatest immunity to electrical interference ("noise"). The 2 millisecond setting has more interference rejection than the 0.3 millisecond mode. Sensor performance (excess gain) is identical in all three response settings.

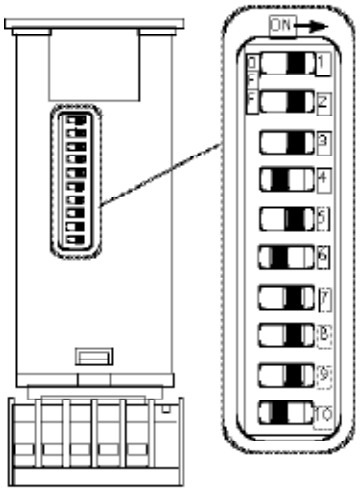
Switch #4 is used to select LIGHT OPERATE or DARK OPERATE. In the LIGHT OPERATE mode, the output will energize (in ON/OFF or LATCH operation) or the timing function will initiate (in DELAY, ONE-SHOT, or LIMIT operation) when the receiver "sees" sufficient light (excess gain greater than 1X). In DARK OPERATE, the output will energize or timing will begin when the receiver is sufficiently dark (excess gain less than 1X).

The diagram at the left shows the location of switches 1-4, and the table summarizes the settings required for each response condition.

NOTE: an adhesive-backed mylar label is supplied, which may be marked to indicate switch programming and then applied to the MAXI-AMP housing as a switch cover.

Timing Logic Programming (CR5 models)

Settings illustrated below are factory settings. Factory settings are "underlined" in the table.



TIMING LOGIC PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4	SWITCH #5	SWITCH #6	SWITCH #7	SWITCH #8	SWITCH #9	SWITCH #10
On/Off	ON	ON	ON	OFF	ON	OFF	ON	—	—	—
On Delay	ON	ON	OFF	OFF	ON	OFF	ON	—	—	—
Off Delay	ON	OFF	ON	OFF	ON	OFF	ON	—	—	—
On and Off Delay	ON	OFF	OFF	OFF	ON	OFF	ON	—	—	—
One-shot	OFF	OFF	ON	OFF	ON	OFF	ON	—	—	—
Delayed One-shot	OFF	OFF	OFF	OFF	ON	OFF	OFF	—	—	—
Limit	ON	ON	OFF	OFF	OFF	OFF	ON	—	—	—
Repeat Cycle	ON	OFF	OFF	ON	ON	OFF	ON	—	—	—
AC Latch	OFF	ON	ON	OFF	ON	ON	ON	—	—	—
DC Latch	ON	ON	ON	OFF	ON	ON	ON	—	—	—
Delay and Latch	ON	ON	OFF	OFF	ON	ON	ON	—	—	—
Limit and Latch	ON	ON	OFF	OFF	OFF	ON	ON	—	—	—
N/C Output								OFF	—	—
N/O Output								ON	—	—
15 Sec. Max. Time								—	OFF	OFF
1.5 Sec. Max. Time								—	ON	OFF
15 Sec. Max. Time								—	OFF	ON

A gr
swit

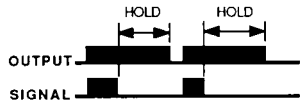
Swit
output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for both functions of a dual timing mode (ON & OFF DELAY, DELAYED ONE-SHOT, and REPEAT CYCLE). However, DELAY and HOLD times are independently adjustable within the selected range.

The diagram shows switch locations, and the table summarizes the program switch positions.

Description of Logic Functions, CR5 models

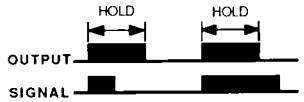
ON/OFF: ON/OFF operation does not involve timing. The output simply follows the action of the input signal. Grounding pin #9 (AUXILIARY) turns the output "off", regardless of the state of the input signal. This may be accomplished by closing a switch or relay contact between pins #9 and #1 (common), or by connecting an open collector NPN (current sinking) output of any external dc device directly to pin #9. NOTE: connect the COMMON of any external dc device to pin #1 of the MAXI-AMP to establish a voltage reference between the dc supply for the external device and the internal dc supply of the MAXI-AMP.

ON DELAY: The ON DELAY timer keeps the output "off" until the selected LIGHT or DARK signal has been present for the preset "DELAY" time. If the input signal is interrupted, the timing is reset and starts over with the next signal. Grounding pin #9 immediately cancels an output in progress and resets the delay timer. The delay timer is restarted when the inhibit signal is removed, if an input signal is present.

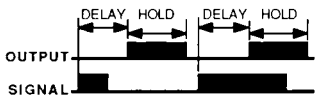


OFF DELAY: The output energizes immediately when the input signal occurs, but does not de-energize until the signal has been removed for the preset OFF-DELAY ("HOLD") time. Grounding pin #9 prevents an output from occuring. If an inhibit input occurs during an output, the output remains "on" for the remainder of the OFF DELAY time.

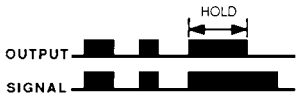
ON & OFF DELAY: ON and OFF DELAY logic combines both timing functions into a single mode. The ON-DELAY ("DELAY") time and the OFF-DELAY ("HOLD") time are independently adjustable within the selected time range. Momentary grounding of pin #9 during the ON-DELAY period resets the DELAY timer. An inhibit signal which occurs during an output will allow the output to stay energized for the remainder of the OFF-DELAY time. ON and OFF DELAY logic is often used in jam and void control, high/low level control, and edge-guiding applications.



ONE-SHOT: The output of a ONE-SHOT function is a pulse of adjustable "HOLD" duration which is independent of the duration of the input signal. With the MAXI-AMP programmed for LIGHT operate, the pulse occurs when the input signal changes from dark to light. In DARK operate, the pulse occurs with a light to dark input transition. Grounding pin #9 prevents the one-shot from triggering, but does not affect a pulse already under way.



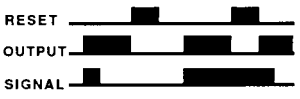
DELAYED ONE-SHOT: A DELAYED ONE-SHOT is initiated by either a momentary or maintained input signal. This input starts the adjustable "DELAY" period, after which the output pulses for an adjustable pulse ("HOLD") time. No further action occurs unless the input is removed and reapplied, beginning a new sequence. Grounding pin #9 during the delay period will cancel the sequence, and no output occurs. This feature is often used for inspection/rejection control logic. An inhibit signal will not affect a pulse under way.



LIMIT: The output of the LIMIT function follows the action of the input, as it does with the ON/OFF function. However, an input signal which is longer than the adjustable LIMIT ("HOLD") time will turn the output "off". Removing the input signal resets the timer. This function is sometimes called "TIME LIMITED ON/OFF", and is useful for energy conservation. Grounding pin #9 cancels the output. Lifting the inhibit restarts the LIMIT timer, if an input signal is present.

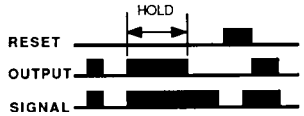
REPEAT CYCLE: The REPEAT CYCLE function provides an oscillating output when an input signal is present. Presence of an input signal triggers an adjustable "DELAY" timer. After the delay, the output energizes for an adjustable "HOLD" period. If the input remains, the output continues to cycle "on" and "off" at this rate indefinitely. When the signal is removed, any output in progress completes and then remains "off" until the next signal and DELAY period. Grounding pin #9 cancels the sequence, but will allow the completion of a "HOLD" period in progress. Lifting the inhibit signal begins the DELAY period, if an input signal is present.

AC LATCH: An AC LATCH is the combination of a ONE-SHOT and a LATCH. A momentary or sustained input will latch the output "on". Grounding pin #9 will reset the latch, even if the input signal remains. The output will not re-latch until the input signal is removed and then reapplied.



DC LATCH: The output will latch "on" whenever the selected LIGHT or DARK input condition occurs. Grounding pin #9 of a dc latch will turn the output "off" regardless of the state of the input signal. If the signal is present when the reset is removed, the output will immediately latch "on" again.

DELAY AND LATCH: The DELAY + LATCH is a combination of the ON-DELAY and DC LATCH functions. An input must be present for at least the adjustable "DELAY" time for the output to latch "on". If the input signal is removed during the timing cycle, the timing is reset. Momentary grounding of pin #9 resets the latch and/or the DELAY timing cycle. Sustained grounding of pin #9 inhibits any output.



LIMIT AND LATCH: The LIMIT + LATCH operates exactly like the LIMIT function, except that the LIMIT ("HOLD") timer can be reset only by the auxiliary input. An output remains latched "off" until reset by momentarily grounding pin #9. In addition to resetting the timer, grounding pin #9 will hold the output "off", regardless of the state of the input signal.

Installation and Troubleshooting of CR Series MAXI-AMP Mod-

WIRING TO MODULE: Input, output, and sensor hookup to a MAXI-AMP module are accomplished using an 11-pole round-pin relay socket. Model RS-11 is described in detail on page 8.

INPUT POWER REQUIREMENTS: CR Series MAXI-AMP modules may be powered by AC voltage across terminals #7 and #8. Alternatively, CR modules may be powered by 12 to 28V dc, with the positive (+) connected to terminal #3 and the DC common (-) connected to terminal #1. **(NOTE: do not connect both AC and DC supply voltages.)** See specifications and hookup data on page 2 for more information.

OUTPUT WIRING: The SPDT output relay has a 5-amp rating (see specifications, page 2). This specification does not forgive the inrush current demand of AC inductive loads such as solenoids and motor starters. Inrush current occurs each time an AC inductive load is energized, and is typically ten times the "holding" current rating of the load. As a result, AC inductive loads with holding current greater than 1/2 amp (1/10 HP) require an interposing relay. In addition, an MOV (metal oxide varistor) transient suppressor should be connected across any relay contact that switches an AC inductive load.

For information on the logic level solid-state output at terminal #9 of CR3 models, refer to page 4.

SENSOR WIRING: Miniature remote sensors connect with five wires to module terminal #1, 2, 3, 10, and 11. Emitters use two wires and receivers use three wires. Diffuse and convergent models combine emitter and receiver connections into a 5-wire ribbon cable. Sensors are available with 30-foot cables as an option, and may be wired up to 50 feet away from the MAXI-AMP. 100-foot lengths of extension cable are available from Banner. All cable splice points should be soldered. Cables need not be run in conduit; however, in order to avoid electrical interference, they should be kept as far as possible (at least several inches) from any high voltage and/or high current wiring.

SENSOR ALIGNMENT:

OPPOSED SENSORS-- visually align the emitter to the receiver. Then secure the emitter, leaving the receiver loosely mounted. With power applied to the MAXI-AMP, find the center of the beam by adjusting the receiver up-down-left-right until the fastest pulse rate is obtained on the "Signal In" status LED. If necessary, reduce the GAIN control (turn control counterclockwise) to find the true beam center. When the optimum receiver position has been found (beam center located), tighten the receiver mounting hardware. (NOTE: it is also possible to complete the alignment by first securing the receiver in place and then moving the emitter to find the beam center.) Note that exact optical alignment is not necessarily the same as optimum mechanical alignment: however, the difference is usually noticeable only near the maximum range limit or under conditions of reduced gain.

After aligning the emitter to the receiver, increase the 15-turn GAIN control to the maximum (fully clockwise) position. Alternately present the "dark" condition (usually an object breaking the beam) and the "light" condition (usually an unblocked beam) to the receiver while monitoring the "Signal In" LED:
If the "Signal In" LED goes "off' with the "dark" condition and "on" with the light condition, no further adjustment is necessary.
If the Signal In" LED stays "on" with the "dark" condition, reduce the GAIN control counterclockwise until the "Signal In" LED just goes "off", then reduce the control another two full turns. Finally, alternate the "light" and "dark" conditions to ensure that the LED follows the action by turning "on" and "off".

DIFFUSE SENSORS-- No alignment is necessary for diffuse (proximity) mode sensors, but care must be taken to mount them where no background objects will be seen, especially when background objects may be more reflective than the part to be sensed. A good rule is to allow a clear distance behind the part to be sensed of at least 3 times the sensing distance. When this is not possible, convergent or opposed sensors must be considered. The best gain setting is either at maximum setting or two full turns below the point where the "Signal In" LED just goes "off" in the dark condition (part absent). After setting the GAIN control, alternate "light" and "dark" conditions to verify that the "Signal In" LED follows the action by turning "on" and "off".

CONVERGENT SENSORS-- Loosely mount the sensor so that the part to be sensed will be nominally located at the sensor focus. Present the part to the sensor. Using the "Signal In" LED, adjust the sensor mounting for the fastest pulse rate, then tighten the mounting hardware to lock the sensor in that position. Remove the part and increase the gain (turn control clockwise) either to maximum or to the point where the "Signal In" LED just turns "on". If the "Signal In" LED turns "on" before reaching maximum gain, reduce the gain (counterclockwise) until the "Signal In" LED just turns "off", plus two full turns. Alternate the "light" condition (part present) and the "dark" condition (part absent) and verify that the "Signal In" LED follows the action by turning "on" and "off".

NOTE: in any of the sensing modes discussed above, if there is less than two full turns of the GAIN control between too little gain and too much gain, try the amplifier's LOW HYSTERESIS mode by turning amplifier programming switch #1 to "off". The LOW HYSTERESIS mode should be used only after exhausting all mechanical measures for increasing optical contrast (see note, page 5).

TROUBLESHOOTING

If the MAXI-AMP module fails to operate, the following procedure will usually identify the cause. The procedure, which requires only a VOM, runs as follows:

1) Remove all wires from the module socket, except for the power supply connections. Measure the supply voltage and compare it to the specified range.
2) Program the module for the factory settings (see page 5) and plug the MAXI-AMP module into its socket. Set the GAIN control clockwise to at least two full turns above minimum setting.
3) Using a jumper wire, connect terminal #2 to terminal #10. This simulates the LIGHT sensing condition. Both the "Signal In" and the "Load Out" LEDs should come "on".
4) With the jumper wire still in place, switch the module to DARK OPERATE by turning amplifier programming switch #4 to OFF. The "Signal In" LED should remain "on" (and pulsing), but the "Load Out" LED should go "off".
5) Remove the jumper wire. The "Signal In" LED should go "off" and the "Load Out" LED should come "on".

This verifies proper amplifier operation.

If a CR5 model amplifier is involved, the logic functions may be tested using a jumper wire between terminal #2 and #10 to simulate the LIGHT condition. If the amplifier checks okay, then test the miniature remote sensor(s) as follows:

1) Connect a VOM (set to the R x 1kΩ scale) to the receiver leads (positive probe to red wire, "common" probe to black wire). Direct the receiver element toward a bright light, and alternately expose and cover the lens. The meter should swing between low impedance (less than 2kΩ) when pointed at a bright light and high impedance (several megΩ) when completely covered. No response (unchanging high or low impedance) indicates phototransistor failure.
2) Connect a VOM (set to the R x 1kΩ scale) to the emitter leads (positive probe to white wire, "common" probe to green wire). The meter should read several kΩ. Zero ohms or infinite resistance indicates LED failure.

If the sensors(s) check okay, remove power from the module and remove the module from its socket. Using a VOM (set to any resistance scale) or a continuity tester, check the continuity of each socket pin receptacle and the corresponding clamp screw terminal.

If the above steps fail to indicate the cause of trouble, reconnect all wires and note the trouble symptoms. Contact the Banner Applications Department during normal business hours at (612) 544-3164 or your local field sales engineer.

WARNING These photoelectric sensing devices 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 output condition.

Never use these products as sensing devices for personnel protection. Their use as safety devices 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.

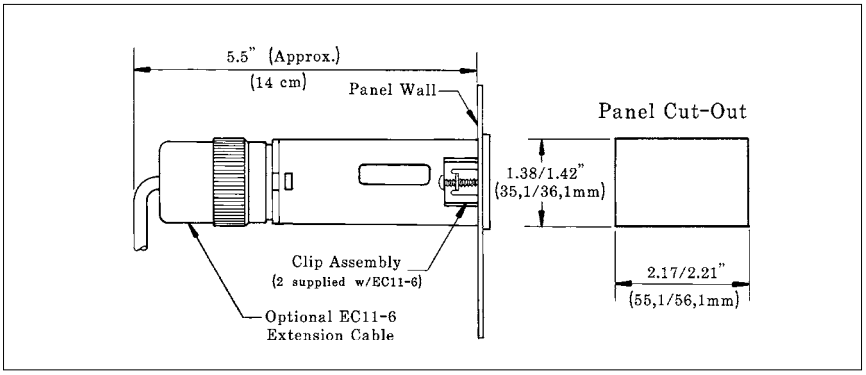
MAXI-AMP System

Mounting and Accessories

Panel Wall Mounting of MAXI-AMP Module

After the panel cutout has been completed and de-burred, slide the MAXI-AMP through the cutout and place one clip assembly into the rectangular depression on each of the two narrow sides of the housing. Orient clips as shown, and alternately tighten the screws for equal pressure against the inside of the panel wall. Do not overtighten the screws. Attach the optional EC11-6 extension cable (described below) to the MAXI-AMP and route the opposite end of the cable to the RS-11 (or equivalent) socket.

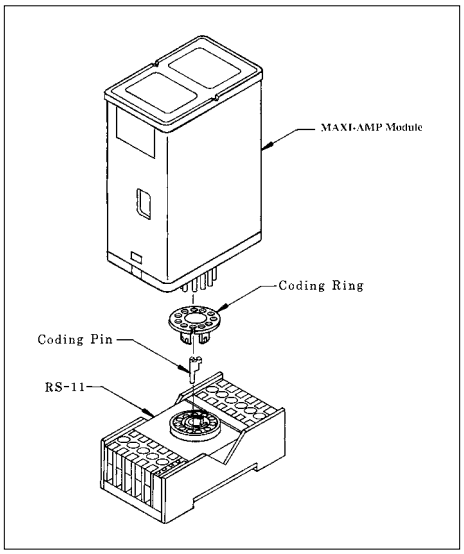
Model EC11-6 extension cable is 6 feet (2m) long. Clips for panel wall mounting of the MAXI-AMP are included with the cable.



Accessories for MAXI-AMP Modules

Model RS-11 Socket

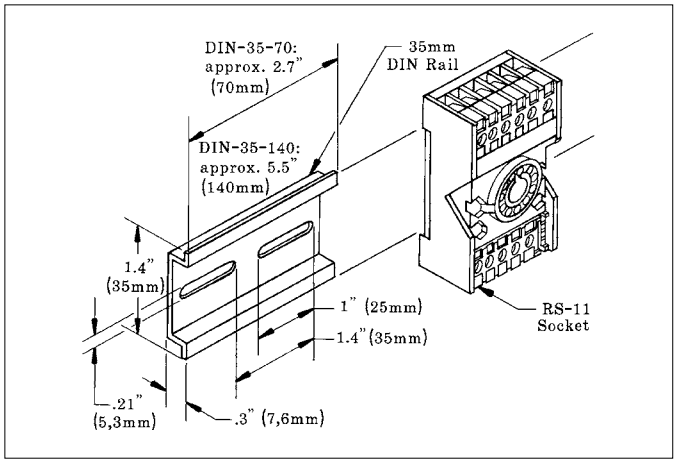
Model RS-11 is an eleven-pole round-pin screw terminal relay socket which is used to make electrical connections to any MAXI-AMP module. The socket provides in-line wire clamp screw terminals which will accept from one #24 AWG up to two #14 wires at each pin. The RS-11 is UL recognized (file #E92191) and CSA approved (file #LR38486). It may be mounted directly to a panel plate or via standard 35mm DIN-rail track (see below). A hold-down wire is supplied with each RS-11 socket (see dimension diagram on page 2).



The RS-11 is supplied with a coding ring and pin (see diagram at right). This allows a MAXI-AMP to be keyed to fit only its own 11-pin socket. The pin is installed in one of the eleven slots in the RS-11, and the notch in the ring is aligned to slip over the pin. When the MAXI-AMP is removed from the RS-11, the coding ring stays with the MAXI-AMP base, while the coding pin remains in the socket.

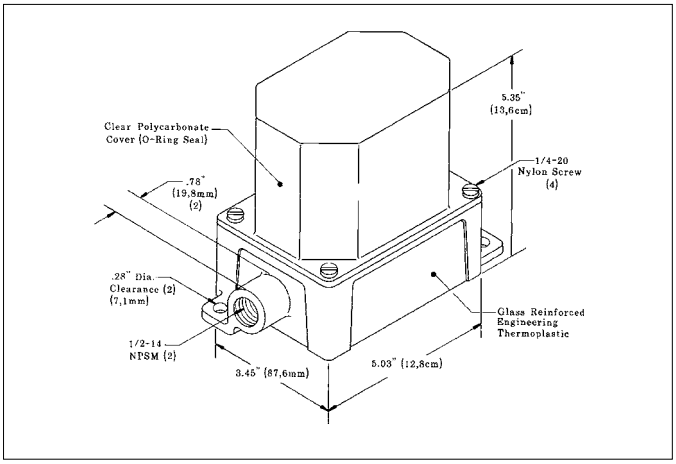
35mm DIN Rail Track

Track model DIN-35-70 accomodates one RS-11 socket. Model DIN-35-105 holds two sockets. Model DIN-35-140 holds up to three sockets. The RS-11 socket is designed to snap (or slide) directly into the 35mm DIN track.



Model BENC-4 Enclosure

Model BENC-4 is a NEMA-4 rated corrosion-resistant enclosure for a MAXI-AMP module or other control device. It is supplied with a DIN-35-70 track for easy mounting of one RS-11 socket. For mounting two sockets, use DIN-35-105.



MAXI-AMP™ CI3RC

Current Trip Point Module

BANNER
the photoelectric specialist

- **Self-contained current sensing amplifier**
- **Works with intrinsically safe barrier to provide power to a Banner SMI912 intrinsically safe DC sensor; converts the signal coming from the sensor to a contact closure**
- **Powered by 105-130 or 210-250V ac (50/60Hz)**
- **INHIBIT input allows use of "gating" sensor**
- **Two output devices: SPDT 5 amp electromechanical relay and opto-isolated transistor for logic level dc switching**

CI3RC module (left) shown with RS-11 socket and DIN rail; also VALU-BEAM SMI912 Series sensor and intrinsic safety barrier.

The Banner MAXI-AMP model CI3RC is a self-contained module which converts the current output signal of an SMI912 series VALU-BEAM to a trip point switch.

VALU-BEAM SMI912 series sensors (see Banner catalog or data sheet P/N 03396) carry Factory Mutual Research's rating for use in hazardous areas. Sensors are wired to model CI3RC using the two-wire hookup, which requires the use of one intrinsic-safety barrier (see next page). In this mode, the SMI912 sensor sinks ≤10 milliamps in the "OFF" state and ≥20 milliamps in the "ON" state. Model CI3RC senses this current change and switches internal relays that may be easily wired to most loads and/or additional control circuitry.

Model CI3RC is powered by either 105-130 or 210-250V ac. The module supplies the power to operate the SMI912 sensor. There are two inputs. A sensor may be connected to the second input to "inhibit" the module output (this use requires an additional barrier). This is useful for "gating" schemes used in inspection or flow control applications. Both inputs are protected against short circuits. Built-in circuit diagnostics indicate an overload of either input by flashing an LED status light.

The MAXI-AMP CI3RC module has two isolated output switches. There is a 5-amp rated SPDT electromechanical relay, and a solid-state transistor switch which may be used for logic-level interfaces.

Banner also offers the CI3RC in kit form for connection to either one or two sensors. See the next page for more information.

SPECIFICATIONS

SUPPLY VOLTAGE: 105 to 130 or 210 to 250V ac, 50/60 Hz (8VA)

OUTPUT CONFIGURATION:
SPDT electromechanical relay:
Contact rating: 250V ac max., 24V dc max., 5 amps max. (resistive load), 1/10 HP at 240V ac. Install transient suppressor (MOV) across contacts which switch inductive loads.
Closure time: 10 milliseconds max.
Release time: 10 milliseconds max.
Maximum switching speed: 20 operations/second.
Mechanical life: 20,000,000 operations
Solid-state dc relay: SPST optically-coupled transistor; 30V dc max., 20mA max.

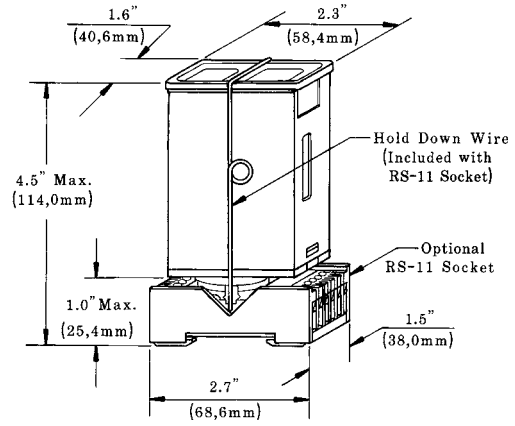
INPUTS:
Trip point for output "OFF": ≤10 milliamps
Trip point for output "ON": ≥20 milliamps
Trip point range for input overload indication:
30mA ≤ I ≤ 80mA.

INDICATOR LEDs: Status indicators for INHIBIT input, OUTPUT "ON", and INPUT (or INHIBIT input) overload/short.

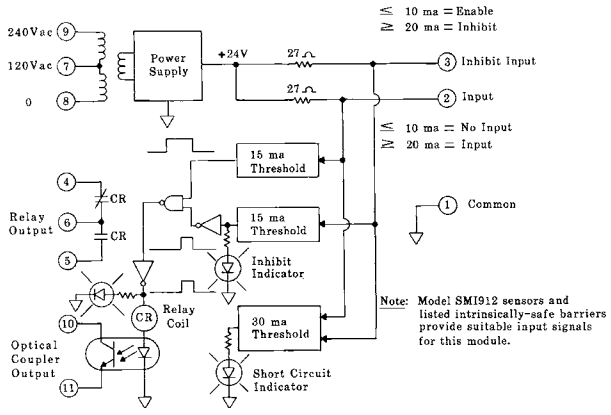
OPERATING TEMPERATURE: 0 to 50°C (32 to 122°F).

CONSTRUCTION: rugged NORYL® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole base. Use RS-11 socket or equivalent.

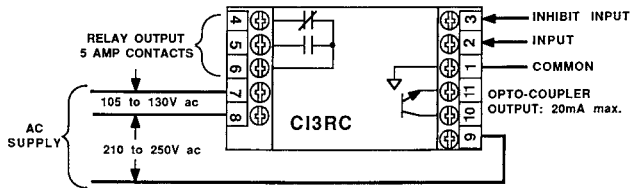
DIMENSION DRAWING



FUNCTIONAL SCHEMATIC



GENERALIZED HOOKUP



WARNING This photoelectric sensing product does NOT include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A failure or malfunction can result in either an energized or a de-energized output condition.

Never use this product as a sensing device for personnel protection. Its 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.

SMI912 Series sensors are certified intrinsically safe ONLY when used with certified energy-limiting intrinsically-safe barriers. Banner does not itself manufacture intrinsically-safe barriers. Barriers may, however, be purchased from Banner as part of a kit which includes one CI3RC current trip point module, one module socket, one 70mm length of DIN rail (for mounting of socket), one DIN rail barrier mount, and one (in kit model CIBK-1) or two (in kit model CIBK-2) certified barriers.

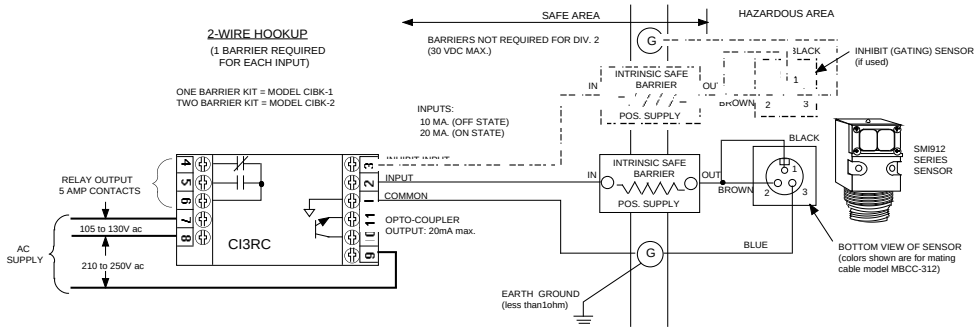
An SMI912 Series sensor is wired through a barrier using the 2-wire hookup. In the 2-wire hookup configuration, the sensor acts as a current sink, drawing less than 10mA in the OFF state and more than 20mA in the ON state. Model CI3RC senses this current change and switches internal relays. The SPDT electromechanical relay in the CI3RC can switch a load which draws up to 5 amps (see specifications). The SPST solid-state relay can switch a dc load of up to 30V dc, max.; 20mA, max.

Terminal #3 of the CI3RC serves as an "INHIBIT" input. This input is used with a second sensor and barrier, shown by the dashed outline in hookup diagram "A". The INHIBIT input is useful for "gating" schemes used in inspection or flow control applications.

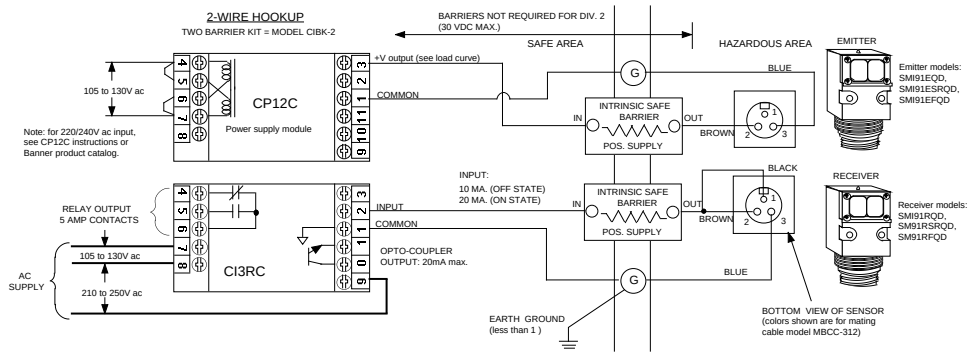
Emitter-only units (SMI91EQD, ESRQD, EFQD) use the 2-wire hookup through a barrier (hookup diagram "B"). The power requirement for each emitter is 10 to 30V dc at 25mA max. Banner power supply model CP12C is recommended for powering up to 10 emitters.

The user of this equipment is responsible for the proper installation and maintenance of the equipment, and must conform with certification requirements relating to barriers and to maximum allowable capacitance and inductance of field wiring. If you have questions about these requirements, Banner applications engineers can refer you to the proper authority.

HOOKUP DIAGRAM A: SMI912 Series SENSOR HOOKUP to CI3RC



HOOKUP DIAGRAM B: SMI91 Series EMITTER/RECEIVER HOOKUP



CIBK-1 & CIBK-2 Kits for Intrinsically Safe Sensors

Model CIBK-1 intrinsic safety kit includes one model CI3RC current amplifier, one intrinsic safety barrier, one socket, and DIN rail mounts. Kit CIBK-1 includes all of the items shown in the photograph (page 1), with the exception of the VALU-BEAM sensor.

For information on VALU-BEAM® SMI912 Series intrinsic safe sensors, see product data sheet P/N 03396 or the Banner product catalog.

Kit CIBK-2 is similar to kit CIBK-1, but contains two intrinsic safety barriers.

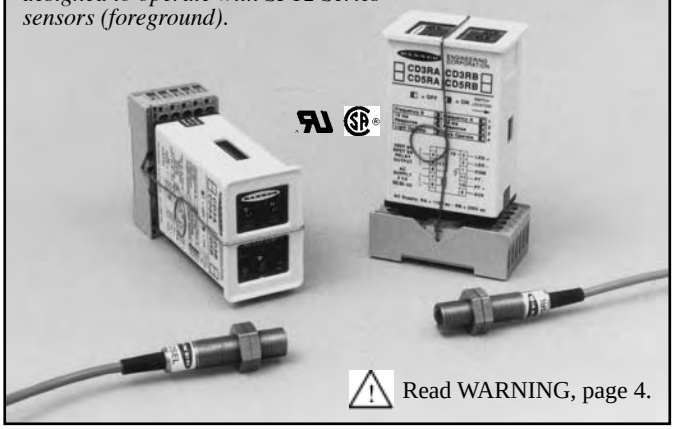
MAXI-AMP™ CD Series

Programmable Modulated Amplifier and Control Modules for use with SP12 Series Preamplified Remote Photoelectric Barrel Sensors

the photoelectric specialist

- **Modulated photoelectric amplifier, power supply, output relay, and versatile timing logic (CD5 models) in one compact, stand-alone package**
- **120 or 240V ac or 12-28V dc operation; requires only the addition of a Banner SP12 preamplified opposed mode sensor pair to create a powerful sensing system**
- **CD5 models are easily programmed for any of *twelve* delay, one-shot, and latch functions (either single or dual timing); interrogation schemes are possible using auxiliary input**
- **Exceptionally high immunity to ambient light and electrical noise; no false pulse on power-up**
- **Rugged, 15-turn potentiometers for precise timing and sensitivity adjustment; tough Noryl® housing**
- **Includes Banner's *exclusive* AID™ alignment system**

MAXI-AMP™ CD Series amplifier and control modules are designed to operate with SP12 Series sensors (foreground).



Read WARNING, page 4.

CD Series MAXI-AMP modules combine power supply, modulated photoelectric amplifier, timing logic (in CD5 models) and output switch in a single compact, cost-saving module. CD Series modules work together with Banner SP12 Series preamplified remote sensors. These sensors offer small size and high power, and are built to operate in highly demanding sensing environments. Their preamplified design gives them exceptionally high immunity to electrical noise (see Banner product data sheet P/N 34466 for further information). MAXI-AMP modules themselves are also ruggedly built for dependable industrial duty.

CD Series MAXI-AMP modules contain a state-of-the-art Banner CMOS modulator/demodulator/amplifier circuit that offers high immunity to both ambient light and electrical interference plus reliable sensor performance. All models have Banner's *exclusive*, patented Alignment Indicating Device (AID™) system*, which lights an LED indicator whenever the receiver sees a "light" condition, and pulses the LED at a rate proportional to the received light signal strength. MAXI-AMP modules operate from a variety of voltages (see tables at right).

All CD Series modules are programmable for LIGHT or DARK operate. Module input response time may be set at either 1.5 or 15 milliseconds. The 15-millisecond response mode offers maximum sensing power (excess gain) with SP12 Series sensors. CD Series modules also feature selectable sensor modulation frequencies ("A" and "B"). This makes it possible to operate two high-powered SP12 Series sensor pairs using different modulation frequencies (at the same response time setting) in close proximity to each other without optical crosstalk.

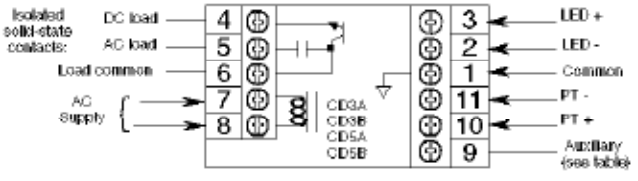
CD5 models include a versatile multi-function timing logic circuit that is programmable for 12 popular and useful delay, one-shot, and latch functions. Each timing function has a choice of three time ranges. Timing and sensitivity adjustments use rugged 15-turn potentiometers for very accurate settings. CD Series module circuit design prevents false outputs on system power-up.

The output circuit for CD3A, 3B, 5A, and 5B modules consists of two SPST solid-state switches: one for ac loads of up to 250V ac (3/4 amp), and a second for dc loads of up to 30V dc (50 mA). Models CD5RA and CD5RB have a 5-amp SPDT electromechanical relay. CD3RA and CD3RB modules have a 5-amp SPDT electromechanical relay *plus* an NPN transistor solid-state switch. For more information on output circuit load capability, refer to the tables (right) and the Specifications section on the next page.

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CD3RA	105 to 130V ac, or 12 to 28V dc	SPDT electromechanical relay, plus NPN transistor solid-state switch	ON/OFF
CD3RB	210 to 250V ac, or 12 to 28V dc		
CD5RA	105 to 130V ac, or 12 to 28V dc	SPDT electromechanical relay (5 amp contact rating)	12 timing functions
CD5RB	210 to 250V ac, or 12 to 28V dc		

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CD3A	105 to 130V ac, or 12 to 28V dc	SPST solid-state contact for switching AC loads up to 250V ac and 3/4 amp, plus solid-state contact for switching DC loads up to 30V dc and up to 50mA.	ON/OFF
CD3B	210 to 250V ac, or 12 to 28V dc		
CD5A	105 to 130V ac, or 12 to 28V dc		12 timing functions
CD5B	210 to 250V ac, or 12 to 28V dc		

Generalized Hookup: models with solid-state output



MAXI-AMP™ CD Series Modules Specifications

SUPPLY VOLTAGE: Models CD3(R)A, CD5(R)A: 105 to 130V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA. **Models CD3(R)B, CD5(R)B:** 210 to 250V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA.
NOTE: do not connect ac power when using external dc power.

OUTPUT CONFIGURATION:
CD3A, CD3B, CD5A, CD5B: Two solid-state SPST switches, one for ac loads of up to 250V ac and up to 3/4 amp, the other for dc loads of up to 30V dc and up to 50mA. **CD3A and CD3B also have a logic level current sinking NPN transistor switch** at pin #9, maximum load 20mA at 12V dc max.

CD3RA and CD3RB: SPDT electromechanical relay (see specifications, below) plus an NPN transistor solid-state logic-level dc switch (at pin #9, maximum load 20mA at 12V dc max.).
CD5RA and CD5RB: SPDT electromechanical relay (specs below).

SPDT Electromechanical Relay Specifications:
CONTACT RATING: 250V ac max, 24V dc max, 5 amps max. (resistive load), 1/10 H.P. at 240V ac. Install a transient suppressor (MOV) across contacts that switch inductive loads.
CLOSURE TIME: 10 milliseconds max.
RELEASE TIME: 10 milliseconds max.
MAXIMUM SWITCHING SPEED: 20 operations/second
MECHANICAL LIFE: 20,000,000 operations

AMPLIFIER:
RESPONSE SPEED: Programmable for 1.5 or 15 milliseconds. NOTE: use 15 millisecond setting for maximum sensor excess gain.
MODULATION FREQUENCY: selectable, "A" or "B".

SENSOR LEAD LENGTH: 100 feet (30 m) maximum, each sensor. When splicing, use *separate* cable for emitter and receiver, or order sensors with extended cable length.

SENSOR HOOKUP: One SP12 Series opposed mode sensor pair per amplifier module. Additionally, one self-contained sensor may be connected at pin #9 (CD5 models) to provide a RESET or INHIBIT signal. +15V dc power for this one additional sensor is available at module pin #3 (40mA maximum load).

TIMERS (CD5 models only):

Timing ranges:	LOW range - 10 to 150 milliseconds MIDDLE range - 0.1 to 1.5 seconds HIGH range - 1 to 15 seconds
Repeatability:	+/-2% of set time over all extremes of supply voltage and temperature

ADJUSTMENTS: Miniature switches are provided for programming of LIGHT/DARK operate, amplifier response time, modulation frequency, normally open or normally closed output and timing function (CD5 models). 15-turn clutched potentiometer for gain (sensitivity) and time settings (CD5 models).

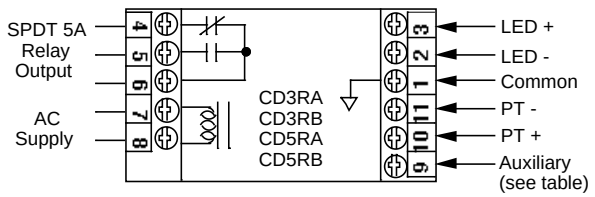
OPERATING TEMPERATURE: 0 to 50°C (+32 to 122°F).

INDICATOR LEDs: Two LEDs. A red indicator LED is "ON" when the module output is energized. Exclusive Banner Alignment Indicating Device (AID™) system lights another red LED indicator whenever the receiver "sees" its own modulated light source, and pulses it at a rate proportional to the strength of the received light signal.

CONSTRUCTION: Rugged Noryl® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole plug base.

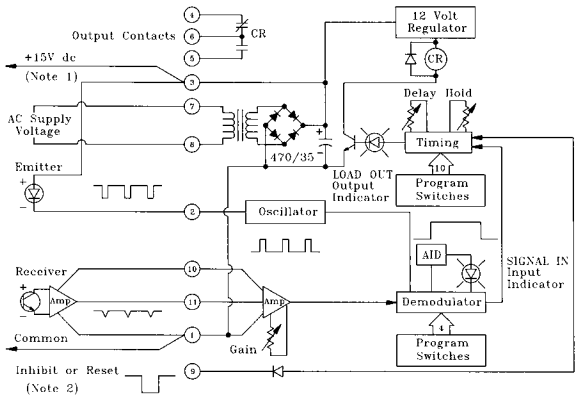
Noryl® is a registered trademark of General Electric Co.

Generalized Hookup:
models with electromechanical relay output



Functional Schematics

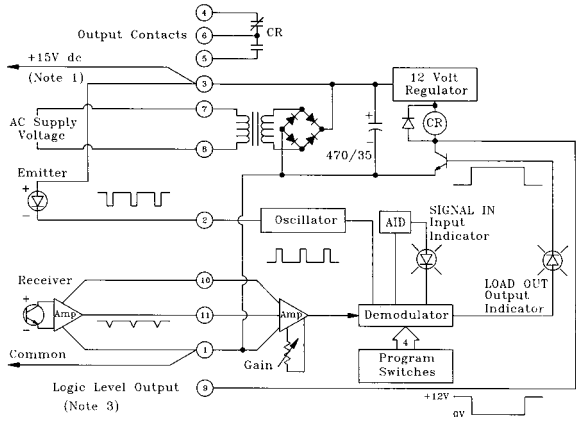
Models CD5RA, CD5RB



NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example, page 3). Current available is 40 mA at 120V ac (240V ac) line level; 30mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). ***Do not connect ac voltage when using external dc power.***

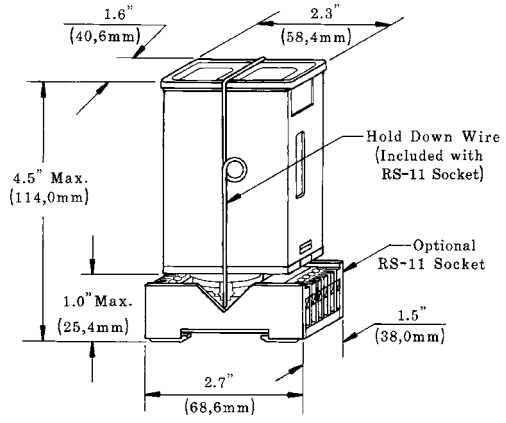
NOTE #2: pulling pin #9 low (to common) will inhibit the timing, or reset the latch of CD5 models (see "Description of Logic Functions", page 5).
NOTE #3: pin #9 of CD3 models may be connected directly as the input to Banner

Models CD3RA, CD3RB



CL Series MAXI-AMPs or to Banner MICRO-AMP™ or Plug Logic modules (see hookup example, page 3).

Dimension Drawing



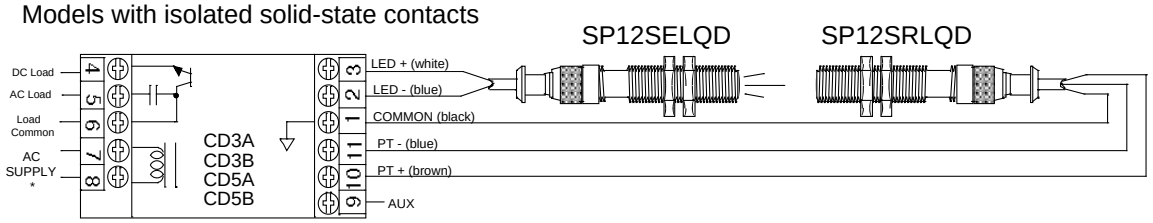
MAXI-AMP CD Series

SP12 Sensor Hookup to CD Series MAXI-AMP™ Modules

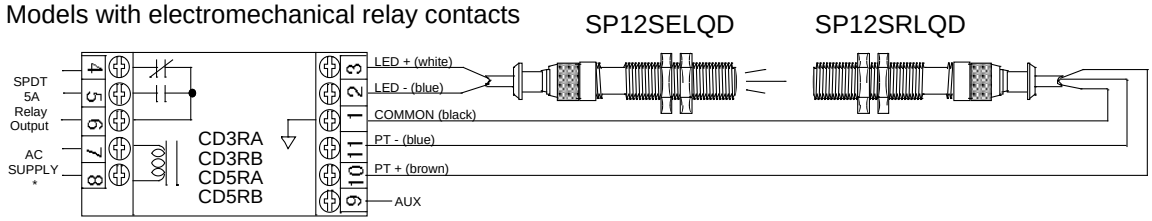
1) Hookup of SP12 Series Sensors (all models)

SP12 Series sensors are especially designed for use with CD Series modules. The basic hookup is given here. Each MAXI-AMP™ CD Series module supports use of one pair of SP12 Series sensors. CD5 Series module models also support use of a GATE or INHIBIT sensor at pin #9 (below, this page).

Models with isolated solid-state contacts



Models with electromechanical relay contacts

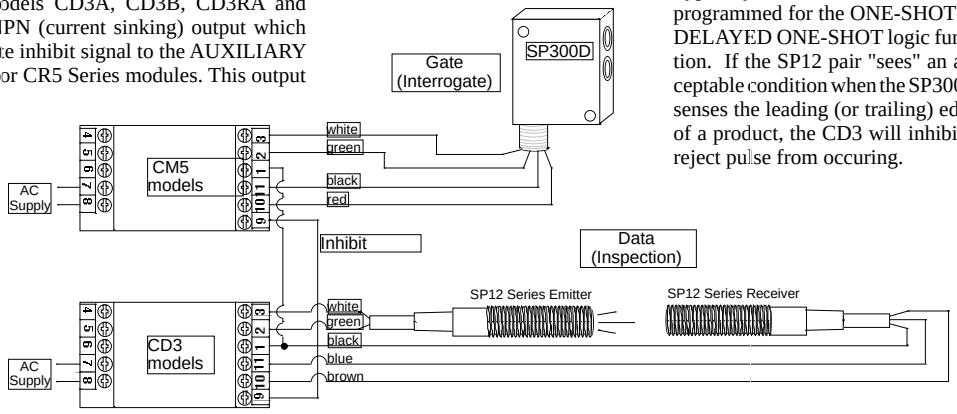


*105 to 130V ac or 210 to 250V ac, 50/60Hz, depending on model. To power the MAXI-AMP™ module from a dc supply, connect +12 to 28V dc at 70mA to terminal #3 and dc common to terminal #1. Make no connection to terminal #7 or #8.

2) Logic Level NPN Output (CD3 models)

The AUXILIARY terminal (#9) of models CD3A, CD3B, CD3RA and CD3RB modules offers a logic-level NPN (current sinking) output which may be used as a fast-response solid-state inhibit signal to the AUXILIARY input of MAXI-AMP CD5, CL5, CM5, or CR5 Series modules. This output may also serve as an input to any MICRO-AMP™, Plug Logic, or CL Series logic module. In addition, this output may interface to other dc devices or circuits like counters, rate meters, or programmable logic controllers. Switching capacity is 20mA at 12V dc.

The example here shows the use of SP12 Series sensors and a CD3 module to provide inspection information, with the SP300D functioning as a product (GATE) sensor.



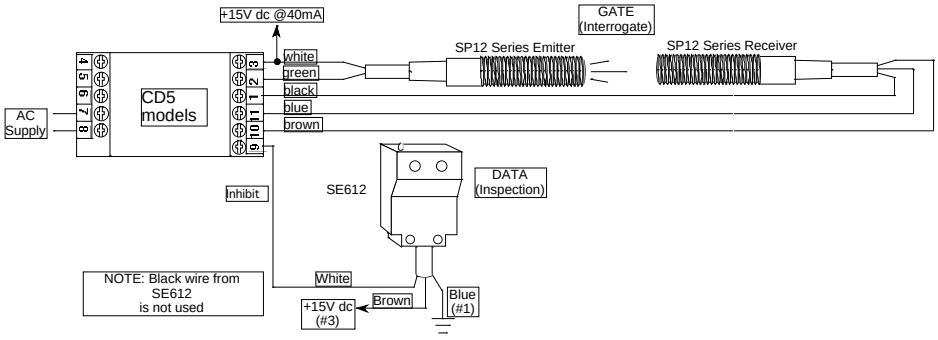
Typically, the CM5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the SP12 pair "sees" an acceptable condition when the SP300D senses the leading (or trailing) edge of a product, the CD3 will inhibit a reject pulse from occuring.

See Hookup Diagram #1 (above) for load and power connection information.

3) Power for External Devices (all models)

External 10 to 30V dc devices such as self-contained sensors may be connected between terminals #3 (+) and #1 (-) of any CD series MAXI-AMP module. Terminal #3 offers 40mA maximum. This is sufficient to power most Banner self-contained dc sensors.

As the example at the right illustrates, the *current sinking* output of a self-contained sensor powered by the MAXI-AMP may be used as the input to the AUXILIARY terminal of a CD5 module.

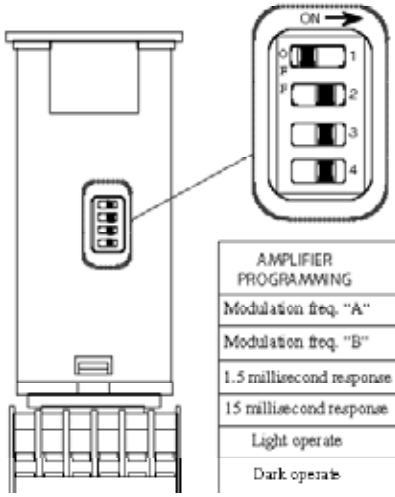


MAXI-AMP CD Se-

Amplifier Programming (all CD Series modules)

Amplifier response conditions may be programmed via the group of four switches located on one of the narrow sides of the MAXI-AMP™ module.

Switch #1 selects the modulation frequency of the amplifier and the emitter light source. When two pairs of SP12 Series sensors are being used in close proximity to each other, the modulation frequency switch of their respective CD Series modules should be set to *different* modulation frequencies. This makes it possible to use the two sensor pairs in close proximity without optical crosstalk. *Both amplifiers must be set for the **same** response time (either 1.5 or 15 milliseconds) to ensure freedom from crosstalk.*



AMPLIFIER PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4
Modulation freq. "A"	OFF	—	—	—
Modulation freq. "B"	ON	—	—	—
1.5 millisecond response	—	OFF	OFF	—
15 millisecond response	—	ON	ON	—
Light operate	—	—	—	ON
Dark operate	—	—	—	OFF

Switches #2 and #3 are used to program the amplifier response time. The 15 millisecond setting allows SP12 Series sensors to operate at their maximum excess gain.

Switch #4 is used to select LIGHT OPERATE or DARK OPERATE. In the LIGHT OPERATE mode, the output will energize (in ON/OFF or LATCH operation) or the timing function will initiate (in DELAY, ONE-SHOT, or LIMIT operation) when the receiver "sees" sufficient light (excess gain greater than 1X). In DARK OPERATE, the output will energize or timing will begin when the receiver is sufficiently dark (excess gain less than 1X).

The diagram at the left shows the location of switches 1-4, and the table summarizes the settings required for each response condition.

NOTE: An adhesive-backed mylar label is supplied. It may be marked to indicate switch programming and then applied to the MAXI-AMP housing as a switch cover.

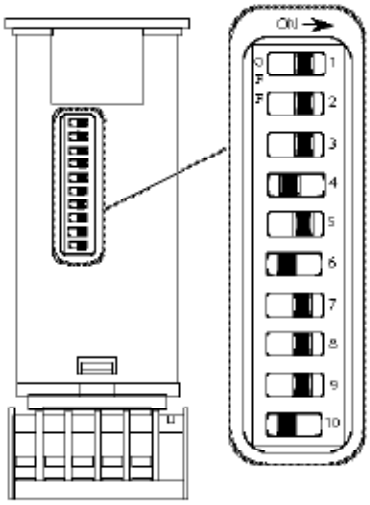
WARNING These photoelectric sensing devices do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in *either* an energized or a de-energized sensor output condition.

Never use these products as sensing devices for personnel protection. Their use as safety devices 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.

Timing Logic Programming (CD5 models)

Settings illustrated below are factory settings, and are "underlined" in the table.



TIMING LOGIC PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4	SWITCH #5	SWITCH #6	SWITCH #7	SWITCH #8	SWITCH #9	SWITCH #10
On/Off	ON	ON	ON	OFF	ON	OFF	ON	—	—	—
On Delay	ON	ON	OFF	OFF	ON	OFF	ON	—	—	—
Off Delay	ON	OFF	ON	OFF	ON	OFF	ON	—	—	—
On and Off Delay	ON	OFF	OFF	OFF	ON	OFF	ON	—	—	—
One-shot	OFF	OFF	ON	OFF	ON	OFF	ON	—	—	—
Delayed One-shot	OFF	OFF	OFF	OFF	ON	OFF	OFF	—	—	—
Limit	ON	ON	OFF	OFF	OFF	OFF	ON	—	—	—
Repeat Cycle	ON	OFF	OFF	ON	ON	OFF	ON	—	—	—
AC Latch	OFF	ON	ON	OFF	ON	ON	ON	—	—	—
DC Latch	ON	ON	ON	OFF	ON	ON	ON	—	—	—
Delay and Latch	ON	ON	OFF	OFF	ON	ON	ON	—	—	—
Limit and Latch	ON	ON	OFF	OFF	OFF	ON	ON	—	—	—

N/C Output	OFF	—	—
N/O Output	ON	—	—
.15 Sec. Max. Time	—	OFF	OFF
1.5 Sec. Max. Time	—	ON	OFF
15 Sec. Max. Time	—	OFF	ON

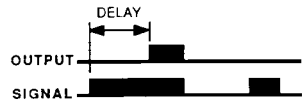
A group of ten switches, located on the side of the module opposite the amplifier program switches, is used to select the timing logic for the CD5 models.

Switches #1 through #7 are used to select the logic function. Switch #8 programs the output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for *both* functions of a dual timing mode (ON & OFF DELAY, DELAYED ONE-SHOT, and REPEAT CYCLE). However, DELAY and HOLD times are independently adjustable within the selected range.

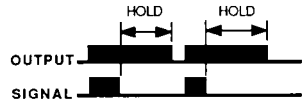
The diagram shows switch locations, and the table summarizes the program switch positions.

Description of Logic Functions, CD5 models

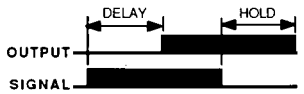
ON/OFF: ON/OFF operation does not involve timing. The output simply follows the action of the input signal. Grounding pin #9 (AUXILIARY) turns the output "off", regardless of the state of the input signal. This may be accomplished by closing a switch or relay contact between pins #9 and #1 (common), or by connecting an open collector NPN (current sinking) output of any external dc device directly to pin #9. NOTE: connect the COMMON of any external dc device to pin #1 of the MAXI-AMP to establish a voltage reference between the dc supply for the external device and the internal dc



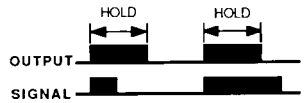
ON DELAY: The ON DELAY timer keeps the output "off" until the selected LIGHT or DARK signal has been present for the preset "DELAY" time. If the input signal is interrupted, the timing is reset and starts over with the next signal. Grounding pin #9 immediately cancels an output in progress and resets the delay timer. The delay timer is restarted when the inhibit signal is removed, if an input signal is present.



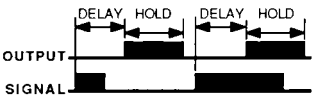
OFF DELAY: The output energizes immediately when the input signal occurs, but does not de-energize until the signal has been removed for the preset OFF-DELAY ("HOLD") time. Grounding pin #9 prevents an output from occuring.



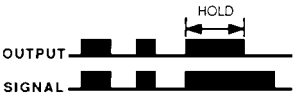
ON & OFF DELAY: ON and OFF DELAY logic combines both timing functions into a single mode. The ON-DELAY ("DELAY") time and the OFF-DELAY ("HOLD") time are independently adjustable within the selected time range. Momentary grounding of pin #9 during the ON-DELAY period resets the DELAY timer. An inhibit signal which occurs during an output will allow the output to stay energized for the remainder of the OFF-DELAY time. ON and OFF DELAY logic is often used in jam and void control, high/low level control, and edge-guiding applications.



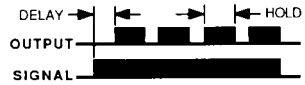
ONE-SHOT: The output of a ONE-SHOT function is a pulse of adjustable "HOLD" duration which is independent of the duration of the input signal. With the MAXI-AMP programmed for LIGHT operate, the pulse occurs when the input signal changes from dark to light. In DARK operate, the pulse occurs with a light to dark input transition. Grounding pin #9 prevents the one-shot from triggering, but does not affect a pulse already under way.



DELAYED ONE-SHOT: A DELAYED ONE-SHOT is initiated by either a momentary or maintained input signal. This input starts the adjustable "DELAY" period, after which the output pulses for an adjustable pulse ("HOLD") time. No further action occurs unless the input is removed and reapplied, beginning a new sequence. Grounding pin #9 during the delay period will cancel the sequence, and no output occurs. This feature is often used for inspection/rejection control logic. An inhibit signal will not affect a pulse under way.



LIMIT: The output of the LIMIT function follows the action of the input, as it does with the ON/OFF function. However, an input signal which is longer than the adjustable LIMIT ("HOLD") time will turn the output "off". Removing the input signal resets the timer. This function is sometimes called "TIME LIMITED ON/OFF", and is useful for energy conservation. Grounding pin #9 cancels the output. Lifting the inhibit restarts the LIMIT timer, if an input signal is present.

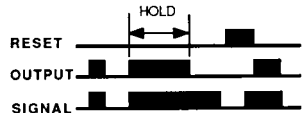


REPEAT CYCLE: The REPEAT CYCLE function provides an oscillating output when an input signal is present. Presence of an input signal triggers an adjustable "DELAY" timer. After the delay, the output energizes for an adjustable "HOLD" period. If the input remains, the output continues to cycle "on" and "off" at this rate indefinitely. When the signal is removed, any output in progress completes and then remains "off" until the next signal and DELAY period. Grounding pin #9 cancels the sequence, but will allow the completion of a "HOLD" period in progress. Lifting the inhibit signal begins

AC LATCH: An AC LATCH is the combination of a ONE-SHOT and a LATCH. A momentary or sustained input will latch the output "on". Grounding pin #9 will reset the latch, even if the input signal remains. The output will not re-latch until the input signal is removed and then reapplied.

DC LATCH: The output will latch "on" whenever the selected LIGHT or DARK input condition occurs. Grounding pin #9 of a dc latch will turn the output "off" regardless of the state of the input signal. If the signal is present when the reset is removed, the output will immediately latch "on" again.

DELAY AND LATCH: The DELAY + LATCH is a combination of the ON-DELAY and DC LATCH functions. An input must be present for at least the adjustable "DELAY" time for the output to latch "on". If the input signal is removed during the timing cycle, the timing is reset. Momentary grounding of pin #9 resets the latch and/or the DELAY timing cycle. Sustained grounding of pin #9 inhibits any output.



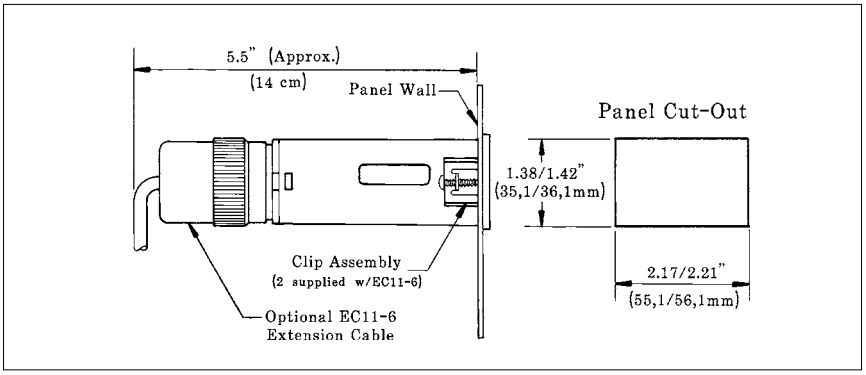
LIMIT AND LATCH: The LIMIT + LATCH operates exactly like the LIMIT function, except that the LIMIT ("HOLD") timer can be reset *only* by the auxiliary input. An output remains latched "off" until reset by momentarily grounding pin #9. In addition to resetting the timer, grounding pin #9 will hold the output "off", regardless of the state of the input signal.

MAXI-AMP System

Mounting and Accessories
Panel Wall Mounting of MAXI-AMP Module

After the panel cutout has been completed and de-burred, slide the MAXI-AMP through the cutout and place one clip assembly into the rectangular depression on each of the two narrow sides of the housing. Orient clips as shown, and alternately tighten the screws for equal pressure against the inside of the panel wall. Do not overtighten the screws. Attach the optional EC11-6 extension cable (described below) to the MAXI-AMP and route the opposite end of the cable to the RS-11 (or equivalent) socket.

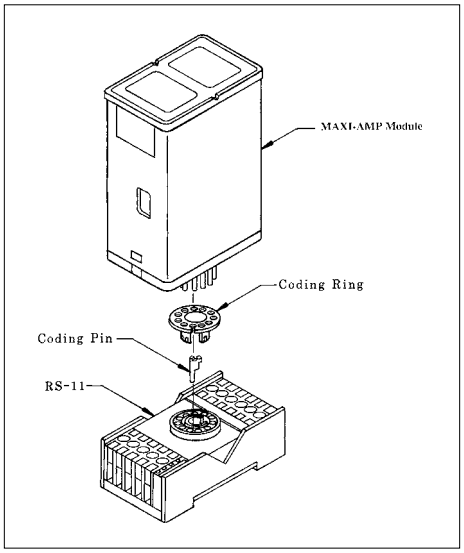
Model EC11-6 extension cable is 6 feet (2m) long. Clips for panel wall mounting of the MAXI-AMP are included with the cable.



Accessories for MAXI-AMP Modules

Model RS-11 Socket

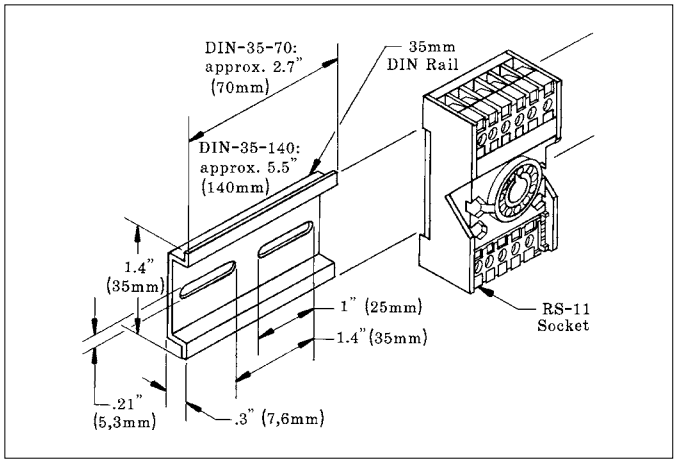
Model RS-11 is an eleven-pole round-pin screw terminal relay socket which is used to make electrical connections to any MAXI-AMP module. The socket provides in-line wire clamp screw terminals which will accept from one #24 AWG up to two #14 wires at each pin. The RS-11 is UL recognized (file #E92191) and CSA approved (file #LR38486). It may be mounted directly to a panel plate or via standard 35mm DIN-rail track (see below). A hold-down wire is supplied with each RS-11 socket (see dimension diagram on page 2).



The RS-11 is supplied with a coding ring and pin (see diagram at right). This allows a MAXI-AMP to be keyed to fit only its own 11-pin socket. The pin is installed in one of the eleven slots in the RS-11, and the notch in the ring is aligned to slip over the pin. When the MAXI-AMP is removed from the RS-11, the coding ring stays with the MAXI-AMP base, while the coding pin remains in the socket.

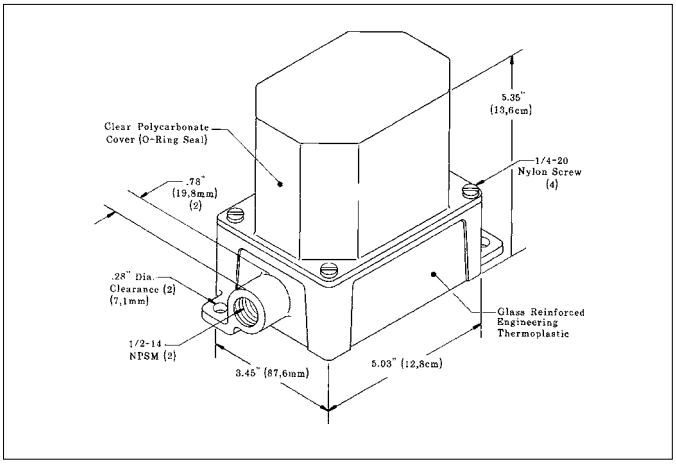
35mm DIN Rail Track

Track model DIN-35-70 accomodates one RS-11 socket. Model DIN-35-105 holds two sockets. Model DIN-35-140 holds up to three sockets. The RS-11 socket is designed to snap (or slide) directly into the 35mm DIN track.



Model BENC-4 Enclosure

Model BENC-4 is a NEMA-4 rated corrosion-resistant enclosure for a MAXI-AMP module or other control device. It is supplied with a DIN-35-70 track for easy mounting of one RS-11 socket. For mounting two sockets, use DIN-35-105.

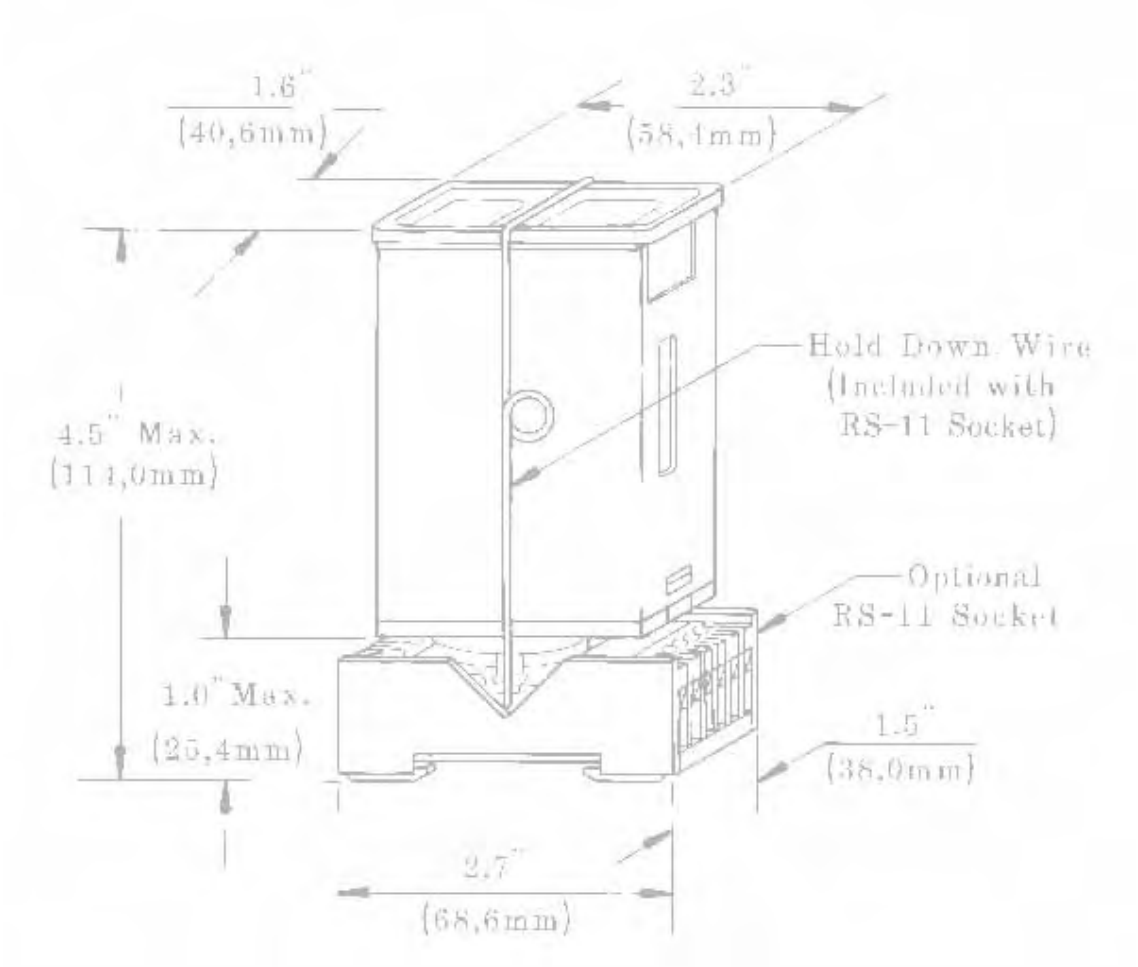


Product Line Specifications

the photoelectric specialist

MAXI-AMP® System

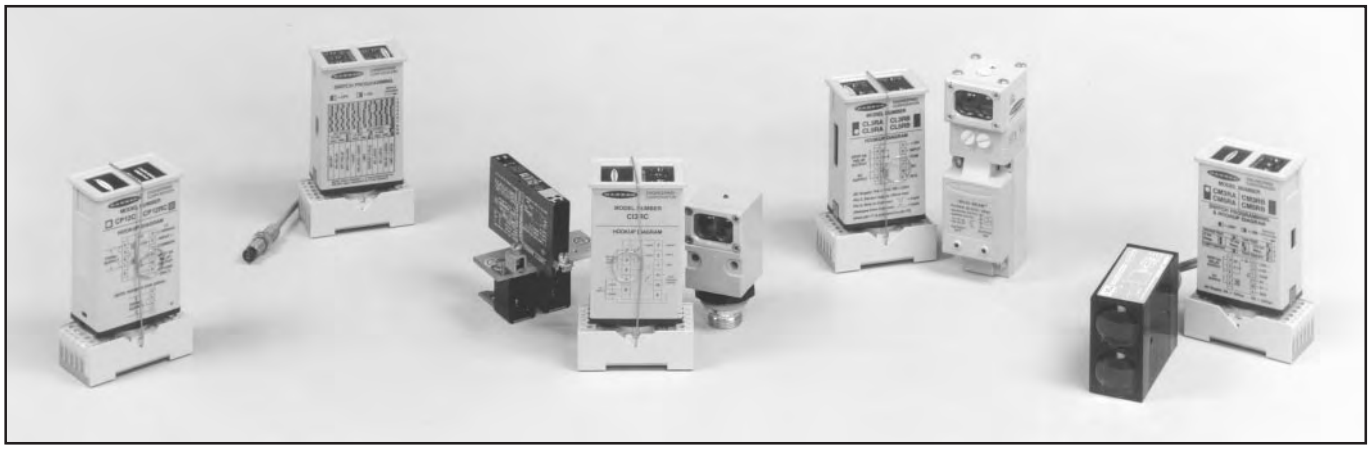
Stand-alone sensor control modules



- **Versatile, cost-effective sensor control modules: models available for use with most Banner photoelectric sensors**
- **Power supply, photoelectric amplifier (CD and CM Series), programmable timing logic (CD5, CM5, and CL5 models), and output relay in a single, compact plug-in module**
- **CD5, CL5, and CM5 models include 12 selectable delay, pulse, and latch timing logic functions (single or dual functions)**
- **All models have 5-amp SPDT electromechanical relay output (solid-state switch optional); some models offer additional solid-state dc switch (see table, page 2)**

MAXI-AMP™ System

Stand-alone Sensor Control Modules



Banner MAXI-AMPs are the most versatile and cost-effective sensor control modules available anywhere. MAXI-AMP system modules combine power supply, photoelectric amplifier (CD and CM series), programmable timing logic (CD5, CM5, and CL5 models), and output relay in a single, compact plug-in module. This integrated *stand-alone* design saves both the expense of a separate control chassis *and* a substantial amount of control panel space. MAXI-AMP modules are powered directly by AC line voltage. Models are available for either 120V ac or 220/240V ac operation.

CD Series MAXI-AMP modules accept input signals from SP12 Series preamplified remote sensors. The preamplified design of this system produces exceptionally high noise immunity.

CM Series MAXI-AMPs are designed to work with the popular line of Banner high-performance modulated *remote* sensors. The CR Series is a low-gain version of the CM Series, and is designed for use with the SP100 Series miniature remote sensors.

CL Series MAXI-AMP modules accept input signals from any Banner dc module and most dc self-contained sensors.

CI Series MAXI-AMPs provide the power supply, current amplifier, and output device for an SMI912 Series *intrinsically safe* sensor. CI Series modules are covered in data sheet P/N 03461.

CD5, CM5, and CL5 models include a multi-function timing logic circuit, which is easily programmed for twelve of the most popular and useful delay, pulse, and latch functions. MAXI-AMPs offer the choice of either single or dual timing functions *in the same module.*

MAXI-AMPs offer a 5-amp SPDT electromechanical relay output. Solid-state switches are available as an option. CD3, CM3 and CL3 models offer an additional solid state dc switch.

MAXI-AMPs are contained in a tough NORYL® housing which measures a compact 1.6 x 2.3 x 4". Electrical connections are made via any standard 11-pole round-pin relay socket (model RS-11).

All MAXI-AMP system modules (except model CI3RC) are CSA certified and UL recognized.

MODULE MODEL	SUPPLY VOLTAGE	USED WITH (INPUT)	OUTPUT CONFIGURATION	LOGIC FUNCTION(S)	REFER TO PAGES ...
CD3RA	105 to 130V ac, or 12 to 28V dc	CD Series MAXI-AMP modules contain a modulated photoelectric amplifier for use with SP12 Series preamplified remote sensors (pp. 7-9).	SPDT electromechanical relay, plus NPN transistor solid-state switch	ON/OFF (output follows input)	See pages 3-9
CD3RB	210 to 250V ac, or 12 to 28V dc				
CD5RA	105 to 130V ac, or 12 to 28V dc		SPDT electromechanical relay	Selection of 12 programmable functions including delay, pulse, limit, cycle, and latch	
CD5RB	210 to 250V ac, or 12 to 28V dc				
CM3RA	105 to 130V ac, or 12 to 28V dc	CM Series MAXI-AMP modules contain a modulated photoelectric amplifier for use with the full complement of Banner high performance modulated remote sensors (pp. 13-17).	SPDT electromechanical relay, plus NPN transistor solid-state switch	ON/OFF (output follows input)	See pages 10-17
CM3RB	210 to 250V ac, or 12 to 28V dc				
CM5RA	105 to 130V ac, or 12 to 28V dc		SPDT electromechanical relay	Selection of 12 programmable functions including delay, pulse, limit, cycle, and latch	
CM5RB	210 to 250V ac, or 12 to 28V dc				
CL3RA	105 to 130V ac, or 12 to 28V dc	CL Series modules accept signals from any Banner DC sensor or module with NPN (current sinking) output.	SPDT electromechanical relay, plus NPN transistor solid-state switch	ON/OFF (output follows input)	See pages 18-21
CL3RB	210 to 250V ac, or 12 to 28V dc				
CL5RA	105 to 130V ac, or 12 to 28V dc		SPDT electromechanical relay	Selection of 12 programmable functions including delay, pulse, limit, cycle, and latch	
CL5RB	210 to 250V ac, or 12 to 28V dc				
CI3RC	105 to 130V ac or 210 to 250V ac	SMI912 series intrinsically safe sensors.	SPDT E/M relay, isolated solid state DC switch	ON/OFF (output follows input)	See data sheet 03461
CP12RC		Supplies 400mA to power MAXI-AMP modules and/or other 10-30V dc sensing devices.	SPDT electromechanical relay		See page 22
CP12C			No output device (power supply only)	No logic function (power supply only)	

MAXI-AMP™ CD Series

Programmable Modulated Amplifier and Control Modules

for use with SP12 Series Preamplified Remote Photoelectric Barrel Sensors

- **Modulated photoelectric amplifier, power supply, output relay, and versatile timing logic (CD5 models) in one compact, stand-alone package**
- **120 or 240V ac or 12-28V dc operation; requires only the addition of a Banner SP12 preamplified opposed mode sensor pair to create a powerful sensing system**
- **CD5 models are easily programmed for any of *twelve* delay, one-shot, and latch functions (either single or dual timing); interrogation schemes are possible using auxiliary input**
- **Exceptionally high immunity to ambient light and electrical noise; no false pulse on power-up**
- **Rugged, 15-turn potentiometers for precise timing and sensitivity adjustment; tough Noryl® housing**
- **Includes Banner's *exclusive* AID™ alignment system**

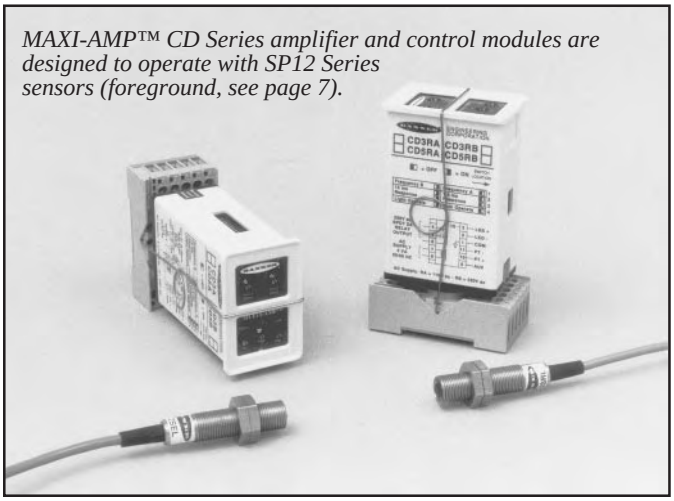
CD Series MAXI-AMP modules combine power supply, modulated photoelectric amplifier, timing logic (in CD5 models) and output switch in a single compact, cost-saving module. CD Series modules work together with Banner SP12 Series preamplified remote sensors. These sensors offer small size and high power, and are built to operate in highly demanding sensing environments. Their preamplified design gives them exceptionally high immunity to electrical noise (see page 7 for further information). MAXI-AMP modules themselves are also ruggedly built for dependable industrial duty.

CD Series MAXI-AMP modules contain a state-of-the-art Banner CMOS modulator/demodulator/amplifier circuit that offers high immunity to both ambient light and electrical interference plus reliable sensor performance. All models have Banner's *exclusive*, patented Alignment Indicating Device (AID™) system, which lights an LED indicator whenever the receiver sees a "light" condition, and pulses the LED at a rate proportional to the received light signal strength. MAXI-AMP modules operate from a variety of voltages (see tables at right).

All CD Series modules are programmable for LIGHT or DARK operate. Module input response time may be set at either 1.5 or 15 milliseconds. The 15-millisecond response mode offers maximum sensing power (excess gain) with SP12 Series sensors. CD Series modules also feature selectable sensor modulation frequencies ("A" and "B"). This makes it possible to operate two high-powered SP12 Series sensor pairs using different modulation frequencies (at the same response time setting) in close proximity to each other without optical crosstalk.

CD5 models include a versatile multi-function timing logic circuit that is programmable for 12 popular and useful delay, one-shot, and latch functions. Each timing function has a choice of three time ranges. Timing and sensitivity adjustments use rugged 15-turn potentiometers for very accurate settings. CD Series module circuit design prevents false outputs on system power-up.

The output circuit for CD3A, 3B, 5A, and 5B modules consists of two SPST solid-state switches: one for ac loads of up to 250V ac (3/4 amp), and a second for dc loads of up to 30V dc (50 mA). Models CD5RA and CD5RB have a 5-amp SPDT electromechanical relay. CD3RA and CD3RB modules have a 5-amp SPDT electromechanical relay *plus* an NPN transistor solid-state switch. For more information on output circuit load capability, refer to the tables (right) and the Specifications section on the next page.

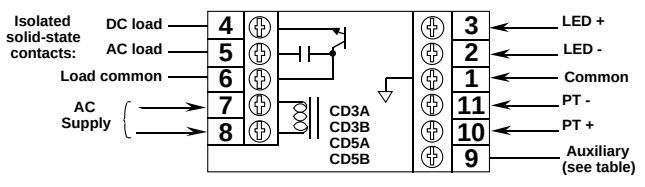


MAXI-AMP™ CD Series amplifier and control modules are designed to operate with SP12 Series sensors (foreground, see page 7).

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CD3RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay, plus NPN transistor solid-state switch	ON/OFF
CD3RB	210 to 250V ac, or 12 to 28V dc		
CD5RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay (5 amp contact rating)	12 timing functions
CD5RB	210 to 250V ac, or 12 to 28V dc		

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CD3A	105 to 130V ac, or 12 to 28V dc	SPST solid-state contact for switching AC loads up to 250V ac and 3/4 amp, plus solid-state contact for switching DC loads up to 30V dc and up to 50mA.	ON/OFF
CD3B	210 to 250V ac, or 12 to 28V dc		
CD5A	105 to 130V ac, or 12 to 28V dc		12 timing functions
CD5B	210 to 250V ac, or 12 to 28V dc		

Generalized Hookup: models with solid-state output



MAXI-AMP™ CD Series Modules Specifications

SUPPLY VOLTAGE: Models CD3(R)A, CD5(R)A: 105 to 130V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA. **Models CD3(R)B, CD5(R)B:** 210 to 250V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA. ***NOTE: do not connect ac power when using external dc power.***

OUTPUT CONFIGURATION:
CD3A, CD3B, CD5A, CD5B: Two solid-state SPST switches, one for ac loads of up to 250V ac and up to 3/4 amp, the other for dc loads of up to 30V dc and up to 50mA. **CD3A and CD3B also have a logic level current sinking NPN transistor switch** at pin #9, maximum load 20mA at 12V dc max.

CD3RA and CD3RB: SPDT electromechanical relay (see specifications, below) plus an NPN transistor solid-state logic-level dc switch (at pin #9, maximum load 20mA at 12V dc max.).
CD5RA and CD5RB: SPDT electromechanical relay (specs below).

SPDT Electromechanical Relay Specifications:
CONTACT RATING: 250V ac max, 24V dc max, 5 amps max. (resistive load), 1/10 H.P. at 240V ac. Install a transient suppressor (MOV) across contacts that switch inductive loads.
CLOSURE TIME: 10 milliseconds max.
RELEASE TIME: 10 milliseconds max.
MAXIMUM SWITCHING SPEED: 20 operations/second
MECHANICAL LIFE: 20,000,000 operations

AMPLIFIER:
RESPONSE SPEED: Programmable for 1.5 or 15 milliseconds. NOTE: use 15 millisecond setting for maximum sensor excess gain.

MODULATION FREQUENCY: selectable, "A" or "B".

SENSOR LEAD LENGTH: 100 feet (30 m) maximum, each sensor. When splicing, use *separate* cable for emitter and receiver, or order sensors with extended cable length.

SENSOR HOOKUP: One SP12 Series opposed mode sensor pair per amplifier module. Additionally, one self-contained sensor may be connected at pin #9 (CD5 models) to provide a RESET or INHIBIT signal. +15V dc power for this one additional sensor is available at module pin #3 (40mA maximum load).

TIMERS (CD5 models only):
Timing ranges: LOW range - 10 to 150 milliseconds
MIDDLE range - 0.1 to 1.5 seconds
HIGH range - 1 to 15 seconds
Repeatability: +/-2% of set time over all extremes of supply voltage and temperature

ADJUSTMENTS: Miniature switches are provided for programming of LIGHT/DARK operate, amplifier response time, modulation frequency, normally open or normally closed output and timing function (CD5 models). 15-turn clutched potentiometer for gain (sensitivity) and time settings (CD5 models).

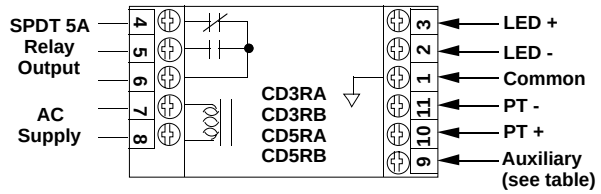
OPERATING TEMPERATURE: 0 to 50°C (+32 to 122°F).

INDICATOR LEDs: Two LEDs. A red indicator LED is "ON" when the module output is energized. Exclusive Banner Alignment Indicating Device (AID™) system lights another red LED indicator whenever the receiver "sees" its own modulated light source, and pulses it at a rate proportional to the strength of the received light signal.

CONSTRUCTION: Rugged Noryl® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole plug base.

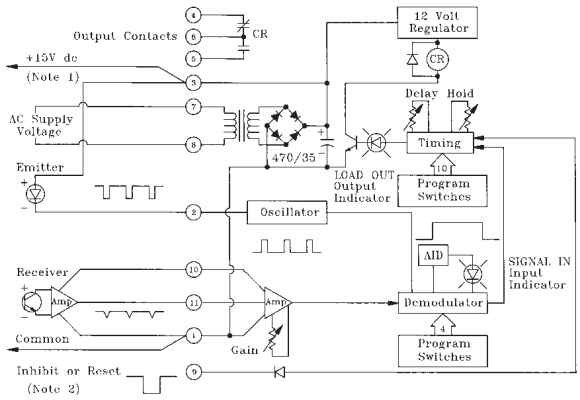
Noryl® is a registered trademark of General Electric Co.

Generalized Hookup:
models with electromechanical relay output



Functional Schematics

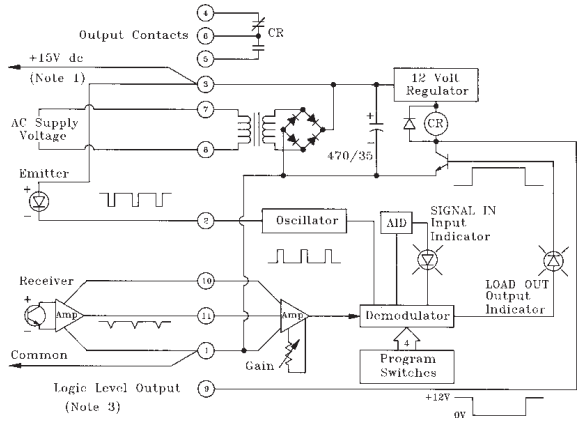
Models CD5RA, CD5RB



NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example, page 9). Current available is 40 mA at 120V ac (240V ac) line level; 30mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). ***Do not connect ac voltage when using external dc power.***

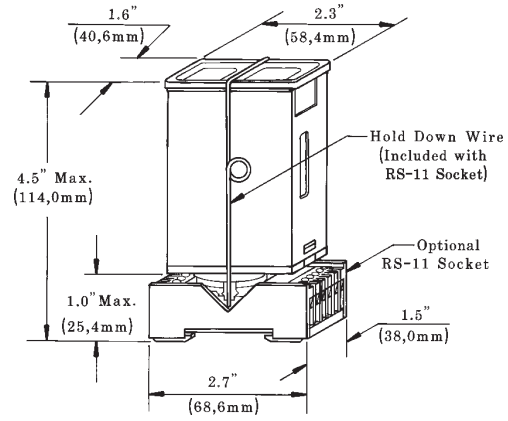
NOTE #2: pulling pin #9 low (to common) will inhibit the timing, or reset the latch of CD5 models (see "Description of Logic Functions", page 6).

Models CD3RA, CD3RB



NOTE #3: pin #9 of CD3 models may be connected directly as the input to Banner CL Series MAXI-AMPs or to Banner MICRO-AMP™ or Plug Logic modules (see hookup example, page 9).

Dimension Drawing



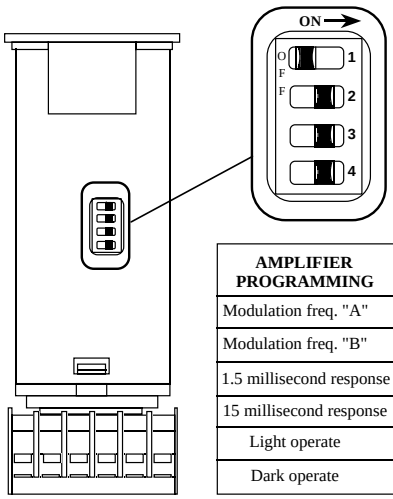
Amplifier Programming (all CD Series modules)

Amplifier response conditions may be programmed via the group of four switches located on one of the narrow sides of the MAXI-AMP™ module.

Switch #1 selects the modulation frequency of the amplifier and the emitter light source. When two pairs of SP12 Series sensors are being used in close proximity to each other, the modulation frequency switch of their respective CD Series modules should be set to *different* modulation frequencies. This makes it possible to use the two sensor pairs in close proximity without optical crosstalk. *Both amplifiers must be set for the **same** response time (either 1.5 or 15 milliseconds) to ensure freedom from crosstalk.*

Switches #2 and #3 are used to program the amplifier response time. The 15 millisecond setting allows SP12 Series sensors to operate at their maximum excess gain.

Switch #4 is used to select LIGHT OPERATE or DARK OPERATE. In the LIGHT OPERATE mode, the output will energize (in ON/OFF or LATCH operation) or the timing function will initiate (in DELAY, ONE-SHOT, or LIMIT operation) when the receiver "sees" sufficient light (excess gain greater than 1X). In DARK OPERATE, the output will energize or timing will begin when the receiver is sufficiently dark (excess gain less than 1X).



Factory settings are shown at left. The "underlined" settings in table below are factory settings.

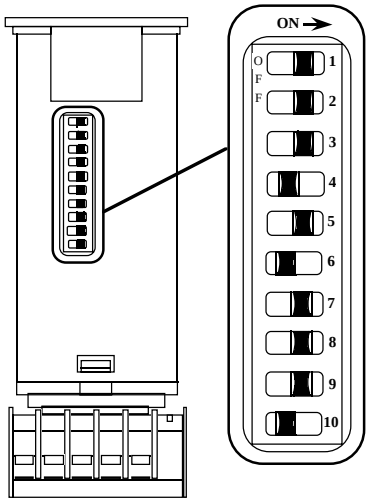
AMPLIFIER PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4
Modulation freq. "A"	**OFF**	—	—	—
Modulation freq. "B"	**ON**	—	—	—
1.5 millisecond response	—	**OFF**	**OFF**	—
15 millisecond response	—	**ON**	**ON**	—
Light operate	—	—	—	**ON**
Dark operate	—	—	—	**OFF**

The diagram at the left shows the location of switches 1-4, and the table summarizes the settings required for each response condition.

NOTE: An adhesive-backed mylar label is supplied. It may be marked to indicate switch programming and then applied to the MAXI-AMP housing as a switch cover.

Timing Logic Programming (CD5 models)

Settings illustrated below are factory settings. Factory settings are "underlined" in the table.



TIMING LOGIC PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4	SWITCH #5	SWITCH #6	SWITCH #7	SWITCH #8	SWITCH #9	SWITCH #10
On/Off	**ON**	**ON**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
On Delay	**ON**	**ON**	**OFF**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
Off Delay	**ON**	**OFF**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
On and Off Delay	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
One-shot	**OFF**	**OFF**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
Delayed One-shot	**OFF**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	—	—	—
Limit	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**ON**	—	—	—
Repeat Cycle	**ON**	**OFF**	**OFF**	**ON**	**ON**	**OFF**	**ON**	—	—	—
AC Latch	**OFF**	**ON**	**ON**	**OFF**	**ON**	**ON**	**ON**	—	—	—
DC Latch	**ON**	**ON**	**ON**	**OFF**	**ON**	**ON**	**ON**	—	—	—
Delay and Latch	**ON**	**ON**	**OFF**	**OFF**	**ON**	**ON**	**ON**	—	—	—
Limit and Latch	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**ON**	—	—	—

N/C Output		**OFF**	—	—
N/O Output		**ON**	—	—
.15 Sec. Max. Time	—		**OFF**	**OFF**
1.5 Sec. Max. Time	—		**ON**	**OFF**
15 Sec. Max. Time	—		**OFF**	**ON**

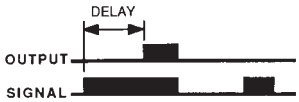
A group of ten switches, located on the side of the module opposite the amplifier program switches, is used to select the timing logic for the CD5 models.

Switches #1 through #7 are used to select the logic function. Switch #8 programs the output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for *both* functions of a dual timing mode (ON & OFF DELAY, DELAYED ONE-SHOT, and REPEAT CYCLE). However, DELAY and HOLD times are independently adjustable within the selected range.

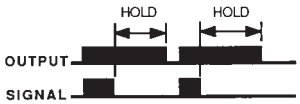
The diagram shows switch locations, and the table summarizes the program switch positions.

Description of Logic Functions for CD5, CL5, CM5, and CR5 models

ON/OFF: ON/OFF operation does not involve timing. The output simply follows the action of the input signal. Grounding pin #9 (AUXILIARY) turns the output "off", regardless of the state of the input signal. This may be accomplished by closing a switch or relay contact between pins #9 and #1 (common), or by connecting an open collector NPN (current sinking) output of any external dc device directly to pin #9. NOTE: connect the COMMON of any external dc device to pin #1 of the MAXI-AMP to establish a voltage reference between the dc supply for the external device and the internal dc supply of the MAXI-AMP.

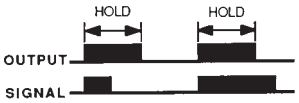


ON DELAY: The ON DELAY timer keeps the output "off" until the selected LIGHT or DARK signal has been present for the preset "DELAY" time. If the input signal is interrupted, the timing is reset and starts over with the next signal. Grounding pin #9 immediately cancels an output in progress and resets the delay timer. The delay timer is restarted when the inhibit signal is removed, if an input signal is present.

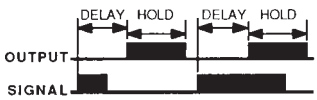


OFF DELAY: The output energizes immediately when the input signal occurs, but does not de-energize until the signal has been removed for the preset OFF-DELAY ("HOLD") time. Grounding pin #9 prevents an output from occuring. If an inhibit input occurs during an output, the output remains "on" for the remainder of the OFF-DELAY time.

ON & OFF DELAY: ON and OFF DELAY logic combines both timing functions into a single mode. The ON-DELAY ("DELAY") time and the OFF-DELAY ("HOLD") time are independently adjustable within the selected time range. Momentary grounding of pin #9 during the ON-DELAY period resets the DELAY timer. An inhibit signal which occurs during an output will allow the output to stay energized for the remainder of the OFF-DELAY time. ON and OFF DELAY logic is often used in jam and void control, high/low level control, and edge-guiding applications.



ONE-SHOT: The output of a ONE-SHOT function is a pulse of adjustable "HOLD" duration which is independent of the duration of the input signal. With the MAXI-AMP programmed for LIGHT operate, the pulse occurs when the input signal changes from dark to light. In DARK operate, the pulse occurs with a light to dark input transition. Grounding pin #9 prevents the one-shot from triggering, but does not affect a pulse already under way.



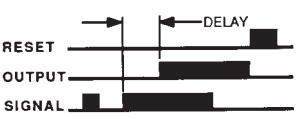
DELAYED ONE-SHOT: A DELAYED ONE-SHOT is initiated by either a momentary or maintained input signal. This input starts the adjustable "DELAY" period, after which the output pulses for an adjustable pulse ("HOLD") time. No further action occurs unless the input is removed and reapplied, beginning a new sequence. Grounding pin #9 during the delay period will cancel the sequence, and no output occurs. This feature is often used for inspection/rejection control logic. An inhibit signal will not affect a pulse under way.

LIMIT: The output of the LIMIT function follows the action of the input, as it does with the ON/OFF function. However, an input signal which is longer than the adjustable LIMIT ("HOLD") time will turn the output "off". Removing the input signal resets the timer. This function is sometimes called "TIME LIMITED ON/OFF", and is useful for energy conservation. Grounding pin #9 cancels the output. Lifting the inhibit restarts the LIMIT timer, if an input signal is present.

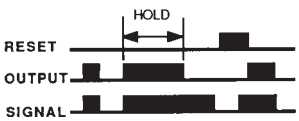
REPEAT CYCLE: The REPEAT CYCLE function provides an oscillating output when an input signal is present. Presence of an input signal triggers an adjustable "DELAY" timer. After the delay, the output energizes for an adjustable "HOLD" period. If the input remains, the output continues to cycle "on" and "off" at this rate indefinitely. When the signal is removed, any output in progress completes and then remains "off" until the next signal and DELAY period. Grounding pin #9 cancels the sequence, but will allow the completion of a "HOLD" period in progress. Lifting the inhibit signal begins the DELAY period, if an input signal is present.

AC LATCH: An AC LATCH is the combination of a ONE-SHOT and a LATCH. A momentary or sustained input will latch the output "on". Grounding pin #9 will reset the latch, even if the input signal remains. The output will not re-latch until the input signal is removed and then reapplied.

DC LATCH: The output will latch "on" whenever the selected LIGHT or DARK input condition occurs. Grounding pin #9 of a dc latch will turn the output "off" regardless of the state of the input signal. If the signal is present when the reset is removed, the output will immediately latch "on" again.



DELAY AND LATCH: The DELAY + LATCH is a combination of the ON-DELAY and DC LATCH functions. An input must be present for at least the adjustable "DELAY" time for the output to latch "on". If the input signal is removed during the timing cycle, the timing is reset. Momentary grounding of pin #9 resets the latch and/or the DELAY timing cycle. Sustained grounding of pin #9 inhibits any output.



LIMIT AND LATCH: The LIMIT + LATCH operates exactly like the LIMIT function, except that the LIMIT ("HOLD") timer can be reset *only* by the auxiliary input. An output remains latched "off" until reset by momentarily grounding pin #9. In addition to resetting the timer, grounding pin #9 will hold the output "off", regardless of the state of the input signal.

MAXI-AMP™ System

SP12 Series Opposed Mode Remote Modulated Barrel Sensors for use with MAXI-AMP CD Series Modules

- **Leakproof NEMA 6P threaded-barrel opposed mode remote sensor pairs; VALOX® or stainless steel housing**
- **Compact and powerful: 1/2" (12mm) in diameter by 2" long; 200-foot sensing range. Apertures are available.**
- **Special preamplified circuit design for noise immunity equal to that of self-contained sensors**

Banner SP12 Series sensors are a family of powerful, modulated, totally-encapsulated opposed mode remote sensor pairs in compact, threaded-barrel type housings. They are the ideal choice for applications that require high excess gain together with small size in difficult sensing environments. SP12 Series sensors are especially effective at penetrating heavy contaminants when used at close range.

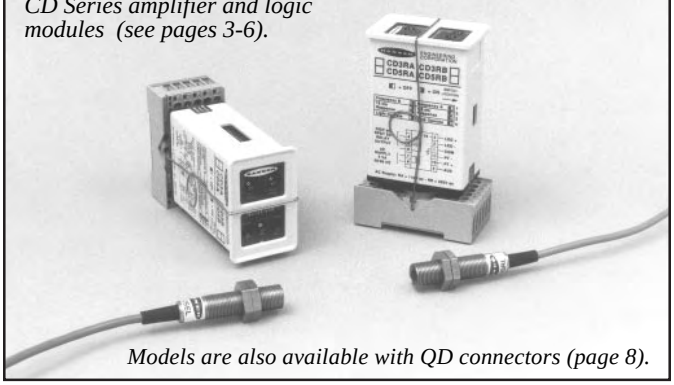
The preamplified design of these sensors results in exceptional noise immunity. Signals carried along remote receiver cables are often subject to interference (from electrical noise sources) that can be as strong as (or stronger than) the desired light signal. The severity of this problem often worsens with increasing sensor cable length. SP12 Series receivers contain a preamplifier that immediately boosts the received light signal to a high level before sending it down the cable to the rest of the sensing system.

SP12 Series sensors are designed for use with the Banner CD Series MAXI-AMP™ modules. CD Series modules provide sensor power, additional amplification, a choice of several programmable timing logic functions (CD5 models), and output circuitry for interfacing to a load. They also allow two different programmable sensor modulation frequencies, making it possible to use multiple high-powered sensor pairs in close proximity to each other without optical crosstalk. CD Series modules are available for a wide range of supply voltages. Each CD module powers one SP12 emitter/receiver pair. See page 3 for more information.

SP12 sensors are rated NEMA 6P (IEC IP67) for use in wet locations. There is a choice of either VALOX® or stainless steel housing style (see table, below). Positive sealing at both ends of the sensors, with no exposed epoxy interfaces, eliminates all leak paths (including capillary leakage). Electronics are fully encapsulated for maximum resistance to mechanical shock and vibration. Lenses are acrylic, and quad-ring sealed. These sensors may be used with watertight, thread-on apertures to create very narrow, very powerful effective beams (see next page).

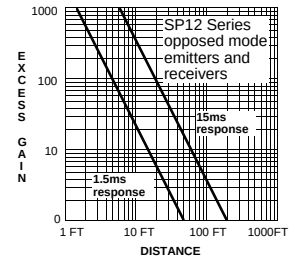
A 1/2" clearance hole is required for mounting. Alternatively, the Banner model SMB12MM mounting bracket may be used (see next page). SP12 Series sensors are supplied with 6-1/2 feet of PVC-covered attached cable, or QD connectors (page 8). Options for models with attached cable are summarized below. The maximum recommended emitter or receiver cable length is 100 feet (each).

SP12 Series sensors (foreground) shown with MAXI-AMP™ CD Series amplifier and logic modules (see pages 3-6).

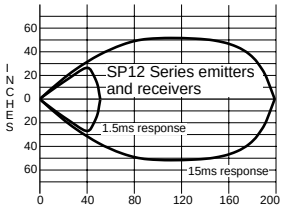


Models are also available with QD connectors (page 8).

Excess Gain Curve



Beam Pattern



Specifications, SP12 Sensors

SUPPLY VOLTAGE: sensors are powered from a Banner CD Series MAXI-AMP™ module (see page 3).

RANGE: up to 200 feet in opposed mode (see gain curve, above).

RESPONSE SPEED: selectable for 1.5 or 15 milliseconds; a function of the MAXI-AMP CD Series module.

LIGHT BEAM: infrared LED, 880nm. Effective beam diameter: 3/8".

CONSTRUCTION: NEMA 6P.
12mm diameter tubular threaded VALOX® or stainless steel housing; positive sealing at both ends, quad-ring sealed acrylic lens. Electronics fully epoxy-encapsulated. Two jam nuts are provided: VALOX® for VALOX® units; stainless steel for stainless steel units. Mounting requires 1/2" diameter clearance hole.

OPERATING TEMPERATURE: -40 to +70°C (-40 to +158°F).

CABLE: sensors are supplied with 6-1/2 feet of PVC-covered 2- or 3-conductor cable. Models with QD connectors are available (page 8).

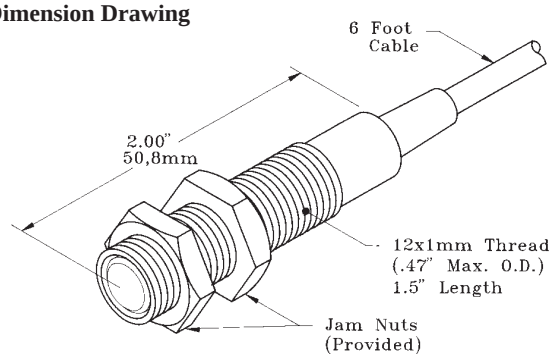
VALOX® is a registered trademark of General Electric Co.

SP12 Series Barrel Sensors

Model	Type	Housing Material
SP12SEL	Emitter	Stainless steel
SP12PEL	Emitter	VALOX®
SP12SRL	Receiver	Stainless steel
SP12PRL	Receiver	VALOX®

NOTE: Models with 30-foot attached cable are available (contact factory for information). **2- and 3-conductor 50- and 100-foot extension cables** (without connectors) are also available. For 2-conductor (emitter) cable: order model EC12E-50 (50') or model EC12E-100 (100'). For 3-conductor (receiver) cable: order model EC12R-50 (50') or model EC12R-100 (100').

Dimension Drawing



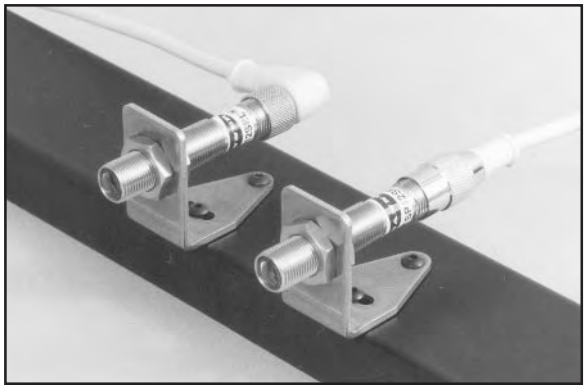
SP12 Series Opposed Mode Remote Modulated Barrel Sensors with Quick Disconnect (QD) Cable Option

The stainless steel models of SP12 Series modulated remote barrel sensors may be ordered with a built-in connector designed to mate with *eurofast*™ quick-disconnect (QD) cables. The resultant sensor model numbers are:

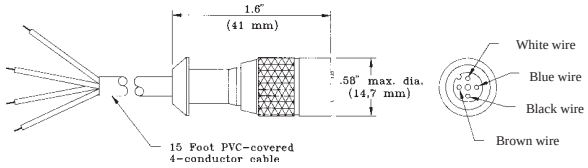
SP12SELQD (emitter), and

SP12SRLQD (receiver).

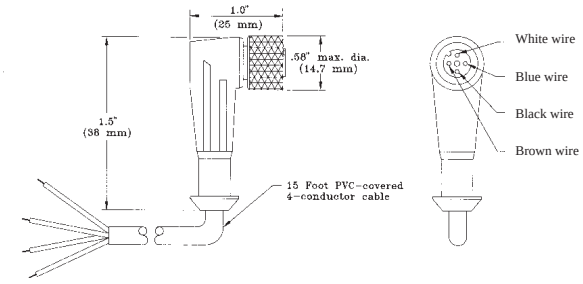
The mating cables are ordered separately. Cables are available in 15 foot lengths with either of two styles of mating connector. Cable model MQDC-415 has a straight connector, and model MQDC-415RA has a right-angled connector (see drawings below). In both models, the plug body is molded to the PVC cable for waterproof integrity. Plug contacts are gold-plated.



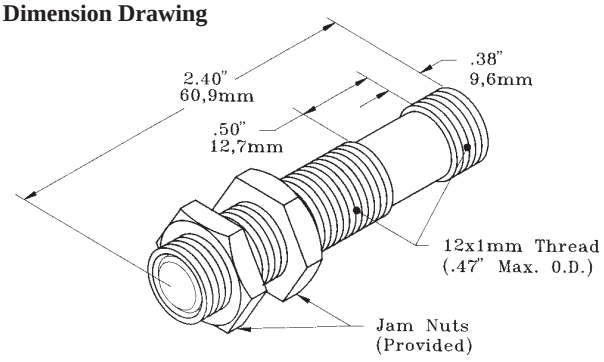
Dimensional Information for MQDC-415 Cable



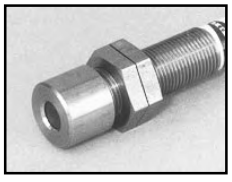
Dimensional Information for MQDC-415RA Cable



Dimension Drawing



Apertures

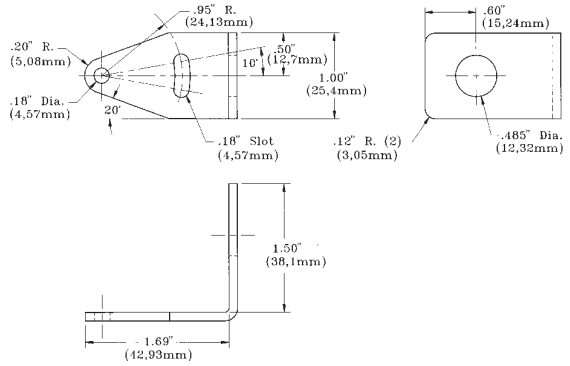


Rectangular and circular thread-on watertight apertures are available for SP12 sensors. Apertures are used to shape and size the sensor's effective beam and to protect the sensor's lens. Use of apertures with these high-gain sensors makes it possible to create very narrow, concentrated sensing beams for demanding applications. **Aperture Kit AP12SC** includes three round apertures with openings of .02", .04". and .10" diameter. **Aperture kit AP12SR** has three rectangular apertures .02", .04", and .10" wide. Both include lens, o-rings, and thread-on housing.

Model SMB12MM Mounting Bracket

Model **SMB12MM** is a stainless steel mounting bracket for SP12 Series sensors. The sensor mounts to the bracket using the two jam nuts supplied with the sensor. This rugged, slotted bracket allows ±10 degrees of lateral movement. Bracket is 12-gauge stainless steel. The bracket mounting holes accommodate #8 hardware.

SMB12MM bracket:

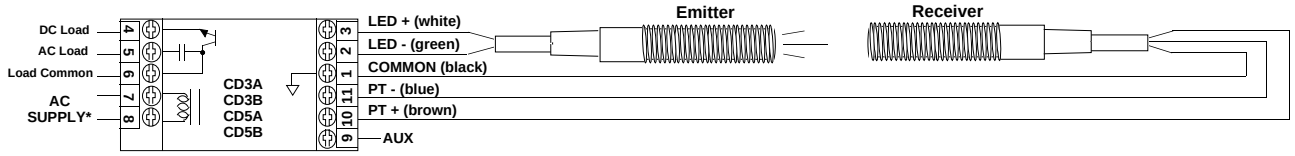


SP12 Sensor Hookup to CD Series MAXI-AMP™ Modules

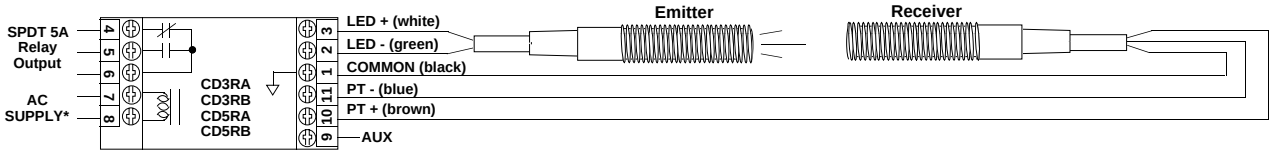
1) Hookup of SP12 Series Sensors (all models)

SP12 Series sensors are especially designed for use with CD Series modules. The basic hookup is given here (QD sensor models shown). Each MAXI-AMP™ CD Series module supports use of one pair of SP12 Series sensors. CD5 Series module models also support use of a GATE or INHIBIT sensor at pin #9 (below, this page).

Models with isolated solid-state contacts



Models with electromechanical relay contacts

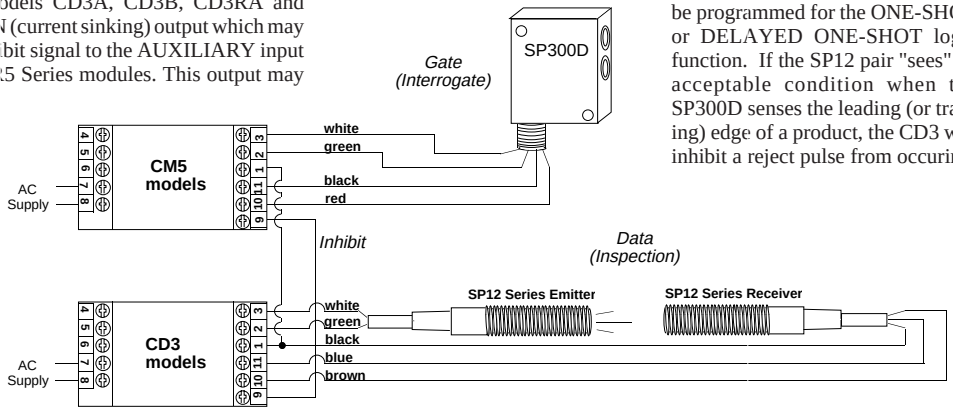


*105 to 130V ac or 210 to 250V ac, 50/60Hz, depending on model. To power the MAXI-AMP™ module from a dc supply, connect +12 to 28V dc at ≥70mA to terminal #3 and dc common to terminal #1. Make no connection to terminal #7 or #8.

2) Logic Level NPN Output (CD3 models)

The AUXILIARY terminal (#9) of models CD3A, CD3B, CD3RA and CD3RB modules offers a logic-level NPN (current sinking) output which may be used as a fast-response solid-state inhibit signal to the AUXILIARY input of MAXI-AMP CD5, CL5, CM5, or CR5 Series modules. This output may also serve as an input to any MICRO-AMP™, Plug Logic, or CL Series logic module. In addition, this output may interface to other dc devices or circuits like counters, rate meters, or programmable logic controllers. Switching capacity is 20mA maximum at 12V dc max.

The example here shows the use of SP12 Series sensors and a CD3 module to provide inspection information, with the SP300D functioning as a product (GATE) sensor.



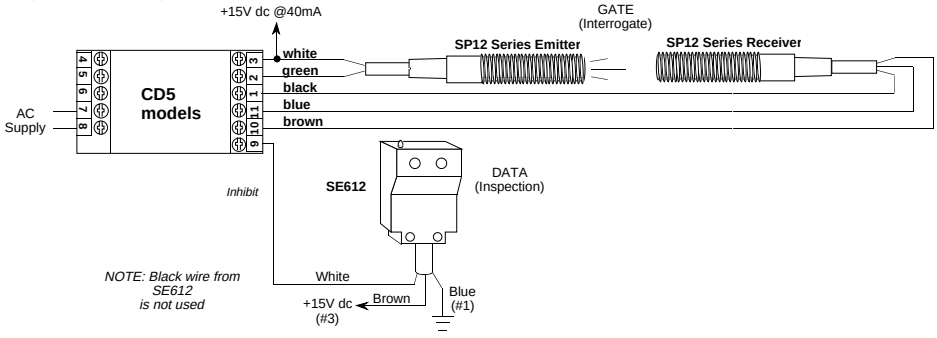
Typically, the CM5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the SP12 pair "sees" an acceptable condition when the SP300D senses the leading (or trailing) edge of a product, the CD3 will inhibit a reject pulse from occuring.

See Hookup Diagram #1 (above) for load and power connection information.

3) Power for External Devices (all models)

External 10 to 30V dc devices such as self-contained sensors may be connected between terminals #3 (+) and #1 (-) of any CD series MAXI-AMP module. Terminal #3 offers 40mA maximum. This is sufficient to power most Banner self-contained dc sensors.

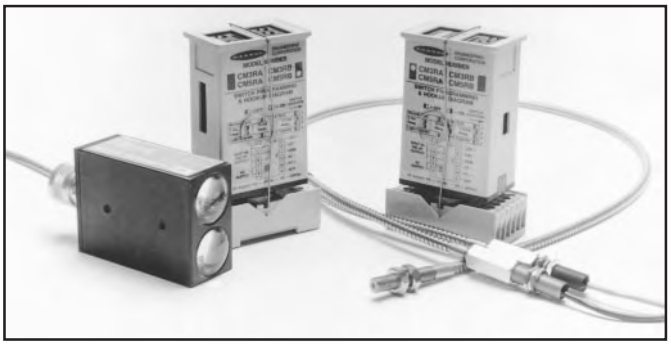
As the example at the right illustrates, the *current sinking* output of a self-contained sensor powered by the MAXI-AMP may be used as the input to the AUXILIARY terminal of a CD5 module.



MAXI-AMP™ CM Series

Modulated Amplifier Modules

Recognized Certified



MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CM3RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay, plus NPN transistor solid-state DC switch	ON/OFF
CM3RB	210 to 250V ac, or 12 to 28V dc		
CM5RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay (5 amp contact rating)	12 timing functions
CM5RB	210 to 250V ac, or 12 to 28V dc		

CM Series MAXI-AMPs combine power supply, modulated photoelectric amplifier, timing logic (in CM5 models) and output relay in a single compact, cost-saving module. CM-series modules work together with the popular family of Banner high-performance modulated remote sensors (pages 13-17). These sensors offer small size and excellent optical performance, and are built to operate in highly demanding sensing environments. MAXI-AMP modules themselves are also ruggedly built for dependable industrial duty.

CM Series MAXI-AMP modules contain the state-of-the-art Banner custom-designed CMOS modulator/demodulator/amplifier circuit, offering high immunity to both ambient light and electrical interference plus reliable sensor performance. All models have Banner's *exclusive,* patented Alignment Indicating Device ("AID™") system, which lights an LED indicator whenever the sensor sees a "light" condition, and pulses the LED at a rate proportional to the received light signal strength.

All CM Series modules are programmable for LIGHT or DARK operate and either high or low hysteresis. Input response time may be set at 0.3, 2, or 10 milliseconds. The 10-millisecond response mode offers enhanced immunity to electrical interference ("noise"), and also minimizes optical "crosstalk" between adjacent sensors. Unlike other amplifier designs, input response time settings of the CM Series modules do *not* affect sensor range.

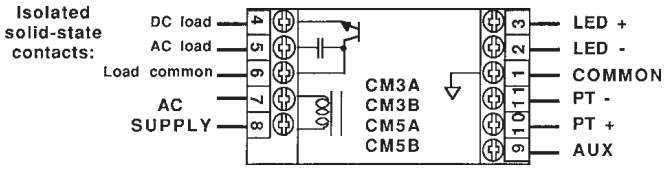
CM5 models include a versatile multi-function timing logic circuit which is programmable for 12 of the most popular and useful delay, one-shot, and latch functions (see page 6). Each timing function has a choice of three time ranges. Timing and sensitivity adjustments are accomplish-ed via rugged 15-turn potentiometers for very accurate settings. CM Series circuitry is designed to prevent false outputs on system power-up.

An auxiliary input is available on CM5 models for interrogation or reset of the selected logic function (see example, page 17). Page 6 describes the function of the auxiliary input for each logic mode. A dc power supply is included for powering an additional self-contained dc sensor.

The output circuit for *all* CM Series modules is an SPDT 5-amp electromechanical relay. *Additionally, CM3 models have an NPN transistor solid-state switch.* The output may be programmed for either normally open or normally closed operation. A solid-state relay is offered as an option to the electromechanical relay (see information below).

Solid-state Output Option

CM Series modules are available with a solid-state relay which replaces the electromechanical relay. This is actually two SPST solid-state contacts. One contact will switch ac loads. The contact is rated at 250V ac maximum and 3/4 amps maximum at 25 degrees C (derated to 1/2 amp at 50 degrees C). The other solid-state contact will switch dc loads of up to 30V dc and up to 50 milliamps. Both contacts are isolated from the MAXI-AMP power supply.



MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CM3A	105 to 130V ac, or 12 to 28V dc	SPST solid-state contact for switching AC loads up to 250 V ac and up to 3/4 amp, plus solid-state contact for switching DC loads up to 30V dc and up to 50mA.	ON/OFF
CM3B	210 to 250V ac, or 12 to 28V dc		
CM5A	105 to 130V ac, or 12 to 28V dc		12 timing functions
CM5B	210 to 250V ac, or 12 to 28V dc		

MAXI-AMP CR Series Modulated Modules for SP100 Series Miniature Remote Sensors

The amount of amplification available from CM Series MAXI-AMP modules is too high to operate with the Banner SP100 Series of miniature modulated remote sensors. CR Series modules correct this incompatibility with a modified modulated amplifier design. CR Series specifications are exactly the same as for the standard CM Series models (listed above) except for the difference in amplifier gain. Available models are listed in the table at the right.

SP100 Series sensors are ideal for OEM machinery and for tight spaces where the use of photoelectric sensors was previously considered impossible. The SP100 Series is described in the Banner catalog.

CR Series modules are also available with the solid-state output option (see above).

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CR3RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay, plus NPN transistor solid-state DC switch	ON/OFF
CR3RB	210 to 250V ac, or 12 to 28V dc		
CR5RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay (5 amp contact rating)	12 timing functions
CR5RB	210 to 250V ac, or 12 to 28V dc		

MAXI-AMP CM and CR Series Specifications

SUPPLY VOLTAGE: Models CM3(R)A, CM5(R)A, CR3(R)A, and CR5(R)A: 105 to 130V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA.
Models CM3(R)B, CM5(R)B, CR3(R)B, and CR5(R)B: 210 to 250V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 70mA.
NOTE: do not connect ac power if using external dc power.

OUTPUT CONFIGURATION:
Models CM3A, CM3B, CM5A, CM5B, CR3A, CR3B, CR5A, CR5B have SPST solid-state relay for switching ac or dc (see page 10).

Models CM3RA, CM3RB, CM5RA, CM5RB, CR3RA, CR3RB, CR5RA, CR5RB have SPDT electromechanical (e/m) relay with the following ratings:
CONTACT RATING: 250V ac max, 24V dc max, 5 amps max. (resistive load), 1/10 H.P. at 240V ac. Install transient suppressor (MOV) across contacts which switch inductive loads.
CONTACT RESPONSE: 10 milliseconds max. open/close; 20 operations/second max.
MECHANICAL LIFE: 20,000,000 operations
CM3 and CR3 models also have a logic level current sinking NPN transistor switch at pin #9. See schematic (right) and hookup info.

AMPLIFIER:
RESPONSE SPEED: programmable for 10, 2, or 0.3 milliseconds. NOTE: use 10 millisecond setting whenever possible for enhanced noise rejection.
HYSTERESIS: if programmed "HIGH", approximately 20%; if programmed "LOW", approximately 5%. NOTE: see cautions for "LOW" setting, page 12.
MODULATION FREQUENCY: approximately 10kHz.

SENSOR LEAD LENGTH: 50 feet (15 m) maximum. Use *separate* shielded cable for emitter and receiver, or order sensors with extended cable length. NOTE: see splicing precautions, page 17.

MULTIPLE SENSOR HOOKUP: Up to three sensors may be wired together to one CM-series amplifier for "OR" operation (in LIGHT operate) or "NAND" operation (in DARK operate). Emitters are connected in *series*, and receivers are connected in *parallel*. When wiring two sensors to one MAXI-AMP, multiply excess gain data for each sensor by 1/2 (obtain data from applicable excess gain curve). When wiring three sensors to one MAXI-AMP, multiply excess gain by 1/3.

TIMERS (CM5 models only):
TIMING RANGES: LOW range - 10 to 150 milliseconds
MIDDLE range - 0.1 to 1.5 seconds
HIGH range - 1 to 15 seconds
REPEATABILITY: +/-2% of set time over all extremes of supply voltage and temperature

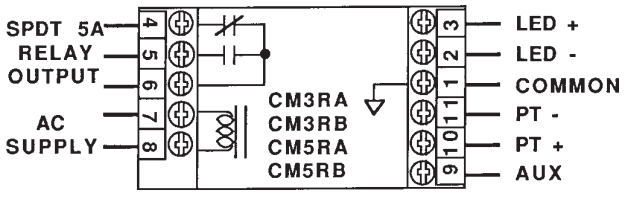
ADJUSTMENTS: Miniature switches for programming of LIGHT/ DARK operate, amplifier response time, amplifier hysteresis, normally open or normally closed output, and timing function (CM5 & CR5 models). 15-turn clutched potentiometer for gain and time setting(s) (CM5 and CR5 models).

OPERATING TEMPERATURE: 0 to 50°C (32 to 122°F).

INDICATOR LEDs: Red indicator LED is "ON" when the module output is energized. Exclusive Banner Alignment Indicating Device (AID™) system lights a red LED indicator whenever the receiver "sees" its own modulated light source, and pulses it at a rate which is proportional to the strength of the received light signal.

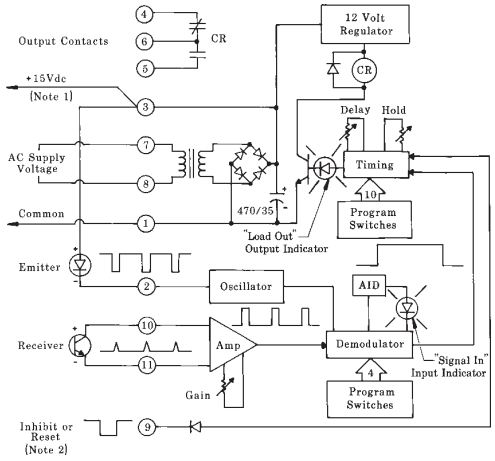
CONSTRUCTION: Rugged NORYL® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole plug base.

Generalized Hookup
models with electromechanical relay output



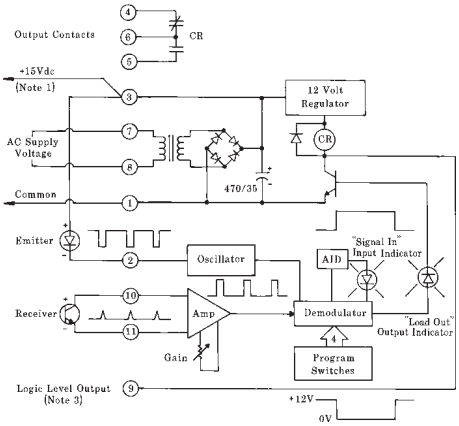
NOTE: If MAXI-AMP is powered by a dc power supply, connect +12 to 28V dc @ ≥70mA to terminal #3 and dc common to terminal #1.
Make no connections to terminal #7 or #8.

Functional Schematics
CM5 & CR5 Models



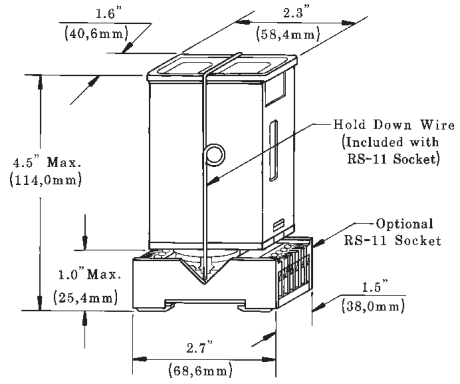
NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example, page 17). Current available is 40 mA at 120V ac (240V ac) line level; 30mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). *Do not connect ac voltage if using external dc power.*
NOTE #2: pulling pin #9 low (to common) will inhibit the timing, or reset the latch of CM5 or CR5 models (see "Description of Logic Functions", page 6).

CM3 & CR3 Models



NOTE #3: pin #9 of CM3 or CR3 models may be connected directly to the AUXILIARY input of a MAXI-AMP or Banner M Series module. It may also serve as the input to Banner CL series MAXI-AMPs or to Banner Plug Logic modules (see hookup example, page 17).

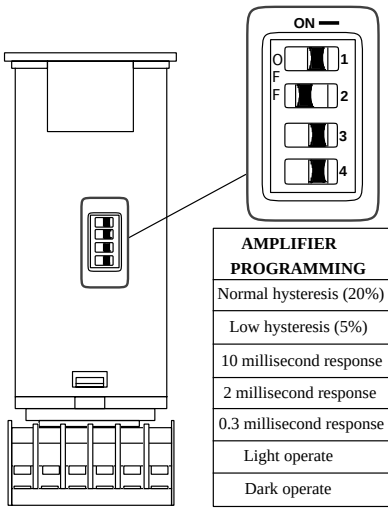
Dimension Drawing



Amplifier Programming (all models)

Amplifier response conditions may be programmed via the group of four switches located on one of the narrow sides of the MAXI-AMP module.

Switch #1 selects the amount of amplifier hysteresis. Hysteresis is the amount of signal change beyond the switching threshold which is required to cause the amplifier output to change state, and is expressed as a percent of amplifier gain. The NORMAL setting of 20% should *always* be used, except for low contrast situations such as many color registration applications.



Factory settings shown at left. "Underlined" settings in table below are factory settings.

AMPLIFIER PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4
Normal hysteresis (20%)	**ON**	—	—	—
Low hysteresis (5%)	**OFF**	—	—	—
10 millisecond response	—	**OFF**	**ON**	—
2 millisecond response	—	**ON**	**ON**	—
0.3 millisecond response	—	**ON**	**OFF**	—
Light operate	—	—	—	**ON**
Dark operate	—	—	—	**OFF**

NOTE: the LOW hysteresis setting should be used only when all sensing conditions remain stable. "Buzzing" of the output (in ON/OFF and LIMIT operation) or false outputs (in DELAY, ONE-SHOT, or LATCH operation) may occur if sensing variables (e.g.- web flutter) result in optical contrast approaching unity.

Switches #2 and #3 are used to program the amplifier response time. The 10 millisecond setting should be used whenever possible for the greatest immunity to electrical interference ("noise"). The 2 millisecond setting has more interference rejection than the 0.3 millisecond mode. Sensor performance (excess gain) is identical in all three response settings.

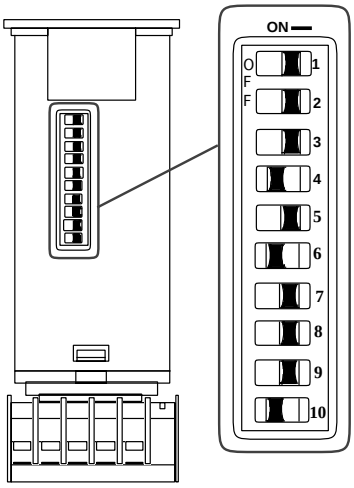
Switch #4 is used to select LIGHT OPERATE or DARK OPERATE. In the LIGHT OPERATE mode, the output will energize (in ON/OFF or LATCH operation) or the timing function will initiate (in DELAY, ONE-SHOT, or LIMIT operation) when the receiver "sees" sufficient light (excess gain greater than 1X). In DARK OPERATE, the output will energize or timing will begin when the receiver is sufficiently dark (excess gain less than 1X).

The diagram at the left shows the location of switches 1-4, and the table summarizes the settings required for each response condition.

NOTE: an adhesive-backed mylar label is supplied, which may be marked to indicate switch programming and then applied to the MAXI-AMP housing as a switch cover.

Timing Logic Programming (CM5 and CR5 models)

Settings illustrated below are factory settings. Factory settings are "underlined" in the table.



TIMING LOGIC PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4	SWITCH #5	SWITCH #6	SWITCH #7	SWITCH #8	SWITCH #9	SWITCH #10
On/Off	**ON**	**ON**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
On Delay	**ON**	**ON**	**OFF**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
Off Delay	**ON**	**OFF**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
On and Off Delay	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
One-shot	**OFF**	**OFF**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
Delayed One-shot	**OFF**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	—	—	—
Limit	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**ON**	—	—	—
Repeat Cycle	**ON**	**OFF**	**OFF**	**ON**	**ON**	**OFF**	**ON**	—	—	—
AC Latch	**OFF**	**ON**	**ON**	**OFF**	**ON**	**ON**	**ON**	—	—	—
DC Latch	**ON**	**ON**	**ON**	**OFF**	**ON**	**ON**	**ON**	—	—	—
Delay and Latch	**ON**	**ON**	**OFF**	**OFF**	**ON**	**ON**	**ON**	—	—	—
Limit and Latch	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**ON**	—	—	—

N/C Output	**OFF**	—	—
N/O Output	**ON**	—	—
.15 Sec. Max. Time	—	**OFF**	**OFF**
1.5 Sec. Max. Time	—	**ON**	**OFF**
15 Sec. Max. Time	—	**OFF**	**ON**

A group of ten switches, located on the side of the module opposite the amplifier program switches, is used to select the timing logic for the CM5 and CR5 models.

Switches #1 through #7 are used to select the logic function. Switch #8 programs the output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for *both* functions of a dual timing mode (ON & OFF DELAY, DELAYED ONE-SHOT, and REPEAT CYCLE). However, DELAY and HOLD times are independently adjustable within the selected range.

The diagram shows switch locations, and the table summarizes the program switch positions.

MAXI-AMP System

Sensors for use with CM Series Modulated Amplifiers

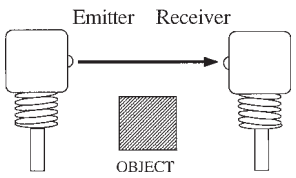
Sensors are epoxy-encapsulated and optics are hermetically sealed. Cables are 6 feet (2m) long. 30-foot (9m) cables available by special order. Sensor accessories are shown on page 24.

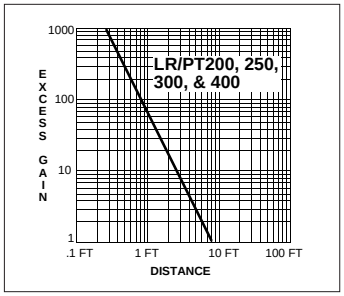
Models/Dimensions ***Excess Gain*** ***Beam Pattern***

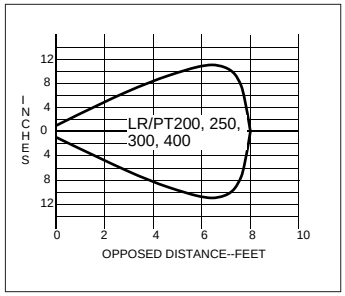
OPPOSED Mode

ALL MODELS:
Range: 8 feet (2,4m)
Beam: infrared, 880nm
Effective Beam:
.14 inch (3,6mm) dia.

LR models are emitters
PT models are receivers







LR200 & PT200

Temp. range: -40 to +100 degrees C
Housing material: black Delrin®

LR250 & PT250

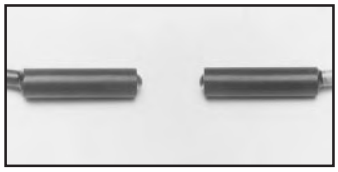
Temp. range: -40 to +100 degrees C
Housing material: black Delrin®

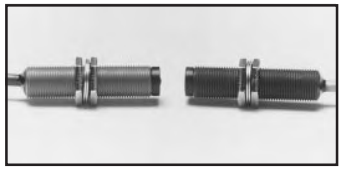
LR300 & PT300

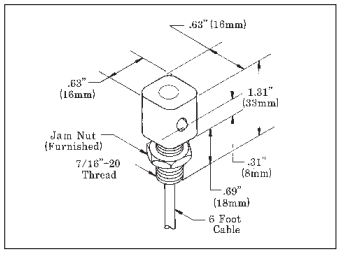
Temp. range: -40 to +80 degrees C
Housing material: black VALOX®

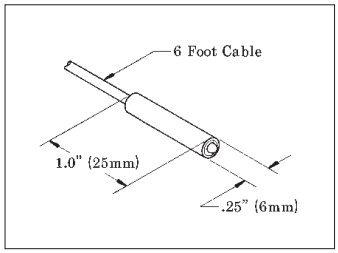
LR400 & PT400

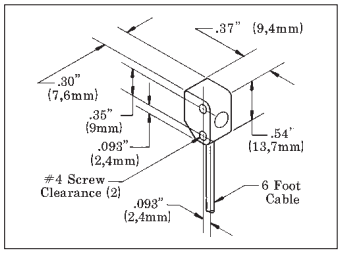
Temp. range: -40 to +100 degrees C
Housing material: anodized alum.

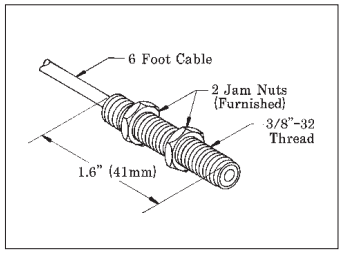












LR/PT200, 250, 300, and 400 opposed mode remote sensors are identical electronically and optically, and differ only in their housings. All are totally epoxy-encapsulated and use hermetically sealed glass lenses to eliminate condensation inside the optical chamber. These sensors may be washed down without damage. Operating temperature is determined by the type of cable used (see specifications above). These sensor pairs feature wide beam angle for forgiving line-of-sight alignment. At the same time, the effective beam of each pair is only 1/8 inch, allowing small-profile resolution and reliable response to fast-moving objects. *LR models are emitters; PT models are receivers.*

LR200 & PT200: this is a right-angle design which mounts through a 7/16 inch (12mm) diameter hole, using the steel jam nut which is included. This pair is used most commonly on small conveyors when it is desireable to run the cable directly down to a wireway.

LR250 & PT250: these sensors feature a 1/4 inch (6,4mm) diameter smooth barrel design, and are usually held in place in a clearance hole with a small set-screw. Optional mounting blocks (shown below) are available. Model SMB250 holds the sensor in place with two set-screws. The block is then mounted to a bracket (like model SMB300, page 15), or directly to a machine frame with two #6 screws. Block model SMB250C holds an LR & PT250 together to converge at approximately 1/2 inch ahead of the block.

LR & PT300: this is a miniature right-angle design which is mounted in place using two #4 screws. This pair uses a very flexible, low-profile 2-wire cable. Despite their small size, the optical performance of the LR/PT300 is equal to the other remote sensor pairs.

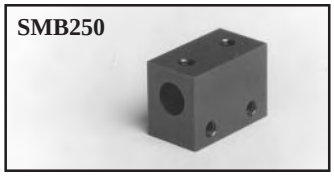
LR400 & PT400: the 3/8 inch (9,5mm) diameter threaded barrel design makes the LR/PT400 the most versatile and most popular remote opposed sensor pair. They are easily mounted through clearance holes using the jam nuts which are supplied. They may be used with optional L4 or L16 lenses for extended range and/or higher excess gain. The addition of an L4 lens on both the LR and PT400 will increase their range from 8 feet to 40 feet and increase the excess gain at any distance by a factor of 25X. A pair of L16 lenses will increase available excess gain by a factor of 250X.

L4 lens

L16 lens

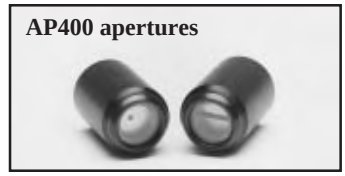
The LR/PT400 pair is often used at close range with optional AP400 aperture assemblies to create a very small and well-defined effective beam for resolving small profiles, increasing sensing repeatability, or easing response time requirements.

SMB250



SMB250C

AP400 apertures



Aperture model	Aperture size
AP400-010	.010" dia.
AP400-015	.015" dia.
AP400-040	.040" dia.
AP400-030R	.030" x .125"

MAXI-AMP System

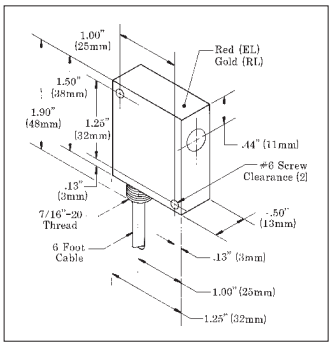
Sensors for use with CM Series Modulated Amplifiers

Sensors are epoxy-encapsulated. Cables are 6 feet (2m) long. 30-foot (9m) cables available by special order.
Sensor accessories are shown on page 24.

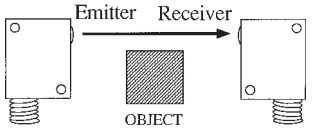
Models/Dimensions ***Excess Gain*** ***Beam Pattern***

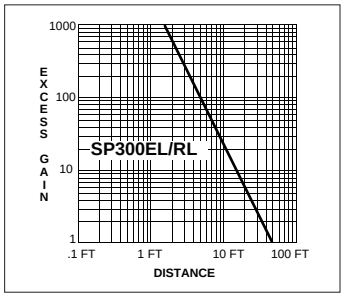
SP300EL & SP300RL

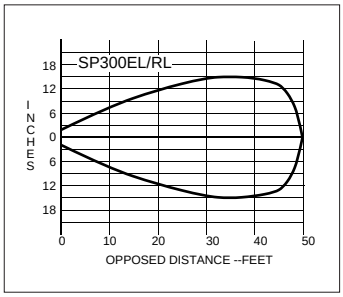
Range: 50 feet (15m)
Effective Beam: .5 inch (13mm) dia.
Temp. range: -40 to +100 degrees C
Housing material: anodized aluminum



Long Range OPPOSED Mode



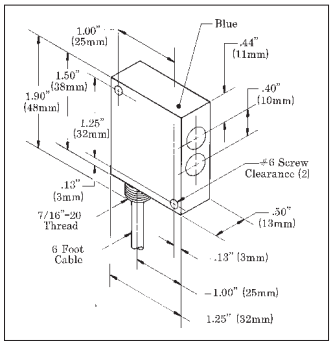




Emitter-receiver pair SP300EL/RL are extremely rugged and are totally encapsulated in anodized aluminum housings. The threaded hub at the cable exit allows for the use of flexible armored cable or protective PVC tubing with the addition of compression gland model CF7-16 (page 24). This pair uses collimating lenses to increase range. These sensors should also be used at short ranges for their high excess gain or to avoid optical "crosstalk" in situations which require several pairs to be mounted adjacent to one another.

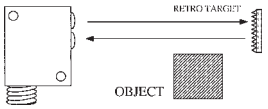
SP300L

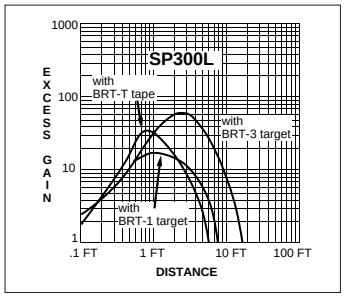
Range: 15 feet (4,5m) with BRT-3 retroreflector
Temp. range: -40 to +80 degrees C
Housing material: blue anodized aluminum

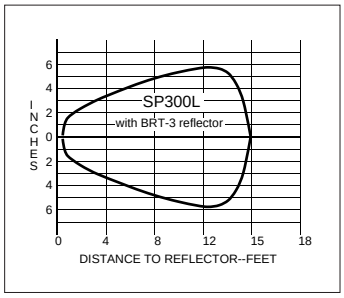


RETROREFLECTIVE Mode

NOTE: for complete information on retroreflective materials, see Banner catalog.







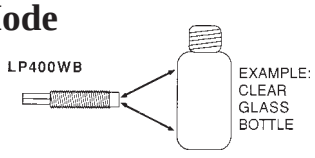
Model SP300L is a remote retroreflective sensor with the same rugged design as the SP300EL/RL, described above. Its useable range is from 6 inches to 15 feet (0,2 to 4,5m) using the model BRT-3 retroreflector.

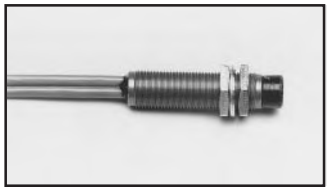
If the object that is to break the beam has a shiny surface, then the SP300L and its retroreflector should be mounted so that the beam is at an angle of 10 degrees or more to that surface in order to eliminate false signals which are caused by proxing.

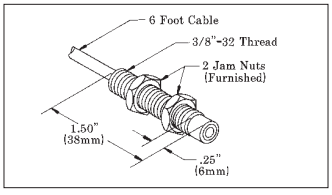
LP400WB

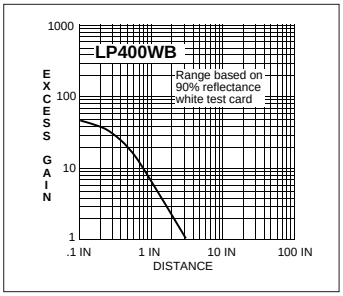
Range: 3 inches (76mm)
Temp. range:
-40 to +80 degrees C
Housing material: blue anodized aluminum

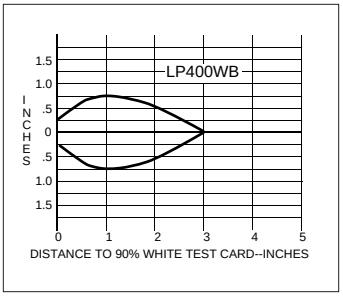
DIVERGENT Mode











"WB" in this model number designates "wide beam". The LP400WB is an infrared divergent mode (wide angle diffuse mode) sensor which is particularly forgiving for reflectively sensing transparent or translucent materials or for sensing objects with irregular surfaces (e.g.- webs with "flutter"). The optics are such that even small threads or wires .005" (0,1mm) or greater in diameter may be detected when they pass within .25" (6mm) of the sensor's plastic lens. Due to its wide response pattern, the LP400WB should not be used for precise positioning control, nor should it be mounted with its lens recessed into a hole.

MAXI-AMP System

Sensors for use with CM Series Modulated amplifiers

Sensors are epoxy-encapsulated. Cables are 6 feet (2m) long. 30-foot (9m) cables available by special order.
Sensor accessories are shown on page 24.

Models/Dimensions ***Excess Gain*** ***Beam Pattern***

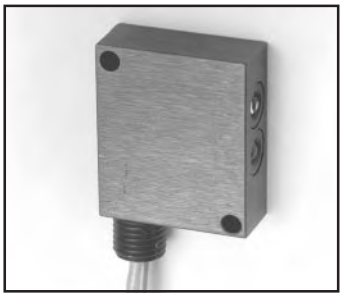
SP300D

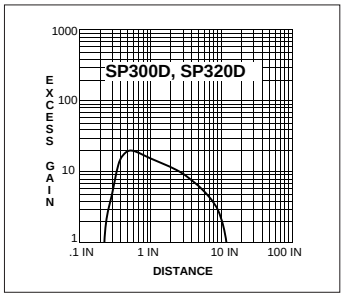
Range: 12 inches (30cm)
Temp. range: -40 to +80 degrees C
Housing material: green anodized aluminum

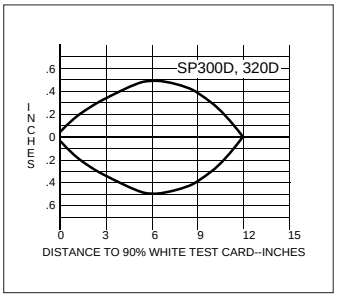
SP320D

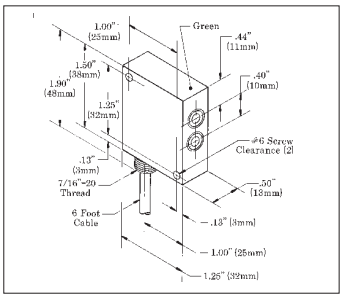
Range: 12 inches (30cm)
Temp. range: -40 to +80 degrees C
Housing material: black VALOX®

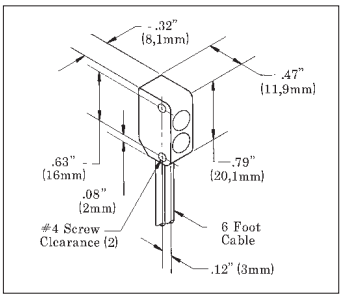
DIFFUSE Mode









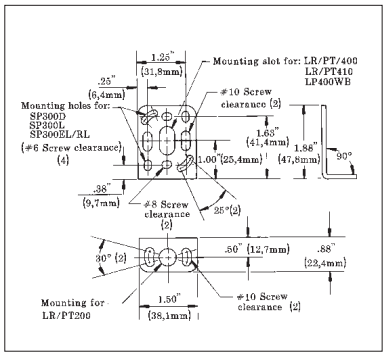


SP300D: the SP300D is the diffuse mode version of the SP300L with the same rugged aluminum housing and totally encapsulated construction. The glass lenses are hermetically sealed, which eliminates any possibility of condensation inside the lenses and allows operation in adverse environments like steam washdown and high vibration. The SP300D may be mounted by its through-holes or with the SMB300 bracket, as shown below.

SP320D: model SP320D is identical to the SP300D, except for its housing. The 320 is a miniature plastic package, designed to fit into very tight locations. It mounts using two #4 (3mm) screws. The SP320D and the SP300D are excellent for nearly any presence sensing application.

SMB300

UNIVERSAL MOUNTING BRACKET for SP300 Sensors

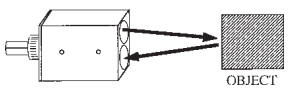


Accessory bracket model SMB300 is designed for 2-axis universal mounting of sensor models SP300EL, SP300RL, SP300L, and SP300D. These sensors are affixed to the SMB300 with two #6 (3,5mm) screws. The bracket, in turn, mounts with two #10 (5mm) screws.

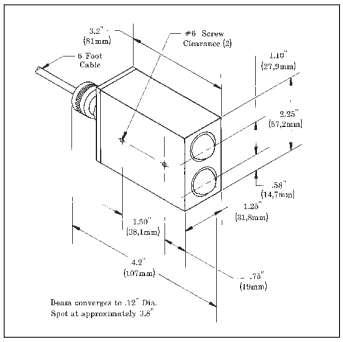
In addition, as indicated by the dimension drawing, the SMB300 has a clearance slot for mounting LR400, PT400, and LP400WB barrel sensors. LR & PT200 sensors may be mounted with the SMB300, using its 7/16-20 threaded hole and steel jam nut, which is supplied with the sensors. LR250 and PT250 sensors may be used with the SMB300 when the SMB250 block is used (see page 13). Also, two SMB250 blocks may be attached to the SMB300 bracket and angled to mechanically converge an LR & PT250 sensor pair.

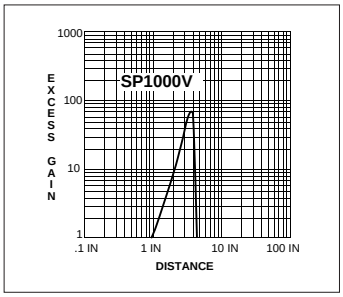
SP1000V CONVERGENT Mode

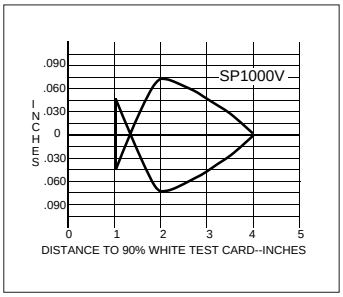
Range: focus at 3.8 inches (96mm)
Temp. range: -40 to +80 degrees C
Housing material: black anodized aluminum



The SP1000V is a convergent mode sensor that produces a very small 0.1 inch (2,5mm) diameter sensing image at a point exactly 3.8 inches (96mm) from its glass lenses. As the excess gain curve illustrates, the SP1000V has a very sharp drop-off of gain beyond the focus point. This feature makes it an excellent choice for detecting a small part which is only a fraction of an inch in front of another surface, such as parts on a conveyor (viewed from above). It is also ideal for fill level detection and for precise positioning control, in lieu of opposed sensing.







MAXI-AMP System

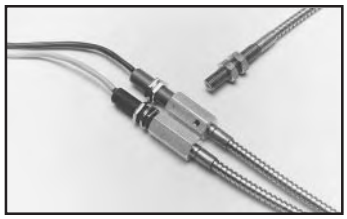
Sensors for use with CM Series Modulated Amplifiers

Sensors are epoxy-encapsulated and optics are hermetically sealed. Cables are 6 feet (2m) long. 30-foot (9m) cables available by special order. Sensor accessories are shown on page 24.

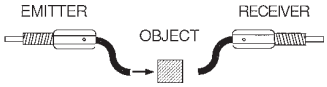
Models/Dimensions ***Excess Gain*** ***Beam Pattern***

FIBER OPTIC Mode

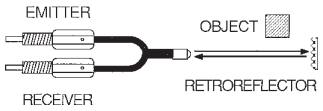
glass fiber optics



OPPOSED MODE

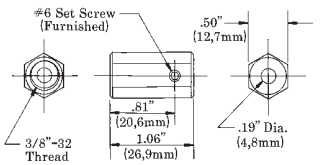


RETROREFLECTIVE MODE



DIFFUSE MODE

FOF-400 Fiber optic Fitting



For complete information on glass fiber optic assemblies and accessories, see Banner product catalog.

LR400 & PT400

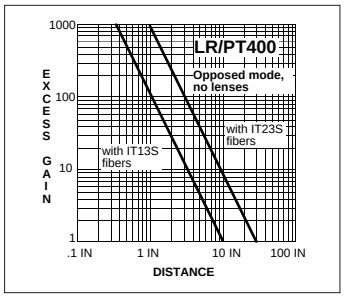
with FOF-400 fittings and fiber optics

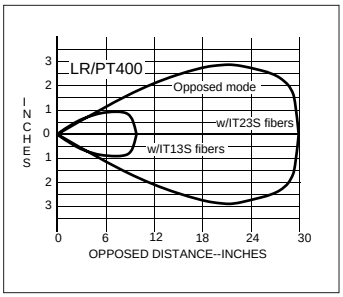
Range: see excess gain curves
Temp. range: -40 to +100 degrees C

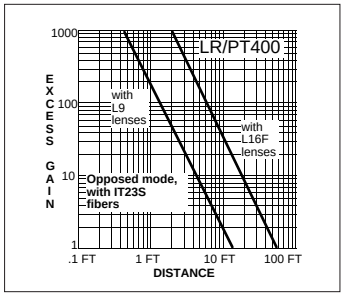
The threaded barrel design of the LR400 and PT400 (see page 14) permit the connection of any Banner glass fiber optic assembly by using two model FOF-400 fittings. The sensors are typically mounted through 3/8 inch (10mm) diameter clearance holes, with the FOF-400 fittings threaded onto them after mounting. Setscrews in the fittings lock the fibers in place, but allow rapid replacement without disturbing any electrical wiring.

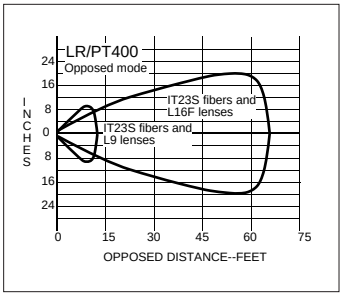
As the excess gain curves show, the LR/PT400 combination produces a high-performance fiber optic sensing system. With the amplifier's 1 millisecond response time, this system can be used for almost any fiber-optic requirement.

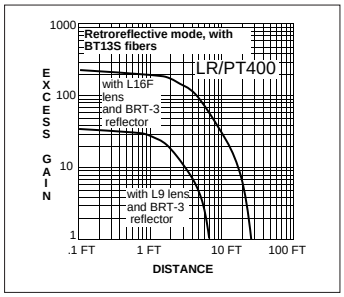
Fiber optic information:
IT13S: individual assembly .06 in. (1,5mm) dia. bundle
IT23S: individual assembly .12 in. (3mm) dia. bundle
BT13S:bifurcated assembly .06 in. (1,5mm) dia. bundle
BT23S:bifurcated assembly .12 in. (3mm) dia. bundle
L9: .5 in. (12mm) dia. lens
L16F: 1.0 in. (25mm) dia. lens

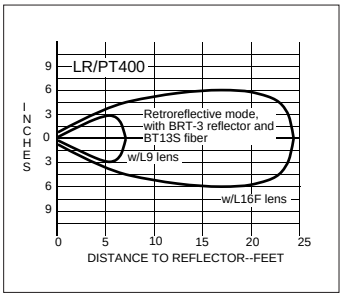


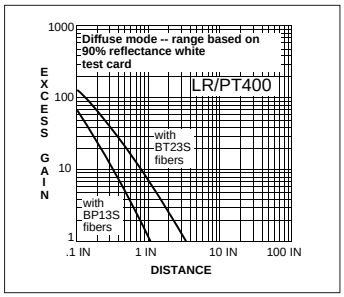


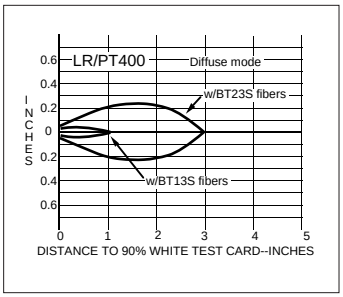












Hookup to CM Series MAXI-AMP Modules

The hookup diagrams on this page and the next include all of the remote sensors for use with CM Series modulated amplifier modules. It is important to note how the shield wire of a remote sensor is wired. The shield wire is the uninsulated wire in each sensor cable. Failure to connect the shield as shown may result in false operation of the amplifier. When wiring emitters, it is good practice to connect the positive (white) wire first. LEDs are sensitive to application of the wrong voltage, and can easily be destroyed.

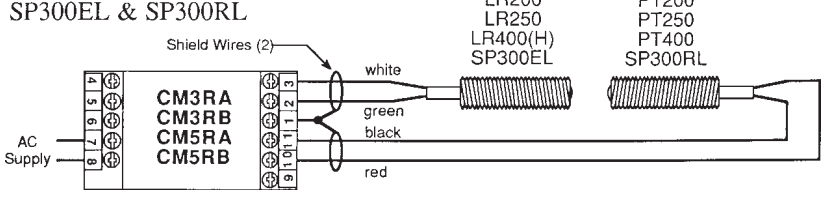
NOTE: up to three sensors may be connected to each amplifier (see specifications).

Hookup of LR/PT200, 250, 300, and 400

TO SENSOR PAIR MODELS:

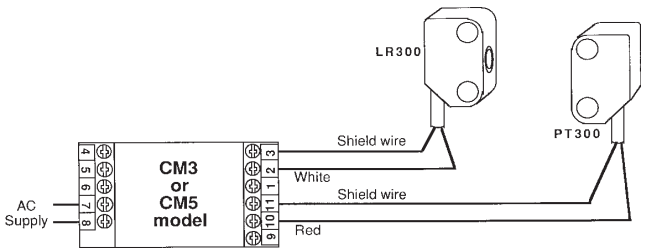
LR200 & PT200
LR250 & PT250
LR400 & PT400
SP300EL & SP300RL

NOTE: both shield wires must be connected to COMMON (terminal #1) to avoid cable crosstalk.

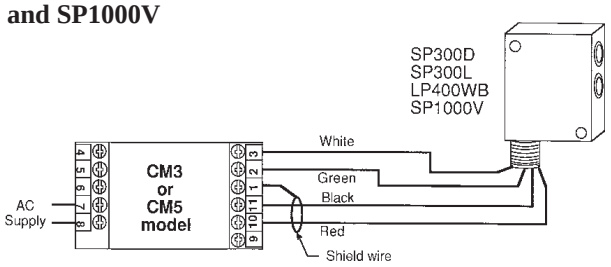


Sensor Hookup Diagrams for CM Series MAXI-AMP Modules

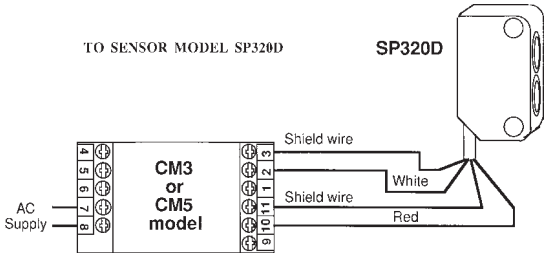
Hookup of LR300 and PT300



Hookup of SP300D, SP300L, LP400WB, and SP1000V



Hookup of SP320D



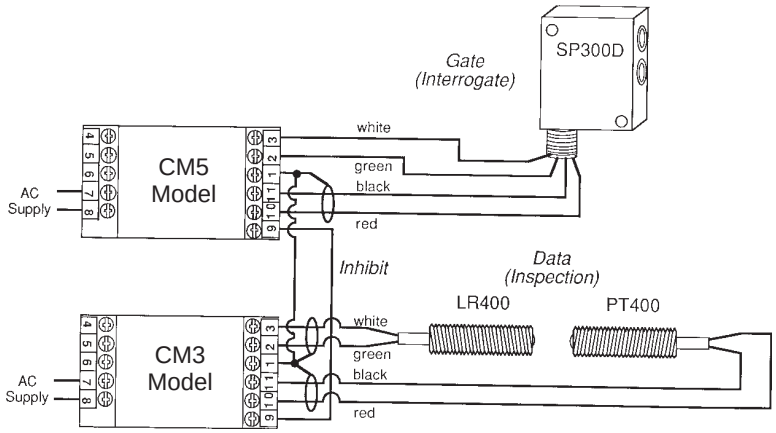
NOTE REGARDING CABLE SPLICING:

When splicing additional cable length to modulated remote sensors, it is important to use a separate shielded cable for emitter and receiver wires. Combining emitter and receiver wires together in the same cable (even if the cable is shielded) will result in direct coupling of the emitter signal to the receiver leads. This is called "cable crosstalk", and will not allow full amplifier sensitivity setting without an amplifier "lock on" situation, which appears as a continuous LIGHT condition. Banner offers extension cable for remote sensors which, if used for cable splicing, will minimize the chances for cable crosstalk (see page 24).

Logic Level NPN Output (CM3 models)

The AUXILIARY terminal (#9) of CM3 models offers a logic-level NPN (current sinking) output which may be used as a fast-response solid-state inhibit signal to the AUXILIARY input of MAXI-AMP CM5 modules. This output may also serve as an input to any B Series, Plug Logic, or CL Series module. In addition, this output may interface to other dc devices or circuits like counters, rate meters, or programmable logic controllers. Switching capacity is 20mA at 12V dc.

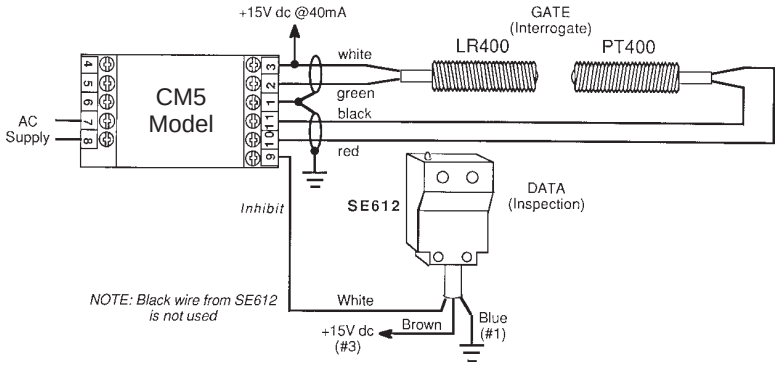
The example here shows the use of LR & PT400 sensors and a CM3 module to provide inspection information, with the SP300D functioning as a product sensor. Typically, the CM5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the LR & PT400 "sees" an acceptable condition when the SP300D senses the leading (or trailing) edge of a product, the CM3 will inhibit a reject pulse from occuring.



Power for External Devices

External 10 to 30V dc devices such as self-contained sensors may be connected between terminals #3 (+) and #1 (-) of any CM series MAXI-AMP module. Terminal #3 offers 40mA maximum. This is sufficient to power most Banner self-contained dc sensors.

As the example at the right illustrates, the *current sinking* output of a self-contained sensor powered by the MAXI-AMP may be used as the input to the AUXILIARY terminal of a CM5 module.



MAXI-AMP™ CL Series

Logic-level Input Modules

Recognized Certified

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CL3RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay, plus NPN transistor solid-state switch	ON/OFF
CL3RB	210 to 250V ac, or 12 to 28V dc		
CL5RA	105 to 130V ac, or 12 to 28V dc	SPDT electro-mechanical relay (5 amp contact rating)	12 timing functions
CL5RB	210 to 250V ac, or 12 to 28V dc		

Banner CL Series MAXI-AMP™ modules are the perfect solution for many sensing/control applications where economy, versatility, dependability, and ruggedness are important. CL Series MAXI-AMPs combine power supply, timing logic (in CL5 models) and output relay in a single compact, cost-saving module. The integrated, *stand-alone* design saves both the expense of a separate control chassis and a substantial amount of panel space. Several models are available, for either 120V ac or 240V ac operation, and either with or without timing logic (models are listed in table at above right). Alternatively, any model may be powered by 12 to 28V dc.

The well-defined electrical characteristics of CL Series MAXI-AMP modules provide a wealth of application possibilities. The input circuit accepts signals from any Banner dc sensor with an NPN (current sinking) output; as well as from MAXI-AMP, MICRO-AMP, and Plug Logic modules. The input is compatible with almost any sensor or circuit which has an NPN transistor (current sinking) output. Additionally, inputs may be generated by limit switches, contact closures, and optical couplers. A 50mA power supply is included for powering 10 to 30V dc devices.

CL5 models offer a versatile multi-function timing logic circuit which is programmable for twelve of the most popular and useful delay, one-shot, and latch functions (see page 6). The MAXI-AMP offers the choice of either single or dual timing functions in the same module. Logic and timing may be easily reprogrammed as control requirements change.

In order to allow accurate timing adjustments, each CL5 model has three time ranges to choose from. Timing adjustments are made via rugged 15-turn potentiometers. Circuitry is included to prevent any possibility of false output on power-up.

An auxiliary input is available on CL5 models for interrogation or reset of the selected logic function by using an additional sensor or input signal (see example, page 20). Page 6 describes the function of the auxiliary input for each logic mode.

The output circuit for all CL Series modules is an SPDT 5-amp electromechanical relay. A solid-state relay is offered as an option to the electromechanical relay (see information below).

Additionally, CL3 models have an NPN transistor solid-state switch. This solid-state output may be used to take advantage of the amplifier's fast 1-millisecond response. This output may be connected directly to the primary or auxiliary input of other Banner logic modules, including CL5 modules, MICRO-AMP logic modules, and Plug Logic modules. In addition, this output can interface to other dc devices or circuits such as counters, rate meters, or programmable controllers. Switching capacity is 20mA at 12V dc. The output may be programmed for either normally open or normally closed operation.

Like all MAXI-AMPs, the CL Series modules are designed both electrically and mechanically for solid dependability in industrial environments.

Solid-state Output Option

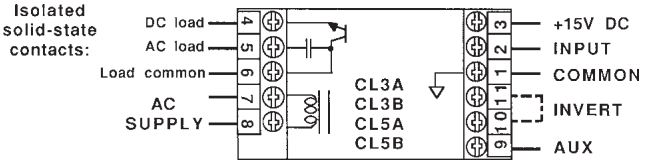
CL Series modules are available with a solid-state relay which replaces the electromechanical relay. This is actually two SPST solid-state contacts. One contact will switch ac loads, and is rated at 250V ac maximum and 3/4 amps maximum at 25 degrees C (derated to 1/2 amp at 50 degrees C). A solid-state contact is particularly helpful when switching inductive ac loads which can cause electrical "noise" and contact damage when switched with a "hard" relay contact.

The other solid-state contact will switch dc loads of up to 30V dc and up to 50 milliamps. Both solid-state outputs are electrically isolated from the MAXI-AMP power supply. Both outputs switch within the 1 millisecond response time of the CL module circuitry. NOTE: ac loads may take up to 1/2 cycle (8.3 milliseconds) to turn "off".

Both outputs are normally open, but may be programmed for normally closed operation.

Except for the output configuration, the specifications for the models listed in the table at the right are exactly the same as for the standard CL Series models.

MODEL	SUPPLY VOLTAGE	OUTPUT	LOGIC
CL3A	105 to 130V ac, or 12 to 28V dc	SPST solid-state contact for switching AC loads up to 250V ac and up to 3/4 amp, plus solid-state contact for switching dc loads up to 30V dc and up to 50mA.	ON/OFF
CL3B	210 to 250V ac, or 12 to 28V dc		
CL5A	105 to 130V ac, or 12 to 28V dc		12 timing functions
CL5B	210 to 250V ac, or 12 to 28V dc		



MAXI-AMP CL Series Specifications

SUPPLY VOLTAGE: Models CL3RA, CL5RA: 105 to 130V ac, 50/60Hz (4 VA), or 12 to 28V dc* at 60mA. Models CL3RB, CL5RB: 210 to 250V ac, 50/60Hz (4 VA), or 12 to 28V dc at 60mA. ***Do not connect ac voltage if using external dc power.**

OUTPUT CONFIGURATION: all models have SPDT electro-mechanical relay:
CONTACT RATING: 250V ac max, 24V dc max, 5 amps max. (resistive load), 1/10 H.P. at 240V ac. Install transient suppressor (MOV) across contacts which switch inductive loads.
CLOSURE TIME: 10 milliseconds max.
RELEASE TIME: 10 milliseconds max.
MAXIMUM SWITCHING SPEED: 20 operations/second
MECHANICAL LIFE: 20,000,000 operations
CL3 models also have a logic level current sinking NPN transistor switch at pin #9. See schematic below and hookup info.

AMPLIFIER:
RESPONSE SPEED: 1 millisecond
INPUT CHARACTERISTICS: input is switched when the voltage at pin #2 is pulled below 1V dc or when less than 1K ohms is connected between pins #2 and #1. When an inverting jumper is connected between pins #10 and #11, input is switched when the voltage at pin #2 rises above 4.5V dc or when the impedance between pins #2 and #1 exceeds 15K ohms.
HYSTERESIS: greater than .35 volts, less than 2 volts.

MULTIPLE SENSOR HOOKUP: any number of switched output devices may be connected in parallel to the input (see hookup example).

TIMERS (CL5 models only):
TIME RANGES: LOW range - 10 to 150 milliseconds
MIDDLE range - 0.1 to 1.5 seconds
HIGH range - 1 to 15 seconds
REPEATABILITY: +/-2% of set time over all extremes of supply voltage and temperature

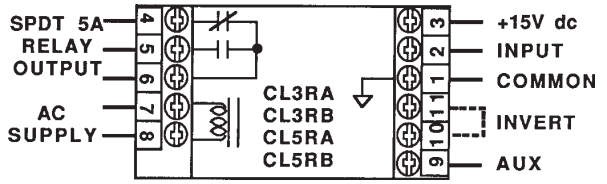
ADJUSTMENTS: Miniature switches for setting of timing function, timing range, and output polarity (CL5 models). 15-turn clutched potentiometer for time setting (CL5 models).

INDICATOR LEDs: Red indicator LEDs for input and output status.

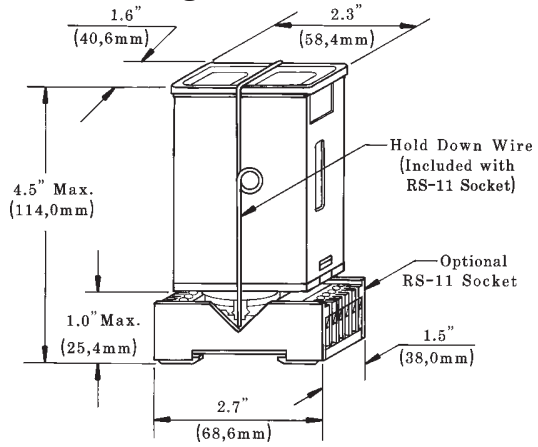
CONSTRUCTION: Rugged NORYL® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole plug base.

OPERATING TEMPERATURE: 0 to 50 degrees C (32 to 122 degrees F).

Generalized Hookup
models with electromechanical relay output

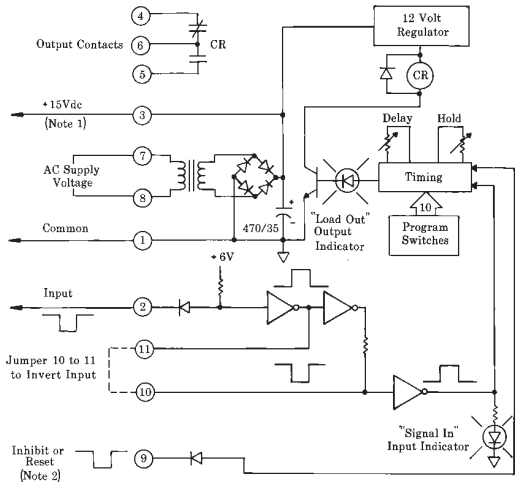


Dimension Drawing

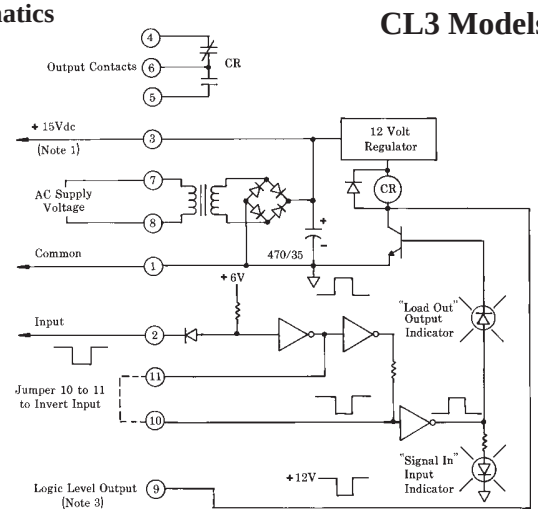


Functional Schematics

CL5 Models



CL3 Models



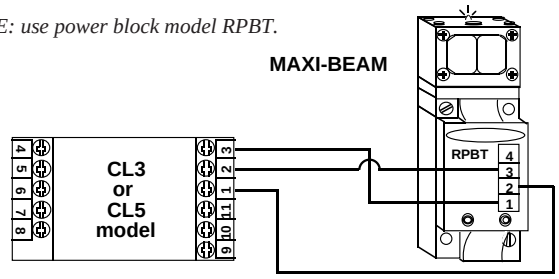
NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example). Current available is 50mA at 120V ac (240V ac) line level; 40mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). **Do not connect ac voltage if using external dc power.**

NOTE #2: pulling pin #9 low (to Common) will inhibit the timing, or reset the latch of CL5 models. (See "Description of Logic Functions", page 6)
NOTE #3: pin #9 of model CL3RA and CL3RB may be connected directly to the primary or auxiliary input of MAXI-AMP model CL5 or to Banner Plug Logic modules.

Sensor Hookup Diagrams for CL Series MAXI-AMP Modules

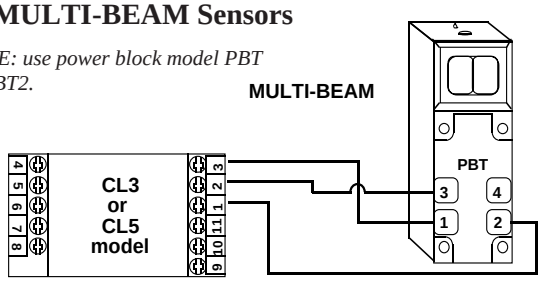
To MAXI-BEAM Sensors

NOTE: use power block model RPBT.



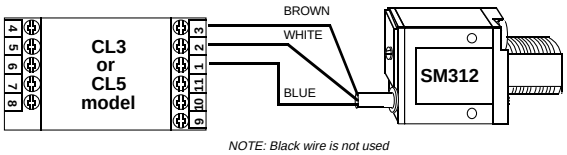
To MULTI-BEAM Sensors

NOTE: use power block model PBT or PBT2.



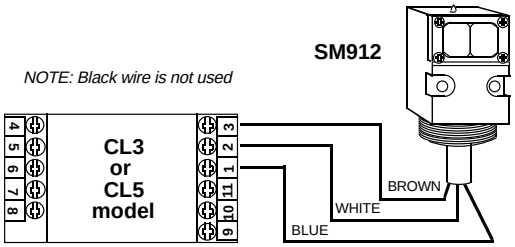
NOTE: the MAXI-AMP cannot power a MULTI-BEAM emitter and receiver pair. Use a separate power source for the emitter (e.g.- power block PBA-1, etc.)

To MINI-BEAM SM312 Series Sensors

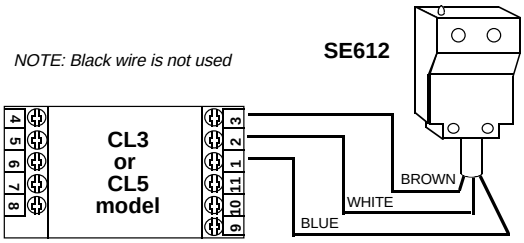


NOTE: Black wire is not used

To VALU-BEAM SM912 Series Sensors

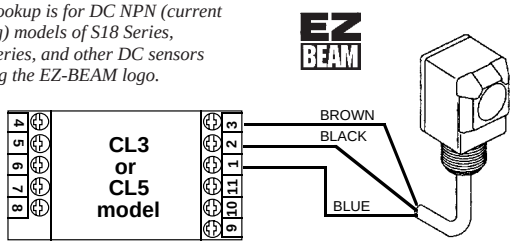


To ECONO-BEAM SE612 Series Sensors



To EZ-BEAM Sensors

This hookup is for DC NPN (current sinking) models of S18 Series, Q25 Series, and other DC sensors bearing the EZ-BEAM logo.



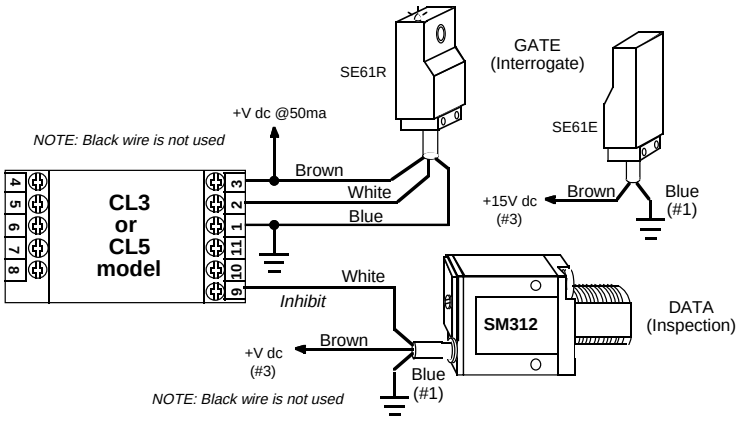
NOTE: White wire is not used

Use of Auxiliary Input (CL5 models)

CL5 model MAXI-AMPs have an auxiliary input at terminal #9 which may be used for the interrogation or reset of the selected logic function. This is accomplished by a switch closure between pins #9 and #1 (Common). The auxiliary input may also be switched by a DC device with an NPN transistor (current sinking) output. The effect of the auxiliary input is described for each logic function on page 6.

This example shows a typical inspection/rejection scheme which uses a Banner MINI-BEAM as the inspection sensor. Typically, the CL5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the SM312 "sees" an acceptable condition when the SE612 senses the leading (or trailing) edge of the product, the SM312 will inhibit a reject pulse from occuring. Reject products will be ejected by the output pulse.

NOTE: the MAXI-AMP can supply 50mA for external 10 to 30V dc devices. Carefully check the current draw of the devices to be powered by the MAXI-AMP.



Hookup of Multiple Self-contained Sensors

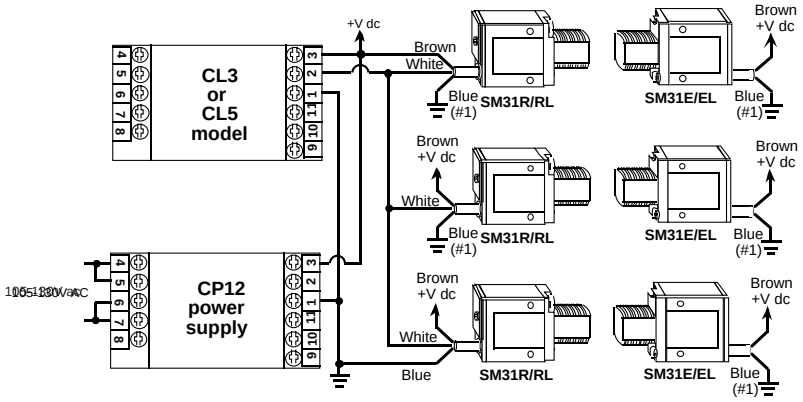
Any number of self-contained dc sensors may be wired together in parallel to a single CL Series MAXI-AMP module to create almost any multiple-sensor logic configuration. Power for the sensors may be obtained from MAXI-AMP 400mA power supply CP12 (shown below) or from 1-amp model PS120-15. The table at the right describes how the four most frequently used multiple-sensor logic configurations may be created.

MINI-BEAM SM312 Series and VALU-BEAM SM912 Series sensors have a switch on the back of their housings which is used to program the sensors for LIGHT or DARK operate. MAXI-BEAM sensors are set for LIGHT or DARK operate using the programming ring. MULTI-BEAM sensors are programmed for LIGHT or DARK operate with the logic module jumper wire. OMNI-BEAMs are programmed by a switch in the sensor block.

For ON/OFF sensor operation, *light operate* is equated to *normally open* output, and *dark operate* is defined as *normally closed.* EZ-BEAM sensors have both a normally open and a normally closed output. Selection of either output determines the LIGHT/DARK operate mode. ECONO-BEAM sensors are not programmable and must be ordered for LIGHT OPERATE (standard models) or DARK OPERATE (model suffix "NC").

The addition of a jumper wire between MAXI-AMP terminals #10 and #11 changes the input response from a low-going to a high-going signal. This feature, combined with the selection of LIGHT or DARK operate at the sensor, allows "AND" logic with parallel sensor connections.

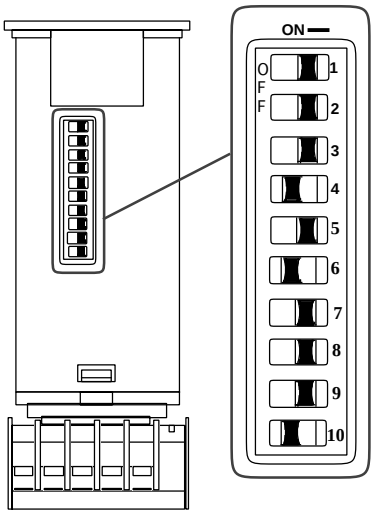
SENSOR PROGRAM: Light or Dark Operate	INVERTING JUMPER Installed Between Module Terminals #10 and #11	OUTPUT OCCURS (AFTER DELAY, IF ANY)	LOGIC DESCRIPTION
LIGHT OPERATE	NO	If any receiver "sees" light	LIGHT "OR"
LIGHT OPERATE	YES	When all receivers "see" dark	DARK "AND"
DARK OPERATE	NO	If any receiver "sees" dark	DARK "OR"
DARK OPERATE	YES	When all receivers "see" light	LIGHT "AND"



Timing Logic Programming (CL5 models)

Settings illustrated below are factory settings. Factory settings are "underlined" in the table.

(NOTE: see page 6 for description of logic functions)



TIMING LOGIC PROGRAMMING	SWITCH #1	SWITCH #2	SWITCH #3	SWITCH #4	SWITCH #5	SWITCH #6	SWITCH #7	SWITCH #8	SWITCH #9	SWITCH #10
On/Off	**ON**	**ON**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
On Delay	**ON**	**ON**	**OFF**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
Off Delay	**ON**	**OFF**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
On and Off Delay	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
One-shot	**OFF**	**OFF**	**ON**	**OFF**	**ON**	**OFF**	**ON**	—	—	—
Delayed One-shot	**OFF**	**OFF**	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	—	—	—
Limit	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**ON**	—	—	—
Repeat Cycle	**ON**	**OFF**	**OFF**	**ON**	**ON**	**OFF**	**ON**	—	—	—
AC Latch	**OFF**	**ON**	**ON**	**OFF**	**ON**	**ON**	**ON**	—	—	—
DC Latch	**ON**	**ON**	**ON**	**OFF**	**ON**	**ON**	**ON**	—	—	—
Delay and Latch	**ON**	**ON**	**OFF**	**OFF**	**ON**	**ON**	**ON**	—	—	—
Limit and Latch	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**ON**	**ON**	—	—	—

N/C Output	**OFF**	—	—
N/O Output	**ON**	—	—
.15 Sec. Max. Time	—	**OFF**	**OFF**
1.5 Sec. Max. Time	—	**ON**	**OFF**
15 Sec. Max. Time	—	**OFF**	**ON**

A group of ten switches located on one side of the module is used to select the timing logic for CL5 models.

Switches #1 through #7 are used to select the logic function. Switch #8 programs the output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for *both* functions of a dual timing mode (ON & OFF DELAY, DELAYED ONE-SHOT, and REPEAT CYCLE). However, DELAY and HOLD times are independently adjustable within the selected range.

The diagram shows switch locations, and the table summarizes the program switch positions.

MAXI-AMP™ System

CP Series Power Supply Modules

MODEL	INPUT VOLTAGE	OUTPUT POWER	OUTPUT DEVICE
CP12C	105 to 130V ac (15 VA) or 210 to 250V ac (15 VA) 50/60Hz	400 milli-amps maximum for 10-30V dc sensing devices	None
CP12RC			SPDT 5-amp electro-mechanical

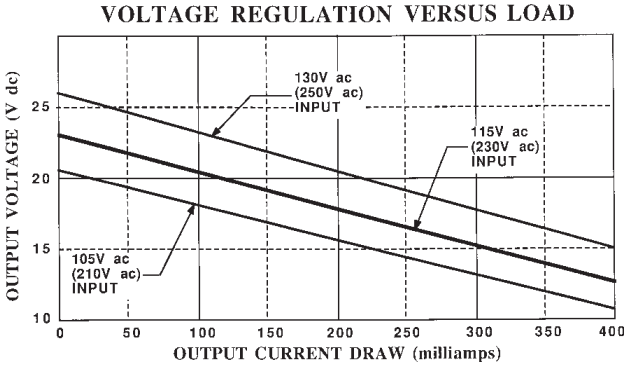
MAXI-AMP CP Series power supply modules provide a convenient source of power for 10 to 30V dc sensing devices such as Banner self-contained dc sensors and/or any of the Banner logic modules and remote amplifiers. It is an excellent way to supply power to a system using multiple MAXI-AMP modules and associated sensors.

These supplies are designed for either 120 or 220/240V ac input voltage (see hookup diagrams). They offer 400 milliamps for powering 10 to 30V dc devices.

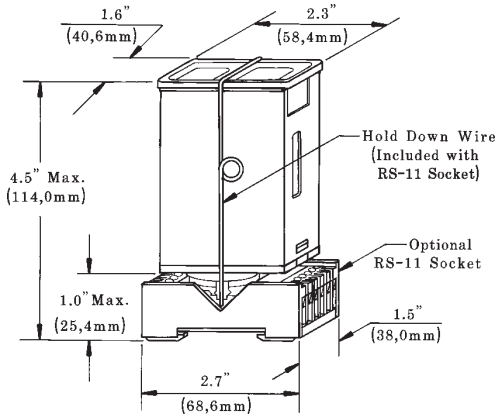
Model CP12RC includes a relay which may be switched by the output of dc sensors or modules. The relay is a single-pole double-throw (SPDT) 5 amp electromechanical type.

CP series power supplies are built into the rugged MAXI-AMP housing. They connect via a standard 11-pole round-pin relay socket (Banner RS-11). The RS-11 socket allows DIN rail mounting of the power supply. Operating temperature for CP series power supply modules is 0 to 50 degrees C (32 to 122 degrees F).

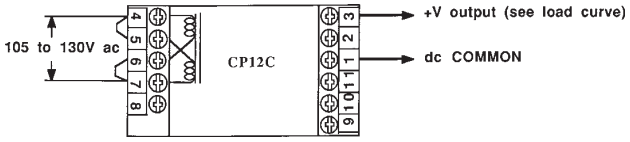
Load Curve



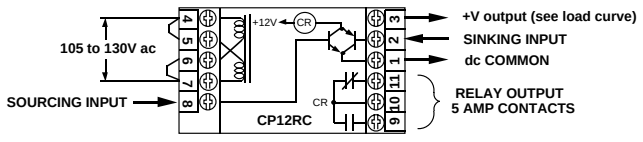
Dimensions



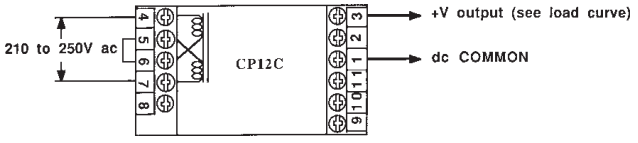
120V ac Hookup Diagram, CP12C



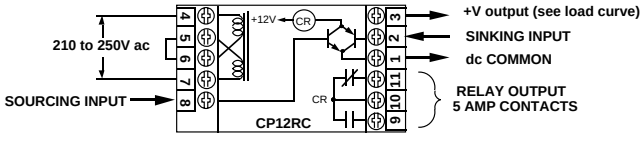
120V ac Hookup Diagram, CP12RC



220/240V ac Hookup Diagram, CP12C



220/240V ac Hookup Diagram, CP12RC



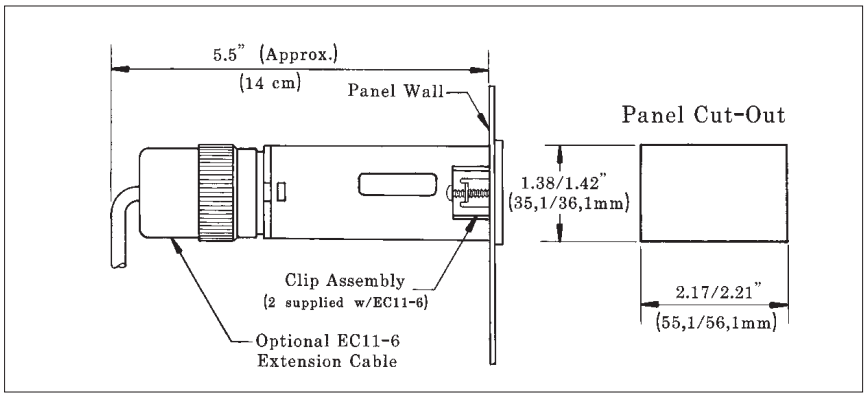
MAXI-AMP System

Mounting and Accessories

Panel Wall Mounting of MAXI-AMP Module

After the panel cutout has been completed and deburred, slide the MAXI-AMP through the cutout and place one clip assembly into the rectangular depression on each of the two narrow sides of the housing. Orient clips as shown, and alternately tighten the screws for equal pressure against the inside of the panel wall. Do not overtighten the screws. Attach the optional EC11-6 extension cable (described below) to the MAXI-AMP and route the opposite end of the cable to the RS-11 (or equivalent) socket.

Model EC11-6 extension cable is 6 feet (2m) long. Clips for panel wall mounting of the MAXI-AMP are included with the cable.

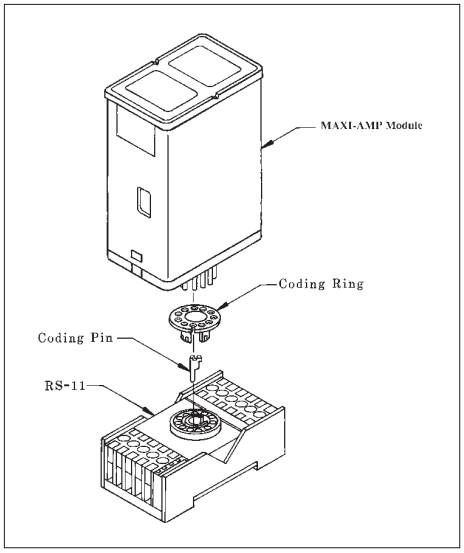


Accessories for MAXI-AMP Modules

Model RS-11 Socket

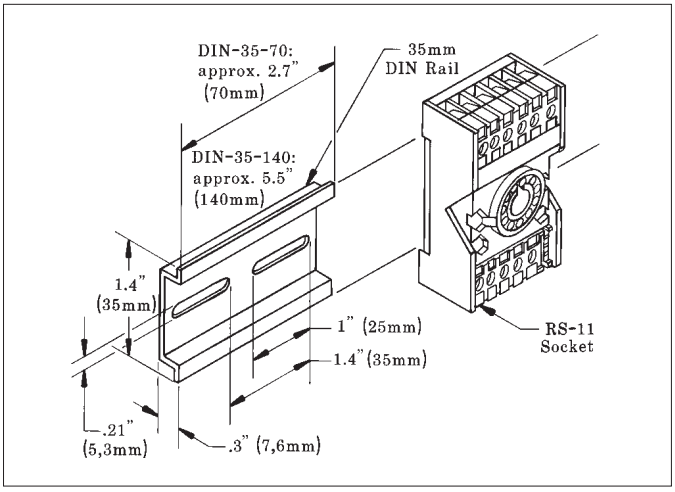
Model RS-11 is an eleven-pole round-pin screw terminal relay socket which is used to make electrical connections to any MAXI-AMP module. The socket provides in-line wire clamp screw terminals which will accept from one #24 AWG up to two #14 wires at each pin. The RS-11 is UL recognized (file #E92191) and CSA approved (file #LR38486). It may be mounted directly to a panel plate or via standard 35mm DIN-rail track (see below). A hold-down wire is supplied with each RS-11 socket (see Dimension Diagram on page 22).

The RS-11 is supplied with a coding ring and pin (see diagram at right). This allows a MAXI-AMP to be keyed to fit only its own 11-pin socket. The pin is installed in one of the eleven slots in the RS-11, and the notch in the ring is aligned to slip over the pin. When the MAXI-AMP is removed from the RS-11, the coding ring stays with the MAXI-AMP base, while the coding pin remains in the socket.



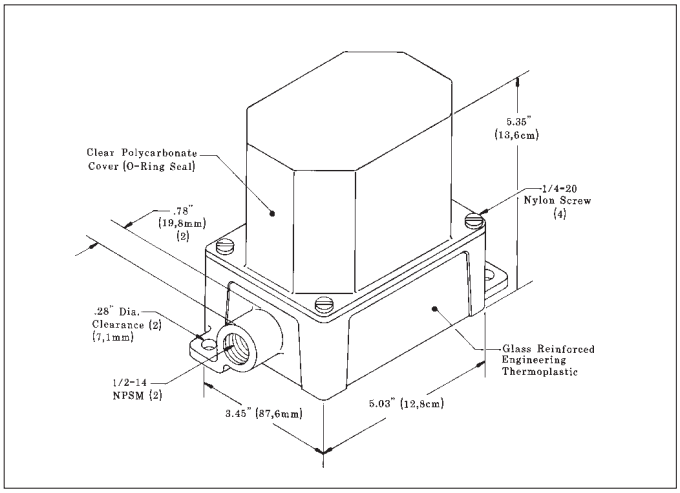
35mm DIN Rail Track

Track model DIN-35-70 accomodates one RS-11 socket. Model DIN-35-105 holds two sockets. Model DIN-35-140 holds up to three sockets. The RS-11 socket is designed to snap (or slide) directly into the 35mm DIN track.



Model BENC-4 Enclosure

Model BENC-4 is a NEMA-4 rated corrosion-resistant enclosure for a MAXI-AMP module or other control device. It is supplied with a DIN-35-70 track for easy mounting of one RS-11 socket. For mounting two sockets, use DIN-35-105.



Accessories for High Performance Modulated Remote Sensors

Extension Cable

Modulated remote sensors require specially designed cable for efficient sensor performance. Extension cable is available in 100 foot (30m) lengths.

Extension Cable Model	Used on Sensor Models	# of Wires	Wire Colors
EC12E-100	SP12SEL, SP12PEL	2	White, Green
EC12R-100	SP12SRL, SP12PRL	3	Black, Blue, Brown
ESC-100	PT200, PT250, PT400, SP300RL	3	White, Green, Shield
RSC-100	LR200, LR250, LR400, SP300EL	3	Red, Black, Shield
SSC-100	SP300D, SP300L, LP400WB, SP1000V	5	White, Green, Red, Black, Shield
EC300E-100	LR300	2	White, Shield
EC300R-100	PT300	2	Red, Shield
EC320-100	SP320D	4	White, Shield, Red, Shield

Cable Protection

AC-6 6 feet (1,8m)
AC-30 30 feet (9m)

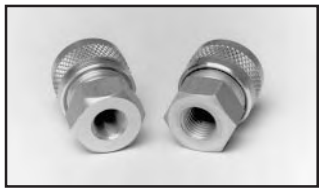
This is mild-steel flexible tubing used with the compression fittings, at right, to achieve maximum protection to sensor cables.
I.D. = 5/16"; O.D. = 7/16".

PVC-6 6 feet (1,8m)
PVC-30 30 feet (9m)

Heavy duty PVC tubing used to protect sensor cable in applications involving moisture and/or corrosive materials. I.D. = 1/4"; O.D. = 3/8".

Compression Fittings used to Attach Protective Tubing to Remote Sensors

CF3-8 3/8"-32 thread
CF7-16 7/16"-20 thread



Compression Fitting Model	Used to Attach Tubing to these Models
CF3-8	LR400, PT400, LP400WB
CF7-16	SP300EL, SP300RL,SP300D,SP300L, LR200, PT200

WARNING MAXI-AMP sensors, amplifiers, and logic modules 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 output condition.

Never use any MAXI-AMP product as a sensing device for personnel protection. Its 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.

MAXI-AMP™ CI3RC2

for SMI Series intrinsically safe sensors

Current Trip Point Module

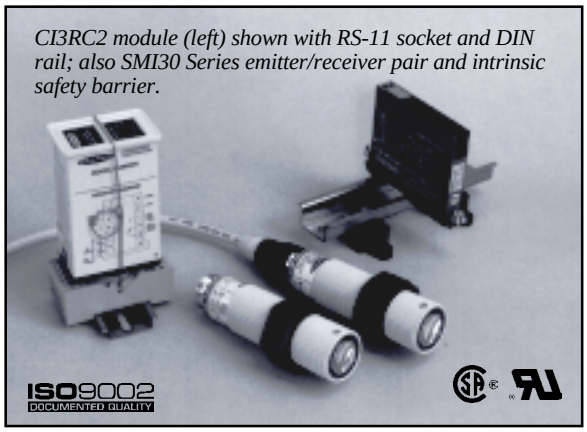
BANNER
the photoelectric specialist

- **Self-contained current sensing amplifier**
- **Works with intrinsically safe barrier to provide power to Banner SMI Series intrinsically safe DC sensor(s); converts input signal from the sensor to a contact closure**
- **Powers a single sensor or both the emitter and receiver of an opposed mode pair**
- **Powered by 105-130 or 210-250V ac (50/60Hz)**
- **Two output devices: SPDT 5 amp electromechanical relay and opto-isolated transistor for logic level dc switching**

The Banner MAXI-AMP model CI3RC2 (p/n 36606) is a self-contained module which converts the current output signal of an SMI Series intrinsically safe sensor to a trip point switch.

Banner SMI Series intrinsically safe sensors carry Factory Mutual Research's rating for use in hazardous areas. Sensors are wired to model CI3RC2 using the two-wire hookup through an intrinsically safe barrier. Refer to the hookups, page 2. The SMI Series sensor sinks ≤10 milliamps in the "OFF" state and ≥20 milliamps in the "ON" state. The CI3RC2 module senses this current change and switches internal relays that may be easily wired to most loads and/or additional control circuitry.

Model CI3RC2 is powered by either 105-130 or 210-250V ac. It supplies dc power to operate a single sensor or both the emitter and receiver of one SMI Series opposed mode sensor pair. The sensor's input to the CI3RC2 is protected against short circuits.



CI3RC2 module (left) shown with RS-11 socket and DIN rail; also SMI30 Series emitter/receiver pair and intrinsic safety barrier.

Built-in circuit diagnostics indicate an input overload by flashing an LED status light.

The MAXI-AMP CI3RC2 module has two isolated output switches. There is a 5-amp rated SPDT electromechanical relay, and a solid-state transistor switch which may be used for logic-level interfaces.

Banner also offers the CI3RC2 Current Trip Point Module as part of a kit. See page 2 for further information. The CI3RC2 may be used with the following Banner Intrinsically Safe sensors: SMI30 Series, SMI912 Series.

SPECIFICATIONS

SUPPLY VOLTAGE: 105 to 130 or 210 to 250V ac, 50/60 Hz (8VA)

OUTPUT CONFIGURATION:
SPDT electromechanical relay:
Contact rating: 250V ac maximum, 24V dc maximum, 5 amps maximum (resistive load), 1/10 HP at 240V ac. Install transient suppressor (MOV) across contacts which switch inductive loads.
Closure time: 10 milliseconds maximum.
Release time: 10 milliseconds maximum.
Maximum switching speed: 20 operations/second.
Mechanical life: 20,000,000 operations
Solid-state dc relay: SPST optically-coupled transistor; 30V dc maximum, 20mA maximum.

EMITTER POWER: +24V dc at 25 mA maximum available at module pin #3.

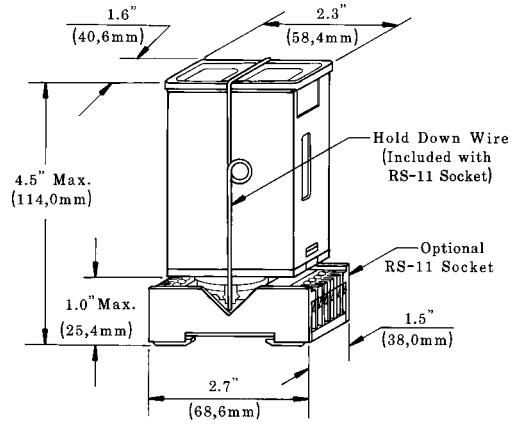
INPUTS:
Trip point for output "OFF": ≤10 milliamps
Trip point for output "ON": ≥20 milliamps
Trip point range for input overload indication: 30mA ≤ I ≤ 80mA.

INDICATOR LEDs:
OUTPUT "ON" and INPUT overload/short.

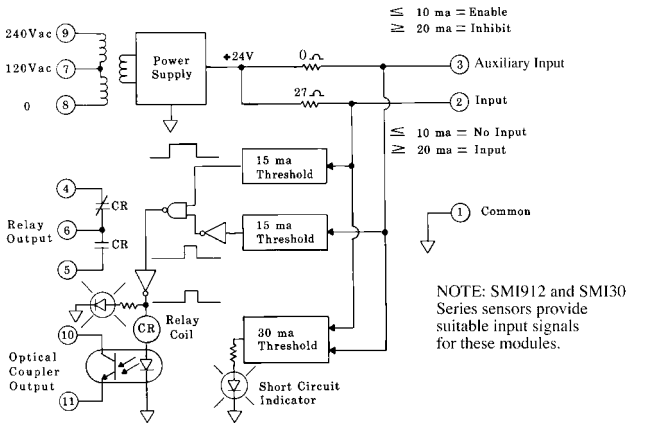
OPERATING TEMPERATURE: 0 to 50°C (32 to 122°F).

CONSTRUCTION: rugged NORYL® polyphenylene oxide (PPO®) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole base. Use RS-11 socket or equivalent.

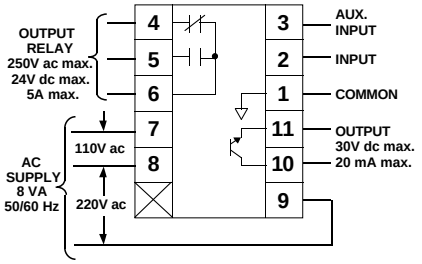
DIMENSION DRAWING



FUNCTIONAL SCHEMATIC



GENERALIZED HOOKUP, CI3RC2



WARNING This photoelectric sensing product does NOT include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A failure or malfunction can result in *either* an energized or a de-energized output condition.

Never use this product as a sensing device for personnel protection. Its 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.

SMI Series sensors are certified intrinsically safe ONLY when used with certified energy-limiting intrinsically-safe barriers. Banner does not itself manufacture intrinsically-safe barriers. Barriers may, however, be purchased from Banner. Kit CI2BK-1 includes one each of the following: single channel barrier, CI3RC2 amplifier, RS-11 socket, DIN rail mount, and a 70 mm DIN rail for mounting the socket. Kit CI2BK-2 provides a dual channel barrier in place of the single channel barrier. Barriers are available separately (below right).

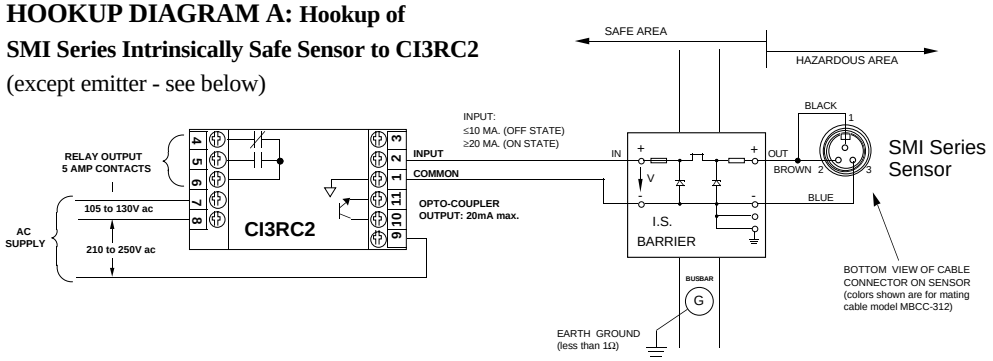
An SMI Series sensor is wired through a barrier using the 2-wire hookup. In the 2-wire hookup configuration, the sensor acts as a current sink, drawing less than 10mA in the OFF state and more than 20mA in the ON state. Model CI3RC2 senses this current change and switches internal relays. The SPDT electromechanical relay in the CI3RC2 can switch a load which draws up to 5 amps (see specifications). The SPST solid-state relay can switch a dc load of up to 30V dc, max.; 20mA, max.

SMI Series emitter-only units also use the 2-wire hookup through a barrier (see hookup diagram "B"). Emitter power (24V dc, 25 mA maximum) is obtained at pin #3. This is sufficient to power *one* emitter.

The user of this equipment is responsible for the proper installation and maintenance of the equipment, and must conform with certification requirements relating to barriers and to maximum allowable capacitance and inductance of field wiring. If you have questions about these requirements, Banner applications engineers can refer you to the proper authority.

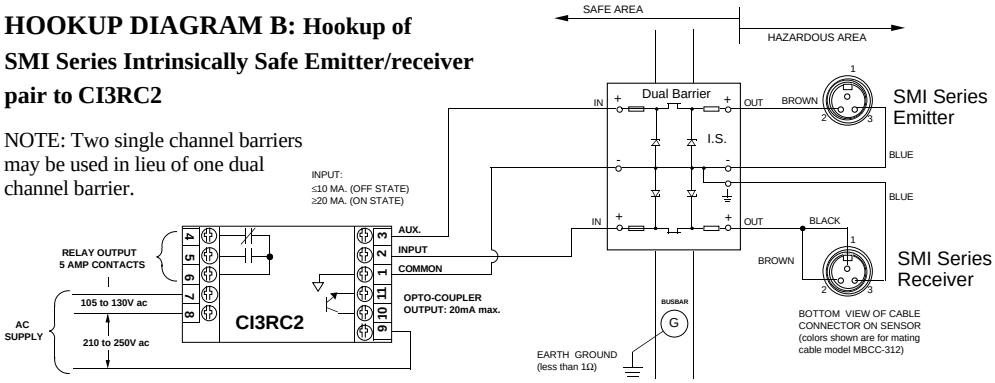
HOOKUP DIAGRAM A: Hookup of SMI Series Intrinsically Safe Sensor to CI3RC2

(except emitter - see below)



HOOKUP DIAGRAM B: Hookup of SMI Series Intrinsically Safe Emitter/receiver pair to CI3RC2

NOTE: Two single channel barriers may be used in lieu of one dual channel barrier.



Kits for use with Intrinsically Safe Sensors

Kit CI2BK-1 (p/n 36860), one each:
- Single-channel barrier
- CI3RC2 amplifier
- RS-11 socket
- DIN rail mount
- 70 mm DIN rail

Kit CI2BK-2 (p/n 36605), one each:
- Dual-channel barrier
- CI3RC2 amplifier
- RS-11 socket
- DIN rail mount
- 70 mm DIN rail

Barriers are available separately:

Single channel barrier: **CIB-1** (p/n 27030)

Dual channel barrier: **CI2B-1** (p/n 36865)