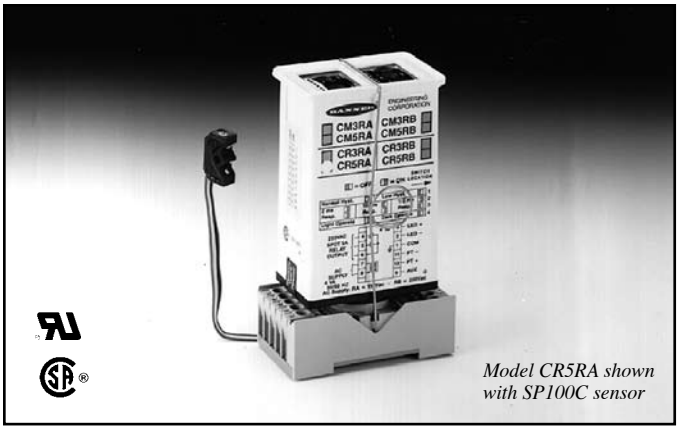
MAXI-AMP™ CR Series

Modulated Amplifier Modules for "100 Series" Sensors

BANNER®
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).

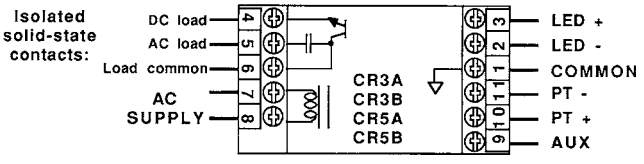
An auxiliary input is available on CR5 models for interrogation or reset of the selected logic function (see example, page 4). Page 6 describes the function of the auxiliary input for each logic mode. A dc power supply is included for powering an additional self-contained dc sensor.

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

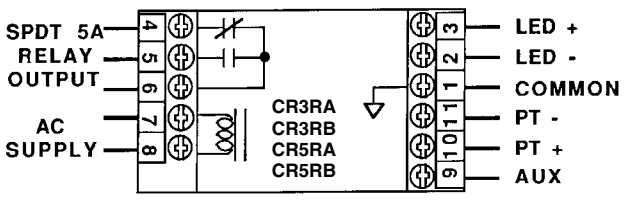
ADJUSTMENTS: Miniature switches for programming of LIGHT/ DARK operate, amplifier response time, amplifier hysteresis, normally open or normally closed output, and timing function (CR5 models). 15-turn clutched potentiometer for gain and time setting(s) (CR5 models).

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.

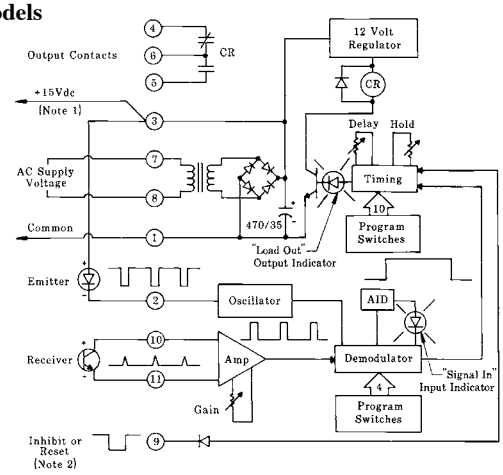
Generalized Hookup



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.

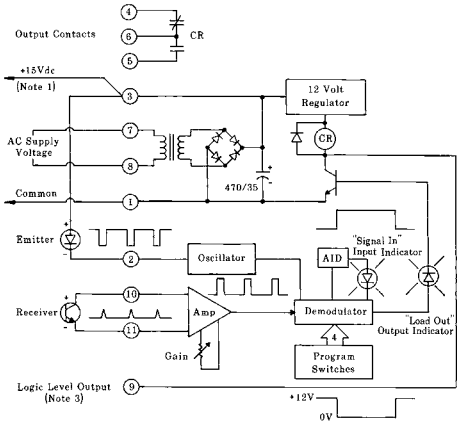
Functional Schematics

CR5 Models



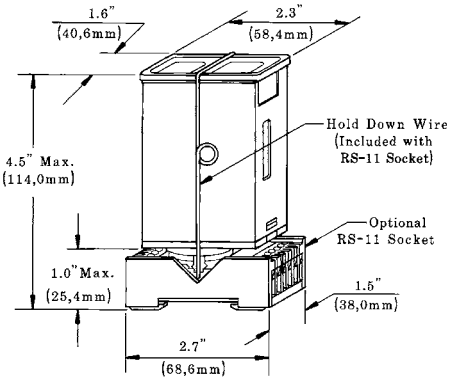
NOTE #1: power is available at pins #3 (+) and #1 (-) for an external 10 to 30V dc device (see hookup example, page 4). Current available is 40 mA at 120V ac (240V ac) line level; 30mA at 105V ac (210V ac) line level. Alternately, the module may be powered by 12 to 28V dc at pins #3 (+) and #1 (-). Do 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.

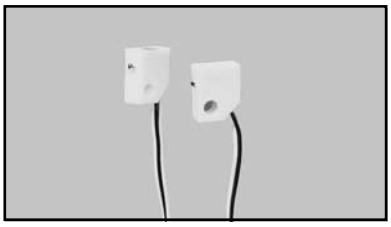
Dimension Drawing



Sensors for use with CR Series Modulated Amplifier Modules

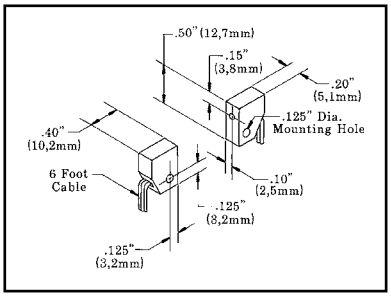
Temperature range for all miniature modulated remote sensors is 0 to 70 degrees C (+32 to 158 degrees F).
Sensors are epoxy-encapsulated and optics are hermetically sealed.

Models/Dimensions — Excess Gain — *Beam Pattern*



SP100E & SP100R

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



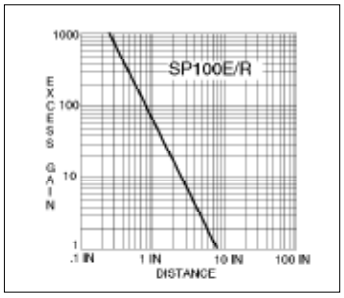
Cable (all 6-foot lengths): SP100E: 2-wire ribbon cable (white, green).

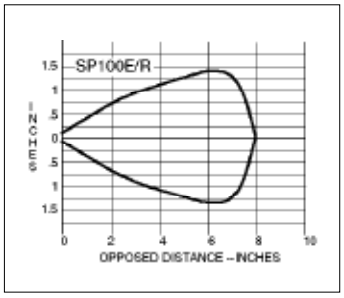
SP100R: 3-wire ribbon cable (red, black, yellow).

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

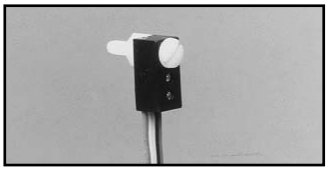
OPPOSED Mode Sensors

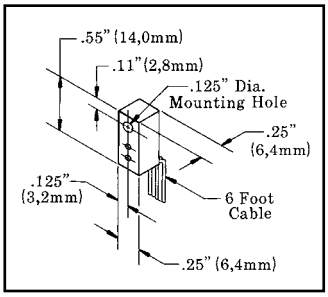
SP100E and SP100R miniature opposed sensors have a slim right-angle design which allows them to be mounted in very tight locations. The thin, flexible ribbon cable which exits from one corner may be run in any direction away from the sensing point. The SP100E and R have a wide beam angle for forgiving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



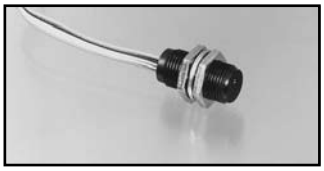


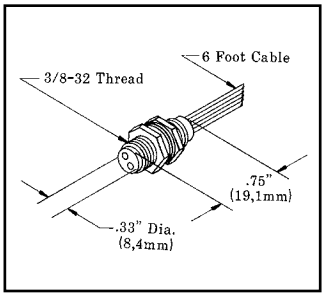
SP100D





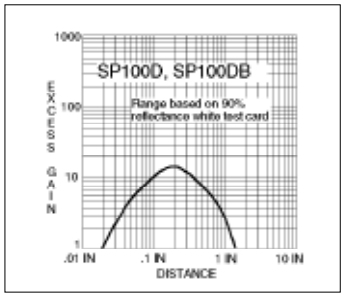
SP100DB

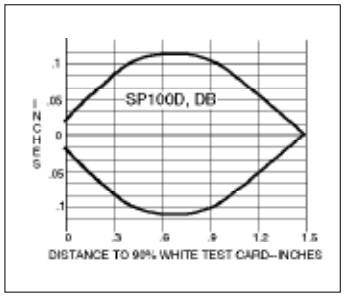




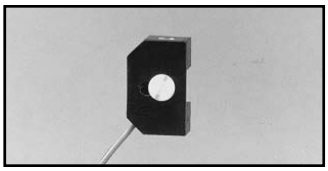
DIFFUSE Mode Sensors

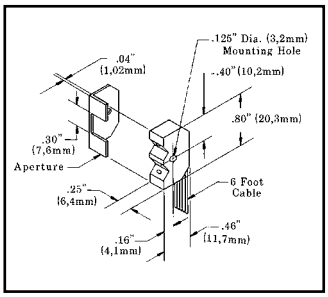
Models SP100D and SP100DB are general-purpose miniature diffuse sensors which detect the reflection of their own light from the surface of an object. The SP100D is a right-angle design which is generally held in place using a #4 (3mm) screw. The SP100DB ("B" = Barrel) is an in-line threaded barrel which 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.



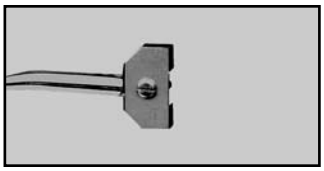


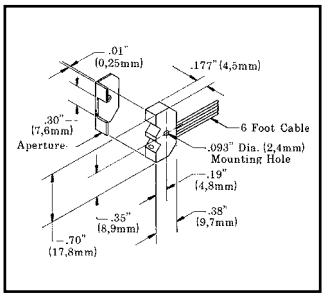
SP100C





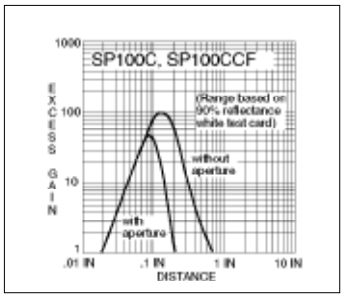
SP100CCF

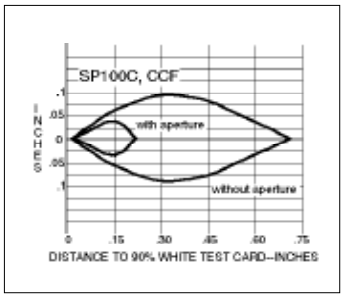




CONVERGENT Mode Sensors

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.

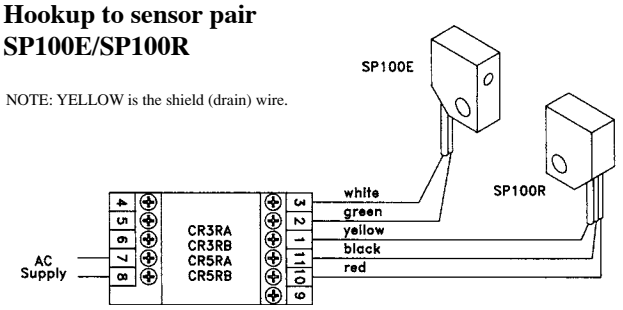




Sensor Hookup Diagrams for CR Series MAXI-AMP Modules

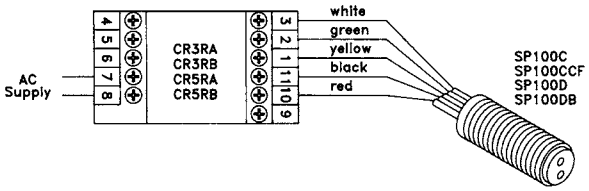
Hookup to sensor pair SP100E/SP100R

NOTE: YELLOW is the shield (drain) wire.



Hookup to sensor models SP100C, SP100CCF, SP100D, SP100DB

NOTE: YELLOW is the shield (drain) wire.

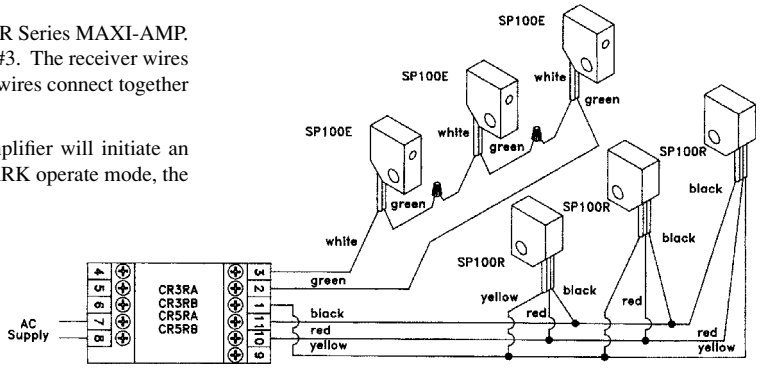


Hookup to multiple sensors

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.

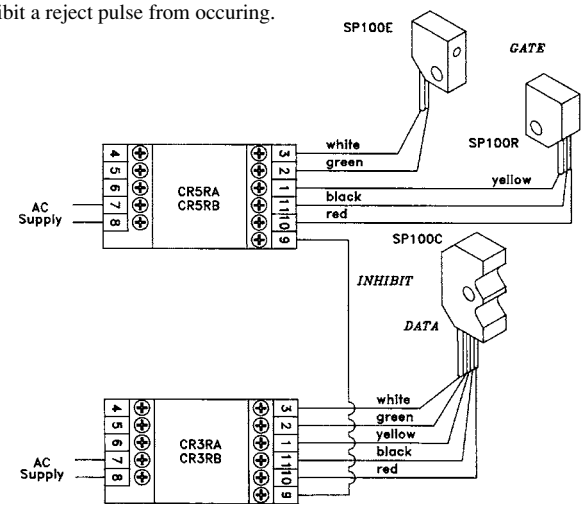
When multiple remote sensors share a common amplifier, the range of each sensor decreases. When wiring two sensors to one MAXI-AMP, multiply excess gain data for each sensor by 1/2 (obtain the data from the applicable excess gain curve). When wiring three sensors to one MAXI-AMP, multiply excess gain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

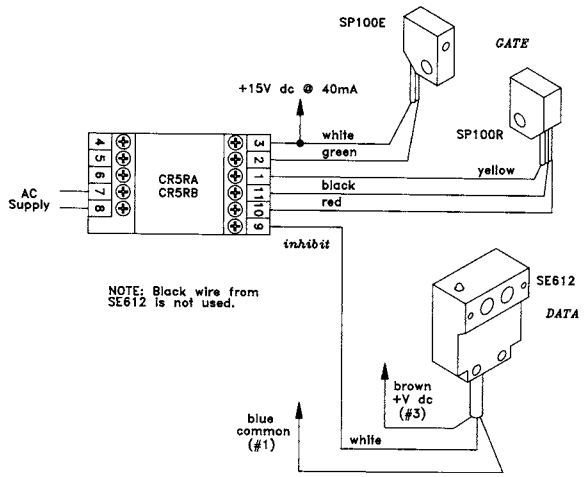


Power for external devices

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.

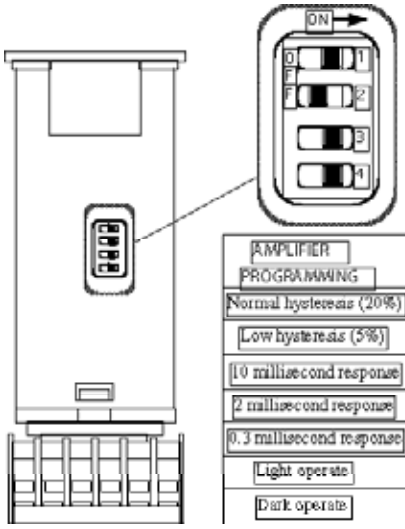
The example shows the use of an SE612 ECONO-BEAM sensor to provide inspection information, with the SP100E/R pair functioning as a product sensor. Typically, the CR5 module would be programmed for the ONE-SHOT or DELAYED ONE-SHOT logic function. If the SE612 "sees" an acceptable condition when the SP100E/R 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.

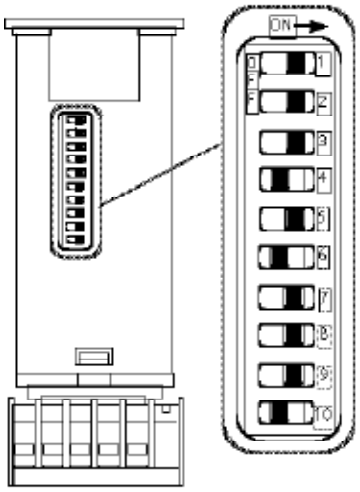
Switch #4 is used to select LIGHT OPERATE or DARK OPERATE. In the LIGHT OPERATE mode, the output will energize (in ON/OFF or LATCH operation) or the timing function will initiate (in DELAY, ONE-SHOT, or LIMIT operation) when the receiver "sees" sufficient light (excess gain greater than 1X). In DARK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

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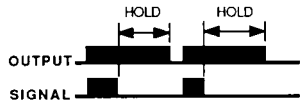
output for either NORMALLY OPEN or NORMALLY CLOSED operation. Switches #9 and #10 program the time range(s). There are three ranges: 10 to 150 milliseconds, 0.1 to 1.5 seconds, and 1 to 15 seconds. The programmed range will be the same for both functions of a dual timing mode (ON & OFF DELAY, DELAYED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

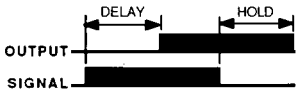
Description of Logic Functions, CR5 models

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.

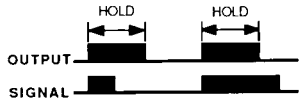
ON DELAY: The ON DELAY timer keeps the output "off" until the selected LIGHT or DARK signal has been present for the preset "DELAY" time. If the input signal is interrupted, the timing is reset and starts over with the next signal. Grounding pin #9 immediately cancels an output in progress and resets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



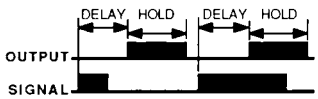
OFF DELAY: The output energizes immediately when the input signal occurs, but does not de-energize until the signal has been removed for the preset OFF-DELAY ("HOLD") time. Grounding pin #9 prevents an output from occuring. If an inhibit input occurs during an output, the output remains "on" for the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



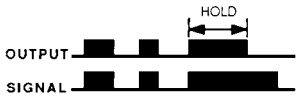
ON & OFF DELAY: ON and OFF DELAY logic combines both timing functions into a single mode. The ON-DELAY ("DELAY") time and the OFF-DELAY ("HOLD") time are independently adjustable within the selected time range. Momentary grounding of pin #9 during the ON-DELAY period resets the DELAY timer. An inhibit 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.



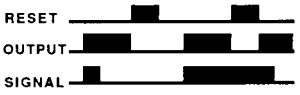
DELAYED ONE-SHOT: A DELAYED ONE-SHOT is initiated by either a momentary or maintained input signal. This input starts the adjustable "DELAY" period, after which the output pulses for an adjustable pulse ("HOLD") time. No further action occurs unless the input is removed and reapplied, beginning a new 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.

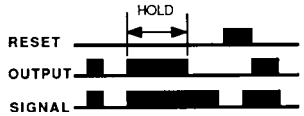
REPEAT CYCLE: The REPEAT CYCLE function provides an oscillating output when an input signal is present. Presence of an input signal triggers an adjustable "DELAY" timer. After the delay, the output energizes for an adjustable "HOLD" period. If the input remains, the output continues to cycle "on" and "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.

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.

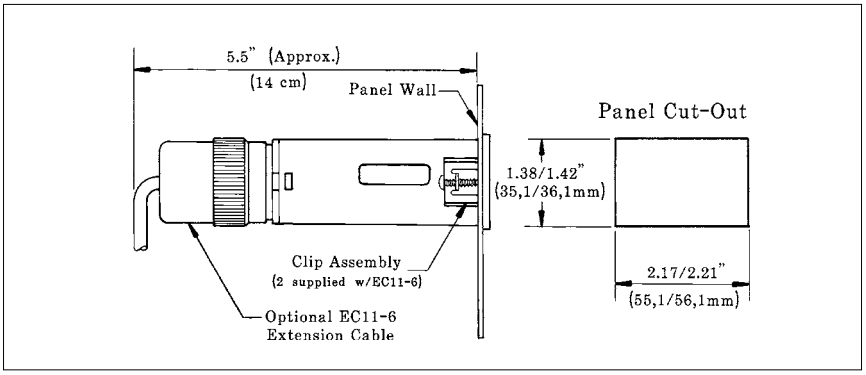
MAXI-AMP System

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.

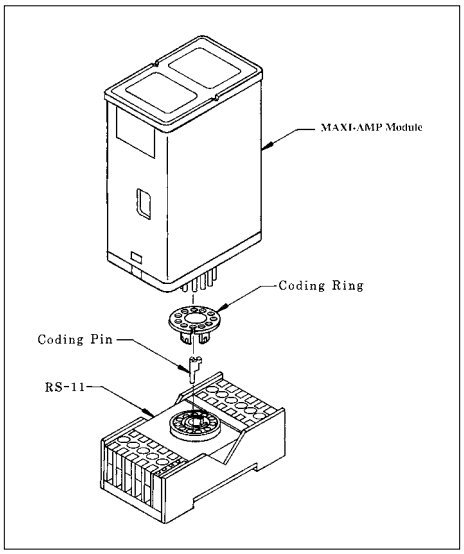
Model EC11-6 extension cable is 6 feet (2m) long. Clips for panel wall mounting of the MAXI-AMP are included with the cable.



Accessories for MAXI-AMP Modules

Model RS-11 Socket

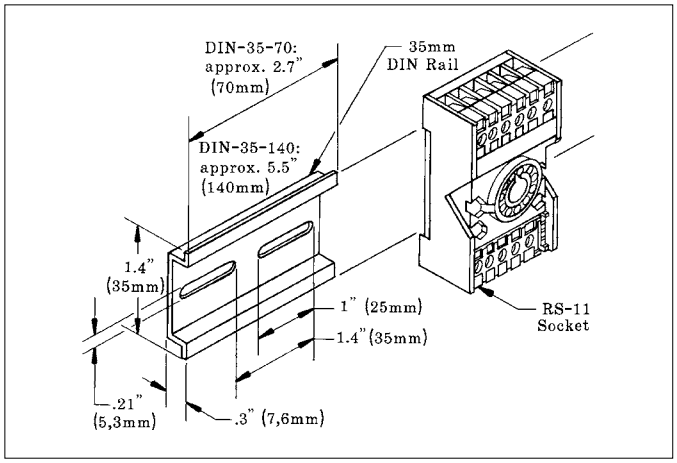
Model RS-11 is an eleven-pole round-pin screw terminal relay socket which is used to make electrical connections to any MAXI-AMP module. The socket provides in-line wire clamp screw terminals which will accept from one #24 AWG up to two #14 wires at each pin. The RS-11 is UL recognized (file #E92191) 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.

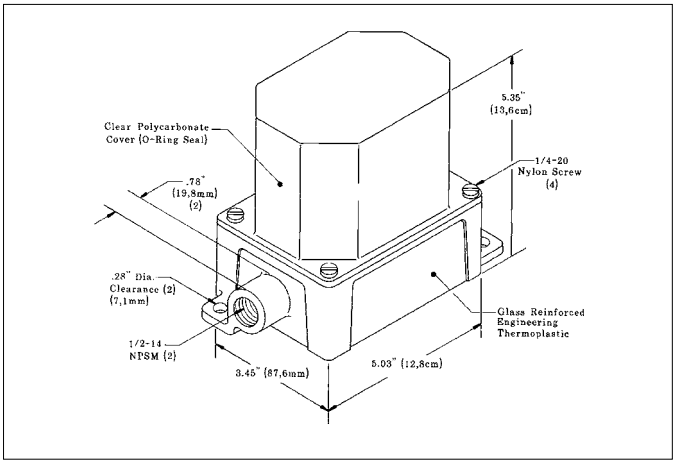
35mm DIN Rail Track

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.



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