

# MICRO-AMP<sup>®</sup> System

## MA3 and MA3P Modulated Amplifiers

Banner MICRO-AMP<sup>®</sup> modules MA3 and MA3P are **modulated amplifiers designed for use with SP100 Series miniature remote sensors**. Miniature photoelectric sensors have traditionally been used as *non-modulated* devices with very limited response. MICRO-AMP amplifiers have a specially-engineered *modulated* design which brings about a dramatic improvement in the optical performance of miniature remote sensors.

MICRO-AMP modules are powered by 10 to 30 volts dc, and feature the patented Banner Alignment Indicator Device (AID™) signal strength LED. Sensor sensitivity is adjustable via a top-mounted GAIN potentiometer. Model MA3 has complementary current sinking (NPN) outputs; model MA3P has complementary current sourcing (PNP) outputs. Circuitry is epoxy-encapsulated and enclosed in a tough molded VALOX<sup>®</sup> housing. Connections may be made to the MICRO-AMP via the optional RS8 socket/wiring base, or the module may be mounted directly to a printed circuit board (page 20).

The small size and the slim ribbon-style connecting cable of SP100 Series sensors make it possible to use photoelectrics in many situations previously thought to be impractical or even impossible.



### MICRO-AMP<sup>®</sup> Model MA3 Specifications

**SUPPLY VOLTAGE:** 10 to 30V dc at less than 20 milliamps (exclusive of load); 10% maximum ripple.

**OUTPUT CONFIGURATION:** two open-collector NPN (current sinking) transistor (solid-state) switches; one normally open (light operate) and one normally closed (dark operate); 150 milliamps maximum, each output. Saturation voltage less than 0.5V dc at 10 milliamp load. Off-state leakage current less than 1 microamp.

**RESPONSE SPEED:** 1 millisecond ON and OFF.

**REPEATABILITY:** 0.3 millisecond.

**SENSOR LEAD LENGTH:** 15 feet (4,5 m) maximum.

**ADJUSTMENT:** GAIN adjustment (single-turn potentiometer; adjust with small flat-blade screwdriver).

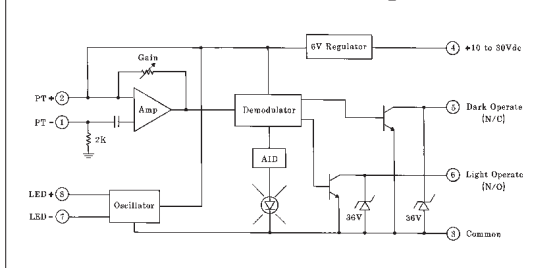
**INDICATOR:** exclusive Banner Alignment Indicator Device (AID™) system lights a red LED indicator whenever the sensor "sees" its own modulated light source, and pulses at a rate proportional to the strength of the received light signal.

**CONSTRUCTION\*:** totally encapsulated plug-in package with molded VALOX<sup>®</sup> housing. Gold-flashed connection pins.

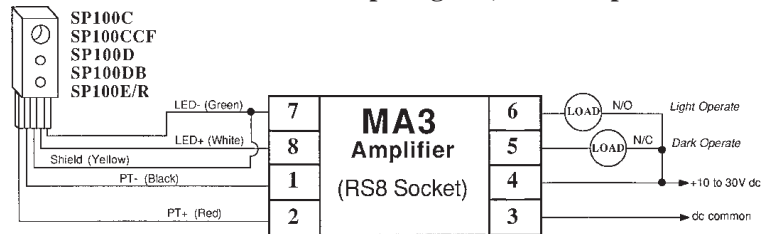
**OPERATING TEMPERATURE:** 0 to +70 degrees C (32 to +158 degrees F).

\*A Dimension Drawing appears on page 2.

Functional Schematic, MA3 Amplifier



Hookup Diagram, MA3 Amplifier

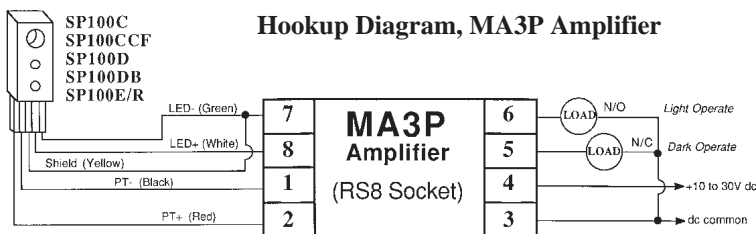


### Model MA3P: PNP (current sourcing) output

Model MA3P has the same specifications and performance as the MA3 amplifier, except that the MA3P has complementary PNP outputs in place of the MA3's NPN configuration.

**OUTPUT:** two PNP transistors, complementary outputs; one normally open (light operate) and one normally closed (dark operate). 150 milliamps maximum, each output. Saturation voltage is less than 1V dc at 10 milliamps. Off-state leakage current is less than 1 microamp.

Hookup Diagram, MA3P Amplifier



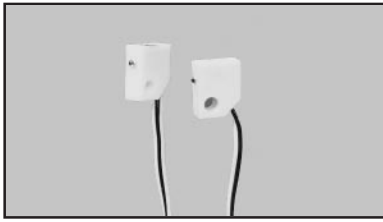
# Sensors for use with MA3 and MA3P Modulated Amplifiers

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

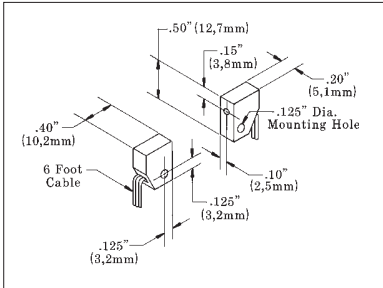
## Excess Gain

## Beam Pattern



### SP100E & SP100R

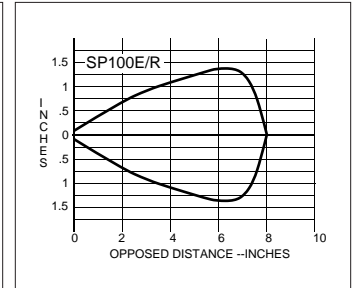
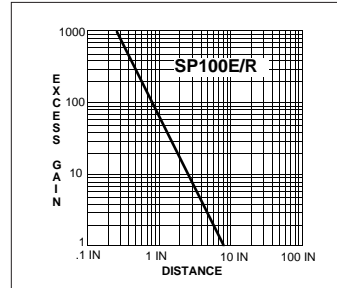
**Range:** 8 inches (20cm)  
**Beam:** infrared, 880nm  
**Effective beam:** .05 inch (1,3mm diameter)



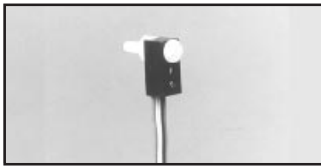
Cable (all 6-foot lengths):  
 SP100E: 2-wire ribbon cable (white, green).  
 SP100R: 3-wire ribbon cable (red, black, yellow).  
 SP100D, DB, C, CCF: 5-wire ribbon cable (white, green, red, black, yellow). See hookup drawing.

### 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 MICRO-AMP module.



### SP100D

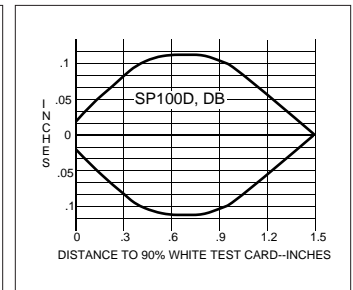
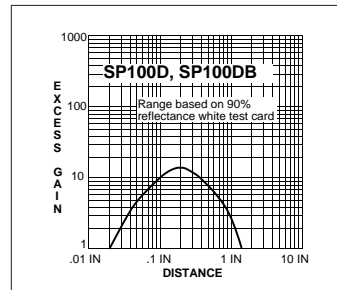
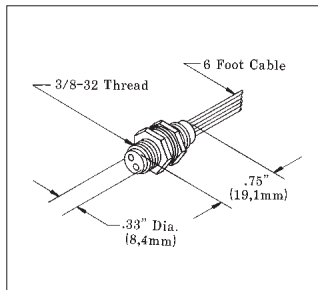
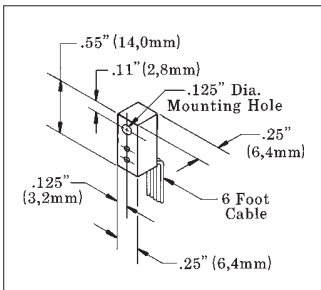


### SP100DB

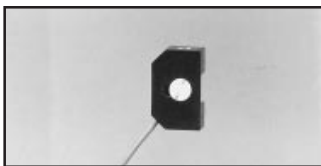


### DIFFUSE Mode Sensors

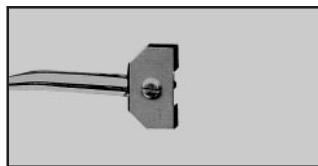
Models SP100D and SP100DB are general-purpose miniature diffuse sensors which detect the reflection of their own light from the surface of an object. The SP100D is a right-angle design which is generally held in place using a #4 (3mm) screw. The SP100DB ("B" = Barrel) is an in-line threaded barrel which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



### 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.

