

SM51 Series Opposed Mode Sensors

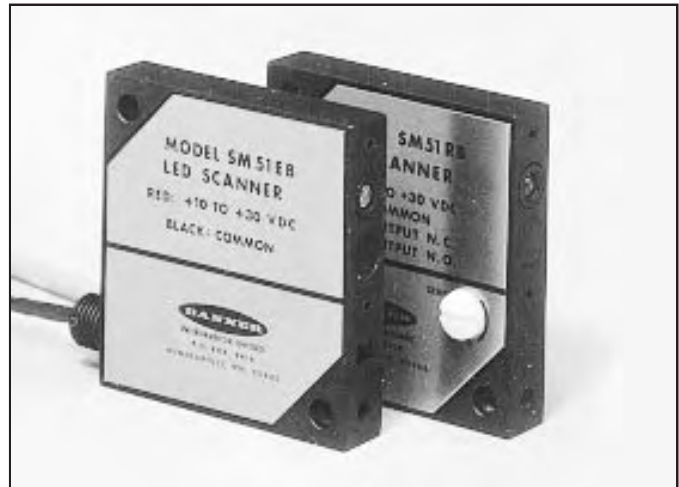
DC sensors with metal housings: SM51EB/RB, SM51EB6/RB6



Banner SM51 Series dc opposed mode sensors are designed for reliable performance in especially hostile industrial environments. These models have totally-encapsulated circuitry within die-cast metal housings for superior resistance to moisture and physical abuse. Models include: SM51EB/SM51RB and SM51EB6/SM51RB6.

The narrow, 1/2" wide housing design has gained this family of sensors the nickname of "the flatpack". Like the MINI-BEAM, this design allows multiple SM51 Series sensors to be easily stacked together side-by-side on 1/2" centers for "curtain of light" or code reading applications.

SM51 Series receivers have *complementary* NPN transistor outputs (one normally open and the other normally closed), which connect directly to Banner MICRO-AMP and MAXI-AMP logic modules, as well as to most logic gates, small relays, and other similar dc loads.

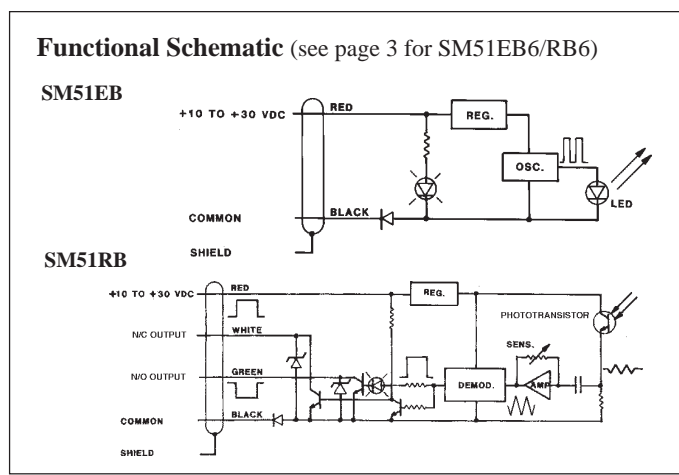
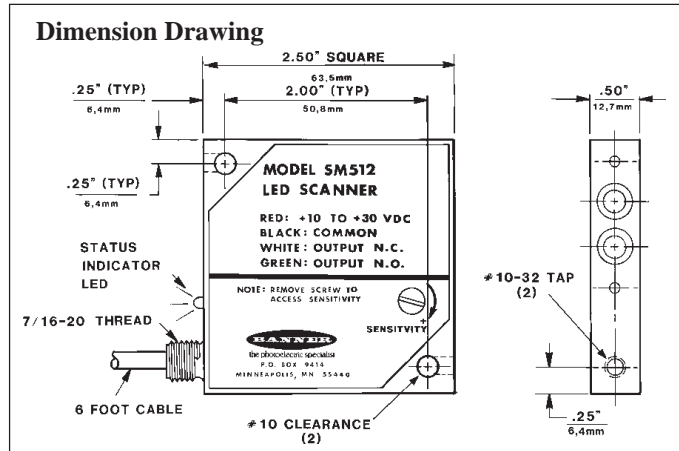


SPECIFICATIONS

- RANGE:** See excess gain curves in individual product descriptions.
- SUPPLY VOLTAGE:** 10-30V dc. Max. allowable ripple 10%; supply current is typically less than 50 mA (emitter) and 25 mA (receiver, exclusive of load).
- RECEIVER OUTPUT CONFIGURATION:** SM51RB has complementary open-collector NPN transistors (one normally open and one normally closed). SM51RB6 has normally open output only. Continuous short-circuit protection. Reverse polarity protection.
- RECEIVER OUTPUT RATING:** Each output transistor is capable of sinking up to 250mA continuously. On-state saturation voltage less than 2 volts at full load and less than 1 volt at signal levels. Off-state leakage current less than 100 microamps. Outputs are reverse-polarity protected.
- RESPONSE TIME:** See individual specifications. Response time is independent of signal strength.
- REPEATABILITY:** See individual specifications. Repeatability is independent of signal strength.

- OPERATING TEMPERATURE:** -40 to +70 °C (-40 to +158 °F).
- CONSTRUCTION:** Die-cast metal housing with stainless steel legend plate. Totally encapsulated. NEMA 1, 2, 3, 3S, 4, 4X, 12, and 13. Cables are .15-inch diameter, PVC covered, shielded (4 conductor, 6 ft. long).
- INDICATOR LED:** Red LED indicator at rear of receiver (above cable exit) lights when the receiver is seeing a "light" signal.
- SENSITIVITY ADJUSTMENT:** Single-turn adjustment, accessible by removing the nylon screw on the side of the receiver.

APPLICATION WARNINGS:
 Outputs will not directly interface TTL logic, due to the reverse-polarity protection diode. Contact the factory for TTL interfacing instructions.
 The short-circuit protection may de-energize the outputs with certain incandescent light bulb or capacitive loads. Contact the factory if these loads are anticipated.



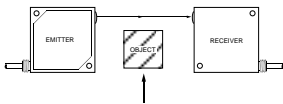
WARNING These photoelectric presence sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in *either* an energized or a de-energized sensor output condition. Never use these products as sensing 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.

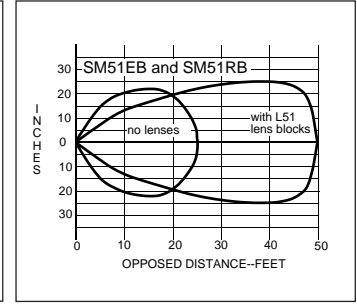
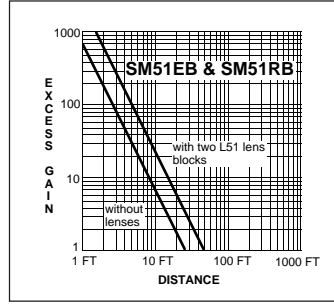
SM51 Series Opposed Mode Sensors

SM51EB/SM51RB

Opposed mode



VOLTAGE: 10-30V dc
RANGE: 25 feet (8 meters)
RESPONSE TIME: 1 millisecond
REPEATABILITY: 0.1 millisecond
SENSING BEAM: infrared, 880nm
EFFECTIVE BEAM: 0.14" dia.

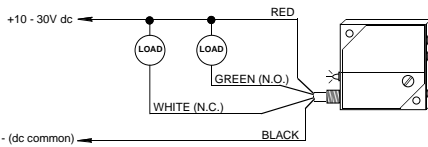


The **fast response time and small effective beam** of this opposed mode sensor pair makes it an excellent choice for sensing small, fast-moving objects over a range of up to 25 feet. Accessory lens block model L51 may be added to either the emitter or receiver or both for extended range. Alternatively, sensors may be purchased with the lens blocks already installed (order models SM51EBL and SM51RBL). With lens blocks attached, this pair will reliably sense objects with 3/8" or larger profiles. The SM51EB and SM51RB also may be fitted with aperture block model L52AB to resolve profiles as small as .040" at shorter sensing ranges. The circuitry of the SM51EB and SM51RB is **compatible with the model MP-8 multiplexer module** to create "curtains of light" for sensing or for measuring objects that pass anywhere through a sensing plane.

Hookup to Load (SM51RB receiver)

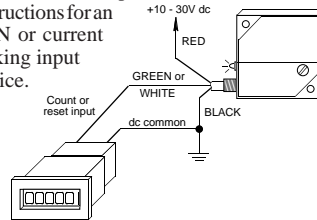
Hookup of SM51RB Receiver to Relay or Solenoid

Receiver SM51RB offer two open collector NPN outputs in a complementary configuration (one normally open and one normally closed). The green output wire switches the load when the receiver "sees" its modulated light source (LIGHT operate). The white output wire switches in the dark condition (DARK operate). Both output circuits can switch up to 1/4 amp.



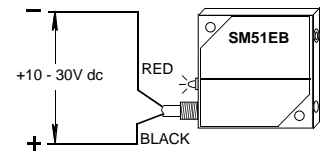
Hookup of SM51RB Receiver Sensor to Counter

Most counters, totalizers, rate meters, etc. accept either output of the SM51RB. Hookup to a battery-powered LCD type is shown here. For other types, follow the counter's hookup instructions for an NPN or current sinking input device.



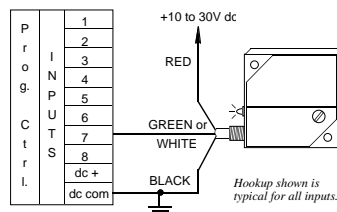
Hookup of SM51EB Emitter

Emitter model SM51EB connects directly to a dc power supply, as shown.



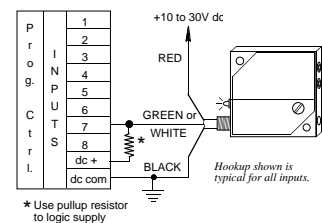
Hookup of SM51RB Receiver to Programmable Controller requiring current sink

Either sensor output is wired directly to any input of the PLC. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



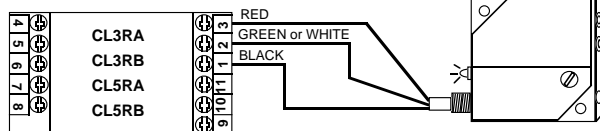
Hookup of SM51RB Receiver to Programmable Controller requiring current source

Either sensor output is wired to any input of the PLC. An external "pullup" resistor is connected between the input and +V of the PLC (input card) power supply. The value of the resistor is not critical: values from 1KΩ to 10KΩ, 1/4 watt or larger, will satisfy most inputs. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).

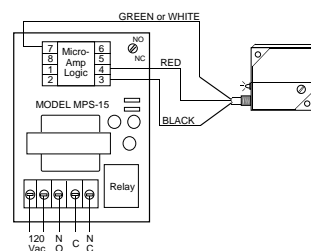


Hookup to MAXI-AMP Logic (CL Series modules)

The output of an SM51RB receiver may be used as an input to Banner MAXI-AMP CL Series logic modules. The MAXI-AMP, when powered by AC voltage, offers a DC supply with enough capacity to power one SM51 Series sensor. An SM51RB receiver may also be used as an input to the auxiliary input of a CL5 module.



Hookup to MICRO-AMP Logic (MPS-15 Chassis)



The output (green or white wire) of an SM51RB receiver connects directly to any input of Banner MICRO-AMP logic-only modules. These MICRO-AMP logic modules may be used:

- MA4-2 One-shot
- MA5 Delay
- MA4G 4-input "AND"
- MA4L Latch

SM51 Series Opposed Mode Sensors

SM51EB6 & SM51RB6

Opposed (non-fiberoptic),
Opposed fiberoptic, and
Diffuse fiberoptic modes

VOLTAGE: 10-30V dc
RANGE: 100 feet in opposed
mode (non-fiberoptic).

See excess gain curves for fiberoptic range information.

RESPONSE TIME: 10 milliseconds

REPEATABILITY: 1 millisecond

SENSING BEAM: infrared, 880nm



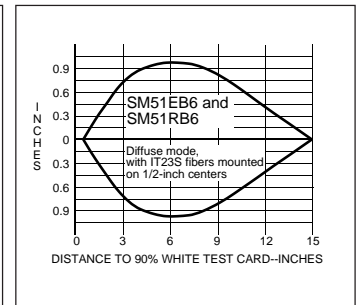
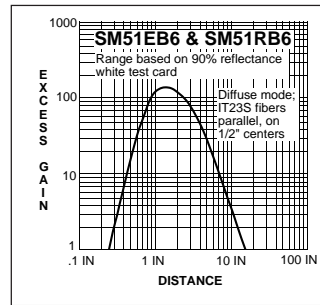
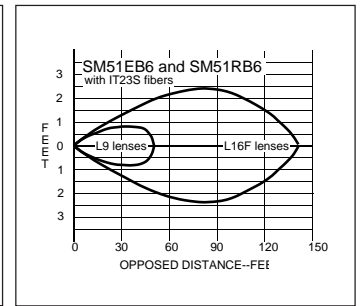
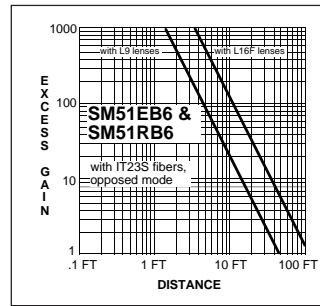
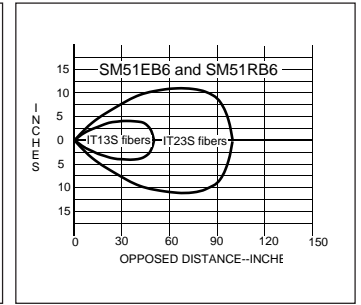
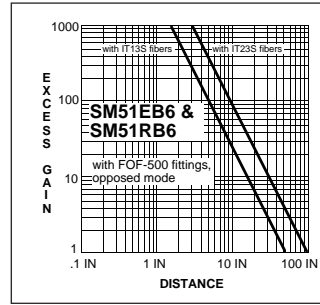
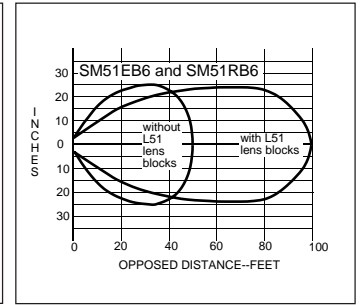
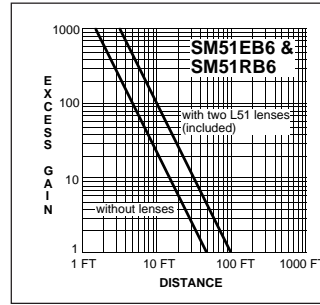
The SM51EB6/SM51RB6 opposed mode sensor pair is a **very high gain** emitter/receiver pair that utilizes an interconnecting synchronizing wire to "gate" the receiver to look for a signal only at the instant when the emitter sends a pulse from its LED. Because of the high power of these sensors, they are often used to "burn through" an opaque container (a cereal box, for example) to determine if contents are present. Special optics enable them to do this job even better than other sensors which may appear to have more excess gain (such as the MULTI-BEAM SBEX and SBRX1). NOTE: lens blocks may be removed for short-range "burn-through" applications.

This sensor pair may also be used with fiber optics by adding the optional FOF500 fittings (or order sensor models SM51EB6FO and SM51RB6FO). When used this way, they provide several times more excess gain than the conventional SM512LBFO. Range when used in the opposed mode with IT23S individual fibers is 7 feet. Sensing range may be extended by use of L9 or L16F lenses (see excess gain curves).

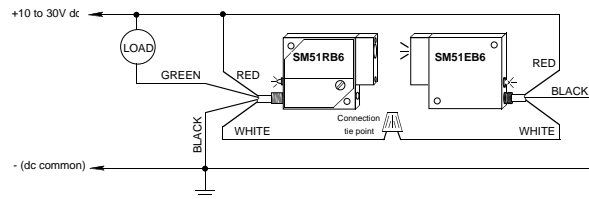
NOTE: the gain of this sensor pair is too high for use with a bifurcated fiber assembly. The very small amount of light that "leaks" through the fiber cladding within the bifurcated bundle is typically enough to operate the high-gain receiver.

For diffuse (proximity) sensing, position two individual fibers side-by-side with the sensing tips parallel to each other or mechanically converged towards the desired sensing point.

The receiver has a normally open output only (green wire); the white wire is used to synchronize the emitter. NOTE: for normally closed output, order special receiver model SM51RB6DO (DO = Dark Operate).



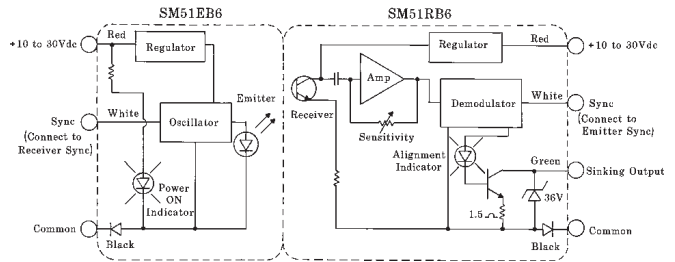
Hookup Diagram



Both the emitter and receiver have white wires which connect together to synchronize (lock on) the pair to a narrow frequency bandwidth. These white wires *must* be connected together if the sensor pair is to operate at high gain. There is only one receiver output, which is the same NPN current sinking circuit used in the other SM512 Series sensors.

The output is normally open (or LIGHT operate). For a normally closed output, specify model SM51RB6DO (DO = Dark Operate).

Functional Schematic



SM51 Series Opposed Mode Sensors

Accessories and Modifications for SM51 Series Sensors



SMB500
Universal steel mounting bracket for 51 Series sensors permits adjustment in both axes. Also available in stainless steel (order model SMB500SS).



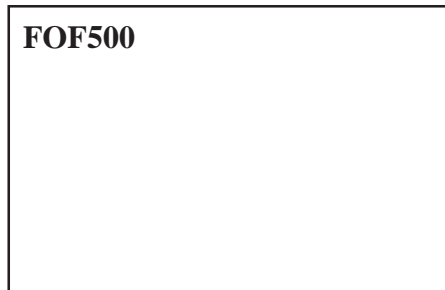
RAR500
Right-angle beam deflector used to reflect the light beam at 90 degrees to the sensor package. Range is reduced by about 50% when using the RAR500.



BZ500
Plastic lens cover for any 51 Series sensor that does not utilize a lens block. Used in food applications where the presence of a glass lens is unacceptable.



L51
For extending the range of any of the 51 Series emitters and receivers. When used on both emitter and receiver, typically doubles the range of unlened units.



FOF500
Fiberoptic interface block. Creates fiberoptic sensor from emitter/receiver pairs. Contact factory for ranges.



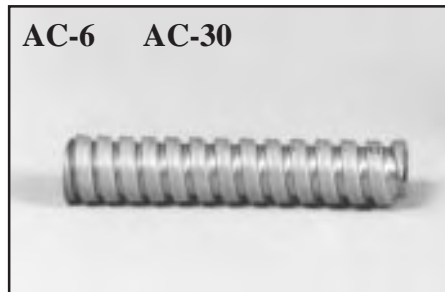
CF7-16
Aluminum compression fitting for the cable entrance at the rear of the 51 Series sensors. May be used with either plastic or flexible steel conduit (PVC-6 or AC-6).



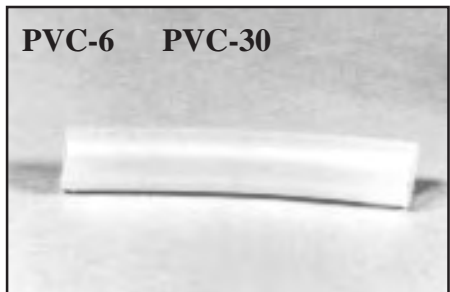
L52AB
Model L52AB (right) is an aperture block used with any of the 51 Series emitters and receivers to create very narrow effective beams.

Each L52AB comes with a .040-inch diameter round aperture and a .030 x .125-inch rectangular aperture. The aperture blocks include sealed clear windows to prevent the apertures from becoming clogged with dirt.

Apertures are normally used on both the emitter and receiver.



AC-6 AC-30
These are 6 and 30-foot lengths of flexible steel conduit and may be used with any of the 51 Series sensors and the CF7-16 fitting to provide protection to the sensor cable. Size: I.D. = 5/16"; O.D. = 7/16".



PVC-6 PVC-30
6 and 30-foot lengths of plastic (PVC) flexible tubing for use with the 51 Series sensors and the CF7-16 in food applications where flexible steel conduit is not allowed. Size: I.D. = 1/4"; O.D. = 3/8".

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

Modification Information for SM51 series Sensors

These modifications are available for SM51 Series sensors. They are not stocked, but are available on a "quote" basis:

HIGH SPEED Modification (model Suffix "MHS")

SM51RB receivers with normal response speed of 1 millisecond may be modified for faster response. Modification "MHS" offers 300 microsecond (0.3 millisecond) on and off response time. This modification is most often used when very small targets must be

sensed. **Repeatability** of SM51RBMHS model is 0.03 millisecond.

CABLE LENGTH Modification (30-foot cable)

Any of the SM51 Series sensors may be built with a cable longer than the standard 6-foot length. The most readily available length is 30 feet. Lengths longer than 30 feet may also be quoted.

SM512 Series Fiber Optic Mode Sensor

Model SM512LBFO DC sensor with metal housing



Banner fiber optic sensor model SM512LBFO is designed for reliable performance in especially hostile industrial environments. It has totally-encapsulated circuitry within a die-cast metal housing for superior resistance to moisture and physical abuse. It is used with Banner glass fiber optic assemblies in the opposed, retroreflective, and diffuse fiber optic sensing modes.

The narrow, 1/2" wide housing design has gained this family of sensors the nickname of "the flatpack". Like the MINI-BEAM, this design allows multiple SM512 Series sensors to be easily stacked together side-by-side on 1/2" centers for use in tight locations.

SM512 Series sensors have *complementary* NPN transistor outputs (one normally open and the other normally closed), which connect directly to Banner MICRO-AMP and MAXI-AMP logic modules, as well as to most logic gates, small relays, and other similar dc loads.



SPECIFICATIONS, SM512LBFO Sensor

RANGE: See page 2. **SENSING BEAM:** 940 nm (infrared).

SUPPLY VOLTAGE: 10-30V dc. Maximum allowable ripple 10%; supply current is typically less than 40mA (exclusive of load).

OUTPUT CONFIGURATION: Complementary open-collector NPN transistors (one normally open and one normally closed), with continuous short-circuit protection. Reverse polarity protection.

OUTPUT RATING: Each output transistor is capable of sinking up to 250mA continuously. On-state saturation voltage less than 2 volts at full load and less than 1 volt at signal levels. Off-state leakage current less than 100 microamps. Outputs are reverse-polarity protected.

RESPONSE TIME: 1 millisecond. Response time is independent of signal strength.

REPEATABILITY: 0.3 millisecond. Repeatability is independent of signal strength.

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

CONSTRUCTION: Die-cast metal housing with stainless steel legend plate. Totally encapsulated. NEMA 1, 2, 3, 3S, 4, 4X, 12, and 13. Cables are .15-inch diameter, PVC covered, and shielded (4 conductor, 6 feet long).

INDICATOR LED: Red LED indicator at rear of sensor (above cable exit) lights when the sensor is receiving a "light" signal.

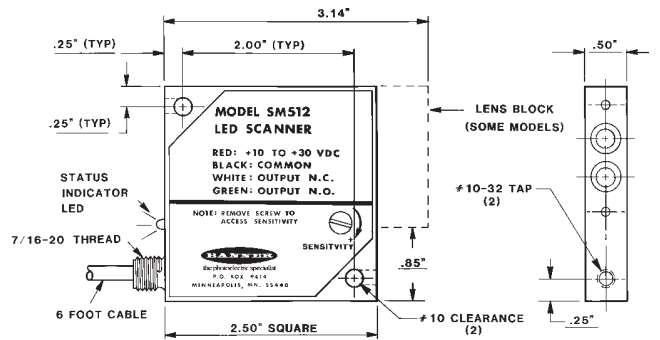
SENSITIVITY ADJUSTMENT: Single-turn adjustment, accessible by removing the nylon screw on the side of the sensor.

APPLICATION WARNINGS:

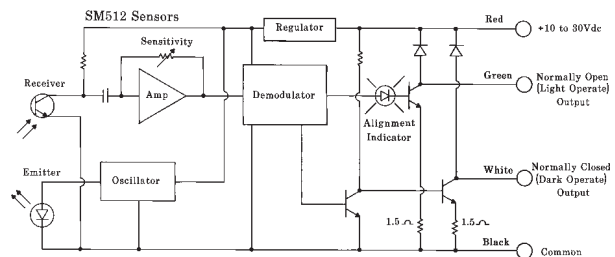
Outputs will not directly interface TTL logic, due to the reverse-polarity protection diode. Contact the factory for TTL interfacing instructions.

The short-circuit protection may de-energize the outputs with certain incandescent light bulb or capacitive loads. Contact the factory if these loads are anticipated.

Dimension Drawing



Functional Schematic



WARNING These photoelectric presence sensors 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.

SM512LBFO Fiber Optic Sensors

SM512LBFO

Opposed fiberoptic, Retroreflective fiberoptic, and Diffuse fiberoptic modes

VOLTAGE: 10-30V dc

RANGE: opposed, retroreflective, and proximity modes. See excess gain curves.

RESPONSE TIME: 1 millisecond

REPEATABILITY: 0.3 millisecond

SENSING BEAM: infrared, 940nm



Model **SM512LBFO** may be used with the full range of Banner glass fiberoptic assemblies for sensing in the fiberoptic opposed, retroreflective, and proximity modes. The small size and fast response time of this sensor make it suitable for most fiberoptic sensing applications.

In the **opposed mode**, the sensing range is up to 10 inches using 1/8-inch diameter fiber bundles, or up to 4 inches using 1/16-inch diameter bundles (used when very small-diameter effective beams are required). With the addition of the L9 or L16F lens, these ranges are increased to 60 and 300 inches, respectively. (The absolute maximum range is, as always, limited by the lengths of the fibers themselves.)

Retroreflective sensing employs the bifurcated (branched) fiber model BT13S along with either the L9 or L16F lens. Notice from the excess gain curves that the excess gain is at its maximum when the target is close to the lens. This is in contrast to most retroreflective sensors, in which the excess gain falls off dramatically at close ranges, and is due to the inherent coaxial nature of the fiber bundles. Retroreflective sensing is also possible using fibers without lenses, but in this mode the fiber will reflect light directly off of objects that are in the "proximity" range of the fiber, typically the first inch from the end of the fiber. Also, the sensing range to a retroreflective target is greatly reduced when a lens is not used (generally to less than 3 feet with a 3-inch diameter reflector and to less than 1 foot using retroreflective tape).

The most commonly used fiberoptic sensing mode is the **diffuse mode**, due to the ease with which fibers may be configured to sense small parts in automatic assembly machines, vibratory feeders, small conveyors, and other "one side only" applications. Lenses are *not* recommended to extend the sensing range of fibers in the proximity mode, since internal reflections from the back of the lens can cause false operation. If more range is necessary, it is best to use two individual fibers converging slightly to intersect at the object. If this is done, lenses may be added without concern for internal reflections.

FIBEROPTIC INFORMATION

IT13S: individual assembly, .06 in. (1.5mm) diameter fiber bundle

IT23S: individual assembly, .12 in. (3mm) diameter fiber bundle

BT13S: bifurcated assembly, .06 in. (1.5mm) diameter fiber bundle

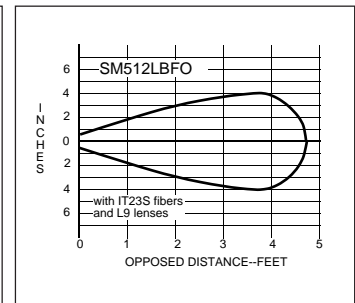
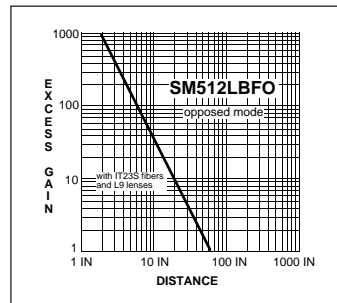
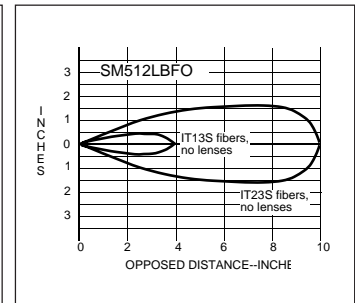
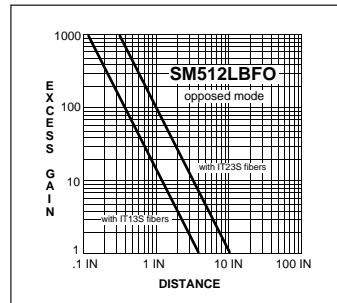
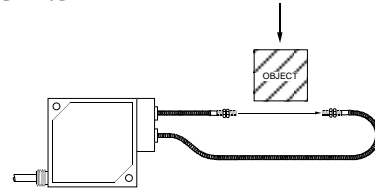
BT23S: bifurcated assembly, .12 in. (3mm) diameter fiber bundle

L9: .5in. (12mm) dia. lens

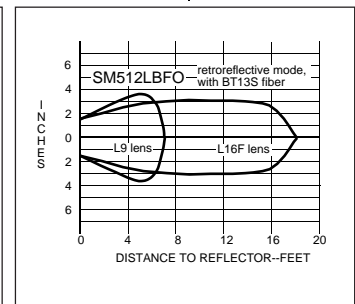
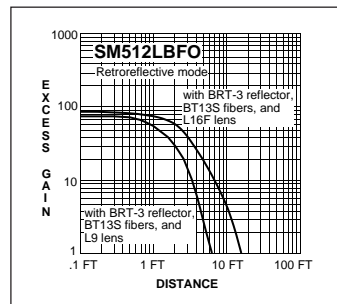
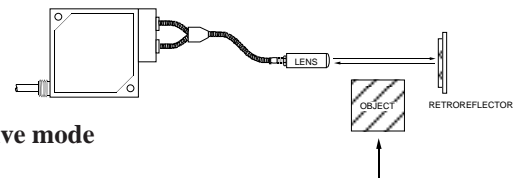
L16F: 1.0 in. (25mm) dia. lens

For more information about Banner glass fiber optic assemblies, see the Banner product catalog.

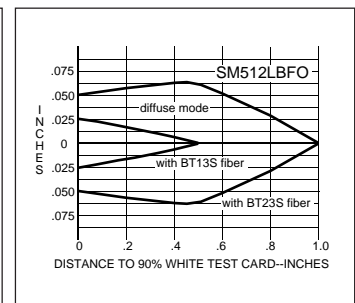
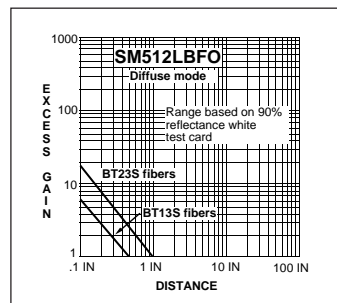
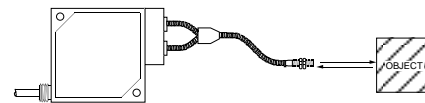
Opposed mode



Retroreflective mode



Diffuse mode

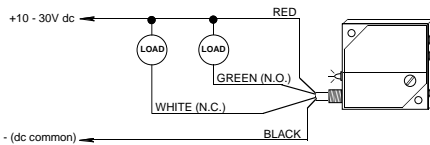


SM512LBFO Fiber Optic Sensors

Hookup Diagrams

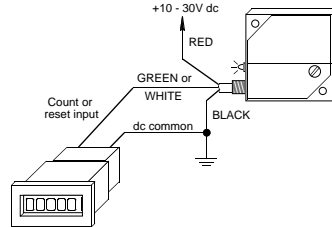
Hookup of SM512LBFO Sensor to Relay or Solenoid

SM512LBFO sensors offer two open collector NPN outputs in a complementary configuration (one normally open and one normally closed). The green output wire switches the load when the receiver "sees" its modulated light source (LIGHT operate). The white output wire switches in the dark condition (DARK operate). Both output circuits can switch up to 1/4 amp.



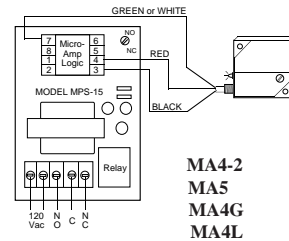
Hookup of SM512LBFO Sensor to Counter

Most counters, totalizers, rate meters, etc. accept either output of the SM512s. Hookup to a battery-powered LCD type is shown here. For other types, follow the counter's hookup instructions for an NPN or current sinking input device.



Hookup to MICRO-AMP Logic (MPS-15 Chassis)

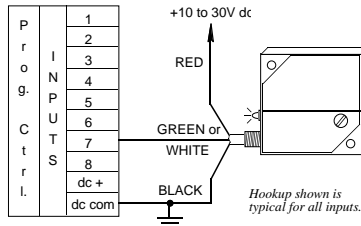
The output (green or white wire) of SM512 Series sensors connects directly to any input of Banner MICRO-AMP logic-only modules. These MICRO-AMP logic modules may be used:



- MA4-2 One-shot
- MA5 Delay
- MA4G 4-input "AND"
- MA4L Latch

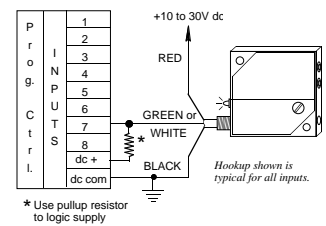
Hookup of SM512LBFO Sensor to Programmable Controller requiring current sink

Either sensor output is wired directly to any input of the PLC. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



Hookup of SM512LBFO Sensor to Programmable Controller requiring current source

Either sensor output is wired to any input of the PLC. An external "pullup" resistor is connected between the input and +V of the PLC (input card) power supply. The value of the resistor is not critical: values from 1KΩ to 10KΩ, 1/4 watt or larger, will satisfy most inputs. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).

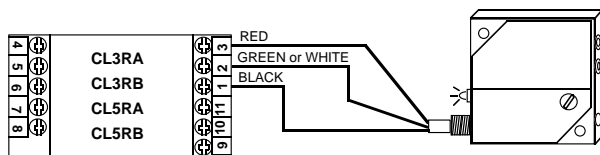


* Use pullup resistor to logic supply

The wiring scheme inverts the LIGHT and DARK output configuration (as seen by the PLC input). The white output becomes LIGHT operate, while the green output is used for DARK operate.

Hookup to MAXI-AMP Logic (CL Series modules)

The output of an SM512LBFO sensor may be used as an input to Banner MAXI-AMP CL Series logic modules. The MAXI-AMP, when powered by AC voltage, offers a DC supply with enough capacity to power one SM512LBFO sensor. An SM512LBFO may also be used as an input to the auxiliary input of a CL5 module.



Modification Information for SM512LBFO Sensors

These modifications are available for SM512LBFO sensors. They are not stocked, but are available on a "quote" basis:

HIGH SPEED Modification (model Suffix "MHS")

SM512LBFO sensors with normal response speed of 1 millisecond may be modified for faster response. Modification "MHS" offers 300 microsecond (0.3 millisecond) on and off response time. This modification is most often used on fiberoptic sensor models when

very small targets must be sensed.

Repeatability of "MHS" models is 0.1 millisecond.

CABLE LENGTH Modification (30-foot cable)

SM512LBFO sensors may be built with a cable longer than the standard 6-foot length. The most readily available length is 30 feet. Lengths longer than 30 feet may also be quoted.

SM512LBFO Fiber Optic Sensors

Accessories and Modifications for SM512LBFO Sensors

SMB500



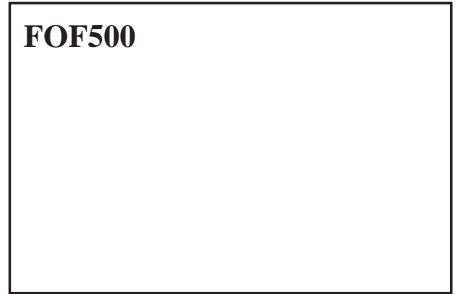
Universal steel mounting bracket for 512 Series sensors permits adjustment in both axes. Also available in stainless steel (order model SMB500SS).

CF7-16



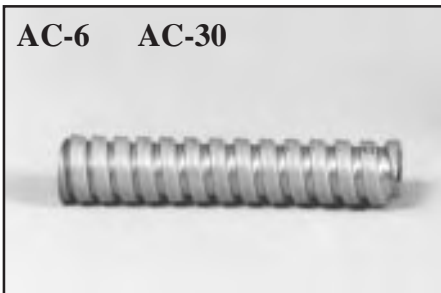
Aluminum compression fitting for the cable entrance at the rear of the 512 Series sensors. May be used with either plastic or flexible steel conduit (PVC-6 or AC-6).

FOF500



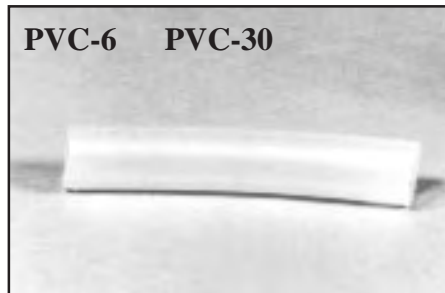
Fiberoptic interface block. Replacement item for SM512LBFO.

AC-6 AC-30



These are 6 and 30-foot lengths of flexible steel conduit and may be used with any of the 512 Series sensors and the CF7-16 fitting to provide protection to the sensor cable. Size: I.D. = 5/16"; O.D. = 7/16".

PVC-6 PVC-30



These are 6 and 30-foot lengths of plastic (PVC) flexible tubing for use with the 512 Series sensors and the CF7-16 in food applications where flexible steel conduit is not allowed. Size: I.D. = 1/4"; O.D. = 3/8".

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

SM512 Series Diffuse Mode Sensors

DC sensors with metal housings: SM512DB, DBX, LBD, and LBDX



Banner SM512 Series dc diffuse mode sensors are designed for reliable performance in especially hostile industrial environments. These sensors have totally-encapsulated circuitry within die-cast metal housings for superior resistance to moisture and physical abuse. Models include: SM512DB, SM512DBX, SM512LBD, and SM512LBDX.

Model SM512DB has a sensing range of 8 inches and a response time of 1 millisecond (ms). Model SM512DBX has greater range (15 inches) and 10 ms response time. Models SM512LBD and LBDX are divergent diffuse sensors with a wide field of view, which makes them ideal for sensing of transparent objects. See the individual product descriptions (page 2) for more information.

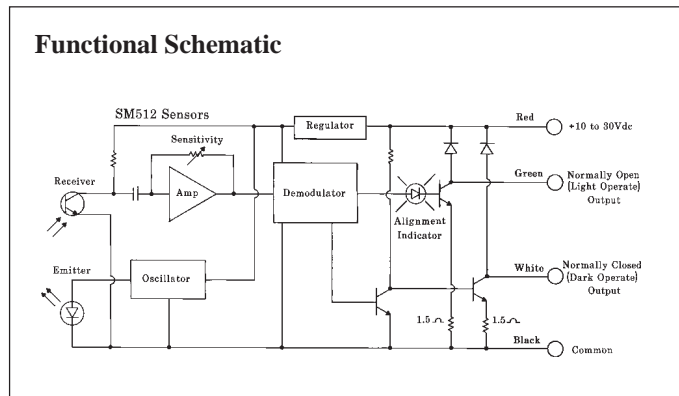
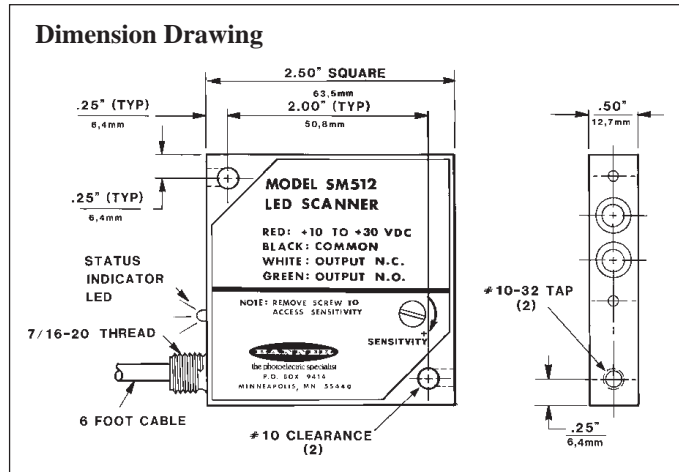
SM512 Series sensors have *complementary* NPN transistor outputs (one normally open and the other normally closed), which connect directly to Banner MICRO-AMP and MAXI-AMP logic modules, as well as to most logic gates, small relays, and other similar dc loads.



SPECIFICATIONS, SM512 Series Diffuse Sensors

- RANGE:** See excess gain curves in individual product descriptions.
- SUPPLY VOLTAGE:** 10-30V dc. Maximum allowable ripple 10%; supply current is typically less than 40mA (exclusive of load).
- OUTPUT CONFIGURATION:** Complementary open-collector NPN transistors (one normally open and one normally closed), with continuous short-circuit protection. All models have reverse polarity protection.
- OUTPUT RATING:** Each output transistor is capable of sinking up to 250mA continuously. On-state saturation voltage less than 2 volts at full load and less than 1 volt at signal levels. Off-state leakage current less than 100 microamps. Outputs are reverse-polarity protected.
- RESPONSE TIME:** See individual sensor specifications. Response time is independent of signal strength.
- REPEATABILITY:** See individual sensor specifications. Repeatability is independent of signal strength.
- OPERATING TEMPERATURE:** -40 to +70 °C (-40 to +158 °F).
- CONSTRUCTION:** Die-cast metal housing with stainless steel legend plate. Totally encapsulated. NEMA 1, 2, 3, 3S, 4, 4X, 12, and 13. Cables are .15-inch diameter, PVC covered, and shielded (4 conductor, 6 feet long).
- INDICATOR LED:** Red LED indicator at rear of sensor (above cable exit) lights when the sensor is receiving a "light" signal.
- SENSITIVITY ADJUSTMENT:** Single-turn adjustment, accessible by removing the nylon screw on the side of the sensor.

APPLICATION WARNINGS:
 Outputs will not directly interface TTL logic, due to the reverse-polarity protection diode. Contact the factory for TTL interfacing instructions.
 The short-circuit protection may de-energize the outputs with certain incandescent light bulb or capacitive loads. Contact the factory if these loads are anticipated.

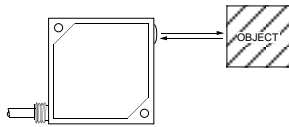


WARNING These photoelectric presence sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in *either* an energized or a de-energized sensor output condition. Never use these products as sensing devices for personnel protection. Their use as safety devices may create an unsafe condition which could lead to serious injury or death.

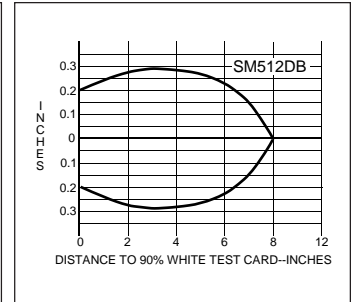
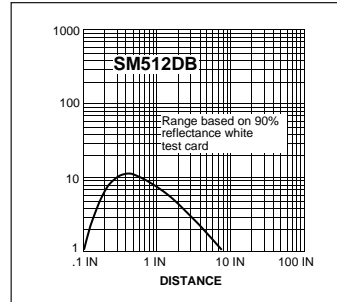
Only MACHINE-GUARD and PERIMETER-GUARD Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices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

SM512 Series Diffuse Mode Sensors

SM512DB Diffuse mode



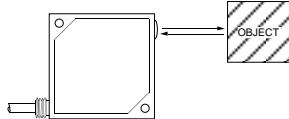
VOLTAGE: 10-30V dc
RANGE: 8 inches (20 centimeters)
RESPONSE TIME: 1 millisecond
REPEATABILITY: 0.3 millisecond
SENSING BEAM: infrared, 940nm



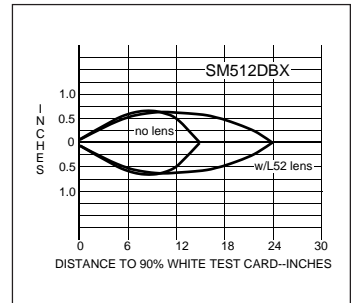
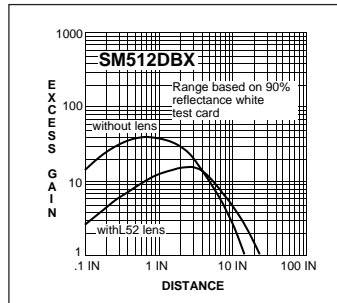
Model **SM512DB** is a **short-range proximity mode sensor** for applications requiring fast response time, such as leading-edge detection in carton-flap gluing installations or presence sensing for triggering high-speed ink-jet type imprinters.

It is **totally encapsulated** and its **lenses are hermetically sealed** to the case, making it **completely leakproof**. It should be used to sense any **matte-finish material** such as paper, corrugated cardboard, wood, dull plastics, or painted metal surfaces. It should not be used to sense transparent objects or those with very shiny surfaces, (unless the position of the shiny surface can be reliably maintained at an angle of 90 degrees to the beam). **It will sense very small parts**, but at greatly reduced ranges: a toothpick, for example, would be reliably sensed at a distance of up to about 1 inch.

SM512DBX Diffuse mode

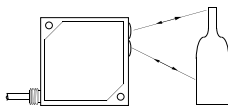


VOLTAGE: 10-30V dc
RANGE: 15 inches (38 centimeters)
RESPONSE TIME: 10 milliseconds
REPEATABILITY: 0.3 millisecond
SENSING BEAM: infrared, 880nm

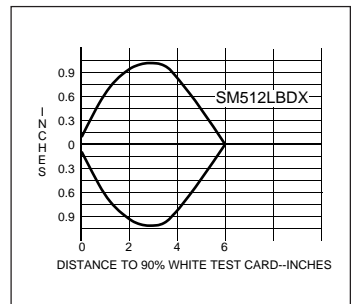
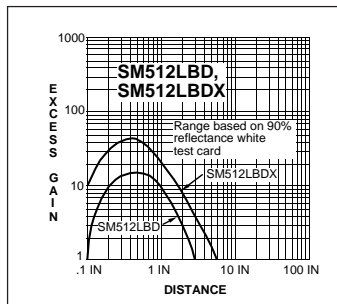


Model **SM512DBX** is a **relatively high power, long range proximity mode sensor**. It has several times the excess gain of the SM512DB, but at the cost of slower response time. It should be used in all proximity mode applications where it is certain that the 10-millisecond response time is not so slow as to cause the sensor to "miss" the object (the sensor must also see the *absence* of the object for at least 10 milliseconds in order to turn off). An important advantage of the SM512DBX is that the repeatability of the response time is extremely good (0.3 milliseconds), so it is sometimes possible to use this slower sensor in precise positioning controls. The range of the SM512DBX may be extended to 24 inches by using the optional model L52 lens block.

SM512LBD SM512LBDX Divergent diffuse mode



VOLTAGE: 10-30V dc
RANGE:
 LBD 3 inches (7.6 centimeters)
 LBDX 6 inches (15 centimeters)



RESPONSE TIME:
 LBD 1 millisecond
 LBDX 10 milliseconds
REPEATABILITY:
 LBD 0.1 millisecond
 LBDX 0.3 millisecond
SENSING BEAM: infrared,

Models **SM512LBD** and **SM512LBDX** are **short-range divergent diffuse mode sensors** with an **extremely wide field of view**. Because of their wide angle of view, they will **reliably sense transparent objects** such as glass or plastic bottles and clear cellophane or poly bags at distances of up to 2 or 3 inches (respectively), even when the object is at an angle to the sensing beam. Most other proximity mode sensors will sense these objects (at even greater ranges) if the object is *perpendicular* to the sensing beam, but at relative angles of even a few degrees the returned light is reflected off in a different direction and never returns to the sensor.

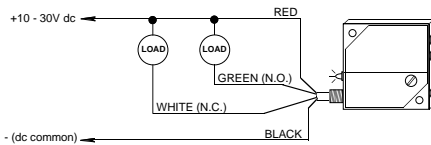
Both models are well-suited to applications where the object will appear within a few inches of the sensor, but where a background object (perhaps more reflective than the object being sensed) makes differentiating between the two difficult. In this respect, the wide angle optics of these sensors serves the same purpose as a convergent sensor. Note that the SM512LBD is "blind" to objects passing very close to the lens. The SM512LBD has somewhat lower excess gain but a faster (1 ms) response time. See excess gain curves.

SM512 Series Diffuse Mode Sensors

Hookup Diagrams

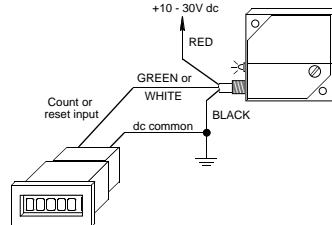
Hookup of SM512 Series Sensor to Relay or Solenoid

SM512 Series sensors offer two open collector NPN outputs in a complementary configuration (one normally open and one normally closed). The green output wire switches the load when the receiver "sees" its modulated light source (LIGHT operate). The white output wire switches in the dark condition (DARK operate). Both output circuits can switch up to 1/4 amp.



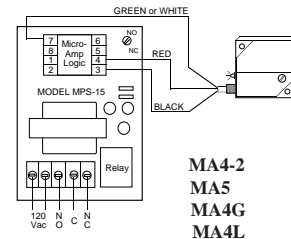
Hookup of SM512 Series Sensor to Counter

Most counters, totalizers, rate meters, etc. accept either output of the SM512s. Hookup to a battery-powered LCD type is shown here. For other types, follow the counter's hookup instructions for an NPN or current sinking input device.



Hookup to MICRO-AMP Logic (MPS-15 Chassis)

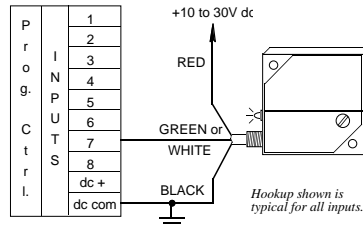
The output (green or white wire) of SM512 Series sensors connects directly to any input of Banner MICRO-AMP logic-only modules. These MICRO-AMP logic modules may be used:



- MA4-2 One-shot
- MA5 Delay
- MA4G 4-input "AND"
- MA4L Latch

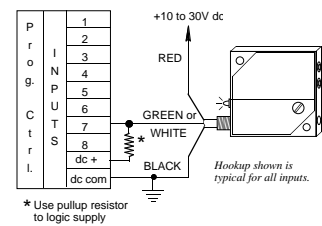
Hookup of SM512 Series Sensor to Programmable Controller requiring current sink

Either sensor output is wired directly to any input of the PLC. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



Hookup of SM512 Series Sensor to Programmable Controller requiring current source

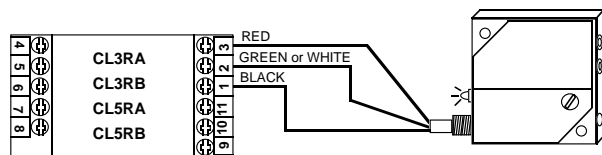
Either sensor output is wired to any input of the PLC. An external "pullup" resistor is connected between the input and +V of the PLC (input card) power supply. The value of the resistor is not critical: values from 1KΩ to 10KΩ, 1/4 watt or larger, will satisfy most inputs. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



* Use pullup resistor to logic supply

Hookup to MAXI-AMP Logic (CL Series modules)

The output of an SM512 series sensor may be used as an input to Banner MAXI-AMP CL Series logic modules. The MAXI-AMP, when powered by AC voltage, offers a DC supply with enough capacity to power one SM512 Series sensor. An SM512 Series sensor may also be used as an input to the auxiliary input of a CL5 module.



Modification Information for SM512 series Sensors

These modifications are available for SM512 Series sensors. They are not stocked, but are available on a "quote" basis:

HIGH SPEED Modification (model Suffix "MHS")

SM512 Series sensors with normal response speed of 1 millisecond may be modified for faster response. Modification "MHS" offers 300 microsecond (0.3 millisecond) on and off response time. **Repeatability** of "MHS" models is 0.1 millisecond.

CABLE LENGTH Modification (30-foot cable)

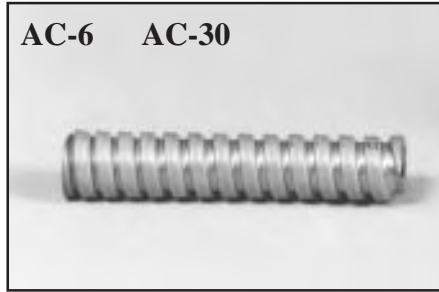
Any of the SM512 Series sensors may be built with a cable longer than the standard 6-foot length. The most readily available length is 30 feet. Lengths longer than 30 feet may also be quoted.

SM512 Series Diffuse Mode Sensors

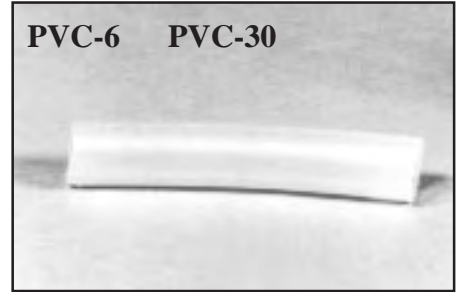
Accessories and Modifications for SM512 Series Sensors



Universal steel mounting bracket for 512 Series sensors permits adjustment in both axes. Also available in stainless steel (order model SMB500SS).



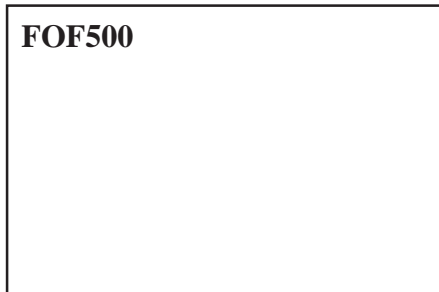
These are 6 and 30-foot lengths of flexible steel conduit and may be used with any of the 512 Series sensors and the CF7-16 fitting to provide protection to the sensor cable.
Size: I.D. = 5/16"; O.D. = 7/16".



These are 6 and 30-foot lengths of plastic (PVC) flexible tubing for use with the 512 Series sensors and the CF7-16 in food applications where flexible steel conduit is not allowed.
Size: I.D. = 1/4"; O.D. = 3/8".



Extends range of SM512DB and SM512DBX by about 50% and reduces beam diameter.



Fiberoptic interface block. Creates a fiberoptic sensor from SM512DB or SM512DBX. Contact factory for ranges.



Aluminum compression fitting for the cable entrance at the rear of the 512 Series sensors. May be used with either plastic or flexible steel conduit (PVC-6 or AC-6).

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

SM512 Series Retroreflective Mode Sensors

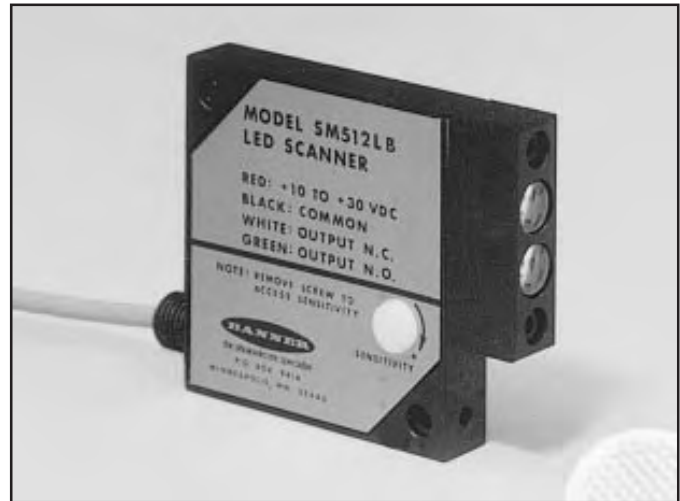
DC sensors with metal housings: SM502A, SM512LB



Banner SM512 Series dc retroreflective mode sensors are designed for reliable performance in hostile industrial environments. These sensors have totally-encapsulated circuitry within die-cast metal housings for superior resistance to moisture and physical abuse. Models include: SM502, SM512LB.

Model SM502A has a visible red sensing beam and a very fast response time and sensing repeatability. It is intended primarily for code reading applications. Model SM512LB has an infrared sensing beam and higher excess gain. It is especially suited to high speed sensing of small parts and precise positioning control.

SM512 Series sensors have *complementary* NPN transistor outputs (one normally open and the other normally closed), which connect directly to Banner MICRO-AMP and MAXI-AMP logic modules, as well as to most logic gates, small relays, and other similar dc loads.



SPECIFICATIONS, SM512 Series Retroreflective Sensors

RANGE: See excess gain curves in individual product descriptions.

SUPPLY VOLTAGE: 10-30V dc for SM512LBD; 12-18V dc for SM502A. Maximum allowable ripple 10%; supply current is typically less than 40mA (exclusive of load).

OUTPUT CONFIGURATION: Complementary open-collector NPN transistors (one normally open and one normally closed), with continuous short-circuit protection. All models have reverse polarity protection.

OUTPUT RATING: Each output transistor is capable of sinking up to 250mA continuously. On-state saturation voltage less than 2 volts at full load and less than 1 volt at signal levels. Off-state leakage current less than 100 microamps. Outputs are reverse-polarity protected.

RESPONSE TIME: 1 millisecond on/off.

REPEATABILITY: See individual sensor specifications.

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

CONSTRUCTION: Die-cast metal housing with stainless steel legend plate. Totally encapsulated; lens assemblies fully gasketed. NEMA 1, 2, 3, 3S, 4, 4X, 12, and 13. Cables are .15-inch diameter, PVC covered, and shielded (4 conductor, 6 feet long).

INDICATOR LED: Red LED indicator at rear of sensor (above cable exit) lights when the sensor is receiving a "light" signal.

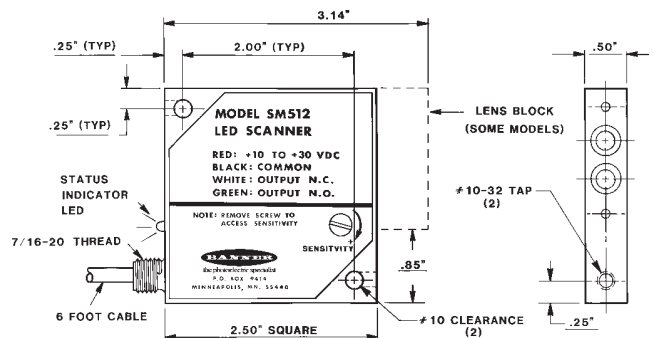
SENSITIVITY ADJUSTMENT: Single-turn adjustment, accessible by removing the nylon screw on the side of the sensor.

APPLICATION WARNINGS:

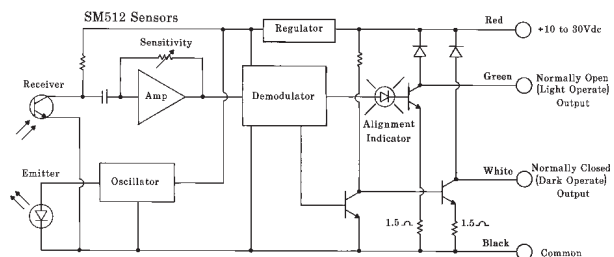
Outputs will not directly interface TTL logic, due to the reverse-polarity protection diode. Contact the factory for TTL interfacing instructions.

The short-circuit protection may de-energize the outputs with certain incandescent light bulb or capacitive loads. Contact the factory if these loads are anticipated.

Dimension Drawing



Functional Schematic



WARNING These photoelectric presence sensors 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.

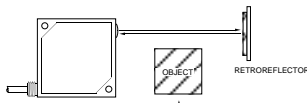
Never use these products as sensing devices for personnel protection. Their use as safety devices may create an unsafe condition which could lead to serious injury or death.

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.

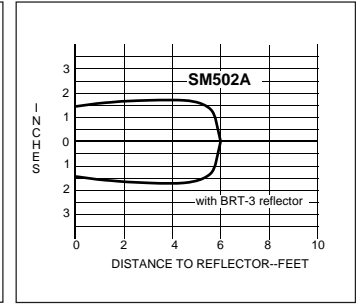
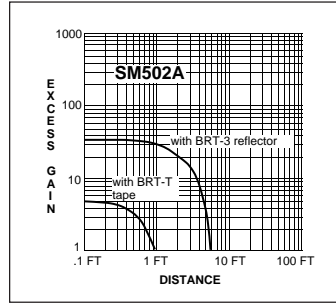
SM512 Series Retroreflective Mode Sensors

SM502A

Retroreflective mode



VOLTAGE: 12-18V dc
RANGE: 6 feet (3 meters)
RESPONSE TIME: 1 millisecond
REPEATABILITY: 0.03 millisecond
SENSING BEAM: visible red, 650nm

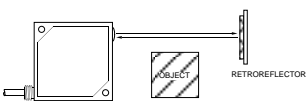


Model **SM502A** is a special-purpose retroreflective sensor with a **visible red LED light beam**. It is intended **primarily for code reading of retroreflective code plates** in automatic warehousing or identification systems. The beam angle is factory-calibrated to be within 1 degree of the mechanical axis of the sensor package, which permits multiple sensors to be mounted adjacent to one another without concern for optical "crosstalk" or individual alignment. The SM502A will reliably differentiate 1/4-inch wide retroreflective code marks on 1/2-inch centers to a distance of 6 inches, or 1/2-inch marks on 1-inch centers to 12 inches.

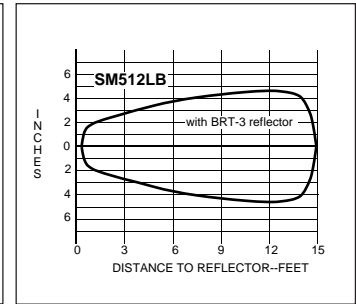
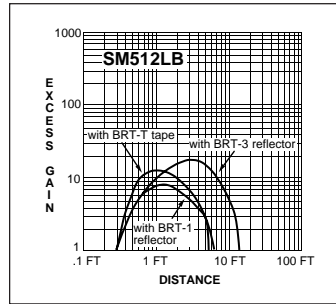
The SM502A is also the **first choice in this sensor family for general-purpose retroreflective applications at ranges out to 3 feet**. Required supply voltage is 12-18V dc, and outputs are protected against momentary short-circuits. The case is sealed but not encapsulated. For 24V dc operation, order special sensor model SM502A24V.

SM512LB

Retroreflective mode



VOLTAGE: 10-30V dc
RANGE: 15 feet (5 meters)
RESPONSE TIME: 1 millisecond
REPEATABILITY: 0.3 millisecond
SENSING BEAM: infrared, 940nm



Model **SM512LB** is an **infrared** retroreflective sensor recommended for use in **general-purpose applications**, especially where high vibration or the presence of fluids, cutting oils, or other liquids dictate the use of a totally-encapsulated sensor. With its 10-30V dc supply voltage and short-circuit proof output transistors, it is nearly indestructible. It is particularly **well-suited to high-speed operation**, such as sensing small parts that move quickly through the sensing field. Its fast response time also permits precise positioning control of moving objects (such as in indexing applications), and the 1-millisecond response time is totally independent of received light signal strength.

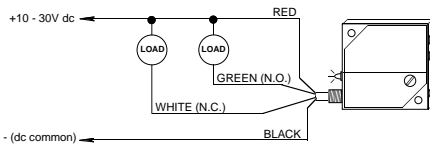
Due to a lens design that reduces "proxing", excess gain falls off rapidly at close ranges. If an application requires sensing a retroreflective target at a range of less than about 6 inches, consider model SM502A.

SM512 Series Retroreflective Mode Sensors

Hookup Diagrams

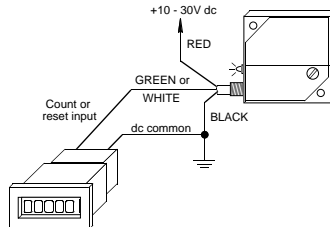
Hookup of SM512 Series Sensor to Relay or Solenoid

SM512 Series sensors (including SM51RB and SM502A) offer two open collector NPN outputs in a complementary configuration (one normally open and one normally closed). The green output wire switches the load when the receiver "sees" its modulated light source (LIGHT operate). The white output wire switches in the dark condition (DARK operate). Both output circuits can switch up to 1/4 amp.



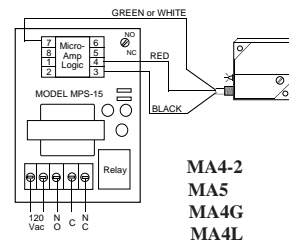
Hookup of SM512 Series Sensor to Counter

Most counters, totalizers, rate meters, etc. accept either output of the SM512s. Hookup to a battery-powered LCD type is shown here. For other types, follow the counter's hookup instructions for an NPN or current sinking input device.



Hookup to MICRO-AMP Logic (MPS-15 Chassis)

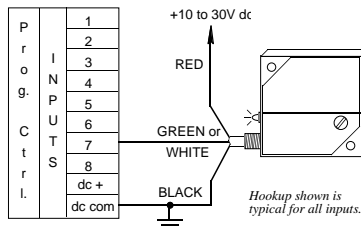
The output (green or white wire) of SM512 Series sensors connects directly to any input of Banner MICRO-AMP logic-only modules. These MICRO-AMP logic modules may be used:



- MA4-2 One-shot
- MA5 Delay
- MA4G 4-input "AND"
- MA4L Latch

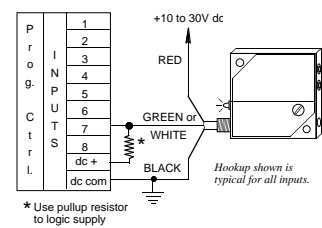
Hookup of SM512 Series Sensor to Programmable Controller requiring current sink

Either sensor output is wired directly to any input of the PLC. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



Hookup of SM512 Series Sensor to Programmable Controller requiring current source

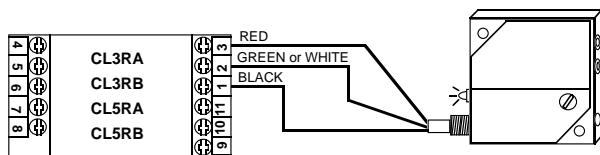
Either sensor output is wired to any input of the PLC. An external "pullup" resistor is connected between the input and +V of the PLC (input card) power supply. The value of the resistor is not critical: values from 1KΩ to 10KΩ, 1/4 watt or larger, will satisfy most inputs. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



* Use pullup resistor to logic supply

Hookup to MAXI-AMP Logic (CL Series modules)

The output of an SM512 series sensor may be used as an input to Banner MAXI-AMP CL Series logic modules. The MAXI-AMP, when powered by AC voltage, offers a DC supply with enough capacity to power one SM512 Series sensor. An SM512 Series sensor may also be used as an input to the auxiliary input of a CL5 module.



Modification Information for SM512 series Sensors

These modifications are available for SM512 Series sensors. They are not stocked, but are available on a "quote" basis:

HIGH SPEED Modification (model Suffix "MHS")

SM512 Series sensors with normal response speed of 1 millisecond may be modified for faster response. Modification "MHS" offers 300 microsecond (0.3 millisecond) on and off response time. This modification is most often used when very small targets must be

sensed. **Repeatability** of model SM512LBDMHS is 0.1 millisecond (.01 millisecond for SM502AMHS).

CABLE LENGTH Modification (30-foot cable)

Any of the SM512 Series sensors may be built with a cable longer than the standard 6-foot length. The most readily available length is 30 feet. Lengths longer than 30 feet may also be quoted.

SM512 Series Retroreflective Mode Sensors

Accessories and Modifications for SM512 Series Sensors



Universal steel mounting bracket for 512 Series sensors permits adjustment in both axes. Also available in stainless steel (order model SMB500SS).



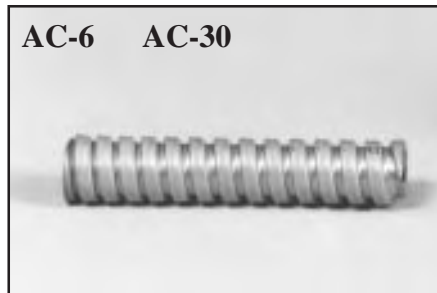
Right-angle beam deflector used to reflect the light beam at 90 degrees to the sensor package. Range is reduced by about 50% when using the RAR500. Use with SM502A only.



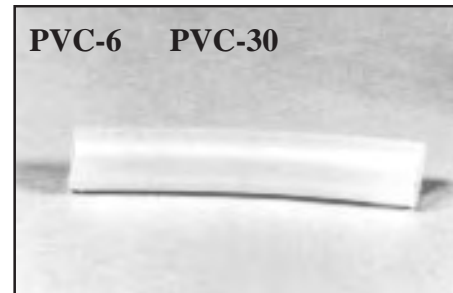
Aluminum compression fitting for the cable entrance at the rear of the 512 Series sensors. May be used with either plastic or flexible steel conduit (PVC-6 or AC-6).



Replacement lens block for the SM512LB.



These are 6 and 30-foot lengths of flexible steel conduit and may be used with any of the 512 Series sensors and the CF7-16 fitting to provide protection to the sensor cable. Size: I.D. = 5/16"; O.D. = 7/16".



These are 6 and 30-foot lengths of plastic (PVC) flexible tubing for use with the 512 Series sensors and the CF7-16 in food applications where flexible steel conduit is not allowed. Size: I.D. = 1/4"; O.D. = 3/8".

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

SM512 Series Convergent Mode Sensors

DC sensors with metal housings: SM512C1, SM512CV1, SM512DBC



Banner SM512 Series dc convergent mode sensors are designed for reliable performance in especially hostile industrial environments. These sensors have totally-encapsulated circuitry within a rugged Delrin® or die-cast metal housing for superior resistance to moisture and physical abuse. Models include: SM512C1, SM512CV1, and SM512DBC

The SM512CV1 and SM512C1 have a fixed focus point 1.25 inches from the sensor face and a .040" and .025" diameter sensing spot, respectively. The "CV1" has a visible sensing beam for easy alignment in precise positioning control applications. The "C1" has an infrared light beam with higher gain for difficult applications. The "DBC" has a visible sensing spot only .010" in diameter for applications requiring a higher degree of precision. See page 3.

SM512 Series sensors have complementary NPN transistor outputs (one normally open and the other normally closed), which connect directly to Banner MICRO-AMP and MAXI-AMP logic modules, as well as to most logic gates, small relays, and other similar dc loads.



SPECIFICATIONS, SM512 Series Convergent Sensors

RANGE: See excess gain curves in individual sensor descriptions.

SUPPLY VOLTAGE: 10-30V dc. Maximum allowable ripple 10%; supply current is typically less than 40mA (exclusive of load).

OUTPUT CONFIGURATION: Complementary open-collector NPN transistors (one normally open and one normally closed), with continuous short-circuit protection. All models have reverse polarity protection.

OUTPUT RATING: Each output transistor is capable of sinking up to 250mA continuously. On-state saturation voltage less than 2 volts at full load and less than 1 volt at signal levels. Off-state leakage current less than 100 microamps. Outputs are reverse-polarity protected.

RESPONSE TIME: 1 millisecond on/off. Response time is independent of signal strength.

REPEATABILITY: 0.3 millisecond. Repeatability is independent of signal strength.

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

CONSTRUCTION: Delrin® (CV1, C1 models) or die-cast metal (DBC model) housing; stainless steel legend plate. Totally encapsulated; lens assemblies fully gasketed. NEMA 1, 2, 3, 3S, 4, 4X, 12, and 13. Cables .15-inch dia., PVC covered, shielded (4 conductor, 6 ft. long).

INDICATOR LED: Red LED indicator at rear of sensor (above cable exit) lights when the sensor is receiving a "light" signal.

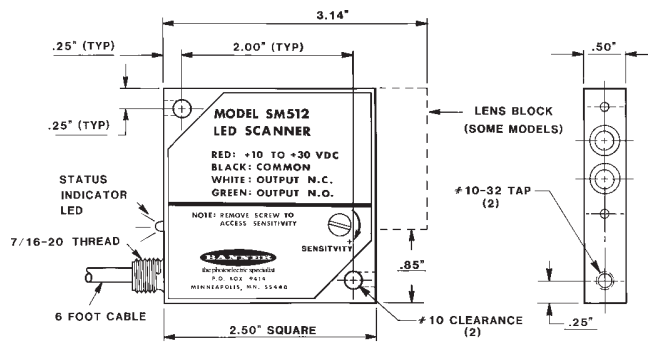
SENSITIVITY ADJUSTMENT: Single-turn adjustment, accessible by removing the nylon screw on the side of the sensor.

APPLICATION WARNINGS:

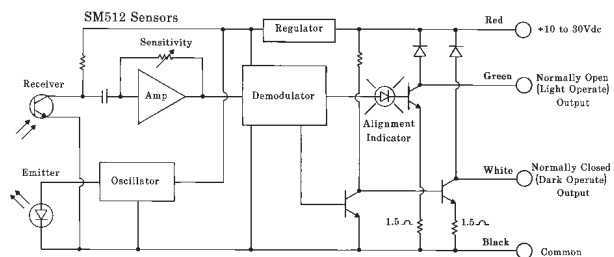
Outputs will not directly interface TTL logic, due to the reverse-polarity protection diode. Contact the factory for TTL interfacing instructions.

The short-circuit protection may de-energize the outputs with certain incandescent light bulb or capacitive loads. Contact the factory if these loads are anticipated.

Dimension Drawing



Functional Schematic



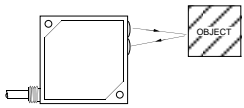
WARNING These photoelectric presence sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in either an energized or a de-energized sensor output condition.

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.

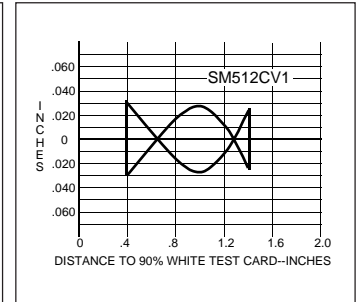
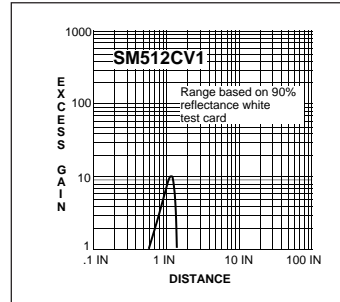
Only MACHINE-GUARD and PERIMETER-GUARD Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices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

SM512 Series Convergent Mode Sensors

SM512CV1 Convergent mode



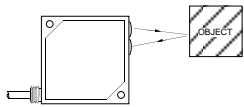
VOLTAGE: 10-30V dc
RANGE: focus at 1.25 inches (32mm)
RESPONSE TIME: 1 millisecond
REPEATABILITY: 0.3 millisecond
SENSING BEAM: visible red, 650nm



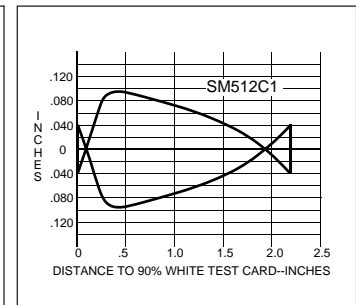
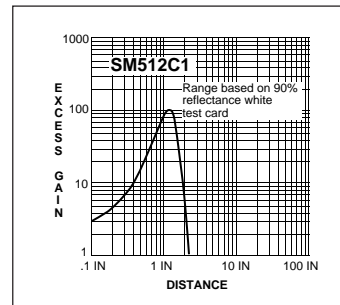
Model **SM512CV1** is a convergent sensor with a **fixed focus point 1.25 inches from the sensor face**. The SM512CV1 uses a visible red beam with a precise .040 inch diameter spot at the focal point. It is used in positioning control applications such as edge-guiding, cut-to-length, or register mark sensing (dark colored marks only). Repeatability when approaching from the side is $\pm .005$ inch, and when approaching from the front is $\pm .050$ inch. The SM512CV1 has a Delrin® case and totally encapsulated electronics.

Note: the SM512CV1 does not have a threaded cable entrance.

SM512C1 Convergent mode

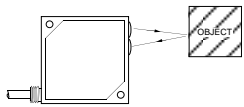


VOLTAGE: 10-30V dc
RANGE: focus at 1.25 inches (32mm)
RESPONSE TIME: 1 millisecond
REPEATABILITY: 0.3 millisecond
SENSING BEAM: infrared, 940nm

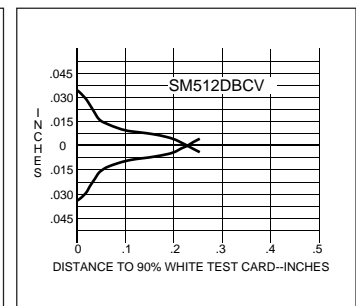
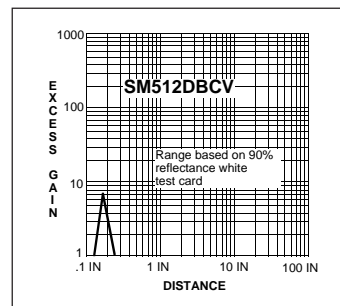


Model **SM512C1** is a convergent sensor with a **fixed focus point 1.25 inches from the sensor face**. The SM512C1 uses a powerful infrared beam with a 1/8" diameter spot, and is used when large amounts of excess gain are required and/or where background objects prevent reliable operation of conventional proximity mode sensors. Typical situations include reflective sensing in dirty environments, sensing clear glass or plastic, and sensing extremely non-reflective materials such as black rubber or rusted metal. The SM512C1 has a Delrin® case and totally encapsulated electronics. Note: model SM512C1 does not have a threaded cable entrance.

SM512DBC1 Convergent mode



VOLTAGE: 10-30V dc
RANGE: focus at .170 inches (4,32mm)
RESPONSE TIME: 1 millisecond
REPEATABILITY: 0.3 millisecond
SENSING BEAM: visible red, 700nm



Model **SM512DBC1** is a **very precise convergent beam sensor** that is ideal for detecting small black marks (such as UPC codes) or miniature parts such as the individual leads of an IC chip. It will also differentiate between heights of objects with an accuracy of better than .030 inches. The SM512DBC1's **visible sensing spot is only .010 inches in diameter**, making it possible to resolve printed marks on .020-inch spacings.

As can be seen from the excess gain curve, the signal falls off very rapidly to the front and rear of the .170-inch focal distance, so it is imperative that the distance from the sensor to the objects being detected be precisely maintained. It is best if this sensing distance is held to within $\pm .020$ inches. This sensor has a die-cast metal housing.

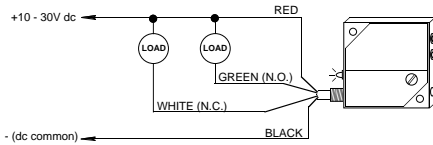
NOTE: Delrin® is acetal homopolymer and is a registered trademark of Dupont plastics.

SM512 Series Convergent Mode Sensors

Hookup Diagrams

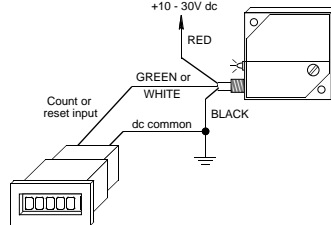
Hookup of SM512 Series Sensor to Relay or Solenoid

SM512 Series sensors offer two open collector NPN outputs in a complementary configuration (one normally open and one normally closed). The green output wire switches the load when the receiver "sees" its modulated light source (LIGHT operate). The white output wire switches in the dark condition (DARK operate). Both output circuits can switch up to 1/4 amp.



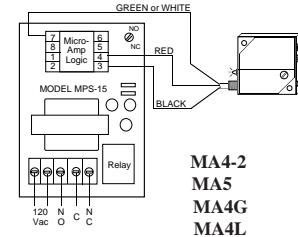
Hookup of SM512 Series Sensor to Counter

Most counters, totalizers, rate meters, etc. accept either output of the SM512s. Hookup to a battery-powered LCD type is shown here. For other types, follow the counter's hookup instructions for an NPN or current sinking input device.



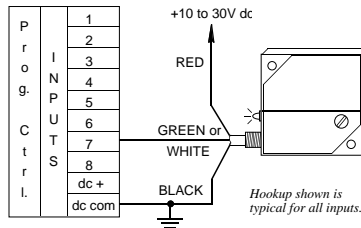
Hookup to MICRO-AMP Logic (MPS-15 Chassis)

The output (green or white wire) of SM512 Series sensors connects directly to any input of Banner MICRO-AMP logic-only modules. These MICRO-AMP logic modules may be used:



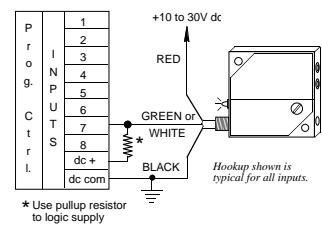
Hookup of SM512 Series Sensor to Programmable Controller requiring current sink

Either sensor output is wired directly to any input of the PLC. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



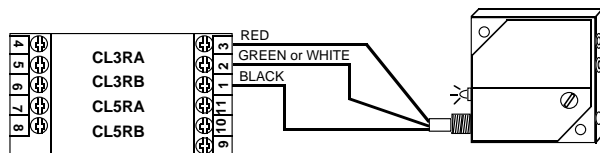
Hookup of SM512 Series Sensor to Programmable Controller requiring current source

Either sensor output is wired to any input of the PLC. An external "pullup" resistor is connected between the input and +V of the PLC (input card) power supply. The value of the resistor is not critical: values from 1KΩ to 10KΩ, 1/4 watt or larger, will satisfy most inputs. Also, connect the negative of the sensor power supply to the negative of the PLC (input card) power supply (if they are separate supplies).



Hookup to MAXI-AMP Logic (CL Series modules)

The output of an SM512 series sensor may be used as an input to Banner MAXI-AMP CL Series logic modules. The MAXI-AMP, when powered by AC voltage, offers a DC supply with enough capacity to power one SM512 Series sensor. An SM512 Series sensor may also be used as an input to the auxiliary input of a CL5 module.



Modification Information for SM512 series Sensors

These modifications are available for SM512 Series sensors. They are not stocked, but are available on a "quote" basis:

HIGH SPEED Modification (model Suffix "MHS")

SM512 Series sensors with normal response speed of 1 millisecond may be modified for faster response. Modification "MHS" offers 300 microsecond (0.3 millisecond) on and off response time. This modification is most often used when very small targets must be sensed. **Repeatability** of "MHS" models is 0.1 millisecond.

CABLE LENGTH Modification (30-foot cable)

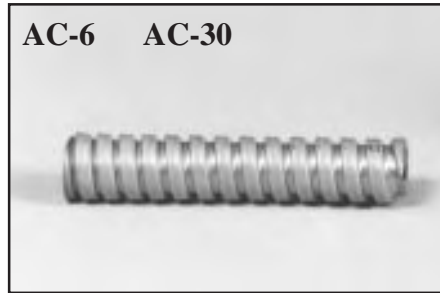
Any of the SM512 Series sensors may be built with a cable longer than the standard 6-foot length. The most readily available length is 30 feet. Lengths longer than 30 feet may also be quoted.

SM512 Series Convergent Mode Sensors

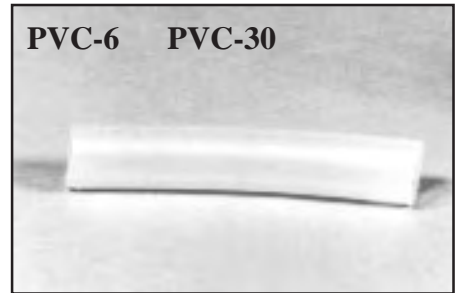
Accessories and Modifications for SM512 Convergent Sensors



Universal steel mounting bracket for 512 Series sensors permits adjustment in both axes. Also available in stainless steel (order model SMB500SS).



These are 6 and 30-foot lengths of flexible steel conduit and may be used with any of the 512 Series sensors and the CF7-16 fitting to provide protection to the sensor cable.
Size: I.D. = 5/16"; O.D. = 7/16".
Note: does not attach to models SM512C1 or SM512CV1.



These are 6 and 30-foot lengths of plastic (PVC) flexible tubing for use with the 512 Series sensors and the CF7-16 in food applications where flexible steel conduit is not allowed.
Size: I.D. = 1/4"; O.D. = 3/8".
Note: does not attach to models SM512C1 or SM512CV1.



Aluminum compression fitting for the cable entrance at the rear of the 512 Series sensors. May be used with either plastic or flexible steel conduit (PVC-6 or AC-6). Note: does not attach to models SM512C1 or SM512CV1.

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

SM53E/SM53R Special Purpose Sensor Pair

Modulated emitter/receiver pair for close-differential (low contrast) sensing



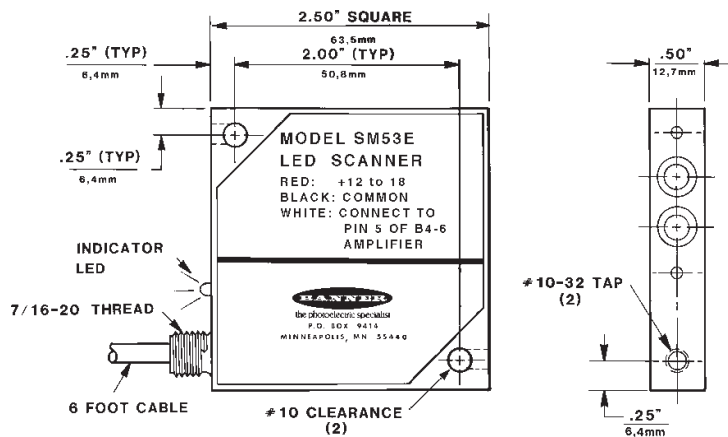
Banner SM53E/R dc sensors are intended for applications in which the signal change too small for reliable operation with conventional sensors. Typical applications include small parts detection and thread break and web flaw detection. It is only necessary to break approximately 10% of the light beam to get a reliable output. These models have totally-encapsulated circuitry within die-cast metal housings for superior resistance to moisture and physical abuse.

The narrow, 1/2" wide housing design has gained this family of sensors the nickname of "the flatpack". These sensors may be ordered with special fittings (page 2) to allow their use in the fiber optic opposed, retroreflective, and diffuse sensing modes.

This sensor pair is used with a Banner B Series ac-coupled amplifier module (page 3). An automatic gain control feedback system adjusts the output of the emitter so that the system sensitivity is always maintained at the proper level.



Dimension Drawing



SPECIFICATIONS, SM53E/SM53R Sensors

RANGE: See page 2

SUPPLY VOLTAGE: 12-18V dc. Power is supplied by the companion B Series ac-coupled amplifier module (see pages 2 and 3).

OUTPUT CONFIGURATION: The output of the receiver connects directly to the B Series module. The module mounts on an MRB Series chassis. The output of the module serves as an input for a variety of output switching devices, which also mount on the MRB Series chassis.

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

CONSTRUCTION: Die-cast metal housing with stainless steel legend plate. Totally encapsulated. NEMA 1, 2, 3, 3S, 4, 4X, 12, and 13. Cables are .15-inch diameter, PVC covered, and shielded (4 conductor, 6 feet long).

INDICATOR LED: Red LED indicator at rear of emitter (above cable exit) lights to indicate "power on". Red receiver LED lights when the AGC circuit has "locked on" to a light signal. NOTE: The AGC circuit must be "locked on" for reliable sensing.



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.

SM53E/SM53R Sensors

SM53E & SM53R

Opposed mode, analog output

VOLTAGE: 10-30V dc
RANGE: 4 feet; 10 feet with L51 lens blocks
RESPONSE: analog
SENSING BEAM: infrared, 880nm



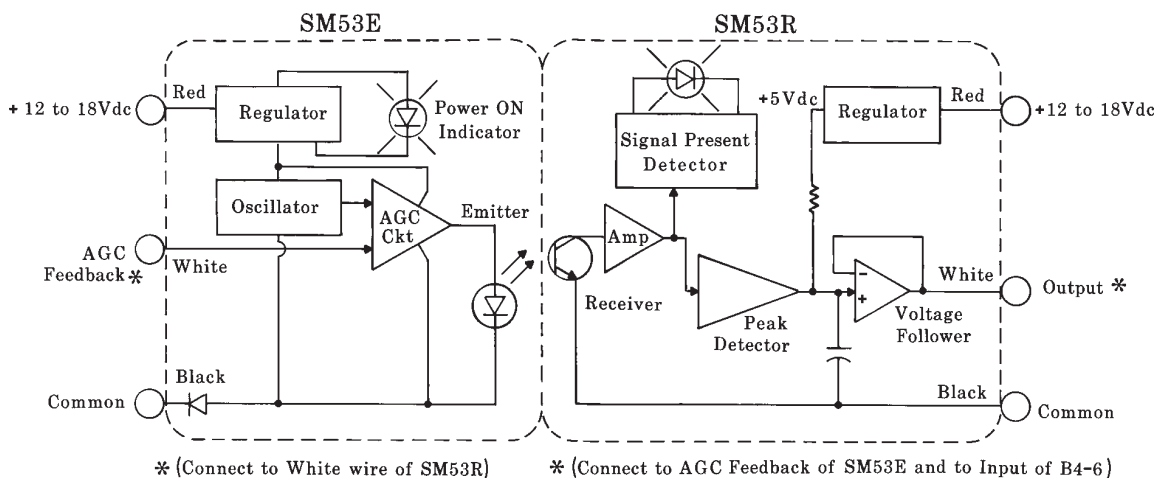
The SM53E/SM53R **opposed mode sensor pair** is a special purpose sensor pair intended for applications where the signal change is so small that sensitivity setting would be difficult with conventional sensors and where small amounts of dirt buildup would prevent reliable operation. These sensors are for use with the model B4-6 ac-coupled pulse amplifier module described in the Banner catalog. The use of an **automatic gain control (AGC) feedback system** adjusts the power output of the emitter so that **the system is always maintained at exactly the right sensitivity**, regardless of the range, the background, or the degree of contamination. Because

of the AGC circuit, there is no need for a sensitivity adjustment on the receiver: sensitivity is set at the B4-6 amplifier module.

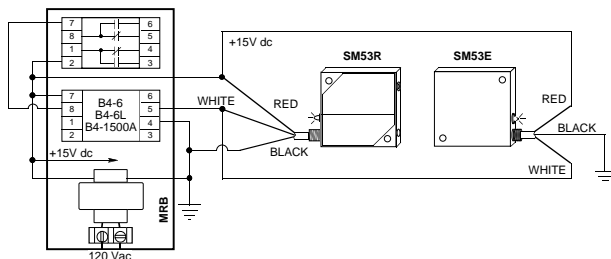
The output of the receiver is maintained at a level of approximately 5V dc. Any interruption of the sensing beam (as little as 10%) results in a short pulse at the receiver output. This pulse is then amplified by the B4-6 to provide a useful logic-level signal.

This sensor pair may also be used with two FOF500 fiberoptic blocks and any of the Banner glass fibers for fiberoptic opposed, retroreflective, or proximity mode sensing. (NOTE: Order models SM53EFO and SM53RFO, sensors which have FOF-500 fiber interface blocks attached). When used with a pair of individual rectangular fibers (models IR23S, IR2.53S, or specials) it is possible to create a "curtain of light" to detect small parts falling at random from vibratory feeders or small presses. It is only necessary to break approximately 10% of the light beam to get a reliable output. **Other applications include thread break and web flaw detection.** A red indicator LED on the emitter verifies "power on", and an LED on the receiver lights when the AGC has "locked on" to a signal.

Functional Schematic, models SM53E and SM53R Analog Output Sensors

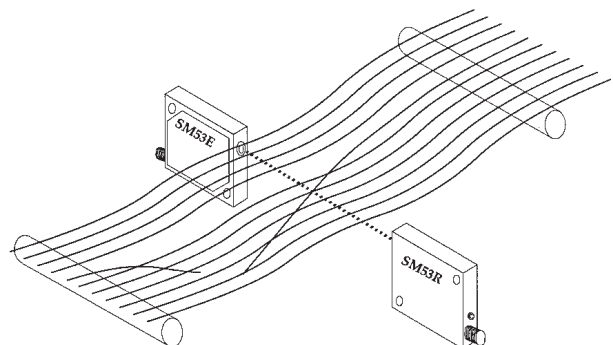


Hookup to B4-6 Module



The SM53E/SM53R sensor pair has an analog output which serves as the input to a B4-6 ac-coupled amplifier. *Note that the white wires from both emitter and receiver tie together at the amplifier input.* This connects together the AGC circuit which regulates the emitter output for constant received light signal strength. The model MRB chassis (shown) operates from 120V ac and provides +15V dc to the sensors and amplifier module.

Yarn Break Detection Application Using SM53E & SM53R



AC-coupled Amplifiers

Banner SM53E/SM53R sensors may be used with the following Banner B Series ac-coupled amplifier modules:

Model	Module Function
B4-6	One-shot, 1 millisecond response
B4-6L	AC latch, 1 millisecond response
B4-1500A	One-shot, 200 microsecond response
B4-3	AC latch, 200 microsecond response

Banner ac-coupled amplifier modules provide a means of transforming the very small signal changes that are sensed by non-modulated photoelectric receivers into conditioned signals that may be used for process control. Modulated receiver model SM53R has a specially-conditioned analog output that is compatible with all of these ac-coupled amplifiers. The SM53E and SM53R form an opposed mode pair that may be fitted with lenses, apertures, or fiberoptic adaptors for a variety of close-differential sensing applications such as yarn break, wire break, and web flaw detection. The power of a modulated LED opposed sensor pair plus the sensitivity of an ac-coupled amplifier offer a solution to many otherwise impossible sensing applications.

AC-coupled amplifiers respond only to quick changes in light level and ignore gradual changes. As a result, very small changes in light level can be amplified. AC-coupled amplifiers are highly sensitive to any input signal change. Their use should be limited to close-differential sensing applications where conditioning of the optical system (e.g. adding apertures, using fiberoptics, etc.) cannot yield reliable sensing contrast.

All models have a sensitivity adjustment which sets the percentage of input signal change that the amplifier will respond to. The one-shot models include a single-turn locking-shaft potentiometer that adjusts the duration of the output pulse. Standard one-shot time range is .01 to 1 second. All models have a light/dark operate switch that selects the direction of the input signal change (light-to-dark or dark-to-light) that the amplifier will respond to.

These B Series ac-coupled amplifiers are powered from 12 to 18V dc or 12V ac. They are designed to be powered by a model MRB Series control chassis. Module model B4-6 is pictured below.

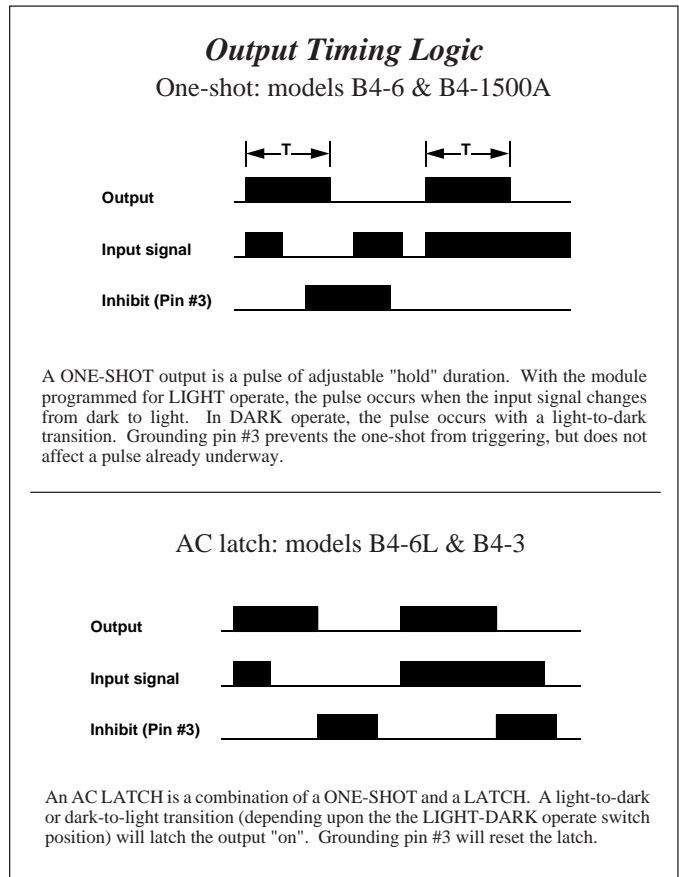
The output of the B Series module is used to control an output switching device, which also mounts on the MRB chassis. Output devices are available to switch a variety of ac and dc loads. For further information on output devices, see the *Special Purpose Sensors and Controls* section of the Banner product catalog.



B4-6 ac-coupled pulse amplifier

Model B4-6 is an ac-coupled amplifier used to detect very small signal changes. It is used with the SM53E/SM53R sensor combination. Response time of this amplifier is 1 millisecond. Grounding pin #3 inhibits operation of the module. NOTE: Objects must be moving at a rate of at least 1 inch per second to be detected reliably by the B4-6. The B4-6 is supplied with a standard male octal base, and plugs into an MRB Series chassis (see hookup diagram, page 2), which also accommodates an output device for switching of the load.

Dimensions: 3.8" x 2.0" x 2.0"



SPECIFICATIONS, B Series ac-coupled modules

SUPPLY VOLTAGE: 12 to 18V dc or 12V ac at less than 100 milliamps, exclusive of load

OUTPUT CONFIGURATION: one current sinking (NPN) open-collector transistor switch

OUTPUT RATING: 250 milliamps maximum capacity; off-state leakage current less than 1 microamp

SENSING RESPONSE TIME: (see above)

TIMING REPEATABILITY: plus or minus 2% of set time for all extremes of supply voltage and temperature

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

CONSTRUCTION: anodized aluminum housing; 2" x 2" x 3.8" with standard octal relay-style base

GROUNDING SYSTEM: negative side of power supply (pin 4) is internally connected to the housing and should be externally connected to earth ground

SM53E/SM53R Sensors

Accessories and Modifications for SM53E/SM53R Sensors



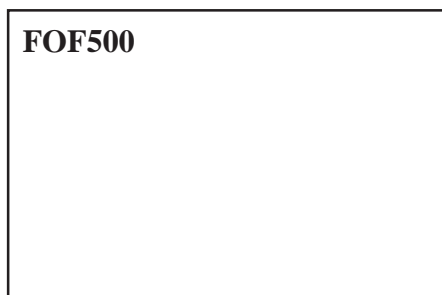
SMB500
Universal steel mounting bracket for SM53 sensors permits adjustment in both axes. Also available in stainless steel (order model SMB500SS).



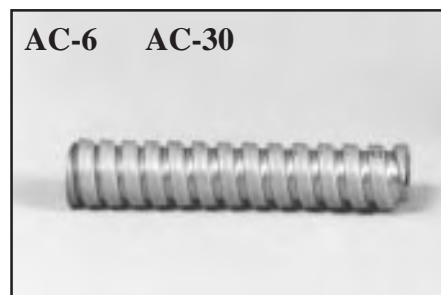
BZ500
Plastic lens cover for any SM53 sensor that does not utilize a lens block. Used in food applications where the presence of a glass lens is unacceptable.



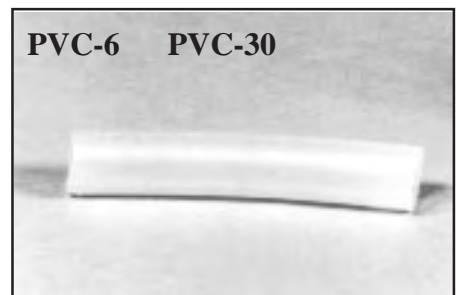
L51
For extending the range of any of the SM53 emitters and receivers. When used on both emitter and receiver, typically doubles the range of unlensed units.



FOF500
Fiberoptic interface block. Creates fiberoptic sensor from SM53 emitter/receiver pairs. Contact factory for ranges.



AC-6 AC-30
These are 6 and 30-foot lengths of flexible steel conduit and may be used with the SM53 sensors and the CF7-16 fitting to provide protection to the sensor cable.
Size: I.D. = 5/16"; O.D. = 7/16".



PVC-6 PVC-30
These are 6 and 30-foot lengths of plastic (PVC) flexible tubing for use with the SM53 sensors and the CF7-16 in food applications where flexible steel conduit is not allowed.
Size: I.D. = 1/4"; O.D. = 3/8".



CF7-16
Aluminum compression fitting for the cable entrance at the rear of the SM53 sensors. May be used with either plastic or flexible steel conduit (PVC-6 or AC-6).



L52AB
Model L52AB (left) is an aperture block used with the SM53 emitters and receivers to create very narrow effective beams.

Each L52AB comes with a .040-inch diameter round aperture and a .030 x .125-inch rectangular aperture. The aperture blocks include sealed clear windows to prevent the apertures from becoming clogged with dirt.

Apertures are normally used on both the emitter and receiver.

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