SM53E/SM53R Special Purpose Sensor Pair

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

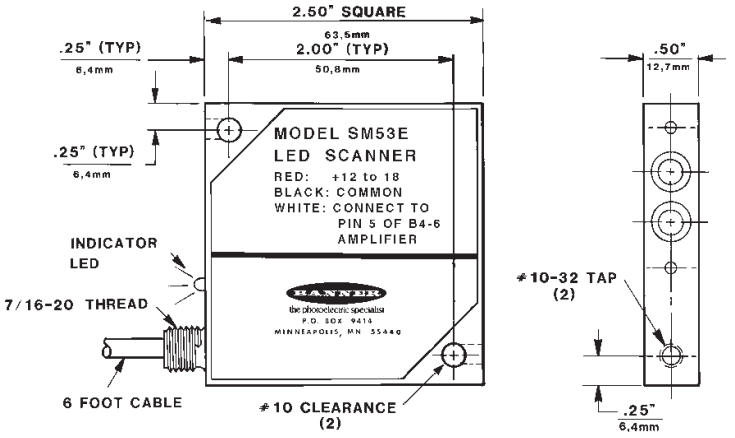
the photoelectric specialist

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.

Printed in USA P/N 34379

SM53E/SM53R Sensors

SM53E & SM53R

Opposed mode, analog output

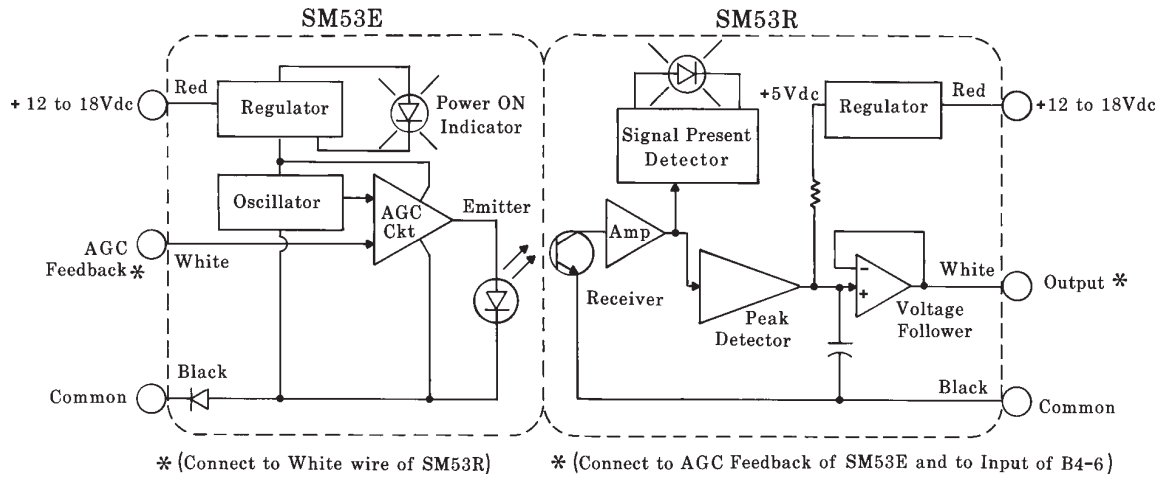
VOLTAGE: 10-30V dc
RANGE: 4 feet; 10 feet with L51 lens blocks
RESPONSE: analog
SENSING BEAM: infrared, 880nm

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.

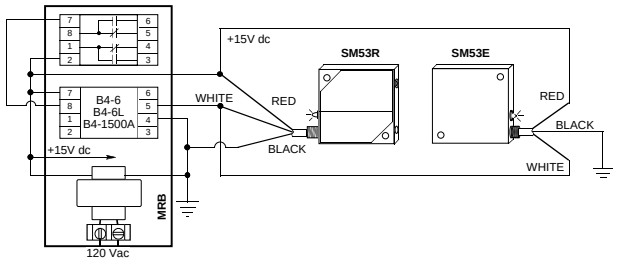
The output of the receiver is maintained at a level of approximately 5V dc. Any interruption of the sensing beam (as little as 10%) results in a short pulse at the receiver output. This pulse is then amplified by the B4-6 to provide a useful logic-level signal.

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



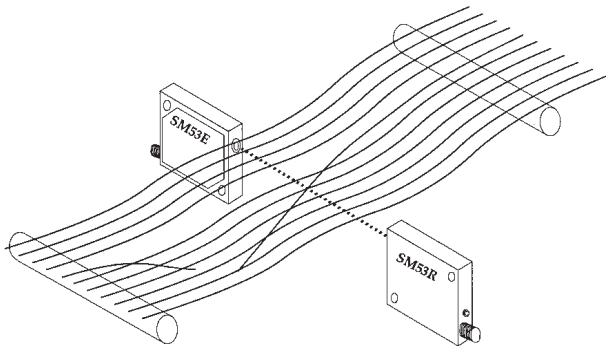
Hookup to B4-6 Module



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.

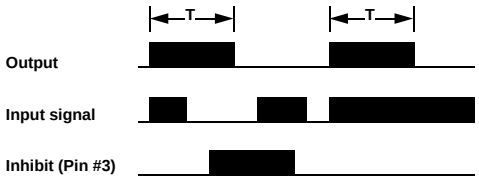
All models have a sensitivity adjustment which sets the percentage of input signal change that the amplifier will respond to. The one-shot models include a single-turn locking-shaft potentiometer that adjusts the duration of the output pulse. Standard one-shot time range is .01 to 1 second. All models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

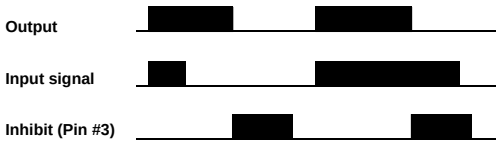
Output Timing Logic

One-shot: models B4-6 & B4-1500A



A ONE-SHOT output is a pulse of adjustable "hold" duration. With the module programmed for LIGHT operate, the pulse occurs when the input signal changes from dark to light. In DARK operate, the pulse occurs with a light-to-dark transition. Grounding pin #3 prevents the one-shot from triggering, but does not affect a pulse already underway.

AC latch: models B4-6L & B4-3



An AC LATCH is a combination of a ONE-SHOT and a LATCH. A light-to-dark or dark-to-light transition (depending upon the the LIGHT-DARK operate switch position) will latch the output "on". Grounding pin #3 will reset the latch.

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

B4-6 ac-coupled pulse amplifier

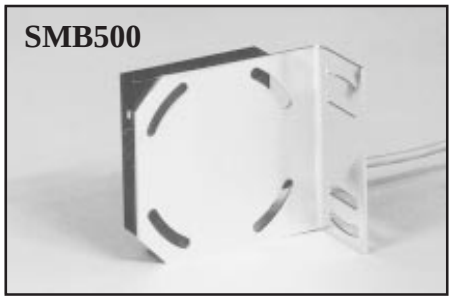
Model **B4-6** is an ac-coupled amplifier used to detect very small signal changes. It is used with the SM53E/SM53R sensor combination. Response time of this amplifier is 1 millisecond. Grounding pin #3 inhibits operation of the module. NOTE: Objects must be moving at a rate of at least 1 inch per second 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"

SM53E/SM53R Sensors

Accessories and Modifications for SM53E/SM53R Sensors

SMB500

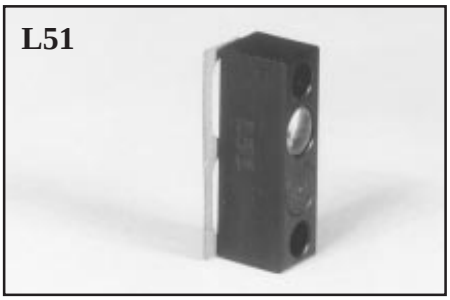


Universal steel mounting bracket for SM53 sensors permits adjustment in both axes. Also available in stainless steel (order model SMB500SS).

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

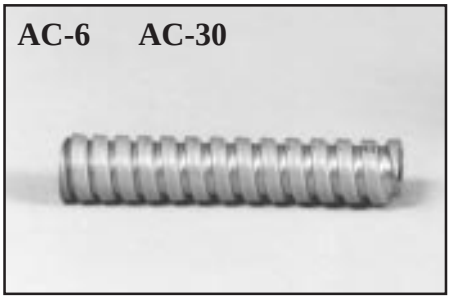


For extending the range of any of the SM53 emitters and receivers. When used on both emitter and receiver, typically doubles the range of unlensed units.

FOF500

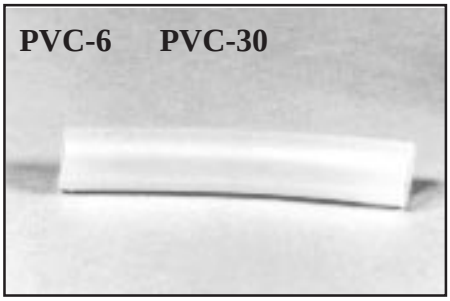
Fiberoptic interface block. Creates fiberoptic sensor from SM53 emitter/receiver pairs. Contact factory for ranges.

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

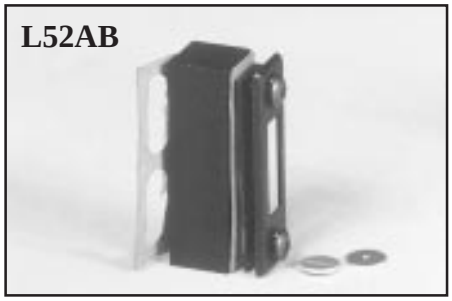


These are 6 and 30-foot lengths of plastic (PVC) flexible tubing for use with the SM53 sensors and the CF7-16 in food applications where flexible steel conduit is not allowed.
Size: I.D. = 1/4"; O.D. = 3/8".

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.

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