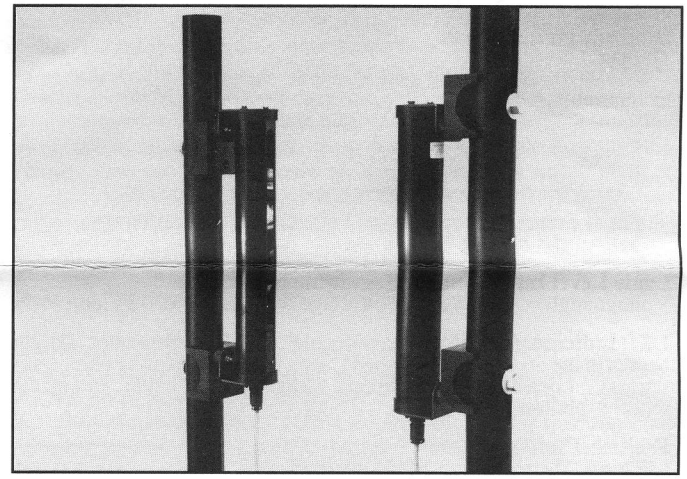
BEAM-ARRAY™ Systems

Measuring light curtains

BANNER
the photoelectric specialist

- **Opposed, multiplexed emitter/receiver arrays ideal for applications such as on-the-fly parts measurement and profiling, hole detection, web guide control, and parts ejection verification and counting**
- **.20-inch diameter light beams on .25-inch centers reliably detect profiles as small as .45 inch**
- **Three outputs:**
  ***Analog:* 0 to +10V dc sourcing**
  ***"Trip"*: logic level output for "all light" condition**
  ***Serial data*: serial data stream**
- **Internal or customer-supplied external clock control**
- **Easy interfacing to PLCs, computers, and other digital instrumentation via Banner BEAM-ARRAY Controller or BEAM-ARRAY Serial Control Module**
- **Provides either *continuous* or *on-demand* scanning**
- **Rugged NEMA-4 construction and anti-vibration brackets for use in hostile industrial environments**
- **Available in 1, 2, 3, and 4-foot array lengths**



- **Performance is *not* limited by optical "depth-of-field" considerations. Wide field of view allows forgiving alignment and minimal maintenance.**

Banner BEAM-ARRAY™ Systems generate a "curtain" of precisely synchronized infrared light beams. BEAM-ARRAYs are ideal for on-the-fly parts measurement and profiling, hole detection, web guide control, part ejection verification and counting, and other applications requiring similar resolution in rugged industrial environments. The system consists of a multiplexed emitter unit of multiple, sequentially-activated LEDs, synchronized with a multiple-phototransistor receiver unit. Each receiver phototransistor looks only for the light from its associated emitter LED, in sequence, and at a time interval determined by either the system's own internal clock or a user-provided external clock. Scanning may be either ***continuous*** (system internally and automatically reset and a new scan initiated following each previous scan) or ***on-demand*** (system reset and each new scan initiated by applying and removing an *external* **DISABLE** signal).

Light beams are on .25-inch centers, resulting in .25-inch measurement accuracy. Each beam has an effective beam diameter of .20 inch. Minimum stationary object diameter for reliable detection is .45 inch, and range (separation distance between emitter and receiver units) is 10 feet maximum. Emitter and receiver arrays are available in lengths of 1, 2, 3, and 4 feet (see page 2).

Unlike camera ("vision") systems, the BEAM-ARRAY System's performance is not limited by optical "depth-of-field" considerations, and so is particularly useful in applications where the sensing position of the object is not closely controlled. Alignment is simple, due to the system's wide field of view and the adjustable anti-vibration mounting brackets (supplied). Operating voltage is +15 to 20V dc at 250mA *total* current for both emitter and receiver, regardless of array length.

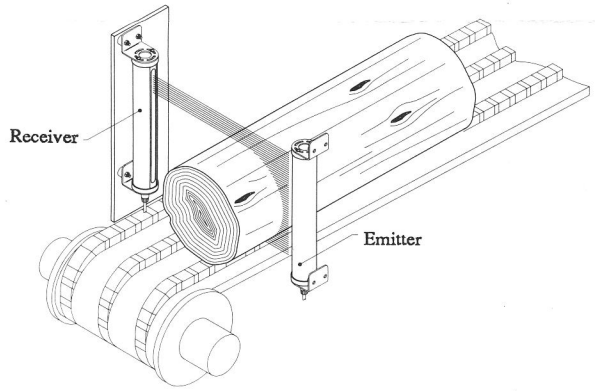
There are two control outputs. · *A logic level "trip" output* (capable of 20mA, continuous) goes from +6V dc when all light beams are established to 0V dc whenever one or more light beams are blocked, and interfaces directly to CMOS and transistor logic.

The other control output, a *0 to +10V dc sourcing analog output,* is proportional to the number of unblocked light beams: the larger the number of unblocked beams, the greater the output voltage. This output is a linear step function and connects directly to loads such as motor controllers and to analog inputs of PLCs. Both outputs update at the end of each scan.

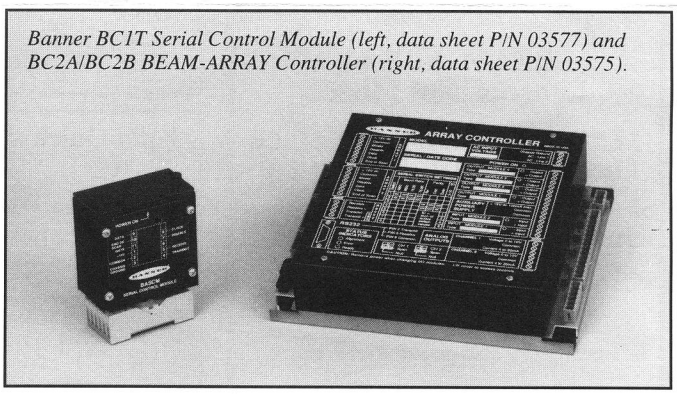
BEAM-ARRAY Systems may be used with a model BC2A or BC2B BEAM-ARRAY Controller to provide user-defined scanning response configurations along with extremely versatile multiple control output capabilities. The BEAM-ARRAY Controller offers up to four programmable discrete and two analog outputs, and supports serial communication with a host computer or PLC via an RS-232C, RS-422, or RS-485 interface. Alternatively, serial Control Module model BC1T will output continuous, gated, or on-demand scan data in binary format (via an RS-232C interface) to a host computer. See photo, below.

NOTE: Save the original BEAM-ARRAY packing material (see page 4).

BEAM-ARRAY System Concept



Banner BC1T Serial Control Module (left, data sheet P/N 03577) and BC2A/BC2B BEAM-ARRAY Controller (right, data sheet P/N 03575).



Specifications: BEAM-ARRAY Systems

Power Requirements: +15 to 20V dc at 250mA (will supply 1 emitter unit and 1 receiver unit, regardless of array length). ***Proper power supply polarity must be observed to avoid damage to units.***

Output Configuration:
Three outputs:

0 to +10V dc sourcing analog output, capable of 20mA max, continuous. Short-circuit protected. Two or more consecutive scans are required for an accurate analog output.

Switched "trip" output, logic level: 0V dc whenever one or more light beams are blocked, +6V dc when all beams are established (20mA maximum continuous, short-circuit protected).

Serial data stream output (see logic level I/O requirements, below, and in text).

Logic Level Input/Output Requirements:
Voltage high = +3 to 12V dc. Voltage low = +0.8 to -12V dc.

LED Indicator: An "All Beams Visible" red LED lights when all light beams in the array are established ("seen" by their receiver phototransistors). Located behind scanning window at the "cable" end of the receiver phototransistor array.

Emitter Configuration: Infrared (880nm) LEDs on .25-inch centers (48 LEDs per foot of emitter array length). Effective beam diameter of each LED is .20 inch.

Receiver Configuration: Phototransistors on .25-inch centers (48 phototransistors per foot of receiver array length).

Scan Time & Timing Logic: Internal clock (factory-set to scan at a rate of 4 milliseconds per foot of array length) or customer-supplied external clock. External clock may not run at faster than .100 millisecond per step (10 kHz).

Resolution: .25-inch measurement accuracy; .45-inch minimum object resolution (smallest profile reliably sensed).

Range: 10 feet maximum separation between emitter and receiver units.

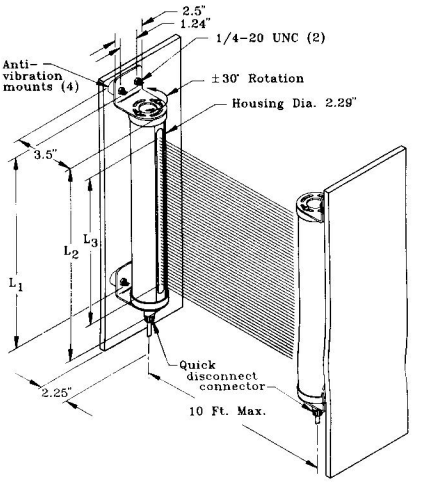
Housing: Black anodized aluminum, NEMA 4.

Hardware Material: Brackets are 11-gauge cold-rolled black zinc-chromate finished steel. Fasteners are black zinc-chromate finished steel. Brackets and fasteners are provided. Mounting posts (seen in photograph) are not included.

Temperature Range: 0 to +50 degrees C (-32 to +122 degrees F).

Cable: .25" diameter, PVC-jacketed, shielded 8-conductor cable, 15 feet long (22 gauge conductors); 9-pin female molded quick disconnect connector on one end (8 wires plus shield). One model BMQD815 cable is provided with each emitter or receiver unit ordered.

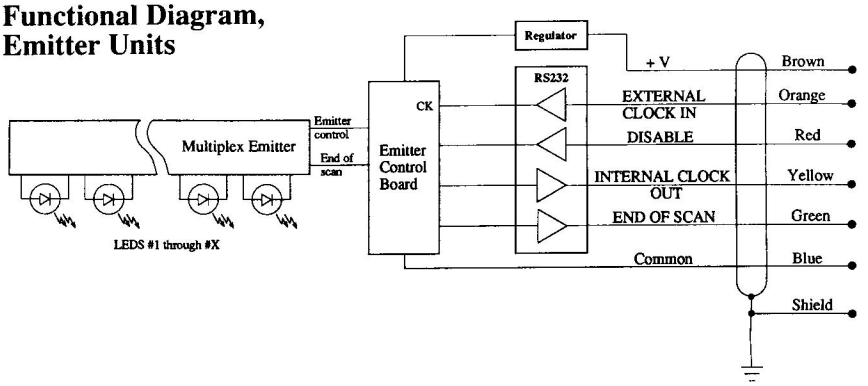
Dimensions, BEAM-ARRAY Systems



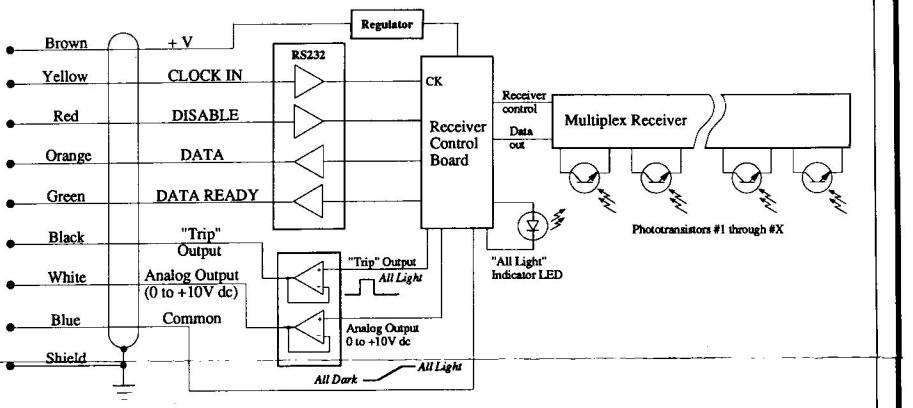
L_1 =
15.5" for BME/R148A
27.5" for BME/R248A
39.5" for BME/R348A
51.6" for BME/R448A

$L_2 = L_3 + 3.4$ inches
L_3 = 1, 2, 3, or 4 feet

Functional Diagram, Emitter Units



Functional Diagram, Receiver Units



BEAM-ARRAY Lengths and Models

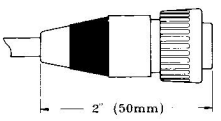
LENGTH	EMITTER	RECEIVER
1 foot	BME148A	BMR148A
2 feet	BME248A	BMR248A
3 feet	BME348A	BMR348A
4 feet	BME448A	BMR448A

NOTE: Emitter and receiver units that are to be used together must be of the same length.

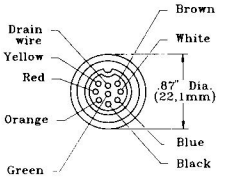
9-pin Quick-disconnect Connector (cable model BMQD815)

Side view

Length of cable = 15 feet



Front view (female contacts)



Operating and Hookup Information

General

BEAM-ARRAY system emitter and receiver units are set up opposite each other, with the receiver phototransistors and emitter LEDs directly facing each other in the same plane (see Concept drawing, page 1, and Alignment procedure, page 4). Circuitry inside the emitter housing switches the emitter LEDs on and off in sequence, beginning at the "cable" end of the emitter, at a rate determined either by the system's *internal clock* (contained within the emitter housing) or by a user-supplied *external clock*. Each phototransistor in the receiver unit "looks", in sequence, only for the light beam from its corresponding emitter LED. The INTERNAL CLOCK OUT line from the emitter and the CLOCK IN line of the receiver connect together to synchronize the two units and ensure that only *one* emitter LED and its associated receiver phototransistor are active at a time. At the end of each complete scan through the array, an ***END OF SCAN*** signal from the emitter unit stops the scan and tells the system that one full scan has been completed. A new scan may then either be initiated immediately (*continuous* scanning, which is internally-triggered) or at a user-controlled interval (*on-demand* scanning, which is externally-triggered), depending upon the type of hookup used (see below and next page).

NOTE: The *scan time* , the time taken for one complete scan of the array, depends upon the model (size) of the array used and the speed of the clock used. The *internal clock,* located in the emitter unit, has a factory-set scan rate of 4 milliseconds per foot of array length. The customer-supplied *external clock* (when used) may be set to scan at any speed up to as fast as 5 milliseconds per foot of array length.

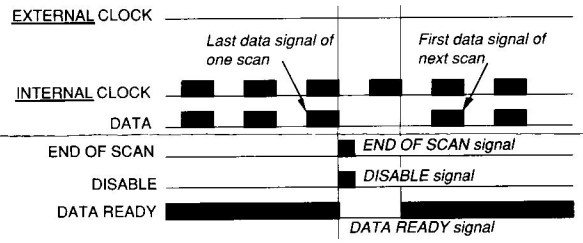
At the end of each scan through the array, a ***DISABLE*** signal (+V) is sent to both DISABLE inputs. This voltage high signal resets the circuit so that it is ready to begin another scan. This "ready" condition exists for as long as the DISABLE input is held "high". To start or enable scanning, the DISABLE input is switched "low". If the system is set up to run *continuously* (see below), with the emitter END OF SCAN line connected to both the emitter and receiver DISABLE inputs, the DISABLE inputs automatically receive the ***RESET*** and ***ENABLE*** signals. For *on-demand* operation, the DISABLE inputs are *not* connected to external controllers which generate the ***RESET*** and ***ENABLE*** signals.

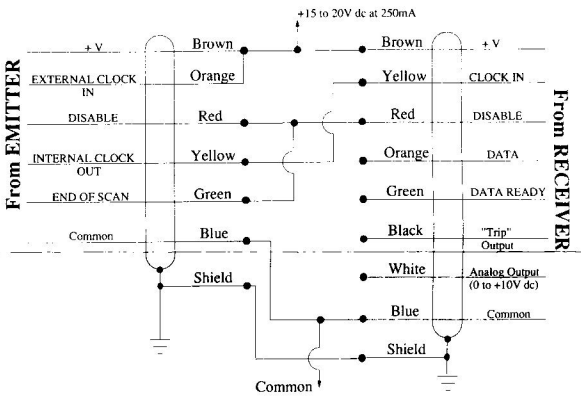
There are four operating modes, decribed below.

Continuous Scanning, Using Internal Clock

For *continuous* scanning, in which each new scan begins automatically, an ***END OF SCAN*** signal from the emitter unit is used. The DISABLE line of the receiver and the DISABLE line of the emitter are connected to the END OF SCAN line from the emitter. The ***END OF SCAN*** signal resets and enables both units for continuous operation. Scanning will repeat for as long as the internal clock is running.

Continuous Scanning Using Internal Clock

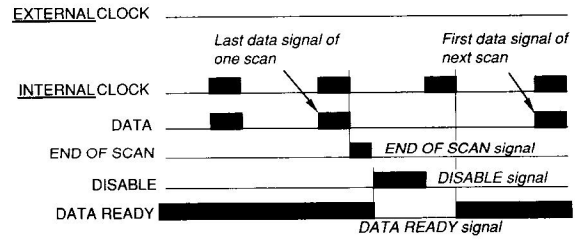


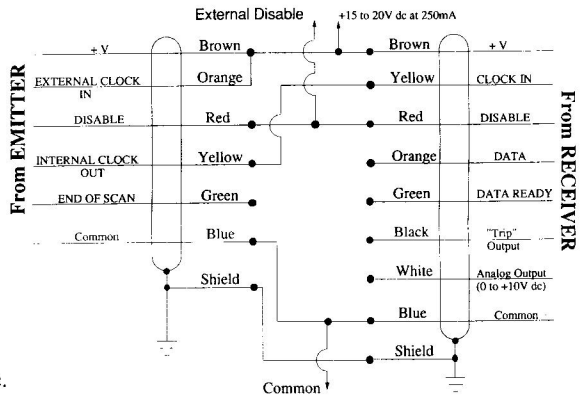


On-demand Scanning, Using Internal Clock

For *on-demand* scanning, both the emitter DISABLE and receiver DISABLE inputs are connected to an *external* **DISABLE** signal line. The END OF SCAN line will go "high" at the end of the last data signal of a scan, and stay "high" until the remote ***DISABLE*** signal is applied. The next scan begins with the first full clock pulse following removal of the remote ***DISABLE*** signal. The figure below shows a timing diagram and hookup for *on-demand* scanning.

On-demand Scanning Using Internal Clock





This operating mode requires an *external* logic-level DISABLE signal. Voltage "low" must be +0.8 to -12V dc; voltage "high" must be +3 to +12V dc.

Serial Data Output

The DATA output of the receiver unit provides a logic level serial data stream of information that indicates the state of each phototransistor (beam complete = voltage "high", beam blocked = voltage "low"). The data output is synchronized with the clock in use so that for each clock pulse, one data bit is produced.

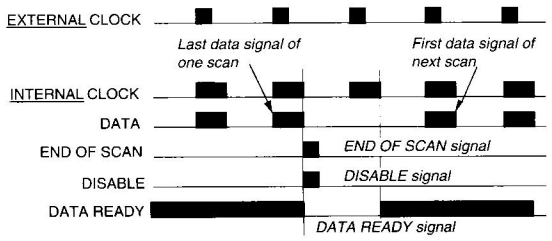
The DATA READY output (from the receiver) may be used to give a sampling circuit advance notice that scan data is forthcoming. The DATA READY line will go "low" when the DISABLE line goes "high" and return to "high" at the end of the next *internal* clock pulse.

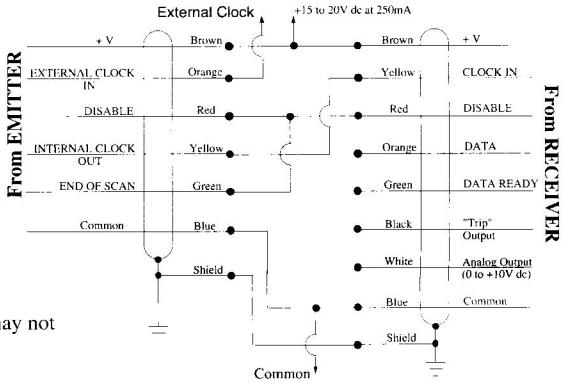
Data output and timing inputs and outputs interface directly with Banner model BC2A and BC2B Controllers and BC1T Serial Control Module.

Using an External Clock

Banner BEAM-ARRAY systems allow the scan time to be controlled by an external customer-supplied clock. The system's internal clock, whose pulses are triggered by the external clock in this operating mode, retains control over the length of the data pulses and the timing of the DATA READY signal. See the timing diagrams below and the **Specifications** section for more information.

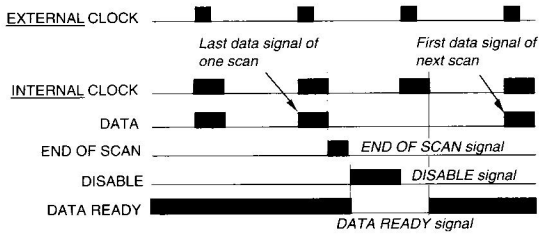
Continuous Scanning Using External Clock

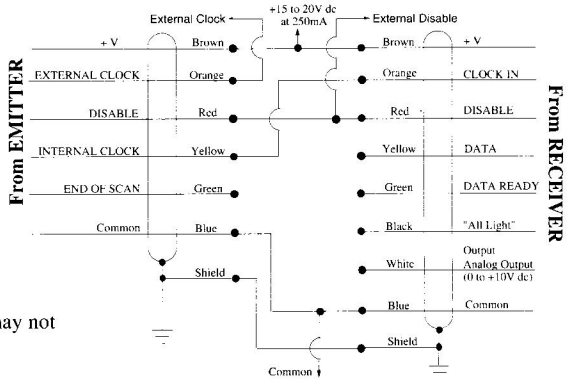




This operating mode requires an *external* logic-level CLOCK signal. Pulse length may not exceed 80 microseconds; rep rate may not be less than 100 microseconds.
Voltage "low" must be +0.8 to -12V dc; voltage "high" must be +3 to +12V dc.

On-demand Scanning Using External Clock





This operating mode requires an *external* logic-level CLOCK signal. Pulse length may not exceed 80 microseconds; rep rate may not be less than 100 microseconds.
Voltage "low" must be +0.8 to -12V dc; voltage "high" must be +3 to +12V dc.

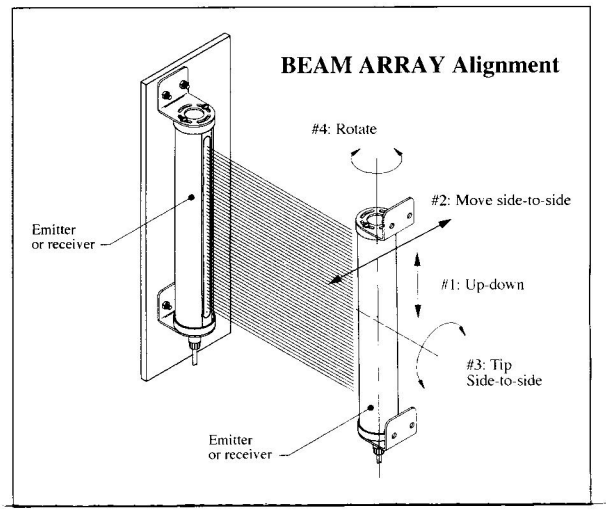
Setup and Alignment

Alignment is forgiving, due to the BEAM-ARRAY system's wide field of view.

BEAM-ARRAY emitter and receiver units must be positioned directly facing each other and parallel to each other (in the same plane). The emitter and receiver units must be aligned so that their related photoelements "line up" (i.e., the "cable end" of both units must point in the same direction). Refer to the drawing at right.

The supports used should be as firm and vibration-free as possible. Mount the receiver unit firmly in place using its attached anti-vibration mounts. Interconnect the receiver and emitter for ***continuous scanning using internal clock*** (see hookup information, page 3), and apply dc power to both units (***important: observe proper dc power polarity***).

Hold the emitter unit at the approximate position where it will be mounted. Locate the "All Beams Visible" LED of the receiver unit (the *visible* red LED mounted behind the window at the "cable" end of the receiver unit phototransistor array). While observing this LED, raise and lower, tilt, and move (side-to-side), the emitter unit in the directions shown by arrows #1, 2 and 3 in the drawing at right. Find the midpoint of the "extremes" of the two axes of adjustment within which the receiver LED indicator remains "on". Mount the emitter in place at this position.



With both units mounted firmly in place, rotate the emitter (direction #4) in its brackets, find the midpoint of the receiver LED "on" zone, and tighten all mounting hardware.

RETURN SHIPMENT: Save your original BEAM-ARRAY packing material in case return shipment to the factory becomes necessary. Damage incurred in return shipment is not covered by warranty!

WARNING This photoelectric presence sensing system does NOT include the self-checking redundant circuitry necessary to allow its 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.

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