



SKAN-A-MATIC®

PHOTOELECTRIC PRODUCTS CATALOG

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SKAN-A-MATIC

The Big Name In Photoelectrics

Skanners And Controls For Any Application

Standard or special purpose, Skan-A-Matic position sensors and controls have your application covered. Our selection of over 100 photoelectric sensors and controls provides the variation in size, type and configuration to meet your specific needs.

Skan-A-Matic Thrubeams deliver the most positive sensing signal. They consist of a separate light source and photodetector placed on opposite sides of objects to be detected. Detection occurs when the beam of light between them is broken by the object.

Skan-A-Matic Reflective Skanners combine a light source and photodetector within a single housing. Light is emitted by the source and returned to the photodetector—either by reflecting off a target or a special retroreflective surface.

Skan-A-Matic Special Purpose Sensors are custom designed for those unique applications not covered by our standard line-up. We offer skanners to detect liquid levels, colors and wafers for the semiconductor industry. Some of our special purpose sensors are furnished with flexible fiberoptic probes to detect objects in inaccessible places. If you have a special need, Skan-A-Matic can design the unit to meet your requirements.

Skan-A-Matic Self-Contained Photoelectric Controls combine sensor and control in one package. This results in less installation time, and lower cost for each sensing position. These sensors also have superior immunity to electrical noise than a separate sensor and control combination.

Skan-A-Matic Controls allow designers the option of altering the function of photoelectric skanners to suit the requirements of each individual application. Our photoelectric controls offer on/off time delay, and other logic circuitry for single and multiple skanner operations. Our modular approach to photoelectric design represents a breakthrough in systems versatility. It allows you to assemble a photoelectric system customized to your particular applications.

Performance As Promised

Skan-A-Matic products are used by hundreds of manufacturers in the U.S. and around the world for their in-house needs and O.E.M. products. These companies have learned that Skan-A-Matic products pay for themselves by offering longer life, greater reliability, and less down time. Plus, the small size and unique capabilities of Skan-A-Matic products allow them to be used in more places and in more ways than other skanners.

Quality Through And Through

Each and every Skan-A-Matic product is capable of the most sophisticated operation, yet rugged enough to withstand the most hostile environments, because quality is a built-in standard.

From the start, our light sources and components are designed to our specifications and fully tested before being shipped to us. All components are then re-tested and burned-in before assembly. Testing and inspection continue during and after assembly. We then test each product to published specifications and inspect them individually before packaging.

To insure the quality and performance of Skan-A-Matic products in harsh environments, we house them for superior durability. Most of our skanners and thrubeams feature rugged, one-piece housings, machined from metal. Components are permanently bonded to the housings with modern, high-strength epoxies. Finally, the housings themselves are completely sealed to exclude any dust or contaminants.

Our confidence in the performance, reliability and durability of every Skan-A-Matic product is so strong, we back each one with a full year warranty on materials and workmanship.

The Best Technical Support In The Business

Skan-A-Matic stands behind each and every one of our products. And we're ready to solve your specific application problems.



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Covers basic facts about photoelectric systems and is recommended reading for anyone interested in the technology.

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The specifications contained in this databook supersede all previously published data.

Industrial Sensors Databook
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Technical Information

The Technical Information section covers some basic facts about photoelectric systems and how they work

and is recommended reading for anyone interested in the technology. The following topics are included:

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TECHNICAL INFORMATION

Components of a Photoelectric System

Skane-A-Matic thrubeams and scanners are photoelectric devices — they react to the presence or absence of light by changing their electrical characteristics. A working system has three basic parts: a light source, a light detector or photodetector, and an amplifying control. These three components may be packaged and arranged in different ways for different applications.

Light Sources



Light sources can be either Incandescent Lamps or Light Emitting Diodes (LED's).

Lamps

INCANDESCENT LAMPS are miniature versions of the common household light bulb — electric current heats a metal filament until it glows. Although most people see only the blue thru the red wavelengths, the energy emitted by an incandescent lamp is a blend of all colors, including infrared. As Fig. 1 shows, the lamp emits most of its energy in the infrared region of the spectrum.

Features

- High output — important for small, rapidly moving, or distant targets
- Wide band emission — essential for distinguishing colors
- Visible light — easier installation and alignment

Limitations

- Waste heat — degrades other electronic components
- Filaments are vulnerable to shock and vibration — may break or may move off-axis
- Filaments degrade over time (approximate life — 10,000 hours at rated voltage)
- Cannot be modulated

LED's

LIGHT EMITTING DIODES are semiconductor devices that emit light when an electrical current is passed thru them. Unlike lamps, they do not have a filament to burn out and therefore have much longer life. Two types of LED's are used in Skane-A-Matic products. The infrared LED, and the visible red LED. Infrared LED's have the greater output, but have the disadvantage of being invisible to the human eye. Sensors made using visible red LED's have the advantage of being easy to install, because the light source can be seen.

LED's must always be wired using the correct polarity and a current limiting resistor must be used in most cases. Always consult the installation instructions for the particular scanner and control being used. In all cases where a resistor is necessary it will be supplied with either the scanner or control.

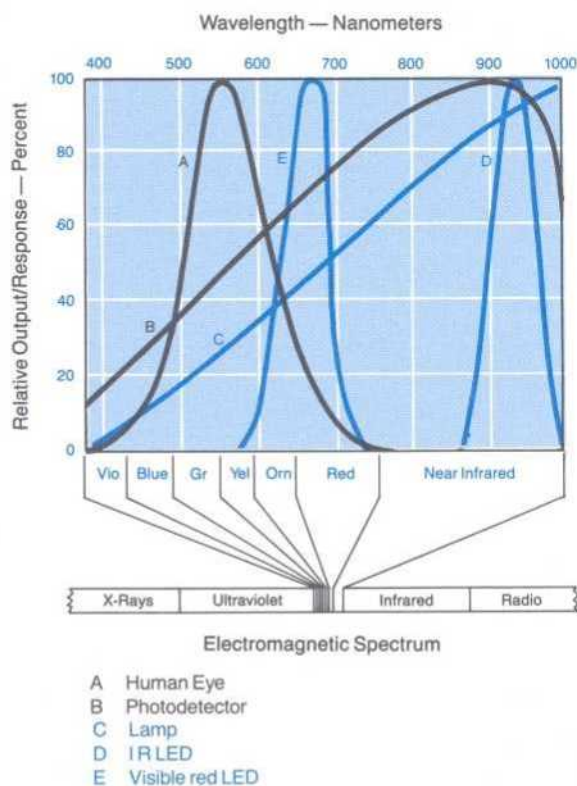


FIG. 1

Components of a Photoelectric System

Photodetectors

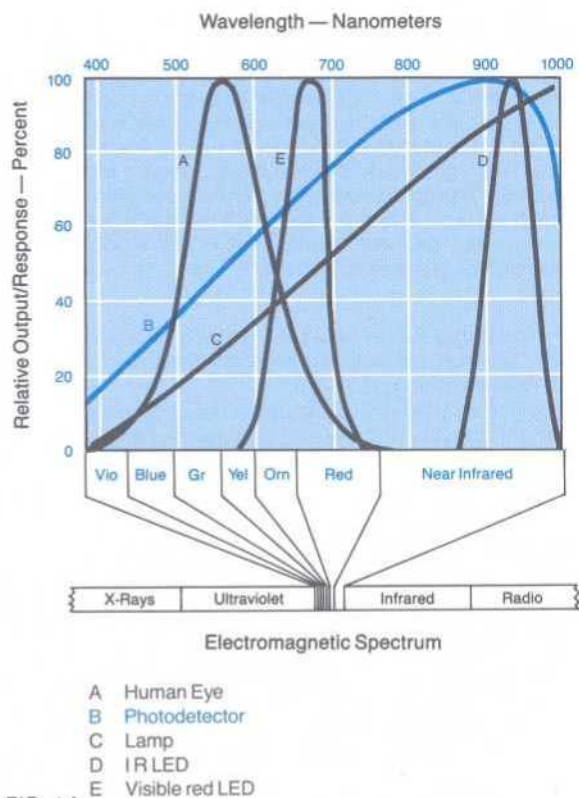


FIG. 1A

Features

- No Filament - Resistant to shock & vibration
- Ten times longer operating life than lamps—100,000 hours (11½ years of continuous operation)
- Can be modulated

Limitations

- Lower output than lamps - limits distance and response time
- Can be damaged by incorrect wiring

Most Skan-A-Matic products use silicon phototransistors to detect light. Like normal signal transistors, they act as valves or switches to regulate the flow of current in a circuit. When light is absent the phototransistor is OFF and conducts only a very small DARK CURRENT. Light striking the transistor turns it ON so that it conducts LIGHT CURRENT. This catalog uses the general term PHOTODETECTOR CURRENT.

As Fig.1A shows, photodetectors respond to light of many wavelengths — from visible blue thru red to the invisible infrared. Notice that the peak of the photodetector response curve lies out in the infrared near the peak emission of LED's and incandescent lamps. This coincidence makes it easy to get a good match between emitter and detector devices and has been a major factor in the present widespread use of photoelectrics.

Optical Filters

The fact that photodetectors respond to such a great range of wavelengths makes them vulnerable to interference from all sources of light, especially sunlight and room lighting. Skanners which will normally be exposed to light from these sources should be protected by optical filters which block visible light but allow the infrared wavelengths to pass. These infrared-passing filters can be made of glass or a plastic material. The glass filters can be used as an exterior cover glass and can withstand elevated temperatures. The plastic filters can only be used within a protective housing and are temperature-rated to only 50°C.

Optical filters are highly effective against light from fluorescent tubes since this light is almost all in the visible portion of the spectrum. If infrared energy from sunlight or incandescent lamps will be encountered, a modulating control should be used.

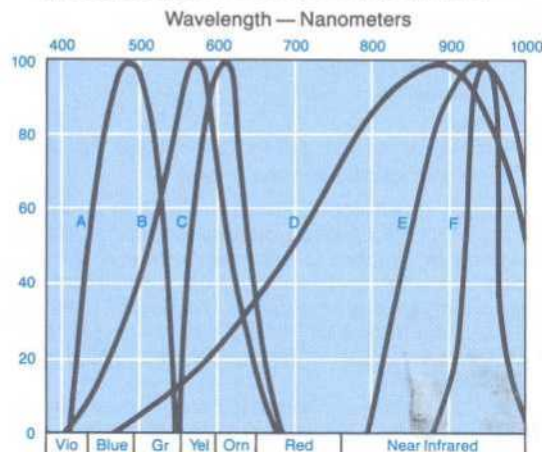
Colors

Black marks against a light background are usually easy to detect; however, skanners often have trouble distinguishing between colors which humans perceive as very different. There are two major reasons why skanners are color-blind. First, a skanner uses a single phototransistor controlling a single electrical circuit. The human eye, in contrast, has thousands of specialized cells each responding to slightly different portions of the spectrum. Second,



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Spectral Response S35 Series Color Skanners



- A Red Color Scanner S35201
- B Visible Color Scanner S35203
- C Blue Color Scanner S35202
- D Any Unfiltered Incandescent Scanner
- E Incandescent Scanner with IR Filter
- F LED Scanner

FIG. 2

Controls

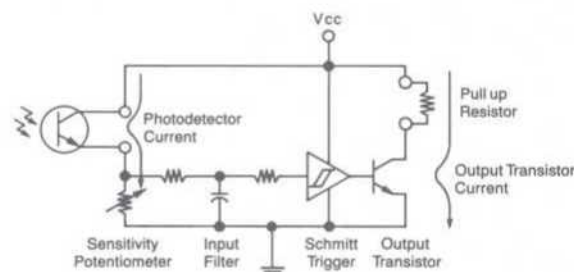


FIG. 3

because silicon phototransistors react most strongly to infrared wavelengths, the reflectivity of a surface at infrared wavelengths controls the scanner's signal. An object which appears dark to our eyes, for example, might appear very bright to a scanner if the object's surface is a good infrared reflector.

There is however, a solution to the problem. Skan-A-Matic's S35 Series "Color Skanners" are designed to detect colored marks. They cannot distinguish between colors, but can detect a mark of predetermined color against a contrasting background. Special filters are used to exclude infrared wavelengths to which a photodetector responds most strongly. This means incandescent lamps must be used for their high output and wide-band visible light. The photodetector current must also be amplified within the scanner since the response to visible wavelengths is poor.

Colored marks are usually made to appear dark against their background. For example, a scanner designed to detect blue includes a filter which blocks blue but passes red wavelengths. The mark seems blue to us because it reflects blue wavelengths and absorbs other wavelengths. When the scanner filter absorbs the blue wavelengths, very little light is left and the mark appears black to the scanner. The contrasting background however, will reflect some red light which passes the filter and is detected. A "red mark" scanner has a filter which blocks red but passes blue wavelengths. Refer to Fig. 2.

A control is the third part of a working photoelectric system. Controls perform two essential functions: amplification and switching.

When a photodetector is darkened, it conducts so little current that it is virtually an open switch. Yet, even when the photodetector is illuminated, current flow is a few milliamps at best and more likely is only a few hundred microamps. These currents are too weak for jobs like turning on power transistors, solid state relays, or relays so they must be boosted up to useful levels by an amplifier.

Most controls pass the input signal thru a resistance-capacitance (RC) network. The RC network acts as a filter to suppress transient noise before it is amplified. The filter gives the control enough noise immunity so that it responds to real signals but not to the electrical noise emitted by motors, switches, and other industrial equipment.

Amplifiers used in Skan-A-Matic controls are based on integrated circuits called operational amplifiers, or op amps.

The op amps can be configured to form a device called a Schmitt trigger which produces a two-value output — either a high or low voltage. Current flowing in the photodetector circuit passes through a potentiometer (pot) which determines the sensitivity of the control. The Schmitt trigger monitors the voltage produced across the sensitivity

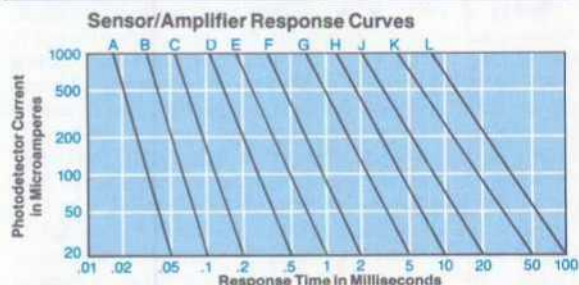


Components of a Photoelectric System

SENSOR/AMPLIFIER RESPONSE DATA The table below denotes which curve applies to a particular sensor/amplifier combination. Each curve gives the combination's response, assuming a known photodetector output. Since some scanners and photodetectors cannot attain the current levels at the top of the curves, their catalog pages should be consulted for maximum output.

Sensor/Amplifier Curve Reference and Typical Response Time in Milliseconds

DEVICE	AMPLIFIER			
	STANDARD		HIGH SPEED	
	CURVE	TIME	CURVE	TIME
P11XXX	G	—	D	—
P30XXX	F	—	B	—
P31XXX	F	—	C	—
P32XXX	F	—	C	—
P33001	G	—	D	—
P34XXX	F	—	C	—
P56001	J	—	F	—
S11XXX	F	.8	C	.08
S12001	G	1.0	D	.10
S13XXX	F	.6	B	.05
S14XXX	F	.8	C	.10
S15XXX	F	.6	B	.05
S17103	G	1.0	D	.10
S17104	J	5.0	F	.50
S17105	K	10.0	F	1.00
S19XXX	F	1.0	B	.08
S20001	G	1.5	E	.40
S22XXX	G	3.0	D	.40
S27XXX	F	.6	B	.04
S28XXX	F	.8	C	.10
S3XXX1	F	.6	B	.04
S3XXX4	F	.6	B	.04
S35201	H	30.0	D	1.50
S35202	H	3.0	D	.30
S35203	H	3.0	D	.30
S51XX1	G	1.5	D	.20
S51XX4	J	7.5	F	.80
S56XX1	G	2.0	D	.25
S56XX4	J	8.0	F	1.00
S58XXX	H	5.0	F	.90



All data is approximate and assumes a sensor operating at its optimum distance, with a target at least as wide as its full field of view and with at least 5:1 light to dark ratio. Since controls with relay or solid state relay outputs have inherent speed limitations, only those with transistor outputs apply in this data. FIG. 4

pot by the photodetector current. When the voltage across the pot reaches a certain threshold, the circuit changes the state of its output. The Schmitt trigger also has hysteresis; that is, the op amp output turns ON at one threshold voltage, but turns OFF at a lower voltage. Hysteresis stops the output from "chattering" (changing state rapidly) when the input signal is noisy.

The amplifier output voltage controls the actual switching device either directly or through a transistor. Because these photoelectric amplifiers have only two output values, they are suitable only for presence/absence sensing and cannot be used for such applications as measuring distances or gray scale values.

Response Time

Response time is the delay between the appearance of a target and the change of output. Response time is a function of the entire system — scanner, amplifier, and output device. Scanner response time decreases as Light Current and the Light Current/Dark Current ratio increase. Scanners with wide Fields of View generally have faster response times since their optics capture more light. When fast response time is required, controls with open collector outputs should be used. For customers who can sacrifice noise immunity in favor of response time, Skan-A-Matic also offers a high-speed control, the T41300.

Output Devices

Some Skan-A-Matic controls can be ordered with any one of three output devices — open collector transistor, relay, or solid state relay.

Open Collector Transistor An open collector transistor has an "uncommitted" collector lead — the collector side of the transistor will "float" until the user makes some connection. The output transistors used by Skan-A-Matic are NPN types, so they must be forward-biased by connecting a source of positive DC voltage to the open collector lead through a "pull-up" resistor or load resistance. Check the maximum voltage and current ratings given for each product before making connections.

The output of an open collector control is simply the voltage level on the collector and it can have only two values. As an example, assume that a reflective scanner and control are wired for "Light Energize". When no target is present, no light is reflected to the photodetector and current flowing in the photodetector circuit is very small. The voltage developed across the sensitivity pot remains below the threshold so the amplifier stays OFF. No current flows into the base of the output transistor so it is also OFF and acts as an open switch. When the output transistor is

TECHNICAL INFORMATION

Open Collector

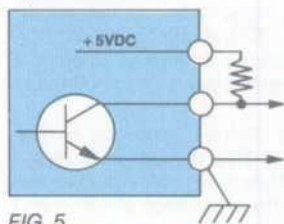


FIG. 5

Diode Protected Open Collector

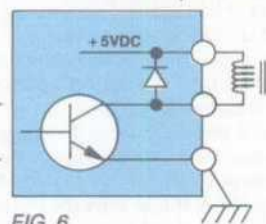


FIG. 6

External Protective Diode Open Collector

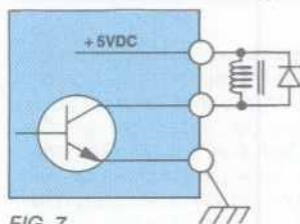


FIG. 7

External DC Power Source Open Collector

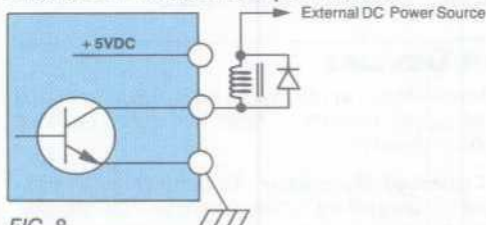


FIG. 8

SPDT Relay

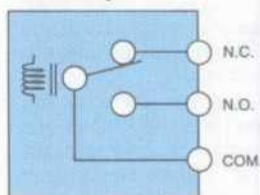


FIG. 9

DPDT Relay

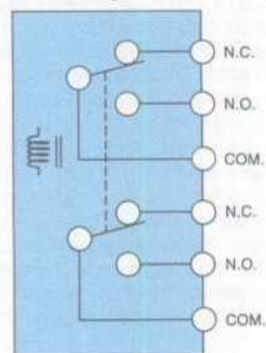


FIG. 10

OFF, the voltage on the collector will be equal to the supply voltage. Therefore, the OFF state of an open collector output will be HIGH voltage.

Continuing with our "Light Energize" example, assume that a target moves into position and reflects light back to the photodetector of the scanner. Current flows in the photodetector circuit and develops several volts across the sensitivity pot. This is above the amplifier's threshold, so the amplifier turns ON and drives current into the base of the output transistor. The output transistor turns ON, acts as a closed switch, and conducts current. The voltage at the collector will be a LOW value — a few tenths of a volt developed across the transistor. The rest of the supply voltage is dropped across the "pull up" resistor or load resistance. The ON state of an open collector or transistor output, then, will be a LOW voltage.

If the open collector output is connected to an inductive load resistance such as a relay coil or solenoid, a shunt diode should be used to protect the output transistor against inductive surges. Some Skan-A-Matic controls can be ordered with the diode built-in for convenience. This precaution is not necessary when driving resistive loads such as logic circuits and other transistors. Refer to Fig. 6, 7 and 8.

Features

- Small, long-life solid-state devices
- Change state very rapidly — switch without radiating large amounts of electrical noise
- Very flexible — interface directly with relays and solenoids, microcomputers and programmable controllers
- Can easily form logic elements like AND gates and OR gates

Limitations

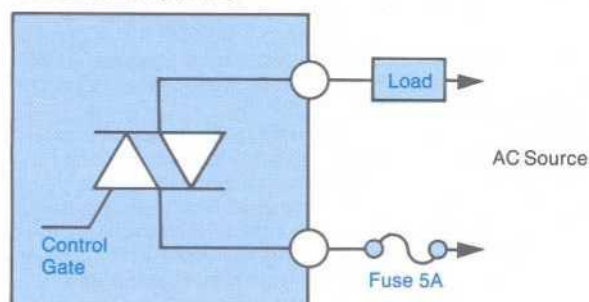
- Can only control DC power at relatively low voltages and currents
- Personnel are often unfamiliar with this device
- No isolation between amplifier and load circuit

Relay A relay is an electrically-controlled switch. When electric current is applied to a coil of wire the coil is energized, i.e. it develops a magnetic field which attracts a metal armature. The armature moves one or more electrical contacts to perform the switching action. The armature is returned to its original position by a spring when the coil is de-energized. The small current provided by the amplifier when it turns ON, energizes the coil and can then control much higher levels of power, either AC or DC.

Relays used by Skan-A-Matic will be listed as SPDT (Single Pole Double Throw) or DPDT (Double Pole Double Throw). The number of "Poles" is the number of moving contacts; "Throw" refers to the number of stationary contacts for each moving contact. SPST, for example, would be a single moving contact and a single stationary contact;

Components of a Photoelectric System

Solid State Relay (Triac)



Equivalent Circuit

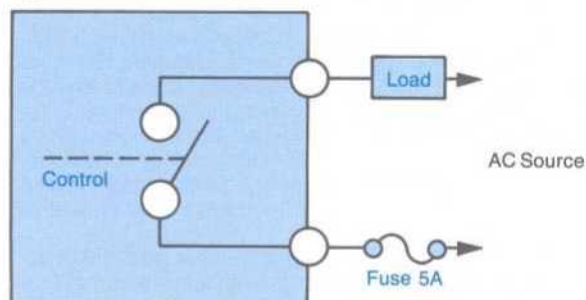


FIG. 11

the circuit would be either closed or open. An SPDT relay would have a single moving contact which could make connection with either of two stationary contacts. A DPDT relay will have two moving contacts, each of which can connect with either of two stationary contacts.

The moving contact of a Double Throw relay will be labelled "COM" or "Common". When the relay is de-energized the moving contact is held against the "NC" or "Normally Closed" stationary contact by the spring. When the relay is energized the armature moves to connect C with the "NO" or "Normally Open" contact.

Relays are rated by the amount of current they can handle at a stated voltage. For example, many relays will be rated for 5 Amps at 115 VAC, but only 3 Amps at 230 VAC or 28 VDC. It might be expected that a relay would handle less current at the higher AC voltage, but why only 3 Amps at the much lower DC voltage? The main problem is that DC current flows only in one direction. When the metal contacts are close but not touching, sparks arc across the gap and vaporize some of the metal. When the relay is switching AC current, the metal surfaces wear symmetrically. When DC current is switched, one contact becomes pitted while the other accumulates a metal deposit. This situation quickly degrades the quality of the electrical connection and shortens the useful life of the relay if it switches high DC currents.

Features

- Handles AC or DC
- Switches high power
- Familiar to personnel
- Isolation between amplifier and load circuit

Limitations

- Physically large — slow to switch — creates electromagnetic noise.
- Mechanical parts are subject to wear — contacts are eroded by arcing — limited life

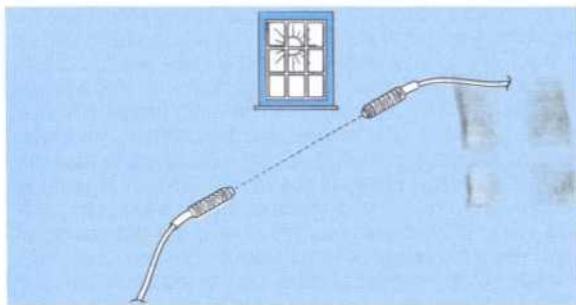
Solid-State Relay Solid-state relays, sometimes called triacs, use semiconductor devices to control AC power. A complete solid-state relay would include the actual triac, an optoisolator, a zero voltage trigger circuit, and an RC network to suppress switching noise.

The solid-state relay output, then, performs the same function as a Single Pole Single Throw switch for AC only (see Fig. 11). When the Schmitt trigger amplifier turns ON, its output current turns ON the optoisolator, which in turn, drives enough current into the trigger circuit of the triac to make it conduct. Because solid-state relays switch when the line voltage crosses zero, response time may be as long as 9 milliseconds.



TECHNICAL INFORMATION

Modulating controls eliminate problems caused by ambient light.



The range of a system can be increased by modulating controls.

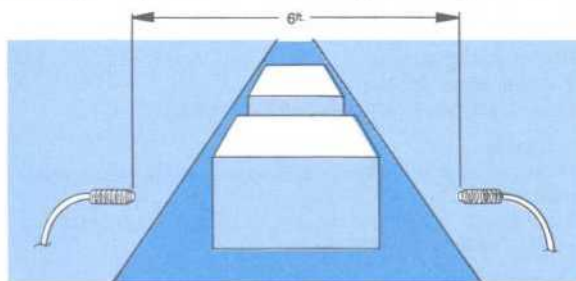


FIG. 11A

Features

- Solid-state — long life
- Electrically quiet
- Isolation

Limitations

- AC only
- Limited current capacity
- Relatively slow

Modulating Controls

Modulating controls turn the light source on and off several thousand times per second. The amplifier portion of the control is designed to respond only to signals with that on/off frequency. Even though the photodetector reacts to other signals, these will be rejected by the amplifying circuitry. Modulating controls have longer response times than a similar but non-modulating control. Because the control must recognize the on/off pattern, the response time must be greater than the period of modulation. As noted earlier, only Light Emitting Diodes (LED's) can be used as the light source for modulated systems — the glowing filament of an incandescent lamp takes too long to heat and cool.

Modulating an LED light source produces two major benefits. First, false triggering from ambient light or random reflections is greatly reduced. Second, the range of the system can be greatly increased. Modulating controls can often extend the useful range of a scanner or thru-beam from 2 to 5 times the range possible with a similar continuous operation control. Two factors contribute to the longer range. When problems with ambient light are eliminated, the sensitivity of the amplifier can be increased. Also, since the LED is being driven for only a fraction of the modulation period, drive current can be momentarily very high, producing a high light output.

As an example, consider a Skan-A-Matic LED light source rated at 100mA for continuous operation. The resistor shipped with the light source would normally limit the current flow thru the LED to 100mA during continuous operation. If the LED is modulated so that it is ON half the time, and OFF half the time (50% duty cycle), momentary drive current can be 200mA without damaging the LED. A lower value resistor would still be needed to limit the drive current to 200mA.

Skan-A-Matic modulating controls have a 50% duty cycle and a built-in current-limiting resistor for 100mA LED's. Any reflective scanner or thru-beam pair with a 100mA LED can be connected directly to the light source terminals of the control. LED's with lower current ratings must be wired in series with an additional external resistor; the correct resistor value is given for each sensor or control on its catalog page under the Compatibility heading.

Sensing Modes

Sensing Modes

Thrubeam

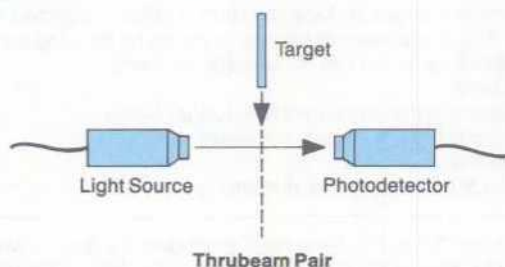


FIG. 12

Photoelectric devices can be packaged and arranged in various configurations to match the application. The different methods are often called sensing modes. Modes can be grouped around two basic principles: thrubeam and reflection.

The thrubeam mode uses components in separate housings. The light source and photodetector are aligned facing each other across a space where the target objects will be passing. When no target is present, the photodetector will be illuminated. The target blocks the beam, cutting off most of the light and causing the output of the control to change state. The region of detection is approximated by an imaginary cylinder between the lenses of the two components with the diameter of the lenses. The target will be detected anywhere along the length of the cylinder as long as most of the light is blocked. Because light from the source makes a one-way trip directly to the photodetector without being reflected, thrubeams offer the greatest range and largest light/dark contrast.

Features

- Longest range
- Highest light/dark ratio
- Target color or surface texture have no effect

Limitations

- Two components must be mounted and wired
- Alignment may be difficult

Retroreflective

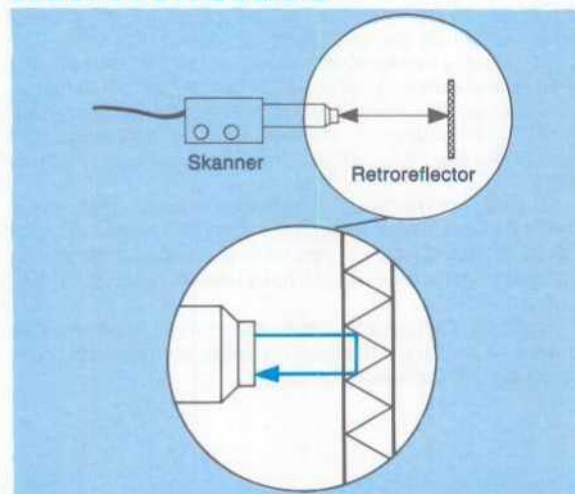


FIG. 13

A variation on the thrubeam principle uses a highly-efficient reflector to return light to the photodetector. Light source and photodetector are placed together, usually in one housing. Light crosses the area where the target object will pass, strikes the retroreflector, and returns to illuminate the photodetector. As with a thrubeam, the target is detected when it blocks the light path.

When light strikes a retroreflective surface within about 15° of the perpendicular to the surface, the light will be reflected back along the same path. One common type of retroreflector seen on bicycles and highway markers uses 3-plane corner reflectors. Another popular type uses tiny glass beads covering adhesive tape or dispersed thru a paint or chalk — this type is common on road and street signs.

Features

- Long range
- High light/dark ratio
- Easy to set-up and install

Limitations

- Can sometimes be confused by reflections from shiny objects



TECHNICAL INFORMATION

Diffuse Reflective

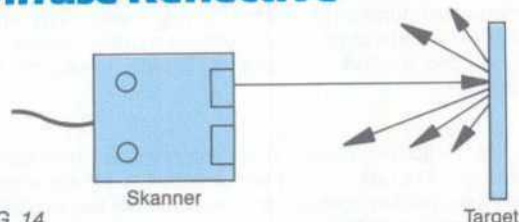


FIG. 14

Specular Reflective

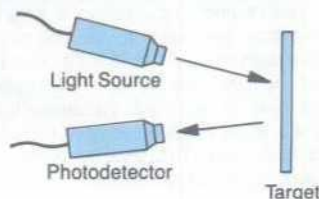


FIG. 15

Most reflective scanners use the scattering of light by the target surface — diffuse reflection. Light emitted by the source reflects from the target surface and returns to a photodetector in the same housing. This principle is generally used for short range applications since the amount of light returning to the photodetector is small.

Features

- One wiring run — installation is fast and easy
- Alignment is non-critical
- Colored marks may be recognized

Limitations

- Light/dark contrast decreases rapidly — short ranges only

A specular reflective system makes use of a shiny or mirror-like target surface to return a strong reflected signal. The photodetector may be in the same housing as the light source, or may be some distance away.

Features

- Greater light/dark contrast — longer range
- Targets may be located precisely

Limitations

- Scanner and target alignments are critical.

Technical Specifications

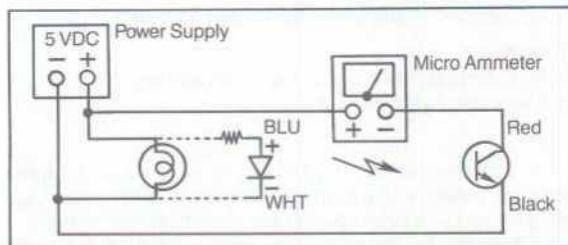


FIG. 16 A



FIG. 16 B

These definitions have been developed by Skan-A-Matic for our convenience and that of our customers; they may not necessarily correspond with definitions of specifications published by other manufacturers. All testing is done by Skan-A-Matic personnel under laboratory conditions which may not exist in many applications. Distance measurements are valid for light sources in continuous operation; modulating controls may increase useful distances by several hundred percent. Light current is measured in the circuit of figure 16 A.

OPTIMUM DISTANCE TO TARGET is defined as that distance between a reflective scanner and a white target which produces the greatest photodetector current. The target used is large enough to completely fill the scanner's view. The distance is measured from the front of the lens or cover glass. The white target is Kodak's Neutral Test Card — 90% reflectance — commonly found in photographic supply stores. (Kodak #R-27 CAT152795 or see Accessories.)

At very close ranges photodetector current is low, since little light can reach the photodetector. With increasing distance, photodetector current rises to a peak, defining the Optimum Distance to Target, then falls off gradually. Refer to Fig. 16 B.

Optimum Distance to Target has no relevance for thru-beams since the photodetector current should fall off continuously with increasing distance.

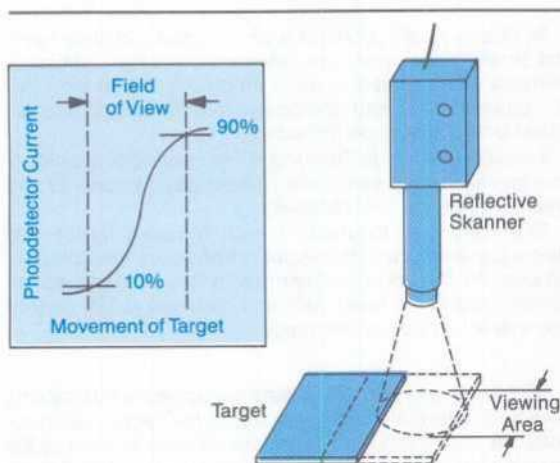


FIG. 17

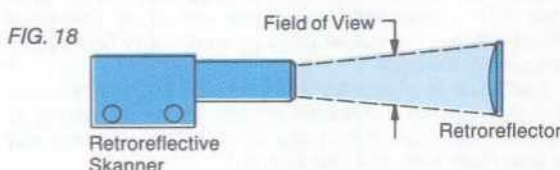


FIG. 18

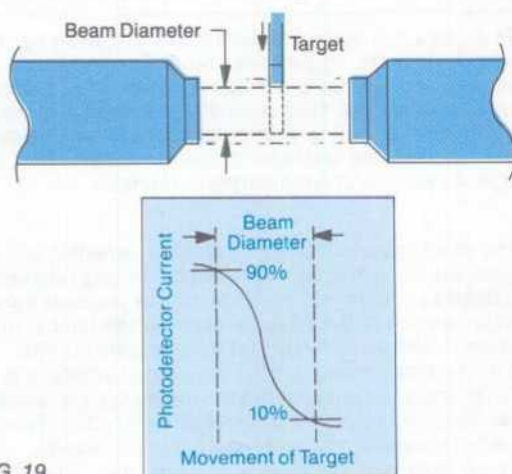


FIG. 19

MAXIMUM USABLE DISTANCE is defined as the greatest distance between a reflective scanner and a white target which produces at least 10 microamps of photodetector current. Currents below 10 microamps produce unacceptably low contrast between light and dark conditions.

RATED SEPARATION is the thrubeam equivalent of Maximum Usable Distance. It is defined as the greatest distance between light source and photodetector that will produce at least 10 microamps of photodetector current.

FIELD OF VIEW is a measure of the area monitored or "seen" by a reflective scanner. The measure is taken with the standard white target at the scanner's Optimum Distance To Target. Photodetector current is measured as the target is moved across the scanner's view, perpendicular to the scanner's optical axis. Photodetector current will range from near zero when the target is out of the scanner's view to some maximum value when the target completely fills the scanner's view. Field of View is defined as the distance the target must move to produce a current change from 10% to 90% of the maximum current. Note that *listed Field of View* is measured at the *Optimum Distance to Target* (see Fig. 17). Field of View generally increases with increasing distance from the scanner; use the Scanner Performance Charts to estimate Field of View at other distances.

When a reflective scanner is used in a retroreflective mode its Field of View no longer depends on the scanner alone. The viewing area of the scanner is effectively the space enclosed by lines extending from the outside edge of the scanner lens to the outside edge of the retroreflector; usually this space will be a truncated cone. The listed Field of View then would be measured halfway between the scanner and retroreflector in the same way Beam Diameter is measured (Fig. 18).

BEAM DIAMETER is a thrubeam's equivalent of Field of View. A light source and photodetector with equal sized lenses are arranged some convenient distance apart. Because the lenses are equal sized, the beam between them may be considered a cylinder. To be detected the target must block most of this imaginary cylinder. **BEAM DIAMETER** is defined as the distance the target must move perpendicular to the beam axis to produce a photodetector current change from 10% to 90% of the maximum value (Fig. 19).

SMALLEST DETECTABLE OBJECT is defined as one-third of the listed Field of View of a reflective scanner or one-third of the listed Beam Diameter of a thrubeam. This is an arbitrary value derived from experience. Actual target objects vary too much in speed, reflectivity, etc., to state that they can be detected. The implication, then, is that a typical rectangular target with a length exceeding the Field of View and a width one-third the Field of View of a scanner, moving slowly across the view of the scanner at the Optimum Distance To Target, can be detected reliably.



TECHNICAL INFORMATION

Quality Control

All Skan-A-Matic products are inspected and tested several times before they are released for sale. Statistical methods are not used — each product is tested individually. Light sources and photodetectors are tested and selected for consistent performance.

Each component is "burned-in" according to individual time specifications, eliminating defective components and greatly increasing field reliability.

Skanners and thrubeams with focused lamps are checked to insure that the filament image crosses the optical axis. Thrubeam components with threaded bodies are rotated around the beam axis and checked at 120 degree intervals for proper performance.

Performance Guarantee

Most skanners and thrubeams presented in this catalog have a Performance Chart included in the Technical Specifications. This chart generally shows a band formed by the variation expected in photodetector current at any given distance from the standard white target, Kodak's Neutral Test Card — 90% reflectance. (Kodak #R-27 CAT1527795 or see *Accessories*.) The terms "Maximum" and "Minimum" on the chart refer to the *expected* values. Two small circles indicate the values used by our Quality Control department at final test.

Each unit is **guaranteed to produce a photodetector current between the Maximum and Minimum values at the distance indicated by the circles.** Dark Current will be less than 10% of Light Current.

Choosing A System

To choose the right components for a reliable system several factors should be considered. Sensing mode requirements and limitations to suit a particular application must be determined. The target size and speed, material and distance, as well as environment, must be analyzed. Also, response time and input/output needs will affect the design of a system for optimum performance.

Thrubeam Or Skanner?

- **1st Choice — Thrubeam**
- **2nd Choice — Retroreflective**
- **3rd Choice — Reflective skanner**

The most important factor in reliable detection will always be the amount of light received by the photodetector. Thrubeams are generally preferred simply because the direct illumination of the photodetector by the light source produces a comparatively large photodetector current.

If thrubeams are impractical, the second choice is usually a reflective skanner used in the retroreflective sensing mode. This mode gives a high photodetector current and is almost as convenient to install as a reflective skanner.

When reflective skanners are used, they should be mounted at or near their Optimum Distance To Target. This ensures the highest possible photodetector current.



Choosing a System

Photodetector current can sometimes be estimated closely enough to indicate whether a reflective skanner will perform reliably or not. Remember that Optimum Distance and Maximum Usable Distance are measured with a white test card which reflects 90% of the light striking it. Due to light scattering by the paper fibers, much of this energy is not captured by the photodetector. Rough, irregular, or dark surfaces will scatter or absorb more light than the test card. In these cases a skanner may be limited to a range much shorter than the Maximum Usable Distance. Smooth, shiny surfaces such as metals and plastics may be detected far beyond the Maximum Usable Distance if the surface is perpendicular to the skanner's optical axis and acts as a mirror.

A typical target must fill a large fraction of a reflective skanner's viewing area to allow the photodetector to capture enough light. If the skanner cannot be close enough to the target so that the width of the target is at least one-third of the skanner's Field of View, a thru-beam or retroreflective mode should be used.

Choosing a Thru-beam

Match the Beam Diameter to the width of the target; the target should be at least one-third as wide as the listed Beam Diameter. Large targets will be detected by thru-beams with large or small Beam Diameters, but small targets will require a small Beam Diameter. Thru-beams are listed in the catalog in order of their Beam Diameters. Beams that are too large can be eliminated immediately and attention can be focused on the Rated Separation, Light Source, and Body Style of the remaining choices.

Thru-beam Example

Consider the problem of detecting quarter-watt resistor bodies. Assume that the resistors are counted within enclosed machinery where ambient light is not a problem, but that vibration is continuous and severe. The beam must cross a space of 2 inches.

First determine what will be required of the control. Because ambient light or long ranges are not factors, there is no need for a modulating control and a lower-cost conventional control can be used. Assuming the control must interface with an electronic counter and that AC line current is the most convenient power source, The T40300 (standard AC control with open-collector output) is probably the best choice.

Experience shows that a thru-beam should have a Beam Diameter no more than 3 times the width of the target. In this case the target width is the resistor diameter, .090 inches, so the thru-beam should have a Beam Diameter of .270 inches or less.

$$\begin{aligned} \text{Max. Beam Diameter} &= 3 \times \text{Target width} \\ &= 3 \times .090" \\ &= .270" \end{aligned}$$

Model #	Beam Diameter (inches)	Rated Separation (inches)
L33/P33	.16	36
L30/P30	.06-.12	3-24
L11/P11	.10	2
L34/P34	.06	6
L56/P56	.03	.5

FIG. 20



Choosing a Reflective Skanner

Expected Performance At 1 Inch

Skanner	Field of View (Inches)	Current
S12	.8	25-125 microamps
S11101	.8	12-200 microamps
S16	.2	45-300 microamps
S13224	.2	50 microamps
S30	.8	10-50 microamps

FIG. 21

The Selection Guide at the beginning of the Thrubeam Section lists these Beam Diameters and Rated Separations. Refer to Fig. 20.

Each of these thrubeams has a Beam Diameter small enough to detect the resistors, but the L56/P56 pair does not have the required 2 inch range. With assurance that the target can be detected reliably, other factors become more important — with the problem of continuous and severe vibration, an LED light source is essential for long life. Notice that the L43/P43 thrubeam is not listed since its Beam Diameter, .40 inches, is so large that it will not be able to detect the resistor.

Match the Field of View to the width of the target; the target should be at least one-third as wide as the skanner's Field of View *at the desired distance*. Skanners are listed in the catalog by order of their Fields of View at their Optimum Distances. Most data sheets include a graph showing Field of View vs. distance from the target, plus a graph showing photodetector current vs. distance. Find a skanner with an appropriate Field of View at the desired distance, then check the second graph to be sure photodetector current will be at least 10 microamps at the desired distance.

Reflective Skanner Example

Suppose we want to use a reflective skanner to detect the white paper tube of a cigarette from a distance of 1 inch. In this case the target is .3 inches wide, so we will be interested in skanners with a Field of View no more than .9 inches at the desired distance of 1 inch.

$$\begin{aligned}\text{Max. Field of View} &= 3 \times \text{Target width} \\ &= 3 \times .3'' \\ &= .9''\end{aligned}$$

By using the performance curves, we can estimate the Fields of View and expected photodetector currents of various skanners at the 1 inch distance. Refer to information given in Fig. 21.

Examining the listing of expected photodetector currents, we will be most interested in the skanners with the highest expected outputs—S16 and S12. Testing shows that each of these skanners easily and reliably detects the cigarette at one inch. An S16 actually developed more than 100 microamps of current, and the S12 more than 75 microamps. The S16 would be the best choice for the application except in areas where shock and vibration or ambient light would be a factor. In that case the S12 would be the best choice because its solid state light source is immune to shock and vibration and can also be used with modulating controls to eliminate the effect of ambient light.



Choosing a System

Choosing a Control

Choosing A Control

	T21	T31	T36	T40 R40	T41	T42 R42	T43 R43	T46 R46	R47	R60
OPERATION Modulating Continuous	X X	X	X	X	X	X	X	X	X	X
HIGH SPEED					X					
OUTPUT Transistor Relay	X	X	X	X	X	X	X	X	X	X
POWER AC DC	X	X	X	X	X	X	X	X	X	X
TIME DELAY/ ONE SHOT			X			X		X	X	X
DUAL CHANNEL/ LOGIC										X

FIG. 22

All Skan-A-Matic sensors except the self-contained C Series, require a separate control. Generally, most Skan-A-Matic scanners or thrubeams may be used with any Skan-A-Matic control, although there are several exceptions to this rule:

- Modulating controls require LED light sources.
- Some sensors cannot be used with R43/T43 control.
- Some sensors are designed for exclusive use with R43/T43 control.

The first step in choosing a control is to determine if continuous operation is satisfactory, or should the light source be modulated?

A conventional control which does not modulate the light source is suitable whenever the sensor will be enclosed within machinery or otherwise protected from ambient light and will be used at typical ranges. Continuous operation is essential whenever incandescent light sources are used. These applications include color sensing and high speed sensing.

When the sensor will not be enclosed, visible light from fluorescent lights can usually be defeated by including filters in the photodetector. If the photodetector cannot be ordered with a filter or if infrared energy from incandescent lamps, sunlight, or hot objects will be encountered, an LED light source and modulating control should be used. Modulating controls can also greatly increase the useful range of any LED scanner or thrubeam at the expense of increased response time.

The second step is to determine if the high-speed T41300 control is required. For reliable operation, the target must remain within the scanner's Field of View at least as long as the expected response time. The Response Time Chart (Fig. 4) shows the expected response time of various scanners with both a standard open collector control and with the T41300. Use the T41300 only if the scanner is definitely too slow even at the high current end of its curve; noise immunity has been sacrificed for speed of response and the T41300 may not be appropriate in some environments.

Beyond the modulating and high speed functions, the technical performance of the various controls will be similar. Types of input power, output device and timing functions are compared in Fig. 22.



TECHNICAL INFORMATION

Using Photoelectric Products

Wiring

Standard

Blue:	light source +
White:	light source -
Red:	photodetector +
Black:	photodetector -

C32 Series

Red:	supply +
White:	supply -
Black:	open collector

C40 Series

Red:	supply +
Black:	supply -
White:	dark energize output
Brown:	light energize output

FIG. 23

Every Skan-A-Matic skanner or thrubeam, except the C Series self-contained units, must be wired to a separate control. Color-coding is consistent throughout the product line. Refer to Fig. 23.

Remember that LED light sources must be wired with correct polarity and usually will need a current-limiting resistor. The LED will be destroyed immediately if it is wired incorrectly. Skan-A-Matic includes a current limiting resistor for operation with 5 VDC. For operation at other voltages calculate the resistor value as follows:

$$R = \frac{E_{\text{supply}} - V_F}{I_F}$$

Where: R = ohms

E supply = DC voltage supply

V_F = Rated forward voltage drop across the LED.
If a range is given, use the lowest value.

I_F = Rated LED forward current.

Any Skan-A-Matic reflective skanner can be ordered with a 5-pin Switchcraft connector as described in the options section. Other types of connectors can be used for special orders. Thru beams are not offered with the standard connector option, but other types of connectors can be included with special orders.

Some controls, such as the R40/T40, may be wired for either Light or Dark-Energize. Others must be ordered from the factory with the desired configuration; for example, T43007 — Light-Energize, T43008 — Dark-Energize. See the individual product data sheets for wiring details.

There is no rated maximum distance between skanner and control; in an electrically-quiet environment, the limiting factor would simply be the resistance of the wiring. Practical distances are generally limited to about 50 feet. Any Skan-A-Matic skanner or thrubeam can be ordered with extra-length leads or the user can add his own wire.

Using Photoelectric Products

Grounding, Shielding, and Noise

Electrical noise is probably the most persistent problem faced by industrial users of photoelectric devices. All the engineering and design effort put into these products can be defeated by improper installation.

This type of problem results from the very low currents flowing in the photodetector circuit. These microamp currents can be disturbed by noise carried along the power supply lines or radiated thru the air. The noise is generated by electrical equipment turning motors on and off, from clutches and brakes, relays and solenoids. The best way to deal with electrical noise is to suppress it at the source. Ideally, each potential noise generator would be fitted with its own suppressor.

Individual photoelectric systems can be protected against noise by following some basic installation rules:

- Be sure to connect the cable shield around the red and black wires to the control's Ground connection.
- Connect the control's Ground terminal to machine frame Ground, or electrical service Ground.
- Keep wiring runs between scanner and control as short as possible.
- Never run photoelectric wiring alongside or in a conduit with AC power supply lines.
- Connect the scanner body to machine frame Ground.

Users planning long wire runs should keep several points in mind:

- Use shielded cable
- Keep the photodetector current as high as possible
- Keep the line resistance down
- Consider using conduit when noise is severe

Logic Operations

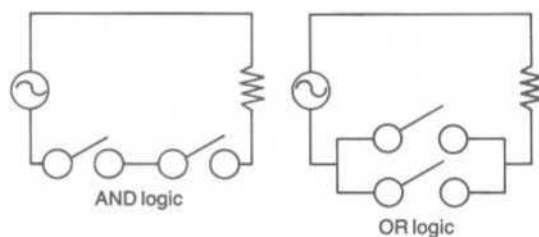


FIG. 24

AND/OR Relay Logic

Never try to use more than one scanner on a standard control. Neither the scanners nor the controls are designed for this sort of "front-end" logic; the attempt will probably fail and possibly damage the units.

Switched outputs from several controls with similar outputs can be tied together to perform OR and AND logic functions (Fig. 24). This is a convenient, safe way to do these logic operations but, again, one control is connected to only one scanner.

In multiple scanner systems the user often would like an output voltage if (A) any scanner sees a target (an OR function) or (B) if all scanners see a target (an AND function). Either can be done with the open collectors of two or more amplifiers tied together through a common load resistor to the desired power supply. This function may also be accomplished with a relay in place of the resistor load.

(A) for OR operation, connect each scanner so that when it detects the target, its amplifier is energized. Connect the amplifier outputs together as in Fig. 25. If any one scanner causes its amplifier to energize, the output voltage goes to zero.



TECHNICAL INFORMATION

OR or AND Functions
with Open Collector Output

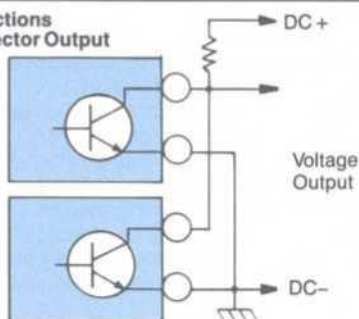


FIG. 25

The Environment

(B) for AND operation, connect each scanner so that when it detects the target, its amplifier is de-energized. Connect the amplifier outputs as in Fig. 25. If all scanners cause their amplifiers to de-energize, the output voltage goes high to DC +.

The only exception to the one scanner/one control rule is the R60 Series, a dual channel control. This heavy duty control is specifically designed to drive the light sources of two scanners. Plug-in cards program the R60 for many basic counting and logic functions. If the desired function is not already available, Skan-A-Matic can quickly design and produce a special card.

Environmental factors such as room lighting, dust, dirt and heat can seriously degrade the performance and reliability of any photoelectric system. The best way to deal with these problems is to take the time to analyze the situation before ordering. Ambient light, for example, can be defeated by purchasing a filtered LED scanner and modulating control. This combination can also give the extra power needed to penetrate the build-up of dust and dirt on scanner lenses.

Careful design of the planned system can prevent many problems before they occur. It would be unwise, for example, to install an unfiltered continuous operation scanner facing overhead lights or a sunlit window. Other examples of avoidable problems would include the installation of scanners over drying ovens, or in crevices or corners where dust build-up is likely.

Temperature Effects

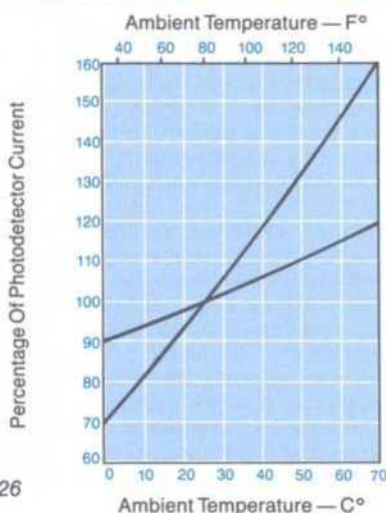


FIG. 26

The operation of a photoelectric system is affected by the temperature changes of its environment. Most applications are not bothered by temperature variations because the change is small compared to the change in photodetector current caused by the target.

Temperature changes MUST be taken into account when the target causes only a small change in photodetector current or when the system is operated throughout a wide temperature range. The photodetector causes most of the change because its gain increases with rising temperature. An LED's light output decreases with rising temperature, which partially compensates for the photodetector. Incandescent lamps do not change with temperature.

Fig. 26 shows the change in photodetector current versus temperature for both LED and lamp systems.

LED devices must be derated at temperatures above 25°C. Their forward current must be reduced as the ambient temperature rises. Derating information is given on individual product pages.

Sensitivity Adjustment of Controls

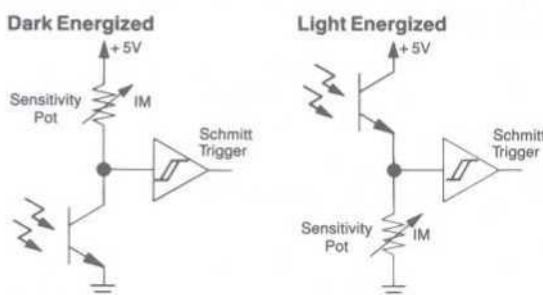


FIG. 27

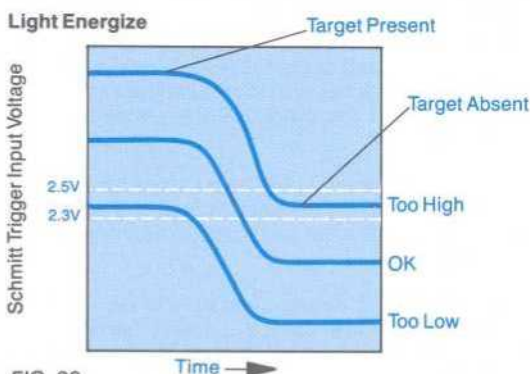


FIG. 28

USING A REMOTE POTENTIOMETER

R40 and T40 Series, R46 and T46 Series

Omit jumper wire connected to pin 6 and connect external pot as shown.

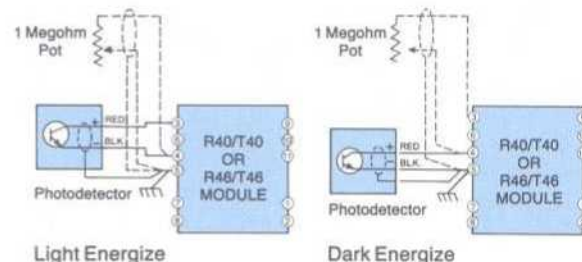


FIG. 29

Fig. 27 shows the relationship between the photodetector, the sensitivity potentiometer (pot) and the Schmitt trigger amplifier. Notice that the photodetector and sensitivity pot divide the +5 Volts DC bias voltage. The Schmitt trigger turns ON when its input voltage rises to about 2.5V and turns OFF when the input voltage falls below about 2.3V because of the hysteresis built into the circuit.

Consider what happens when the control is wired for LIGHT ENERGIZE. The amplifier stays OFF as long as the voltage at the amplifier input remains below 2.5V. Since the 2.5V is half of the bias voltage, the amplifier stays OFF as long as the resistance of the sensitivity pot is less than the resistance of the photodetector. The resistance of the photodetector decreases as the intensity of captured light increases. The Schmitt trigger amplifier turns ON when the resistance of the photodetector falls below the resistance of the sensitivity pot.

All Skan-A-Matic controls except the T21004 have sensitivity pots which give higher resistance and higher sensitivity when turned clockwise. From the example above, we see that when resistance across the pot is high, only a little light will drive the resistance of the photodetector low enough to turn ON the amplifier.

Fig. 28 shows Schmitt trigger input voltage at three different settings of the sensitivity pot. The curve labeled "TOO HIGH" is produced when the sensitivity is turned too far clockwise — the control is ON continuously. The "TOO LOW" curve shows a control that can never switch ON because the sensitivity is turned too far counterclockwise.

Using a Remote Potentiometer

The R40/T40 and R46/T46 Series controls can be wired with a remote sensitivity adjustment. This is recommended in cases where the sensitivity must often be readjusted, or if the control is located in an inaccessible area. When a remote potentiometer is used, the internal sensitivity pot has no effect. Wiring must be done using shielded cable. The value of the external potentiometer is one megohm, and multiple turn potentiometers, such as the CTS Series VA45, are recommended.

TECHNICAL INFORMATION

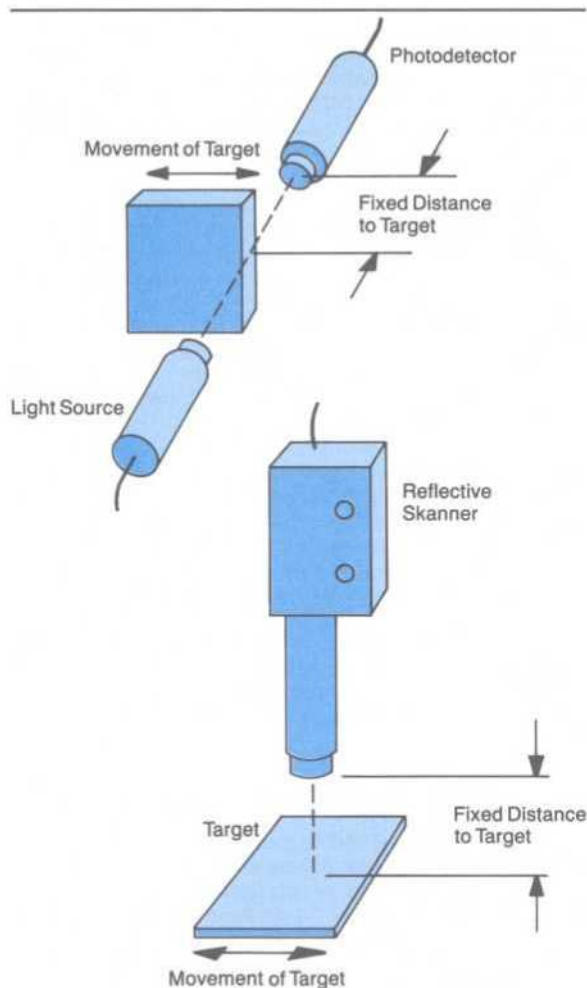


FIG. 30

Sensitivity Adjustment Procedure

- Verify that the photoelectric amplifier has been wired correctly for the desired mode of operation: light or dark energized.
- The sensitivity control is a 15 turn potentiometer with a slip clutch at each end to prevent over adjusting. Turn the sensitivity control 15 turns counter-clockwise to the absolute minimum sensitivity setting. NOTE: The R47/R48 and R60 Series controls have a 4 turn potentiometer, requiring 4 turns counter-clockwise for the minimum sensitivity setting.
- With the distance from sensor to target remaining constant, move the target in and out of the Field of View or Beam Diameter, perpendicular to the sensor axis (see Fig. 30) and observe the amplifier's output.
- Adjust the sensitivity control in a clockwise direction until the output of the amplifier changes state. Continue to move the target in and out of the field of view and to rotate the sensitivity control in a clockwise direction, counting the turns, until the output of the amplifier stops changing state.
- For optimum performance, the best setting for the sensitivity control is midway between the point at which the amplifier first detected the target and the point at which detection stopped.
- Should the output still be changing state at the end of 15 turns, set the sensitivity control midway between the point when detection started and when the end of the 15 turns was reached.
- When the sensitivity control has an adjustment range of less than one turn this means that there is not enough margin of safety for reliable operation. In this case, the distance from sensor to target may be varied, the lamp voltage decreased or the LED current reduced.
- Time delay amplifier sensitivity may be adjusted in a similar manner by first adjusting the time delay control fully counter-clockwise in order to minimize the duration of time delay.



Glossary

Ambient Conditions of the working environment, i.e. light, temperature, vibration and humidity.

Beam Break See thru-beam.

Beam Diameter Measure of the size of the target which can be detected by a thru-beam.

Chassis Mount Individual electrical components and devices mounted on a printed circuit board with terminal strip connectors.

Coaxial Light source and photodetector on the same optical axis.

Collimate Make parallel; e.g., a collimating lens makes parallel the light rays emitted from a lamp.

Continuous Operation Steady or non-varying output from an LED as opposed to a modulated output.

Dark Current Amount of electric current flowing thru a photodetector when light is absent.

Dark Energize Absence of light energizes switched output.

Delay On/Off Controlled time delay between input change and output change.

Derate Change of listed engineering specifications with change in environment, usually temperature.

Diffuse Reflection Reflection of light in many directions from rough or irregular surfaces.

Diode Protected Collector Built-in diode protects output transistor; for use with inductive loads.

Duty Cycle Percent of time LED light source is driven by modulating control.

Eye Mark See registration mark.

Fiber Optic A fiber or strand of glass or plastic which carries light.

Field of View Area seen by a reflective skanner at a given distance.

Hysteresis The difference between the turn ON voltage and the turn OFF voltage in a Schmitt trigger.

Instant On/Off No controlled delay between an input and its effect on switched output.

Lamp An incandescent light source.

LED Light Emitting Diode — A semiconductor device which produces light energy when stimulated by electric current.

Light Current Amount of electric current flowing thru a photodetector when light is present.

Light Energize Presence of light energizes switched output.

Maximum Usable Distance Greatest distance between reflective skanner and white target which produces at least 10 microamps of photodetector current.

Modulating A control designed to turn the light source on and off very rapidly; modulated-pulsed or discontinuous.

One-Shot A timer which produces a single electrical pulse of pre-determined length for inputs of varying length; the input must return to its original state for another output pulse to be produced.

Open Collector Common method of using a transistor as an output switch; current must be supplied by the user thru a pull-up resistance.

Operating Voltage Highest forward bias voltage which can be safely applied to a photodetector.

Optimum Distance to Target Distance between a reflective skanner and a white target which produces the maximum Light Current.

Photodetector Light detecting part of a photoelectric device.

Plug-In Mount Electrical components and devices sealed inside a can or module; connections thru projecting pins to a separate socket.

Rated Separation Greatest distance between a thru-beam's light source and photodetector which will produce at least 10 microamps of photoelectric current.

Reflective Skanner Device with a light source and photodetector in one housing; target is detected by reflected light.

Registration Mark Mark of contrasting color placed on sheet materials, esp. packaging wraps; used to control cutting operations.

Response Time Time interval between an input change and the corresponding output change.



TECHNICAL INFORMATION

Glossary

Retroreflection A method or system using a high-efficiency reflector to return emitted light to a reflective skanner.

Reverse Voltage Maximum voltage which may be safely applied to a polarized device in the reverse direction.

Schmitt Trigger Amplifier with only two output states; output will go to high level when input exceeds threshold voltage; output will go to low level when input drops below a second and lower threshold voltage.

Sensor Inclusive term for all photoelectric devices; especially photodetectors.

Smallest Detectable Object Smallest rectangular target which can be detected reliably.

Spectral Emission The wavelengths produced by a light source.

Spectral Response Wavelengths producing a measurable response in a photodetector.

Specular Reflection Reflection of light from a smooth surface; e.g., a mirror.

Target Object to be detected.

Target, White Kodak Neutral Test Card — 90% reflectance (Kodak #R-27 CAT1527795 or see *Accessories*); used for testing comparison.

Thrubeam A light source and photodetector in separate housings; target must break beam to be detected.



Thrubeams

Thrubeams, or thrubeam pairs, are photoelectric sensing devices packaged in two separate housings. One part, the light source, produces light and projects it as a narrow beam. The other half of the pair, the photodetector, is positioned some distance away facing the light source so it can sense the emitted light.

When the space between light source and photodetector is clear, the photodetector is brightly illuminated and electric current flows in the photo-

detector circuit. A target is detected when an opaque object blocks the beam path—the photodetector is darkened and conducts less current. An amplifying control monitors the flow of current in the photodetector circuit and turns a switch on or off when necessary. Because of this high contrast between the light and dark states, a thrubeam provides highly reliable indication that a target is present.

Thrubeam Selection Guide

Series	Rated Separation	Beam Diameter	Smallest Detectable Object	Light Source	Input Current (mA) Continuous/Modulated	Body	Mounting	Description	Page
L43/P43 SUPER THRUBEAM	100'	.40"	.15"	IR LED	100/1000	Aluminum	3/4-16 THD	Powerful modulated beam for extreme distances, dirty atmospheres, normally opaque materials. AC coupled pre-amplifier. Use with R43/T43 Super Pulsar control only.	28
L33/P33	36"	.16"	.05"	IR LED Vis Red LED	100/1000 50/80	Aluminum Stainless Steel	3/8-24THD 5/16-24 THD	Heavy duty housings for shock and vibration. Very powerful for its size. 3 models	30
LP30/P30	3"-24"	.06"-12"	.02"-1.04"	Lamp IR LED	115 100/1000 or 40/80	Aluminum, Brass, Stainless steel	Various	General purpose beam series, 4 styles of light source, 4 styles of detectors. Use any detector with any light source.	32
L34/P34	6"	.06"	.02"	IR LED	80/120	Stainless steel	8-32 THD	Very small and powerful pair. Heavy duty housings protect against abuse.	38
L11/P11	2"	.10"	.04"	IR LED	40/80	Plastic	—	Small, economical pair designed for OEM. Clamp or bracket mount.	40
L56/P56	.50"	.030"	.010"	Lamp IR LED	115 100/1000	Aluminum/plastic composite	.113" holes	Unusual design has fiber optic bundle in semi-rigid snout. Bend snout by hand to any shape. Detects very small objects.	41
L60/P60	36"	.06"	.02"	IREDA/LED	60/120 mA 40/80 mA	Plastic	.086" holes	Small plastic package for precise detection in areas where space is at a minimum. IRED or LED source may be specified.	43



THRUBEAMS

Long Range Modulated L43/P43 Series Super LED Thrubeam

Features:

- Rated Separation: 100 ft.
- Beam Diameter: .40 in.
- Smallest Detectable Object: .15 in.
- Powerful modulated beam
- Glass lens
- Ambient light immunity
- Penetrates many opaque objects
- Penetrates dusty environment



Description:

The L43/P43 Series is a high intensity thrubeam pair designed for photoelectric sensing at long range or through opaque objects. It consists of an LED light source and an amplified photodetector. Each is housed in a threaded, anodized aluminum body which is ideally suited for industrial environments. Sealed lenses make both units dust-tight and water resistant. An infrared filter is included in the photodetector to block visible ambient light.

The photodetector employs an AC coupled, voltage output amplifier which must operate in a modulated mode. **The L43/P43**

pair should therefore be used *only* with an R43/T43 "Super Pulser." This control modulates the LED, amplifies the detected signal and optimizes system performance.

When properly aligned in a clear atmosphere and used in conjunction with the Super Pulser, the L43/P43 pair can sense over a 100 ft. range or through many solid or opaque objects. The beam diameter between light source and photodetector is approximately .40 inch. The units may also be positioned side by side at a 35 ft. distance from a 3 inch retro-disk for retroreflective applications.

Typical Applications:

- Safety barriers
- Security barriers
- Missing label detection
- Detection of an object on a conveyor
- Detection of a product in a package

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	1 A max., 10% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	940 nm peak
BODY	Red anodized aluminum
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 85°C
LEADS	2 cond. 22 ga., PVC covered cable, 6 ft. long, Type E

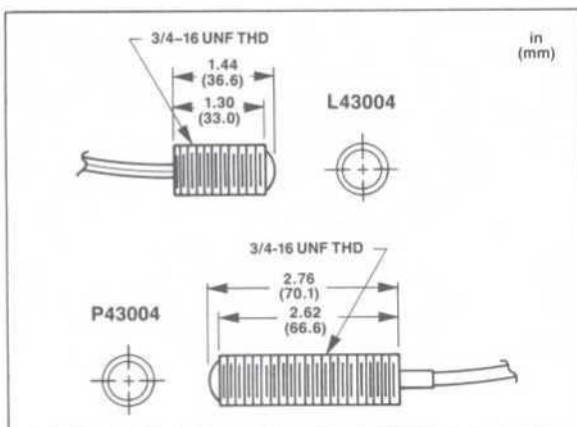
PHOTODETECTOR

Operating Voltage	± 5V to ± 15VDC
Spectral Response	910 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm
BODY	Blue anodized aluminum
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	4 cond. 26 ga. PVC covered cable with shield, 6 ft. long, Type L



L43/P43 Series

Dimensions:



Compatibility With Controls:

The L43/P43 are designed exclusively for use with the R43/T43 Series modulating controls.

Model Selection Guide:

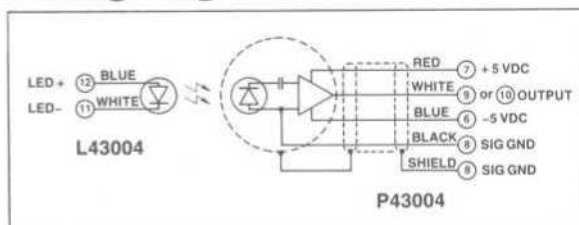
Part #	Description
L43004	Light Source
P43004	Photodetector

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Wiring Diagram:



Circled numbers denote connection to socket of R43/T43 Series "Super Pulser."



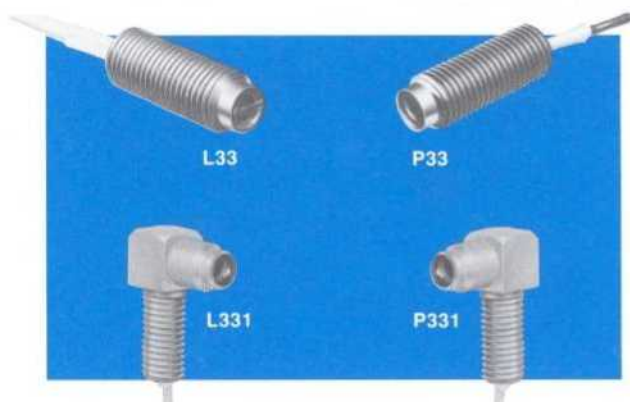
THRUBEAMS

Miniature LED Pair

L33/P33 Series

Features:

- IR or Visible Red LED light Source Available
- Plastic lens
- Small size
- Long life
- Our most popular thrubeam pair
- Two body styles available



Description:

The L33/P33 Series is a rugged LED thrubeam combination in miniature size, designed for use under conditions of severe shock and vibration. A specially selected Light Emitting Diode and photodetector are matched for optimum performance and are mounted in identical heavy duty housings.

Any L33 or P33 Series unit can be obtained in a choice of 3 models: a barrel body of anodized aluminum, a barrel body of stainless steel, or a right angle body of anodized aluminum.

The L33 Series contains a lens system to efficiently direct the LED's energy and is suitable for modulated operation. The IR model photodetector contains a filter to block visible ambient light.

Typical Applications:

- Parts counting
- Edge control
- Vibratory bowl feeders
- Positioning
- Detection of small parts
- Safety barrier
- Conveyor control

Specifications: (at 25°C)

LIGHT SOURCE—IR LED

Input	100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	1 A max., 10% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	940 nm peak

LIGHT SOURCE—VISIBLE RED LED

Input	50 mA max. with resultant voltage drop of 1.8 VDC typical; derate at 1 mA per degree above 25°C ambient
Modulated Input	80 mA max., 50% duty cycle at 1 kHz min.
Reverse Voltage	4V max.
Spectral Emission	660 nm peak

BODY

See Model Selection Guide

TEMPERATURE

Operating: 0° to 50°C
Storage: -40° to 85°C

LEADS

2 cond. 24 ga., teflon covered cable, 6 ft. long, Type A

PHOTODETECTOR

Operating Voltage	20 VDC max.
Response Time	See Response Time Chart under <i>Technical Information</i>
Spectral Response	910 nm peak

FILTER (Used w/ IR light source) Transmits less than 5% at 750 nm and less than 0.1% at 700 nm

BODY

See Model Selection Guide

TEMPERATURE

Operating: 0° to 50°C
Storage: -40° to 50°C

LEADS

2 cond. 26 ga., teflon covered cable with shield, 6 ft. long, Type B

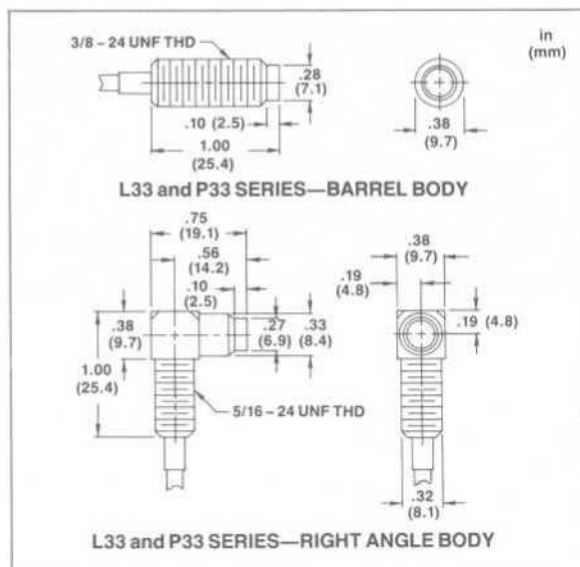
OPERATING PARAMETERS

LIGHT SOURCE	RATED SEPERATION	BEAM DIAMETER	SMALLEST DETECTABLE OBJECT
IR LED	36"	.16"	.05"
VISIBLE RED LED	24"	.10"	.03"

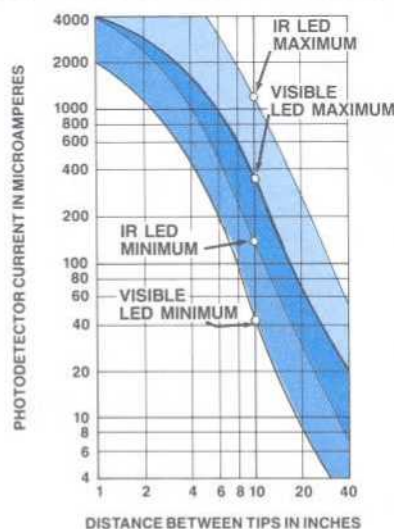


L33/P33 Series

Dimensions:



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The L33/P33 Series is compatible with all Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

The **IR light source** utilizes a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.

The **visible red light source** utilizes a 50 mA Light Emitting Diode. A 68 ohm, 1/2 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, 6.8 ohm 1/4 W current limiting resistor must be used.

Model Selection Guide:

LIGHT SOURCE—IR LED

Part #	Body Style	Body
L33007	Barrel	Red anodized aluminum
L33014	Barrel	Stainless steel with red epoxy bead
L33107	Right Angle	Red anodized aluminum

PHOTODETECTOR—USE WITH IR LED ONLY

Part #	Body Style	Body
P33001	Barrel	Gold anodized aluminum
P33014	Barrel	Stainless steel with black epoxy bead
P33101	Right Angle	Gold anodized aluminum

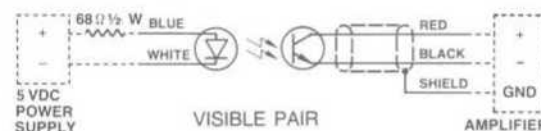
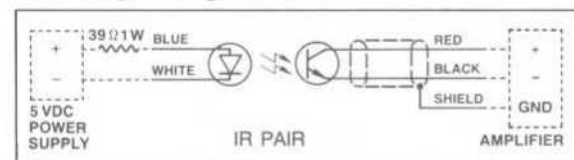
LIGHT SOURCE—VISIBLE RED LED

Part #	Body Style	Body
L33008	Barrel	Black anodized aluminum
L33018	Barrel	Stainless steel with red epoxy bead
L33108	Right Angle	Black anodized aluminum

PHOTODETECTOR—USE WITH VISIBLE RED LED ONLY

Part #	Body Style	Body
P33008	Barrel	Gold anodized aluminum
P33018	Barrel	Stainless steel with white epoxy bead
P33108	Right Angle	Gold anodized aluminum

Wiring Diagram:





THRUBEAMS

General Purpose

L30/P30 Series

Features:

- Rated Separation: .3 to 24 in.
- Beam Diameter: .09 to .12 in.
- Smallest Detectable Object: .02 to .04 in.
- Plastic lens
- Small size
- Interchangeability within series



Description:

The L30/P30 Series is a family of compatible general purpose thrubeams. Any L30 light source may be used with any P30 photodetector. The units offer similar performance in a variety of body sizes, styles and materials. All units have metal housings, lenses and epoxy sealing.

Several L30/P30 Series models are available with several options such as protective sheathing and/or filters which block visible light.

Engineering specifications will vary with the models actually used; refer to Model Selection Guide.

Typical Applications:

- Parts counting
- Edge control
- Detection of small parts
- Web break

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—LED

Input 100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 1 A max., 10% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

BODY

Stainless steel or brass; see Model Selection Guide

TEMPERATURE

Operating: 0° to 70°C
Storage: -40° to 70°C

LEADS

2 cond. 24 AWG., teflon covered cable, 6 ft. long. Type A

PHOTODETECTOR

Operating Voltage 20 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

BODY

Brass

FILTER (optional)

Transmits less than 5% at 750 nm and less than 0.1% at 700 nm

TEMPERATURE

Operating: 0° to 50°C—standard units
Storage: -40° to 50°C

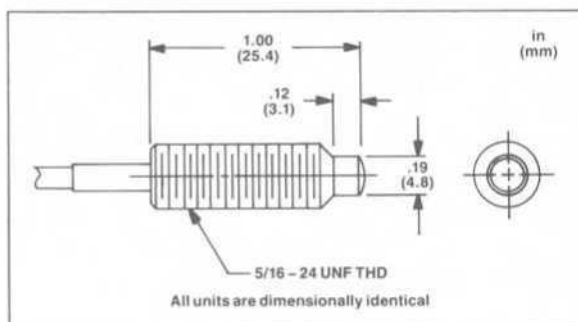
LEADS

2 cond. 26 AWG., teflon covered cable with shield, 6 ft. long, Type B



L30/P30 Series

Dimensions:



Variations:

LEADS

Extra lead lengths available. See pg. 129.

Options:

PROTECTIVE SHEATH

Can be factory installed over the standard teflon covered leads by adding a suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: L32001-M
- S For armor, square locked stainless steel, 3/16" O.D. Example: L32001-S

Compatibility With Controls:

The L30/P30 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED light sources only. For high speed operation use the T41300 High Speed Amplifier.

The LED light source utilizes a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.

Model Selection Guide:

LIGHT SOURCE

Part #	Light Source	Body	Rated* Separation	Beam Diameter	Smallest Detectable Object
L32001	Lamp	Brass	24"	.12"	.04"
L32004	LED	Stainless	3-10" **	.09"	.03"

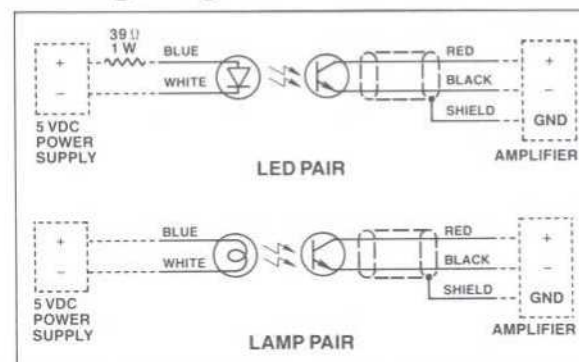
*When used with P30 Photodetectors and Skan-A-Matic electronic controls.

**L32004 will operate with P32011 and P32013 photodetectors at 10" and with the P30011, P31011, P34021 and P34071 at 3".

PHOTODETECTOR

Part #	Operating Voltage	Body	Filter	Beam Diameter	Smallest Detectable Object
P32011	20 VDC max.	Brass	No	.12"	.04"
P32013	20 VDC max.	Brass	Yes	.12"	.04"

Wiring Diagram:

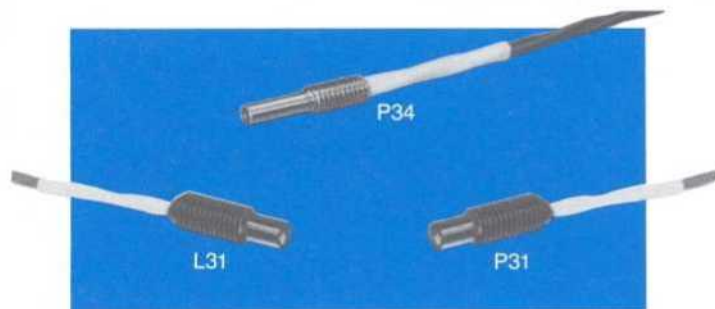




L30/P30 Series (Continued)

Features:

- Rated Separation: 10 to 24 in.
- Beam Diameter: .06 to .12 in.
- Smallest Detectable Object: .02 to .04 in.
- Small size
- Interchangeability within series



Description:

The L30/P30 Series is a family of compatible general purpose thrubeams. Any L30 light source may be used with any P30 photodetector. The units offer similar performance in a variety of body sizes, styles and materials. All units have metal housings, lenses and epoxy sealing.

Several L30/P30 Series models are available with several options such as protective sheathing and/or filters which block visible light.

Engineering specifications will vary with the models actually used; refer to Model Selection Guide.

Typical Applications:

- Parts counting
- Edge control
- Detection of small parts
- Web break

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—LED

Input 40 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 80 mA max., 50% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

BODY Black anodized aluminum

TEMPERATURE Operating: 0° to 50°C
Storage: -40° to 50°C

LEADS 2 cond. 24 AWG., teflon covered cable, 6 ft. long, Type A

PHOTODECTOR

Operating Voltage 30 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

BODY

Black anodized aluminum or stainless steel; see Model Selection Guide

FILTER (optional)

Transmits less than 5% at 750 nm and less than 0.1% at 700 nm

TEMPERATURE

Operating: 0° to 50°C
Storage: -40° to 50°C

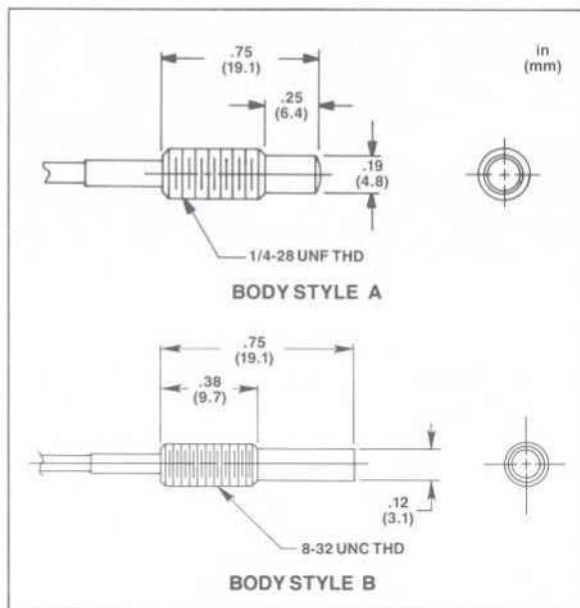
LEADS

2 cond. 26 AWG., teflon covered cable with shield, 6 ft. long, Type B



L30/P30 Series

Dimensions:



Compatibility With Controls:

The L30/P30 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED light sources only. For high speed operation use the T41300 High Speed Amplifier.

The LED light source utilizes a 40 mA Light Emitting Diode. A 100 ohm, 1/4 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, a 27 ohm, 1/4 W current limiting resistor must be used.

Model Selection Guide:

LIGHT SOURCE

Part #	Light Source	Body Style	Rated* Separation	Beam Diameter	Smallest Detectable Object
L31011	Lamp	A	15"	.120"	.04"
L31014	LED	A	5"	.120"	.04"

*When used with P30 Photodetectors and Skan-A-Matic electronic controls.

PHOTODETECTOR

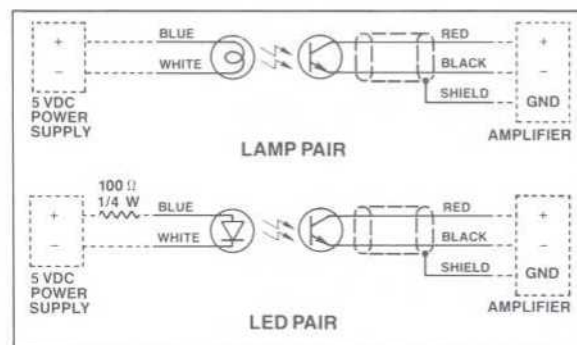
Part #	Body	Body Style	Filter	Beam Diameter	Smallest Detectable Object
P31011	Anodized Aluminum	A	No	.08"	.03"
P31013	Anodized Aluminum	A	Yes	.08"	.03"
P34021	Stainless	B	No	.06"	.02"
P34023	Stainless	B	Yes	.06"	.02"

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Wiring Diagram:





L30/P30 Series (Continued)

Features:

- Rated Separation: 10 to 15 in.
- Beam Diameter: .06 to .12 in.
- Smallest Detectable Object: .02 to .04 in.
- Small size
- Interchangeability within series



Description:

The L30/P30 Series is a family of compatible general purpose thrubeams. Any L30 light source may be used with any P30 photodetector. The units offer similar performance in a variety of body sizes, styles and materials. All units have metal housings, lenses and epoxy sealing.

Several L30/P30 Series models are available with several options such as protective sheathing and/or filters which block visible light.

Engineering specification will vary with the models actually used; refer to Model Selection Guide.

Typical Applications:

- Parts counting
- Edge control
- Detection of small parts
- Web break

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input	5.0 VDC, 115 mA
BODY	Gold anodized aluminum
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	2 cond. 24 AWG., teflon covered cable, 6 ft. long. Type A

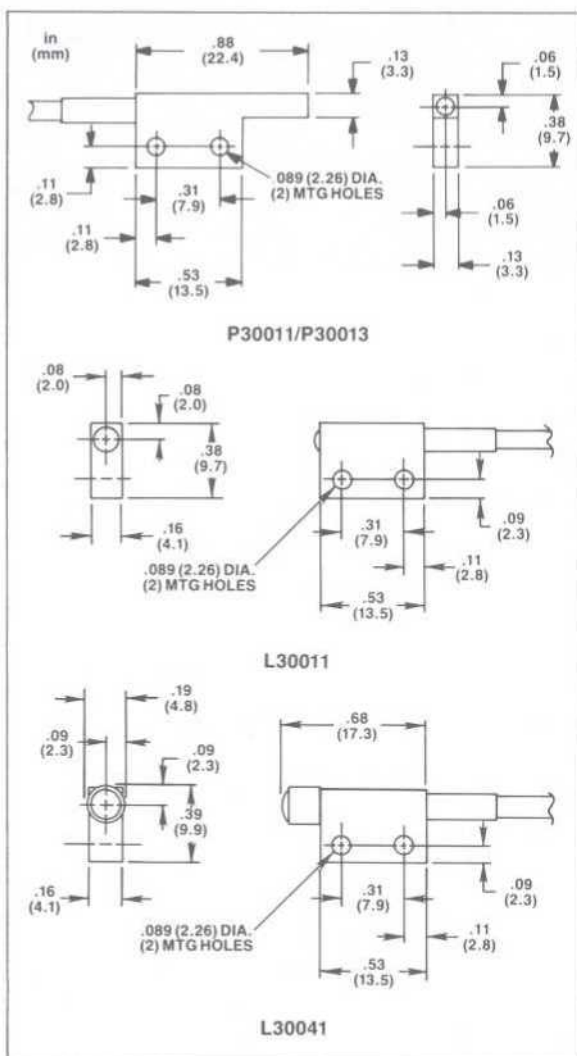
PHOTODETECTOR

Operating Voltage	30 VDC max.
Response Time	See Response Time Chart under <i>Technical Information</i>
Spectral Response	910 nm peak
FILTER (optional)	Transmits less than 5% at 750 nm and less than 0.1% at 700 nm
BODY	Gold anodized aluminum
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	2 cond. 26 AWG., teflon covered cable with shield, 6 ft. long, Type B



L30/P30 Series

Dimensions:



Compatibility With Controls:

The L30/P30 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED light sources only. For high speed operation use the T41300 High Speed Amplifier.

Model Selection Guide:

LIGHT SOURCE

Part #	Rated* Separation	Beam Diameter	Smallest Detectable Object
L30011	10"	.12"	.04"
L30041	15"	.12"	.04"

*When used with P30 Photodetectors and Skan-A-Matic electronic controls.

PHOTODETECTOR

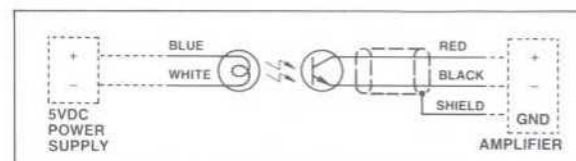
Part #	Filter	Beam Diameter	Smallest Detectable Object
P30011	No	.06"	.02"
P30013	Yes	.06"	.02"

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Wiring Diagram:





THRUBEAMS

Subminiature LED Pair L34/P34 Series

Features:

- Rated Separation: 6 in.
- Beam Diameter: .06 in.
- Smallest Detectable Object: .02 in.
- Glass lens
- Rugged stainless steel body
- Immune to visible ambient light
- Smallest industrial pair



Description:

A small and durable LED thrubeam pair, designed for precise detection in restricted and abusive areas. Specially selected Light Emitting Diodes and photodetectors are mounted in stainless steel bodies and offered as the tiniest industrial pair in the photoelectric sensing market.

The infrared energy from the LED light source can be detected

by the photodetector from as far as 6 inches away and can be modulated to defeat the effects of ambient light. In addition, the filter in the photodetector blocks visible light to the sensor. Solid state components and rugged construction assure the user of trouble-free operation and long life.

Typical Applications:

- Detecting component leads
- Edge control
- Web break
- Wire break

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	60 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	120 mA max., 50% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	940 nm peak
BODY	Stainless steel
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	2 cond. 24 AWG., teflon covered cable, 6 ft. long. Type A

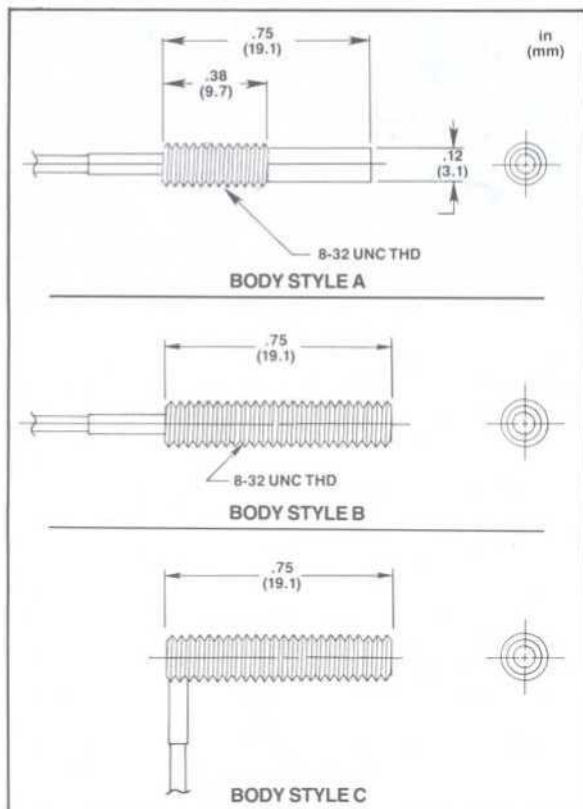
PHOTODETECTOR

Operating Voltage	30 VDC max.
Response Time	See Response Time Chart under <i>Technical Information</i>
Spectral Response	910 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm
BODY	Stainless steel
TEMPERATURE	Operating 0° to 50°C Storage: -40° to 50°C
LEADS	2 cond. 26 AWG., teflon covered cable with shield, 6 ft. long, Type B



L34/P34 Series

Dimensions:



Compatibility With Controls:

The L34/P34 Series is compatible with all Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

The light source utilizes a 60 mA Light Emitting Diode. A 68 ohm, 1/2 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls, such as our R42/T42 and R43/T43, a 6.8 ohm, 1/4 W current limiting resistor must be used.

Model Selection Guide:

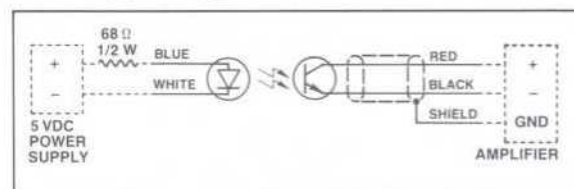
Part #	Body Style	Description
L34024	A	Light Source
P34024	A	Photodetector
L34035	B	Light Source
P34035	B	Photodetector
L34040	C	Light Source
P34040	C	Photodetector

Variations:

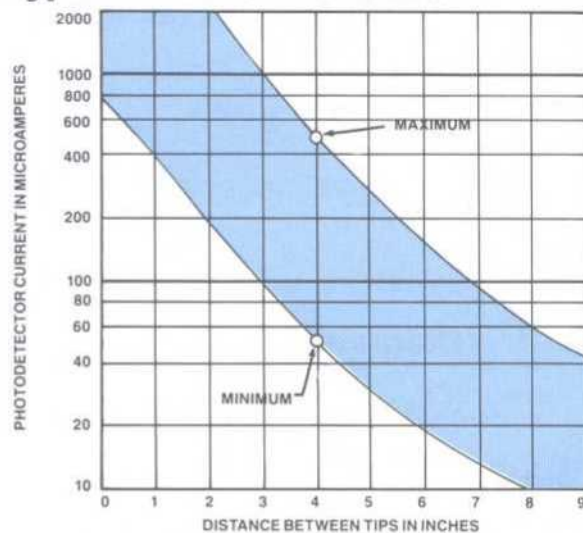
LEADS

Extra lead lengths available. See pg. 129.

Wiring Diagram:



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Phone 800-448-2900

Fax 800-223-5138



THRUBEAMS

OEM Pair

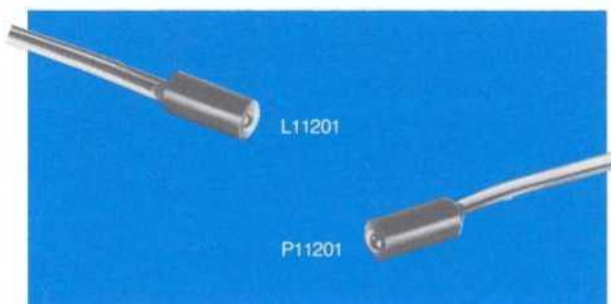
L11/P11 Series

Features:

- Rated Separation: 2 in.
- Beam Diameter: .10 in.
- Smallest Detectable Object: .04 in.
- Plastic lens
- Immune to visible ambient light
- Least expensive thrubeam pair

Description:

The L11/P11 Series is offered for industrial applications where cost is a critical factor and metal units are not considered necessary. The thrubeam pair utilizes rugged plastic bodies suitable for clamp mounting. An infrared filter blocks visible



ambient light to the sensor. A plastic lens collimates the beam and protects the unit.

Typical Applications:

- Pharmaceutical tablet detection
- Edge control

- Counting
- Small part detection

Specifications: (at 25°C)

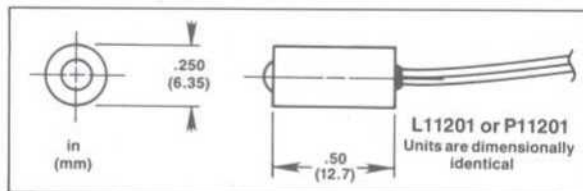
LIGHT SOURCE—LED

Input	40 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	80 mA max., 50% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	940 nm peak
BODY	Black plastic with plastic lens
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	2 cond. 26 AWG., PVC covered cable, 6 ft. long. Type C

PHOTODETECTOR

Operating Voltage	30 VDC max.
Response Time	See Response Time Chart under <i>Technical Information</i>
Spectral Response	880 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm.
BODY	Black plastic with plastic lens
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	2 cond. 26 AWG., PVC covered cable 6 ft. long, Type C

Dimensions:



Compatibility With Controls:

The L11/P11 Series is compatible with all Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

The light source utilizes a 40 mA Light Emitting Diode. A 100 ohm, 1/4 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls, such as our R42/T42 and R43/T43, a 27 ohm, 1/4 W current limiting resistor must be used.

Model Selection Guide:

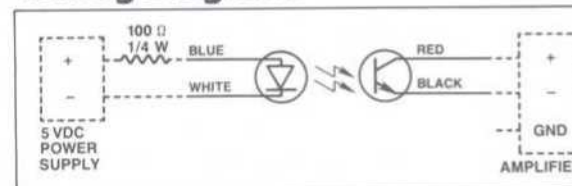
Part #	Description
L11201	Light Source
P11201	Photodetector

Variations:

LEADS

Extra lead lengths available. Use Type C for both L11 and P11 — see pg. 129.

Wiring Diagram:



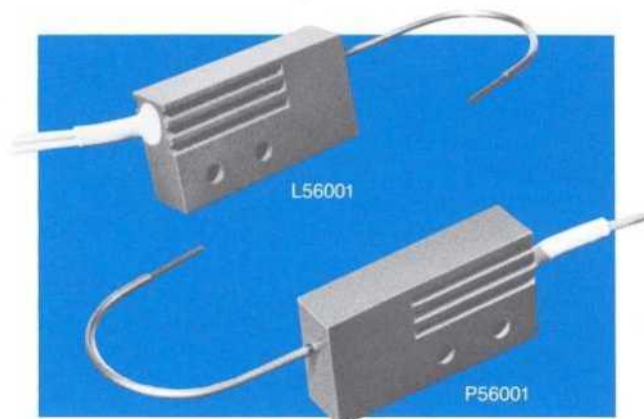


THRUBEAMS

Flexible Snout Fiber Optic Pair L56/P56 Series

Features:

- Rated Separation: .50 in.
- Beam Diameter: .030 in.
- Smallest Detectable Object: .010 in.
- Formable snout
- Snout lengths available to 12 in.
- High temperature tip operable up to 200°C
- Detects minute objects
- Works in places normally inaccessible to other thrubeams



Description:

The L56/P56 Series is a thrubeam combination in subminiature size, designed to detect small targets with extreme accuracy. A specially selected lamp and matched photodetector are mounted into strong aluminum housings.

The semirigid snouts containing the fiber bundles can be bent

easily by hand to position the tips for alignment and are self-retaining. The tips are hardened stainless steel to enable clamping with a nylon set screw. The aluminum backbody acts as heat sink to minimize sensor drift.

Typical Applications:

- Counting small objects
- Detecting component leads
- Precise edge detection
- Registration mark detection
- Wire break detection

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—LED

Input 100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 1 A max., 10% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

BODY Aluminum/plastic composite—black for lamp, red for LED units

TEMPERATURE Operating: Body 0° to 50°C

Tip -40° to 200°C

Storage: -40° to 50°C

LEADS 2 cond. 26 AWG., teflon covered cable, 6 ft. long. Type A

PHOTODETECTOR

Operating Voltage 20 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

FILTER (optional) Transmits less than 5% at 750 nm and less than 0.1% at 700 nm

BODY Aluminum/plastic composite—blue color

TEMPERATURE Operating: Body 0° to 50°C

Tip -40° to 200°C

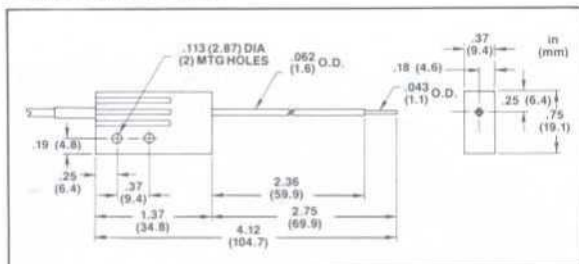
Storage: -40° to 50°C

LEADS 2 cond. 26 AWG., teflon covered cable with shield, 6 ft. long. Type B



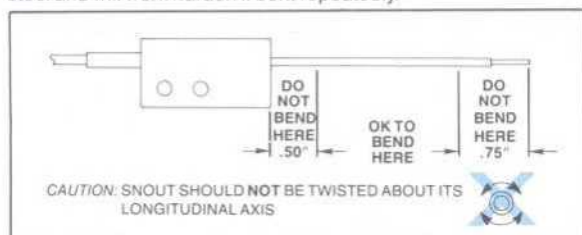
L56/P56 Series

Dimensions:

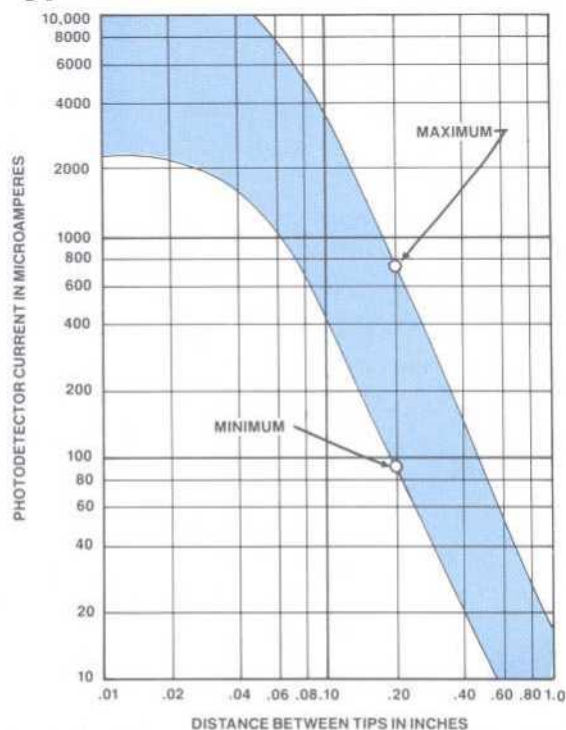


FORMING SNOUT

CAUTION: DO NOT USE PLIERS OR SHARP CORNERS FOR FORMING. Use of pliers or sharp corners for forming will destroy units. Bend snout by hand on a pencil or similar cylindrical object that is .25" diameter or larger. The snout is annealed stainless steel and will work harden if bent repeatedly.



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The L56/P56 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED light sources only. For high speed operation use the T41300 High Speed Amplifier.

The LED versions of this series utilize a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.

Model Selection Guide:

LIGHT SOURCE

Part #	Description
L56001	Light Source — Lamp
L56004	Light Source — IR LED

PHOTODETECTOR

Part #	Description
P56001	Photodetector
P56201	Photodetector with Filter

Variations:

SNOOTS

Lengths from .500 in. minimum up to 12 in. maximum are available.

Flexible monocoil snouts instead of standard semi-rigid annealed steel are available.

Can be factory-formed to customer specifications.

LEADS

Extra lead lengths available. See pg. 129.

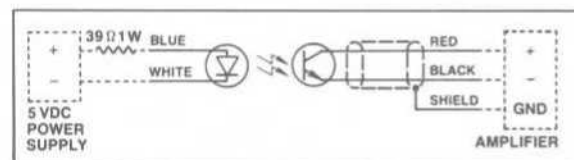
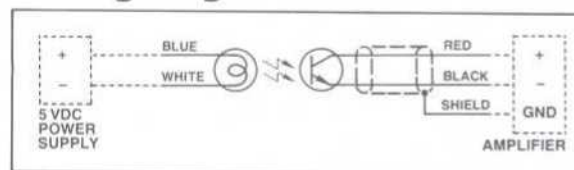
Options:

PROTECTIVE SHEATH

Can be factory installed over the standard teflon covered leads by adding a suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: L56001-M
- S For square locked stainless steel armor, 3/16" O.D. Example: L56001-S

Wiring Diagram:





THRUBEAMS

Subminiature LED/IRED Pair

L60/P60 Series

Features:

- Up to 36" separation with modulating control
- Beam Diameter: 0.06"
- Smallest Detectable Object: 0.02"
- Glass Lenses
- Rugged Polycarbonate Body
- Resistant to ambient visible radiation (P60001)
- Available with Red LED source (L/P60002)



Description:

A small and durable IRED or LED thrubeam pair designed for precise detection in areas where space is at a premium. Specially manufactured and selected IREDs, LEDs, and phototransistors are enclosed in glass-filled polycarbonate housings, each designed to mount in 0.02 in³ of equipment volume.

The energy from the radiation source can be detected by the companion sensor as far away as 36 inches (L/P60001 pair)

and can be modulated to defeat the effects of ambient radiation. In the P60001, an integral IR-bandpass filter provides greater than 60 dB attenuation to wavelengths shorter than 700 nanometers. The P60002 has no optical filtering and may be used with either source (L60001 or L60002).

Solid-state components and rugged construction assure long life and trouble-free operation.

Typical Applications:

- Detecting Component Leads
- Edge Control
- Web Break
- Wire Break

Specifications: (at 25°C)

RADIATION SOURCE - IRED, L60001

Input	60 mA maximum with $1.1 \leq V_F \leq 1.7V$; derate at 1 mA/°C above 25°C ambient.
Modulated Input	120 mA max. at 1 kHz and 50% duty cycle.
Spectral Emission	940 nm peak
Reverse Voltage	2 V max.

RADIATION SOURCE - LED, L60002

Input	40 mA maximum with $1.3 V \leq V_F \leq 2.0$; derate at 0.7 mA/°C above 25°C ambient
Modulated Input	80 mA max. at 1 kHz and 50% duty cycle.
Spectral Emission	660 nm peak
Reverse Voltage	2 V max.

BODY

Glass-filled polycarbonate

Operating: 0°C to 50°C
Storage: -40°C to 50°C

LEADS
2 conductor, 26 AWG, PVC-insulated, 6 ft minimum length. Type P.

PHOTODETECTOR

Operating Voltage	30 VDC (V_{CE})
Response Time	See Response Time Chart under Technical Information.
Spectral Response	910 nm peak, (P60001) filtered down 26 dB at 750 nm and down 60 dB at 700 nm.

BODY

Glass-filled polycarbonate

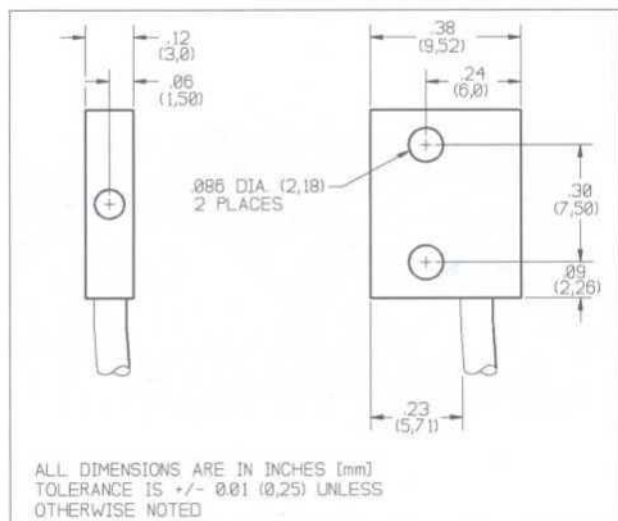
Operating: 0°C to 50°C
Storage: -40°C to 50°C

LEADS

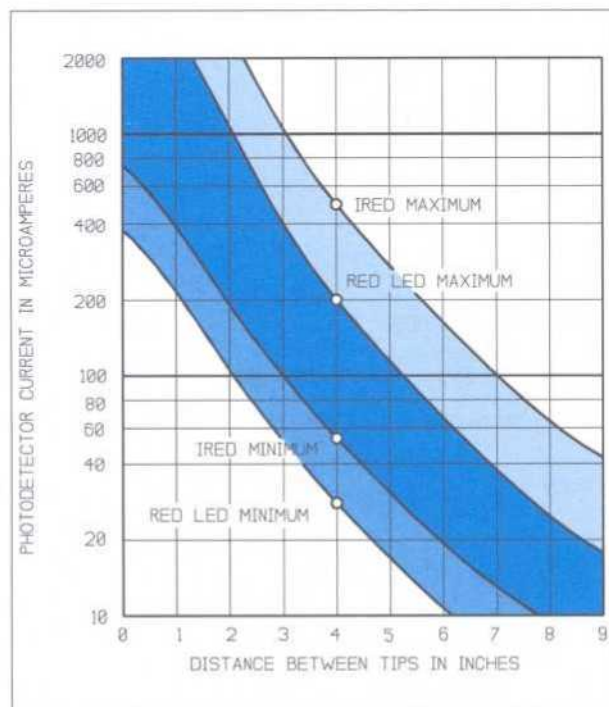
2 conductor with shield, 26 AWG, PVC-insulated, 6 ft minimum length. Type Q.



Dimensions:



Typical Performance Chart:



Compatibility With Controls:

The L60/P60 Series is compatible with all Clarostat Photoelectric Controls Products described in this databook (see pages 93 through 126). For high-speed operation, use the T41300 High-Speed Amplifier.

The L60001 radiation source uses a Gallium Arsenide infrared-emitting diode. A 68 ohm, 1/2 watt series current limiting resistor is supplied and *must be used* with all controls supplying 5 volts DC for source power; for modulating controls such as the R42/T42, R43/T43, or T80, a 27 ohm 1/4 watt resistor *must be used*.

The L60002 radiation source uses a visible red light-emitting diode; DC operation *requires the use of* an 82 ohm, 1/2 watt series limiting resistor. When operating with a modulating control, a 39 ohm, 1/4 watt resistor *must be used*.

Model Selection Guide:

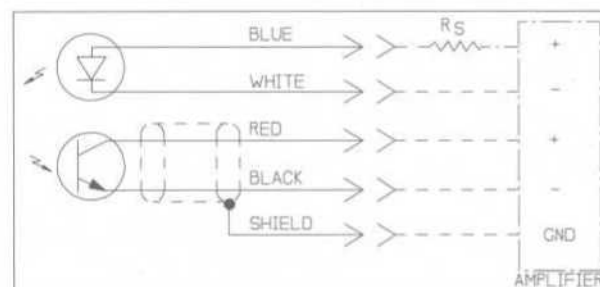
Part Number	Description
L60001	Infrared Source
L60002	Visible Red Source
P60001	Phototransistor with Filter
P60002	Phototransistor w/o Filter

Variations:

LEADS

Additional lead lengths may be specified; contact Clarostat Sensors Division or the local Sales Representative.

Wiring Diagram:



Reflective Skanners

Reflective skanners use the same physical principles as thrubeams except that the two components—light source and photodetector—are placed together in the same housing. Light is projected into space by the source. The target object reflects some of this light, and a portion of it enters the photodetector, causing increased current flow in the photodetector circuit. Since most of the light emitted by the light source is lost, only a small percentage is collected by the photodetector.

Reflective skanners do not have the range capabilities of thrubeams, since their light/dark con-

trast ratio is not as great. However, they do have advantages over thrubeams in many situations. First, they need only be located on one side of the target object—this means that only one wiring run is needed and that there will be no problem aligning two separate components. Second, reflective skanners can sometimes detect clear, thin films such as cellophane which cannot be detected by thrubeams. Third, reflective skanners can often distinguish targets by surface characteristics such as texture and color.

Reflective Scanner Selection Guide

Series	Smallest Detectable Object	Optimum Distance to Target	Field of View	Maximum Usable Distance	Light Source	Input Current (mA) Continuous/Modulated	Body	Mounting	Description	Page
S22 RETRO-SKAN	.15"	N/A	N/A	30" (with 3" Retro-Disc)	IR LED	100/1000	Aluminum	1/2-20 THD .180" holes	Rugged, shock resistant unit designed to be used with retro-reflective disc or tape only. Use in beam break applications. Infrared LED 2 body styles.	46
S12 SQUINT-SKAN	.12"	.18"	.35"	1.5"	IR LED	100/1000	Aluminum	.125" holes	Only 3/4 inch square. Unit is designed to withstand shock and vibration in production machinery. Popular with OEM users. Infrared LED	48
S111 PLASTI-SKAN	.06"	.15"	.18"	1.3"	IR LED	40/80	Plastic	.089" holes	For use where cost is critical and metal housings are not necessary.	50
S13	.04"	.30"	.11"	1.5"	IR LED	60/120	Aluminum	3/8-24 THD .089" holes	Smallest general purpose LED skanner. Flat mount or threaded body. Both have maximum usable distance of 1.5 inches	52
S30 SKAN-COAX	.04"	.10"	.10"	.8"-1.0"	Lamp IR LED Vis Red LED	115 100/1000 50/80	Aluminum	Various	Fiber optic skanner with either lamp or LED light source. General purpose unit detects .04 inch objects at optimum distance. Detects large targets at 1 inch. A best seller. 6 models	54
S14/S15/S16	.04"-.05"	.07"-.16"	.10"-.15"	.4"-3.0"	Lamp	115	Aluminum, Brass	3/8-24 THD .089" holes	Our smallest general purpose skanner with incandescent light source. 8 models.	57
S27 MICRO-SKAN	.01"	.02"	.04"	.20"	IR LED	80/120	Gold plated TO18 can	—	Designed for OEM users, this unique skanner has 4 gold-plated pins for direct connection to printed circuit board. Available in 3 other mounting styles.	60
S51/S52 MINI-SKAN	.011"	.030"	.033"	.100"	Lamp IR LED Vis Red LED	115 100/1000 50/80	Aluminum/Brass	5/16-THD .089" holes	Fiber optic skanner with threaded barrel front body. Back body has 3 styles.	63
S56 NANO-SKAN	.007"	.010"	.020"	.070"	Lamp IR LED Vis Red LED	115 100/1000 50/80	Aluminum/plastic composite	.113" holes	Fiber optic skanner with semi-rigid snout. Bend snout by hand to any shape.	66
S56 HIGH-SPEED NANO-SKAN	.007"	.010"	.020"	.070"	Lamp IR LED	115 100/1000	Aluminum/Plastic Composite	.144" holes	The High-Speed NANO-SKAN is a high resolution skanner designed for applications where target size and/or speed of movement are beyond the capability of standard sensors. Fiber-optic construction with semi-rigid snout. Bend snout by hand to any shape.	69
S58 PICO-SKAN	.004"	.008"	.012"	.020"	Lamp	115	Aluminum/plastic composite	.113" holes	Fiber optic skanner with semi-rigid snout. Bend snout by hand to any shape.	71



REFLECTIVE SKANNERS

Retroreflective LED S22 Series RETRO-SKAN®

Features:

- Smallest Detectable Object: .15 in.
- Operates with retroreflective disc to 30 inches
- Dust, dirt and contamination protected
- Responds only to the reflection from the retroreflector
- Glass filter blocks visible ambient light
- Two body styles available
- Can be modulated

Description:

RETRO-SKAN is designed to be used with a retroreflector to provide a thru-beam detection system. Like other LED scanners it emits an invisible infrared beam which is reflected back into its photodetector. This unit differs, however, in its ability to respond *only* to a retroreflector, while ignoring other surfaces which pass before it.

A rugged aluminum housing and quality components give RETRO-SKAN excellent shock and vibration resistance, consistent performance and long life. A sealed lens and infrared filter exclude dust and contamination and block out visible ambient light. The scanner may also be modulated with the R42/T42 Series to obtain full ambient immunity. Two body styles with 6 ft. leads are offered.

The scanner's range will vary with the size and quality of the retroreflector surface. Target position within the beam is not critical



but more reflective objects should be placed closer to the retroreflector to obtain the most positive beam-break.

The chart below offers a few examples to show RETRO-SKAN's operational parameters.

Retroreflector		Max. Distance Scanner to Retroreflector	Field of View ⁽¹⁾	Smallest Detectable Object
Size	Type			
1/2"x1"	Retro-Tape	4.0"	.44"	.15"
7/8" dia.	Retro-Disc	12.0"	.62"	.21"
3" dia.	Retro-Disc	30.0"	1.56"	.52"

⁽¹⁾See *Field of View* under *Technical Specifications* in *Technical Information*.

Typical Applications:

- Web break
- Cloth or paper detection
- Laminated sheet counting
- Box sortation

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	1 A max., 10% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	940 nm peak

PHOTODETECTOR

Operating Voltage	20 VDC max.
Response Time	See Response Time Chart under <i>Technical Information</i>
Spectral Response	910 nm peak; filtered to respond to less than 5% at 700 nm and less than 0.1% at 600 nm

BODY

Red anodized aluminum

TEMPERATURE

Operating: 0° to 50°C
Storage: -40° to 50°C

LEADS

4 cond. 26 ga., PVC covered cable with shield, 6 ft. long, Type G

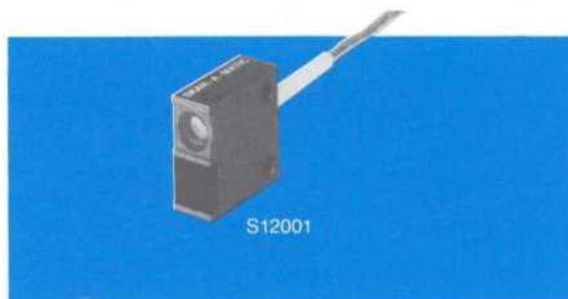


REFLECTIVE SKANNERS

Miniature LED S12 Series SQUINT-SKAN®

Features:

- Smallest Detectable Object: .12 in.
- Optimum Distance to Target: .18 in.
- Field of View: .35 in.
- Maximum Usable Distance: 1.5 in.
- Glass filter blocks visible ambient light
- Can be modulated
- Shock and vibration resistant



Description:

The SQUINT-SKAN® is a rugged LED reflective skanner in a miniature size designed for use under conditions of severe shock and vibration. A specially selected Light Emitting Diode and photodetector are mounted in an aluminum housing with a cover glass to keep out dust and contamination. The filter over the photodetector

blocks visible light from fluorescent lamps and some radiation from incandescent lamps. The IR energy emitted from the LED is invisible to the human eye. The SQUINT-SKAN® is suitable for modulated operation.

Typical Applications:

- Proximity sensing
- Registration mark detection

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	1 A max., 10% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	940 nm peak

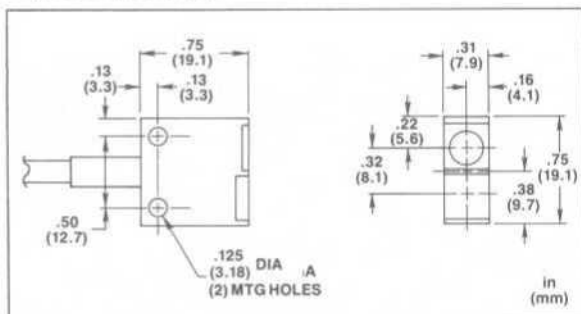
PHOTODETECTOR

Operating Voltage	20 VDC max.
Response Time	See Response Time Chart under Technical Information
Spectral Response	910 nm peak; filtered to respond to less than 5% at 700 nm and less than 0.1% at 600 nm
BODY	Red anodized aluminum
TEMPERATURE	Operating: 0° to 70°C Storage: -40° to 70°C
LEADS	4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)

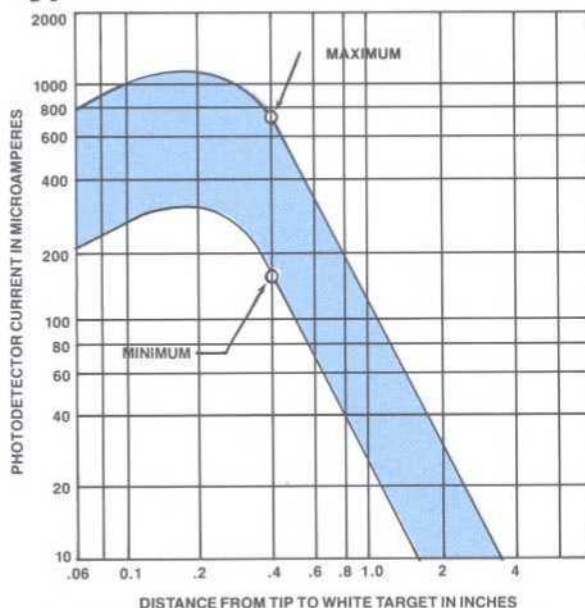


S12 Series

Dimensions:



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The SQUINT-SKAN® is compatible with all Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

This skanner utilizes a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.

Model Selection Guide:

Part #	Description
S12001	Standard Unit

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

PROTECTIVE SHEATH

Can be factory installed over standard Type J lead (Shielded Quad) only. Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S12001-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S12001-S

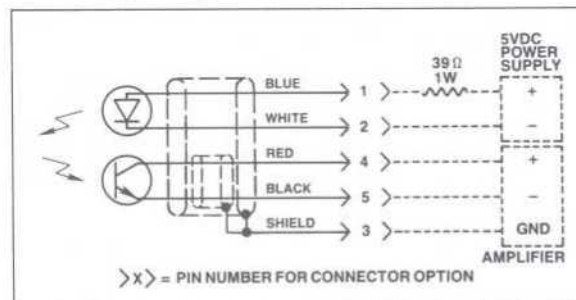
CONNECTOR

The S12 Series skanner is available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

- P For connector pair with in-line receptacle. Example: S12001-P
- F For connector pair with flanged, panel-mount receptacle. Example: S12001-F

See Options for a more detailed description.

Wiring Diagram:



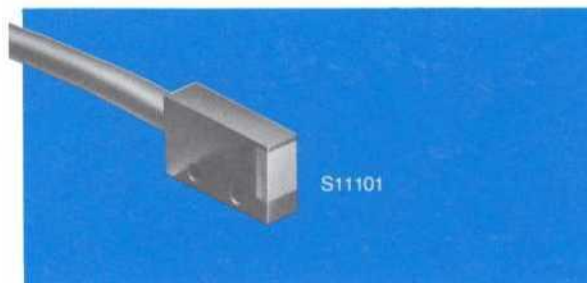


REFLECTIVE SKANNERS

Miniature LED S111 Series PLASTI-SKAN®

Features:

- Smallest Detectable Object: .06 in.
- Optimum Distance to Target: .15 in.
- Field of View: .18 in.
- Maximum Usable Distance: 1.3 in.
- Glass filter blocks visible ambient light
- Sealed cover glass



Description:

The PLASTI-SKAN is an inexpensive scanner suitable for general use where metal units are not considered necessary. Quality components and construction assure Skan-A-Matic's usual reliability and long life, and the use of a Light Emitting Diode provides

excellent shock and vibration resistance. An infrared filter blocks ambient light to the photodetector and serves to keep out dust and contamination.

Typical Applications:

- Proximity detection
- Web break detection
- End of tape detection
- General purpose skanning

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	40 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	80 mA max., 50% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	940 nm

PHOTODETECTOR

Operating Voltage	30 VDC max.
Response Time	See Response Time Chart under Technical Information

Spectral Response	910 nm peak; filtered to respond to less than 5% at 700 nm and less than 0.1% at 600 nm
BODY	Black plastic

TEMPERATURE

Operating: 0° to 50°C
Storage: -40° to 50°C

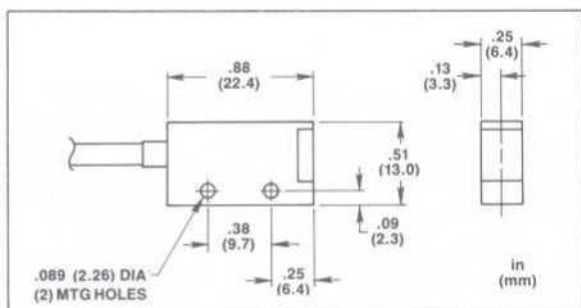
LEADS

4 cond. 26 AWG., PVC covered cable with shield, 6 ft. long, Type G

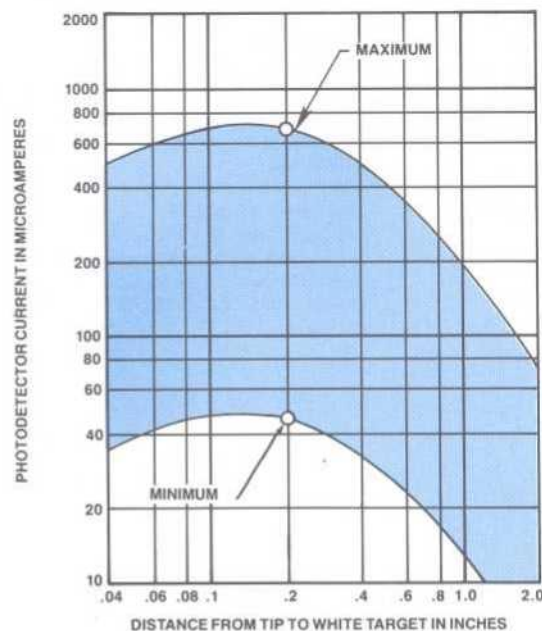
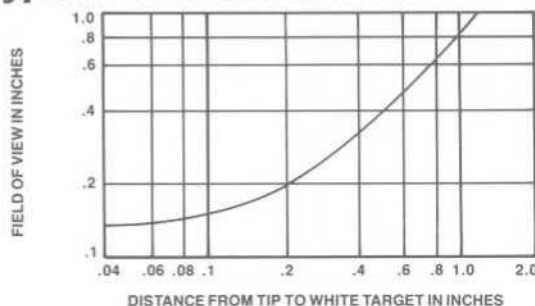


S111 Series

Dimensions:



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The PLASTI-SKAN is compatible with most Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

This skanner utilizes a 40 mA Light Emitting Diode. A 100 ohm, 1/4 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42, a 27 ohm, 1/4 W current limiting resistor must be used. The S111 Series is not compatible with the R43/T43 modulating controls.

Model Selection Guide:

Part #	Description
S11101	Standard Unit

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

SHIELDED QUAD

Four conductor, 26 gauge, Teflon covered cable with shielded photodetector leads and overall shield. Order by adding the suffix -J. Example: S11101-J

PROTECTIVE SHEATH

Can be factory installed over Shielded Quad. It is not necessary to order the Shielded Quad separately; it is included with the protective sheath at no extra charge. Order by adding the suffix as follows:

-S For square locked stainless steel armor, 3/16" O.D. Example: S11101-S

CONNECTOR

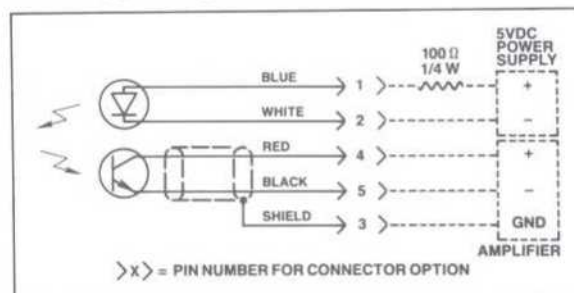
The S111 Series skanner is available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

-P For connector pair with in-line receptacle. Example: S11101-P

-F For connector pair with flanged, panel-mount receptacle. Example: S11101-F.

See Options for a more detailed description.

Wiring Diagram:





REFLECTIVE SKANNERS

Subminiature LED S13 Series

Features:

- Smallest Detectable Object: .04 in.
- Optimum Distance to Target: .30 in.
- Field of View: .11 in.
- Maximum Usable Distance: 1.5 in.
- Small size
- Two body styles
- Shock and vibration resistant



Description:

The S13 Series includes some of the smallest skanners in the industrial sensing market. These LED units provide shock and vibration resistance, long life, and dependable operation in economical, ready to mount packages. Two body styles are available.

The S13224 and S13324 utilize infrared Light Emitting Diodes. In each, the LED energy is focused through a collimating lens and a specially matched photodetector is used to obtain optimum performance. A filter over the photodetector blocks out visible light.

Typical Applications:

- Parts inspection
- Tachometer pickup
- Unprocessed film sprocket hole detection
- General purpose sensing

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	60 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	120 mA max., 50% duty cycle at 1 kHz in.
Reverse Voltage	2 V max.
Spectral Emission	940 nm peak

PHOTODETECTOR

Operating Voltage	30 VDC max.
Response Time	See Response Time Chart under Technical Information
Spectral Response	910 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm

BODY

TEMPERATURE

LEADS

Black anodized aluminum

Operating: 0° to 50°C

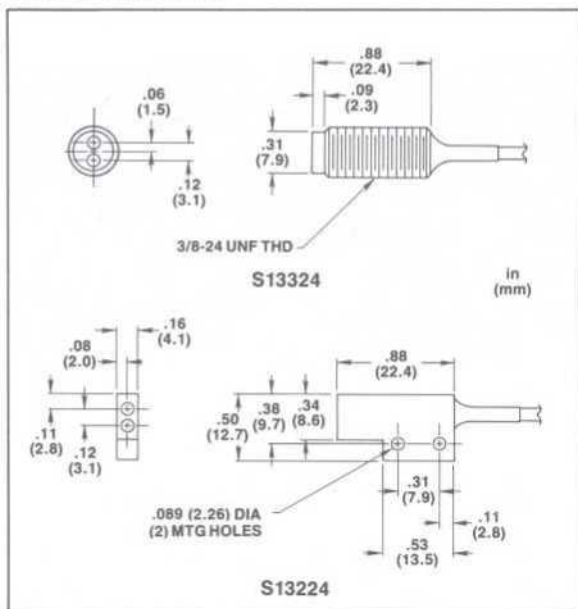
Storage: -40° to 50°C

4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)

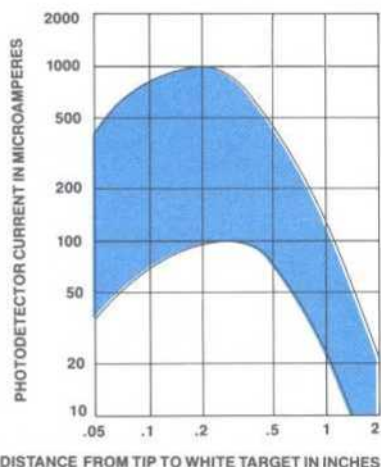
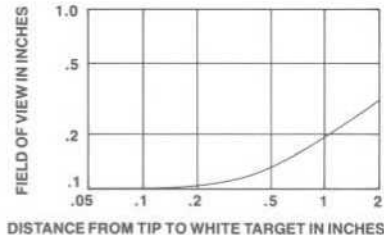


S13 Series

Dimensions:



Typical Performance Chart:



Compatibility With Controls:

The S13224 and S13324 are compatible with all Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

These skanners utilize a 60 mA Light Emitting Diode. A 68 ohm, 1/2 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, a 6.8 ohm, 1/4 W current limiting resistor must be used.

Model Selection Guide:

Part #	Description
S13224	Rectangular body skanner
S13324	Threaded body skanner

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

PROTECTIVE SHEATH

Available on S13324 only. Can be factory installed over standard Type J lead (Shielded Quad). Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S13324-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S13324-S

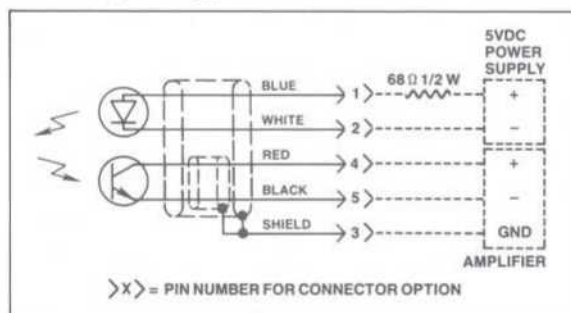
CONNECTOR

The S13 Series skanner is available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows.

- P For connector pair with in-line receptacle. Example: S13224-P
- F For connector pair with flanged, panel-mount receptacle. Example: S13224-F

See Options for a more detailed description.

Wiring Diagram:





REFLECTIVE SKANNERS

Coaxial Fiber Optic S30 Series SKAN-COAX®

Features:

- Smallest Detectable Object: .04 in.
- Optimum Distance to Target: .10 in.
- Field of View: .10 in.
- Maximum Usable Distance: .6 to 1.0 in.
- Most versatile unit
- Coaxial optical system
- Lamp, IR LED, or Visible Red LED Versions
- Fiber optic illumination



S30 Series

Description:

The SKAN-COAX® is a versatile coaxial fiber optic scanner that has been a best seller for years. No other scanner in our product line offers so many options or body styles.

The light source, lamp, IR LED, or Visible Red LED, is located in the backbody where its heat can be dissipated by the rugged aluminum housing. Light is transmitted to the barrel tip by a bundle of glass fibers. The photodetector is located at the center of the barrel

tip with the illuminating fibers surrounding it. This construction ensures efficient light collection by the photodetector for a high light/dark contrast.

The coaxial fiber optic illumination gives evenly distributed light for highly predictable results at any orientation. This construction allows the tip to remain at ambient temperature so that the optical surfaces remain relatively free of air-borne dust.

Typical Applications:

- For inspection and sorting
- Accurate edge and position control
- Registration mark detection
- Encoders
- Web break detection
- Counting
- End of tape detection
- Small part detection
- Detecting semiconductors
- General purpose sensing

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—IR LED

Input 100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 1 A max., 10% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

LIGHT SOURCE—VISIBLE RED LED

Input 50 mA max. with resultant voltage drop of 1.8 VDC typical; derate at 1 mA per degree above 25°C ambient

Modulated Input 80 mA max., 50% duty cycle at 1 kHz min.

Reverse Voltage 4 V max.

Spectral Emission 660 nm peak

PHOTODETECTOR

Operating Voltage 30 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

FILTER (optional) Transmits less than 5% at 750 nm and less than 0.1% at 700 nm

BODY Lamp Unit: Blue anodized aluminum
IR LED Unit: Red anodized aluminum
Visible Red LED:

Black anodized aluminum
LED Unit: Red anodized aluminum

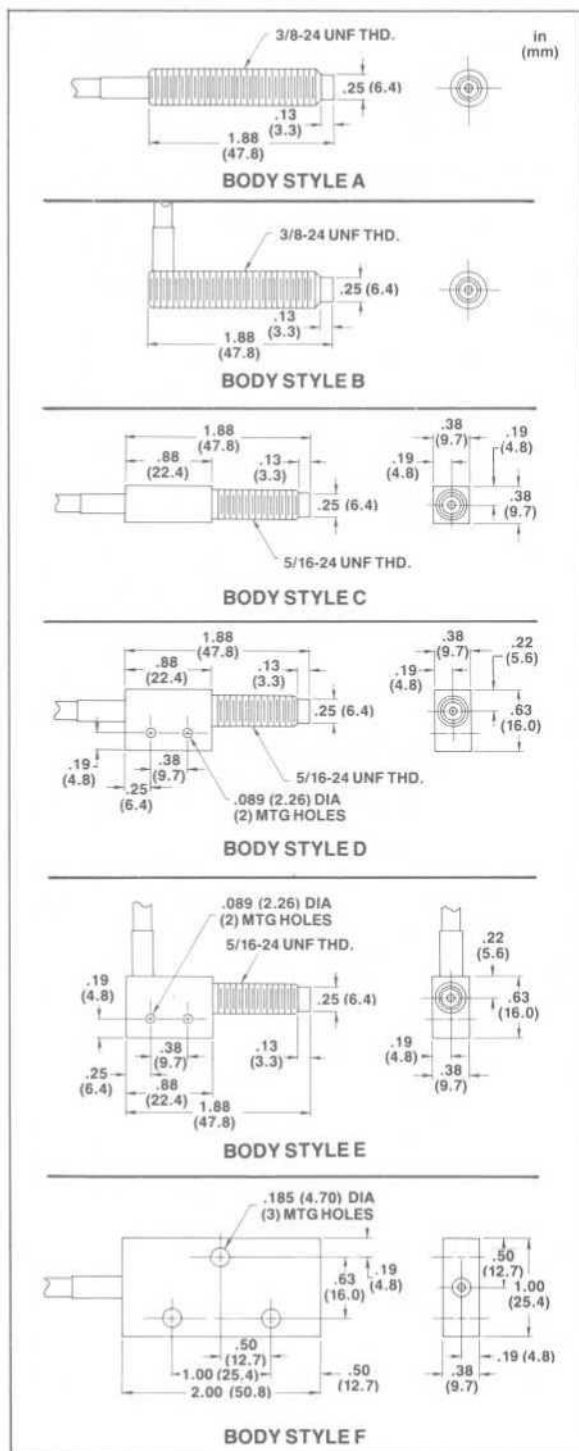
TEMPERATURE Operating: 0° to 50°C
Storage: -40° to 50°C

LEADS 4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)

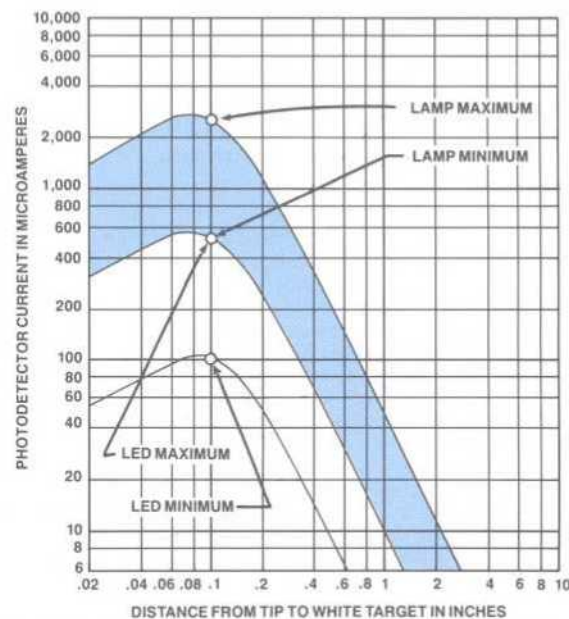
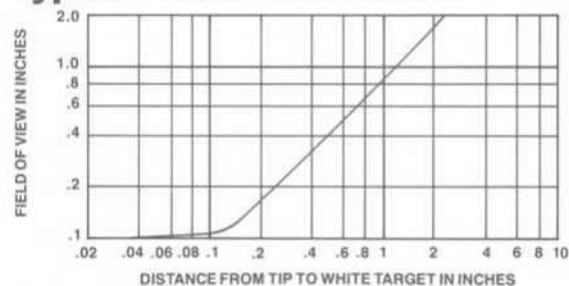


S30 Series

Dimensions:



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The S30 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED scanners only. For high speed operation use the T41300 High Speed Amplifier.

The **IR LED** versions of these series utilize a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.

The **visible red LED** versions of these series utilize a 50 mA Light Emitting Diode. A 68 ohm, 1/2 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, a 6.8 ohm, 1/4 W current limiting resistor must be used.



S30 Series

Model Selection Guide:

To specify the S30 Series skanner construct a six digit part number denoting body style, light source, and filtered or unfiltered unit. Construct part number as follows.

Part # S 3					
Body* Style	Use #	Light Source	Filter	Use #	
A	010	Lamp	No	1	
B	011	IR LED	No	4	
C	110	Lamp	Yes	5	
D	220	IR LED	Yes	6	
E	225	Visible red LED	No	8	
F	310				

* Refer to Dimensions for Body Style.

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

PROTECTIVE SHEATH

Can be factory installed over standard Type J lead (Shielded Quad) only. Order by adding suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S30101-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S30101-S

CONNECTOR

The S30 Series skanner is available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows.

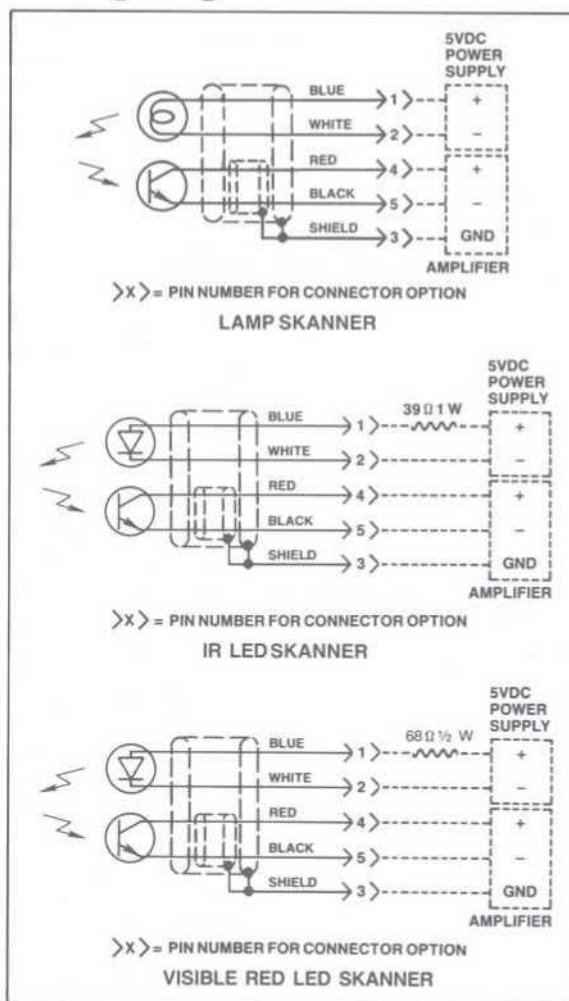
- P For connector pair with in-line receptacle. Example: S30101-P
- F For connector pair with flanged, panel-mount receptacle. Example: S30101-F

See Options for a more detailed description.

ADJUSTABLE FOCUS OPTICAL MAGNIFIER B05001

A lens system accessory designed for use with Type C, D and E body styles with lamp light sources. See Accessories for more detailed information.

Wiring Diagram:





REFLECTIVE SKANNERS

Subminiature S14/S15/S16 Series

Features:

- Smallest Detectable Object: .04 to .05 in.
- Optimum Distance to Target: .07 to .16 in.
- Field of View: .10 to .15 in.
- Maximum Usable Distance: .5 to 3.0 in.
- Side-looking model

Description:

The S14, S15, and S16 Series are the smallest incandescent reflective skanners in the Skan-A-Matic product line. The S14 Series offers a side-looking configuration which is useful for many applications where space is restricted or front-looking skanners



cannot be mounted easily. The S15 Series has a threaded barrel housing with a cover glass to protect the lamp and photodetector from contamination. Two models of the S16 include a collimating lens which helps produce a Maximum Usable Distance of 3 inches.

Typical Applications:

- Parts inspection
- Reflective sensing in restricted areas
- Tachometer pickup
- Film sprocket hole detection
- General purpose sensing

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

PHOTODETECTOR

Operating Voltage 20 VDC max.
Response Time See Response Time Chart under *Technical Information*

Spectral Response 910 nm peak

FILTER (optional) Transmits less than 5% at 750 nm and less than 0.1% at 700 nm

BODY Gold anodized aluminum or passivated brass — see Model Selection Guide

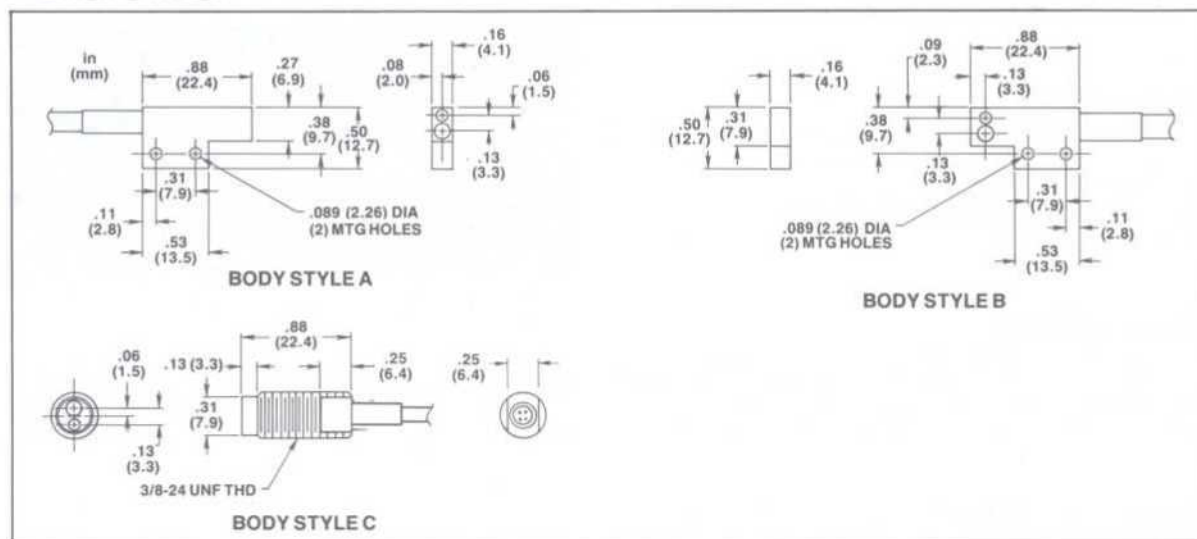
TEMPERATURE Operating: 0° to 50°C
Storage: -40° to 50°C

LEADS 4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)



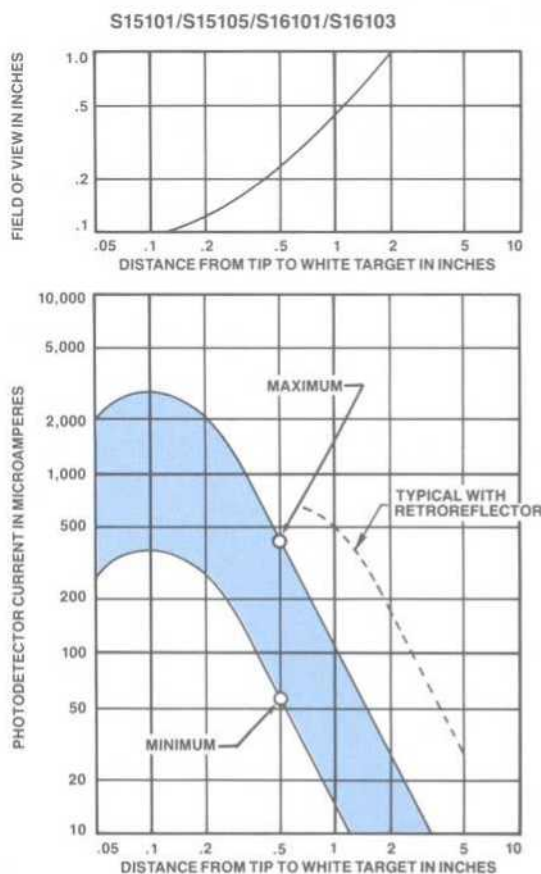
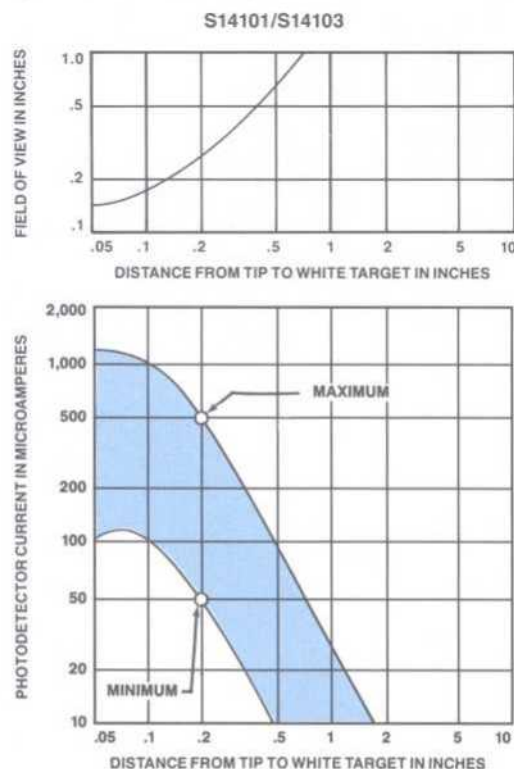
S14/S15/S16 Series

Dimensions:



Typical Performance Chart:

The dashed line shows the typical current with a 7/8" diameter retroreflector. If there is no dashed line, the use of a retroreflector is not recommended. Circles indicate guaranteed test limits. See Quality Control under *Technical Information*, pg. 16.

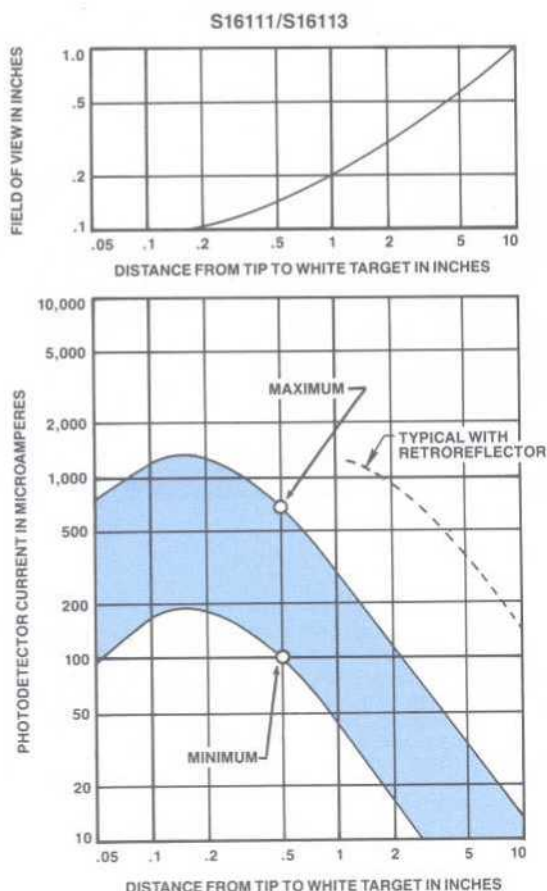


Phone 800-448-2900

Fax 800-223-5138



S14/S15/S16 Series



Variations:

LEADS

Extra lead lengths available. See pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

CONNECTOR

The S14, S15, and S16 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows.

-P For connector pair with in-line receptacle. Example: S14101-P

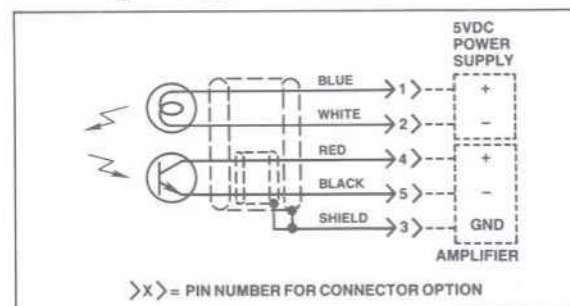
-F For connector pair with flanged, panel-mount receptacle. Example: S14101-F

See Options for a more detailed description.

RETROREFLECTIVE TAPE and RETROREFLECTIVE DISCS

Available — see Accessories.

Wiring Diagram:



Compatibility With Controls:

The S14, S15 and S16 Series are compatible with all Skan-A-Matic controls except modulating controls which are used with LED skanners only. For high speed operation use the T41300 High Speed Amplifier.

Model Selection Guide:

Part#	Smallest Detectable Object	Optimum Distance to Target	Field of View	Maximum Usable Distance	Body	Body Style	Filter
S14101	.050"	.07"	.15"	.4"	Aluminum	B	No
S14103	.050"	.07"	.15"	.4"	Aluminum	B	Yes
S15101	.035"	.10"	.10"	1.2"	Brass	C	No
S15105	.035"	.10"	.10"	1.2"	Brass	C	Yes
S16101	.035"	.10"	.10"	1.2"	Aluminum	A	No
S16103	.035"	.10"	.10"	1.2"	Aluminum	A	Yes
S16111	.035"	.16"	.11"	3.0"	Aluminum	A	No
S16113	.035"	.16"	.11"	3.0"	Aluminum	A	Yes



REFLECTIVE SKANNERS

Subminiature LED S27 Series MICRO-SKAN®

Features:

- Smallest Detectable Object: .01 in.
- Optimum Distance to Target: .02 in.
- Field of View: .03 in.
- Maximum Usable Distance: .20 in.
- Small size
- Four styles available
- Printed circuit board mount available
- LED light source
- Coaxial optical system
- Filtered photodetector
- Low cost



Description:

The MICRO-SKAN is a small but complete scanner of simple appearance and economic design, specifically intended for the OEM and high volume industrial market. The unit has excellent shock and vibration resistance and inherent long life. Its quality, performance and reliability meet the high standards of all Skan-A-Matic products. The LED directs infrared energy through a formed epoxy lens to the target. The reflected energy is received by a fiber optic rod at the lens center, then passes through an ambient light

filter to the photodetector.

The S27301 illustrated above is housed in a type TO-18 plated steel can with four gold-plated copper leads. The rigid leads of the basic unit may be plugged into a mating socket or be soldered to a printed circuit board. MICRO-SKAN is also available in a threaded aluminum housing, in a side mounted aluminum block, or already mounted on a P.C. board.

Typical Applications:

- Edge control
- EOT and BOT detectors
- Registration mark sensing
- Small part detection
- Wire break sensing
- Punch card reading

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	60 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	120 mA max., 50% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	880 nm

PHOTODETECTOR

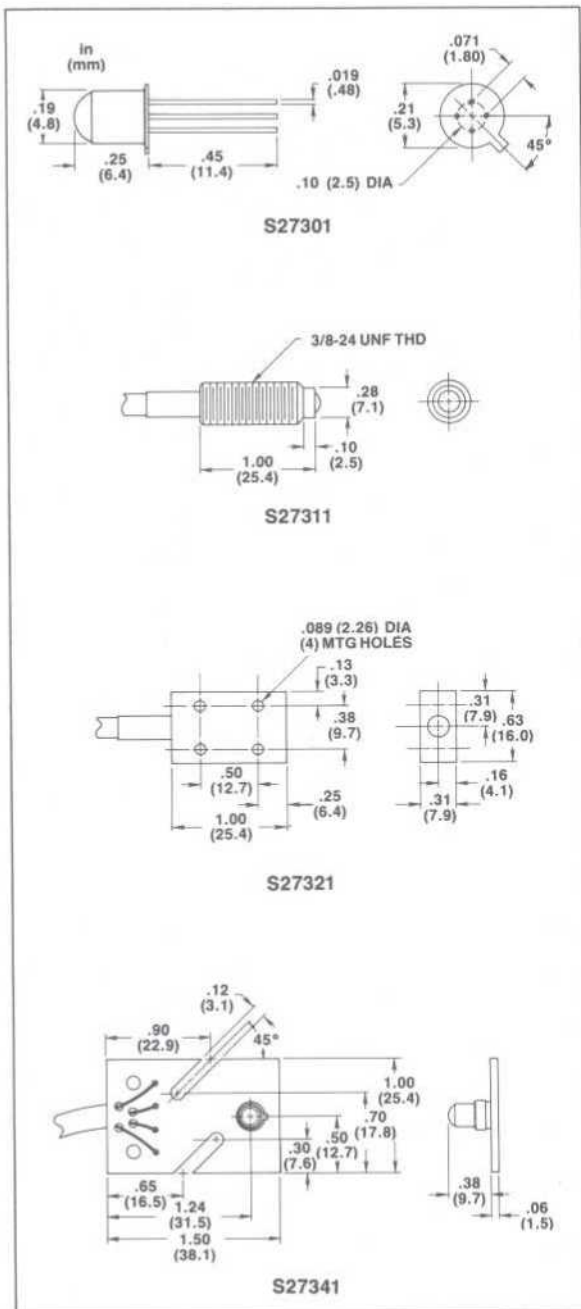
Operating Voltage	30 VDC max.
Response Time	See Response Time Chart under Technical Information
Spectral Response	880 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm
Optical Centering	Optical and mechanical axis coincide within $\pm .010^{\circ}$
BODY	See Model Selection Guide
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	See Model Selection Guide

Phone 800-448-2900

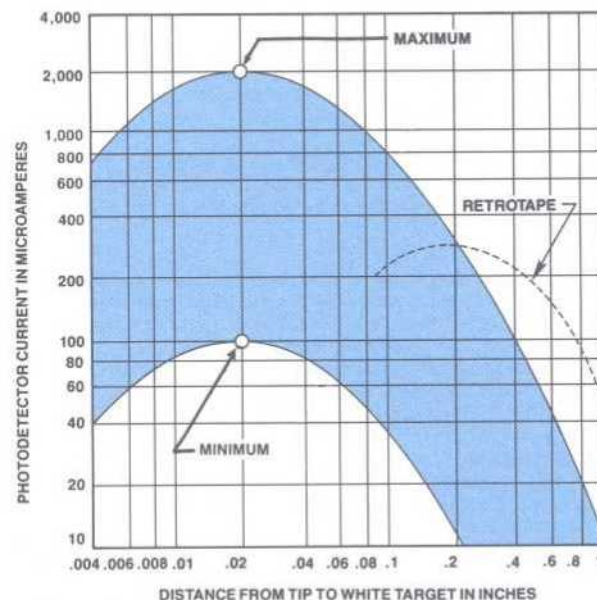
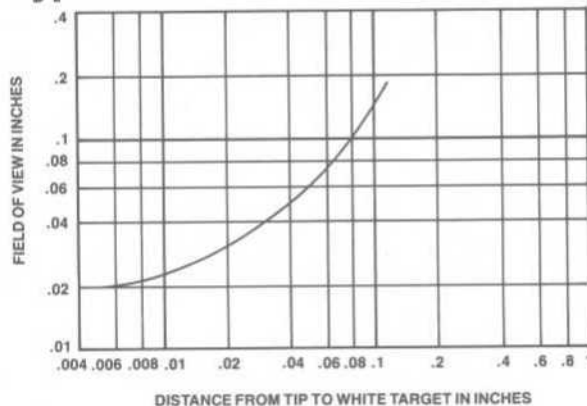
Fax 800-223-5138

S27 Series

Dimensions:



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The S27 Series is compatible with most Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

These skanners utilize a 60 mA Light Emitting Diode. A 68 ohm, 1/2 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42, a 6.8 ohm, 1/4 W current limiting resistor must be used. The S27 Series is not compatible with the R43/T43 modulating controls.



S27 Series

Model Selection Guide:

Part #	Description
S27301	Basic skanner housed in a TO-18 gold-plated steel can with epoxy lens and four gold-plated copper leads

The following models house the basic S27301 skanner and have 6 ft. of 4 conductor, 26 gauge, PVC covered cable with shield. Type G:

Part #	Description
S27311	Threaded aluminum housing
S27321	Side mount aluminum housing
S27341	Glass epoxy printed circuit board mounted

Variations:

LEADS

Extra lead lengths available on the S27311, S27321, and S27341. Use Type G — see pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths on the S27311, S27321 and S27341 — see pg. 129.

SHIELDED QUAD

Four conductor, 26 gauge, Teflon covered cable, with shielded photodetector leads and overall shield available on the S27311, S27321 and S27341. Order by adding the suffix -J. Example: S27311-J

PROTECTIVE SHEATH

Can be factory installed over Shielded Quad on the S27311 and S27321. It is not necessary to order the Shielded Quad separately; it is included with the protective sheath at no extra charge. Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S27311-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S27311-S

CONNECTOR

The S27311, S27321 and S27341 are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

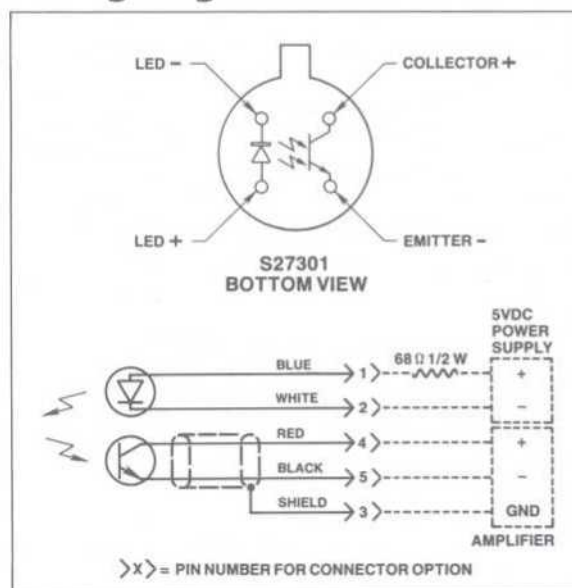
- P For connector pair with in-line receptacle. Example: S27311-P
- F For connector pair with flanged, panel-mount receptacle. Example: S27311-F

See *Options* for a more detailed description.

RETROREFLECTIVE TAPE and RETROREFLECTIVE DISCS

Available — see *Accessories*.

Wiring Diagram:





REFLECTIVE SKANNERS

Fiber Optic S51/S52 Series MINI-SKAN®

Features:

- Smallest Detectable Object: .011 in.
- Optimum Distance to Target: .030 in.
- Field of View: .033 in.
- Maximum Usable Distance: .100 in.
- Coaxial optical system
- Lamp, IR LED, or Visible Red LED Versions
- LED can be modulated
- Three body styles available
- High temperature tip



Description:

Light from the lamp or LED located in the back body is transmitted coaxially to the target through the outer ring of glass fibers in the threaded barrel. Light then reflects from the target back

through the inner fiber optic bundle to the photodetector in the backbody. This provides maximum light to dark contrast and the most efficient return of light to the sensor.

Typical Applications:

- For inspection and sorting
- Detecting semiconductors
- Encoders
- Small parts handling
- Accurate edge and position control
- Robotics

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—IR LED

Input 100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 1 A max., 10% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

LIGHT SOURCE—VISIBLE RED LED

Input 50 mA max. with resultant voltage drop of 1.8 VDC typical; derate at 1 mA per degree above 25°C ambient

Modulated Input 80 mA max., 50% duty cycle at 1 kHz min.

Reverse Voltage 4 V max.

Spectral Emission 660 nm peak

PHOTODETECTOR

Operating Voltage 20 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

FILTER (optional) Transmits less than 5% at 700 nm and less than 0.1% at 600 nm

BODY Aluminum, black for lamp units, red for IR and visible red LED units. Passivated brass barrel

TEMPERATURE Operating: Body 0° to 50°C

Tip: -40° to 125°C

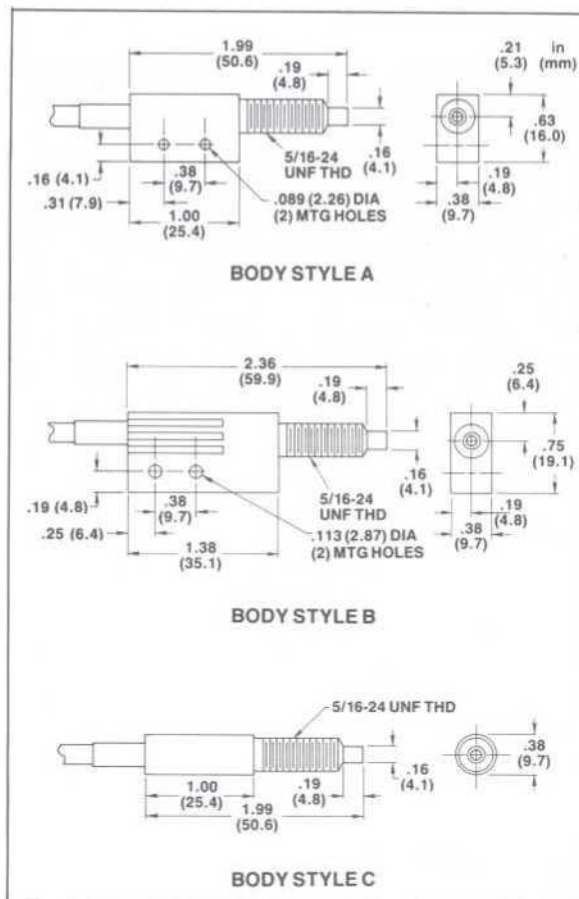
Storage: -40° to 50°C

LEADS 4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)

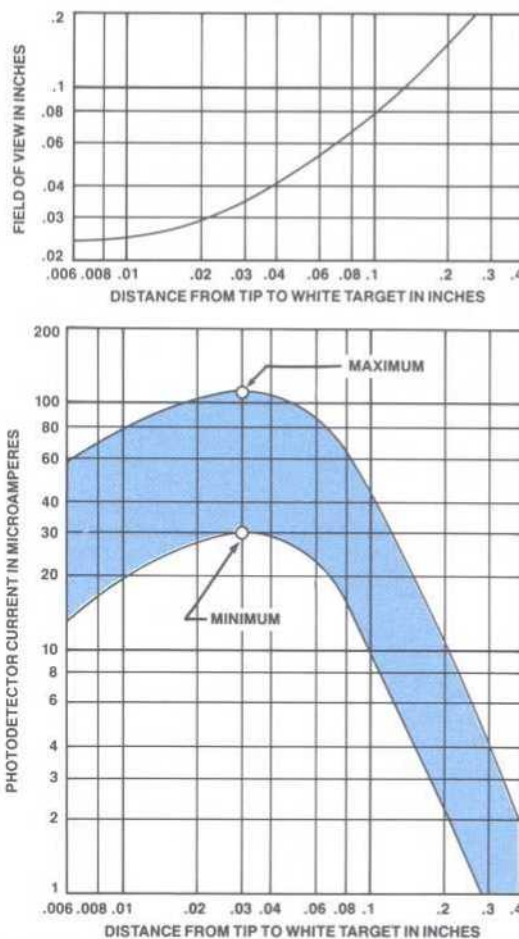


S51/S52 Series

Dimensions:



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The S51 and S52 Series are compatible with all Skan-A-Matic controls except modulating controls which are used with LED skanners only. For high speed operation use the T41300 High Speed Amplifier.

The **IR LED** versions of this series utilize a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.

The **visible red LED** versions of this series utilize a 50 mA Light Emitting diode. A 68 ohm, 1/2 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, a 6.8 ohm, 1/4 W current limiting resistor must be used.



S51/S52 Series

Model Selection Guide:

Part #	Light Source	Body Style	Filter
S51101	Lamp	A	No
S51105	Lamp	A	Yes
S51104	IR LED	B	No
S51106	IR LED	B	Yes
S51108	Visible red LED	B	No
S52101	Lamp	C	No
S52105	Lamp	C	Yes

Variations:

LEADS

Extra lead lengths available. See pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

PROTECTIVE SHEATH

Can be factory installed over standard Type J lead (Shielded Quad). Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S51101-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S51101-S

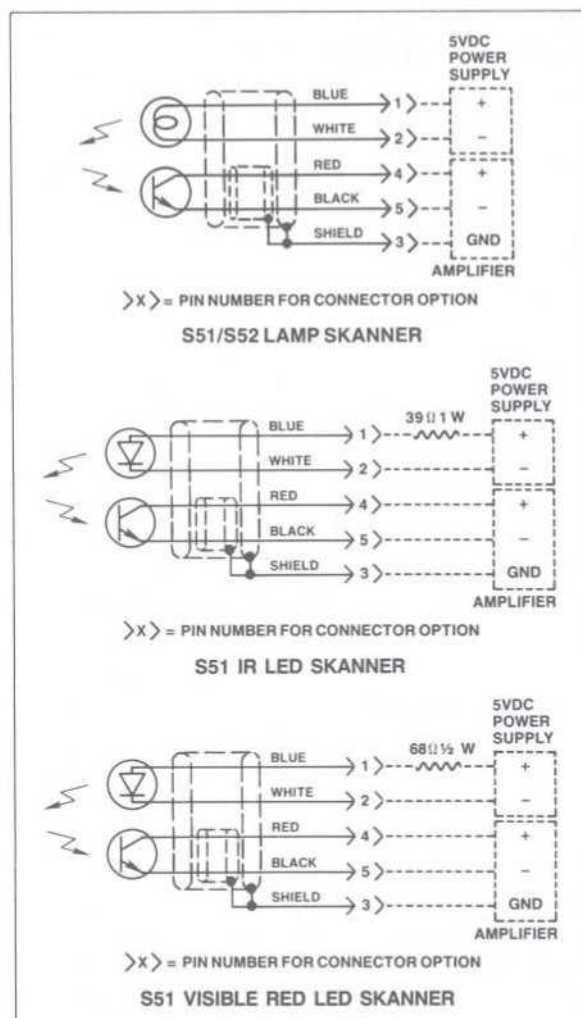
CONNECTOR

The S51 and S52 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

- P For connector pair with in-line receptacle. Example: S51101-P
- F For connector pair with flanged, panel-mount receptacle. Example: S51101-F

See *Options* for a more detailed description.

Wiring Diagram:





REFLECTIVE SKANNERS

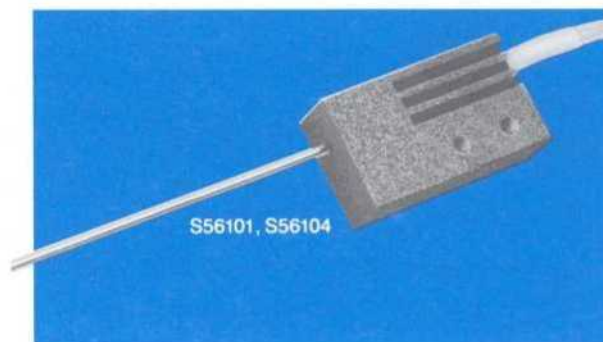
Fiber Optic Flexible Snout

S56 Series

NANO-SKAN®

Features:

- Smallest Detectable Object: .007 in.
- Optimum Distance to Target: .010 in.
- Field of View: .020 in.
- Maximum Usable Distance: .070 in.
- Coaxial optical system
- Lamp, IR LED, or Visible Red LED Versions
- Available with snout lengths to 12 in.
- Formable snout
- Works in places normally inaccessible to other skanners
- High temperature tips, operable up to 200°C



Description:

Light from the lamp or LED located in the backbody is transmitted coaxially to the target through the outer ring of glass fibers in the formable snout. Light then reflects from the target back through the inner fiber optic bundle to the photodetector in the backbody. This provides maximum light to dark contrast and the most efficient return of light to the sensor.

The semi-rigid snout containing the coaxial fiber bundle can be bent easily by hand to position the tip at the target and the desired shape is self-retaining. The snout tip is hardened stainless steel to enable clamping with a nylon set screw. An aluminum backbody acts as heat sink to minimize sensor drift due to lamp heat.

Typical Applications:

- For inspection and sorting
- Detecting semiconductors
- Encoders
- Small parts handling
- Accurate edge and position control
- Vibratory bowl Feeders

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—IR LED

Input 100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 1 A max., 10% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

LIGHT SOURCE—VISIBLE RED LED

Input 50 mA max. with resultant voltage drop of 1.8 VDC typical; derate at 1 mA per degree above 25°C ambient

Modulated Input 80 mA max., 50% duty cycle at 1 kHz min.

Reverse Voltage 4 V max.

Spectral Emission 660 nm peak

PHOTODETECTOR

Operating Voltage 20 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

FILTER (optional) Transmits less than 5% at 700 nm and less than 0.1% at 600 nm

BODY Aluminum/plastic composite — black for lamp units, red for IR and visible red LED units.

TEMPERATURE Operating: Body 0° to 50°C

Tip -40° to 200°C

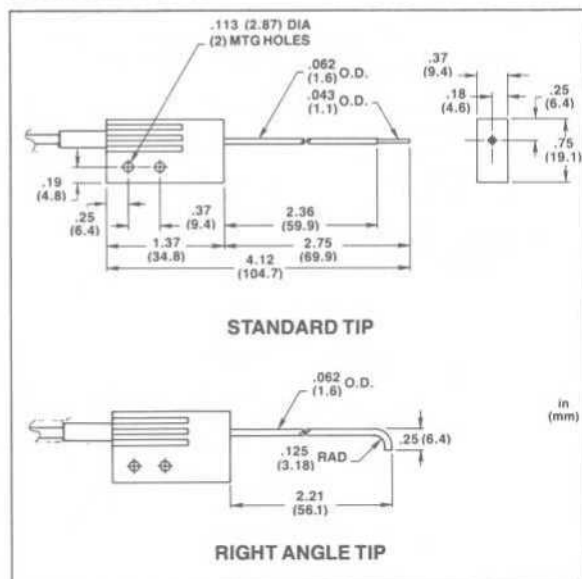
Storage: -40° to 50°C

LEADS 4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)



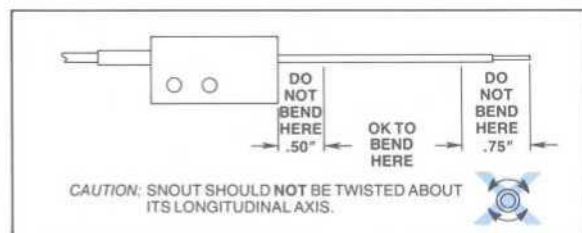
S56 Series

Dimensions:

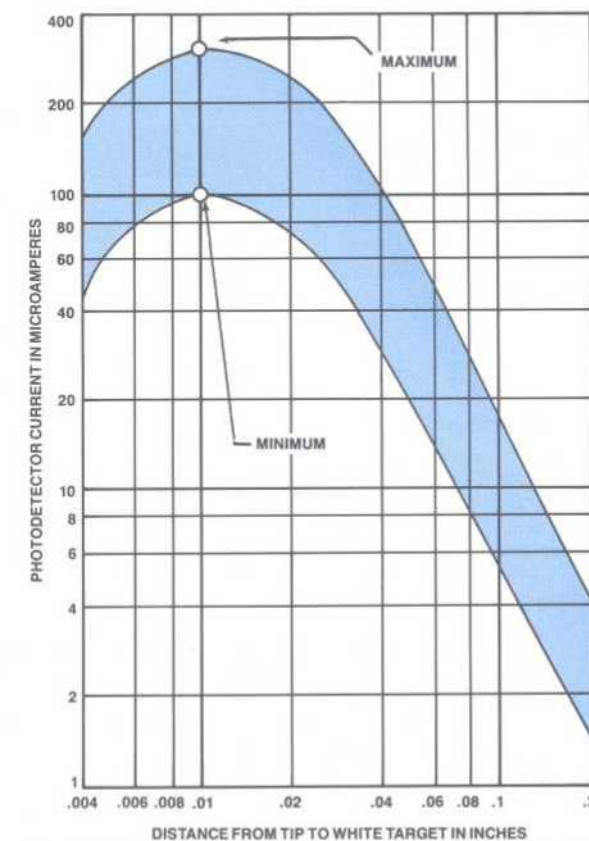
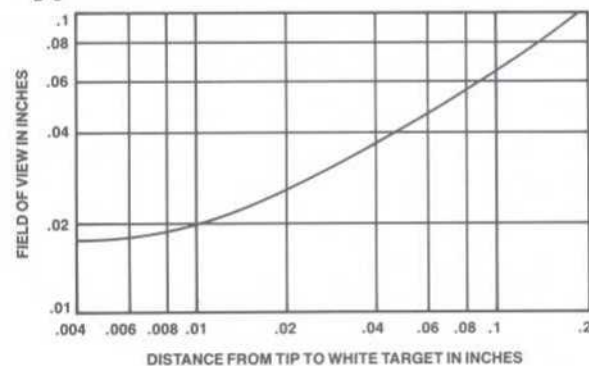


FORMING SNOOT

CAUTION: DO NOT USE PLIERS OR SHARP CORNERS FOR FORMING. Use of pliers or sharp corners for forming will destroy units. Bend snout by hand on a pencil or similar cylindrical object that is .25" diameter or larger. The snout is annealed stainless steel and will work harden if bent repeatedly.



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.



S56 Series

Compatibility With Controls:

The S56 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED skanners only. For high speed operation use the T41300 High Speed Amplifier.

The **IR LED** versions of this series utilize a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.

The **visible red LED** versions of this series utilize a 50 mA Light Emitting diode. A 68 ohm, 1/2 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, a 6.8 ohm, 1/4 W current limiting resistor must be used.

Model Selection Guide:

To specify the S56 Series skanner construct a six digit part number denoting snout style, light source, and filtered or unfiltered unit. Construct part number as follows.

Part # S 5 6

Snout Style	#
Semi-rigid	1
Semi-rigid with right angle tip	2
Flexible monocoil. Overall length 4.5"	4

Light Source	Filter	#
Lamp	No . . .	01
Lamp	Yes . . .	02
IR LED	No . . .	04
IR LED	Yes . . .	05
Visible red LED	No . . .	08

Variations:

LEADS

Extra lead lengths available. See pg. 129.

SNOUTS

Lengths from .500 in. to 12 in. maximum are available. Contact factory.

Snouts can be factory-formed to customer specifications.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

PROTECTIVE SHEATH

Can be factory installed over standard Type J lead (Shielded Quad) only. Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S56101-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S56101-S

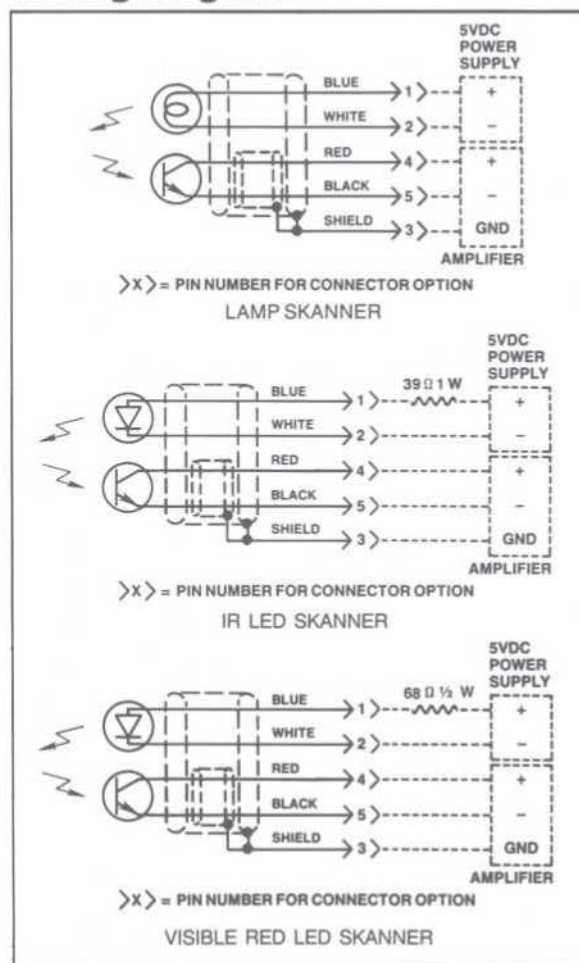
CONNECTOR

The S56 Series skanner is available with the connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

- P For connector pair with in-line receptacle. Example: S56101-P
- F For connector pair with flanged, panel-mount receptacle. Example: S56101-F

See Options for a more detailed description.

Wiring Diagram:



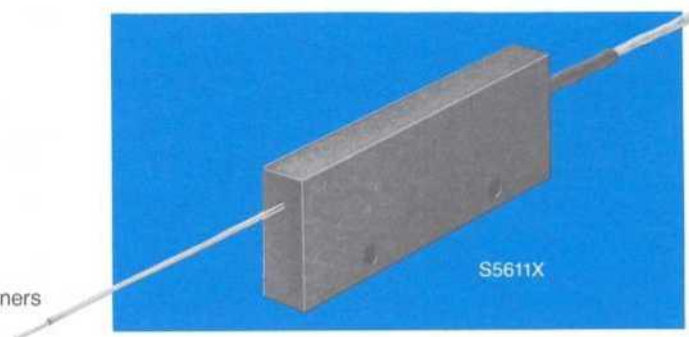


REFLECTIVE SKANNERS

High Speed NANO-SKAN[®] with Preamp S56 Series

Features:

- Smallest Detectable Object: .007 in.
- Optimum Distance to Target: .010 in.
- Field of View: .020 in.
- Maximum Usable Distance: .070 in.
- Available with snout lengths to 12 in.
- Formable snout
- Works in places normally inaccessible to other skanners
- High temperature tips, operable up to 200°C



Description:

The High Speed Nano-Skan[®] is a high resolution scanner designed for applications where target size and/or speed of movement are beyond the capability of standard sensors. In addition to the photodiode normally used, a preamplifier is included to boost the signal level, accelerate the response, and convert the output to a more easily used linear voltage.

It should be emphasized that, though a preamp is included, each

scanner requires an amplifier to be able to switch a load. Standard Skan-A-Matic current amplifiers may not be used but a special voltage T44000 control is now available for this purpose. This is a complete control which requires only 115VAC input and has a response time of 20 microseconds. This time should be added to the speed of the selected scanner to obtain the response of the scanner/amplifier combination.

Specifications: (at 25°C)

INPUT POWER See Model Selection Guide

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—IR LED

Input 100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 1 A max., 10% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

OUTPUT See Model Selection Guide

SPECTRAL RESPONSE See Model Selection Guide

RESPONSE SPEED See Model Selection Guide

BODY

TEMPERATURE

Aluminum/plastic composite

Operating: Body

0° to 50°C

Tip

-40° to 200°C

Storage: -40° to 50°C

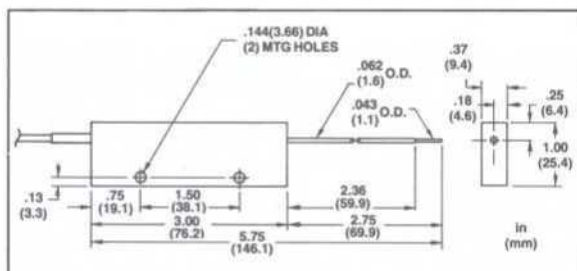
LEADS

4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)



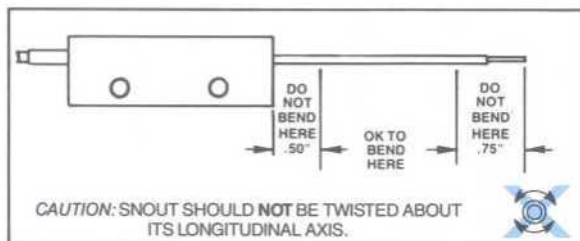
S56 Series

Dimensions:

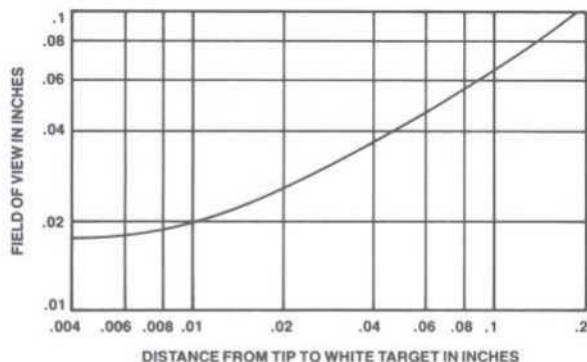


FORMING SNOOT

CAUTION: DO NOT USE PLIERS OR SHARP CORNERS FOR FORMING. Use of pliers or sharp corners for forming will destroy units. Bend snout by hand on a pencil or similar cylindrical object that is .25" diameter or larger. The snout is annealed stainless steel and will work harden if bent repeatedly.



Typical Performance Chart:



Model Selection Guide:

SPECIFICATION

SKANNER CATALOG NUMBER

	S56110	S56111	S56112	S56113
Light Source	Lamp	Lamp	LED	Lamp
Color Filters	No	No	No	Yes
IR Filter	No	No	Yes	No
Input Current				
at +5VDC $\pm 10\%$	130mA	130mA	50mA	130mA
at -5VDC $\pm 10\%$	10mA	10mA	10mA	10mA

Output Voltage at Optimum Distance to Target

Max:	.12V	2.00V	.12V	2.00V
Min:	.03V	.50V	.03V	.50V

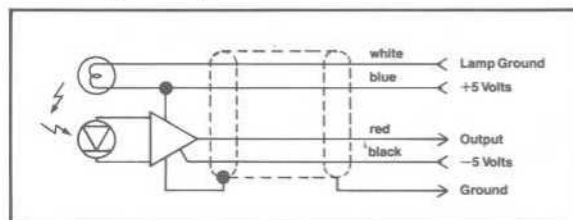
Dark Output-	Max: .01V	.03V	.01V	.03V
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Spectral Response

Peak	800nm	800nm	940nm	600nm
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Response Speed	3 μ sec	20 μ sec	20 μ sec	100 μ sec
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Wiring Diagram:





REFLECTIVE SKANNERS

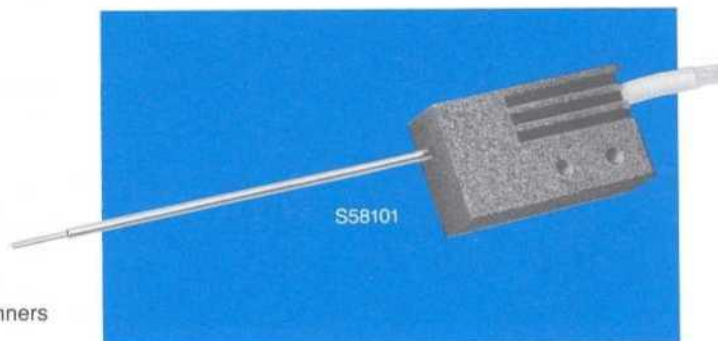
Fiber Optic Flexible Snout

S58 Series

PICO-SKAN®

Features:

- Smallest Detectable Object: .004 in.
- Optimum Distance to Target: .006 in.
- Field of View: .012 in.
- Maximum Usable Distance: .020 in.
- Coaxial optical system
- Available with snout lengths to 12 in.
- Formable snout
- Works in places normally inaccessible to other skanners
- High temperature tip, operable up to 200°C



Description:

Light from the lamp located in the backbody is transmitted coaxially to the target through the outer ring of glass fibers in the formable snout. Light then reflects from the target back through the inner fiber optic bundle to the photodetector in the backbody. This provides maximum light to dark contrast and the most efficient return of light to the sensor.

The semi-rigid snout containing the coaxial fiber bundle can be bent easily by hand to position the tip at the target and the desired shape is self-retaining. The snout tip is hardened stainless steel to enable clamping with a nylon set screw. An aluminum backbody acts as heat sink to minimize sensor drift due to lamp heat.

Typical Applications:

- For inspection and sorting
- Detecting semiconductors
- Small parts handling
- Accurate edge and position control

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

PHOTODETECTOR

Operating Voltage 20 VDC max.
Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

BODY

Aluminum/plastic composite

TEMPERATURE

Operating: Body

0° to 50°C

Tip

-40° to 200°C

Storage: -40° to 50°C

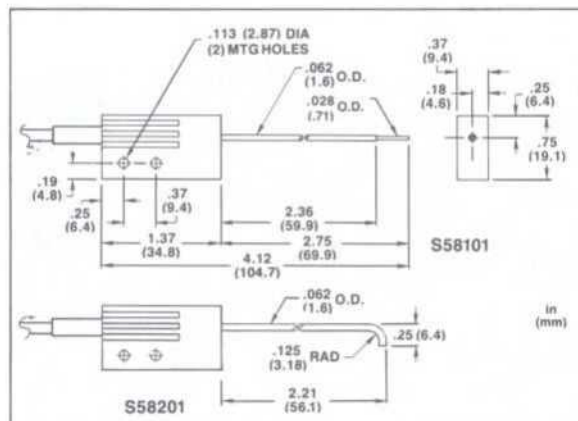
LEADS

4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)



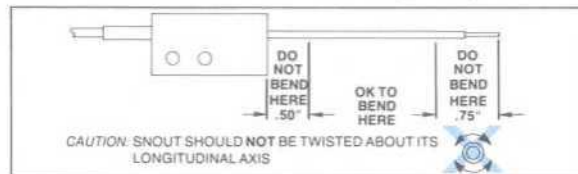
S58 Series

Dimensions:

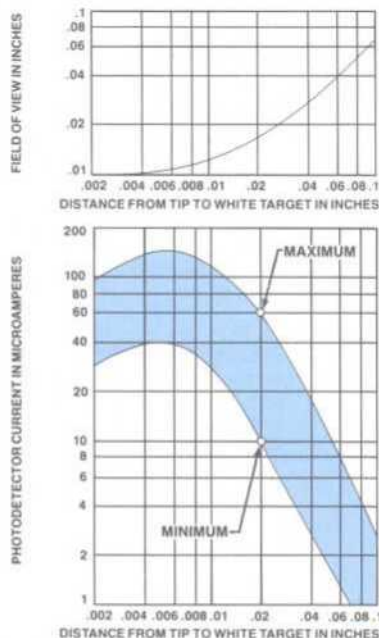


FORMING SNOOT

CAUTION: DO NOT USE PLIERS OR SHARP CORNERS FOR FORMING. Use of pliers or sharp corners for forming will destroy units. Bend snout by hand on a pencil or similar cylindrical object that is .25" diameter or larger. The snout is annealed stainless steel and will work harden if bent repeatedly.



Typical Performance Chart:



Circles indicate guaranteed test limits. See Quality Control under Technical Information, pg. 16.

Compatibility With Controls:

The S58 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED scanners only. For high speed operation use the T41300 High Speed Amplifier.

Model Selection Guide:

Part #	Description
S58101	Semi-rigid snout
S58201	Semi-rigid snout with right angle tip
S58401	Flexible monocoil snout. Overall length 4.5"

Variations:

LEADS

Extra lead lengths available. Use Type J — see pg. 129.

SNOUTS

Lengths from .500 in. to 12 in. maximum are available. Contact factory.

Snouts can be factory-formed to customer specifications.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

PROTECTIVE SHEATH

Can be factory installed over standard Type J lead (Shielded Quad) only. Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S58101-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S58101-S

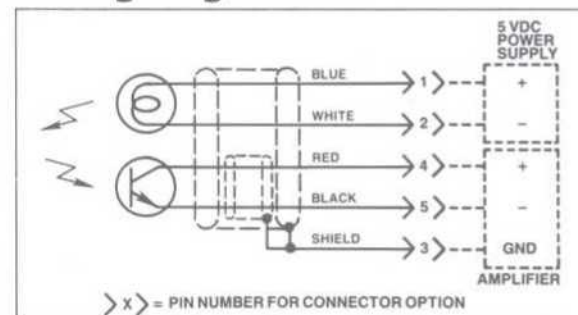
CONNECTOR

The S58 Series skanner is available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

- P For connector pair with in-line receptacle. Example: S58101-P
- F For connector pair with flanged, panel-mount receptacle. Example: S58101-F

See Options for a more detailed description.

Wiring Diagram:



Phone 800-448-2900

Fax 800-223-5138



Special Purpose Sensors

Special Purpose Sensors are designed for unusual situations where nothing else will do the job. These sensors are often of limited usefulness for applications other than the original design application. The S19 Sight Glass Skanner, for example, has only one known application—detecting the liquid column in a transparent sight glass tube.

The S28 Wafer-Skan was originally designed to detect silicon wafers for the semiconductor indus-

try but can be used for many short range applications. The S35 can be used to detect a predetermined color against a contrasting background. The S17, with its detachable fiber optic cables, can be used when skanning must be done in a hostile environment. The heat and chemical-resistant cables can be exposed to harsh conditions while the skanner body remains at a safe distance.

Special Purpose Sensor Selection Guide

Series	Optimum Distance to Target	Field of View	Light Source	Input Current (mA) Continuous/Modulated	Body	Mounting	Description	Page
S35 COLOR DETECTION SKANNER	10"	10"	Lamp	115	Aluminum	5/16-24THD .113" holes	Fiber optic skanner with current amplifier. Detects colored marks where contrast is adequate. Filter combinations for most colors. Maximum usable distance is .25", smallest detectable object is .03".	74
S28 WAFER-SKAN	.05"	N/A	LED	40/80	Aluminum	.093" holes	Fixed focus skanner sees specular reflection from smooth surfaces. Designed to detect silicon wafers.	76
S19 SIGHT GLASS SKANNER	N/A	N/A	Lamp	115	Aluminum	—	Semi-circular housing containing light source and detector. Clamps around transparent sight glass tubes. Detects presence of most liquids. 6 sizes to fit tubes from 1/4" TO 1" O.D.	78
S17L17/P17 ENVIRO-SKAN	See Description	See Description	Lamp LED	115 100/1000	Aluminum	Various	Detachable flexible fiber optic cables. Unit can be used as reflective skanner or as thru-beam pair. For hostile environments. High temperature cables withstand 200°C. With reflective cables: Smallest Detectable Object is .025" Optimum Distance to Target is .040" Field of View is .070" Maximum Usable Distance is from .10" to .50" With thru-beam cables: Smallest Detectable Object is .028" Beam Diameter is .080" Rated Separation is from .5" to 2.0"	80



SPECIAL PURPOSE SENSORS

Color Detection Scanner S35 Series

Features:

- Smallest Detectable Object: .03 in.
- Optimum Distance to Target: .10 in.
- Field of View: .10 in.
- Maximum Usable Distance: .25 in.
- Color mark detection
- Coaxial optical system
- Three models for different color sensitivity



Description:

The S35 Series Color Detection Scanner is designed to detect a wide range of colored marks including blue, green, yellow, orange and red. The units contain an incandescent lamp, a photodetector, a combination of optical filters, and feature the fiber optic construction of the S30 Series SKAN-COAX. Because there is usually a low optical contrast between a colored mark and its background, a sim-

ple, one stage current amplifier boosts the photodetector current.

Light from the backbody is transmitted coaxially through the outer ring of glass fibers to the colored mark. Light then reflects from the target surface, through the filters, to the photodetector located in the tip of the threaded barrel.

Typical Applications:

- Detection of "eye marks" on packaging material
- Orientation of toothpaste tubes for sealing

- Detection of marks that are transparent at infrared wavelengths

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

PHOTODETECTOR

Operating Voltage 15 VDC max.
Response Time See Response Time Chart under *Technical Information*
Spectral Response See Spectral Response Chart under *Colors in Technical Information*

BODY

Red anodized aluminum: S35201
 Blue anodized aluminum: S35202
 Black anodized aluminum: S35203

TEMPERATURE

Operating: 0° to 50°C
 Storage: -40° to 50°C

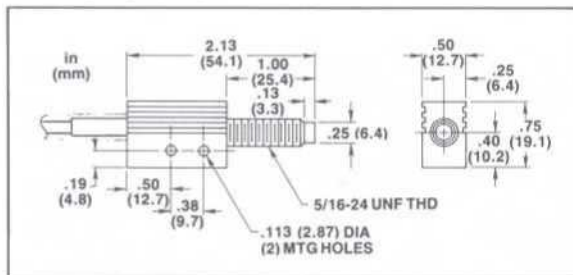
LEADS

4 cond. 26 AWG., teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)



S35 Series

Dimensions:



Color Selection Chart:

BACK-GROUND COLOR	MARK COLOR						
	Black	Red	Orange	Yellow	Green	Blue	White
Black	*	V ² B ²	V ² B ²	V ² B ²	V ² R ²	V ² R ²	V ² B ² R ²
Red	V ¹ B ¹	*	*	*	B ¹ R ²	B ¹ R ²	V ² R ²
Orange	V ¹ B ¹	*	*	*	B ¹ R ²	B ¹ R ²	V ² R ²
Yellow	V ¹ B ¹	*	*	*	B ¹ R ²	B ¹ R ²	V ² R ²
Green	V ¹ R ¹	B ² R ¹	B ² R ¹	B ² R ¹	*	*	V ² B ²
Blue	V ¹ R ¹	B ² R ¹	B ² R ¹	B ² R ¹	*	*	V ² B ²
White	V ¹ B ¹ R ¹	V ¹ R ¹	V ¹ R ¹	V ¹ R ¹	V ¹ B ¹	V ¹ B ¹	*

- R — Red color skanner, S35201
 B — Blue color skanner, S35202
 V — Visible color skanner, S35203
 1 — Mark will appear to skanner as darker than background
 2 — Mark will appear to skanner as lighter than background
 * — With **extreme** contrast between mark and background, it is possible, but quite difficult, to detect some combinations of these colors.

Note: This color selection chart should be used with the understanding that it is only a guide and not a guarantee that all color combinations can be detected. Colored inks can vary significantly as can the reflectivity of various printing surfaces.

The only way to make certain a particular color combination can be detected is to actually test the skanners on the combination. Skan-A-Matic field representatives are equipped with demonstration units and can perform this test. The Applications Engineering Lab is also available to perform this test. There is no charge or obligation for either method of testing.

Compatibility With Controls:

The S35 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED skanners only. For high speed operation use the T41300 High Speed Amplifier.

Model Selection Guide:

Part #	Description	Color Detection Capability
S35201	Red Color Skanner	Red, orange, yellow, or black marks on a white background as well as some other color backgrounds.
S35202	Blue Color Skanner	Blue, green, or black marks on a white background as well as some other color backgrounds.
S35203	Visible Color Skanner	The widest variety of marks regardless of background color as long as the contrast between mark and background is high. If contrast is low, use either red or blue color skanner as specified by the color selection chart.

For further information consult Color Selection Chart.

Variations:

LEADS

Extra lead lengths available. Use Type J — see pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

PROTECTIVE SHEATH

Can be factory installed over standard Type J lead (Shielded Quad). Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S35201-M
- S For square locked stainless steel armor 3/16" O.D. Example: S35201-S

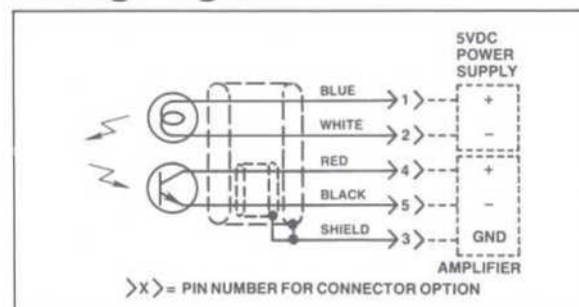
CONNECTOR

The S35 Series skanner is available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows.

- P For connector pair with in-line receptacle. Example: S35201-P
- F For connector pair with flanged, panel-mount receptacle. Example: S35201-F

See Options for a more detailed description.

Wiring Diagram:





SPECIAL PURPOSE SENSORS

Semiconductor Wafer Detection

S28 Series

WAFER SKANNER

Features:

- Operating distance: .050 in.
- Detects semiconductor wafers
- LED skanner
- Subminiature size
- Can be modulated
- Three different body styles



Description:

The S28 Series skanner is a specially constructed LED sensor designed to detect wafers for the semiconductor industry. Polished and unpolished wafers can be detected from the same sensing point.

The unit employs matched and focused components assembled in a sealed aluminum body with an ambient filter and protective cover glass.

Typical Applications:

- Proximity sensing
- Detection of specular surfaces

Specifications: (at 25°C)

LIGHT SOURCE—LED

Input	40 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient
Modulated Input	80 mA max., 50% duty cycle at 1 kHz min.
Reverse Voltage	2 V max.
Spectral Emission	930 nm peak

PHOTODETECTOR

Operating Voltage	30 VDC max.
Spectral Response	910 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm

BODY

Black anodized aluminum

TEMPERATURE

Operating: 0° to 50°C
Storage: -40° to 50°C

LEADS

S28001	Four tinned leads for circuit board mounting
S28002	4 cond. 26 AWG., teflon covered cable, with shielded photodetector leads and overall shield, 6 ft. long. Type J (Shielded Quad)
S28003	

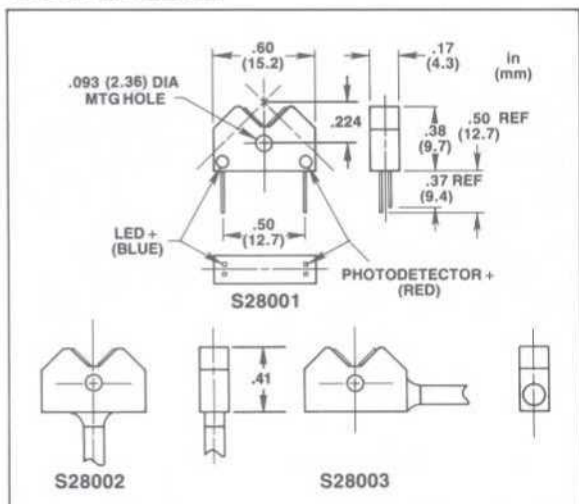
Color Coding

S28001	LED: (blue dot) long lead (+), short lead (-) Sensor: (red dot) long lead (+), short lead (-)
--------	--



S28 Series

Dimensions:



Compatibility With Controls:

The S28 Series is compatible with most Skan-A-Matic controls. For high speed operation use the T41300 High Speed Amplifier.

These skanners utilize a 40 mA Light Emitting Diode. A 100 ohm, 1/4 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42, a 27 ohm, 1/4 W current limiting resistor must be used. The S28 Series is not compatible with the R43/T43 modulating controls.

Model Selection Guide:

Part #	Description
S28001	Skanner for circuit board mounting
S28002	Skanner with bottom mounted cable
S28003	Skanner with side mounted cable

Variations:

LEADS

Extra lead lengths available. Use Type J — see pg. 129.

Options:

CONNECTOR

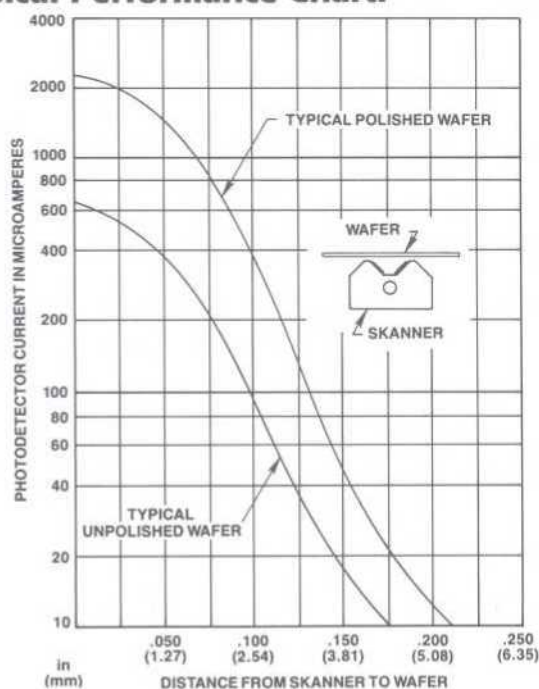
The S28 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

-P For connector pair with in-line receptacle. Example: S28001-P

-F For connector pair with flanged, panel-mount receptacle. Example: S28001-F

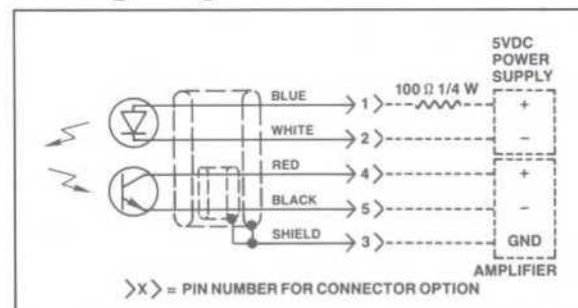
See Options for a more detailed description.

Typical Performance Chart:



With the skanner placed at .050 inches from a white target, photodetector current will be a minimum of 250 microamperes.

Wiring Diagram:





SPECIAL PURPOSE SENSORS

Liquid Level Detection

S19 Series

SIGHT GLASS SKANNER

Features:

- Detects liquid level in sight glass tubes
- Works with any liquid
- Works with any clear tubing
- Standard models available up to 1 inch diameter
- Replaceable light source and photodetector



Description:

The S19 Series Sight Glass Skanners contain a light source and photodetector mounted in a rugged aluminum housing. The housing clamps onto the sight glass tube with two thumb screws with tension springs for easy positioning. Both the light source and photodetector are field replaceable.

It has applications in metering systems of virtually any liquid from water to chemicals. The photodetector sees reflected light when there is no liquid present.

Typical Applications:

- High/low level alarms
- Liquid level control

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—LED

Input 40 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 80 mA max., 50% duty cycle at 1 kHz min.

Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

PHOTODETECTOR

Operating Voltage 30 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak

BODY

Black anodized aluminum

TEMPERATURE

Operating: 0° to 50°C

Storage: -40° to 50°C

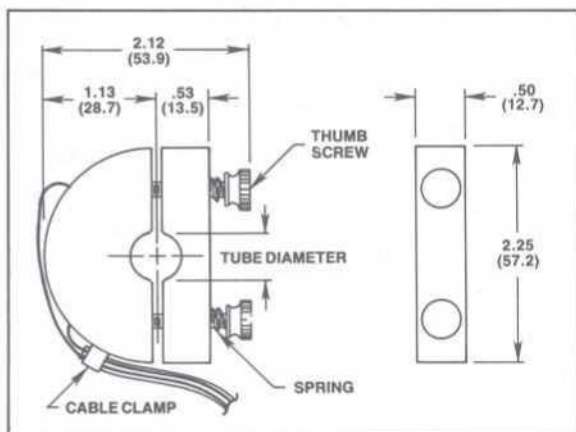
LEADS

Two 2 cond. 24/26 AWG., teflon covered cables with overall PVC jacket, 6 ft. long



S19 Series

Dimensions:



Performance Data:

With clear water and clear glass tube:
 I_L (with no liquid) 50 microamps min.
 250 microamps max.
 I_D (with liquid) 1/10 of I_L

Compatibility With Controls:

The S19 Series is compatible with all Skan-A-Matic controls except modulating controls which are used with LED light sources only. For high speed operation use the T41300 High Speed Amplifier.

The IR LED versions utilize a 40 mA Light Emitting Diode. A 100 ohm, 1/4 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42, a 27 ohm, 1/4 W current limiting resistor must be used. The S19 Series is not compatible with the R43/T43 modulating controls.

Model Selection Guide:

Part #	Light Source	Tube O.D.	Tube Wall Thickness	
			Min.	Max.
S19051	Lamp	1/4"	.04"	.08"
S19054	IR LED	1/4"	.04"	.08"
S19081	Lamp	3/8"	.05"	.09"
S19084	IR LED	3/8"	.05"	.09"
S19101	Lamp	1/2"	.06"	.10"
S19104	IR LED	1/2"	.06"	.10"
S19111	Lamp	5/8"	.06"	.11"
S19114	IR LED	5/8"	.06"	.11"
S19121	Lamp	3/4"	.06"	.13"
S19124	IR LED	3/4"	.06"	.13"
S19141	Lamp	1"	.10"	.20"
S19144	IR LED	1"	.10"	.20"

The skanners above are designed to operate with sight glass tubes having outer diameters and wall thicknesses as shown. If a tube varies from these dimensions, a sample should be sent to the Application Engineering Department. If major modification or a special skanner is required, additional charges and shipment time will be quoted.

Variations:

Extra lead lengths available. See pg. 129.

Options:

CONNECTOR

The S19 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

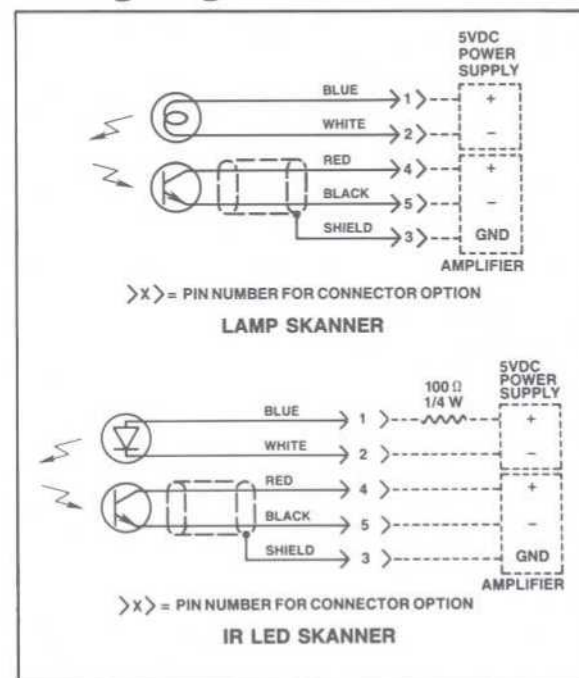
- P For connector pair with in-line receptacle. Example: S19101-P
- F For connector pair with flanged, panel-mount receptacle. Example: S19101-F

See Options for a more detailed description.

REPLACEMENT PARTS

- L01044 Replacement Lamp
- P01044 Replacement Photodetector

Wiring Diagram:





SPECIAL PURPOSE SENSORS

Hostile Environment S17/L17/P17 Series ENVIRO-SKAN®

Features:

- Thrubeam and reflective models available
- Replaceable fiber optic cables
- High temperature cables up to 200°C available
- Color detection models available
- Shock and vibration resistant
- Two mounting styles

Description:

The ENVIRO-SKAN® Series includes fiber optic thrubeams and skanners for use in severe temperatures, shock and vibration environments, restrictive locations, and where electrical interference or dangerous conditions may exist. The scanner body with light source and photodetector can remain in a safe area while fiber optic cables transmit light to and from the target. The same scanner body will accommodate either reflective or thrubeam cables and will operate with standard Skan-A-Matic controls. Set screws and a wrench are provided to secure the cable tips and permit easy disassembly.

Typical Applications:

- Sensing in places normally inaccessible to other skanners or thrubeams
- Sensing in high temperature environments

Specifications: (at 25°C)

LIGHT SOURCE—LAMP

Input 5.0 VDC, 115 mA

LIGHT SOURCE—LED

Input 100 mA max. with resultant voltage drop of 1.1 to 1.7 VDC; derate at 1 mA per degree above 25°C ambient

Modulated Input 1 A max., 10% duty cycle at 1 kHz min.

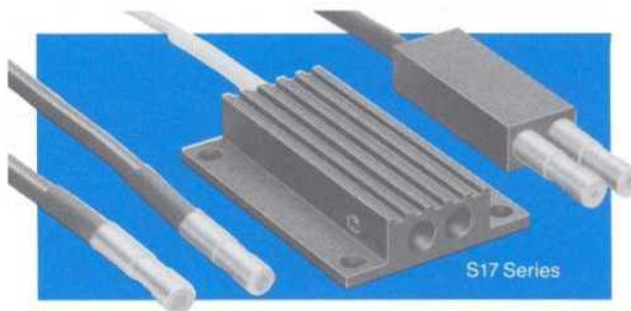
Reverse Voltage 2 V max.

Spectral Emission 940 nm peak

FIBER OPTIC CABLES

MATERIAL Standard: Glass fibers with PVC jacket and stainless steel tips
High Temp. Glass fibers with stainless steel flex armor sheath and stainless steel tips

TEMPERATURE Operating & Storage:
Standard -40°C to 100°C
High Temp -40° to 200°C



Fiber optic cables are available in standard or high temperature versions and in reflective or thrubeam types, with a choice of 3 lengths and 2 sensing tips. The reflective cable has two fiber bundles, a single sensing tip and twin ferrules to fit into the scanner body. A red dot identifies the ferrule which mates with the sensor aperture. Two single bundle cables must be used for thrubeam applications; a lens is available to fit the threaded tip.

- Sensing in areas of high electrical noise
- Registration mark detection

PHOTODETECTOR (except in Color Mark Skanners)

Operating Voltage 20 VDC max.

Response Time See Response Time Chart under Technical Information

Spectral Response 910 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm

PHOTODETECTOR (in Color Mark Skanners)

Operating Voltage 15 VDC max

Response Time See Response Time Chart under Technical Information

Spectral Response 570 nm peak; See Spectral Response Chart under Colors in Technical Information

BODY

Anodized aluminum, black
TEMPERATURE Operating:
0° to 50°C
Storage:
-40° to 50°C

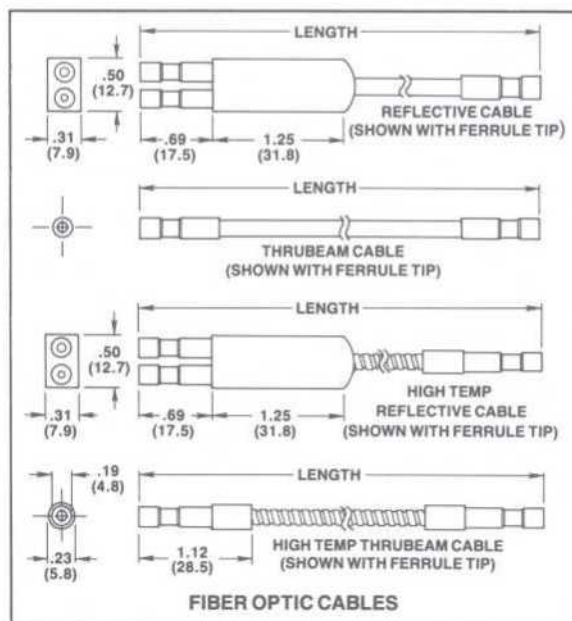
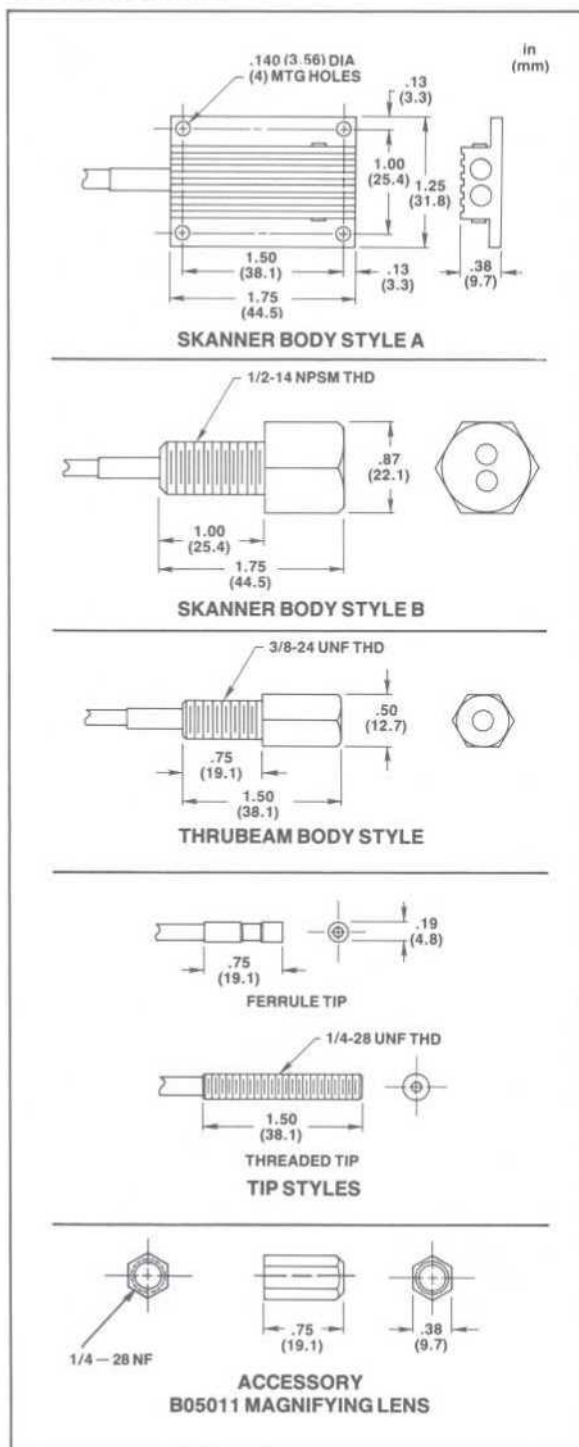
LEADS

S17 Series: 4 cond. 26 AWG. teflon covered cable with shielded photodetector leads and overall shield, 6 ft. long, Type J (Shielded Quad)
L17101: 2 cond. 26 AWG. teflon covered cable with shield, 6 ft. long, Type A
L17104: 2 cond. 26 AWG. teflon covered cable with shield, 6 ft. long, Type A
P17103: 2 cond. 24 AWG., teflon covered cable, 6 ft. long, Type B



S17/L17/P17 Series

Dimensions:



Caution: Fiber optic cables have a 1" bending radius but should **NOT** be twisted about their longitudinal axes.

Performance Data:

REFLECTIVE FIBER OPTIC CABLE
 Smallest Detectable Object: .025 in.
 Optimum Distance to Target: .040 in.
 Field of View: .070 in.

When used with	Maximum Usable Distance will be
S17103 or S17403	.50 in.
S17104 or S17404	.30 in.
S17105 or S17405	.10 in.

THRUBEAM FIBER OPTIC CABLE

Beam Diameter: .080 in.
 Smallest Detectable Object: .026 in.

When used with	Rated Separation will be
S17103 or S17403	2.0 in.
S17104 or S17404	2.0 in.
S17105 or S17405	0.5 in.
L17101/P17103	2.0 in.
L17104/P17103	1.2 in.

Compatibility With Controls:

The S17/L17/P17 Series are compatible with all Skan-A-Matic controls except modulating controls which are used with LED skanners and light sources only. For high speed operation use the T41300 High Speed Amplifier.

The LED versions of this series utilize a 100 mA Light Emitting Diode. A 39 ohm, 1 W current limiting resistor is supplied and must be used with Skan-A-Matic controls furnishing 5 VDC for light source power. With modulating controls such as our R42/T42 and R43/T43, no current limiting resistor is used.



S17/L17/P17 Series

Model Selection Guide:

SKANNER BODY (Fiber Optic Cables also required)

Part#	Description	Body Style
S17103	Incandescent Scanner	A
S17104	LED Scanner	A
S17105	Color Mark Scanner	A
S17403	Bulkhead Style Incandescent Scanner	B
S17404	Bulkhead Style LED Scanner	B
S17405	Bulkhead Style Color Mark Scanner	B

THRUBEAM BODY (Fiber Optic Cables also required)

Part #	Description
L17101	Incandescent Light Source
L17104	LED Light Source
P17103	Photodetector with IR Filter

FIBER OPTIC CABLES

(Thrubeam Pair or Scanner Body also required)

Length	Reflective For use with Scanner Body only (1 required)		Thrubeam For use with All Body Styles (2 required)	
	Ferrule Tip	Threaded Tip	Ferrule Tip	Threaded Tip
Standard				
12"	F17302	F17312	F17202	F17212
24"	F17304	F17314	F17204	F17214
36"	F17306	F17316	F17206	F17216
High Temperature				
12"	F17352	F17362	F17252	F17262
24"	F17354	F17364	F17254	F17264
36"	F17356	F17366	F17256	F17266

Variations:

LEADS

Extra lead lengths available. See pg. 129.

For S17 Series skanners use Type J.

For L17101 and L17104 use Type A.

For P17103 use Type B.

Options:

PROTECTIVE SHEATH

Can be factory installed on the S17 Series skanners and L17/P17 thrubeams. Order by adding the suffix as follows:

- M For square locked galvanized steel with black PVC jacket, 9/32" O.D. Example: S17103-M
- S For square locked stainless steel armor, 3/16" O.D. Example: S17103-S

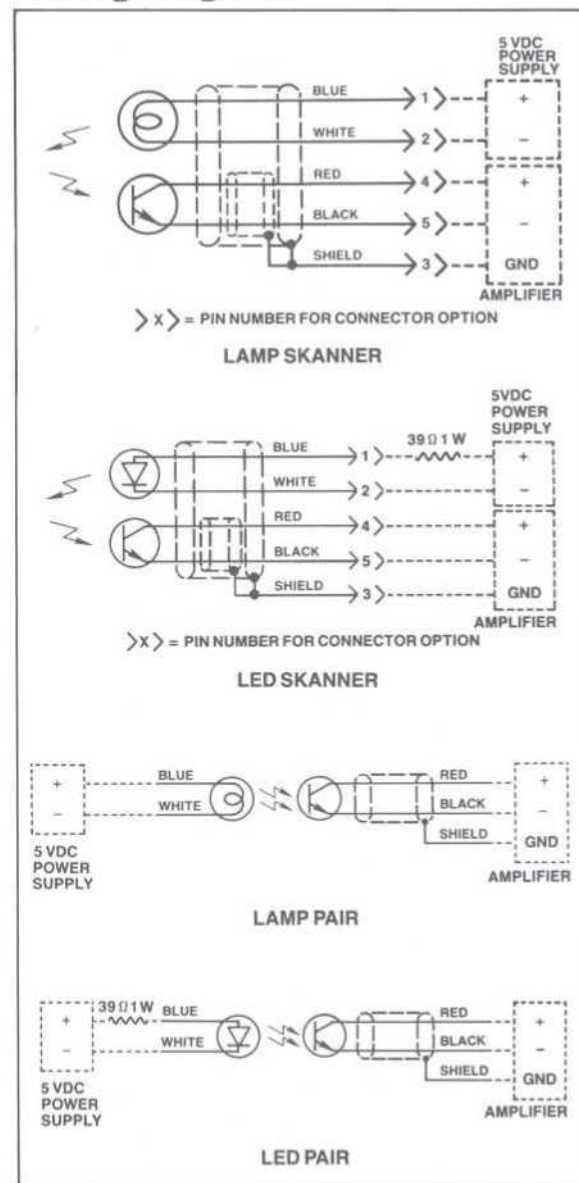
CONNECTOR

The S17 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

- P For connector pair with in-line receptacle. Example: S17103-P
- F For connector pair with flanged, panel-mount receptacle. Example: S17103-F.

See Options for a more detailed description.

Wiring Diagram:



Accessories:

MAGNIFYING LENS #B05011

Increases Rated Separation of thrubeam cables approximately 2 times. Install on light source cables with threaded tips only.



Self-Contained Photoelectric Controls

Self-Contained Photoelectric Controls combine the function of a reflective skanner and a DC powered control in one package. This has several advantages for the user. Hookup is simplified by having one device to wire up rather than two. Interference by electrical noise generated in industrial environments is minimized by reducing the

distance from the sensor to the control to zero. Most units are directly compatible with programmable controllers, and can be connected with just a three or four wire hookup. A Self-Contained Photoelectric Control has a lower purchase price than a separate skanner and control thus reducing inventory cost.

Self-Contained Photoelectric Controls

Series	Smallest Detectable Object	Optimum Distance to Target	Beam Diameter	Field of View	Maximum Usable Distance	Light Source	Power Input	Body	Mounting	Description	Page
C32 SKAMP	.04"	.10"	N/A	.1"	3"	Lamp LED	5 VDC @ 185 mA or 8-25 VDC @ 60 mA	Aluminum	3/8-24 THD .125" holes	Fiber optic skanner with internal amplifier and open-collector output. Interfaces directly to TTL and programmable controllers. Continuous operation only. LIGHT or DARK energized models. Models operate from .08" to 3.0"; can detect object as small as .04".	84
C40000 REFLECTIVE SQUARE SKAMP	.010" .030"	1" ± .15" 2" ± .75"	N/A	.03" .1"	N/A	visible red LED	5 or 8-28 VDC @ 100 mA	die-cast zinc	.185" holes Mounting bracket supplied	DC powered skanner/amplifier providing reflective sensing and control functions in a single package. The modulated visible red LED Light source is easily aligned with target. Units can be wired directly to programmable controllers.	86
C40000 RETRO-REFLECTIVE SQUARE SKAMP	1"	N/A	3"	N/A	10' (with 3" Retro-disc)	visible red LED	5 or 8-28 VDC @ 100 mA	die-cast zinc	.185" holes Mounting bracket supplied	DC powered skanner/amplifier providing retroreflective sensing and control functions in a single package. The modulated visible red LED light source is easily seen when aligned with a retroreflector. Units can be wired directly to programmable controllers. Polarized models available.	86
C56 NANO-SKAMP	.007"	.010"	N/A	.020"	.070"	Lamp LED	5 VDC @ 185 mA or 8-25 VDC @ 60 mA	Aluminum	.125"	Fiber optic skanner with flexible snout, internal amplifier and open-collector output. Interfaces directly to TTL and programmable controllers. Continuous operation only. LIGHT or DARK energized models. Models operate from .004" to .07"; can detect objects as small as .007".	89
C80	.25"	8"	N/A	N/A	20' (with 3" Retro-disc)	red LED	5 VDC 5-24 VDC or 24-240 VAC and 12-240 VDC Power requirements 0.5 watts typical	Plastic	NS35 DIN rail or Side mount	Modular control with a total of 27 options for optics, input voltage, and outputs. Interfaces to TTL and programmable controllers. The wide voltage range input allows use on AC or DC.	91



SELF-CONTAINED PHOTOELECTRIC CONTROLS

Amplified Coaxial C32 Series SKAMP®

Features:

- Optimum Distance to Target: .10"
- Maximum Usable Distance: 3"
- Field of View: 0.1"
- Smallest Detectable Object: .04"
- Scanner/amplifier in one package
- Open collector output
- Coaxial optical system
- Lamp or LED light sources
- 5 VDC or 8-25 VDC models
- Light or Dark energize models



Description:

The C32 Series SKAMP® is a self-contained photoelectric scanner/amplifier designed to provide sensing and control capability from a single convenient point. It combines the fiber optic construction of the SKAN-COAX® scanner with an adjustable sensitivity, hybrid amplifier in a compact integral package.

The C32 Series is available with either an incandescent or LED light source in models wired for light energized or dark energized operation. Its internal amplifier has a sensitivity control and LED output indicator to allow adjustment without additional equipment. The amplifier has a fixed amount of hysteresis and provides an

open collector output, which is compatible with most programmable controllers and microprocessors.

When light is reflected to the sensor of the light energized models, the LED output indicator is activated and the output transistor conducts, pulling the output to ground potential. In dark energized models, the absence of reflection causes the output to energize.

Models are available for input voltages of 5 VDC or any voltage between 8 and 25 VDC.

Typical Applications:

- Direct wiring to counters
- Tachometer pickup
- Registration mark detection
- Synchronization

Specifications: (at 25°C)

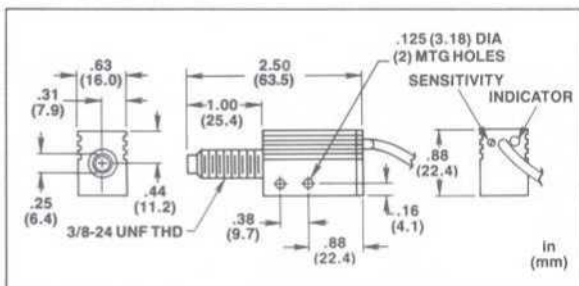
POWER INPUT	+5 VDC $\pm 5\%$, 185 mA max. or 8-25 VDC at 60 mA max.
OUTPUT	Open collector NPN transistor to switch up to 30 VDC at 100 mA max.
SENSITIVITY ADJUSTMENT	15 turn
RESPONSE TIME	500 μ s typical
BODY	Black anodized aluminum

SPECTRAL RESPONSE	910 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C
LEADS	3 cond. 28 ga., teflon covered cable with shield, 6 ft. long, Type N

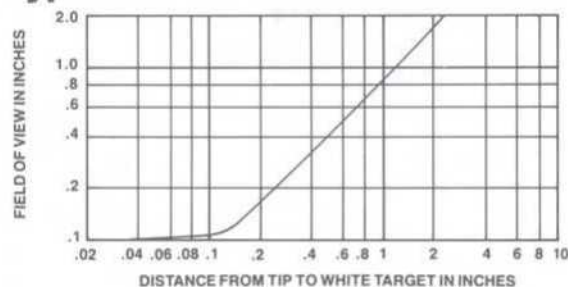


C32 Series

Dimensions:



Typical Performance Chart:



Model Selection Guide:

Model	Operating Mode	Light Source	Input Voltage
C32211	Light	Lamp	5 VDC
C32221	Dark	Lamp	5 VDC
C32214	Light	LED	5 VDC
C32224	Dark	LED	5 VDC
C32414	Light	LED	8 to 25 VDC
C32424	Dark	LED	8 to 25 VDC

Variations:

LEADS

Extra lead lengths available. Use Type N — see pg. 129.

Options:

COIL CORD

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

CONNECTOR

The C32 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

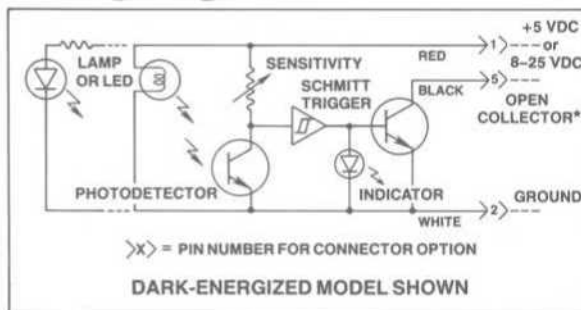
- P For connector pair with in-line receptacle. Example: C32211-P
- F For connector pair with flanged, panel-mount receptacle. Example: C32211-F

See Options for a more detailed description.

ADJUSTABLE FOCUS OPTICAL MAGNIFIER B05003

A lens system accessory for use with lamp light sources. See Accessories for more detailed information.

Wiring Diagram:



*See Technical Information for output connections



SELF-CONTAINED PHOTOELECTRIC CONTROLS

Modulated Visible Beam Control

C40000 Series

Square SKAMP®

Features:

- Scanner/amplifier in one package
- Complementary open collector outputs
- Coaxial optical system
- Rugged NEMA 12 cast zinc housing
- Visible red LED light source
- Alignment indicator
- Two operating frequencies available
- High Speed models available



Description:

The C40000 Series Square Skamps are totally self contained, modulated sensors with a visible red light source and dual complimentary open collector outputs.

These controls are DC powered with 5 VDC or 8 to 28 VDC. The built-in amplifier provides photoelectric sensing and control in one convenient package. The amplifier responds only to the modulated frequency of the LED source, this feature prevents false triggering from high ambient light or other light sources. The skanners can be ordered with either of two modulating frequencies to avoid interference with a nearby skanner.

The dual complimentary open collector transistor outputs will interface easily with programmable controllers and microprocessors as well as direct switching of DC powered devices up to 30 VDC at 100mA max.

The LIGHT energized output transistor will conduct when the proper light signal is reflected back into the sensor. The alignment indicator will also be ON when the skanner sees its reflected light. The DARK energized output transistor conducts when light is not reflected back into the sensor.

Reflective:

Models with one and two inch operating distances are offered. The coaxial optics unlike conventional two lensed optics provide increased flexibility in their operating ranges.

The one inch models detect objects as small as 0.01" over an operating range of ± 0.15 " from its optimum distance of 1.1".

The two inch models detect objects as small as 0.03" over an operating range of ± 0.75 " from its optimum distance of 2.1".

A 15 turn sensitivity pot is provided for precise adjustments of the amplifier's set point. An output indicator is also provided to visually confirm operation of the skanner.

Typical Applications: Reflective

- Inspecting and sorting
- Detecting semiconductor orientation
- Accurate edge and position control
- Small parts handling
- Direct wiring to programmable controllers
- Registration mark sensing
- Broken drill bit detection

Retroreflective:

The visible red light source of the retroreflective model is easily seen when aligned to a retroreflector and the output indicator confirms operation. The coaxial optics permit operation at close or long range without the need to adjust the sensitivity of the unit.

Polarized versions are available to respond only to a retroreflective disc. This feature assures that the skanner will not respond to other reflective materials such as shrink wrap or foil.

Typical Applications: Retroreflective

- Conveyor control
- Box sortation
- Security barriers
- Automated warehouses
- Direct wiring to programmable controllers

Phone 800-448-2900

Fax 800-223-5138



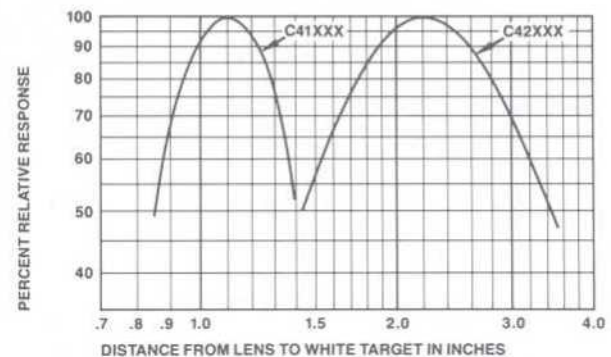
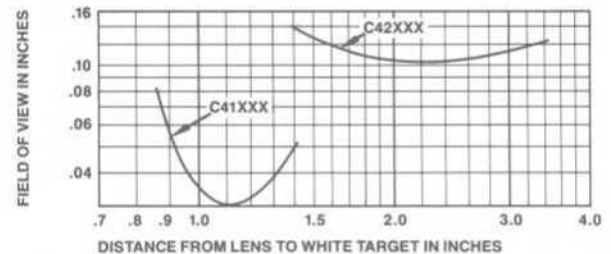
C40000 Series

Specifications: (at 25°C)

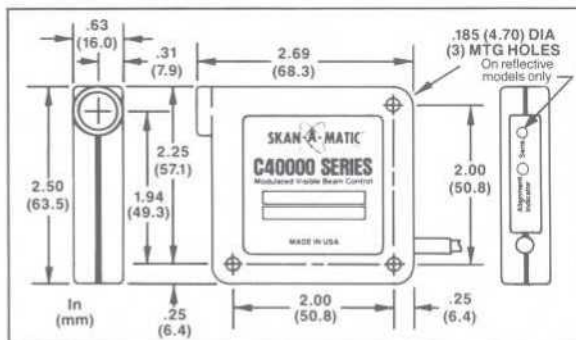
POWER INPUT	5 VDC $\pm$ 5% or 8-28 VDC, 75 mA max.															
OUTPUTS	Open collector NPN transistors to switch up to 30 VDC at 100mA max.															
RESPONSE TIME	Standard: 5 ms typical. Counting rate 100 cps. High Speed: 0.5 ms typical. Counting rate 1000 cps.															
BODY	Black die-cast zinc NEMA 12 housing.															
OPERATING PARAMETERS	Reflective <table><tr><th>Type</th><th>Operating Range</th><th>Smallest Detectable Object</th></tr><tr><td>1"</td><td>1" $\pm$0.15"</td><td>.01"</td></tr><tr><td>2"</td><td>2" $\pm$0.75"</td><td>.03"</td></tr></table> Retroreflective <table><tr><th>Type</th><th>Distance to 3" Retro-Disc</th></tr><tr><td>Non-Polarized</td><td>10 ft.</td></tr><tr><td>Polarized</td><td>5 ft.</td></tr></table>	Type	Operating Range	Smallest Detectable Object	1"	1" $\pm$ 0.15"	.01"	2"	2" $\pm$ 0.75"	.03"	Type	Distance to 3" Retro-Disc	Non-Polarized	10 ft.	Polarized	5 ft.
Type	Operating Range	Smallest Detectable Object														
1"	1" $\pm$ 0.15"	.01"														
2"	2" $\pm$ 0.75"	.03"														
Type	Distance to 3" Retro-Disc															
Non-Polarized	10 ft.															
Polarized	5 ft.															
SPECTRAL EMISSION	660nm (red)															
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 50°C															
LEADS	4 cond. 24 ga., PVC covered cable with shield, 6 ft. long, Type I															

Typical Performance Chart:

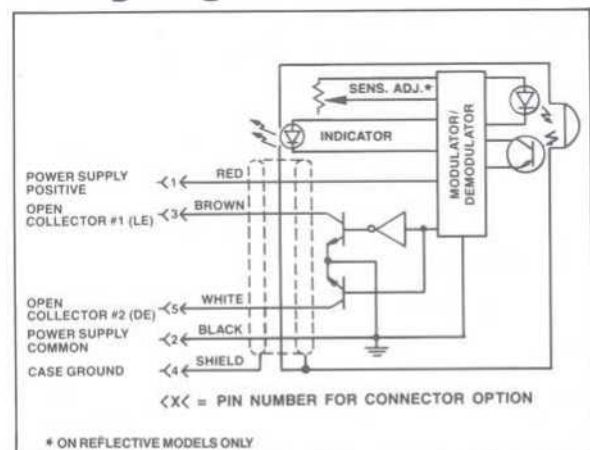
FOR REFLECTIVE MODELS ONLY



Dimensions:



Wiring Diagram:





C40000 Series

Model Selection Guide:

To specify the C40000 Series Modulated Visible Beam Control construct a six digit part number denoting type, input, modulating frequency, and amplifier.

Part #	C 4				
--------	-----	--	--	--	--

Type	Use #
1" Reflective	1
2" Reflective	2
10" Retro	0
5" Retro/polarized*	5

Input	Use #
5 VDC	0
8-28 VDC	1

Amplifier	Use #
Standard	0
High Speed	1

Modulating Frequency	Use #
High	0
Low	4

*Not for use with Retro-Tape. Use Retro-Disc only.

Variations:

LEADS

Extra lead lengths available. Use Type I — see pg. 129.

Options:

PROTECTIVE SHEATH

Can be factory installed. Order by adding the suffix as follows:

-S For square locked stainless steel armor, 3/16" O.D. Example: C40100-S.

CONNECTOR

The C40000 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

-P For connector pair with in-line receptacle. Example: C40100-P

-F For connector pair with flanged, panel-mount receptacle.

Example: C40100-F

See Options for a more detailed description.

ACCESSORY POWER SUPPLY/OUTPUT SWITCH B07186

Specifications:

POWER INPUT	115 or 230 VAC $\pm 10\%$ 50-400Hz, 1 VA
SKANNER POWER	5 VDC at 100 mA
OUTPUT	Solid State Relay capable of switching 5 to 280 VAC at up to 1 Amp

TEMPERATURE

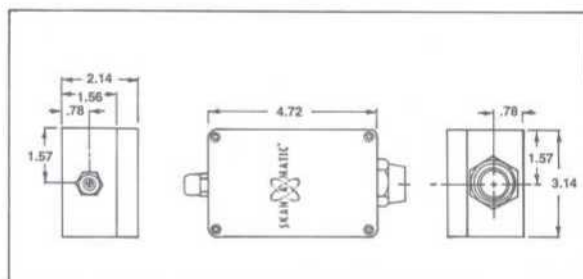
Operating: -0° to 50°C

Storage: -40° to 70°C

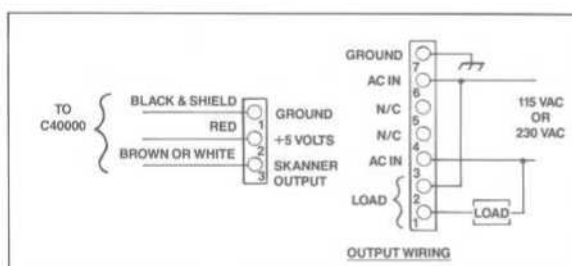
ENCLOSURE

Watertight and corrosive resistant ABS plastic with 1/2" conduit HUB power entrance, and watertight bushing for skanner cable entrance.

Dimensions:



Wiring Diagram:





SELF-CONTAINED PHOTOELECTRIC CONTROLS

Fiber Optic Flexible Snout C56 Series NANO-SKAMP®

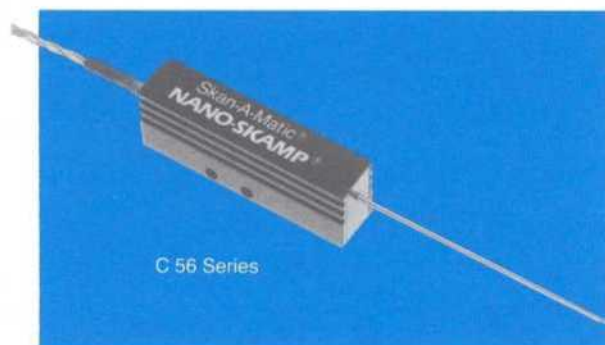
Features:

- Smallest Detectable Object: .007 in.
- Optimum Distance to Target: .010 in.
- Field of View: .020 in.
- Maximum Usable Distance: .070 in.
- Scanner/amplifier in one package
- Open collector output
- Coaxial optical system
- Programmable Controller Compatible
- Formable snout
- Works in places normally inaccessible to other scanners
- Light or Dark energize models

Description:

The C56 NANO-SKAMP® is a self-contained photoelectric scanner/amplifier designed to provide sensing and control capability from a single convenient point. It combines the fiber optic construction of the NANO-SKAN® with a hybrid amplifier in a compact integral package.

NANO-SKAMP® is available with either 5 VDC or 8–25 VDC input voltages in models wired for light energized or dark energized operation. Its internal amplifier has a sensitivity control and LED output indicator to allow adjustment without additional equipment. The amplifier has a fixed amount of hysteresis and provides an open collector output, which is compatible with program-



mable controllers and microprocessors.

When light is reflected to the sensor of the light energized models, the LED output indicator is activated and the output transistor conducts, pulling the output to ground potential. In dark energized models, the absence of reflection causes the output to energize.

The semi-rigid snout containing the coaxial fiber bundle can be bent easily by hand to position the tip at the target and the desired shape is self-retaining. The snout tip is hardened stainless steel to enable clamping with a nylon set screw.

Typical Applications:

- Direct wiring to counters
- Tachometer pickup
- For inspection and sorting
- Detecting semiconductors
- Encoder
- Programmable controller input
- Small parts handling
- Accurate edge and position control
- Vibratory bowl feeders

Specifications: (at 25°C)

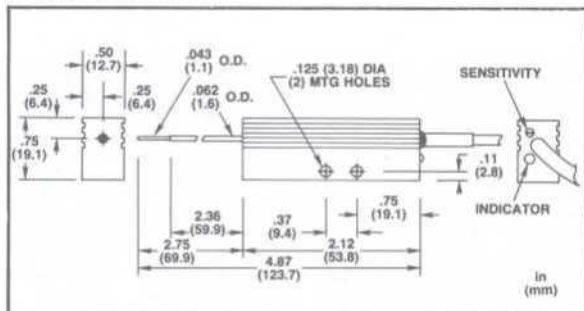
POWER INPUT	+5 VDC $\pm 5\%$, 185mA max. or 8 to 25 VDC 60mA max.
OUTPUT	Open collector NPN transistor to switch up to 30 VDC at 100 mA max.
SENSITIVITY ADJUSTMENT	15 turn
RESPONSE TIME	500 μ s typical
BODY	Aluminum/plastic composite—black
SPECTRAL EMISSION	880 nm

SPECTRAL RESPONSE	910 nm peak; filtered to respond to less than 5% at 750 nm and less than 0.1% at 700 nm
TEMPERATURE	Operating: 0° to 50°C Storage: –40° to 50°C
LEADS	3 cond. 28 ga., teflon covered cable with shield, 6 ft. long, Type N



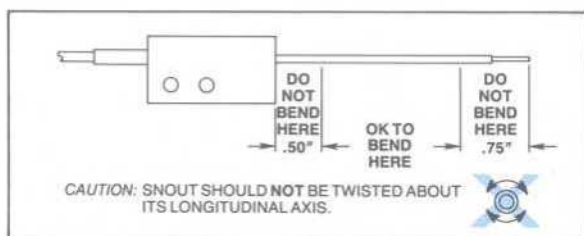
C56 Series

Dimensions:

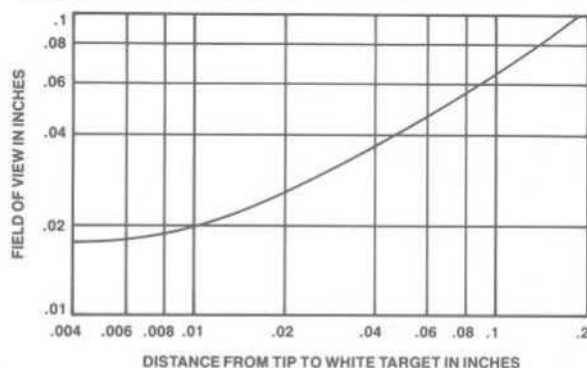


FORMING SNOOT

CAUTION: DO NOT USE PLIERS OR SHARP CORNERS FOR FORMING. Use of pliers or sharp corners for forming will destroy units. Bend snout by hand on a pencil or similar cylindrical object that is .25" diameter or larger. The snout is annealed stainless steel and will work harden if bent repeatedly.



Typical Performance Chart:



Model Selection Guide:

Model	Voltage	Output Energizes	Light Source
C56200	5 VDC	Light	LED
C56210	5 VDC	Dark	LED
C56230	5 VDC	Light	Lamp
C56240	5 VDC	Dark	Lamp
C56260	8-25 VDC	Light	LED
C56270	8-25 VDC	Dark	LED

Variations:

LEADS

Extra lead lengths available. Use Type N — see pg. 129.

SNOOTS

Lengths from .500 in. to 12 in. maximum are available. See Price List for further information.

Snouts can be factory-formed to customer specifications.

Options:

COIL CORD:

Four conductor, 28 gauge, coil cord with shield available in 10 ft. (fully extended) or 20 ft. (fully extended) lengths — see pg. 129.

CONNECTOR

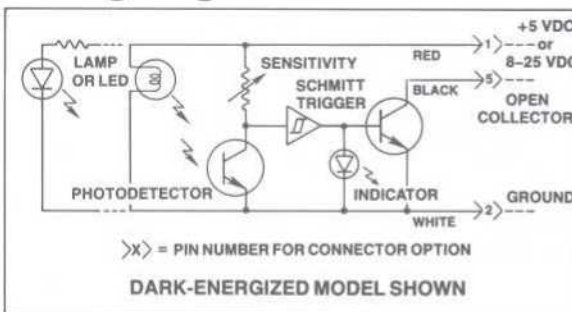
The C56 Series skanners are available with connector installed. The mating half is furnished for field connection. Order by adding a suffix as follows:

-P For connector pair with in-line receptacle. Example: C56200-P

-F For connector pair with flanged, panel-mount receptacle. Example: C56200-F

See Options for a more detailed description.

Wiring Diagram:



*See Technical Information for output connections

SELF-CONTAINED PHOTOELECTRIC CONTROLS

Modulated Visible-Beam Control

C80 Series

Features:

- Scanner and Amplifier in one package
- Choose from three output types
- Choose from three optical systems
- Choose from three input power sources
- Red LED light source
- Distinctive yellow NEMA 4 rated enclosure
- Alignment indicator
- NS35 DIN rail or side mounting



Description:

The C80 Series Skanners are totally self-contained, modulated sensors with a range of user-specificity previously unavailable in the photoelectric market.

These units may be ordered for 5 volt DC operation, 5 to 24 volt DC operation, or 24 to 240 volt AC *and* 12 to 240 volt DC operation. The built-in amplifier provides sensing and control circuitry in one convenient package.

Modulation of the LED source minimizes the possibility that a false output will occur due to the presence of spurious ambient radiation, whether visible or infrared.

The range of output types available assures that these controls will not only be compatible with existing controlled functions but will remain compatible with those yet to be designed.

The availability with optional glass fiber optics allows the use of this control in applications where most plastic-enclosed controls could not be used; the control stays out of the hazardous environment - only the rugged glass fiber optic cables extend in to the potentially hazardous area.

Reflective:

These devices are designed to provide an output when a reflective object comes into the field of view. The range of use depends on the reflectivity of the object and its contrasting background, but objects as small as 0.25" can be detected at distances up to 8 inches.

A sensitivity control is provided to allow the user to set the desired trip point, and a red LED indicator provides instant visual feedback for setup and future alignment or maintenance.

Typical Applications: Reflective

- Edge and position control
- Parts handling
- Label detection
- Broken tool detection

Retroreflective:

The visible red light source of the C80 Series is easily seen when aligned to a retroreflector and the output confirms operation; the sensitivity control allows exact adjustment to compensate for distance between the Scanner and the retroreflector.

The polarized version responds only to a retroreflective disc. This feature assures that the unit will not respond to other reflective materials such as shrink wrap, foil, or any other polished, specular surface.

Typical Applications: Retroreflective

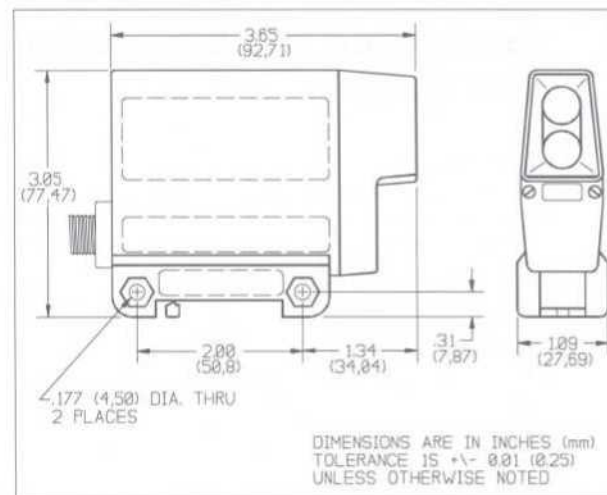
- Conveyor control
- Box sorting
- Security barriers
- Automated warehouses
- Process automation
- Excessive height/width sensor



Specifications:

POWER INPUT:	0.5 watt typical
OUTPUT:	AC - 0.75 A max at 20 to 240 VAC DC - 100 mA max at $V_{CE(sat)}$
SENSITIVITY ADJUSTMENT:	270° rotation
DELAY TIME:	up to 15 second typical
TEMPERATURE:	Storage: -40°C to to 50°C Operating: 0°C to 50°C
RESPONSE TIME:	5 milliseconds typical
COUNTING RATE:	100 counts per second typical

Dimensions:



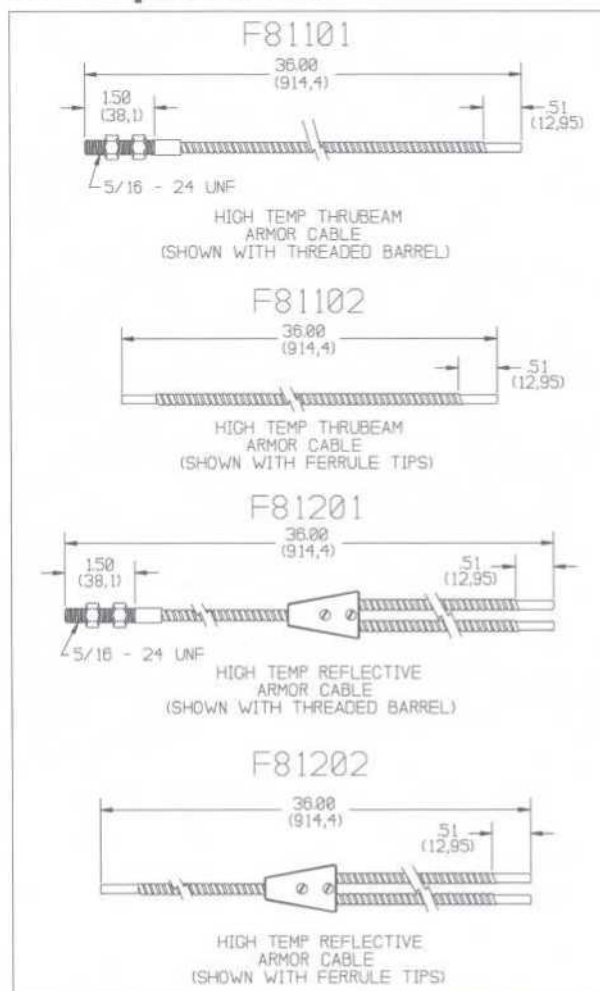
Model Selection Guide:

To specify the C80 Series Scanner for your application, construct a six-digit alphanumeric part number using the part number guide below.

Part Number	C	8			
Input power options					
5 VDC		0			
24-240 VAC or VDC		1			
5-24 VDC		2			
Optics options					
Standard *(see below)		0			
Polarized Retro		1			
Glass Fiber Optic Ports		2			
Output options					
AC output		0			
NPN output		1			
PNP output		2			
Cable options					
Standard cable			0		

*Standard implies use as either a reflective or retroreflective scanner.

Fiber Optic Cables:



Phone 800-448-2900

Fax 800-223-5138



Controls

Controls produce the useful output in photoelectric systems. A control has two main functions—it must amplify the very small current flowing in the photo-detector circuit, and it must perform some sort of switching action to let outside equipment know that a target has been detected. Controls will usually have secondary functions, including: power supply, sensitivity control, visible indication of the state of the output, and logic and time delay functions.

Skan-A-Matic photoelectric devices are designed to be used as interchangeable modules. Individual pieces work together as a complete system. Most controls will operate any skanner or thrubeam. This means you have the freedom of choosing a control and mating it with any scanner to achieve optimum sensing performance.

Control Selection Guide

Series	Input	Switched Output	Response Time	Enclosure	Mounting	Description	Page
T21004	5 VDC @ 2 mA	40 VDC @ 40 mA	*	1 inch square plastic module	Printed circuit board	DC control with Schmitt trigger amplifier and open collector output.	94
T21104	5 VDC @ 20 mA	40 VDC @ 100 mA	*	1 inch square plastic module	Printed circuit board	DC control with Schmitt trigger amplifier and open collector output. Sensitivity control and output indicator LED.	95
T21028	5 VDC @ 110 mA	28 VDC @ 100 mA	5 ms	1x2 inch plastic module	Printed circuit board	Modulating circuitry in PC mount module. Provides ambient light immunity.	96
T31 T32	5 and 8-28 VDC @ 28 mA	25 VDC @ 250 mA	*	Plastic can, plastic module	8 pin socket, flat mount	DC control with Schmitt trigger amplifier and open collector output. Sensitivity control and output indicator LED. T32 has terminal strip.	97
T325	5 VDC @ 125 mA	30 VDC @ 100 mA	5 ms	Plastic module	Flat mount	DC powered modulating amplifier. Provides ambient light immunity. LIGHT and DARK energize models available.	99
T36	5, 12, 24 VDC @ 18 mA	Input VDC @ 100 mA	*	Plastic can	8 pin socket	DC control for time delay or one-shot mode. Schmitt trigger amplifier and open collector output. Sensitivity and time delay control. Output indicator LED.	101
R40 T40	115 VAC @ 2 VA	115 VAC @ 5 A, SPDT 25 VDC @ 100 mA	25 ms *	Plastic can	11 pin socket	AC control with Schmitt trigger amplifier. Sensitivity control and output indicator LED. T40 has open collector output. 230 VAC model available.	103
T41300	115 VAC @ 2 VA	25 VDC @ 100 mA	*	Plastic can	11 pin socket	High speed AC control with open collector output. Sensitivity control and output indicator LED. 230 VAC model available.	105
R42 T42	115 VAC @ 2 VA	115 VAC @ 5 A, SPDT 25 VDC @ 100 mA	25 ms 5 ms	Plastic can	11 pin socket	Modulating control for LED sensors. Rejects ambient light. Programmable for two modulating frequencies. Two time delay modes. 230 VAC model available.	107
R43 T43 SUPER PULSER	115 VAC @ 4VA	115 VAC @ 5 A, SPDT 25 VDC @ 100 mA	25 ms 1 ms	Plastic can	12 pin socket	Modulating control for LED sensors. More powerful than R42/T42. Operates on phase principle with larger gain, better rejection of ambient light. Sensitivity and phase controls. Output and alignment indicators. T43 has open collector 230 VAC model available.	109
T44000	115 VAC @ 2 VA	250 mA open collector	20 ms	Plastic can	11 pin socket	AC control designed for use with the S56 Series High-Speed NONO-SKAN with preamplifier. The T44000 includes an open collector output, a sensitivity adjust and an output indicator.	112
R48 T48	115 VAC @ 2 VA	15 VAC @ 5 A, SPDT 25 VDC @ 100 mA	25 ms *	Plastic can	11 pin socket	AC control for time delay or one-shot modes. Schmitt trigger amplifier. Sensitivity and time delay controls, output indicator LED. T48 is open collector output. 230 VAC model available.	114
R47/R48	115 VAC @ 2 VA	5 A, 10 A relay 2.0 A solid state relay 250 mA open collector	25 ms with relay 9 ms with solid state relay	NEMA 12 steel box	Wall mount	Circuit board chassis operates one sensor. Choice of plug-in circuit cards for time delay, one shot pulse, or batch counting. Output switch can be relay, or open collector. Sensitivity and timing controls. 230 VAC model available. R48 is chassis only.	117
R60	115 VAC @ 10 VA	5 A, 10 A relay 2.5 A triac 250 mA open collector	25 ms with relay 9 ms with solid state relay	NEMA 12 steel box	Wall mount	Two channel circuit board chassis takes a variety of logic cards. Sensor channels can operate separately or together. Sensitivity and timing controls. Output switch can be relay, or open collector 230 VAC model available. Enclosure optional.	120
T60	5 VDC or 8-28 VDC @ 175 mA	Open-collector NPN and PNP rated at 100 mA	5 ms	Plastic module	NS32 or NS35 DIN rail	DC-powered modulating amplifier. Provides ambient light rejection with complementary NPN and PNP outputs.	125

* See Response Time Chart in Technical Information



CONTROLS

Photoelectric Amplifier

Printed Circuit Board Mount

T21004

Features:

- Modular approach
- Printed circuit board mounting
- Low power consumption
- Small size
- Gold plated leads
- Epoxy encapsulated



Description:

The T21004 photoelectric amplifier module is designed to amplify output from a photodetector. The output of the photodetector is taken as the input of the module. A Schmitt Trigger circuit within the module insures positive switching of the output stage to a completely ON or completely OFF condition. An external sensitivity pot is used to adjust

the input threshold current at which the amplifier will trigger. To insure output stability a small amount of Hysteresis (approximately 0.2 volts) is built into the circuitry.

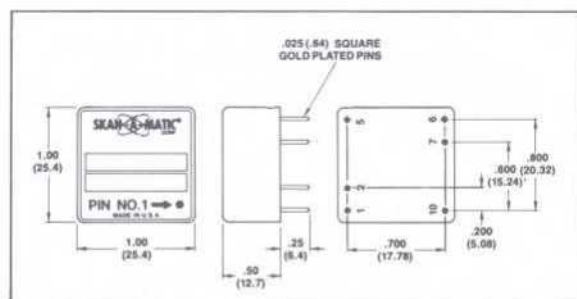
The module can be connected so that its output is energized when the photodetector is either LIGHT or DARK.

Specifications: (at 25°C)

INPUT	Threshold Voltage: 40% to 60% of supply voltage
OUTPUT	Open collector NPN transistor to switch up to 40 VDC at 40mA max. Energized with photodetector either LIGHT or DARK depending upon connection.
RESPONSE TIME	See Standard Amplifier under Response Time Chart in <i>Technical Information</i>

POWER SUPPLY	4 to 6 VDC at 2mA max., 5% regulation
SENSITIVITY ADJUSTMENT	External 1 megohm potentiometer.
TEMPERATURE	Operating: 0° to 50 °C Storage: -40° to 70°C

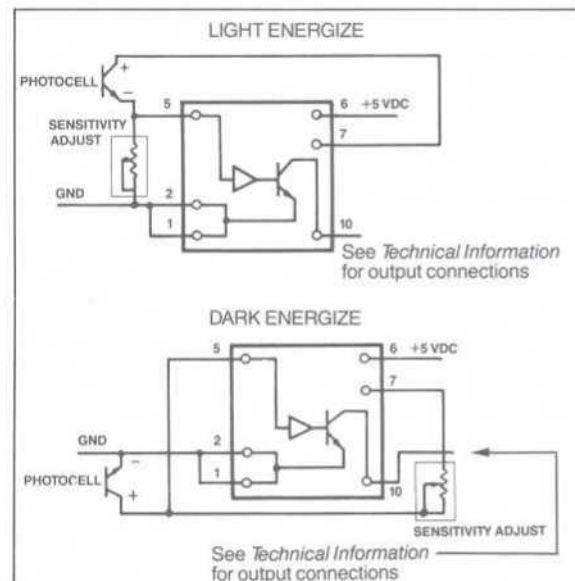
Dimensions:



Accessories:

- B01001 MODULE SOCKET**
Facilitates easy replacement of the module

Wiring Diagram:





T21 Series

Photoelectric Amplifier Printed Circuit Board Mount T21104

Description:

The T21104 photoelectric amplifier module is designed to amplify output from a photodetector to a level suitable for operating devices requiring DC voltage signal input. The output of the photodetector is taken as the input to the module. A Schmitt Trigger circuit within the module ensures positive switching of the output state to a completely "ON" or completely "OFF" condition. An internal sensitivity pot is used to adjust the input threshold current at which the amplifier will trigger. To ensure output stability a small amount of hysteresis (approximately 0.2 volts) is built into the circuitry. An indicator LED is provided to monitor amplifier state. It is ON when the photodetector is dark and OFF when photodetector is light. The module can be connected so that its output is energized when the photodetector is either LIGHT or DARK.

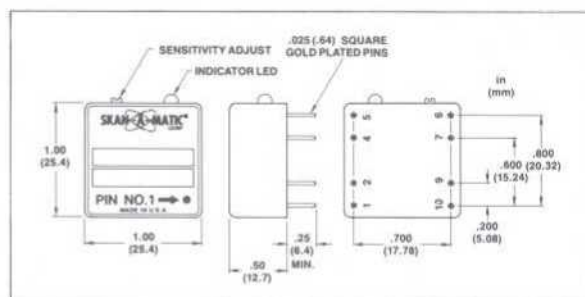


Specifications: (at 25°C)

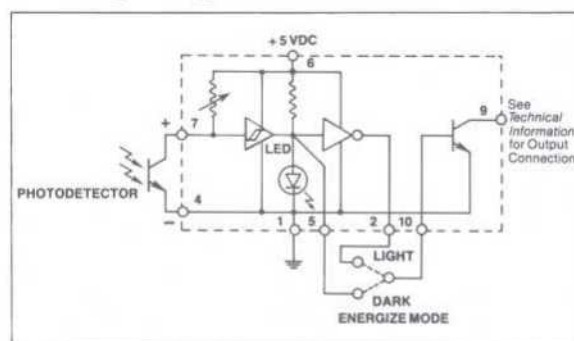
INPUT	Threshold Voltage: 40% to 60% of supply voltage
OUTPUT	Open collector NPN transistor to switch up to 40 VDC at 100 mA max. Energized with photodetector either LIGHT or DARK depending upon connection.
RESPONSE TIME	See Standard Amplifier under Response Time Chart in <i>Technical Information</i>

POWER SUPPLY	4 to 6 VDC at 20 mA max., 5% regulation
SENSITIVITY	
ADJUSTMENT	15 turn
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 70°C

Dimensions:



Wiring Diagram:



Accessories:

B01001 MODULE SOCKET

Facilitates easy replacement of the module

T22063 FOUR CHANNEL AMPLIFIER PC BOARD

Four T21104 modules mounted on a 4 1/2" X 4 1/2" circuit board with individual jumpers for LIGHT or DARK energize.

B01004 PC BOARD EDGE CONNECTOR

The B01004 edge connector mates with the above circuit board. It has a high impact plastic body with 22 gold plated contacts on .156" centers. For solder termination.



T21 Series

Modulating Photoelectric Amplifier Printed Circuit Board Mount T21028

Description:

The T21028 is a modulating photoelectric control designed for circuit board mounting. The module is powered from a single 5 volt DC supply and will operate with any Skan-A-Matic sensor that has an LED light source. The T21028 is used where ambient light may interfere with sensor operation. The LED is modulated at approximately 2 kHz, and the receiver is tuned to respond to a signal of this frequency.

The output can be used in a variety of ways. The outputs from pins 10 and 11 can be used to drive TTL loads directly. The buffer transistor can be used to increase the output capability and can be



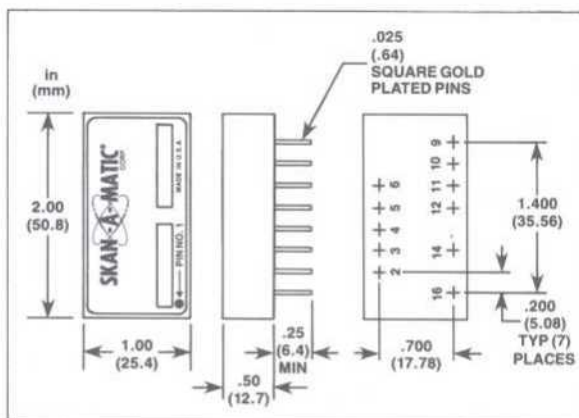
wired in either Open Collector or Open Emitter configuration.

A Skan-A-Matic sensor using a 100 mA LED can be connected directly to pins 14 and 16 as shown. For sensors with 40 mA and 60 mA LED's a 27 ohm, 1/4 W and a 6.8 ohm, 1/4 W current limiting resistor respectively must be used.

Specifications: (at 25°C)

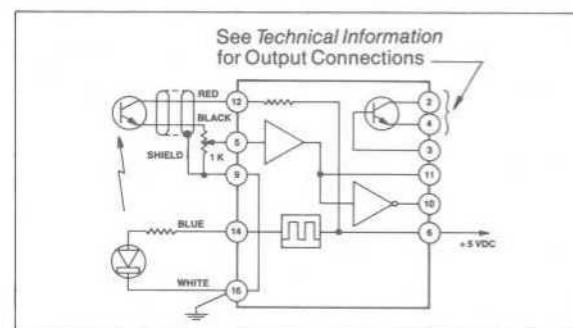
POWER INPUT	5 VDC $\pm$.25 VDC at 110 mA max.
EXTERNAL POTENTIOMETER	1K ohm (15 turn) recommended located in close proximity to the module. Larger values will offer more sensitivity but less ambient light rejection. The converse is true for smaller values.
OUTPUT	Pins 10 & 11: HI VDC = 4.1 V at 4 mA max. source LO VDC = 0.5 V at 1 mA max. sink Buffer Transistor: NPN transistor to switch up to 28 VDC at 100 mA max.
RESPONSE TIME	5 milliseconds. Counting rate 100 cps max.
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 70°C

Dimensions:



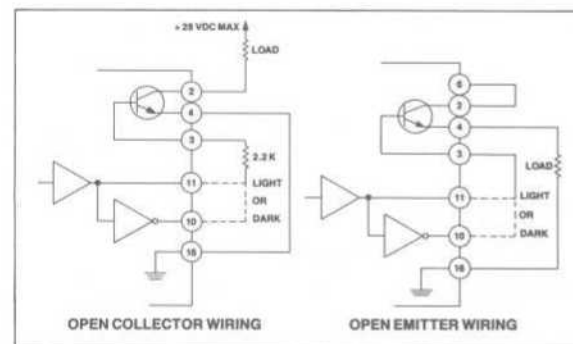
Wiring Diagram:

INPUT WIRING



Photodetector	Pin 10	Pin 11
DARK	HI	LO
LIGHT	LO	HI

OUTPUT WIRING



Note: In the Open Collector Wiring a 2.2 K ohm resistor must be used.



CONTROLS

Photoelectric Amplifiers

T31/T32 Series

Features:

- Open collector output
- Plug-in or screw mount with terminal strip
- Output indicator LED
- 15 turn sensitivity adjustment
- May be wired LIGHT or DARK energize
- 5 VDC or 8–28 VDC models input

Description:

The T31/T32 Series photoelectric controls are designed to amplify the photodetector signal from one reflective skanner or thru-beam pair, and to drive an output transistor to switch a load. These controls do not supply power for the lamp or LED portion of the photoelectric device.

Power input to the amplifier can be 5 VDC or 8-28 VDC, to be specified by the catalog part number. The output is an open collec-



tor capable of driving loads up to 250 milliamps and switching 28 VDC maximum. A Schmitt Trigger designed into the unit provides positive switching action.

The T31 Series unit is a plug-in module for socket mounting while the T32 Series is a screw mounted unit with terminal strip. A red LED output indicator is provided on both models and both have an internal 15 turn potentiometer to adjust the sensitivity.

Specifications: (at 25°C)

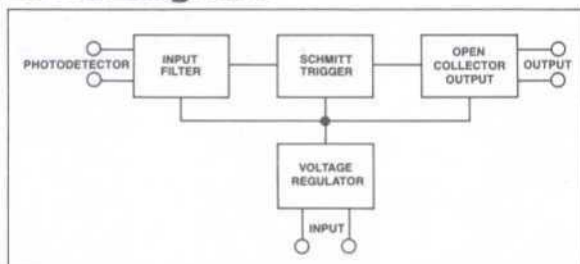
POWER INPUT	5 ± 10% or 8–28 VDC, 28 mA. Voltage specified by proper part number.
SENSOR VOLTAGE	5 VDC 1 mA max. supplied by unit
OUTPUT	Open collector to switch up to 28 VDC at 250 mA max. An external diode should be used when switching inductive loads.
SENSITIVITY ADJUSTMENT	15 turn External pot may be used.

RESPONSE TIME	See Standard Amplifier under Response Time Chart in <i>Technical Information</i>
TEMPERATURE	Operating: 0° to 50°C Storage: –40° to 70°C
ENCLOSURE	T31 Series: 8 pin plug-in module, .687" pin circle dia.; black molded plastic case. Socket not included. T32 Series: Screw mounted module with 7 screw terminals.

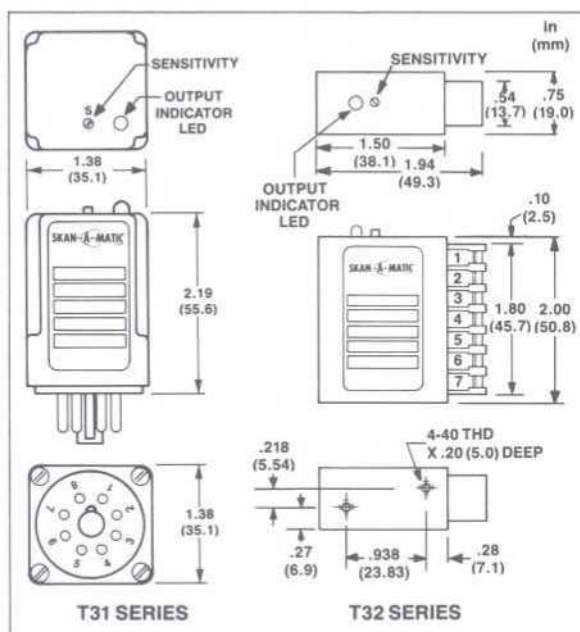


T31/T32 Series

Block Diagram:



Dimensions:



Compatibility With Sensors:

The T31/T32 Series controls are designed to be used with most Skan-A-Matic reflective skanners and thru-beam combinations. Lamp and LED power, however, must be provided from a separate power source. For proper connection of LED light sources, calculate resistor values using formula under Wiring section of *Technical Information*.

Model Selection Guide:

Part #	Input Voltage	Enclosure
T31101	5VDC	8 Pin Plug
T31102	8-28 VDC	8 Pin Plug
T32001	5VDC	Screw Terminal
T32002	8-28VDC	Screw Terminal

Accessories:

RELAYS

The T31/T32 Series control may be used to drive an external relay or solid state relay. The following are available:

R02003 Solid State Relay rated 2.0 amps at 20-140VAC. Life is 10 million operations at rated load.

R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.

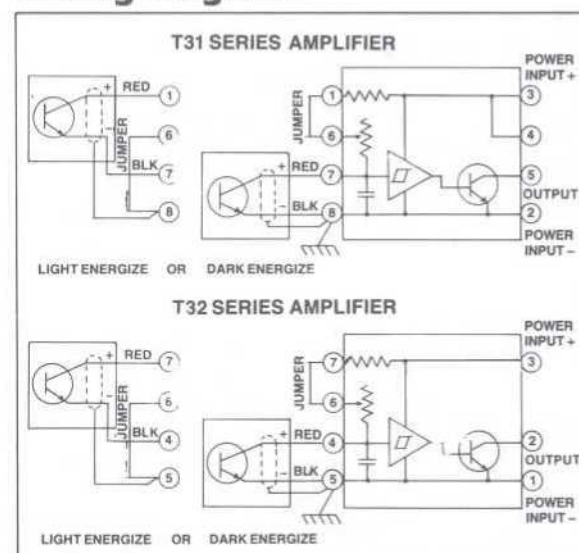
R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.

All are 8 pin, plug-in modules. Sockets are not included.

SOCKET

Available — see *Accessories & Options*, pg 127.

Wiring Diagram:



CONTROLS

LED Modulating Amplifier T325 Series

Features:

- Ambient light immunity
- Selectable modulation frequencies
- Open collector output
- Output indicator LED
- 15 turn sensitivity adjustment
- Available in LIGHT or DARK energize models



Description:

These controls provide ambient light immunity in a small, convenient DC-powered package. Each control modulates the LED light source of a reflective skanner or thru-beam pair and responds

only to photodetector signals with the same modulation frequency. The user may select either of two modulating frequencies to eliminate crosstalk between closely spaced sensors.

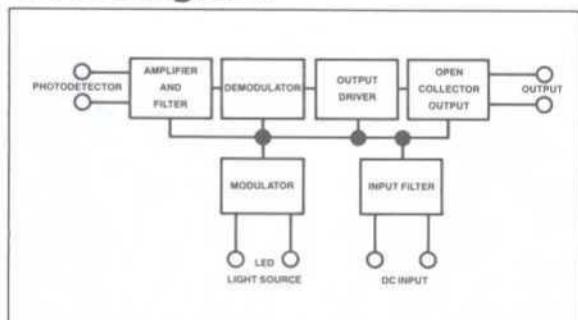
Specifications: (at 25°C)

POWER INPUT	5 VDC $\pm 5\%$, 125 mA	RESPONSE TIME	5 milliseconds typ. Counting rate 100 cps.
LED POWER	Supplied by unit. Internal resistor included for 100 mA LED	SENSITIVITY ADJUSTMENT	15 turn
SENSOR VOLTAGE	5 VDC at 1 mA max.	TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 70°C
OUTPUT		ENCLOSURE	Screw mounted black plastic module with 7 screw terminals.
Open			
Collector	NPN transistor to switch up to 30 VDC at 100 mA max.		

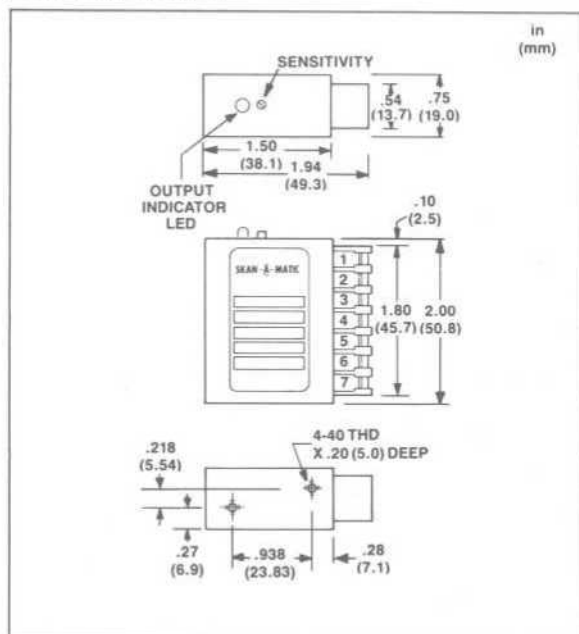


T325 Series

Block Diagram:



Dimensions:



Compatibility With Sensors:

A T325 Series control can operate any LED thru-beam pair or scanner. A 100 mA LED can be wired directly across terminals 3 and 4. Others require an external 1/4W resistor between the blue (+) lead and terminal 3. For a 60 mA LED use a 6.8 ohm resistor; for a 40 mA LED use a 27 ohm resistor. A 6.8 ohm and 27 ohm resistor are included with each control. These controls should not be used to operate an incandescent lamp device.

Model Selection Guide:

Part #	Description
T32501	DARK Energize
T32521	LIGHT Energize

Accessories:

RELAYS

The T325 Series control may be used to drive an external relay or solid state relay. The following are available:

R02003 Solid State Relay rated 2.0 amps at 20-140VAC. Life is 10 million operations at rated load.

R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.

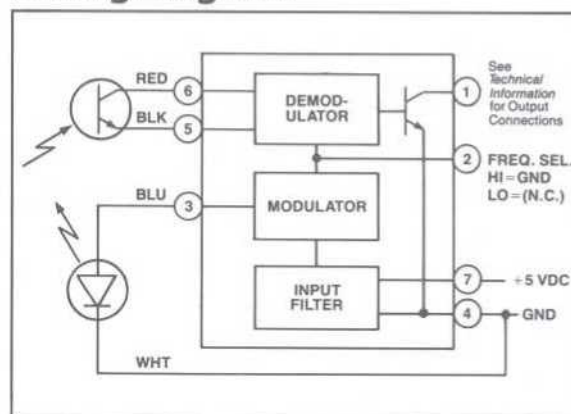
R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.

All are 8 pin, plug-in modules. Sockets are not included.

SOCKET

Available — see *Accessories & Options*, pg. 127.

Wiring Diagram:





CONTROLS

Photoelectric Amplifier with Time Delay T36 Series

Features:

- Open collector output
- Output indicator LED
- 6 time delay modes available
- 5, 12 and 24 VDC input

Description:

The T36 Series are time delay photoelectric controls designed to operate one reflective skanner or thru-beam pair. Each unit amplifies the photodetector signal actuating the timer which switches the output transistor. These controls do not supply power for the lamp or LED portion of the photoelectric device. Sensitivity and time delay adjustments are provided on the module.

Specifications: (at 25°C)

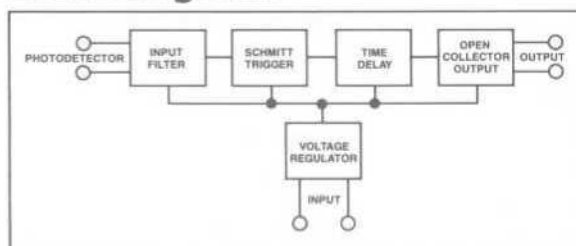
POWER INPUT	5, 12, or 24 VDC, 18 mA. Voltage specified by part number
SENSOR VOLTAGE	5 VDC, 1 mA max., supplied by unit.
OUTPUT	Diode protected open collector to switch supply voltage at 250 mA max.
SENSITIVITY ADJUSTMENT	15 turn



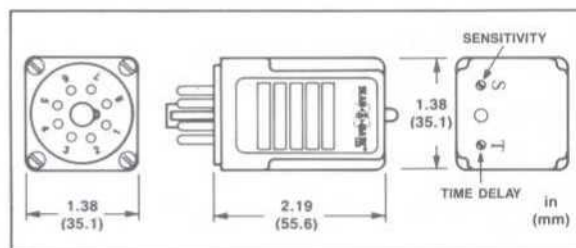
Power input can be 5, 12 or 24 VDC to be specified by the catalog part number. The output is a diode protected NPN collector capable of driving loads up to 250 milliamps at a maximum voltage equal to the power input voltage. Positive switching is effected by the Schmitt Trigger and the low voltage regulated logic circuitry assures consistent time delay performance.

TIME DELAY ADJUSTMENT	15 turn. Mode and delay range must be specified.
RESPONSE TIME	See Standard Amplifier under Response Time Chart in <i>Technical Information</i>
TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 70°C
ENCLOSURE	8 pin plug-in module, .687" pin circle dia.; black molded plastic case. Socket not included.

Block Diagram:



Dimensions:



Compatibility With Sensors:

The T36 Series controls are designed to be used with most Skan-A-Matic reflective skanners and thru-beam combinations. Lamp and LED power, however, must be provided from a separate power source. For proper connection of LED light sources calculate resistor values using formula under Wiring section of *Technical Information*.

Model Selection Guide:

To specify a T36 Series control, the part number must consist of a type letter and five digits, denoting series, input voltage, delay or pulse mode and timing range. Construct the part number as follows:

Part #	T	3	6		
Series					
Input Voltage					
5 VDC		1			
12 VDC		2			
24 VDC		3			
Timing Range (See Range Chart)					
Time Delay				1, 2 or 3	
Pulse Width				1, 2 or 3	
Delay Mode (See Mode Chart)					
Time Delay				1, 2, 3 or 4	
Adjustable Pulse				.5 or 6	

Example: T36213 denotes a control with 12 volt input wiring for LIGHT energize, delay ON operation in the 1 to 60 second timing range.



T36 Series

Accessories:

RELAYS

The T36 Series control may be used to drive an external relay or solid state relay. The following are available:

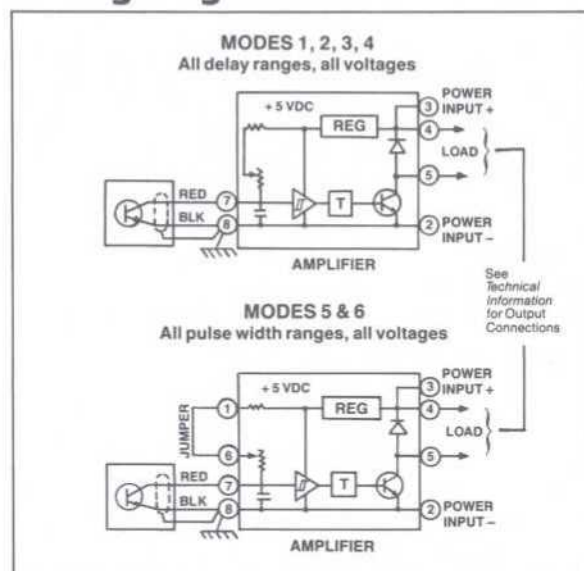
R02003 Solid State Relay rated 2.0 amps at 20-140VAC. Life is 10 million operations at rated load.

R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.

R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.

All are 8 pin, plug-in modules. Sockets are not included.

Wiring Diagram:



Time Delay Mode Chart:

FUNCTION	MODE	OUTPUT STATE	PHOTODETECTOR STATE			
			DARK	LIGHT	DARK	LIGHT
Delay ON Instant OFF	1 LIGHT Energize	Energize	ΔT		ΔT	
	De-energize					
2 DARK Energize	Energize		ΔT		ΔT	
	De-energize					
Instant ON Delay OFF	3 DARK Energize	Energize	ΔT		ΔT	
	De-energize					
4 LIGHT Energize	Energize		ΔT		ΔT	
	De-energize					
Instant ON Adjustable One-Shot	5 DARK Energize	Energize Short Duration	ΔP		ΔP	
		De-energize				
	6 LIGHT Energize	Energize Long Duration	ΔP		ΔP	
		De-energize				

Time Delay Modes:

MODE 1 is LIGHT, delay ON. If the photodetector is LIGHT for a period of time greater than set with the adjustment, the output will energize. It will remain energized until the photodetector is DARK, then it will immediately de-energize.

MODE 2 is the same as MODE 1 except it will energize when the photodetector is DARK and will remain energized until the photodetector is LIGHT, then it will immediately de-energize.

MODE 3 is LIGHT, delay OFF. If the photodetector is DARK the output will energize instantly. It will remain energized as long as the photodetector is DARK. When the photodetector is LIGHT for the period of time set with the adjustment, the output will de-energize.

MODE 4 is the same as MODE 3 except it will energize when the photodetector is LIGHT and will remain energized as long as the photodetector is LIGHT. When the photodetector is DARK for the period of time set with the adjustment, the output will de-energize.

ONE-SHOT ADJUSTABLE PULSE MODES 5 AND 6

MODE 5 will output a pulse when the photodetector is DARK. The output pulse will always be of the same preset duration, regardless of the state of the photodetector.

MODE 6 is the same as MODE 5 except the output is energized when the photodetector is LIGHT.

Time Delay Range Chart:

Modes 1, 2, 3, 4 (ΔT)		Modes 5, 6 (ΔP)	
Range 1	.05 to 3.0 sec.	Range 1	.002 to .100 sec.
Range 2	.25 to 15.0 sec.	Range 2	.020 to 1.0 sec.
Range 3	1.0 to 60.0 sec.	Range 3	.200 to 10.0 sec.

Repeatability of time delay and adjustable pulse width ranges is 2% to 15 seconds, 5% to 1 minute.



CONTROLS

Amplifier with Power Supply R40/T40 Series

Features:

- Complete photoelectric control
- Open collector, relay, or solid state relay output
- Output indicator LED
- 15 turn sensitivity adjustment
- Regulated DC power supply
- May be wired LIGHT or DARK energize
- 115 or 230 VAC input

Description:

The R40/T40 Series are complete photoelectric controls, which operate with one reflective skanner or thru-beam pair. Each unit provides light source power, amplifies the photodetector signal, and functions as an output switch. Only standard AC line voltage is



required. The R40 Series has a relay output while the T40 units have transistor or solid state relay output. A red LED output indicator and sensitivity adjustment are provided.

Specifications: (at 25°C)

R40 Series

POWER INPUT	115 or 230 VAC $\pm$ 10%, 50–400 Hz, 2VA
LAMP POWER	5 VDC at 125 mA max. supplied by unit.
LED POWER	125 mA max. Requires external resistor.
SENSOR VOLTAGE	5 VDC supplied by unit
OUTPUT	Relay, SPDT, 5 amp at 115 VAC. 3 amp at 230 VAC or 28 VDC resistive load 100mA minimum load.
Life	100,000 operations at rated load with a cycle rate = 2 second ON/2 seconds OFF. 1 million at 1/5 rated load.
SENSITIVITY ADJUSTMENT	15 turn. External potentiometer may be used. See Using a Remote Potentiometer in <i>Technical Information</i> .
RESPONSE TIME	25 milliseconds max. Counting rate 40 cps.
TEMPERATURE	Operating: 0° to 50°C Storage: –40° to 70°C
ENCLOSURE	11 pin plug-in module. .750" pin circle dia.; black molded plastic case. Socket not included.

T40 Series

Specifications same as R40 except as follows:

OUTPUT

Open Collector	NPN transistor to switch up to 25 VDC at 100 mA max.
Diode Protected Collector	NPN transistor to switch up to 5 VDC at 100 mA max.
Solid State Relay 2.0A	20-240 VAC. Response time 9 milliseconds max. 100 million operations at rated load. Minimum load current of 20mA. 4mA max. leakage current.

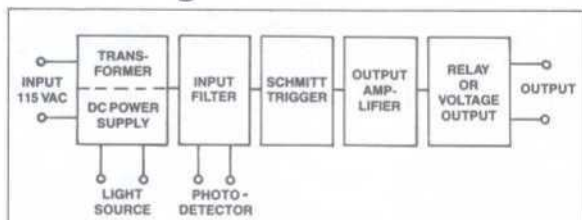
RESPONSE TIME

See Standard Amplifier under Response Time Chart in *Technical Information*

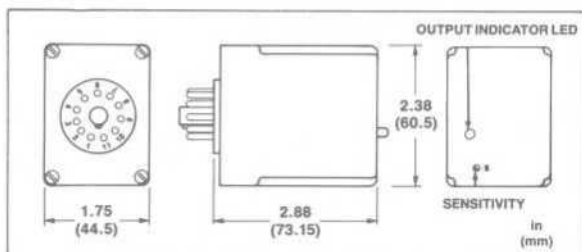


R40/T40 Series

Block Diagram:



Dimensions:



Compatibility With Sensors:

These controls are designed to be used with most Skan-A-Matic reflective skanners and thrubeam combinations. When using LED light sources with these controls, a current limiting resistor must be used. This resistor is supplied with each skanner or thrubeam.

Model Selection Guide:

Choice of unit depends on the type of output and the speed of response desired. If a relay output is desired, the R40 Series is suitable. The T40 Series with open collector or diode protected collector output may be used to control DC voltages and give much faster response. The T40 Series with solid state relay may be used where AC is being switched at a high repetition rate. To specify a control, the part number must consist of a type letter and five digits. Select the desired output and construct the number as follows:

Part#	4	0	0	0	0
Output Type					
Relay Output	R				
Open Collector Output .T					
Series					
Output Option					
5 Amp Relay (R40 only)		1			
Solid State Relay (T40 only)		2			
Open Collector (T40 only)		3			
Diode Protected NPN Collector (T40 only)		5			

230 VAC models available. Add the suffix "230 VAC" to part number. Example: T40300-230 VAC denotes a control with an open collector output and 230 VAC input.

Accessories:

RELAYS

The T40300 or T40500 control may be used to drive an external relay or solid state relay. The following are available:

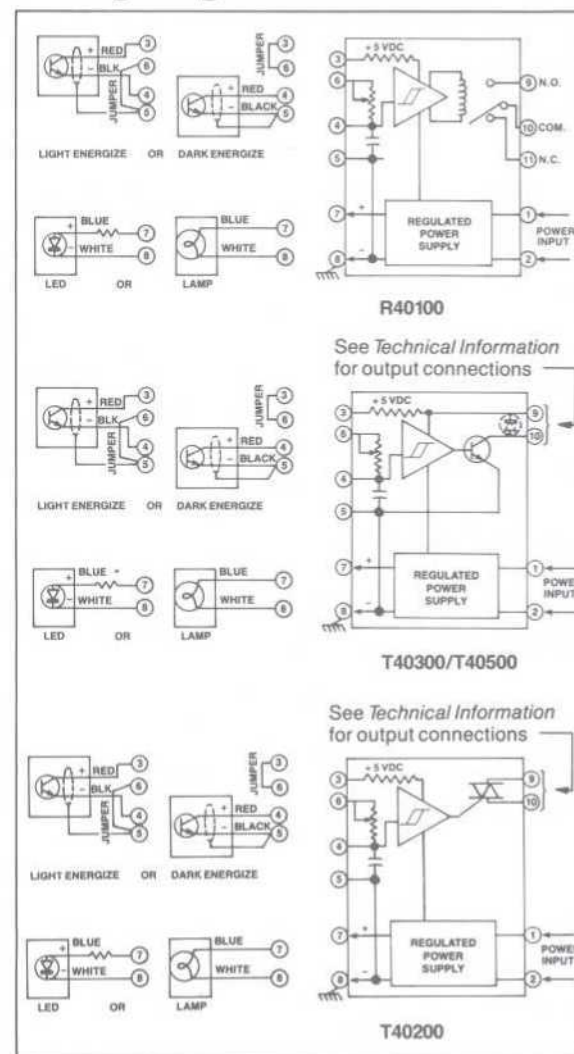
R02003 Solid State Relay rated 2.0 amps at 20-140VAC. Life is 10 million operations at rated load.

R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.

R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.

All are 8 pin, plug-in modules. Sockets are not included.

Wiring Diagram:





CONTROLS

High-Speed Amplifier with Power Supply T41300

Features:

- High speed
- Complete photoelectric control
- Output LED indicator
- 15 turn sensitivity adjustment
- Regulated DC power supply
- May be wired LIGHT or DARK energize
- Open collector output
- 115 or 230 VAC input



Description:

The T41300 is a complete photoelectric control designed to operate with one reflective skanner or thru-beam pair. The unit amplifies the photodetector signal, provides light source power and

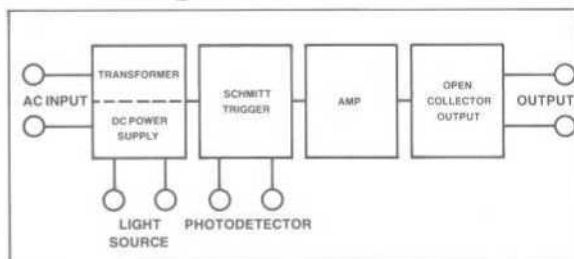
functions as an output switch. Only standard 115 or 230 VAC input is required. The unit has an open collector transistor output and is equipped with a red LED output indicator.

Specifications: (at 25°C)

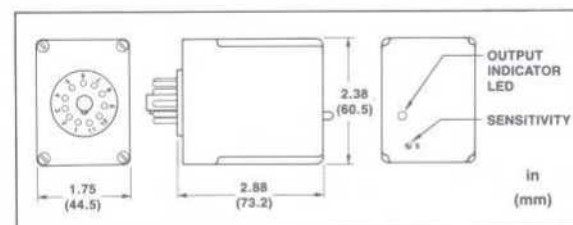
POWER INPUT	115 or 230 VAC $\pm$ 10%, 50–400 Hz, 2 VA
LAMP POWER	5 VDC at 125 mA max. supplied by unit
LED POWER	125 mA max. Requires external resistor
SENSOR VOLTAGE	5 VDC at 1 mA
OUTPUT	Open collector, to switch up to 100 mA at 25 VDC max.
SENSITIVITY ADJUSTMENT	15 turn

RESPONSE TIME	See High Speed Amplifier under Response Time Chart in <i>Technical Information</i>
TEMPERATURE	Operating: 0° to 50°C Storage: –40° to 70°C
ENCLOSURE	11 pin plug-in module, .750" pin circle dia.; black molded plastic case. Socket not included.

Block Diagram:



Dimensions:





T41300 Series

Compatibility With Sensors:

The T41300 is designed to be used with most Skan-A-Matic reflective skanners and thrubeam combinations. This amplifier should be utilized wherever high speed operation is required. When using LED light sources with these controls, a current limiting resistor must be used. This resistor is supplied with each LED skanner or LED thrubeam light source.

Model Selection Guide:

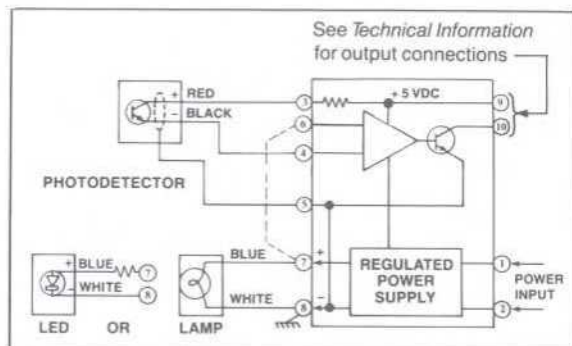
Part#	Power Input
T41300	115 VAC
T41300-230 VAC	230 VAC

Accessories:

SOCKET

Available — see *Accessories & Options*, pg. 127.

Wiring Diagram:



For **DARK Energize** operation, make **no** connection between pins 6 and 7.

For **LIGHT Energize** operation, jumper pin 6 to pin 7.

All system components should have same "machine ground".



CONTROLS

LED Modulating Amplifier R42/T42 Series

Features:

- Provides ambient light immunity
- Avoids cross-talk between adjacent sensors
- Available in LIGHT or DARK energize models
- Time delay available
- Total photoelectric control
- Open collector or relay output available
- 115 or 230 VAC input

Description:

The R42/T42 Series offers complete controls designed to provide photoelectric sensor immunity to ambient light. Each will operate one LED reflective scanner or thru-beam pair *but cannot be used with an incandescent lamp device*. Each control provides modulated light source power, amplifies the phototransistor signal and functions as an output switch. Delay ON or Delay OFF timing modes available.

Only standard 115 or 230 VAC input is required. The R42 Series includes an output relay, while the T42 Series has an open collector transistor to switch an external load. Each module is



R42/T42
Series

equipped with a red LED output indicator, and has its own sensitivity adjustment. Separate models are provided for "LIGHT energize" or for "DARK energize" operation and cannot be modified in the field. The user may wire the control for two different modulating frequencies to avoid cross-talk.

These modulating controls, while defeating the problem of ambient light, do not affect the operating distance or target resolution of any sensor. When used with any sensor, the T42 responds in 5 milliseconds, while the R42, limited by its mechanical relay, responds in 25 milliseconds.

Specifications: (at 25°C)

R42 Series

POWER INPUT	115 or 230 VAC $\pm 10\%$, 50–400 Hz, 2 VA
LED POWER	Supplied by unit. Internal resistor included for 100 mA LED
SENSOR VOLTAGE	5 VDC at 1 mA max.
OUTPUT	Relay, SPDT, 5 amp at 115 VAC, 3 amp at 230 VAC or 28 VDC resistive load. 100 mA minimum load.
Life	100,000 operations at rated load, with a cycle rate = 2 seconds ON/2 seconds OFF
RESPONSE TIME	25 milliseconds typ. Counting rate 40 cps typ.
SENSITIVITY ADJUSTMENT	15 turn

TEMPERATURE

Operating: 0° to 50°C
Storage: –40° to 70°C

ENCLOSURE

11 pin plug-in module; .750" pin circle dia.; black molded plastic case. Socket not included.

T42 Series

Specifications same as R42 Series except as follows:

OUTPUT

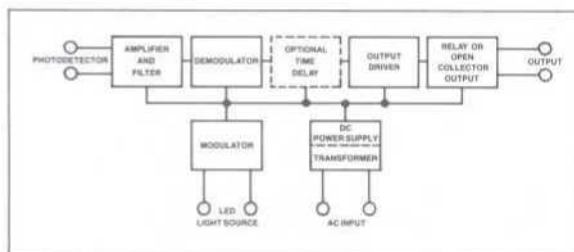
Open
Collector

NPN transistor to switch up to 25 VDC at 100 mA max.

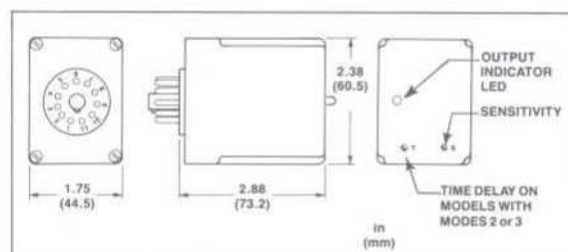
RESPONSE TIME

5 milliseconds max. Counting rate 100 cps max.

Block Diagram:



Dimensions:



Phone 800-448-2900

Fax 800-223-5138

R42/T42 Series

Compatibility With Sensors:

An R42 and 142 Series control can operate any LED thrubeam pair or skanner. A 100 mA LED can be wired directly across terminals 7 and 8. Others require an external 1/4 W resistor between the blue (+) lead and terminal 7. For a 60 mA LED use a 6.8 ohm resistor; for a 40 mA LED use a 27 ohm resistor. A 6.8 ohm and 27 ohm resistor are included with each R42 or T42 Series control. These controls should not be used to operate an incandescent lamp device.

Model Selection Guide:

Part # 4 2

Output Type

Relay	R
Open Collector . . .	T

Series

Timing Mode

None	0
Delay ON	2
Delay OFF	3

LIGHT or DARK Energize

LIGHT	7
DARK	8

Timing Range

None	0
.05 to 3.00 sec.	1
.25 to 15.0 sec.	2
1.0 to 60.0 sec.	3

Repeatability of time delay and adjustable pulse width ranges is 2% to 15 seconds, 5% to 1 minute

Accessories:

RELAYS

The T42 Series control may be used to drive an external relay or solid state relay. The following are available:

R02003 Solid State Relay rated 2.0 amps at 20–140VAC. Life is 10 million operations at rated load.

R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.

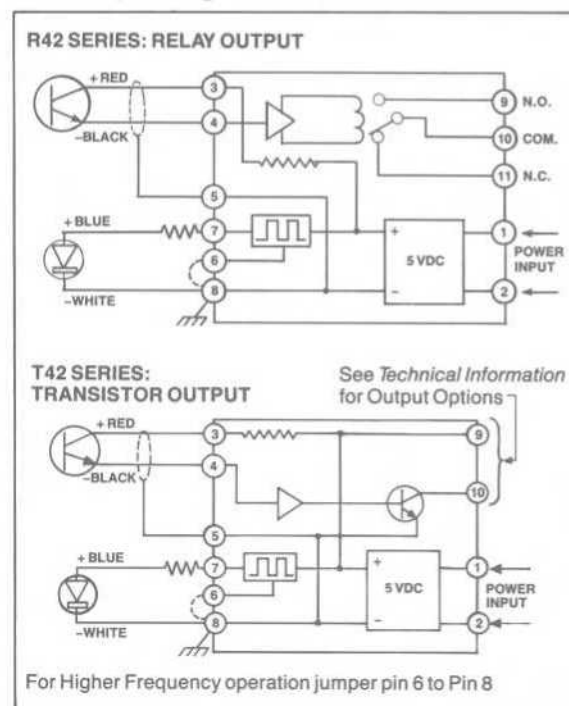
R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.

All are 8 pin, plug-in modules. Sockets are not included.

SOCKET

Available — see *Accessories & Options*.

Wiring Diagram:

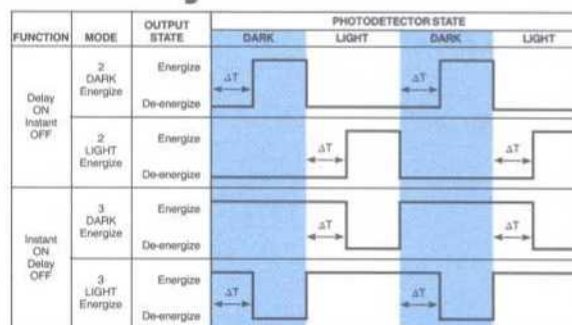


Time Delay Modes:

MODE 2 is delay ON. When specified for DARK the output will energize if the photodetector is DARK for a period of time greater than set. It will remain energized until the photodetector is LIGHT, then it will immediately de-energize. The converse occurs when the control is specified for LIGHT.

MODE 3 is delay OFF. When specified for DARK the output will energize instantly if the photodetector is DARK. It will remain energized as long as the photodetector is DARK. When the photodetector is LIGHT for the period of time set with the adjustment, the output will de-energize. The converse occurs when the control is specified for LIGHT.

Time Delay Mode Chart:





CONTROLS

LED Modulating Amplifier

R43/T43 Series

SUPER PULSER®

Features:

- Increased range
- Enhanced ambient light immunity
- Two sensitivity ranges
- Relay or open collector output
- Total photoelectric control
- 115 or 230 VAC input

Description:

R43 and T43 Series controls expand sensor capability by means of LED modulation and phase sensitive detection. These controls increase operating distance 2 to 5 times, provide ambient light immunity and increase beam penetration. The difference between the two units is that the R43 Series has an output relay while the T43 Series has an open collector transistor.

These controls provide modulated light source power to oper-



ate a single LED reflective skanner or an LED thru-beam pair. Incandescent light sources may *not* be used with R43 or T43 controls. Photodetector signal amplification and output switching functions are integral to both units. The R43 and T43 can be ordered for either "LIGHT energize" or "DARK energize" operation. Phase and sensitivity adjustments and indicators are located on top of the modules.

Typical Applications:

- Penetrate dusty atmosphere
- Increase operating distance
- Reject ambient light
- Sense single vs. multiple layers

Specifications:

R43 Series

POWER INPUT	115 or 230 VAC $\pm$ 10%, 50–400 Hz, 4VA
LED POWER	Supplied by unit. Internal resistor included for 100 mA LED.
SENSOR VOLTAGE	$\pm$ 5 VDC supplied by unit
OUTPUT	Relay, SPDT, 5 amp 115 VAC, 3 amp 230 VAC or 28 VDC resistive load. .5A minimum load. 100,000 operations at rated load, with a cycle rate = 2 seconds ON/2 seconds OFF, 1 million at 1/5 rated load.
Life	25 milliseconds max. Counting rate 40 cps max.
RESPONSE TIME	15 turn
ADJUSTMENTS	Operating: 0° to 50°C
TEMPERATURE	Storage: – 40° to 70°C
ENCLOSURE	12 pin plug-in module, black molded plastic case. Socket is included.

T43 Series

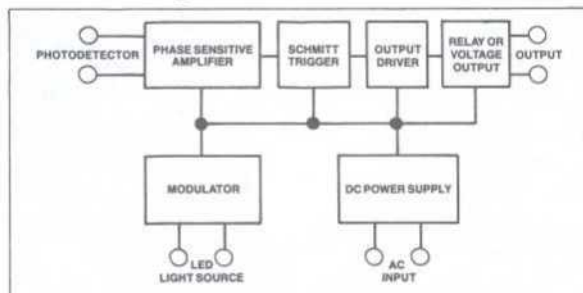
Specifications same as R43 except as follows:

OUTPUT	
Open Collector	NPN transistor to switch up to 25 VDC at 100 mA max.
Analog	DC voltage proportional to sensor signal and sensitivity setting. 0 to – 3V range from Pin 5. 10K ohm min. load.
RESPONSE TIME	1 millisecond max. Counting rate 400 cps max.

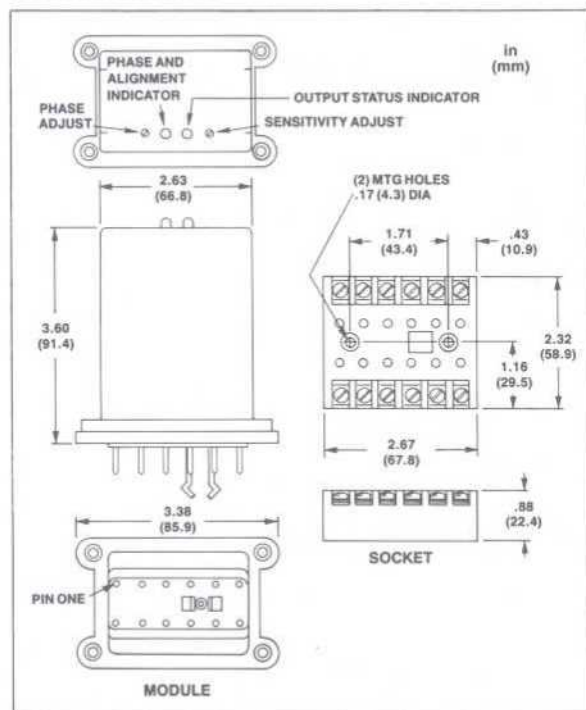


R43/T43 Series

Block Diagram:



Dimensions:



Compatibility with Sensors:

An R43 or T43 Series control can operate any LED thrubeam pair or scanner except the S111, S20, S22 and S27 Series scanners. A 100 mA LED can be wired directly across terminals 11 and 12. Others require an external 1/4 W resistor between the blue (+) lead and terminal 12. For a 60 mA LED use a 6.8 ohm resistor; for a 40 mA LED, use a 27 ohm resistor. Both a 6.8 ohm and 27 ohm resistor are included with each R43 or T43 Series control. These controls should not be used to operate an incandescent lamp device.

Model Selection Guide:

Part #	Output	Mode
R43007	Relay	LIGHT Energize
R43008	Relay	DARK Energize
T43007	Transistor	LIGHT Energize
T43008	Transistor	DARK Energize

230 VAC models available. Add the suffix "230 VAC" to Part #.
Example: R43007-230 VAC

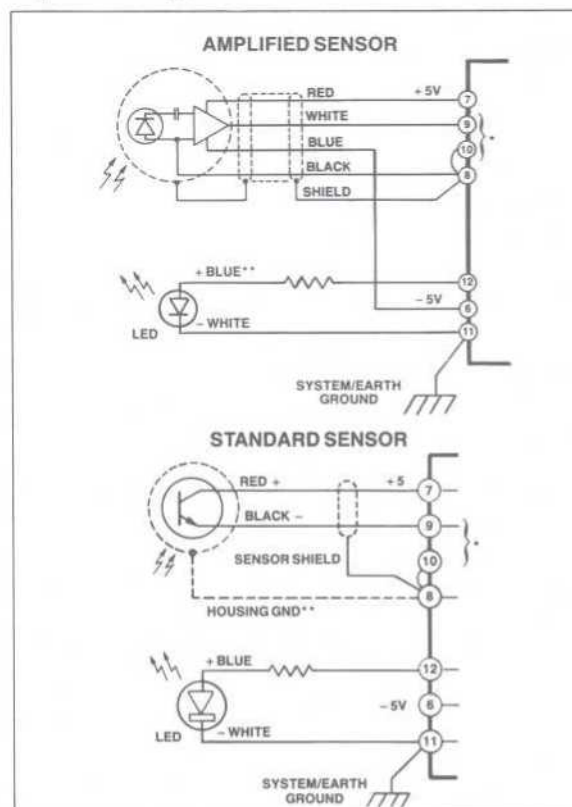
Accessories:

RELAYS

The T43 Series control may be used to drive an external relay or solid state relay. The following are available:
R02003 Solid State Relay rated 2.0 amps at 20-140VAC. Life is 10 million operations at rated load.
R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.
R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.
All are 8 pin, plug-in modules. Sockets are not included.

Wiring Diagram:

Input Wiring:



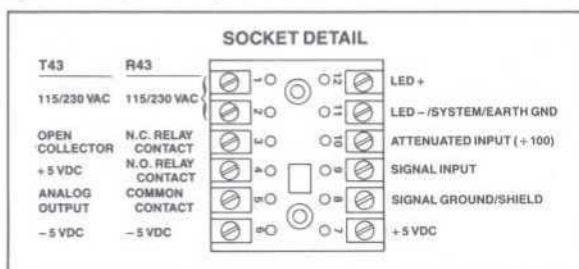
*See Input Connections

**For additional noise immunity, connect sensor body to terminal 8

R43/T43

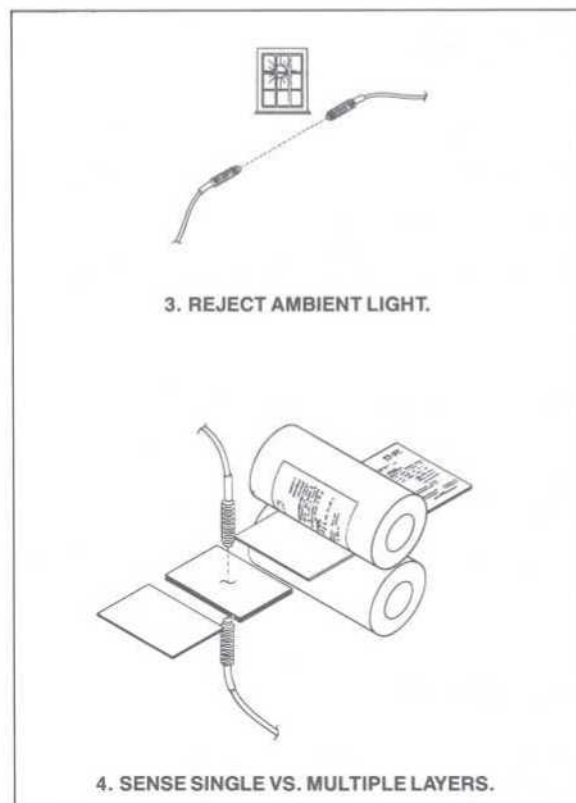
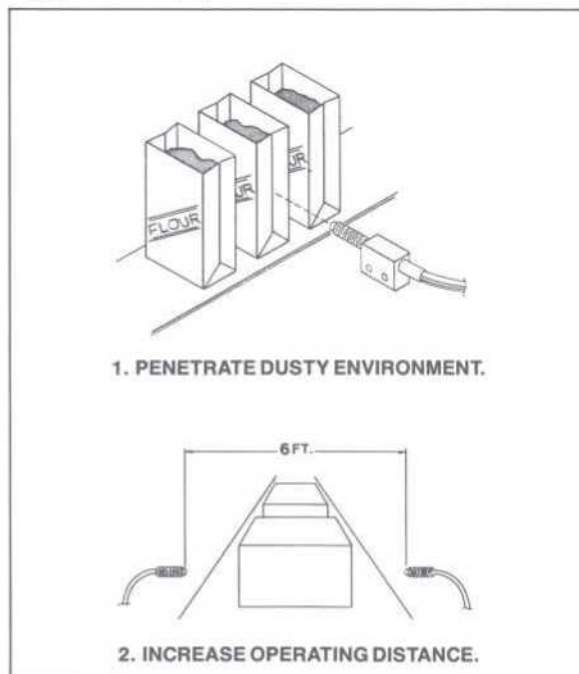
Input Connections:

Two types of sensor connections are shown in the diagram, the amplified sensor and the standard sensor. The amplified sensor requires both ± 5 VDC connections, while the standard sensor connects only to $+5$ VDC. All amplified sensors have S43 or P43 Series numbers, all others are standard sensors. The diagram shows both types of sensors wired in the high sensitivity mode. Connect input to pin 9, jumper from pin 8 to 10. To wire in the low sensitivity mode connect input to pin 10, jumper from pin 8 to 9. The "HI" mode should be used for all long range and most other applications. The "LO" mode should be used when too high a sensor signal makes sensitivity adjustment difficult (i.e. when sensitivity pot operates in the first two turns from full CCW). With standard sensors and, if an extremely high level of ambient light exists, a 100 ohm to 1000 ohm resistor may be wired between signal input and ground. A lower value resistor will provide more light immunity but less gain, and vice versa.



NOTE: Photodetector leads should be shielded and electrically isolated from LED leads.

Typical Applications:





CONTROLS

Control for Preamplified Skanners T44000

Features:

- Open collector output
- Plug-in
- Output indicator LED
- 15 turn sensitivity adjustment
- May be wired LIGHT or DARK energize



Description:

The T44000 is a complete control designed for use with the S56 Series High Speed NANO-SKAN® with preamplifier. It cannot be used with standard skanners, without a preamp, which provide a current output. Each control provides light source power, amplifies the scanner's output signal and functions as an output switch.

Only 115VAC input is required. A self contained, regulated power supply converts this power into both plus and minus 5VDC, which are required to operate the preamplifier in the scanner. The control includes an open collector transistor output, an external sensitivity adjustment and a red output indicator LED. If a relay or triac output is required, see Accessories.

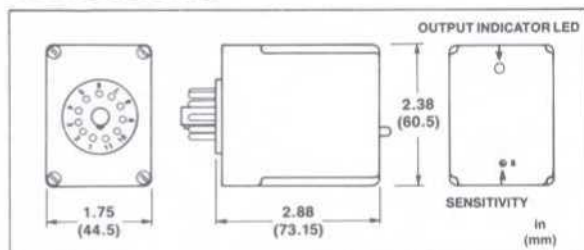
Specifications: (at 25°C)

POWER INPUT	115VAC $\pm 10\%$, 50-500Hz, 2VA	SENSITIVITY ADJUSTMENT	15 turn adjustable between .02 and 2.0V
POWER FOR SKANNER	+5VDC at 130mA max. -5VDC at 10mA	RESPONSE TIME	20 microseconds typ.
OUTPUT	Open collector NPN transistor to switch up to 25VDC at 250mA max. Protective diode should be added when driving inductive loads.	TEMPERATURE	Operating: 0° to 50°C Storage: -40° to 70°C
		ENCLOSURE	11 pin plug-in module. .750" pin circle dia.; black molded plastic case. Socket not included.



T44000

Dimensions:



Accessories:

RELAYS

The T44 Series control may be used to drive an external relay or solid state relay. The following are available:

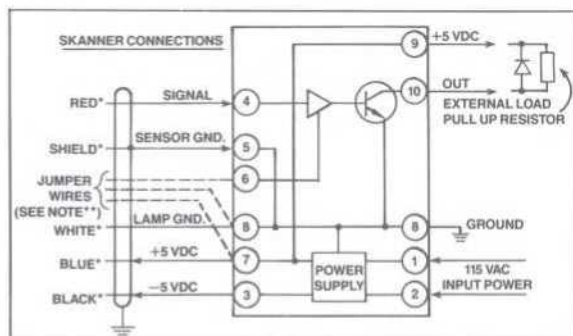
R02003 Solid State Relay rated 2.0 amps at 20-140VAC. Life is 10 million operations at rated load.

R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.

R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.

All are 8 pin, plug-in modules. Sockets are not included.

Wiring Diagram:



* LEADS SHOWN ARE THOSE FROM AN S56 Series High Speed NANO-SKAN® with preamp.

** JUMPER MUST BE EXTERNALLY WIRED TO PIN 6, WITH PINS 6 AND 7 CONNECTED, CONTROL WILL ENERGIZE WHEN SENSOR IS DARKENED; WITH PINS 6 AND 8 CONNECTED, CONTROL WILL ENERGIZE WHEN SENSOR SEES LIGHT.



CONTROLS

Amplifier with Time Delay R46/T46 Series

Features:

- Six time delay modes available
- Relay or open collector output
- Complete photoelectric control
- 15 turn adjustments
- Output indicator LED
- May be wired LIGHT or DARK energize
- 115 or 230 VAC input



R46/T46 Series

Description:

The R46/T46 Series offers complete time delay photoelectric controls designed to operate one reflective scanner or thru-beam pair. Each unit provides light source power, amplifies the photodetector signal, actuating the timer which switches the output load.

Only standard 115 or 230 VAC input is required. The R46 Series has a relay output, while the T46 Series has transistor output. Each is equipped with a red LED output indicator and sensitivity and time delay adjustments.

Specifications: (at 25°C)

R46 Series

POWER INPUT	115 or 230 VAC $\pm 10\%$, 50–400 Hz, 2 VA
LAMP POWER	5 VDC at 125 mA max. supplied by unit
LED POWER	125 mA max. Requires external resistor
SENSOR VOLTAGE	5 VDC supplied by unit
OUTPUT	Relay, SPDT, 5 amp at 115 VAC. 3 amp at 230 VAC or 28 VDC resistive load. 100 mA minimum load.
Life	100,000 operations at rated load, with a cycle rate = 2 seconds ON/2 seconds OFF.
RESPONSE TIME	25 milliseconds max. Counting rate 40 cps max.
SENSITIVITY ADJUSTMENT	15 turn. External potentiometer may be used. See Using a Remote Potentiometer in <i>Technical Information</i> .
TIME DELAY ADJUSTMENT	15 turn
TEMPERATURE	Operating: 0° to 50°C Storage: –40° to 70°C
ENCLOSURE	11 pin plug-in module. .750" pin circle dia.; black molded plastic case. Socket not included.

T46 Series

Specifications same as R46 except for the following:

OUTPUT

Open Collector NPN transistor to switch up to 25 VDC at 100 mA max.

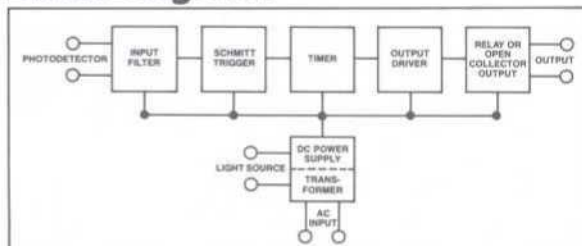
Diode Protected Collector NPN transistor to switch inductive loads up to 5 VDC at 100 mA max.

RESPONSE TIME See Standard Amplifier under Response Time Chart in *Technical Information*

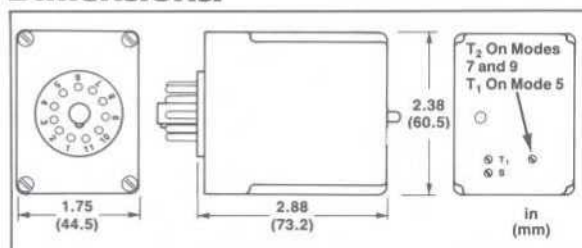


R46/T46 Series

Block Diagram:



Dimensions:



Compatibility With Sensors:

These controls are designed to be used with most Skan-A-Matic reflective scanners and thrubeam combinations. When using LED light sources with these controls, a current limiting resistor must be used. This resistor is supplied with each scanner or thrubeam. The Response Time Chart in *Technical Information* gives the response time of various sensors when used with "T" Series controls. Use this data to select the desired combination.

Model Selection Guide:

To specify a control, the part number must consist of a type letter and five digits, denoting series, output option, delay or pulse mode and timing range. Construct the number as follows:

Part #	4	6			
Output Type					
Relay	R				
Open Collector T					
Series					
Output Option					
5 Amp Relay (R46 only)	1				
Open Collector (T46 only)	3				
Diode Protected NPN Collector (T46 only) . . .	5				
Timing Range (See Range Chart)					
Time Delay	1, 2, or 3				
Pulse Width	1, 2, or 3				
Delay Mode (See Mode Chart)					
Time Delay	2, 3 or 7				
Adjustable Pulse	5 or 9				
Zero Speed or Stop Motion	8				

230 VAC models available. Add the suffix "230 VAC" to part number. Example: T46321-230 VAC denotes an open collector control with a delayed ON operation mode in the .05 to 3.0 second range with 230 VAC input.

Accessories:

RELAYS

The T46 Series control may be used to drive an external relay or solid state relay. The following are available:

R02003 Solid State Relay rated 2.0 amps at 20-140VAC. Life is 10 million operations at rated load.

R00030 DPDT Relay rated 5 amps at 115VAC or 28 VDC resistive load. Life is 100,000 operations at rated load.

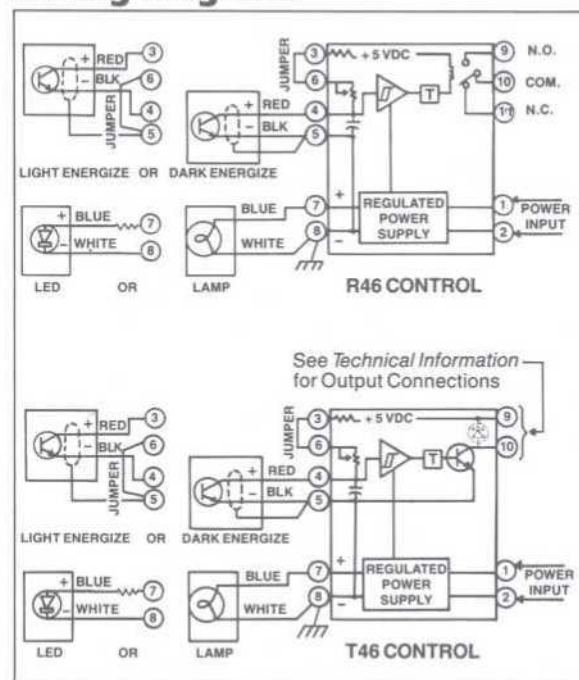
R00031 DPDT Relay rated 10 amps at 115VAC or 28VDC resistive load. Life is 25,000 operations at rated load.

All are 8 pin, plug-in modules. Sockets are not included.

SOCKET

Available — see *Accessories & Options*, pg. 127.

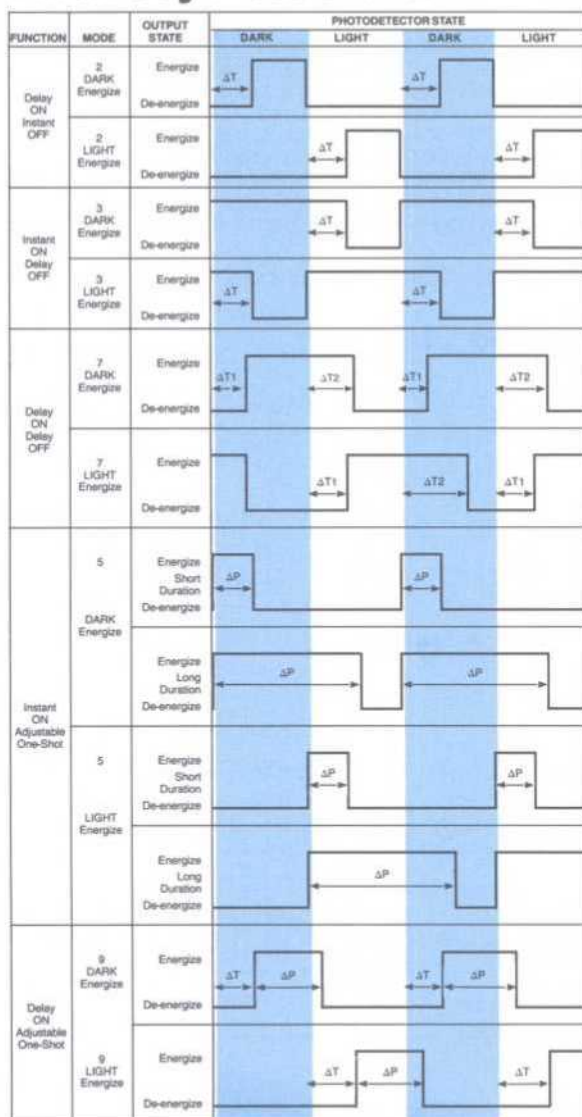
Wiring Diagram:





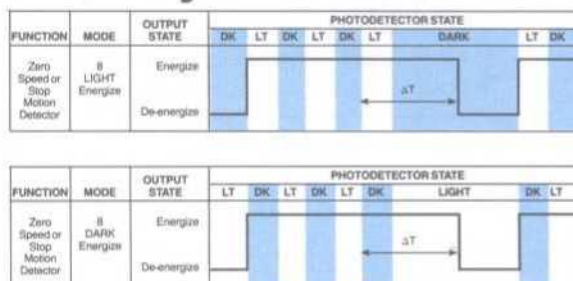
R46/T46 Series

Time Delay Mode Chart:



NOTE:
May be wired for dark energize or light energize operation. See wiring diagrams.
Separate Mode 7 delays must be in same timing range. See Range Chart.

Time Delay Mode Chart-Mode 8:



Time Delay Modes:

MODE 2 is delay ON. When wired for DARK the output will energize if the photodetector is DARK for a period of time greater than set with adjustment. It will remain energized until the photodetector is LIGHT, then it will immediately de-energize. The converse occurs when the control is wired for LIGHT.

MODE 3 is delay OFF. When wired for DARK the output will energize instantly if the photodetector is DARK. It will remain energized as long as the photodetector is DARK. When the photodetector is LIGHT for the period of time set with the adjustment, the output will de-energize. The converse occurs when the control is wired LIGHT.

MODE 7 combines the delay ON and delay OFF in one control. When wired for DARK output energizes after the photodetector has been DARK for the set time and de-energizes when the photodetector has been LIGHT for a set time. Both times are independently adjustable. The converse occurs when the control is wired LIGHT.

One-shot Adjustable Pulse Modes 5 and 9

MODE 5 when wired DARK will output a pulse when the photodetector is DARK. The output pulse will always be of the same preset duration, regardless of the state of the photodetector. The converse occurs when the control is wired LIGHT.

MODE 9 when wired DARK, combines a delay ON as in MODE 2, and a pulse as in MODE 5. When the photodetector is dark for the period of time set with the adjustment, an output pulse will occur, as in MODE 5. Both the delay and pulse are independently adjustable. The converse occurs when the control is wired LIGHT.

Zero Speed or Stop Motion Detector

MODE 8 when wired LIGHT, the output will energize on a dark to light transition of the photodetector and remain energized as long as additional dark to light transitions are seen. If no transitions are seen for the time set, the output will de-energize. It will remain de-energized until another dark to light transition is seen. The converse occurs when the control is wired DARK.

Time Delay Range Chart

Modes 2,3,7,8 (ΔT)		Modes 5,9 (ΔT and ΔP)	
Range 1	.05 to 3.00 sec.	Range 1	.002 to .100 sec.
Range 2	.25 to 15.0 sec.	Range 2	.020 to 1.00 sec.
Range 3	1.0 to 60.0 sec.	Range 3	.200 to 10.0 sec.

Repeatability of time delay and adjustable pulse width ranges is 2% to 15 seconds, 5% to 1 minute.



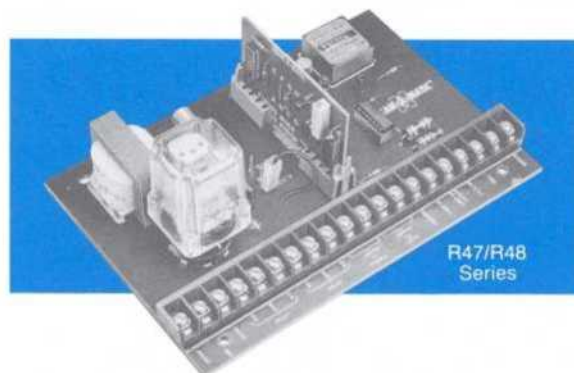
CONTROLS

Industrial Control R47/R48 Series

Available thru 1/95

Features:

- Chassis mounted unit
- Programmable timing and counting modes
- Four output options
- Plug-in relays
- NEMA 12 enclosure available
- 115 or 230 VAC input



Description:

The basic R47/R48 Series offer straight-thru ON/OFF controls, like the R40, but with a choice of four output devices. This basic ON/OFF control can be wired for either LIGHT or DARK energize operation. A jumper to latch feature locks the output ON once it has been energized by the sensor. A jumper to disable feature prevents the output from energizing. These features add extra programming capability.

The basic ON/OFF operation of the R47/R48 Series can be overridden by optional plug-in accessory cards. These cards provide a variety of time delay and counting functions and add greater flexibility to the basic control.

Specifications: (at 25°C)

POWER INPUT	115 or 230 VAC $\pm$ 10%, 50–400 Hz, 2VA
LAMP POWER	Hi: 5VDC @ 125 mA max. Lo: 3VDC @ 95 mA max.
LED POWER	Hi: 100 mA Lo: 35 mA
SENSOR VOLTAGE	5 VDC at 1 mA max.
OUTPUT OPTIONS	
Open Collector	NPN transistor to switch up to 40 VDC at 250 mA max. Integral to chassis.
Relay 5A	DPDT, 115 VAC or 28 VDC resistive load. 100,000 operations at rated load, with a cycle rate = 2 seconds ON/2 seconds OFF. Response time 25 milliseconds max. Counting rate 40 cps max. Replacement Part #R00030
Relay 10A	DPDT, 115 VAC or 28 VDC resistive load. 25,000 operations at rated load. Response time 25 milliseconds max. Counting rate 40 cps max. Replacement Part #R00031
Solid State Relay 2.0 A	20–140 VAC. Response time 9 milliseconds max. 10 million operations at rated load. Replacement Part #R02003
SENSITIVITY ADJUSTMENT	4 turn
TIME DELAY ADJUSTMENT	15 turn
AMPLIFIER RESPONSE	See Standard Amplifier under Response Time Chart in <i>Technical Information</i>

OPERATIONAL MODES

ON/OFF Control	May be set to either LIGHT energize or DARK energize by a jumper connection on the chassis panel
Time Delay	See Mode Chart
Batch Counters	Two digit and four digit batch counters are available. The desired batch size is programmed with thumbwheel switches. Once the set number of counts has been reached, the output of the R47/R48 will energize for an adjustable period of .02 to 1.0 second.

TEMPERATURE	Operating: R47 Series (enclosed chassis) 0° to 40°C R48 Series (open chassis) 0° to 50°C Storage: -40° to 70°C
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CHASSIS DIMENSIONS	5.0" (127.0mm) deep x 7.6" (193.0mm) wide x 3.0" (76.2mm) high max., .196" (4.98mm) dia. mounting holes on 4.25" (108.0mm) x 6.25" (158.8mm) centers. See Wiring Diagram & Dimensions.
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OPTIONAL ENCLOSURE DIMENSIONS	NEMA 12 box 6.8" (172.7mm) deep x 9.5" (241.3mm) wide x 4" (101.6mm) high max., .30" (7.62mm) mounting holes on 4" (101.6mm) x 8.75" (222.3mm) centers. No access holes provided.
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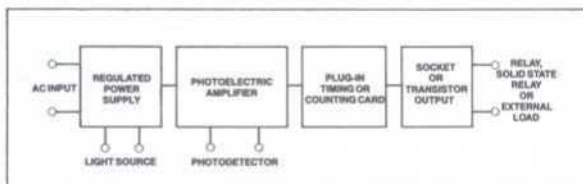
Phone 800-448-2900

Fax 800-223-5138



R47/R48 Series

Block Diagram:



Compatibility With Sensors:

These controls are designed to be used with most Skan-A-Matic reflective skanners and thru-beam combinations. When using LED light sources with these controls, a current limiting resistor must be used. The proper resistor is supplied on the control for light sources with 100 mA and 40 mA LED's. The 100 mA LED's are connected to the "LED HI" terminal, the 40 mA LED's are connected to the "LED LO" terminal. Units with the 60 mA LED's should be connected to the lamp terminal using a 68 ohm 1/4 W resistor supplied with the sensor. See Standard Amplifier under Response Time Chart in *Technical Information* for the response time of various sensors when used with various "T" Series controls. Use this data to select the desired combination.

Model Selection Guide:

To specify a control of this series construct a six digit part number denoting enclosure, output option, delay or pulse mode, and timing range. Construct as follows:

Part # R 4					
Enclosure		Timing Range (See Range Chart)			
NEMA 12.....7		ON/OFF.....0			
Chassis Only.....8		Time Delay.....1, 2, or 3			
		Pulse Width.....1, 2, or 3			
Output		Delay Mode (See Mode Chart)			
5 Amp Relay.....1		ON/OFF.....0			
Solid State Relay...2		Time Delay.....1, 2, 3, 4, 7, or 8			
Open Collector.....3		Adjustable Pulse.....5, 6, 9, or 0			
10 Amp Relay.....4					

230 VAC models available. Add suffix "230 VAC" to Part #.
Example: R47100-230 VAC

Accessories:

ACCESSORY TIMER CARDS

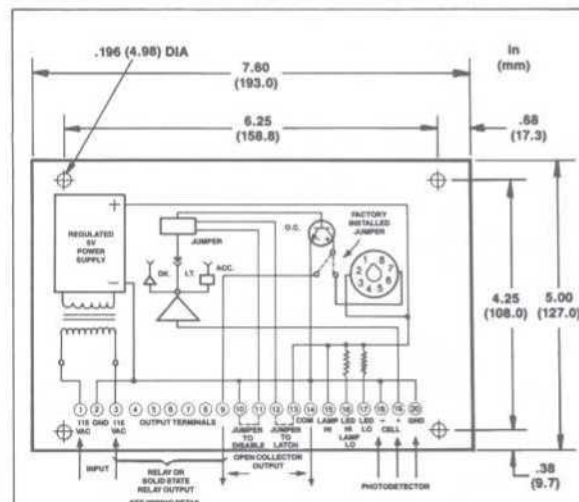
Interchangeable time delay cards may be ordered separately to convert an ON/OFF control or to change an existing mode or range. Order as part no. T221XX, with the last two digits selected above. Example: Order card with delay mode 2 and timing range 1 as T22121

BATCH COUNTER CARDS

2 digit and 4 digit models are available, each completely contained on a plug-in circuit card. Batch counters cannot be used if timer cards are employed. Order separately as:

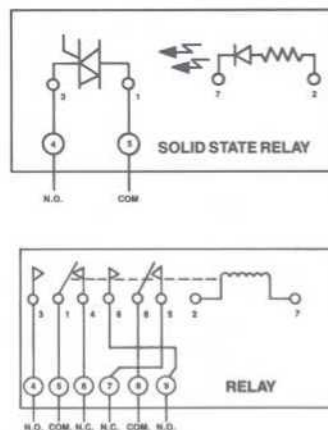
T22018.....to count from 0 to 99
T22008.....to count from 0 to 9999

Wiring Diagram & Dimensions:



When an accessory board is used, jumper on control chassis must be moved to "Accy" position.

WIRING DETAIL-RELAY & SOLID STATE RELAY





R47/R48 Series

Time Delay Mode Chart:

FUNCTION	MODE	OUTPUT STATE	PHOTODETECTOR STATE			
			DARK	LIGHT	DARK	LIGHT
Delay ON Instant OFF	1 LIGHT Energize	Energize		ΔT		ΔT
	2 DARK Energize	Energize	ΔT		ΔT	
Instant ON Delay OFF	3 DARK Energize	Energize		ΔT		ΔT
	4 LIGHT Energize	Energize	ΔT		ΔT	
Delay ON Delay OFF	7 DARK Energize	Energize	ΔT_1	ΔT_2	ΔT_1	ΔT_2
	8 LIGHT Energize	Energize		ΔT_1	ΔT_2	ΔT_1
Instant ON Adjustable One-Shot	5 DARK Energize	Energize Short Duration	ΔP		ΔP	
		Energize Long Duration	ΔP		ΔP	
	6 LIGHT Energize	Energize Short Duration		ΔP		ΔP
		Energize Long Duration		ΔP		ΔP
Delay ON Adjustable One-Shot	9 DARK Energize	Energize	ΔT	ΔP	ΔT	ΔP
	0 LIGHT Energize	Energize	ΔT	ΔP	ΔT	ΔP

Time Delay Modes:

MODE 1 is LIGHT, delay ON. If the photodetector is LIGHT for a period of time greater than set with the adjustment, the output will energize. It will remain energized until the photodetector is DARK, then it will immediately de-energize.

MODE 2 is the same as MODE 1 except it will energize when the photodetector is DARK and will remain energized until the photodetector is LIGHT, then it will immediately de-energize.

MODE 3 is LIGHT, delay OFF. If the photodetector is DARK the output will energize instantly. It will remain energized as long as the photodetector is DARK. When the photodetector is LIGHT for the period of time set with the adjustment, the output will de-energize.

MODE 4 is the same as MODE 3 except it will energize when the photodetector is LIGHT and will remain energized as long as the photodetector is LIGHT. When the photodetector is DARK for the period of time set with the adjustment, the output will de-energize.

MODE 7 combines the delay ON and delay OFF in one control. The output energizes after the photodetector has been DARK for the set time and de-energizes when the photodetector has been LIGHT for a set time. Both times are independently adjustable.

MODE 8 is the same as MODE 7 except the output energizes after the photodetector has been LIGHT for a set time and de-energizes when the photodetector has been DARK for a set time. Again both times are independently adjustable.

One-Shot Adjustable Pulse Modes:

These modes are available for either DARK or LIGHT energize operation and adjustable either shortened or lengthened pulse outputs.

MODE 5 will output a pulse when the photodetector is DARK. The output pulse will always be of the same preset duration, regardless of the state of the photodetector.

MODE 6 is the same as MODE 5 except the output is energized when the photodetector is LIGHT.

MODE 9 combines a delay ON, as in MODE 1, and a pulse, as in MODE 5. When the photodetector is DARK for the period of time set with the adjustment, an output pulse will occur, as in MODE 5. Both the delay and pulse times are independently adjustable.

MODE 0 combines a delay ON as in MODE 2, and a pulse, as in MODE 6. When the photodetector is LIGHT for the period of time set with the adjustment, an output pulse will occur, as in MODE 6. Both the delay and pulse times are independently adjustable.

Time Delay Range Chart:

Modes 1, 2, 3, 4, 7, 8 (ΔT)	Modes 5, 6, 9, 0 (ΔT and ΔP)
Range 1 .05 to 3.00 sec.	Range 1 .002 to .100 sec.
Range 2 .25 to 15.0 sec.	Range 2 .020 to 1.00 sec.
Range 3 1.0 to 60.0 sec.	Range 3 .200 to 10.0 sec.

Repeatability of time delay and adjustable pulse width ranges is 2% to 15 seconds, 5% to 1 minute.



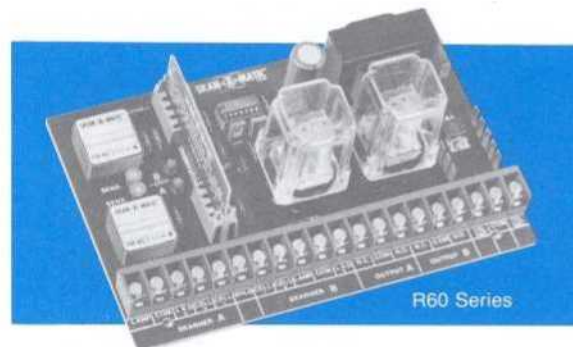
CONTROLS

Dual Channel Industrial Control R60 Series

Available thru 1/95

Features:

- Dual channel control
- Plug-in cards perform logic functions
- Four output options
- Plug-in relays
- Chassis mounted unit
- NEMA 12 enclosure available
- 115 or 230 VAC input



Description:

The R60 Series offers dual channel controls designed to operate two photoelectric sensors. The two channels can be used independently or be combined through the use of plug-in Logic Cards. A control's function can be changed at any time by substituting a different card. A number of standard Logic Cards are listed and described in this catalog; others designed for special applications can be quoted and engineered on request.

The R60 Series requires 115 or 230 VAC input and provides light source power and photodetector amplification for each channel. The control is ordered in modular form to enable the user to select the desired operational function and type of output(s). A Chassis and Logic Card must be ordered to obtain a functional control. The Output Device and Enclosure are optional.

Specifications: (at 25°C)

POWER INPUT	115 or 230 VAC $\pm$ 10%, 50–400 Hz, 10 VA
LAMP POWER	5 VDC at 125 mA per channel
LED POWER	100 mA per channel
SENSOR VOLTAGE	5 VDC supplied by unit at 1 mA max.
OUTPUT OPTIONS	
Open Collector	NPN transistor to switch up to 40 VDC at 250 mA max. Integral to chassis.
Relay 5 A	SPDT, 115 VAC or 28 VDC resistive load, 100,000 operations at rated load, with maximum cycle rate = 2 seconds ON/2 seconds OFF, Response time 25 milliseconds max. Counting rate 40 cps max. Part #R00030
Relay 10 A	SPDT, 115 VAC or 28 VDC resistive load, 25,000 operations at rated load. Response time 25 milliseconds max. Counting rate 40 cps max. Part #R00031
Solid State Relay 2.0 A	20–140 VAC. Response time 9 milliseconds max. 10 million operations at rated load. Part # R02003

SENSITIVITY ADJUSTMENT	4 turns with indicator LED for each channel.
RESPONSE TIME	See Standard Amplifier under Response Time Chart in <i>Technical Information</i>
OPERATIONAL MODES	See Logic Card descriptions
TEMPERATURE	Operating: 0° to 40°C (enclosed chassis) 0° to 50°C (open chassis) Storage: –40° to 70°C
CHASSIS DIMENSIONS	5.0" (127.0mm) deep x 7.6" (193.0mm) wide x 3.0" (76.2mm) high max., .196" (4.98mm) dia. mounting holes on 4.25" (108.0mm) x 6.25" (158.8mm) centers. See Wiring Diagram & Dimensions.
OPTIONAL ENCLOSURE DIMENSIONS	NEMA 12 box 6.8" (172.7mm) deep x 9.5" (241.3mm) wide x 4" (101.6mm) high max., .30" (7.62mm) mounting holes on 4" (101.6mm) x 8.75" (222.3mm) centers. No access holes provided.

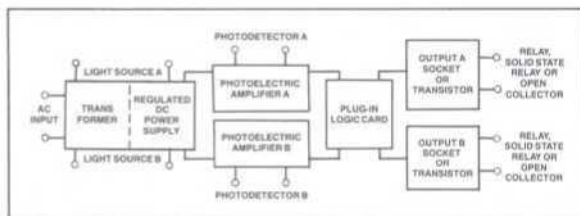
Phone 800-448-2900

Fax 800-223-5138



R60 Series

Block Diagram



Compatibility With Sensors:

The R60 controls are designed to be used with most Skan-A-Matic reflective skanners and thru-beam combinations. When using LED light sources with these controls, a current limiting resistor must be used. The proper resistor is supplied on the control for light sources with 100 mA LED's. The 100 mA LED's are connected to the "LED" terminal. Units with 40 mA and 60 mA LED's should be connected to the "LAMP" terminals using a 120 ohm, 1/4 W or 68 ohm 1/2 W current limiting resistor respectively; these resistors are supplied with each sensor.

Model Selection Guide:

CHASSIS

Order the Chassis by specifying last digit of the part number to indicate choice of outputs. Either channel includes an 8 pin socket to accept a relay or an open collector transistor output.

Chassis Part# R 6 0 0 0

Outputs		
#	Channel A	Channel B
0...	Socket	Socket
1...	Open Collector	Open Collector
2...	No Output	Socket
3...	No Output	Open Collector
4...	Open Collector	Socket
5...	Socket	Open Collector

LOGIC CARD

The Logic Card is a required component for each control. Since some functions use only one output, it is wise to select the desired card before ordering the Chassis.

Logic Card — One Required per Chassis	
Part#	Description
T22020	High/Low Level or Edge Control; 2 outputs
T22021	Low to High Level Control; 1 output
T22022	Trigger/Inspect — for timed interval; 1 output
T22023	Trigger/Inspect — for full sensing interval; 1 output
T22028	Two Channel Independent — LIGHT or DARK; 2 outputs
T22029	AND/NAND — OR/NOR Logic; 1 output
T22033	Trigger/Inspect — momentary during sensing interval; 1 output

OUTPUT DEVICE

An Output Device is required only when a socket output is selected on the Chassis. None is required with a transistor output. The device may be a plug-in relay or solid state relay.

Output Device — Required for Socket Outputs Only

Part#	Description
R00030	5 amp plug-in relay
R00031	10 amp plug-in relay
R02003	2.0 amp plug-in solid state relay

ENCLOSURE

The Enclosure is an option which must be specified separately. When ordered together, Enclosure and Chassis are factory assembled before shipment.

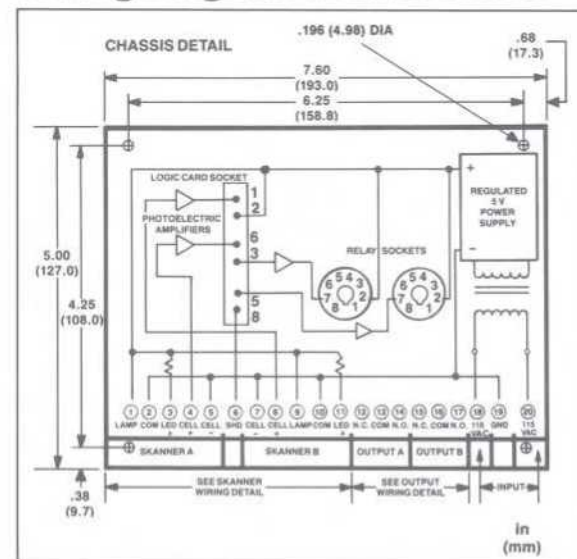
Enclosure — Optional

Part#	Description
B07016	NEMA 12 steel box with hinged cover

Example: To obtain an open chassis control (without enclosure) to operate two sensors in a full sensing interval Trigger/Inspect function, with a 5 amp relay on Output Channel B only, order R60002 + T22023 + R00030.

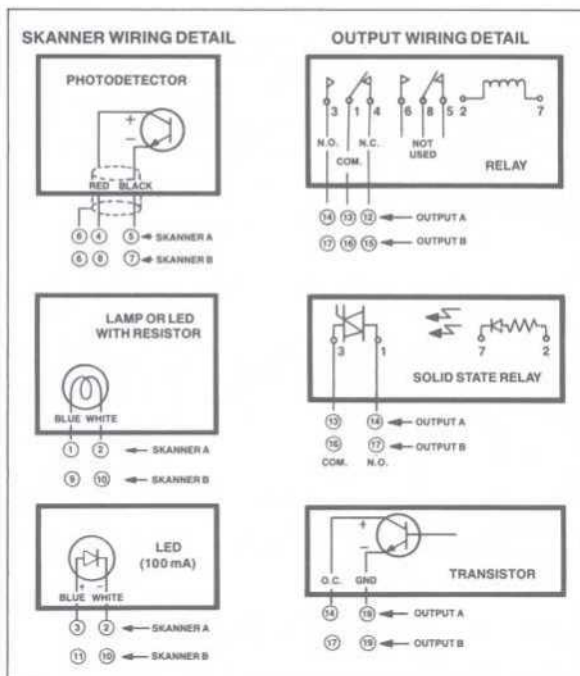
230 VAC models available. Add the suffix "230 VAC" to the part number. Example: R60001-230 VAC

Wiring Diagram & Dimensions:



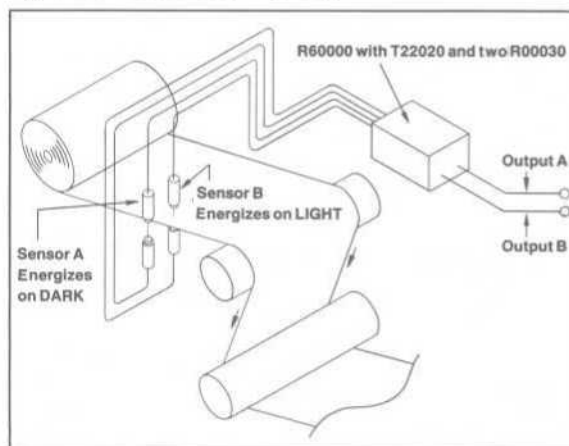


R60 Series



Edge Control

Aligns material by sensing single edge.

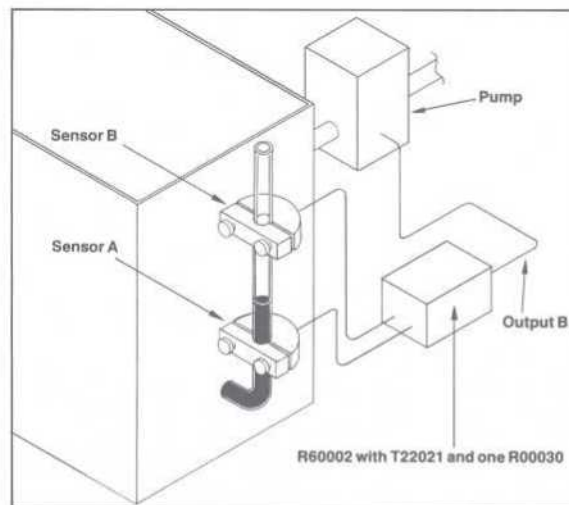


T22021 Low to High Level Control — 1 Output

Two S19 Series Sight Glass Skanners and a single output form a low to high level control. Typically, sensor A is positioned on a sight glass at the low level and sensor B is placed at the high level. When the level is below the low point, sensors A and B both see light and output B is energized. The output remains energized until the level reaches the high point, cutting off light to sensor B, as well as sensor A. When both sensors A and B darken, output B is de-energized. Use with Chassis R60002 or R60003.

Low to High Level Control

Keeps liquid within desired limits.



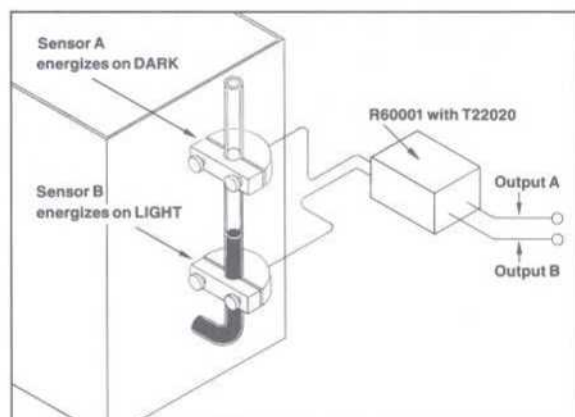
Logic Card Description/Typical Applications:

T22020 High/Low Level or Edge Control — 2 Outputs

May be used with two S19 Series Sight Glass Skanners or other thru-beam type sensors. Two outputs control high and low levels, product edges, etc. Sensor A is positioned at the high point and sensor B at the low point. When level or edge reaches high point, it cuts off light to sensor A, which energizes output A; sensor B is de-energized at this point. When level or edge drops below low point, sensor B sees light and energizes output B. When level or edge is between positions A and B, neither output is energized. Use with Chassis R60000, R60001, or R60005.

High/Low Level Control

Detects at maximum and minimum points.



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Fax 800-223-5138

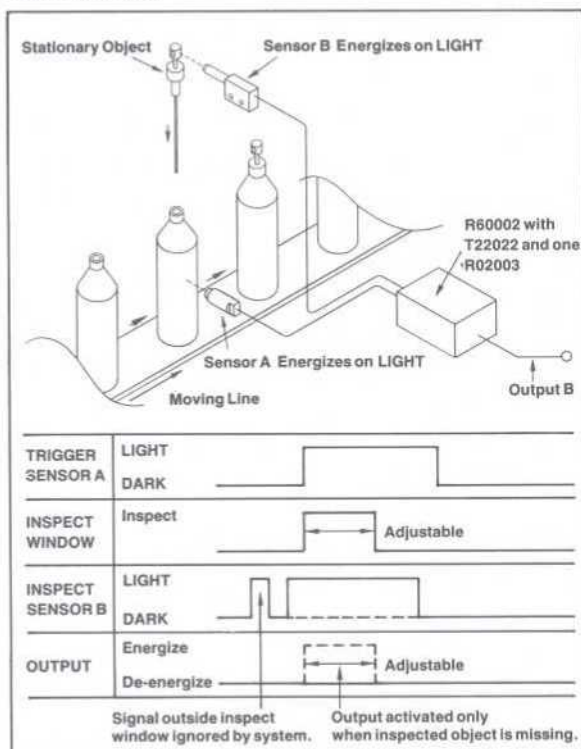
R60 Series

T22022 Trigger/Inspect for Timed Interval — 1 Output

Two sensors and single output form an inspection system. When trigger sensor A senses a target, it opens an adjustable time window. Sensor B must detect its target during the entire time window; if it does not, an alarm condition will be indicated on Output B. Both the time window and the alarm duration are adjustable from .02 to 1.0 seconds. The sensors can each be set to detect on LIGHT or DARK and the normal state of Output B can be energized or de-energized. Use with base chassis R60002 or R60003.

Trigger/Inspect for Timed Interval

Confirms presence and correct alignment of part before assembly.

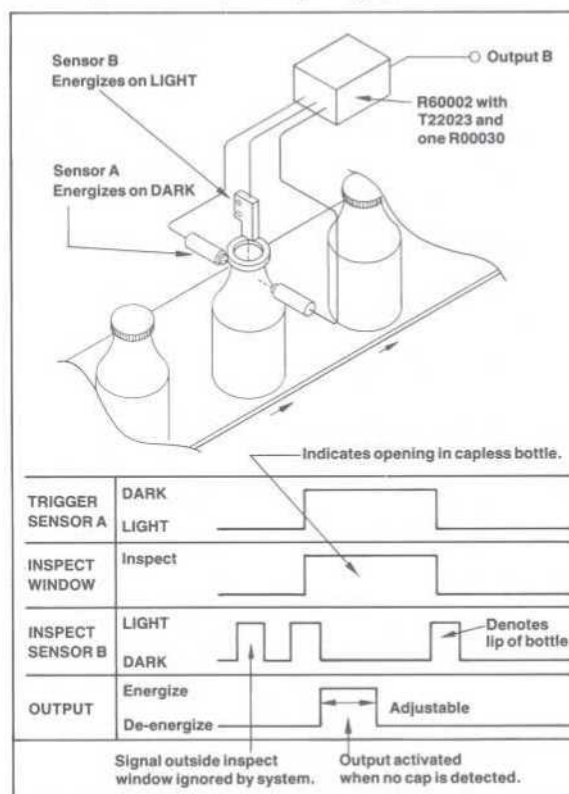


T22023 Trigger/Inspect — For Full Sensing Interval, 1 Output

Utilizes two sensors and a single output in the same manner as T22022, except that sensor B is activated for the entire time that trigger sensor A sees its target, instead of for an adjustable time window. Sensor B must detect its target for the entire inspect window; if it detects partially or not at all, an alarm condition occurs. As in T22022, the output is on channel B and has an adjustable interval from .02 to 1.0 second. Use with Chassis R60002 or R60003.

Trigger/Inspect For Full Sensing Interval

Confirms presence of cap before packaging.





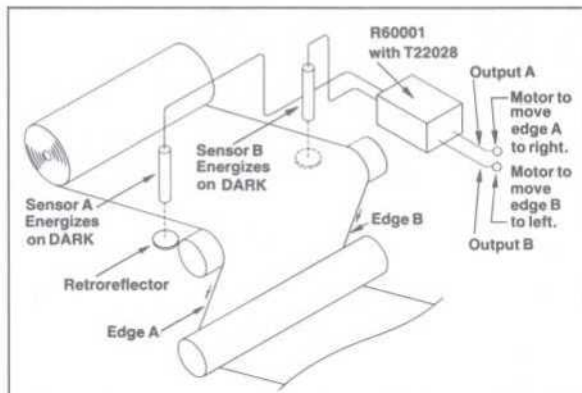
R60 Series

T22028 Two Channel Independent — LIGHT or DARK, 2 Outputs

Utilizes two sensors and outputs to provide two independent controls on one chassis. Particularly suited for two separate functions or for two distinct parts of a single application. Channels A and B can each be set for LIGHT or DARK operation. Use with Chassis R60000, R60001 or R60005.

Two Channel Independent

Aligns material by sensing two edges.

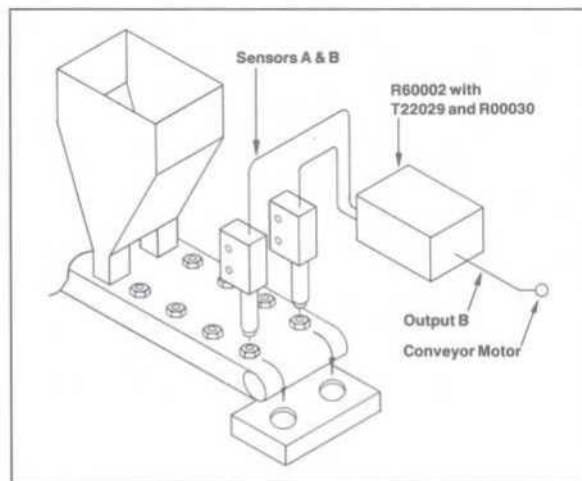


T22029 AND/NAND — OR/NOR Logic — 1 Output

Works with two sensors and a single output to perform any of four logic functions. Programming switches on the logic card may be adjusted to: set sensors A and B for either LIGHT or DARK operation; select the logic function; and select either one-shot or straight through output. The one-shot can be adjusted from .02 to 1.0 second. Use with Chassis R60002 or R60003.

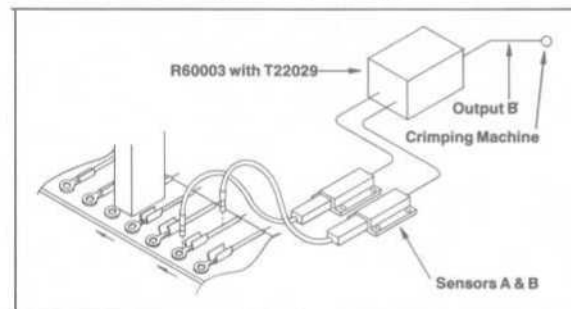
Control with OR Logic

Stops line if either part is missing.



Control with AND Logic

Assembles wire and lug when both are in place.

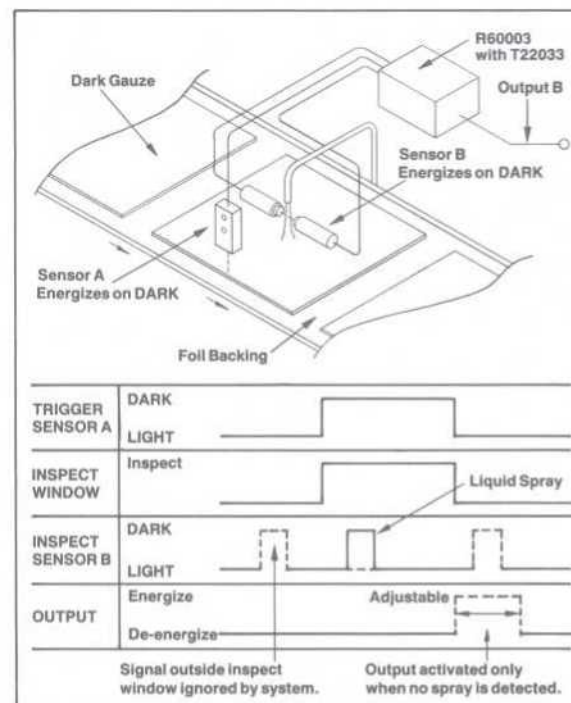


T22033 Trigger/Inspect — Momentary During Sensing Interval, 1 Output

Utilizes two sensors and a single output in the same manner as T22023, except that sensor B can be activated only momentarily during the time that trigger sensor A sees its target. If sensor B detects its target at any time during the inspect window, it allows output B to remain in a de-energized condition. If sensor B fails to detect, it activates output B. Output B may be a resettable latch or a one-shot. The one-shot is adjustable from .02 to 1.0 second. Use with Chassis R60002 or R60003.

Trigger/Inspect — Momentary during sensing interval

Confirms that each pad receives liquid spray.





CONTROLS

IRED/LED Modulating Amplifier

T60 Series

Features:

- Ambient light immunity
- PNP and NPN open-collector outputs
- Output indicator LED
- 25 turn sensitivity adjustment
- User-selectable LIGHT or DARK energize
- Mounts on either NS32 or NS35 DIN rails



Description:

These controls provide ambient light immunity in a small, DIN Rail mountable, DC-powered package. Each control modulates the LED or IRED radiation source of a reflective scanner or thru-beam pair and responds only to photodetector inputs

with the same modulation frequency. The user may connect either or both (PNP and NPN) open-collector outputs as required by subsequent electronic circuitry.

Specifications: (at 25° C)

POWER INPUT: 5 VDC or 8-28 VDC, 175 mA peak
IRED/LED:
POWER: Supplied by unit; internal resistor included for 100 mA source

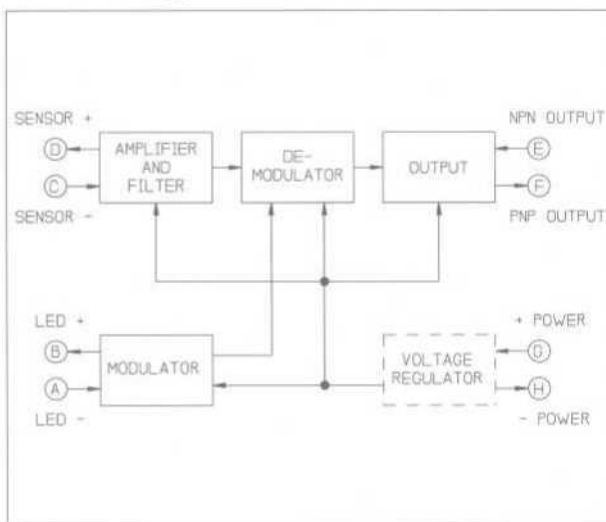
SENSOR VOLTAGE: 5 VDC at 5 mA max.
OUTPUT: Open-collector NPN and PNP transistors ($|V_{BRUCEO}| \geq 30V$), both rated for 100 mA at $V_{CE(sat)}$.

RESPONSE TIME: 5 milliseconds typical; counting rate: 100 cps

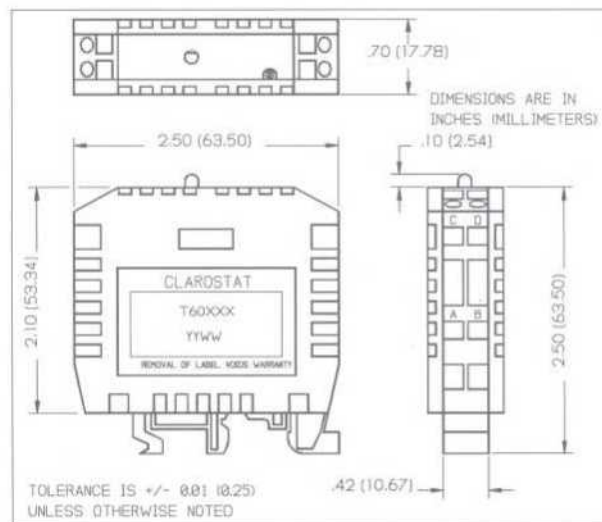
SENSITIVITY ADJUSTMENT: 25 turns nominal
TEMPERATURE: Operating: 0°C to 50°C
 Storage: -40°C to 50°C

ENCLOSURE: NS32 or NS35 DIN Rail mountable plastic enclosure

Block Diagram:



Dimensions:



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Fax 800-223-5138



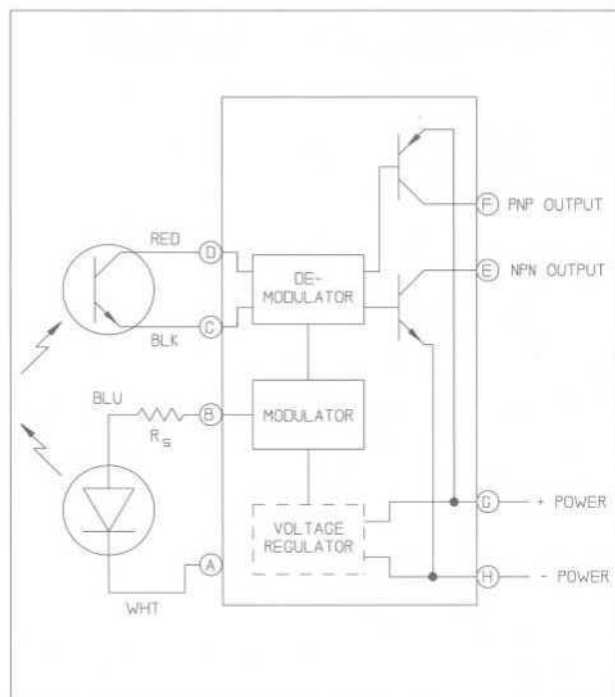
Compatibility With Sensors:

T60 Series controls can operate any LED or IRED thru-beam pair or scanner. A 100 mA rated emitter can be wired directly across terminals A and B. Infrared or light emitters with current ratings less than 100 mA require an external 0.25 watt resistor between the blue lead and terminal B. For an emitter rated at 60 mA, use a 6.8 ohm resistor; for a 40 mA rated device, use a 27 ohm resistor. A 6.8 ohm and a 27 ohm resistor are included with each control. *These controls cannot be used to operate an incandescent lamp device.*

Model Selection Guide:

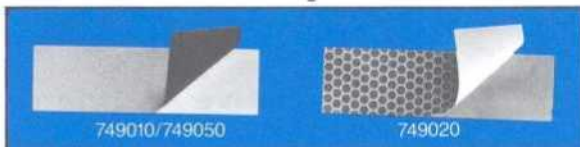
Part Number	Description
T60001	5 VDC POWER INPUT
T60002	8-28 VDC POWER INPUT

Wiring Diagram:



ACCESSORIES & OPTIONS

Retroreflective Tape:



749010 tape is a high efficiency, exposed lens retroreflective tape with a pressure sensitive adhesive back. It has almost twice the efficiency of the 749020 tape but its surface is not protected by a plastic film and is more subject to wear.

749020 tape is a medium efficiency retroreflective tape. The reflecting surface is protected with a clear plastic film and is backed with pressure sensitive adhesive.

749050 tape is a low efficiency exposed lens, high temperature retroreflective tape with a pressure sensitive adhesive back.

Each tape is one inch wide and can be ordered in one foot increments. Minimum order is a one foot length.

Retroreflective Discs:



These reflectors feature a sealed optical system having a clear plastic face with a prism-like molded rear surface fused to a plastic backing. Retroreflective discs should be used where durability, maximum retroreflective efficiency and permanent mounting are desired.

Part #	Description	Luminance Factor*	Temperature Continuous (°F)	Temperature 30 Min. (°F)
749010	Retro-Tape	900	175	250
749020	Retro-Tape	670	150	150
749050	High Temp Retro-Tape	200	350	500
749030	Retro-Disc	3000	NA	NA
749040	Retro-Disc	3000	NA	NA

*Expressed as times brighter than a white surface

Photoelectric Control Sockets:



The 770040 and 770050 sockets can be used for installing all Skan-A-Matic controls with standard 8 and 11 pin bases. The sockets feature high impact plastic bodies with plated contacts and hardware. Terminals will accept two wires as large as 12 gauge. Two 15/16" diameter mounting holes are provided that will accept up to a No. 6 screw. The 8 pin socket (770040) has max. dimensions of 2-1/4" square and 3/8" thick with mounting holes on 1.687" centers. The 11 pin socket (770050) has max. dimensions of 2-5/8" square and 3/8" thick with mounting holes on 2.218" centers.

Neutral Test Cards:

The 813010 Neutral Test Card (Kodak #R-27 CAT1527795) is an 8" x 10" cardboard sheet used as a reference of known reflection. Its white side has 90% reflectance. 2 cards per pack.

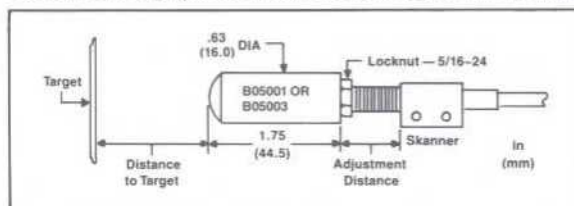
Adjustable Focus Magnifiers

The adjustable focus magnifiers are accessories designed for use with the lamp versions of the S30 Series SKAN-COAX® with a 1/8"-24 threaded barrel and with the lamp versions of the C32 Series SKAMP®. They should not be used on any of the LED units.



	Skanner Only	Skanner with magnifier		
		Adjustment	Distance set at	
Distance to Target	.10"	.62"	.44"	.19"
Field of View	.10"	.09"	.18"	.25"

The B05001, used on the S30 Series, has 1/8"-24 UNF threads on the inside. The B05003, used on the C32 Series, has 1/8"-24 UNF threads on the inside. Both have a sealed glass lens. The lens cylinder is simply screwed on the skanner barrel and is hand adjusted to focus on various targets at different distances as shown in the chart.



B07037 Infrared Detector Card



The B07037 is designed to detect proper conversion of an infrared LED light source. Phosphor screen 3/4" X 3/4" converts infrared energy to visible light with approximately 10% efficiency.

Cable Connectors:



All skanners are available with multi-pin cable connector. Standard skanner leads are terminated in male portion; female portion is included for field connection. Add "P" suffix for connector pair with in-line receptacle or "F" suffix for pair with flanged, panel mounted receptacle. Example: S32201-P. Cable connectors can also be ordered individually—use Skan-A-Matic part numbers B01006 or B01007.

Connector wiring: Lamp or LED-pin 1 positive, pin 2 negative. Shield-pin 3. Photodetector-pin 4 positive, pin 5 negative.



TECHNICAL INFORMATION

Standard Lead Wire Lengths

Thrubeams:

Non-Self-Contained

PART NUMBER	PAGE	STANDARD LEADS	
		TYPE	LENGTH

Light Sources:

L11201.....	40.....	C.....	6 ft
L30011.....	36.....	A.....	6 ft
L30041.....	36.....	A.....	6 ft
L31011.....	34.....	A.....	6 ft
L31014.....	34.....	A.....	6 ft
L32001.....	32.....	A.....	6 ft
L32004.....	32.....	A.....	6 ft
L33007.....	30.....	A.....	6 ft
L33008.....	30.....	A.....	6 ft
L33014.....	30.....	A.....	6 ft
L33018.....	30.....	A.....	6 ft
L33107.....	30.....	A.....	6 ft
L33108.....	30.....	A.....	6 ft
L34024.....	38.....	A.....	6 ft
L34035.....	38.....	A.....	6 ft
L34040.....	38.....	A.....	6 ft
L43004.....	28.....	E.....	6 ft
L56001.....	41.....	A.....	6 ft
L56004.....	41.....	A.....	6 ft
L60001.....	43.....	P.....	6 ft
L60002.....	43.....	P.....	6 ft

Photodetectors:

P11201.....	40.....	C.....	6 ft
P30011.....	36.....	B.....	6 ft
P30013.....	36.....	B.....	6 ft
P31011.....	34.....	B.....	6 ft
P31013.....	34.....	B.....	6 ft
P32011.....	32.....	B.....	6 ft
P32013.....	32.....	B.....	6 ft
P33001.....	30.....	B.....	6 ft
P33008.....	30.....	B.....	6 ft
P33014.....	30.....	B.....	6 ft
P33018.....	30.....	B.....	6 ft
P33101.....	30.....	B.....	6 ft
P33108.....	30.....	B.....	6 ft
P34021.....	34.....	B.....	6 ft
P34023.....	34.....	B.....	6 ft
P34024.....	38.....	B.....	6 ft
P34035.....	38.....	B.....	6 ft
P34040.....	38.....	B.....	6 ft
P43004.....	28.....	L.....	6 ft
P56001.....	41.....	B.....	6 ft
P56201.....	41.....	B.....	6 ft
P60001.....	43.....	Q.....	6 ft
P60002.....	43.....	Q.....	6 ft

Reflective Skanners:

Non-Self-Contained

PART NUMBER	PAGE	STANDARD LEADS	
		TYPE	LENGTH

Light Sources:

S11101.....	50.....	G.....	6 ft
S12001.....	48.....	J.....	6 ft
S13224.....	52.....	J.....	6 ft
S13324.....	52.....	J.....	6 ft
S14101.....	57.....	J.....	6 ft
S14103.....	57.....	J.....	6 ft
S15101.....	57.....	J.....	6 ft
S15105.....	57.....	J.....	6 ft
S16101.....	57.....	J.....	6 ft
S16103.....	57.....	J.....	6 ft
S16111.....	57.....	J.....	6 ft
S16113.....	57.....	J.....	6 ft
S22004.....	46.....	G.....	6 ft
S22104.....	46.....	G.....	6 ft
S27301.....	60.....	—.....	—
S27311.....	60.....	G.....	6 ft
S27321.....	60.....	G.....	6 ft
S27341.....	60.....	G.....	6 ft
S30101.....	54.....	J.....	6 ft
S30104.....	54.....	J.....	6 ft
S30105.....	54.....	J.....	6 ft
S30106.....	54.....	J.....	6 ft
S30108.....	54.....	J.....	6 ft
S30111.....	54.....	J.....	6 ft
S30114.....	54.....	J.....	6 ft
S30115.....	54.....	J.....	6 ft
S30116.....	54.....	J.....	6 ft
S30118.....	54.....	J.....	6 ft
S31101.....	54.....	J.....	6 ft
S31104.....	54.....	J.....	6 ft
S31105.....	54.....	J.....	6 ft
S31106.....	54.....	J.....	6 ft
S31108.....	54.....	J.....	6 ft
S32201.....	54.....	J.....	6 ft
S32204.....	54.....	J.....	6 ft
S32205.....	54.....	J.....	6 ft
S32206.....	54.....	J.....	6 ft
S32208.....	54.....	J.....	6 ft
S32251.....	54.....	J.....	6 ft
S32254.....	54.....	J.....	6 ft
S32255.....	54.....	J.....	6 ft
S32256.....	54.....	J.....	6 ft
S32258.....	54.....	J.....	6 ft
S33101.....	54.....	J.....	6 ft
S33104.....	54.....	J.....	6 ft
S33105.....	54.....	J.....	6 ft
S33106.....	54.....	J.....	6 ft
S33108.....	54.....	J.....	6 ft
S51101.....	63.....	J.....	6 ft
S51104.....	63.....	J.....	6 ft

Reflective Skanners:

Non-Self-Contained

PART NUMBER	PAGE	STANDARD LEADS	
		TYPE	LENGTH

Light Sources: (Continued)

S51105.....	63.....	J.....	6 ft
S51106.....	63.....	J.....	6 ft
S51108.....	63.....	J.....	6 ft
S52101.....	63.....	J.....	6 ft
S52105.....	63.....	J.....	6 ft
S56101.....	66.....	J.....	6 ft
S56102.....	66.....	J.....	6 ft
S56104.....	66.....	J.....	6 ft
S56105.....	66.....	J.....	6 ft
S56108.....	66.....	J.....	6 ft
S56201.....	66.....	J.....	6 ft
S56202.....	66.....	J.....	6 ft
S56204.....	66.....	J.....	6 ft
S56205.....	66.....	J.....	6 ft
S56208.....	66.....	J.....	6 ft
S56401.....	66.....	J.....	6 ft
S56402.....	66.....	J.....	6 ft
S56404.....	66.....	J.....	6 ft
S56405.....	66.....	J.....	6 ft
S56408.....	66.....	J.....	6 ft
S56110.....	69.....	J.....	6 ft
S56111.....	69.....	J.....	6 ft
S56112.....	69.....	J.....	6 ft
S56113.....	69.....	J.....	6 ft
S58101.....	71.....	J.....	6 ft
S58201.....	71.....	J.....	6 ft
S58401.....	71.....	J.....	6 ft

Special Purpose Sensors:

PART NUMBER	PAGE	STANDARD LEADS	
		TYPE	LENGTH

L17101.....	80.....	A.....	6 ft
L17104.....	80.....	A.....	6 ft
P17103.....	80.....	B.....	6 ft
S17103.....	80.....	J.....	6 ft
S17104.....	80.....	J.....	6 ft
S17105.....	80.....	J.....	6 ft
S17403.....	80.....	J.....	6 ft
S17404.....	80.....	J.....	6 ft
S17405.....	80.....	J.....	6 ft
S19051.....	78.....	J.....	6 ft
S19081.....	78.....	J.....	6 ft
S19101.....	78.....	J.....	6 ft
S19111.....	78.....	J.....	6 ft
S19121.....	78.....	J.....	6 ft
S19141.....	78.....	J.....	6 ft
S28001.....	76.....	—.....	— ft
S28002.....	76.....	J.....	6 ft



TECHNICAL INFORMATION

Special Purpose Sensors:

(Continued)

PART NUMBER	PAGE	STANDARD LEADS	
		TYPE	LENGTH
S28003.....	76.....	J.....	6 ft
S35201.....	74.....	J.....	6 ft
S35202.....	74.....	J.....	6 ft
S35203.....	74.....	J.....	6 ft

Fiber Optic Cables:

For use with S17/L17/P17 Series

PART NUMBER	PAGE
F17256 or F17266.....	80
F17356 or F17366.....	80

Special Order Lead Wire Lengths

TYPE	DESCRIPTION
A	2 cond. 24 AWG Teflon covered
B	2 cond. 26 AWG Teflon covered, with shield
C	2 cond. 26 AWG PVC covered
D	4 cond. 24/26 AWG Teflon covered, with shield
E	2 cond. 22 AWG PVC covered
F	2 cond. 22 AWG PVC covered, with shield
G	4 cond. 26 AWG PVC covered, with shield
H	4 cond. 20/24 AWG PVC covered, with shield
I	4 cond. 24 AWG PVC covered, with shield
J	4 cond. 26 AWG Teflon covered with shielded photodetector leads and overall shield (Shielded Quad)
L	4 cond. 26 AWG PVC covered, with shield
N	3 cond. 28 AWG Teflon covered, with shield
P	2 cond. 26 AWG, PVC covered
Q	2 cond. 26 AWG, PVC covered with shield

NOTE: For special lead length pricing, call Clarostat Sensors Customer Service or your Authorized Skan-A-Matic Distributor.

Self-Contained Photoelectric Controls:

PART NUMBER	PAGE	STANDARD LEADS	
		TYPE	LENGTH
C32211.....	84.....	N.....	6 ft
C32221.....	84.....	N.....	6 ft
C32214.....	84.....	N.....	6 ft
C32224.....	84.....	N.....	6 ft
C32414.....	84.....	N.....	6 ft
C32424.....	84.....	N.....	6 ft
C40000.....	86.....	I.....	6 ft
C40001.....	86.....	I.....	6 ft
C40100.....	86.....	I.....	6 ft
C40101.....	86.....	I.....	6 ft
C40040.....	86.....	I.....	6 ft
C40041.....	86.....	I.....	6 ft
C40140.....	86.....	I.....	6 ft
C40141.....	86.....	I.....	6 ft
C41000.....	86.....	I.....	6 ft
C41001.....	86.....	I.....	6 ft
C41040.....	86.....	I.....	6 ft
C41041.....	86.....	I.....	6 ft
C41100.....	86.....	I.....	6 ft
C41101.....	86.....	I.....	6 ft
C41140.....	86.....	I.....	6 ft
C41141.....	86.....	I.....	6 ft
C42000.....	86.....	I.....	6 ft
C42001.....	86.....	I.....	6 ft
C42040.....	86.....	I.....	6 ft
C42041.....	86.....	I.....	6 ft
C42100.....	86.....	I.....	6 ft
C42101.....	86.....	I.....	6 ft
C42140.....	86.....	I.....	6 ft
C42141.....	86.....	I.....	6 ft
C45000.....	86.....	I.....	6 ft
C45001.....	86.....	I.....	6 ft
C45100.....	86.....	I.....	6 ft
C45101.....	86.....	I.....	6 ft
C45040.....	86.....	I.....	6 ft
C45041.....	86.....	I.....	6 ft
C45140.....	86.....	I.....	6 ft
C45141.....	86.....	I.....	6 ft

Self-Contained Photoelectric Control Accessories:

PART NUMBER	DESCRIPTION	PAGE
B07186...	Power Supply/ Output Switch	88

Options:

Available only on specified product series.

Refer to catalog.

Coil Cord: Four cond. 28 ga. coil cord with shield.
10 ft. (fully extended)
20 ft. (fully extended)

Protective Sheath: 3 extra inches of lead included for wiring. Add suffix to part number.

FOR SKANNERS: Can be factory installed over Shielded Quad only.

FOR THRUBEAMS: Can be factory installed over the standard Teflon covered leads.

EXTRA LENGTHS: When ordering extra lengths in excess of standard lead length specified for unit, price of lead inside the protective sheath must also be added.

-M Square locked galvanized steel with black PVC jacket, 9/32" O.D.
-S Square locked stainless steel armor, 3/16" O.D.

Connector: For cable connector installed on skanner, add suffix to part number.

-P Connector pair with in-line receptacle

-F Connector pair with flanged, panel-mount

Cable connector pairs can be ordered individually. See Accessories.