Photoelectric Sensors

Photoelectric Performance

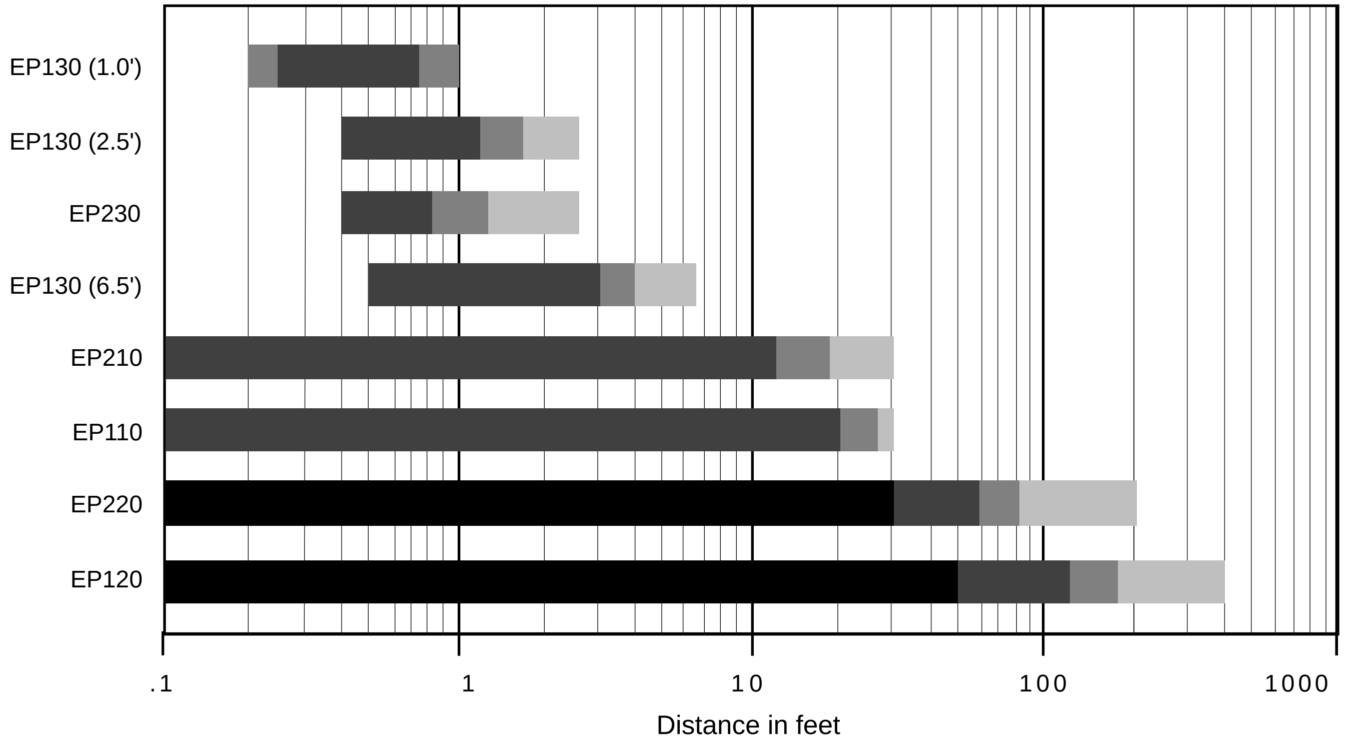
The selection of the proper photoelectric sensor for an application is critical for reliable, trouble-free operation. The graphs shown below are meant to be a guide for matching a type of environment to the sensor types most likely to perform in that environment.

Fiber optic sensor types are not shown due to the different performance characteristics of the many styles of fiber optic cables.

These charts were derived from the Excess Gain Curves for each product. Excess Gain Curves for specific sensors are available on request from Namco Controls.

If you have any questions regarding the suitability of a Namco photoelectric sensor for your application, call our toll-free Technical Assistance Hotline at 1-800-NAMTECH (1-800-626-8324).

- (light grey) Suitable for use at these ranges in "clean" environments with no dirt, dust, or water accumulation on the lenses.
- (medium grey) Can be used at these ranges in slightly dirty environments; lenses should be cleaned regularly. Typical of warehouse or light industrial installations.
- (dark grey) At these ranges, the sensor can be used in moderately dirty applications where there is visible contamination of lenses or reflectors. Lenses should be cleaned regularly. Most industrial applications fit this category.
- (black) Suitable for use in extremely dirty environments, or where heavy smoke, steam, or dust is present or when lenses will be cleaned only rarely. Typical environments are steel or paper mills.



NOTE: EP570 – See Excess Gain Chart in Photoelectric WFI Sensors section.

Evolution of Photoelectrics

As photoelectrics have evolved, increasing emphasis has been placed on offering user-oriented values. Indicator lamps have been incorporated to signal sensing status; circuits have been expanded to include a solution for every wiring application; and with the implementation of surface mount technology, the features-to-size ratio has improved.

Sensor Light Sources

The first photoelectrics used incandescent light sources. These early products were susceptible to ambient light conditions and limited in application. With the introduction of light emitting diodes ("L.E.D.'s"), the opportunity for applying photoelectric sensors expanded. By modulating (pulsing) the L.E.D. and tuning the receiving photodiode to respond only to this rate of change, immunity to ambient light is improved. Further enhancements have been achieved by incorporating transmission filters to improve the signal-to-noise ratio associated with ambient light.

Reflectors are used in some sensing modes to provide an effective method for returning the emitted light beam to the receiving photodiode. While the most fundamental reflector returns the incident light back to the source only when the incident light strikes the reflector at 90 degrees to the surface of the reflector, the more commonly used "corner cube" retro-reflector will return the incident light to the receiving photodiode over a wide range of incident angles, making alignment angle with respect to the sensor significantly less critical.

Polarizing a light source orients the emitted rays into one plane. If a receiving photodiode is polarized in the same plane as the received light, it will detect the light. In sensing modes where retro-reflectors are used, the retro-reflector shifts the incident light 90 degrees. Photoelectric sensors designed for this mode of sensing are polarized to expect a shift of the incident light by the retro-reflector. Any light returned by specular reflection (from shiny objects) is not shifted and is intentionally undetected by the receiver.

Photoelectric controls are applicable in a wide range of industrial situations because of their long life, versatility, safety, and reliability. Namco's sensors have been tested and proven over many years of operation in all types of environments. Their precision optics can detect objects that cannot be detected by conventional photoelectrics. Namco photoelectric sensors are available in incandescent or LED and feature rugged construction, long-life LED output indication, and insensitivity to ambient light. They also offer time delays, logic delay systems, short circuit protection, and reverse polarity protection. All electronic circuitry is solid state. DC units may be operated from plant power supply or from optional relay/power pack combinations.

Performance

The performance of photoelectrics is dependent on environmental conditions; e.g., air contamination, steam, fog, oil spray. Excess gain is merely a statement of how much extra gain the sensor has over the minimum it needs to communicate in ideal conditions at a given range. The higher the excess gain for a given distance, the more likely the photoelectric is to be able to penetrate through the contamination to reach and be detected by the corresponding receiving photodiode. Since most applications are less than ideal, photoelectrics should be selected with ample excess gain for the intended range.

Output Options

Most of the photoelectrics offered in this catalog are self-contained in that no external stages of circuitry are required to operate the sensors. Newer circuit types include 2-wire AC for ease of installation and lowest cost installation, 3-wire AC for load current independent of input current, and 4-wire DC for user selectable sink (NPN) or source (PNP) connection. All of these are Programmable Logic Controller compatible.

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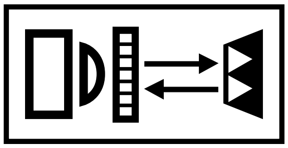
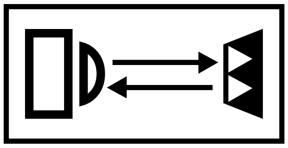




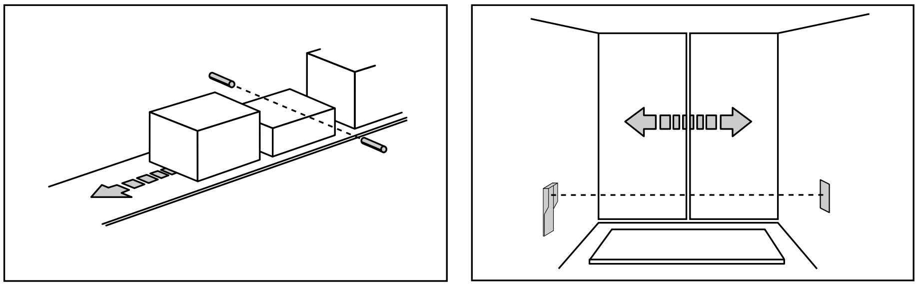
Retro-Reflective Sensing Mode

Retro-reflective sensing is particularly effective in applications that offer the following conditions: (1) the object to be sensed is generally opaque; (2) a reflector can be easily installed so that the object must pass between the reflector and the sensor; or (3) the object may be detected by adding reflective tape to the object.

Available ranges of retro units are generally a fraction of the range of comparable size thru-beam units.

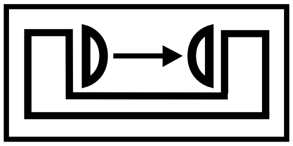
In the retro-reflective mode, a single sensor is used to both send and receive light directed to a reflector. Objects passing between the sensor unit and its corresponding reflector interrupt the light beam and signal the sensor to provide the indicated output. Using corner cube reflectors enables the light signal to be returned to the sensor over a wide range of incident angles.

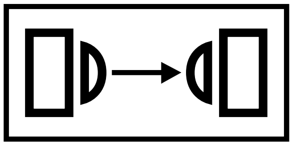
Retro-reflective sensing is popular for its simplicity of installation, and if properly equipped with polarizing options, is independent of target material/color/texture. Operates at distances of up to 30 feet.



Thru-Beam Sensing Modes

Thru-Beam (Opposed) Sensing Mode

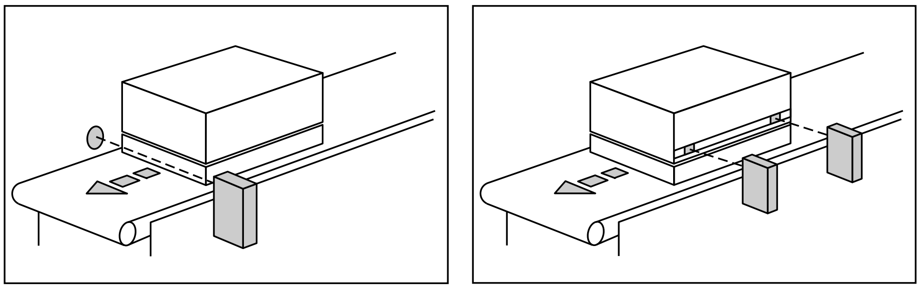




Thru-beam sensing should be employed wherever longer sensing ranges (up to 400 ft.) are required and where harsh or dirty environments require more powerful performance or individually mounted transmitted receiver units.

Thru-beam configurations consist of separate emitter and receiver units aimed at one another and separated so that objects will pass between both units. Without the presence of objects, the emitted light beam is sensed by the receiver. As objects pass between the two units, the light beam is interrupted, and the corresponding sensor output is provided.

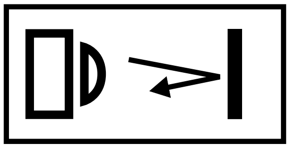
Thru-beam is the most reliable sensing mode. Since the receiver is a separate unit, sensing is totally immune to false proxing from shiny objects. Sensing of transparent objects may require gain control adjustment. Thru-beam systems are inherently higher cost and require additional wiring to the second unit.

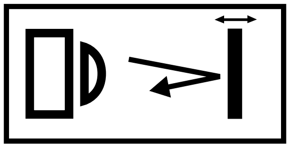


Retro-Reflective Sensing Modes

Diffuse Proximity Sensing Mode

Diffuse proximity sensing should be used when the following conditions exist: (1) the object itself is sufficiently reflective to return incident light to the receiver photodiode; (2) the installation of a reflector on the opposite side of the object is impractical.



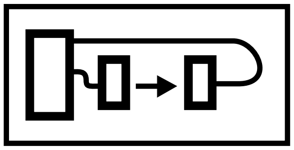


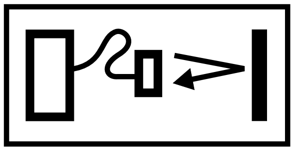
The diffuse proximity mode utilizes a single sensor unit as emitter and receiver and relies upon the object sighted to reflect sufficient light to be sensed by the receiver. Absence of objects in the light beam path result in light not returned to the receiver.

Diffuse sensing is the lowest cost approach but depends on the reflectivity (and color) of the target material. This system is suitable for detecting like objects where the gain can be adjusted once for the best performance.

Fiber-Optic Sensing Mode

Introducing a set of fiber-optic cables to photoelectric sensors adds considerable flexibility from an applications perspective. Fiber-optics work well in applications requiring either small part detection or where space in the immediate vicinity of the target object is at a premium. Using fiber-optic cables to reach into environments too harsh for the sensor unit itself is a common application. Fiber-optic cables are immune to electrical and radio frequency interference (EMI and RFI).





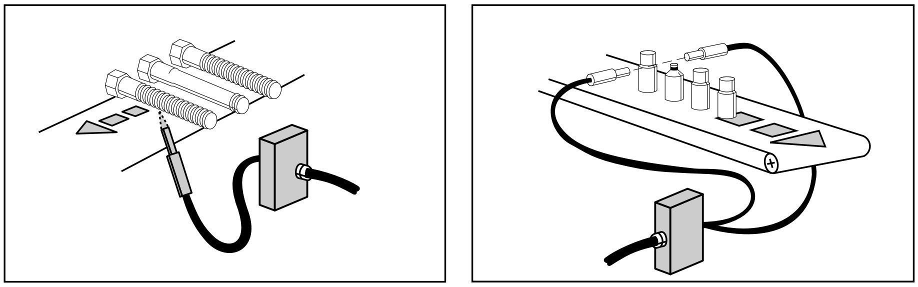
The fiber-optic sensing mode is obtained simply by adding fiber-optic cables to an existing sensor designed to accommodate them. While any sensing mode could utilize fiber-optics, typical cable offerings are designed for thru-beam and diffuse operation. Glass and plastic core materials are common in the industry, each offering their respective advantages and tradeoffs.

Glass cables have better light transmission capabilities, higher operating temperatures and cost, with a sacrifice in physical flexibility. Glass cables cannot be cut to length by the average user.

Plastic cables are lower temperature rated, are less efficient in light transmission, more flexible, lower cost, and can be easily cut to length in the field.

Protective jacketing for fiber-optics include either stainless steel spiral wrap armor or extruded pvc for glass fibers and extruded pvc for plastic fibers.

Both glass and plastic fiber-optic cables offer immunity to electrical interference and permit relocating of the sensor unit in applications where the environment in the sensing area is unusually harsh.



Fiber Optic Sensing Modes

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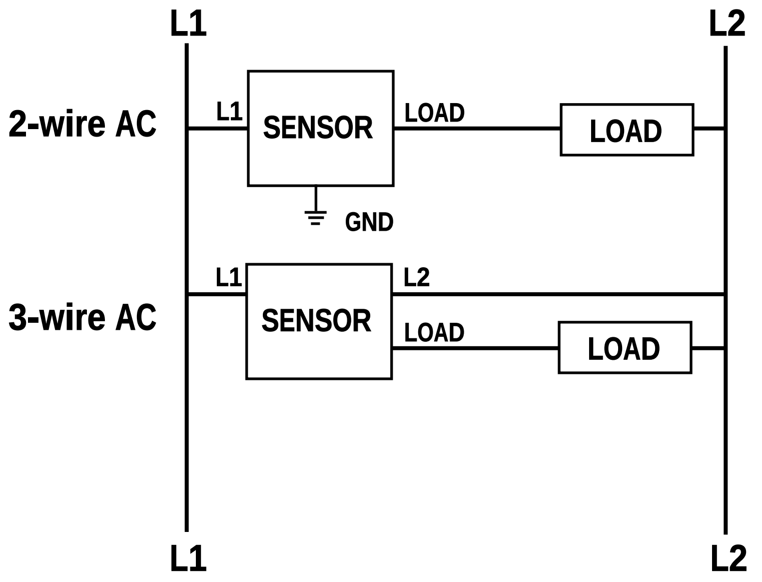
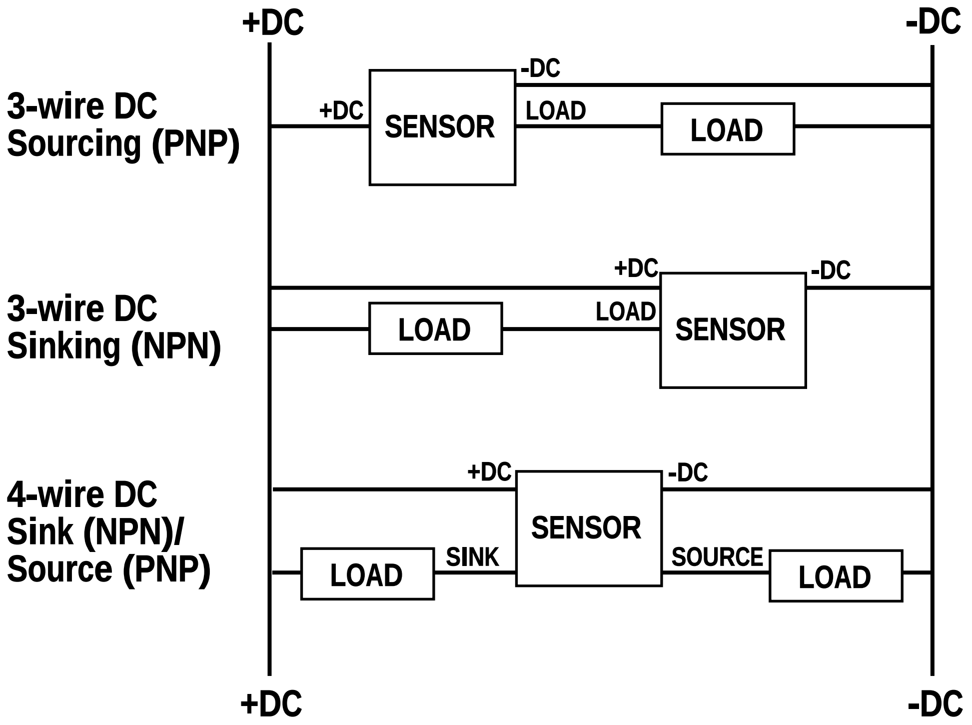
Notes:

1. These diagrams are valid for sensors with cables and connectors.
2. Sensors may or may not have ground connections or grounded housings. Refer to the specific connector or cable diagram for your particular sensor's model number to determine if it is grounded.
3. The markings on these wiring diagrams (L1, Load, etc.) are identical to those on the connector diagrams.
4. All switches are Normally Opened (N.O.) unless specifically marked Normally Closed (N.C.).
5. All switch outputs are Sourcing unless specifically marked Sink.

AC Wiring Diagrams



DC Wiring Diagrams



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