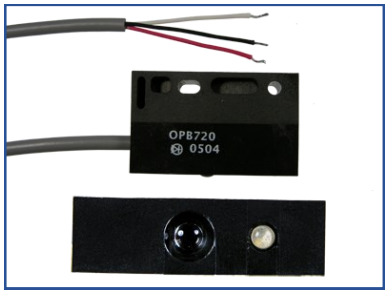
Characteristics of the OPB720 Reflective Switch

Application Bulletin 232

- OPB720A-06Z, Typical Reflective distance 6” [15 cm]
- OPB720A-12Z, Typical Reflective distance 12” [30 cm]
- OPB720A-30VZ, Typical Reflective distance 30” [76 cm]



General Information

The **OPB720** series of reflective switches are designed for operation in areas that have a reasonable amount of ambient light. The **OPA720** sensor is **NOT** affected by ambient light in most conditions. The device is designed with an internal optical driver that synchronizes the LED and Photosensor using a synchronous driver detection scheme to minimize the effects of ambient light.

The **OPB720** Series reflective switches detects objects as far away as 30” (76 cm) using standard 90% reflective material, and can detect objects as small as 0.08” (2 mm) in close proximity of the device. The **OPB720** series consists of three standard reflective switching distances OPB720A-06Z for typically 6” (15 cm), **OPB720A-12Z** for typically 12” (30 cm) and **OPB720A-30VZ** for typically 30” (76 cm).

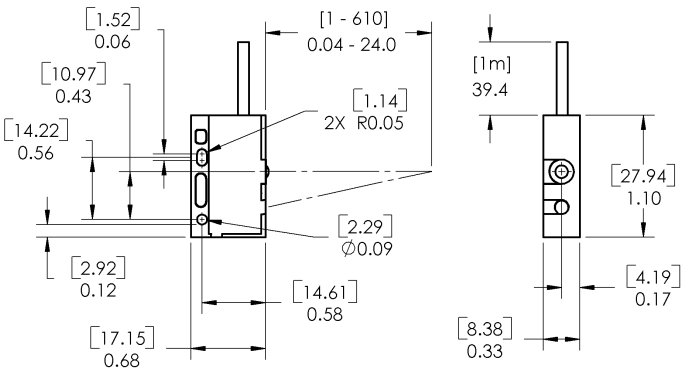
This sensor has a logical output that switches from a high level with reflective target to a low level with no reflection target. With the addition of hysteresis, the **OPB720** series minimizes switching oscillations on the output. The type of material used for the target is very dependent on the distance that can be achieved for the sensor. Taking this into consideration, the **OPB720** series can be used in either a reflective or interruptive mode. As an example, the **OPB720-12Z** can easily be used in a reflective mode for distances around 12” (305 mm) while when reflecting off of a retro-reflective target (similar to 3M 3870 or Nippon Crystallite) at distances around 85” (216 mm) the device operates well in the interruptive mode. See the included charts for typical distances with different reflective material for other versions of the **OPB720** series devices.

The **OPB720** series has an NPN open collector output drive transistor with power requirements compatible to most PLCs and TTL gates.

Size

The OPB720A series is 1.1” [28mm] long, 0.33” [8.4mm] wide and 0.68” [17.2mm] deep with a minimum interconnect cable length of 39.4” [1m]. The 26 AWG interconnect cable is designed for ease of use by connection either directly to a PCBoard or adding a connector. The cable has three wires which consist of Red (Vcc), Black (Ground) and White (Open-Collector Output).

Mounting holes are located near the rear of the device and capable of accepting a 2-56 or equivalent screw. One of the mounting holes is round while the other is elongated to assist in the assembly process.



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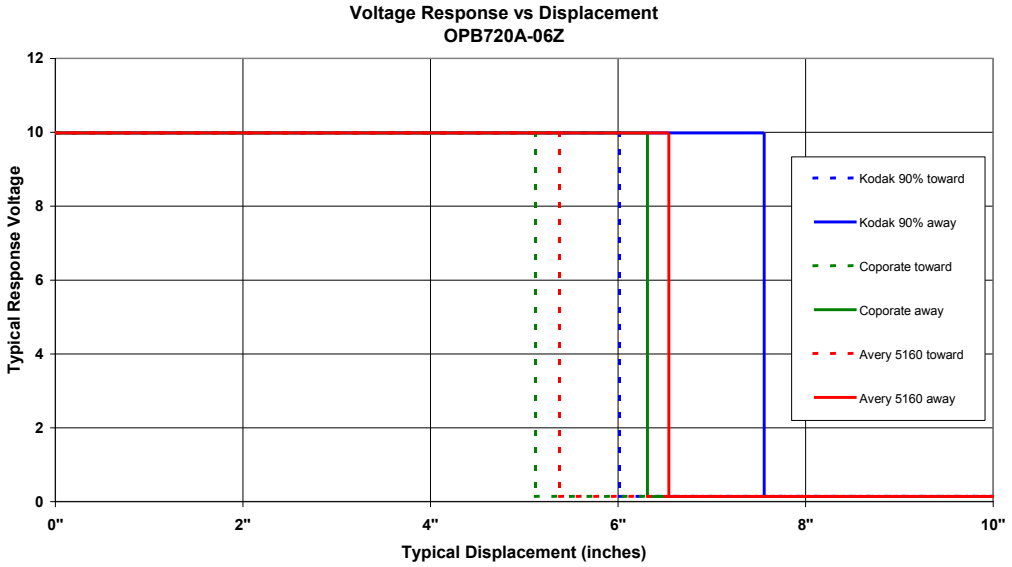
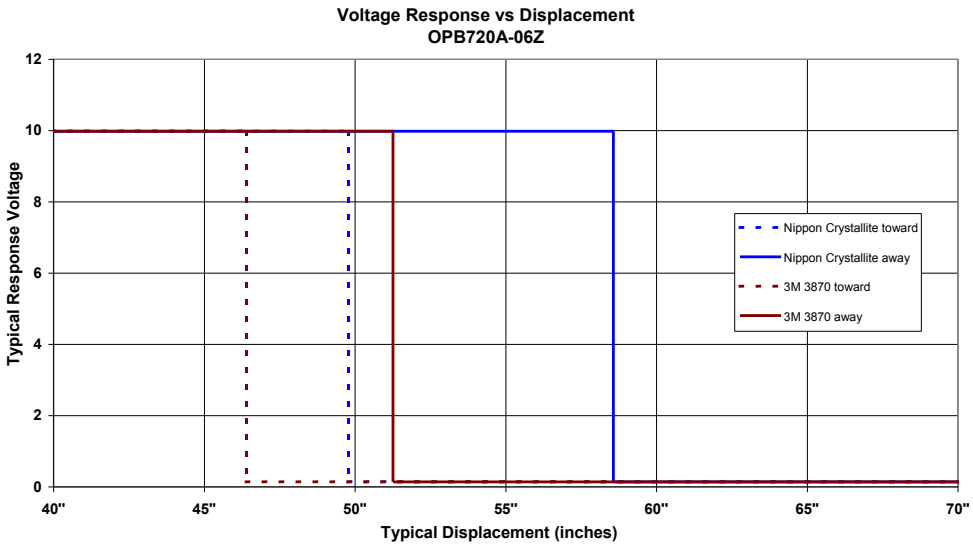
Operation

The OPB720 device turns off the output transistor when a target reflects sufficient light to the photosensor element. When the reflected signal is reduced to a level below the internal threshold the output transistor turns on thus providing a low signal output. In order to switch the output transistor off, a more intense light signal is required. This change in signal level keeps the device from oscillating and the effect is called hysteresis.

The first device we will look at for switching conditions is the OPB720A-06Z. This device is designed to switch from the reflective light to the non reflective light levels with a target around 6" [15 cm] from the front surface of the device (see below). This is the normal reflective operating condition. The type and size of reflective material may change the distance of operation. The solid line is for a target moving away from the device.



If a longer distance is required, the device can be used in an interruptive mode. When a small reflective target approximately 2" [5 cm] square of 3M-3870 or Nippon Crystallite) is placed in the transmissive path of the device, the operating distance can be increased considerably. As can be seen below, this distance can be increased for an operating distance between 8" [20 cm] and 45" [114 cm]. In this mode the device is normally reflecting and when an object interrupts the beam the device switches states.



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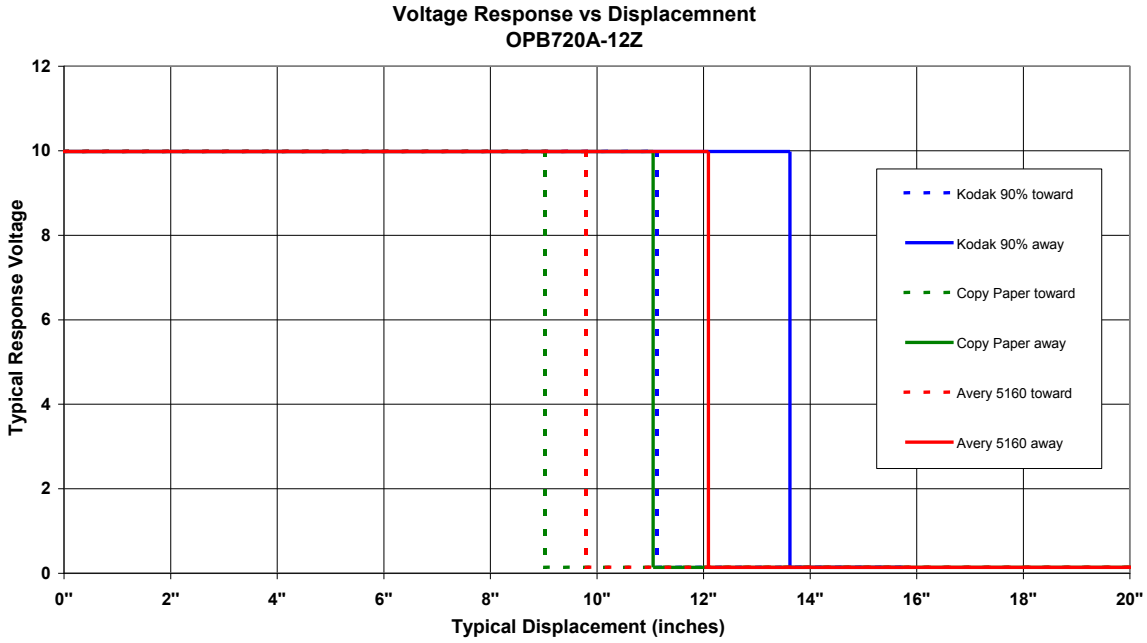
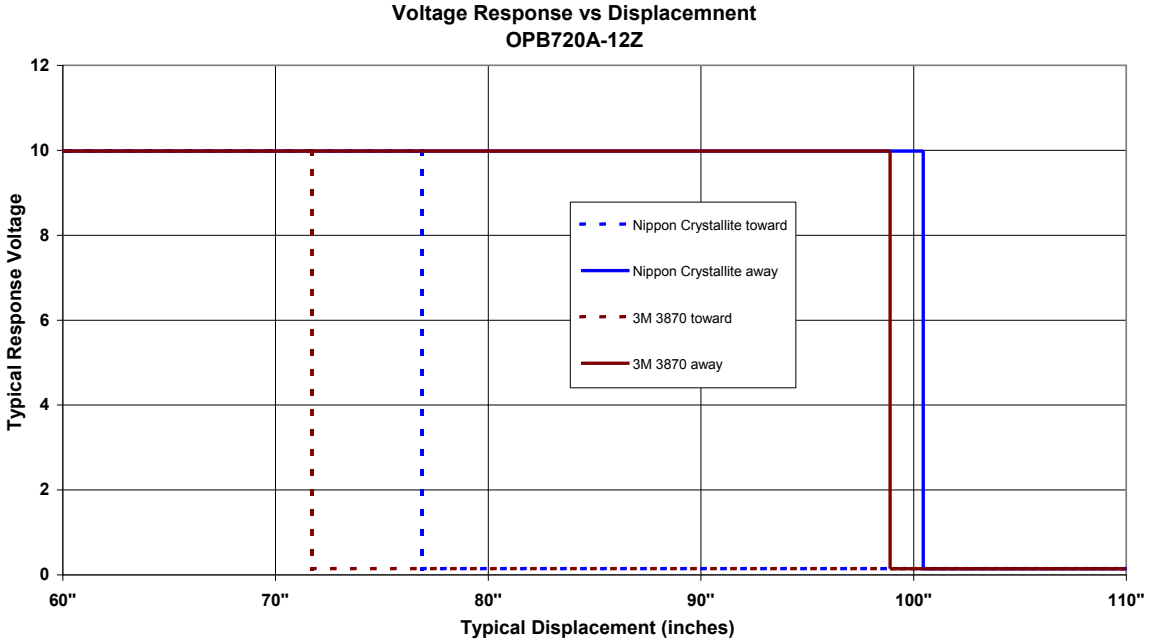
The following graphs shows the typical distances that can be expected for the OPB720A-12Z and OPB720A-30VZ. The OPB720A-30VZ uses a VCSEL (Vertical Cavity Surface Emitting Laser) as a light emitting device. The laser classification for this device is Class 1M, which requires minimum safety considerations(1).





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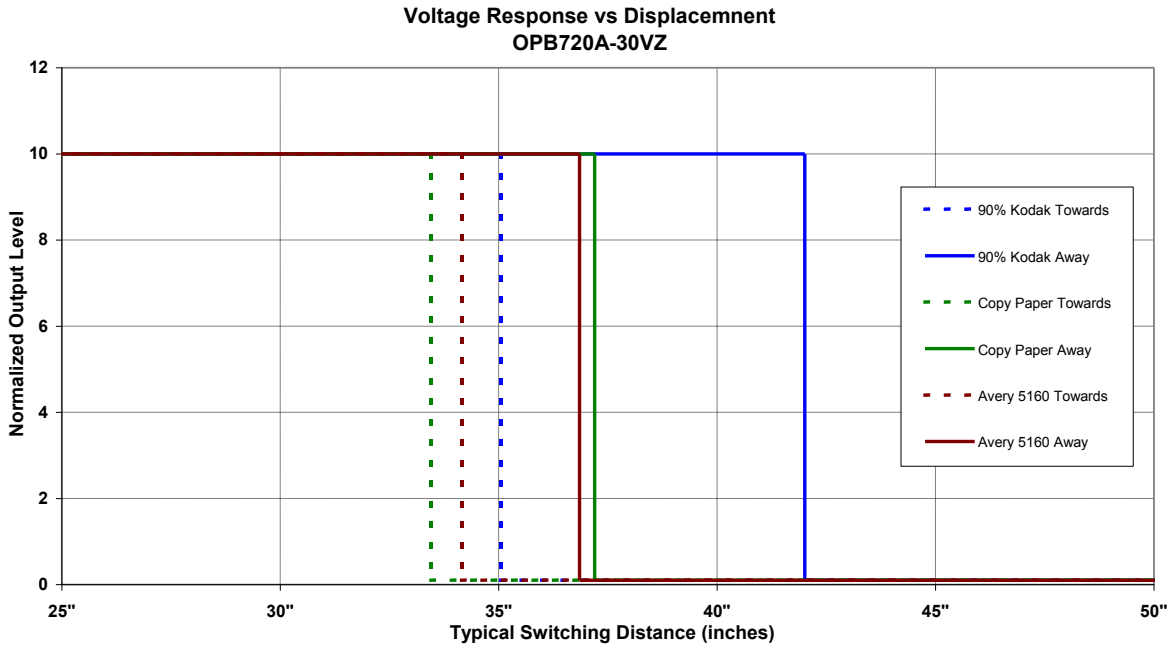

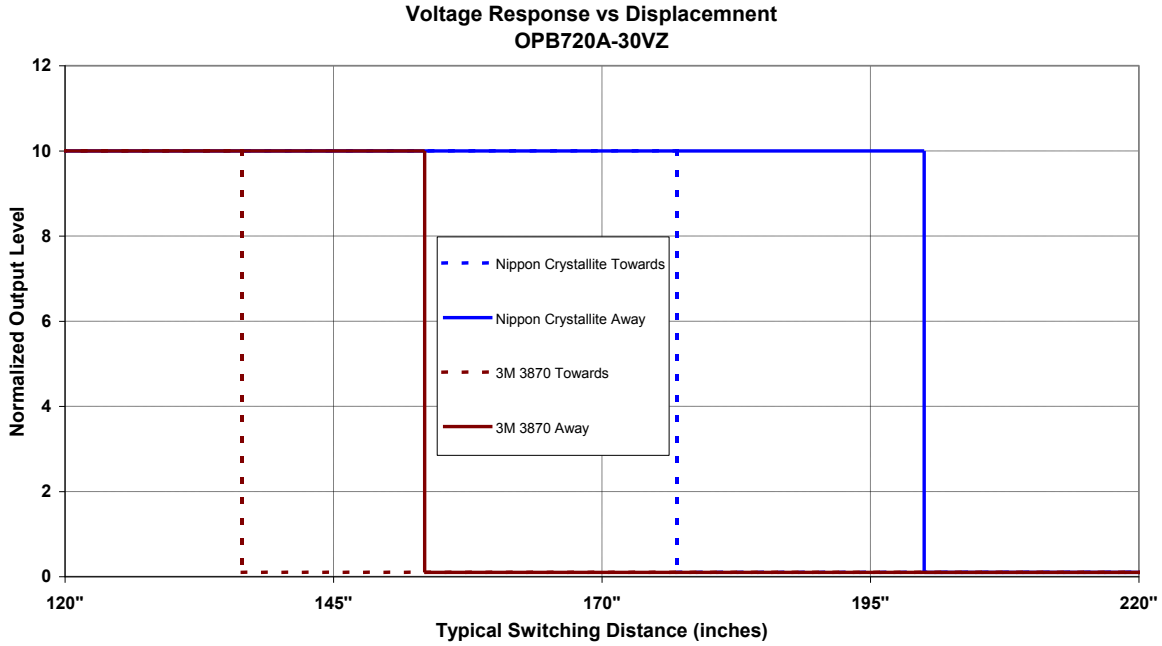

Do NOT directly view this device with a magnifier closer than 4" [10 cm]. Additional laser safety information can be found on the website. See application bulletin #221. Classification is not marked on the device due to space limitations. See package outline for centerline of optical radiance. Operating devices beyond maximum rating may cause devices to exceed rated classification

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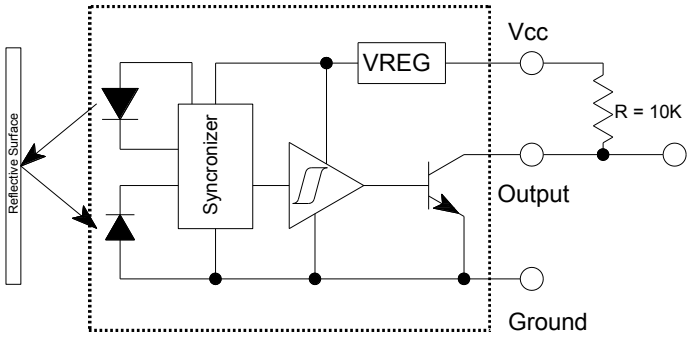
Hook-Up

The OPB720 series requires minimal external components. The below schematic shows a typical schematic that can be used.

Vcc for the **OPB720A-06Z** and **OPB720A-12Z** can range from +10 volts to +30 volts and +15 volts to +30 volts for the **OPB720-30VZ**. If you connect the load resistor R to a separate power supply the output voltage can range up to +30 volts. This allows the user the ability to easily separate the active sensor from the load electronics.



OPB720

Reflective Operation

When the OPB720 is in the standard reflective operation mode, the two possible states are when the device receives sufficient reflected light from the target and when insufficient light is present to trip the device. When sufficient light is present for the sensor to recognize it the output will be in the "High" state (when the output transistor is OFF). When a small amount or no light is reflected from a target, the output transistor is turned "ON" resulting in an electrical "LOW" level.

The primary switching consideration is dependent on the distance and **direction** of a target moving toward or away from the sensor. As an example: the OPB720A-06 typically switches at a distance greater than 6" [15 cm], from High" to "Low", as a target is moved away. The OPB720A-06 switches from "Low" to "High" as the target is moves toward the sensor. The distance is typically less than 6" [15 cm].

A secondary switching consideration is dependent on the reflectivity of the target to near Infrared light (890 nm). As can be seen from the distance graphs, standard 90% reflective material, copy paper and white Avery labels have similar reflectivity while retro-reflective material similar to 3M 3870 and Nippon Crystallite reflect light back to the sensor at a much more intensive level thus increasing the reflective distance. This phenomena allows us to use the OPB720 series sensors in either a reflective or interruptive mode.

In the interruptive mode, the light is normally reflected back to the target. The material typically used for this application is highly reflective, such as 3M 3878 or Nippon Crystallite. Looking at the graph for the OPB720A-06 shows the typical switching position using 90% white reflective material is increased from 6" to 50". In order to properly utilize the OPB720 in the reflective mode, any target that will reflect light back to the sensor must be beyond the 90% reflective distance consideration.

Conclusion

The OPB720 series reflective sensors operate over a wide range of distances from 0.1" [0.25 cm] to 150" [381 cm]. The type and size of material may change the operating conditions.

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