Overview

What Are Displacement Sensors?

A Displacement Sensor is a device that measures the distance between the sensor and an object by detecting the amount of displacement through a variety of elements and converting it into a distance. Depending on what element is used, there are several types of sensors, such as optical displacement sensors, linear proximity sensors, and ultrasonic displacement sensors.

Operating Principles and Classification

1. Optical Displacement Sensors (e.g. Smart Sensor ZX-L-N series)

● Outline

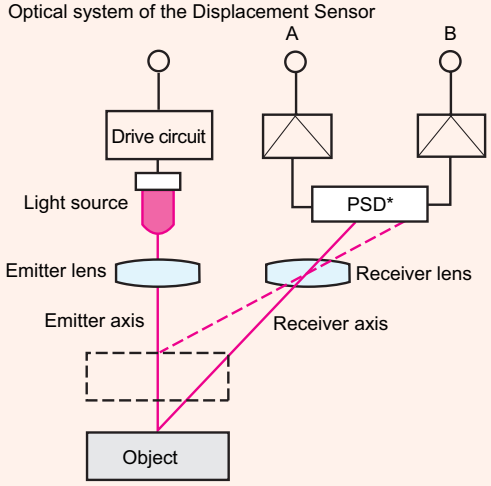
These sensors use a triangulation measurement system. Some sensors employ a PSD, and others employ a CCD (CMOS) as the light receiving element.

● PSD Method

Light from the light source is condensed by the lens and directed onto the object.
Light reflected from the object is condensed onto a one-dimensional position sensing device (PSD)* by the receiving lens. If the position of the object (the distance to the measuring device) changes, the image formation positions on the PSD will differ and the balance of the two PSD outputs will change.
If the two outputs are A and B, calculate A/(A + B) and use appropriate values for the span coefficient “k” and the offset “C” as shown below.

$$\text{Displacements} = \frac{A}{(A + B)} \bullet k + C$$

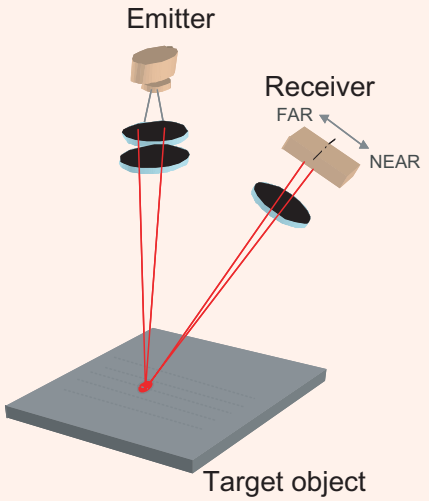
Optical system of the Displacement Sensor

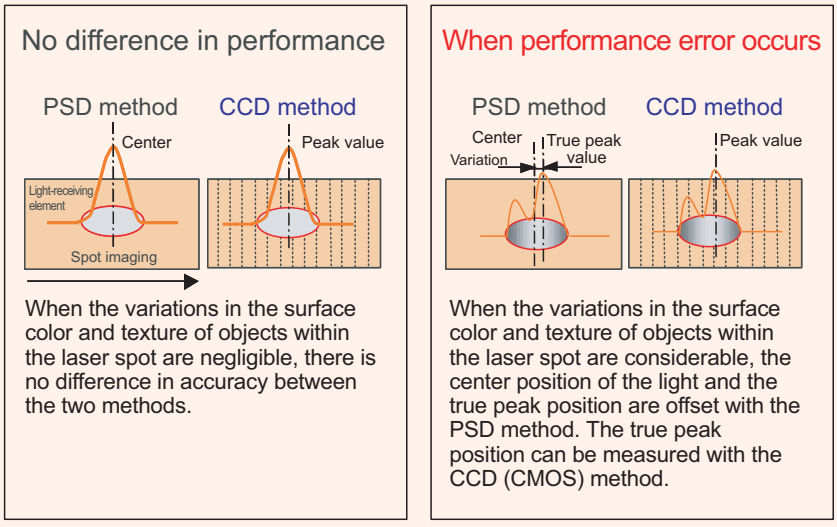


* PSD: Position Sensitive Device

● CCD (CMOS) Method

Compared with a sensor that employs the PSD method, a sensor that employs a CCD (CMOS) as the light receiving element provides a more accurate measurement of displacement without being affected by surface color and texture of objects.
The sensor detects the amounts of light on individual pixels in the CCD (CMOS) and converts them into a distance when a spot beam that reflects off of the surface of the object is projected onto the light receiving element.





Overview

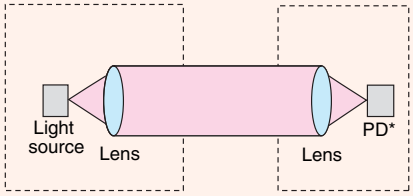
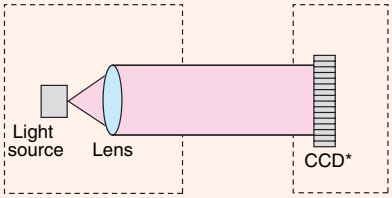
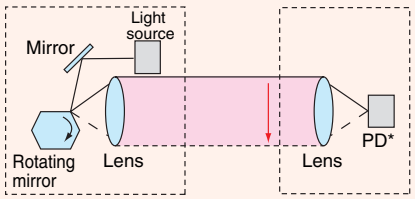
What Are Measurement Sensors?

A Measurement Sensor is a device that measures the dimensions of an object by converting changes in amount of light into electrical signals when the object interrupts a wide laser beam.

Operating Principles and Classification

Optical Measurement Sensors

Measurement Sensors, which measure the widths or positions of objects, use one of the following three methods: light intensity determination, CCD, or laser scanning.
All types of measurement sensors consist of an emitter and a receiver.

Detection principle	Product names / models	Structure	Application
Light Intensity Determination Method A parallel laser beam is emitted from an emitter to a receiver and is focused onto a light receiving element by a lens at the receiver. If there is an object between the emitter and receiver, the incident level of the laser beam decreases, and the sensor outputs the changes resulting from the width of the object as changes in a linear output.	Smart Sensor **ZX-LT**	 *PD: Photo Diode	• Determining outer diameters • Detecting edge positions (opaque object only)
CCD Method A one-dimensional CCD image sensor is used in the receiver to recognize the position of an object. The CCD method uses digital processing, so it enables the sensor to perform more accurate measurements compared with the light intensity determination method.	Parallel Beam Line Sensor **ZX-GT**	 *CCD: Charge Coupled Device	• Determining outer diameters • Detecting edge positions (including transparent objects) • Determining pin pitch • Detecting bar positions
Laser Scanning Method The sensor performs measurements by emitting a laser beam while scanning a small diameter laser beam from the emitter. The sensor measures the time that an object blocks the beam as the width of the object, and then calculates the outer diameter of the object.	Laser Micrometer **3Z4L**	 *PD: Photo Diode	• Determining outer diameters (including transparent objects) • Detecting edge positions (including transparent objects) • Determining pin pitch