Use Retro-Reflective Tape To Enhance Sensor Performance

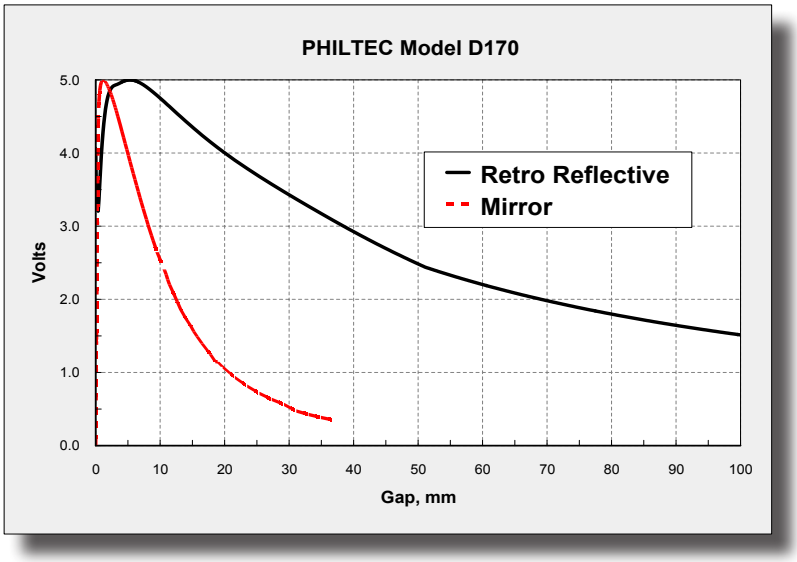
The Problem - To Measure Large Displacements of Mechanisms with Multi-Axis Translational and Rotational Displacements (i.e., engine dynamics, shock studies, weapons dynamics)

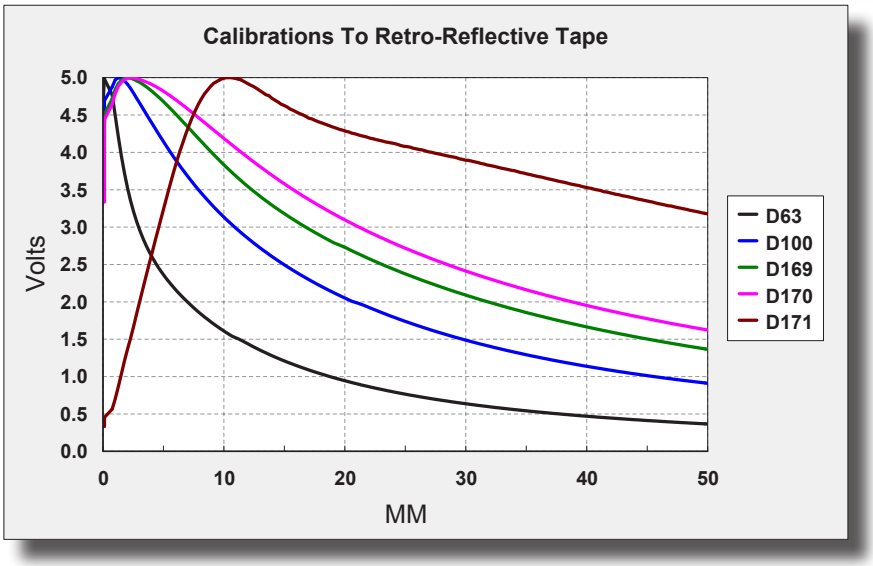
Sample Requirements - 3 Sensors for X, Y & Z Axis Displacements

- Working Distances Up to 150 mm
- Rotation of 10 to 15°

The Solution - Philtec's D Type sensors (Reflectance Dependent models) have limited operating ranges and are very sensitive to target tilt when used with specular or diffuse reflective targets. Retro-reflective tape* applied to a target will increase a sensor's operating range about 5x and render it insensitive to target tilt.

*Retro-reflective tape, also referred to as reflective tape or safety tape, is used on anything you want to see at a distance, or in the dark, or on life-saving equipment. Light rays striking reflective tape reflect at 180° to their angle of incidence.



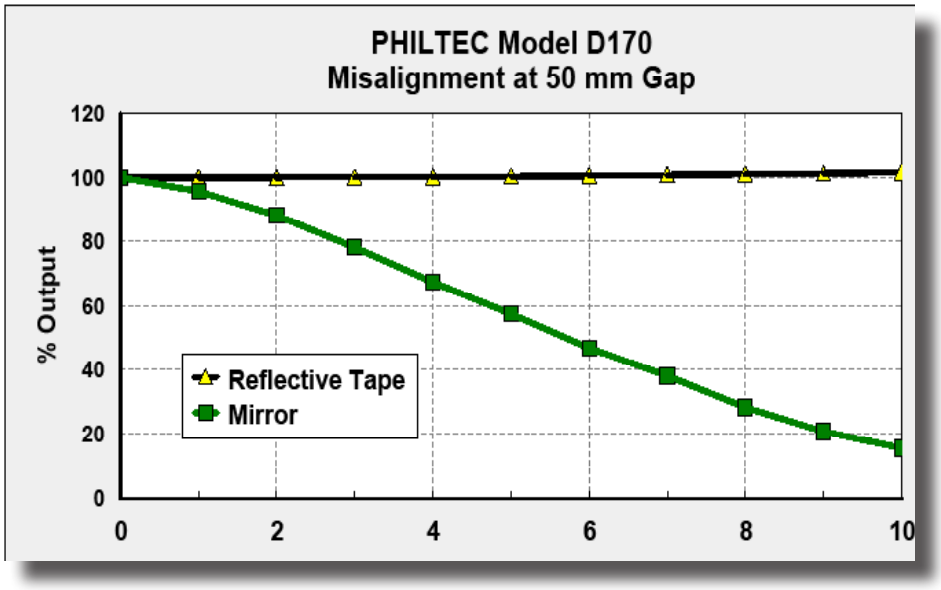


Misalignment or Target Tilt

It is the nature of reflective tape that it returns light rays directly back to their source of illumination. Reflective tape is therefore inherently insensitive to tilt or misalignment.

The charts here show the output of the model D170 sensor at a gap of 50 mm. With an ordinary reflective surface, such as a front surface mirror, the sensor's output is extremely sensitive to tilt: about 50% of the output power is lost at 5° tilt.

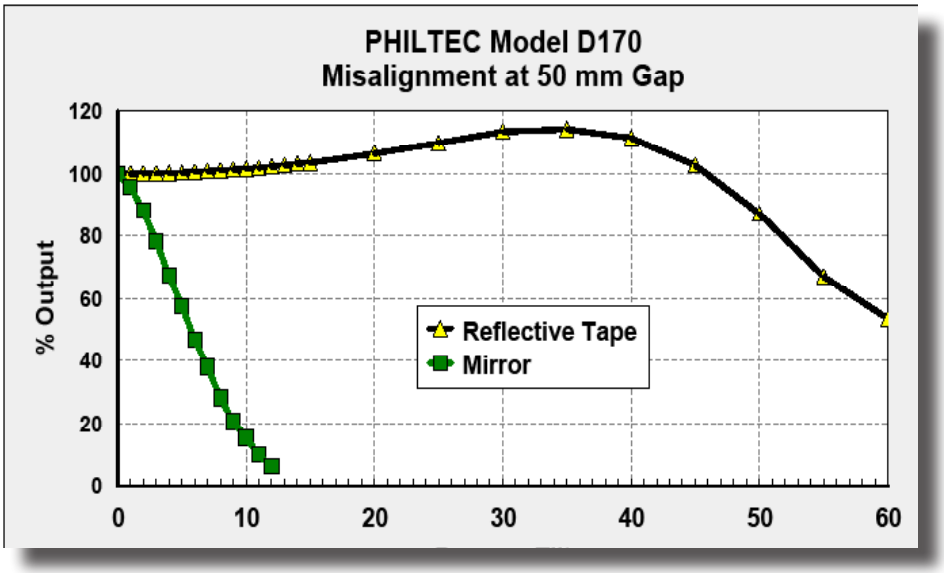
With reflective tape the sensor shows no loss of output at 5° tilt, and it can be used with great efficiency at angles up to 45° or more.



PISTON STROKE

The precise measurement of Top Dead Center (when a piston reaches the end of its stroke) is enhanced thru the use of reflective tape.

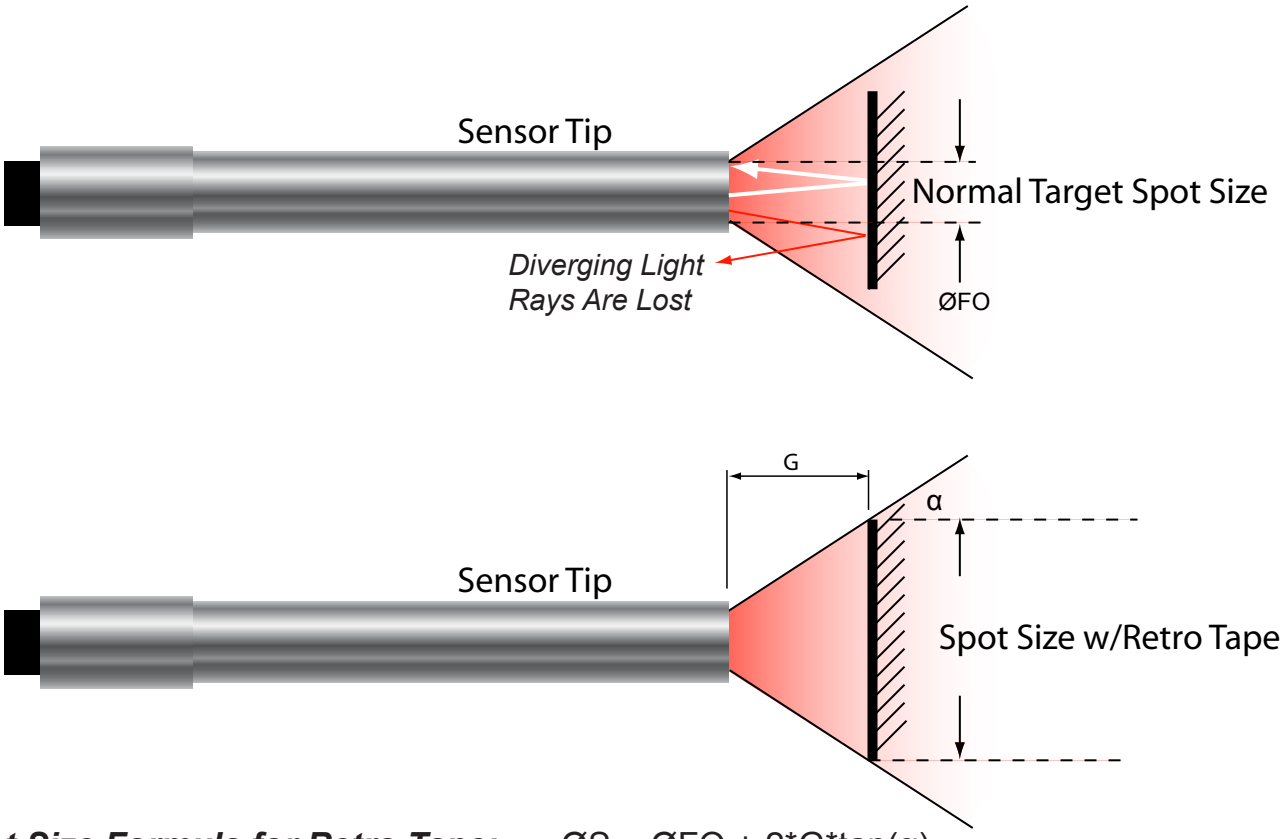
- Reflective tape is applied to the piston head.
- Philtec's sensor is mounted in a spark plug hole.
- The engine is externally driven without ignition.



Active Target Area (Spot Size)

With normal surfaces and mirrors, the active target area is equal to the area of the fiber optic bundle in the sensor tip, because all light rays that diverge outward do not reflect back into the tip.

When using retro-reflective tape, the active target area increases with increasing distance from the sensor tip, because, all of the light rays that diverge away from the tip are returned back into it.



Spot Size Formula for Retro Tape: ØS = ØFO + 2*G*tan(α)

where, ØS = Spot size diameter

ØFO = Fiber Optic Bundle Diameter (see Product Data Sheets)

G = Gap from Tip to Target Surface

α = the ½ Beam Angle of the fiber optic probe

½ BEAM ANGLE, α	Models
33°	**D20, D63**
15°	**D6, 12, D21, D47, D64, D100, D125, D169**
12.5°	**D170, D171, D240**