Philtec Application Note

No. 62
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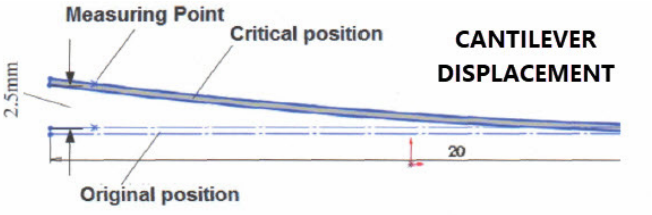
Type D Sensor Applications With Tilt

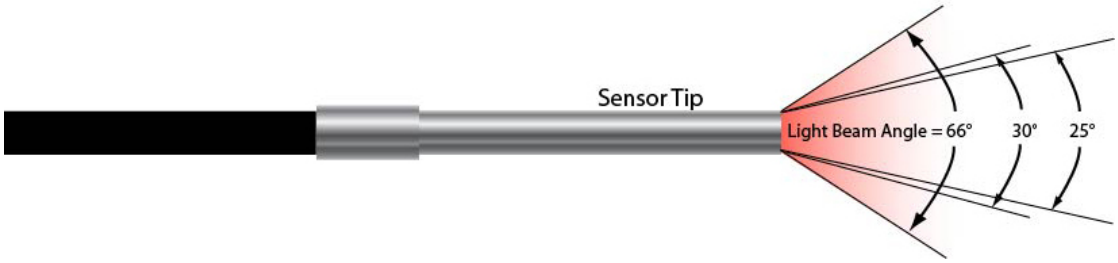
BACKGROUND

Sensor probes are to be generally mounted normal (perpendicular) to a target surface. With some applications, such as *displacement of a cantilever beam*, the target surface rotates as deflects. In other applications, due to installation constraints, the probe can not be mounted normal to the surface. In applications where tilt is unavoidable, what sensors can be used?



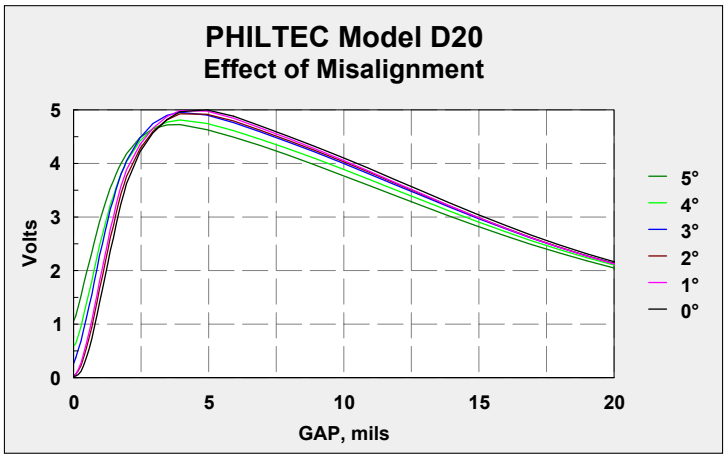
SENSOR SELECTION GUIDANCE

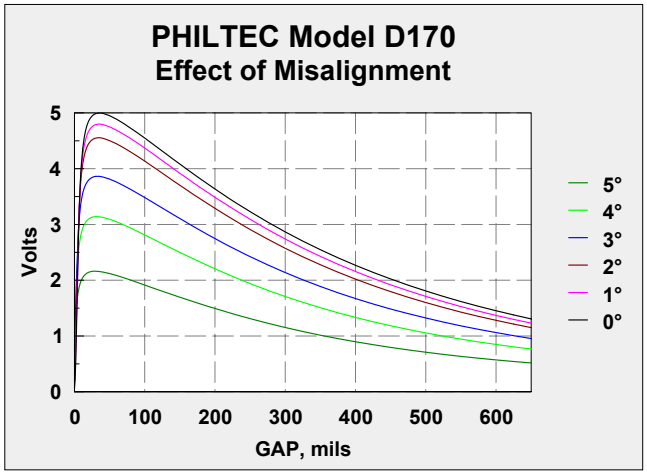
Philtec sensors emit light over an included angle, dependent upon the fiber numerical aperture (NA):
NA = .55, β = 66°
NA = .25, β = 30°
NA = .22, β = 25°



Models with 66° have the shortest operating range. For example, D20, D63.
Models with 30° have moderate range. For example D100, D125, D169.
Models with 25° have the longest range. For example D170, D171, D240.

Small short range sensors (like D20) are less sensitive to tilt than large long range sensors (like D170).

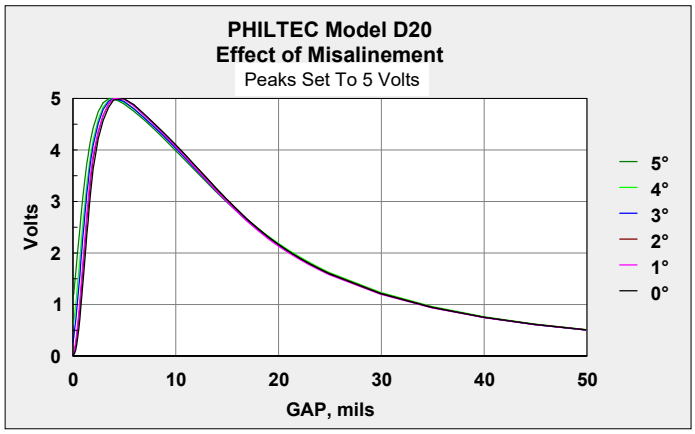


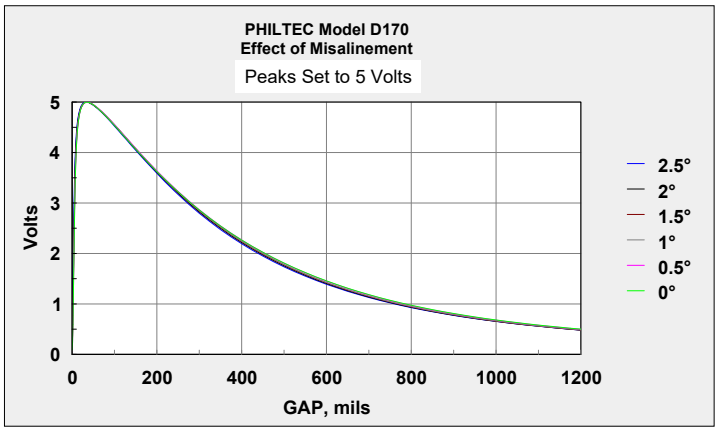


Type D Sensor Applications With Tilt

PROBE ANGLE IS FIXED - SMALL ANGLES

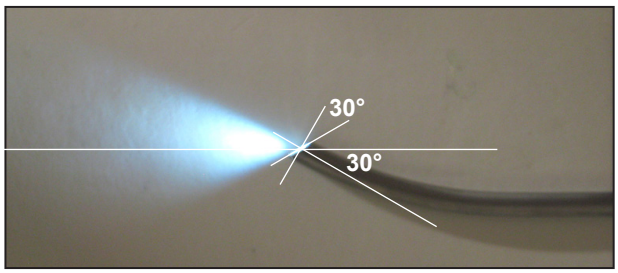
If a sensor probe is installed at a small angle of tilt <5°, the sensor's response will be the same as if it were installed normal to the surface - ***when Optical Peak when set to 5 volts.***





PROBE ANGLE IS FIXED - LARGE ANGLES

Due to installation constraints, if a probe can not be fixtured normal to a target surface - the face of the probe can be polished at angle to 'bend' the light. The probe face acts like a prism, refracting the light rays to be normal to the target surface.



The amount of light refraction can be calculated from:

$ß° = SIN^{-1}[IR * SINα] - α$, where

ß = Light Bend Angle
α = Fiber Polish Angle
IR = Refractive index of the glass fibers

note: na = numerical aperture of fiber

Example Calculations		
Grind Angle, α°	.25na β°	.22na β°
10	5.9	5.3
20	12.7	11.4
30	22.3	19.6