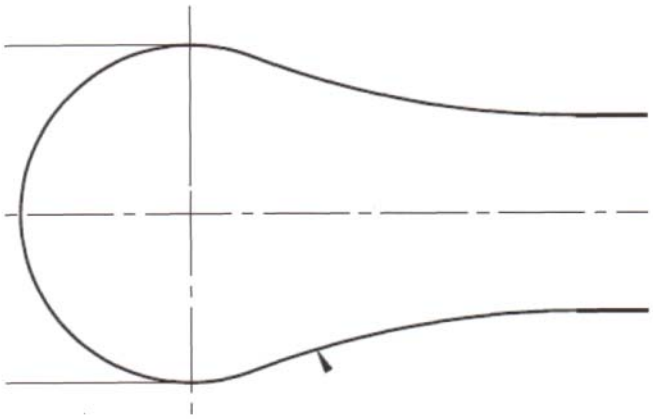
RC vs. D Model with Tilting Targets

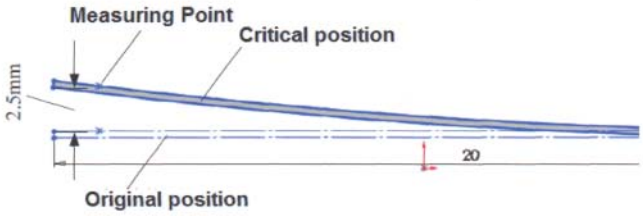
Q. Which type of sensor is more suitable? D or RC type? A customer has the metal reed valve shown here. It is 20 mm long. One end is fixed and one end will displace upward 2.5 mm. Reed valves consist of thin flexible metal or fiberglass strips fixed on one end that open and close upon changing pressures across opposite sides of the valve much like heart valves do. They are intended to restrict flow to a single direction.

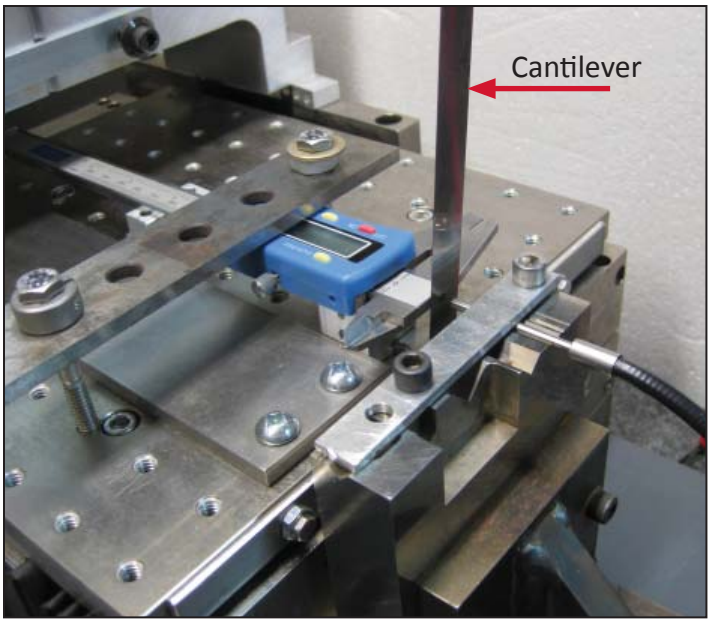


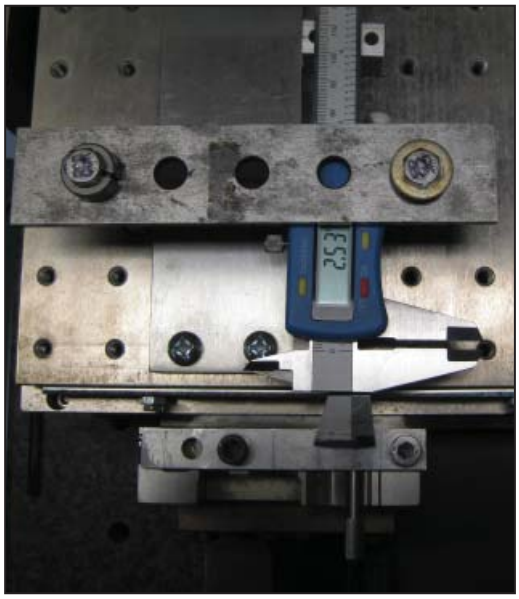
A. The RC sensor is the better choice.

Because the part rotates as it displaces, in place calibration is required.

- To simulate the application we used a 0.008" thick 'feeler gage' clamped vertically as a cantilever arm.
- RC and D type probe tips were mounted 20 mm above the fixed end.
- A dial indicator gage was mounted a couple of mm above the probe tip.
- The dial indicator was used to deflect the cantilever arm with measured displacements.



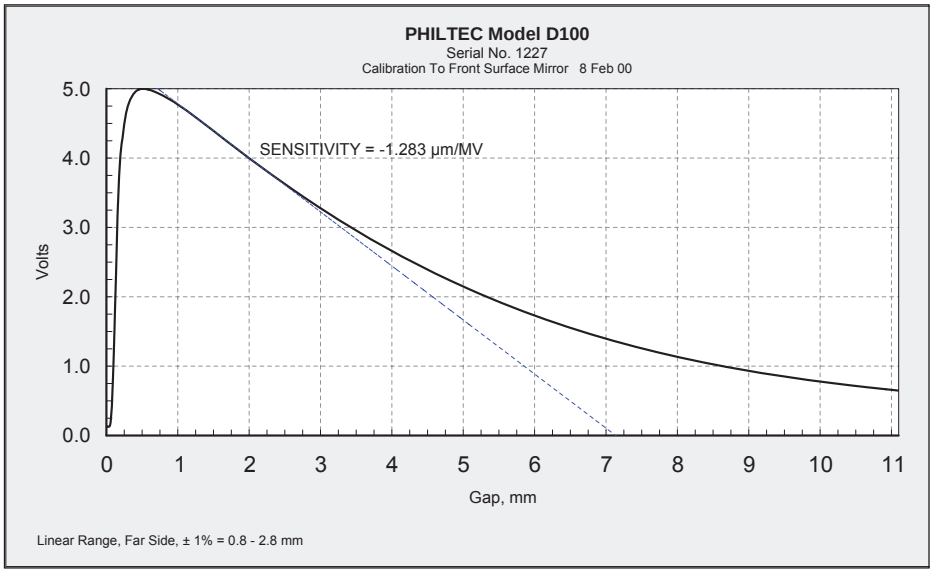




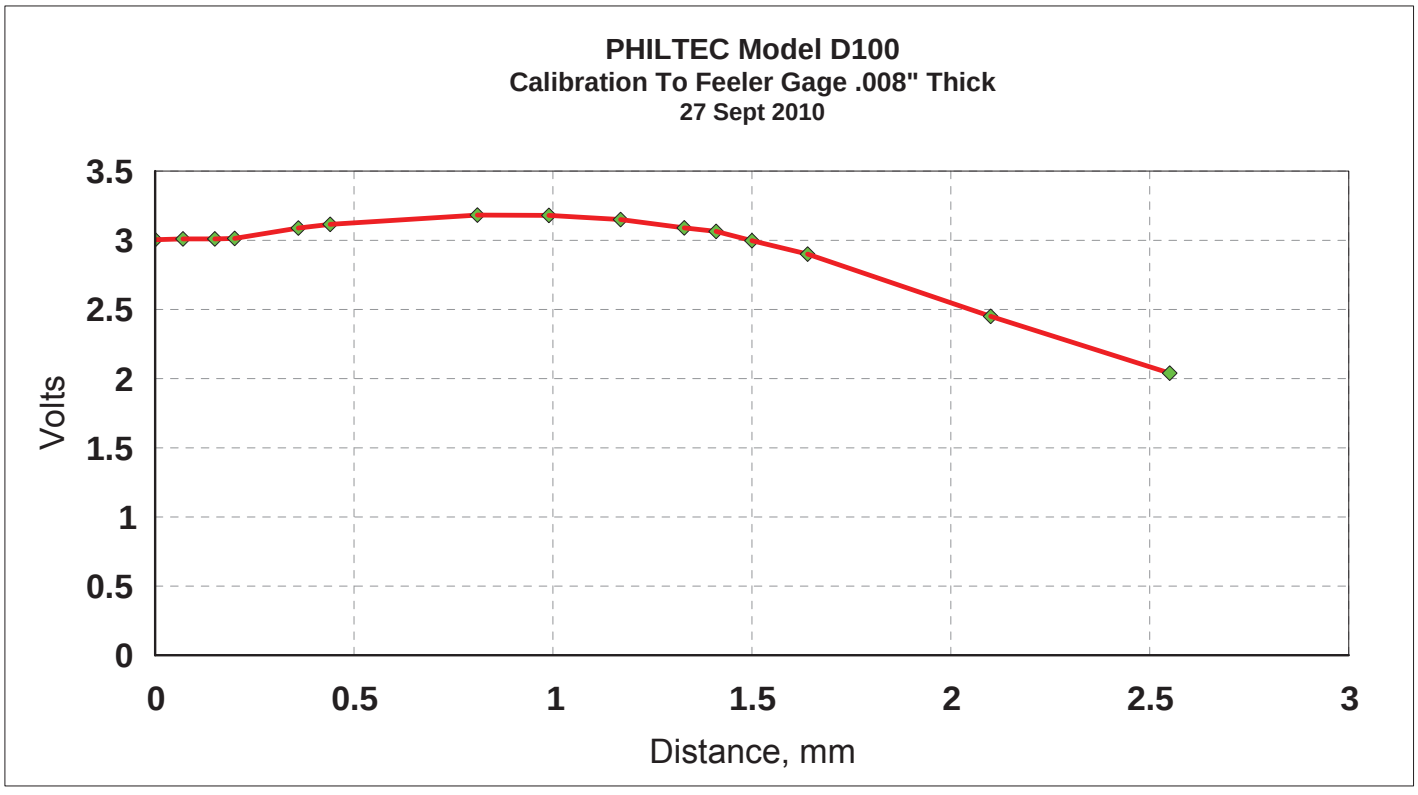
D SENSOR RESULTS

A D type sensor was first set into position and the optical peak set to 5 volts for the cantilever arm.

The gap was then set to:
~ 3.5 mm (3 VDC) for the start of the test.

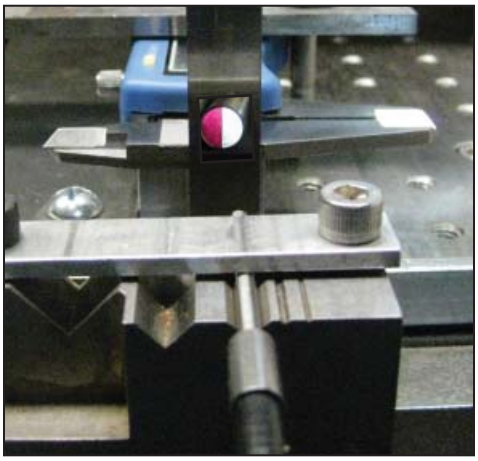


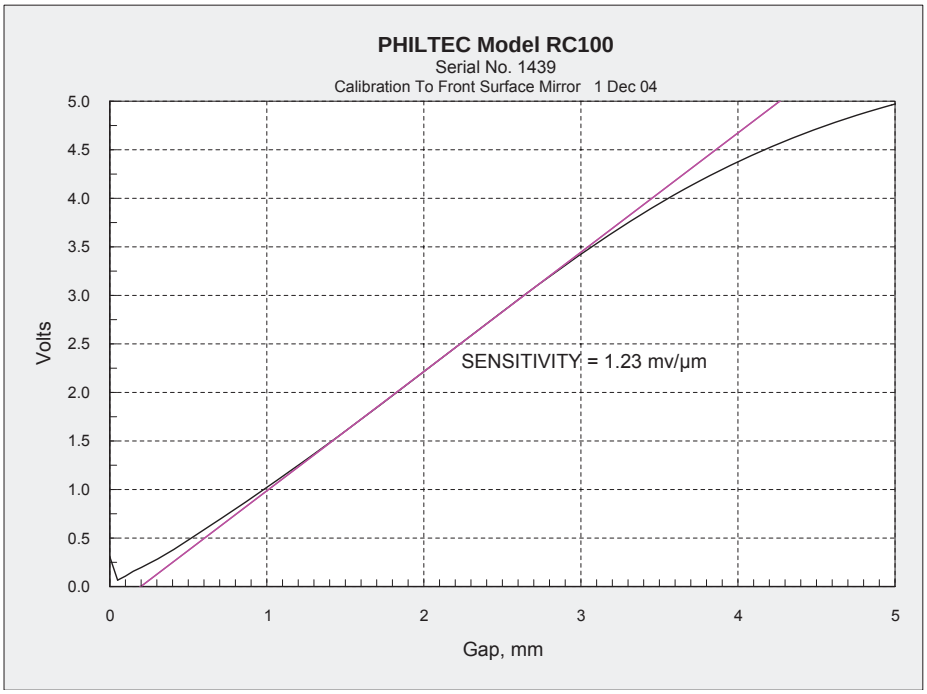
According to the calibration chart, the voltage should increase from 3.0 to 4.75 as the gap reduces from 3.5 to 1 mm. The results shown below are not very good. Rotation of the cantilever arm reduces the sensor output voltage at about the same magnitude as the gap reduction causes the voltage to increase. The result is very little change is voltage for the first 1.5 mm of displacement.



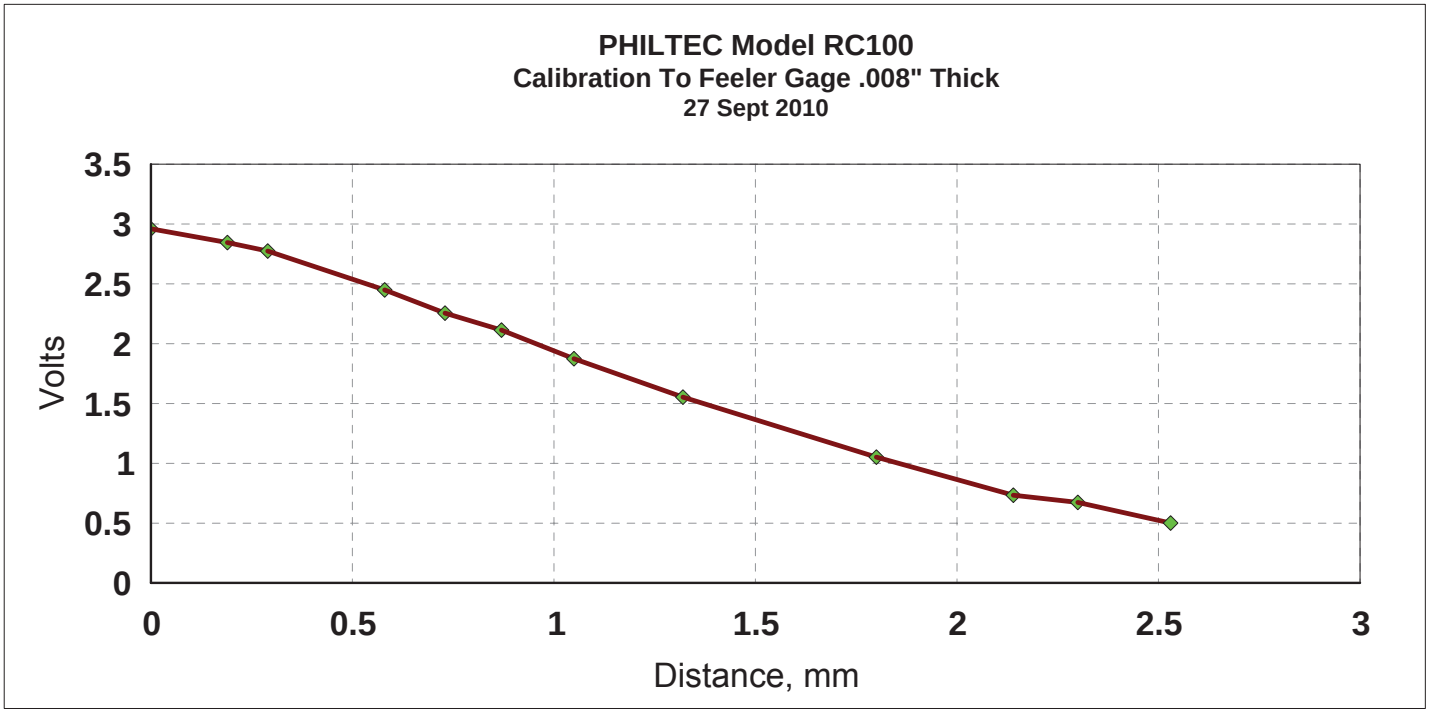
RC SENSOR RESULTS

The RC type sensor was next set into position with the fiber optic bundles arranged side-by-side horizontally as shown here.





The gap was then set to:
~ 2.75 mm (3 VDC) for the start of the test. According to the calibration chart, the voltage should decrease from 3.0 to 0.25 as the gap reduces from 2.75 to 0.25 mm. The results shown below are very good. The RC sensor has much less sensitivity to rotation of the target when the fiberoptics are oriented as shown above.

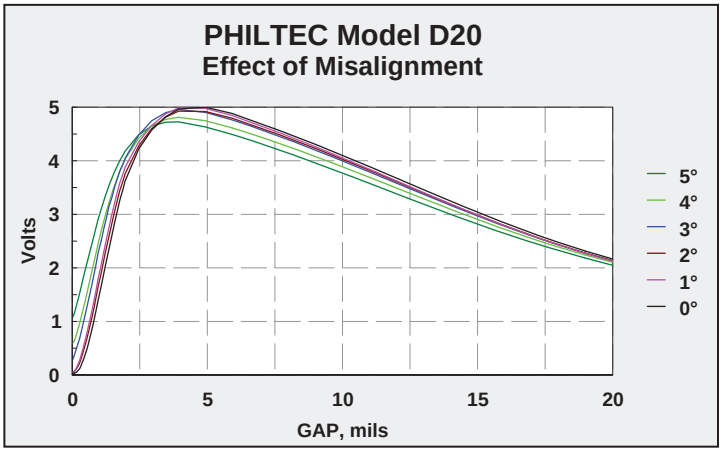


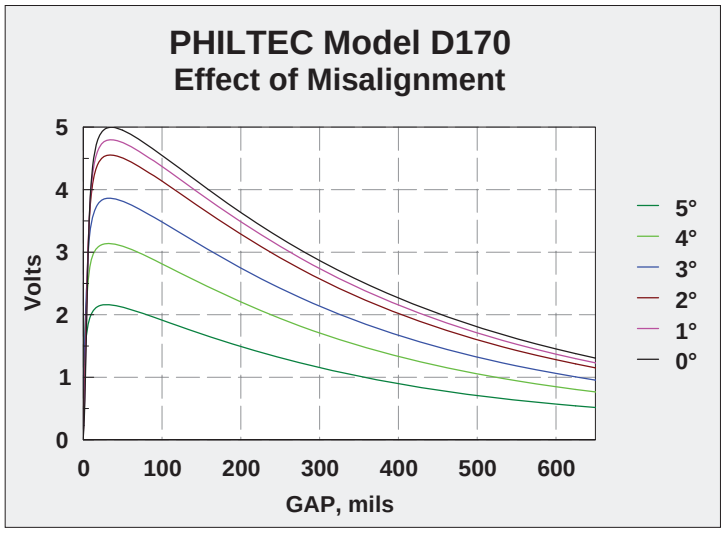
PERPENDICULARITY

D Models

When a target surface tilts under a Type D probe tip the output voltage drops. Small diameter probes such as D6 and D20 models are much less sensitive to misalignment than larger tips like the D169-D171, where ±0.5° perpendicularity is recommended.

If the probe is mounted with a fixed angle of misalignment, the probe's peak output can be set to 5 volts at that angle and the sensor operated normally.

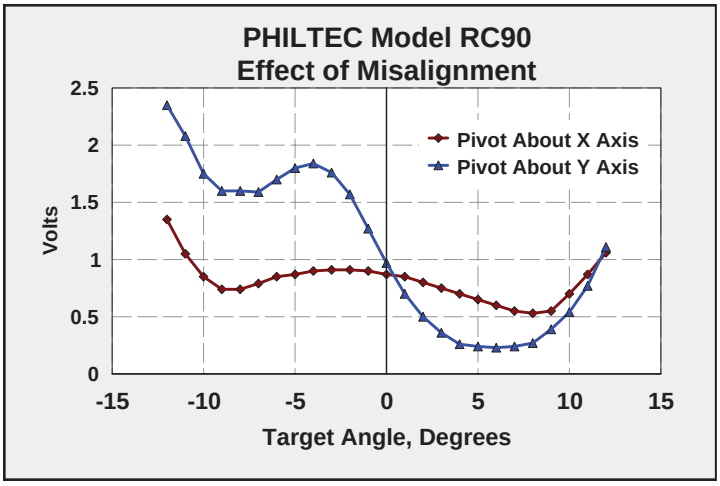




RC Models

RC models have two adjacent bundles of fibers in the tip. Therefore, the output voltage does not simply drop with increasing tilt. We define the X and Y axes as shown in the illustration below. Orientation of the probe tip with target tilt about the X axis will produce the most favorable results.

For example, the chart below shows the effect of misalignment with a model RC90 probe. When the target tilts about the Y axis, the sensor is very sensitive to tilt, and operation should stay within ±0.5°. With tilt about the X axis, the device is very insensitive to tilt, giving good results between ±10°.



RC Models