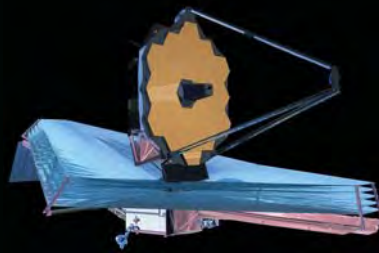


FROM  
INNER SPACE  
TO  
OUTER SPACE  
**PHILTEC**  
FIBEROPTIC SENSORS  
SOLVE  
YOUR  
MEASUREMENT  
PROBLEMS



**PHILTEC**  
FIBEROPTIC SENSORS

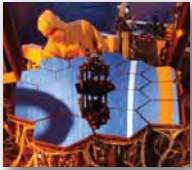
DISTANCE | DISPLACEMENT | VIBRATION

# PHILTEC APPLICATIONS

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Aerospace sensor applications are among the most demanding in the world. Philtec sensor systems have been successfully engineered into these extreme environments:

- Pressurized Cryogenic Fluids - liquid oxygen and liquid nitrogen
- Extreme Temperatures - down to 4°K and up to +450°C
- Ultra-High Vacuum
- Strong Vibrations



## James Webb Space Telescope

Philtec sensors & vacuum passthru hardware were used to measure displacements of critical components of this Hubble Replacement Telescope as they were brought down to the cold temperatures of outer space.



## Mars Rover

Nasa's JPL developed a Sonic Driller to drill core samples of rocks on Mars. Philtec's sensor was used to characterize the harmonic analysis and axial motion of the drill because it can detect high frequency low amplitude motions.



## Space Shuttle

In the wake of the Challenger disaster, Thiokol engineers used Philtec sensors installed between the joints of rocket sections to determine how much separation occurred during firing.



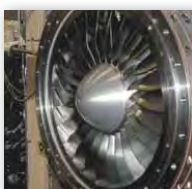
## Space Shuttle

Nasa's MSFC used Philtec probes in a LOX pressurized cryogenic environment to monitor bearing deflections in the Space Shuttle Main Engine



## Flight Tests

Philtec 90° tip sensors were used for Airbus 380 flight tests to measure the displacement of thrust reversors.



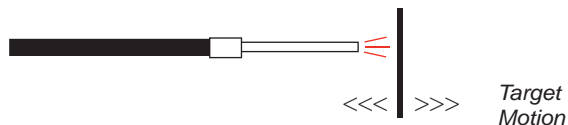
## Turbine Testing

Philtec sensors have been used for various measurements such as speed of 1,000,000 rpm micro-turbines; shaft displacements, blade clearance and growth in power turbines; time-of-arrival and flutter in gas turbine and turboshaft engines.

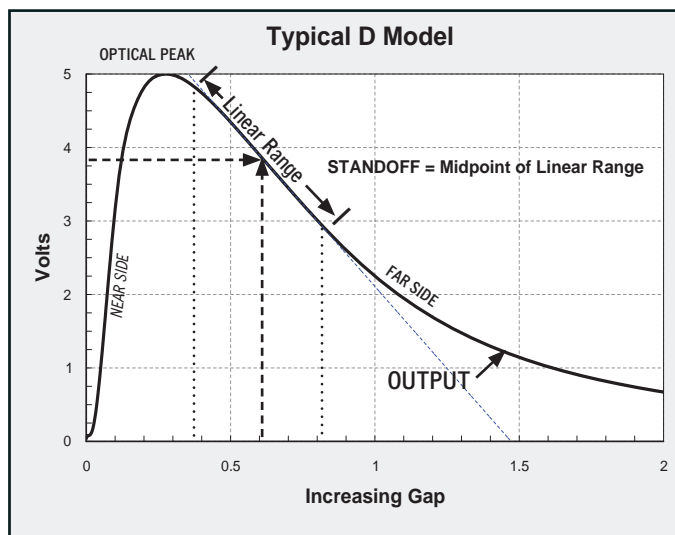
# D TYPE SENSORS REFLECTANCE DEPENDENT

Maximum range 50 mm

Philtec D Type Sensors are recommended when the target moves along the axis of the sensor; i.e., single axis vibration where the target reflectivity is constant.



D type sensors provide an output proportional to distance and reflectance of the target. The output function is double-valued: Near Side operation gives highest resolution; Far Side operation gives moderate sensitivity with larger operating range.



## MODEL

Feature	Unit	D6	D12	D20	D21	D47	D63	D64	D100	D125	D169	D170	D171
Tip Diameter	mm	0.81	0.81	0.81	0.81	1.61	3.18	3.18	3.18	3.96	4.76	4.76	4.76
Fiber Diameter	mm	0.15	0.3	0.51	0.53	1.16	1.6	1.63	2.54	3.18	4.32	4.32	4.32
Total Range	mm mils	1 40	2 80	1.3 50	2 80	5 200	3 125	6 250	10 400	15 600	20 800	30 1200	50 2000
Optical Peak	mm	0.23	0.23	0.13	0.28	11	0.15	0.3	0.43	0.48	0.56	1	9.6
NEAR SIDE													
Standoff	mm	.05	.08	.03	.08	.05	.03	.08	.08	.08	.08	.1	2.0
Linear Range	mm	.04	.05	.02	.03	.05	.02	.04	.04	.05	.06	.06	1.9
Sensitivity	mv/μm	47	40	80	40	43	90	50	43	40	40	25	0.9
Resolution 100 Hz	μm	.06	.005	.007	.012	.013	.004	.013	.005	.006	.008	.015	0.3
Resolution 20 KHz	μm	.33	.05	.025	.05	.04	.008	.05	.032	.02	.04	.04	0.9
Resolution 200 Hz	μm	1.2	.1	.05	.1	.1	.015	.1	.15	.04	.1	.1	2.5
FAR SIDE													
Standoff	mm	.43	.53	.3	.7	1.2	.66	1.1	2.0	2.1	2.5	4.8	15
Linear Range	mm	.23	.48	.25	.4	1.5	.76	1.4	2.5	2.9	3.5	6.4	6.1
Sensitivity	mv/μm	5	3	8	3	1.6	2.8	1.6	0.8	0.6	0.5	0.3	0.3
Resolution 100 Hz	μm	0.1	.04	.06	.15	.1	.12	.5	.75	.25	.43	1.2	1.7
Resolution 20 KHz	μm	1.3	.4	.25	0.6	1	.3	1.0	1.5	1.1	1.5	2.5	3
Resolution 200KHz	μm	4	1.2	.5	1.3	2	0.55	2.0	3.0	1.5	3.8	6.4	10

## APPLICATIONS FOR D TYPE SENSORS

Actuator Dynamics  
Bearing Vibration  
Casting Porosity Check  
Diaphragm Deflection  
Fuel Injector Dynamics

Impact & Shock Studies  
Parts Positioning  
Piezoelectric Crystal Vibration  
Piston Registration (TDC)  
Piston Stroke

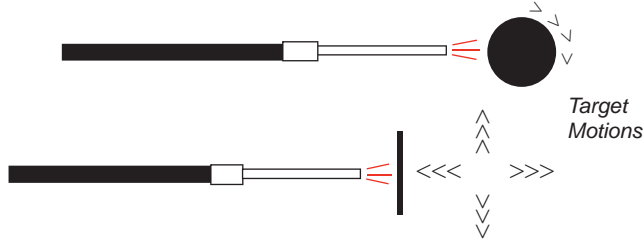
Scratch Detection  
Servo-Control  
Solenoid Travel  
Speed Sensing  
Structural Deformation

Surface Finish Evaluation  
Turbine Blade Vibration  
Ultrasonic Vibration  
Vacuum Process Control  
Valve Dynamics & Stroke

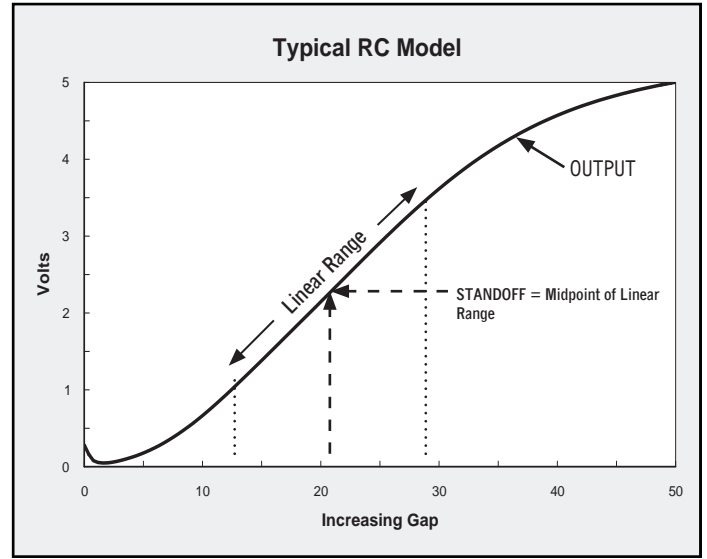
# RC TYPE SENSORS REFLECTANCE COMPENSATED

Maximum range 21 mm

Philtec RC Type Sensors are recommended when the target rotates or moves past the sensor.



RC Sensors provide an output signal proportional to distance only. Reflectance changes of the target do not effect the output. The output function is single-valued.



## MODEL

Feature	Unit	RC12	RC20	RC25	RC60	RC62	RC63	RC90	RC100	RC140	RC171	RC190
Tip Diameter	mm	3.18	0.81	7.14	1.83	7.14	7.14	7.93	3.18	7.93	4.75	7.93
Fiberoptic Area	mm	0.31 x 1.57	∅ 0.51	0.64 x 3.18	∅ 1.52	1.58 x 3.18	1.58 x 3.18	2.29 x 4.75	∅ 2.54	3.73 x 4.75	∅ 4.34	4.83 x 4.75
Total Range	mm mils	0.5 20	1.3 50	0.76 30	3.2 125	2 80	4 160	9 350	5 200	10 400	12.7 500	21 825
Standoff	mm	0.3	.51	0.3	1.5	1	1.4	3.8	2.2	7.5	5.6	12.4
Linear Range	mm	.09	0.4	0.2	1	.64	1.6	2.3	1.8	1.7	4.0	3.3
Sensitivity	mv/ µm	21	6	10	2.2	3	1.6	0.8	1.3	6	0.6	0.55
Resolution 100 Hz	µm	.08	.25	.08	0.6	0.25	0.5	1	0.75	0.9	2.5	2.5
Resolution 20 KHz	µm	0.3	1	.3	1.8	1	2	4	3	3.6	7.5	7.5
Resolution 200KHz	µm	1	2	1	3.6	2	4	8	6	7.1	15	15

OPERATING PRINCIPLE: Two fiber bundles are arranged side-by-side. Light exits one side, reflects off the target and returns to the sensor thru both sides. A ratiometric calculation of those two signals provides the distance measurement which is independent of target reflectance variations; i.e., **reflectance compensated**.



## APPLICATIONS FOR RC TYPE SENSORS

Automated Parts Inspection  
Bearing/Rotor Dynamics  
Commutator Profile  
Computer Disc Assembly  
Deformation Studies

Distance To Glass  
Distance To Paper  
Distance To Plastic  
Dynamic Expansion  
Hard Disc Thickness

Process Control  
Rotor Runout  
Shaft Orbits  
Structural Deformation  
Surface Finish Evaluation

Turbine Blade Clearance  
Ultrasonic Vibration  
Ultra-High Vacuum  
Vibration Studies  
Warpage

# PHILTEC ADAPTABILITY

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These non-contact fiberoptic sensors are adaptable to a broad range of applications where the advantages of fiberoptics make them the best choice to solve the measurement problem.

- Philtec Sensors Are Commonly Used
- Inside of Mechanisms
  - In Cryogenic Environments
  - In High Electrical Fields
  - In Hazardous Environments
  - In High Magnetic fields
  - At High Temperatures
  - At High Pressures
  - Submerged in Oils, Water, or Other Fluid
  - In Vacuum
- 

## CUSTOM PROBES

Custom Probes Made to Customer Specifications Are Common

**Very Small Probes**



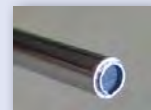
**Threaded Probes**



**90° Probes**



**High Pressure Probes**



# PHILTEC FIBEROPTIC SENSORS

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**Non-Contact**

▶ **No Effect On Target**



**Small Size**

▶ **Small Target Spot Size**



**Configurable**

▶ **Access Hard to Reach Targets**



**Fiberoptics**

▶ **Intrinsically Safe**

▶ **EMF Noise Immunity**

▶ **Vibration & Shock Resistant**

▶ **Survive Extreme Environments**

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