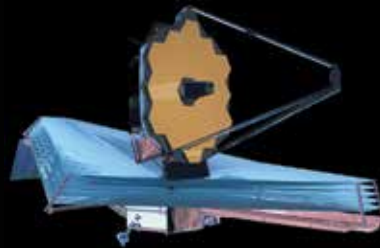


FROM
INNER SPACE
TO
OUTER SPACE
PHILTEC
FIBEROPTIC SENSORS
SOLVE
YOUR
MEASUREMENT
PROBLEMS



PHILTEC
FIBEROPTIC SENSORS

DISTANCE | DISPLACEMENT | VIBRATION

WWW.PHILTEC.COM

PRODUCT GUIDE

PHILTEC APPLICATIONS

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.



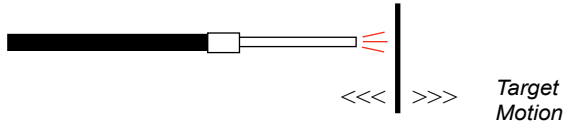
Turbine Testing

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.

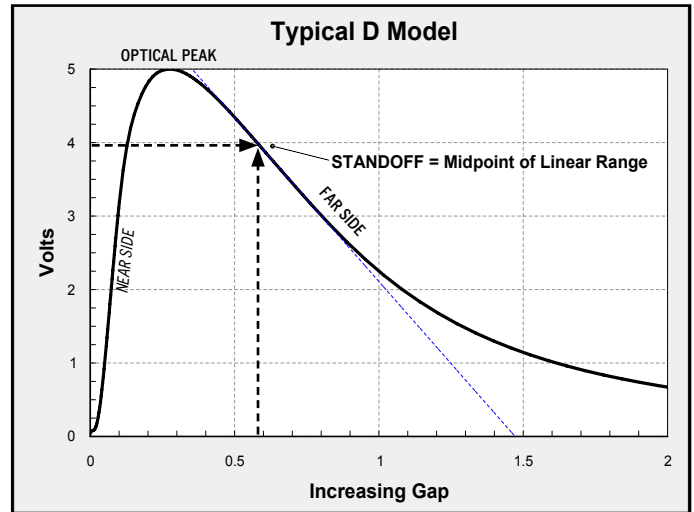
D TYPE SENSORS REFLECTANCE DEPENDENT

Maximum range 76 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.



ANALOG OUTPUT MODELS

Feature	Unit	D6	D12	D20	D21	D47	D63	D64	D100	D125	D169	D170	D171	D240	
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	7.92	
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	6.1	
Total Range	mm mils	1 40	2 80	1.3 50	2 80	5 200	3 125	6 240	10 400	15 600	20 800	30 1200	50 2000	76 3000	
Optical Peak	mm	0.25	0.25	0.12	0.25	0.3	0.15	0.3	0.4	0.4	0.65	0.9	8	14	
NEAR SIDE															
Standoff	mm	.09	.087	.03	.06	.06	.038	.053	.05	.05	.04	.09	0.9	4.2	
Linear Range	mm	.05	.045	.02	.04	.046	.02	.036	.04	.05	.16	.064	0.5	4.5	
Sensitivity	mv/ μm	38	40	90	40	43	100	40	35	40	40	27	0.7	0.5	
Resolution 100 Hz	μm	.08	.008	.008	.015	.010	.002	.018	.013	.002	.008	.008	0.3	0.5	
Resolution 20 KHz	μm	.38	.075	.020	.05	.035	.013	.035	.04	.013	.038	.05	2.9	3	
Resolution 200 Hz	μm	1.1	.12	.04	.1	.07	.026	.05	.1	.025	.076	.1	5.8	6	
FAR SIDE															
Standoff	mm	0.48	0.53	0.3	0.7	1.1	.50	1.1	1.7	2.4	2.6	3.8	13	35	
Linear Range	mm	0.33	0.41	0.25	0.7	1.3	.70	1.3	2.3	3.3	4.0	6.0	5.7	16	
Sensitivity	mv/ μm	5.5	4.4	8	4	1.6	3.2	1.3	0.7	0.6	0.5	0.33	0.33	0.19	
Resolution 100 Hz	μm	0.15	0.1	0.04	0.08	0.1	0.13	0.13	0.2	0.13	1.25	0.6	0.6	1	
Resolution 20 KHz	μm	1.3	0.8	0.2	0.65	0.9	0.3	0.8	1.9	0.7	3.0	3.8	4.3	8	
Resolution 200KHz	μm	2.5	1.5	.4	1.3	1.8	1.6	1.5	3.8	1.8	6.0	7.5	8.6	16	

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

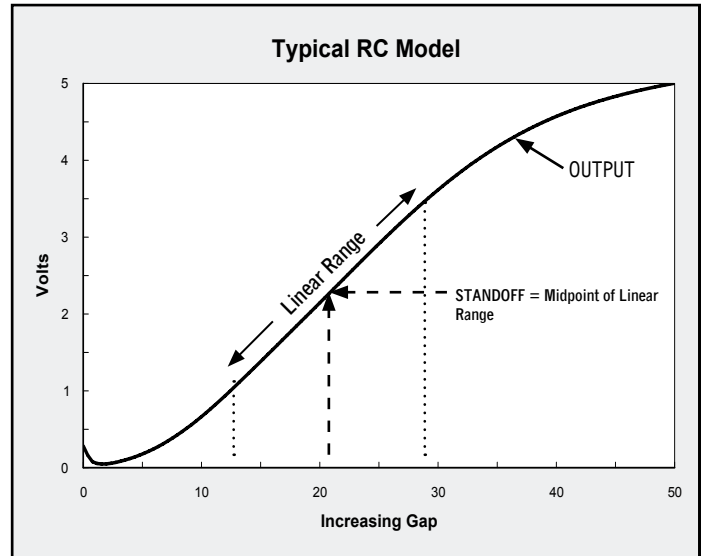
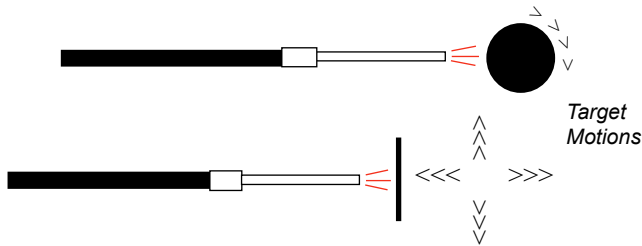
Scratch Detection
Servo-Control
Solenoid Travel
Speed Sensing
Structural Deformation

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

RC TYPE SENSORS REFLECTANCE COMPENSATED

Maximum range 40 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.

ANALOG OUTPUT MODELS

Feature		RC10	RC12	RC20	RC25	RC60	RC62	RC63	RC90	RC99	RC100	RC140	RC171	RC190	RC290
Tip Diameter	mm	2.0	3.18	0.81	4.754	1.83	4.75	4.75	7.93	3.18	3.18	7.93	4.75	7.93	7.93
Fiberoptic Area	mm	0.25 x 1.6	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	0.5 x 2.5	∅ 2.54	3.73 x 4.75	∅ 4.34	4.83 x 4.75	∅ 7.44
Total Range	mm mils	1.3 50	0.4 16	1.3 50	0.76 30	3.2 125	2 80	4 160	9 350	5.1 200	5.1 200	6 240	12.7 500	25.4 1000	40 1600
Standoff	mm	0.5	0.3	.48	0.3	1.4	1	1.4	3.8	2.5	2.2	7.0	4.4	12.7	20
Linear Range	mm	0.25	.09	0.36	0.2	1	.75	1.2	2.3	1.5	2.0	1.5	3.8	3.4	11
Sensitivity	mv/ µm	6.7	21	5	10	2.2	3	1.3	0.8	1.3	1.3	1.4	0.6	0.5	0.23
Resolution 100 Hz	µm	0.5	0.08	0.25	.05	0.6	0.25	0.7	0.6	2	0.8	0.4	2.5	3	6.8
Resolution 20 KHz	µm	1	0.23	0.5	0.3	1.8	1	2	4	8	3	2.3	5.6	6.7	13
Resolution 200KHz	µm	2.5	0.45	1	0.6	3.6	2	4	8	15	6	4.6	11	13.4	25

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 FIBEROPTICS

Standard sensor cables use glass fibers with a protective sheathing. Cable and tip materials are chosen for best compatibility with the application's environment. In the most extreme conditions, the glass fibers can be exposed to cryogenic temperatures near absolute zero and elevated temperatures above 300°C (up to 480°C).

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

OPERATING WAVELENGTH

850 nm LEDs are the standard light source of Philtec sensors.

QUARTZ FIBER PROBES

Quartz fibers are required for use in applications where the temperatures exceed the limitations of glass fibers, and also in radiation environments. Probes made using quartz fibers and ceramic adhesives can operate up to 800°C.

Metals emit light energy in the red spectrum when heated above 600°C. For applications >600°C, Philtec sensors operate in the blue spectrum at 470 nm. Blue light operation effectively eliminates light interference from hot glowing parts and infrared heating elements.



CUSTOM PROBES

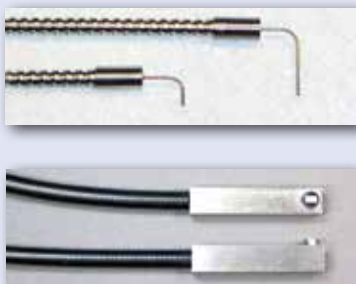
Very Small Probes



Threaded Probes



90° Probes



High Pressure Probes



SENSOR HARDWARE

Analog sensors are fast responding units ideal for relative motion measurements in dynamic applications. Available in D and RC type single channel packages.

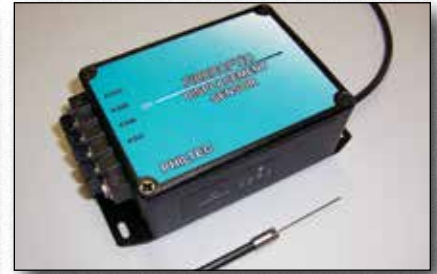
- **Analog Output**
0 - 5 volt with 20 KHz standard bandwidth.

Speeds > 1 MHz are available



D

Reflectance Dependent



RC

Reflectance Compensated

Digital sensors are the best choice for absolute distance measurements, multiplexing and process control applications. Calibration data stored on-board. D and RC models available.

- **Digital Output**
Linearized distance output via RS232 or USB with 5KHz maximum data rates.

FREE SOFTWARE INCLUDED!

Each sensor includes free software that enables you to use your PC to:

- Setup Sensors For Operation
- Select Calibration Tables For Specific Targets
- Store Additional Calibrations
- View Live Graphs Of Sensor Outputs
- Save Data To File



10DMS 19" rack for powering and controlling up to 10 digital sensors. Features ruggedized plug-in sensor modules. Mix or match any combination of sensor models, RC or D type.

- **10 Channel Racks**
Use any combination of Philtec's digital sensors



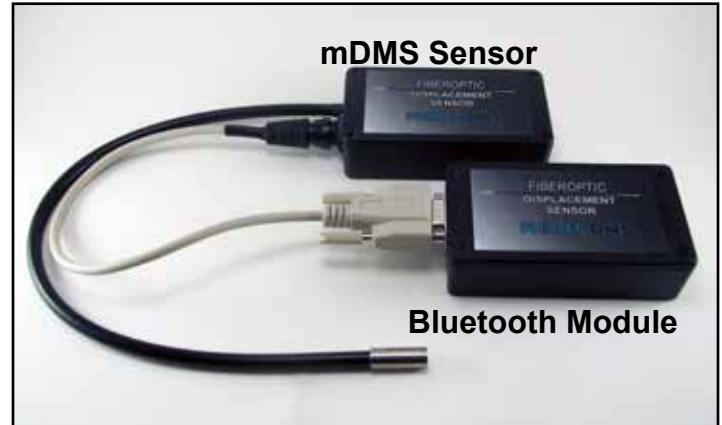
Wireless sensors. An accessory pack enables any Philtec sensor with RS-232 output to be run in **wired** or **wireless modes**.

BAP2 includes:

- Bluetooth Battery/Radio Module
- USB Bluetooth Micro Adaptor
- 15 Ft. Mini to Standard USB Cable
- 1 Ft. Sensor Data Link Cable
- Operating Software

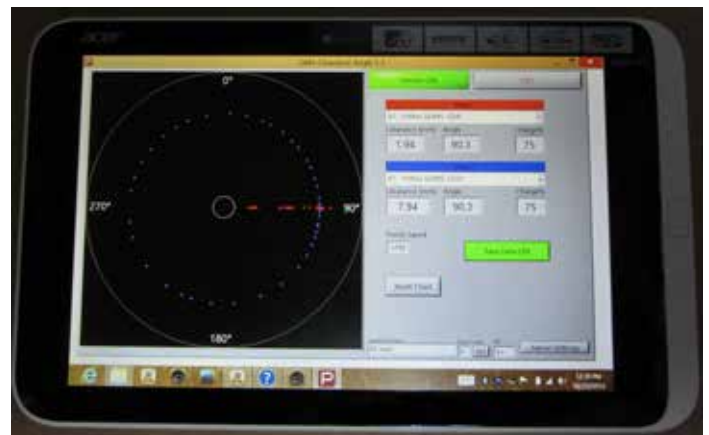
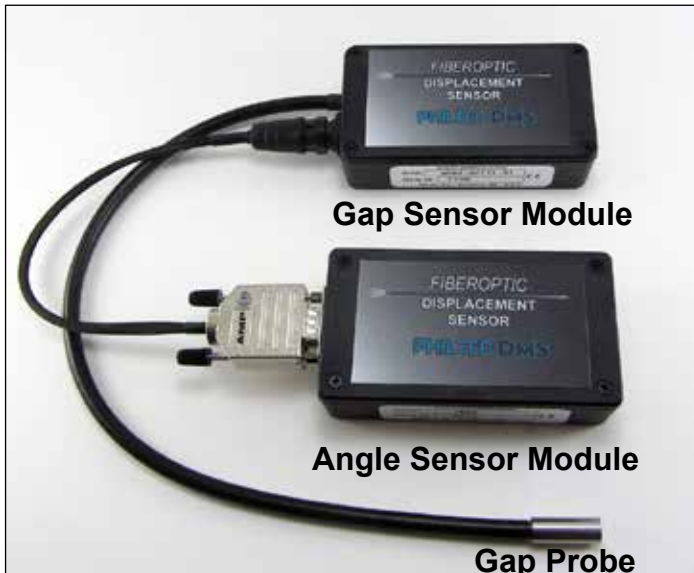
Specifications

- Time To Charge: 4 Hours
- Run Time: 10 Hours w/full charge
- Standby Mode: 4 Weeks Max.
- Run Time: 3 Hours After 4 weeks Standby
- Max. Data Rate = 900 Samples/Second



CMS 3000 CLEARANCE MEASUREMENT SYSTEM

A Wireless Sensor System for Cold Clearance Measurements of Large Frame Gas Turbines



PC Tablet Preloaded with Philtec Software for Display and Data Collection

CMS 3000 provides wireless turbine blade-mounted fiberoptic sensors and **Windows** Tablet to digitally capture the full 360° picture of casing roundness and gap data. This product represents a major advancement in the state-of-the-art.

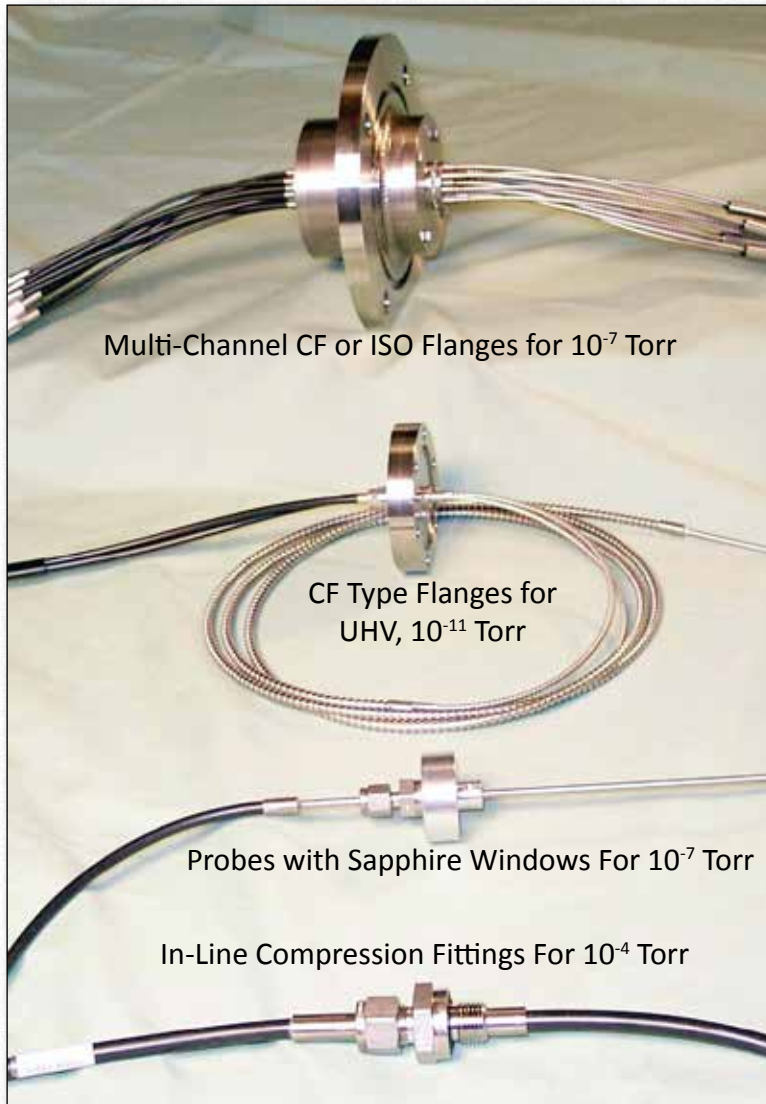
OPERATION

- Rotor/turbine blade-mounted fiberoptic probes with electronic modules provide distance and angle output data...
- The rotor is manually turned slowly...
- The Tablet collects gap and angle info, displays live charts, and saves the data to a micro SD chip for engineering to offload and analyze...

VACUUM HARDWARE

Fiberoptic Displacement Sensors are ideal for displacement and position measurements in vacuum. They have a wide temperature range, are UHV compatible, small in size and can have sub-micron accuracy.

Philtec's line of vacuum passthru hardware enables the installation of fiberoptic probes into vacuum chambers over a wide variety of applications, such as:




- In High Electrical Fields
- In High Magnetic fields
- At High Temperatures
- At High Pressures
- In Ultra High Vacuum
- In Cryogenic Fluids
- At Cryogenic Temperatures

MEASUREMENTS IN VACUUM OUR SPECIALTY

Custom Systems to Customer Specifications


PHILTEC FIBEROPTIC SENSORS

 **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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